IPOs & LOCKUP LENGTH

CAN INFORMATION ASYMMETRY AND MORAL HAZARD EXPLAIN LOCKUP LENGTH?

JOHAN RUDENGREN

JAKOB SOLLBE

Bachelor Thesis

Stockholm School of Economics

2020

IPOs & Lockup Length: Can Information Asymmetry and Moral Hazard Explain Lockup Length?

Abstract:

In this paper we examine the determinants of IPO lockup length. The focus is primarily on moral hazard and information asymmetry. We find support for moral hazard as a driver of lockup length, but not for information asymmetry. The research is based on Swedish data and then compared to results from research done on US and UK data. This is an attempt to discern what specific features in the country's IPO environment that could explain the different results in prior literature. We also combine this with other literature on the role of cornerstone investors in IPOs. We hypothesize that the asymmetric information between different investors will decrease as a consequence of cornerstone investors, but we find no evidence for this.

Keywords:

Initial Public Offerings, Lockup length, Information asymmetry, Moral hazard

Authors:

Johan Rudengren (24052)
Jakob Sollbe (24174)

Tutors:

Adam Altmejd, Postdoctoral Researcher, Department of Finance

Examiner:

Adrien d'Avernas, Assistant Professor, Department of Finance

Acknowledgements:

We would like to thank our tutor Adam Altmejd for his support and advice to our thesis.

Bachelor Thesis
Bachelor Program in Business & Economics
Stockholm School of Economics

1 Introduction

An initial public offering (IPO) is often a milestone in a company's history. This process usually represents an opportunity for founders and early investors to secure a cash out. However, there may arise a conflict of interest. Investors who intend to invest in the IPO fear that this cash out will be at their expense and are therefore less inclined to invest. Thus, there is a trade-off for owners when listing their company on a stock exchange. On one hand, there is a risk for owners to have a large share of their wealth invested in a single company but on the other hand, it is necessary to attract investors. At the same time, post-IPO investors are exposed to many uncertainties. Companies reveal a lot of information in their prospectuses but there is still a discrepancy in information between pre-IPO investors and post-IPO investors. Furthermore, post-IPO investors worry that management's interests will not necessarily be aligned with the shareholders if they do not retain ownership. To mitigate these problems pre-IPO investors normally commit to not sell their shares during a certain time period, which is referred to as the lockup period. We intend to explore potential explanations for such commitment.

Several explanations have been proposed for using lockup agreements, moral hazard and information asymmetry are the most discussed reasons. Brav & Gompers (2003) advocated that agency costs was the primary driver for lockups while Brau et al. (2005) later argued that information asymmetry was equally important. Yung & Zender (2010) tried to find a resolution to these different views and hypothesized that moral hazard and information asymmetry are not mutually exclusive. Hoque (2014) followed this path and did his research based on UK data, instead of US data, but did not find support for information asymmetry. So far, to the best of our knowledge, this has not been researched on Swedish data. Our study will be a replication of Hoque, but we will use Swedish data.

Our study examines 181 Swedish IPOs over a 15-year period (2005-2019). The Swedish IPO environment has elements of both the US and the UK. Similar to the UK there is no quiet period in Sweden, but on the other hand, the Swedish IPOs are more similar to the US in terms of a standardization of numbers of days for IPO lockup time. The median is 360 days in Sweden, which is somewhere in between the US (180 days) and the UK (598 days). Our study aims at looking at the different results between Hoque's (2014) and Yung & Zender's (2010)

research articles and see which factors in the IPO environment seem to account for the differences.

Similarly to Hoque (2014) and Yung & Zender (2010), we will also hypothesize that all companies suffer from both moral hazard and information asymmetry, but one is the more dominating for some firms while the other is more dominating for other firms. Depending on what is most likely to affect the lockup period for a specific firm, we will divide our companies into different subsamples based on moral hazard and information asymmetry proxies. This sub-sample creation will be central to this study.

The proxies in this study will be more similar to the ones used by Hoque since the intent is to examine what aspects of UK's IPO environment can account for the different result to the former study. Brav & Gompers (2003) examined rent seeking as a potential determinant for the lockup period. They did not find any support for this theory in their study, nor did any of the later research papers on this subject. Rent seeking will therefore not be further investigated in this study.

To further contribute to this area, we have tested an additional proxy for information asymmetry. Samdani (2019) shows that having cornerstone investors, prior to the IPO, decreases the heterogeneous beliefs among investors and contributes to more efficient financial reporting. Based on this, we hypothesize that having cornerstone investments before the IPO could signal quality of the firm and decrease the gap in information between pre-IPO investors and post-IPO investors. Thus, it could serve as a proxy for information asymmetry.

The fundamental assumption for this thesis is that moral hazard and information asymmetry are not mutually exclusive as drivers of lockup length. Our results show that moral hazard works as a driver of lockup lengths, but we find no support for information asymmetry. Moreover, we recognize that the effect of moral hazard on lockup length abates as our proxy for moral hazard increases. This suggests that firms that are exposed to a risk of moral hazard, extend the length of their lockup to reassure post-IPO investors that management's interests will continue to be aligned with the investors' also after the IPO. However, when it has reached a certain degree of risk for moral hazard, firms do not adjust the lockup length for an increasing risk. Furthermore, we do not find evidence for cornerstone investors as a proxy for information asymmetry.

This study will contribute to the literature on IPO in three ways. Firstly, it will extend the limited Swedish IPO literature on lockup length. We have hand-collected data from Swedish prospectuses in order to conduct the study due to lack of data. Secondly, Hoque (2014) suggested that the different result from his study to the work by Yung & Zender (2010) could be explained by different IPO environments. Since the Swedish IPO procedures are a mix of the two prior studies, this study will narrow down which factors are important and shed a light on important factors, not brought up by Hoque. Lastly, we add theories about potential proxies for information asymmetry by Sadmani (2019) to the work by Yung & Zender and Hoque.

2 Literary Review

2.1 Lockup Agreement

Committing to a lockup agreement could be costly for equity holders, since the shareholders have to bear more idiosyncratic risk. Research has confirmed that issued firms underperform compared to other firms in the 3-year aftermarket (Ritter, 1991). Despite this well documented phenomenon, insiders commit to lockup their shares. Mohan and Chen (2001) argue that influential investors demand insiders to commit to a lockup agreement. They suggest that the length of the lockup period provide information to investors about the riskiness of the IPO. This is in line with Leland and Pyle's (1977) findings who showed that an entrepreneur's willingness to invest in their own firm signals quality and abstaining from selling equity could increase the value of the firm. It only works as a signaling device if such commitment results in a higher marginal gain for entrepreneurs of high-quality firms than entrepreneurs of low-quality firms. Welch (1989) also supported the signaling effect of shareholders keeping equity in the firm. This theory was later developed by Courteau (1995) who did not only consider whether the equity holders agreed to commit to a lockup or not, but also the length of the agreement. Her study shows that the length of the lockup agreement works as a compliment to retention of equity.

Previous research has pointed out three key determinants of lockup agreement length: (1) One suggestion is that firms want to signal their quality to decrease information asymmetry. (2) Another option is that such commitment will alleviate moral hazard problems associated with the IPO. This relates to the actions taken by insiders after the offering, sometimes management's incentives are not aligned with those of the shareholders. This option is referred to as the commitment hypothesis. (3) Lastly, rent seeking could be a reason for lockup periods. Rent seeking in this case means that the underwriter wants to extract additional compensation from the issuing firm by forcing insiders to pursue a Secondary Equity Offering (SEO) in order to cash out (Brav & Gompers, 2003). We cannot find any paper supporting rent seeking.

2.2 Information Asymmetry

Brav & Gompers (2003) only found support for moral hazard as a determinant of the length of the lockup period. Brau et al. (2005) revisited Brav & Gompers's thesis and reached a different conclusion. They extended Brav & Gomper's model for information asymmetry and constructed a formal model for signaling. Brau et al. argued that the invert relation between lockup and information asymmetry is an equally relevant explanation as moral hazard. More recently, Yung & Zender (2010) have done research on the issue and have proposed a possible resolution. They hypothesized that firms suffer from both moral hazard and information asymmetry, but one friction is dominating to different sets of firms. Similarly, to Brau et al (2005), their study also concluded that there is evidence supporting both asymmetric information and moral hazard as determinants for lockup length, but for different sets of firms.

IPOs are often associated with information asymmetry frictions. Pre-IPO investors usually possess more information about the firm than post-IPO investors. Firms usually take measures to mollify these problems. One mean that has been discussed in IPO literature is underpricing. Rock (1986) argues that well informed investors will crowd out less informed investors if the shares are priced at the expected value and well-informed investors will otherwise not participate in the IPO. Then to compensate uninformed investors, firms underprice their shares. This is usually referred to as the winner's curse problem. The reputation of the investment bank that is involved in the issue could also serve as a signaling mechanism to decrease information asymmetry (Beatty & Ritter, 1986). If the investment bank does not underprice enough, it will be difficult to attract investors due to the winner's curse problem, but if it underprices too much it will lose future deals. This builds on the assumption that future issuing firms can discern investment bankers who consistently misprice issues. Carter & Manaster (1990) also confirm that the underwriter could decrease asymmetric information. In addition to hiring a prestigious underwriter, information asymmetry is tied to the size of the firm. Larger and more mature firms are less exposed to asymmetric information (Beatty & Ritter, 1986). Hoque (2014) also uses the exchange where the company lists, as a proxy for information asymmetry.

2.3 Moral Hazard

One major friction for firms going public is insider ownership according to Brav & Gompers (2003). Leland & Pyle (1977) showed that insiders retaining their equity can alleviate the moral hazard problem and hence increase the value of the firm. This builds on the idea that it will be more expensive for low quality firms to imitate this action than the benefit from it and they will therefore stop. This results in a separating equilibrium. In a separating equilibrium, investors can separate different companies and the companies' private information is revealed by the actions they take such as committing to a lockup. A crucial part of creating a separating equilibrium apart from directors committing to a lockup agreement, is how long this agreement is. Brav & Gompers found support for insiders agreeing to a lockup contract could work as a commitment mechanism that mitigates moral hazard frictions.

Hoque (2014) and Yung & Zender (2010), assumed that information asymmetry and moral hazard are not mutually exclusive. In contrast to Yung & Zender's result who found evidence for both moral hazard and information asymmetry as determinants of lockup length, Hoque only found support for moral hazard when he based his research on UK data. The difference in their results, Hoque attributed to the different IPO environments in the UK and the US, where Yung & Zender did their research (see section 3.1 for a further explanation of the different IPO environments).

2.4 Cornerstone Investors

Bubna & Prabhala (2014) suggest that cornerstone investors in an IPO attract more institutional investors and play a certification role. However, their findings show that cornerstone investors have a smaller effect on retail investors. This finding was unanticipated since the original reason for using cornerstone investors was to decrease information asymmetry for small investors. Furthermore, Dambra et al (2015) confirm that cornerstone investors decrease information asymmetry. They show that communication between institutional investors and the underwriter results in more exchange of information among IPO participants. Furthermore, Sadmani (2019) postulates that cornerstone investors are encouraged to conduct due diligence about the company. Hence, heterogeneous beliefs among investors, decrease as a consequence of cornerstone investors. Samdani provides evidence that the standard deviation for the IPO return is smaller for cornerstone-backed IPOs than non-cornerstone-backed IPOs. Post-IPO

return is considered a proxy for heterogeneity of investors' beliefs. Based on this Samdani suggests that cornerstone backing decreases heterogeneity of investors believes.

3 IPO Environment

3.1 The IPO Market

In Sweden there are two regulated stock exchanges: NASDAQ OMX Stockholm (referred to as NASDAQ hereafter) and Nordic Growth Market Equity (NGM). In addition to these, there are three multilateral trading facilities (MTF), First North, NGM Nordic MTF and Spotlight. In general NASDAQ is for larger companies whereas less mature companies use either NGM or one of the MTF:s. There are different requirements to be listed on NASDAQ and NGM. In order to be listed on NASDAQ at least 25% of the total shares have to be possessed by the public and 10% to be listed on NGM. In addition to this there are also requirements on financial reporting, to be eligible for a listing on NASDAQ the firm has to have published annual reports three years consecutively before going public (Avanza, 2016).

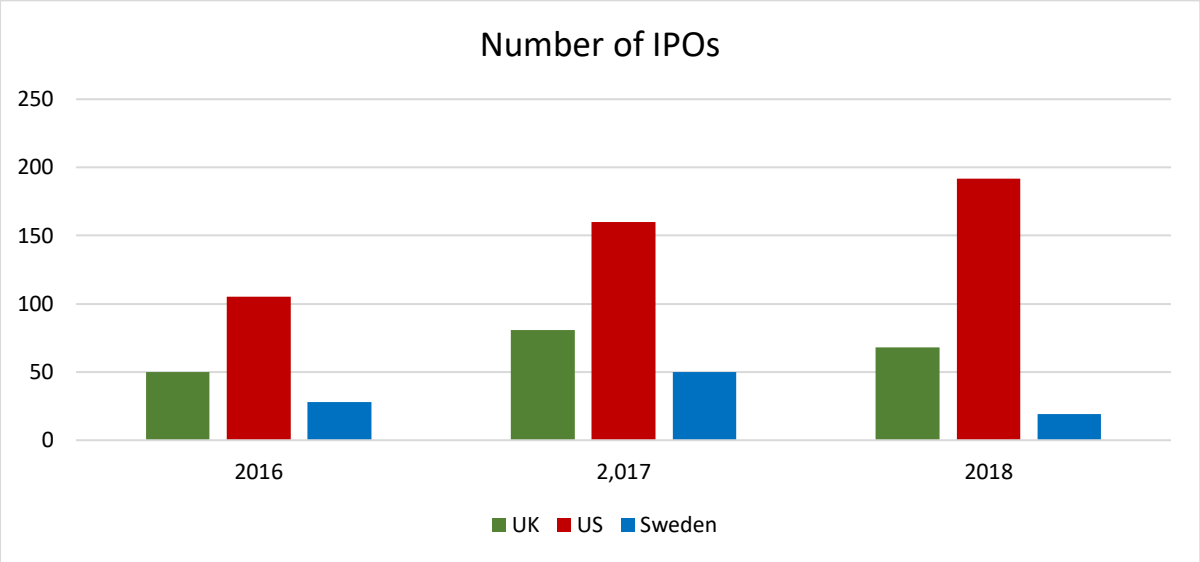


Table 1

The table shows the number of IPO deals in the UK, the US and Sweden 2016-2018 (Statista, 2019 & 2020).

As we can depict from the graph there are many more IPO deals in the US and the UK than in Sweden. This is not surprising, since the US and the UK have significantly larger populations than Sweden. Both London and New York are global financial hubs. The number of IPOs also variate over the years. In 2016, the number of IPOs in the US was 105 whereas two years later in 2018, the same figure was 192. Lowry (2003) suggest two potential explanations for the variation in IPOs each year: variations in business cycles and investor optimism.

The US has a particular feature which is different to both the UK and Sweden. The US Securities and Exchange Commission (SEC) requires all companies to have a "quiet period" of 40 calendar days after the IPO. During this time the firm is prohibited from revealing forward-looking information. The reason for this quiet period is to give time to investors to make their own assessment of the company and make a valuation of the firm protected from management or affiliated analysts' bias (Bradley, Jordan, Ritter & Wolf, 2004). Neither the UK nor Sweden have any similar regulations.

In addition to the number of IPO deals annually and the quiet period, there are other differences between the European market and the US market. The median age of firms getting listed on an exchange in the US is significantly lower than in Europe. Ritter (2003) reports that the median age in Europe is 13 years whereas in the US it is seven years. Beatty & Ritter (1986) argue that more mature firms are less exposed to asymmetric information. Hence, we could conjecture that US IPOs are to a larger extent, exposed to asymmetric information.

Barron et al (2002) report that there is a larger disagreement among analysts about the value of a firm comprised to a higher degree of intangibles. This result is primarily applicable on high technology manufacturing firms. Barron et al argue that the greater dispersion in valuations of these firms could be attributed to the importance of individual analysts' ability to forecast future earnings for these firms. Lev (2004) explains further the difficulty for investors to value R&D projects. He means that investors consistently undervalue R&D heavy companies because the investors exaggerate the riskiness associated with these ventures. Moreover, Lev nuances the picture of mispricing firms by adding that large firms like Microsoft that have shown a proven concept and an ability to convert intangible assets into revenues are less affected by this phenomenon. This suggests that high-tech companies are more exposed to asymmetric information. When comparing our sample to Yung & Zender's (2010) from the US, we could see that a larger share of IPOs in the US is considered high-tech firms. Our sample consists of 39% high-tech firms while their sample consists of nearly 47% high-tech firms. Hence, we could conjecture that US IPOs are to a larger extent exposed to asymmetric information.

3.2 Lockup Agreement

The regulations regarding lockup agreements differ between Sweden, the US and the UK. Both in Sweden and in the US, there is no legal requirement for owners to commit to a lockup agreement, although it is prevalent. In the UK however, it is mandatory for companies with a trading record of less than three years to have a lockup agreement or justify the absence.

4 Data Collection and Sample Statistics

4.1 Data collection

Our initial sample was obtained using the Thomson Securities Data Corporation (SDC Platinum) database, an established database for IPO research (WRDS 2019). The initial sample consisted of 247 initial public offerings of Swedish stocks during the time period 2005-2019. Previous research in the US and in the UK have reached different conclusions regarding the primary driver of lock up length and the research on Swedish IPOs and lockup is limited. In addition, Sweden's institutional IPO setting has elements of both the UK and the US market. Hence, the Swedish market is suitable for the research question. The IPO environment differs from each country and therefore it would be hard to draw conclusions from a dataset containing data from IPOs in several countries. Therefore, we limited the study to Swedish IPOs.

Furthermore, we used the SDC database to collect additional information, such as lock up length and necessary control variables. SDC did not include all lockup days, it included only 102 observations with lockup days from the 247 IPOs. To obtain the remaining observations and to control for errors, each prospectus was retrieved from the Swedish Securities and Exchange Commission's prospectus database. The prospectus was also used to find the percentage of director ownership in each firm, since SDC did not include this variable in their database. Neither Hoque (2014) nor Yung & Zender (2010), included observations with no lockup days. Hence, to increase comparability with Hoque and Yung & Zender, the firms with missing lockup days data in SDC and the prospectus, were excluded from the sample. The sample was filtered down to 181 observation and 66 observations were excluded.

The returns of the firms and the return for OMXS30 were used to compute the standard deviation of residuals from a simple market model regression. This data was retrieved from the Thomson Reuters Eikon Database and Yahoo Finance. To create comparability with Hoque (2014), we calculated the standard deviation, by taking the return between 80 days and 11 days before lockup expiration for the companies and OMXS30, relative to the return on the lockup expiration date. Then we conducted a simple regression where the firm return was the dependent variable and the market return was the independent variable. This gave us a measure

of post IPO volatility, which we use as a measure of information asymmetry, the higher the volatility, the higher information asymmetry.

Neither Eikon nor any other database, reported the historical returns for 4 of the observations. For another 9 of our observations, the lockup period had not expired. This meant that the variable standard deviation could not be calculated for these observations. However, all other variables were reported for these observations. Since our dataset is already considerably small, we decided to impute these observations, meaning that we took the mean of the standard deviation variable for the 168 observations that we had data for. The imputation will bias our results towards the results that we had for the 168 observation, although we can see that the imputation has a minimal impact on our results (see 6.3.1).

Ritter (1991) emphasizes the importance of sample selection and its implications for the result. The exclusion of firms with missing data may bias the research towards higher performance firms, since low performing firms are more likely to be delisted or go bankrupt. We encountered this problem in SDC Platinum, where some firms that were delisted or had gone bankrupt, were not included in the SDC database. To mitigate this problem, we complemented our data from SDC with data from the Swedish Securities and Exchange Commission's (Finansinspektionen) prospectus database. Since our research focuses on the underlying drivers of lock up length, a sample with higher performance firms would bias the results to other underlying factors, which are more prominent in high performance firms and less representative for the full sample.

4.2 Sample statistics

Table 2 shows the clustering of lockup days around 360 and 365 days and that the distribution is skewed (See Appendix A). Approximately 80% of the lockup days are either 360 days or 365 days. Furthermore, the sample demonstrated another clustering around 180 days, more than 10% of the sample had lockup days of 180 days. Higher observations could also be observed. A number of firms had 540 or 720 days. However, all observations above 720 days, represent more extreme observations. When comparing our findings to (Hoque, 2014) and (Yung & Zender, 2010), we can see that the US and Swedish lockup time are more standardized than in the UK.

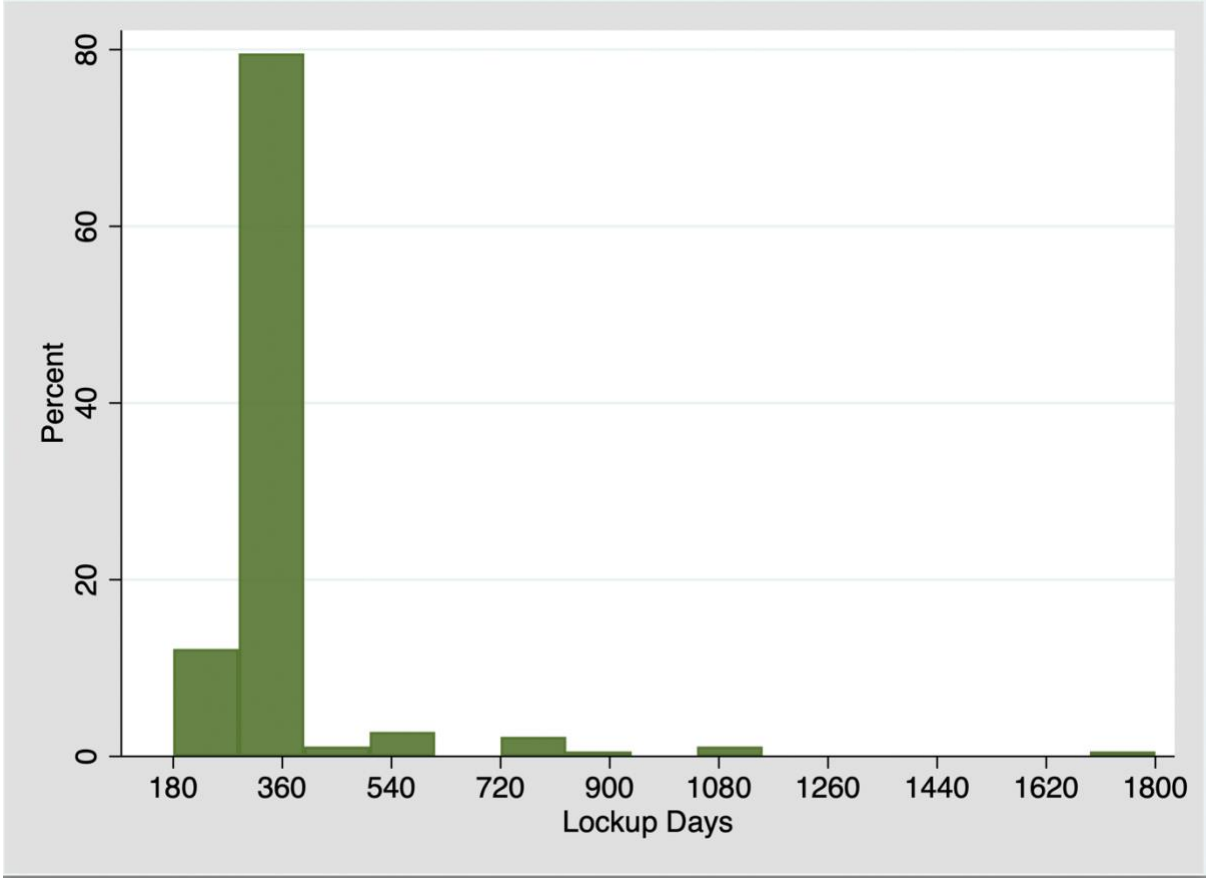


Table 2

Histogram of the number of lockup days for the full sample. The X-axis shows the number of lockup days and the Y-axis shows the observation as percentages of the full sample.

Table 3 shows that lockup length in Sweden has been clustered around 360/365 days during the last 15 years. The number of lockup days is approximately the same over the entire sample. We see no pattern of increased clustering over the years as Hoque (2014) and Yung & Zender (2010) do. Furthermore, the maximum and minimum lock up days are also similar across the years. The maximum number of lock up days is 1800 and the minimum number of lockup days is 180. Hoque also found clustering, but the difference was that he found clustering around both one- and two-year lockups. Similar to our Swedish data sample, Yung & Zender found one clustering point around 180 days whereas our data sample has a clustering around 360/365 days.

Year	N	Mean	Max	Min	Proportion of IPOs using 360/365 Lockup Days
2005	1	360	360	360	100%
2006	4	360	360	180	25,00%
2007	7	336	365	180	71,43%
2008	1	180	180	180	0,00%
2009	0	N/A	N/A	N/A	N/A
2010	9	317	540	180	55,56%
2011	6	500	366	180	83,33%
2012	1	942	942	942	0,00%
2013	1	360	360	360	100,00%
2014	14	347	450	180	71,43%
2015	28	323	540	180	74,07%
2016	28	370	1092	180	85,71%
2017	51	422	720	180	88,24%
2018	19	342	365	360	100,00%
2019	11	377	1800	325	57,14%

Table 3

Shows the distribution of lockup length for each year and the proportion of IPOs using 360/365 lockup days for each year.

Table 4 displays the characteristics of the IPOs each year and its distribution, in absolute numbers and as percentage of IPOs each year. Approximately 84% of the IPOs in the sample were conducted between 2014-2019. During the latest year, Sweden has seen a rapid increase of IPOs conducted. IPOs were considerably rarer, during the first decade of 2000. Since our dataset was small, we included the observations for 2005-2013 to get as many observations as possible. Additionally, the use of prestigious underwriters has increased. Only two IPOs in our

sample before 2014, used prestigious underwriters. The percentage of IPOs on NASDAQ and the other exchanges seems to be evenly distributed over the years. Cornerstone backed IPOs have seen a rapidly increase since 2015. Furthermore, the distribution of firms with high and low director ownership also seems to be evenly distributed over the years.

IPO Characteristics Measured in Absolute Numbers

Year	Prestigious Underwriter	Non-Prestigious Underwriters	NASDAQ IPOs	Alternative Exchange IPOs	Cornerstone Backed IPOs	Non-Cornerstone Backed IPOs	High Director Ownership	Low Director Ownership	Number of IPOs
2005	0	1	1	0	0	1	0	0	1
2006	0	4	2	2	0	4	1	2	4
2007	1	6	4	3	0	7	4	2	7
2008	0	1	1	0	0	1	0	0	1
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
2010	0	9	3	6	0	9	1	1	9
2011	1	6	6	1	1	6	0	3	6
2012	0	1	0	1	0	1	1	0	1
2013	0	1	1	0	0	1	0	1	1
2014	2	12	13	1	1	13	3	4	14
2015	9	19	17	11	12	16	6	9	28
2016	2	26	12	16	10	18	9	7	28
2017	3	48	15	36	21	30	13	6	51
2018	0	19	6	13	8	11	5	4	19
2019	1	10	6	5	9	2	3	2	11

IPO Characteristics Measured As Percentage of IPOs Per Year

Year	Prestigious Underwriter	Non-Prestigious Underwriters	NASDAQ IPOs	Alternative Exchange IPOs	Cornerstone Backed IPOs	Non-Cornerstone Backed IPOs	High Director Ownership	Low Director Ownership	Number of IPOs
2005	0,00%	100,00%	100,00%	0,00%	0,00%	100,00%	0,00%	0,00%	1
2006	0,00%	100,00%	50,00%	50,00%	0,00%	100,00%	25,00%	50,00%	4
2007	14,29%	85,71%	57,14%	42,86%	0,00%	100,00%	57,14%	28,57%	7
2008	0,00%	100,00%	100,00%	0,00%	0,00%	100,00%	0,00%	0,00%	1
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
2010	0,00%	100,00%	33,33%	66,67%	0,00%	100,00%	11,11%	11,11%	9
2011	16,67%	100,00%	100,00%	16,67%	16,67%	100,00%	0,00%	50,00%	6
2012	0,00%	100,00%	0,00%	100,00%	0,00%	100,00%	100,00%	0,00%	1
2013	0,00%	100,00%	100,00%	0,00%	0,00%	100,00%	0,00%	100,00%	1
2014	14,29%	85,71%	92,86%	7,14%	7,14%	92,86%	21,43%	28,57%	14
2015	32,14%	67,86%	60,71%	39,29%	42,86%	57,14%	21,43%	32,14%	28
2016	7,14%	92,86%	42,86%	57,14%	35,71%	64,29%	32,14%	25,00%	28
2017	5,88%	94,12%	29,41%	70,59%	41,18%	58,82%	25,49%	11,76%	51
2018	0,00%	100,00%	31,58%	68,42%	42,11%	57,89%	26,32%	21,05%	19
2019	9,09%	90,91%	54,55%	45,45%	81,82%	18,18%	27,27%	18,18%	11

Table 4

The table represents the IPO characteristics over the full sample, both in absolute numbers and as percentage of IPOs each year. Prestigious underwriters are defined as the global investment banks. NASDAQ is firms that raise money on the main exchange in Sweden and alternative markets are companies that raise money on NGM or one of the MTF:s. Cornerstone backed IPOs are IPOs which have an institutional investor that commit to buying shares in the IPO prior to the public filing. Director ownership is defined as the proportion of shares owned by managers post IPO. Low director ownership is (<0.25 percentile) and high director ownership is (>0.75 percentiles).

Table 5 exhibits statistics for the full sample and for the various subsamples (see section 4.3 for the sub-sample creation). In our sample the mean market value is 2233 million SEK and the median is 890 million SEK. Director ownership is lower in Sweden than in both the US and in the UK. The mean director ownership of our sample is 27% compared to 43% in the US (Yung & Zender, 2010) and 29% in the UK (Hoque, 2014).

The mean lockup length for large firms is longer than for small firms, but the median is the same for both subsamples. Similar to Hoque's (2014) findings, director ownership is larger for small firms compared to large firms. Director ownership is 36% for small firms on average and 21% for large firms.

The mean lockup time for the IPOs on the alternative exchanges is similar to the full sample, 366 days while the median is 360 days. The same figures for IPOs on NASDAQ are 379 days respectively 360 days. Director ownership is substantially higher for alternative exchanges, 36%, compared to the NASDAQ subsample, 18%. However, this is not surprising since the mean market value of firms listed on alternative exchanges is just a fraction of the mean market value for firms listed on NASDAQ, 500 million SEK compared to 4105 million SEK. As stated above, director ownership is on average higher for small firms compared to large firms. Higher director ownership on alternative exchange is also in line with Hoque (2014).

To summarize, we could find that lockup length for small IPOs and IPOs on alternative exchanges display shorter lockup periods and higher director ownership than the other subsamples. These results are not similar to either Hoque's or Yung's & Zender's (2010). Hoque found longer lockup length and higher director ownership in these subsamples, whereas Yung & Zender found no significant difference in director ownership in these subsamples.

The mean lockup length for the high director ownership subsample is higher than for the low director ownership subsample, 399 days respectively 337 days. The market value of the high directorship ownership subsample is less than half of the low director ownership subsample. These results are in line with those of Hoque (2014).

		Lockup length	Market value	Director ownership
Full sample	Mean	372	2232,6	0,2735
	P10	180	51,2	0,0100
	Median	360	889,5	0,1723
	P90	365	4717,5	0,7047
		Lockup length	Market value	Director ownership
Small IPOs	Mean	369	112,3	0,3586
	P10	180	30,4	0,0385
	Median	360	89,7	0,3010
	P90	453	243,2	0,7478
		Lockup length	Market value	Director ownership
Large IPOs	Mean	401	5628,3	0,2134
	P10	360	1914,0	0,0069
	Median	360	3200,0	0,0761
	P90	406	10090,0	0,6000
		Lockup length	Market value	Director ownership
Nasdaq IPOs	Mean	379	4105,0	0,1804
	P10	180	800,0	0,0050
	Median	360	2275,0	0,0750
	P90	366	8000,0	0,5904
		Lockup length	Market value	Director ownership
Alternative Exchange IPOs	Mean	366	499,6	0,3596
	P10	180	43,0	0,0290
	Median	360	190,8	0,3351
	P90	365	1330,0	0,7537
		Lockup length	Market value	Director ownership
Low director ownership Q1	Mean	337	3367,7	0,0159
	P10	180	117,6	0,0020
	Median	360	1710,0	0,0116
	P90	365	10098,0	0,0360
		Lockup length	Market value	Director ownership
High director ownership Q4	Mean	398,0	1618,1	0,6579
	P10	180	50,5	0,4928
	Median	360	447,0	0,6426
	P90	720	3559,0	0,8333

Table 5

The table represents summary statistics across all subsamples. Full sample, small IPOs vs large IPOs, Nasdaq vs alternative exchanges and low director ownership vs high director ownership. Director ownership quartile 1 is low director ownership (<0.25 percentile) and Director ownership quartiles 4 is high director ownership (>0.75 percentiles). Small IPOs are companies smaller than 300 million SEK (<0.33 percentile) and large IPOs are companies bigger than 1655 million SEK (>0.67 percentile). NASDAQ is firms that raise money on the main exchange in Sweden and alternative markets are companies that raise money on NGM or one of the MTF:s.

5 Method and Hypothesis Development

5.1 Variables

Variables	Definition
Log lockup days	The log value of number of lockup days.
Standard devaition	A measure of post IPO stock volatility.
Director ownership	Proportion of shares owned by managers post IPO.
High-tech	Defined as firms which operates in one of the following industries cumputer manufacturing, electronic equipment, computer and data processing and optical, medical and scientific equipment.
Exchange	Describes where the firm is listed. NASDAQ is the main exchange. Other exchanges are Nordic Growth Market Equity. Then there are three MTF:s, First North, Spotlight and NGM Nordic.
Log market value	The log value of the company's market capitalization value in millions.
Prestigious underwriters	Defined as global investment banks (Derrien & Kecskes, 2007). For example Goldman Sachs is a prestigious underwriter, Nordea is not.
Cornerstone-backed IPOs	IPOs which have an institutional investor that commit to buying shares in the IPO prior to the public filing.

Table 6

Definitions of all variables used in the regression.

5.1.1 Dependent variable

The dependent variable in the regressions is *log of lockup days*. By using the log-value we can avoid a skewness towards large numbers. For instance, some companies have a significantly longer lockup period than others, by using the log-value the impact of these values is reduced.

5.1.2 Independent variables

Our regressions include two independent variables of interest for our analysis, *Standard Deviation* which is our measure for information asymmetry and *Director Ownership*, which is our measure for moral hazard. Both variables are defined above. In order to create comparability to Hoque (2014), we constructed director ownership quartiles dummy variables, which means that we divided the variable director ownership into four different quartiles, based on each firm's director ownership. For example, if a firm has low director ownership it would be in quartile one and if the firm has high director ownership it would be in quartile four. Hoque did this to capture the effects of different degrees of director ownership.

5.1.3 Control variables

Previous studies, among others Hoque (2014) and Yung & Zender (2010), have shown that other variables than director ownership and standard deviation are correlated with lockup length. To create comparability with Hoque, our regressions included the same control variables. The regressions included the following control variables: the log market capitalization value in millions, if the firm had a prestigious underwriter, if the firm was listed on the main stock exchange and if the firm was a high-tech firm. All control variables are defined above.

All companies that used prestigious underwriters, were listed on NASDAQ, which comes as no surprise, since prestigious underwriters are expensive and only larger firms can afford them. To avoid that the prestigious underwriter variable and the exchange variable would take effect from each other, we excluded the prestigious underwriter variable from the regressions. The NASDAQ variable was constructed as a dummy variable and received a value of 1 if the firm was listed on NASDAQ and 0 if it was listed on NGM or one of the MTF:s. The high-tech variable was also constructed as a dummy variable, the company received a value of 1 if it operated in a high-tech industry, and 0 otherwise.

5.2 Hypothesis Development

5.2.1 Moral hazard and lockups

One major friction for firms going public is insider ownership according to Brav & Gompers (2003). Investors fear that insiders' motivation for listing their company is to monetize and hence investors are more reluctant to participate in the IPO. Additionally, investors fear that managements' interests will not be aligned with those of the investors if insiders sell their equity share. In order to mitigate these problems, insiders commit to lockup their shares for a certain time period to show good faith to attract investors. Committing to a longer lockup period is costlier for insiders of low-quality firms than insiders of high-quality firms. Thus, we would believe that firms who suffer from a greater risk of moral hazard also should exhibit longer lockup periods to attract investors. Yung & Zender (2010) hypothesized that the length of the lockup was primarily driven by moral hazard for some sets of firms. Later, Hoque (2014) made the same assumption. We use the same hypotheses as Hoque:

H1a. For all the IPOs, the proxy for moral hazard (director ownership) is positively related to lockup length.

H1b. For the high moral hazard sample, the director ownership is positively related to the lockup length.

5.2.2 Asymmetric Information and lockups

In addition to moral hazard, firms seeking to get listed on an exchange suffer from information asymmetry. There is often a gap between the information pre-IPO investors and post-IPO investors possess. In order to maximize the value of the firm, companies try to bridge this gap and reveal more information to investors. This information is revealed both through formal filings such as prospectuses, but also actions that reveal information, signaling. A signaling mechanism to alleviate this problem is hiring a prestigious underwriter (Carter & Manaster, 1990). The size of the firm also affects the degree of asymmetric information investors are exposed to. Larger and more mature firms suffer less from information asymmetry (Beatty & Ritter, 1986). Firms listed on the alternative investment market in the UK are more affected by asymmetric information than firms listed on the main market (Hoque, 2014). Hence, we would expect that firms listed on other markets than NASDAQ in Sweden suffer to a greater extent from asymmetric information. To increase the comparability to Hoque's study we use the same measure for information asymmetry, standard deviation. We use the same hypothesis for information asymmetry as Hoque:

H2. For the high asymmetric information sample, standard deviation should be positively related to the lockup length.

Furthermore, Samdani (2019) found that cornerstone investments decrease heterogenous beliefs among investors. Hence, we expect that non-cornerstone-backed investment will be more affected by asymmetric information. In order to test if cornerstone investors could be used as a proxy for information asymmetry, we test if it is negatively correlated with standard deviation.

H3. Cornerstone-backed IPOs should be negatively correlated with standard deviation.

5.3 Sub-sample creation

Our hypothesis, which is in line with Hoque's (2014), is that firms suffer from both moral hazard and information asymmetry. Similarly to Yung & Zender (2010) and Hoque we will assume that one of the two frictions are more acute for different sets of firms. To test our hypothesis, we created sub-samples based on the proxies that Hoque used for the two frictions. The subsamples for information asymmetry are firm size and where the company is listed. We believe hypothesis H2 will be most important in the high information asymmetry samples. The proxy for moral hazard is director ownership and thus we believe hypothesis H1b will be most important in the high moral hazard subsample.

Subsample	**Proxy**	**Sample size**
Small IPOs	High Information Asymmetry	60
Large IPOs	Low Information Asymmetry	61
Nasdaq IPOs	Low Information Asymmetry	87
Alternative Exhange IPOs	High Information asymmetry	94
High Director Ownership IPOs	High Moral Hazard	46
Low Director Ownership IPOs	Low Moral Hazard	46

Table 7

Summary of all subsamples and the proxies used in each subsample.

One problem that arises, is that our dataset does not contain enough observations to divide our dataset into one sub-sample for each proxy. Therefore, we divide our full sample in the following sub-samples; Small IPOs, Large IPOs, Nasdaq IPOs, Alternative exchange IPOs, Low director ownership and High director ownership. We do not create a sub-sample for prestigious and non-prestigious underwriters since all the prestigious underwriter observations are included in the NASDAQ subsample.

5.4 Regression Model and Statistical Tests

The regression formula for the full sample was as follows:

$$Log\ Lockup\ days_i = \beta_0 + \beta_1 Standard\ Deviation_i + \ +\beta_2 Director\ OwnershipQ2_i + \beta_3 Director\ OwnershipQ3_i + \beta_4 Director\ OwnershipQ4_i + \beta_5 NASDAQ_i + \beta_6 High\ Tech_i + \beta_7 Log\ Market\ value_i + \varepsilon_i$$

Since our full sample and the majority of our subsamples experienced heteroscedasticity (see Appendix B), we conducted Ordinary Least Square Regressions (OLS) with robust standard errors to mitigate the heteroskedasticity.

We began with a t-test to test if the mean standard deviation of non-cornerstone backed IPOs was larger than the standard deviation for cornerstone backed IPOs, since the variable never had been tested in these circumstances before. Then a simple regression was performed on the full sample, where standard deviation was the dependent variable and the cornerstone variable was the independent variable. If we could show that the cornerstone backed IPOs had a negative correlation with standard deviation, and that the variable had explanatory power for standard deviation, it would be included in the regression.

Then we conducted a regression for the full sample, with all the independent variables (listed earlier) included. After that, we did a regression for the full sample with only the measure for information asymmetry, standard deviation, included as independent variable, and the control variables. Then we did a regression for the full sample with only the proxy for moral hazard, director ownership, included, and the control variables. Lastly, we did one regression on each subsample, with all variables included. By following these steps, we can first see which proxy that have the strongest effects on the full sample. When isolating the proxies for information asymmetry and moral hazard, we can analyze their explanatory power in isolation to each other. To test hypothesis H1b and H2 we did one regression on each subsample. Furthermore, we conducted several robustness tests on our regression model to further validate our results.

6 Results

6.1 Test

Variable	Obs	Mean	Std. Err.	Std. Dev.
Standard Deviation Non-Cornerstone backed IPOs	119	0.0782	0.0095	0.1032
Standard Deviation Cornerstone backed IPOs	62	0.0829	0.1373	0.1081
diff		-0.0046	0.1668	
t = -0.2780				
P(T > t) = 0.6093				

Table 8

T-test of mean difference between standard deviation of non-cornerstone backed IPOs and cornerstone backed IPOs.

Table 8 shows that the mean standard deviation for non-cornerstone backed IPOs are not higher, as hypothesized. The p-value of the test is 61% and we can therefore not reject our null hypothesis that non-cornerstone IPOs have a larger standard deviation. To further validate our results, we conducted a simple regression with the cornerstone dummy variable to analyze if the cornerstone variable had explanatory power for our measure of information asymmetry, standard deviation.

6.2 Cornerstone variable test

	Full Sample	
	Coef	t-stat
Cornerstone_dummy	-0.009	-0.50
Intercept	0.083	10.31
Observations	181	
R-squared	0.0018	

Table 9

The table shows a simple regression where standard deviation is the dependent variable and cornerstone-dummy is the independent variable.

* Significant at 10%

**Significant at 5%

***Significant at 1%

This regression in table 8 was made to test whether there is a negative correlation between cornerstone-backed IPOs and standard deviation which is our measurement for information asymmetry. The coefficient for cornerstone-dummy is insignificantly different from zero in our sample, thus we can reject H3. Furthermore, cornerstone-backed IPOs will not be used as a proxy for information asymmetry in the coming regressions since we cannot find support for this proxy.

6.3 Determinants of lockup length

6.3.1 Regression Results for Full Sample

Full Sample						
	All Variables		Information Asymmetry		Moral Hazard	
	Coef	t-stat	Coef	t-stat	Coef	t-stat
Standard deviation	-0.023	-0.22	-0.130	-0.12		
Dir Own 2 (low)	0.039*	1.74			0.038*	1.70
3	0.058*	1.66			0.058*	1.66
4 (high)	0.058*	1.77			0.058*	1.78
Log(Marke value)	0.041	1.46	0.036	1.37	0.042	1.49
High-Tech	0.033	1.62	0.029	1.41	0.032	1.62
NASDAQ	-0.010	-0.34	-0.021	-0.77	-0.009	-0.33
Observations	181		181		181	
R-squared	0.0521		0.0264		0.0518	

Table 10

Shows the multiple regression results for the full sample. Our variables of interest are standard deviation, our measure for information asymmetry and director ownership, our measure for moral hazard.

* Significant at 10%

**Significant at 5%

***Significant at 1%

In table 10 we present the regressions results for the full sample. The first regression includes all variables. The second regression includes our measurement for information asymmetry, standard deviation, and all control variables. The last regression includes our measurement for moral hazard, director ownership, and all control variables. Hence, we can see the effect of information asymmetry and moral hazard in isolation to each other.

For our full sample, with all variables included, we find support for moral hazard as a driver of lockup length, which supports hypothesis H1a. Our regression shows that the lockup length increases by a factor of 3.9% as we move from director ownership quartile 1 to 2, a factor of 5.8% from quartile 1 to 3 and 1 to 4. These results implicate that the lockup length for the full sample increases as we proceed from quartile 1 to 2 and 2 to 3 but there is no significant difference in terms of lockup length between the two highest quartiles. This in turn suggests that there is a breaking point for the full sample, where an increased risk for moral hazard does not affect the lockup length. Hoque (2014) also finds support for moral hazard as a driver of lockup length for his full sample regression. In contrasts to our results, Hoque identifies a decrease in lockup length between quartile 3 and 4, whereas we see no difference between quartile 3 and 4. This further supports that there is a breaking point where the impact of moral hazard on lockup length decreases. In other words, when insider holdings have reached a certain level, an increase in insider holdings does not affect the lockup length.

Furthermore, we do not find support for information asymmetry in either the regression where all variables are included, nor the regression which only includes variables for information asymmetry. Standard deviation is insignificantly different from zero in both regressions. Hoque (2014) does not find support for information asymmetry either, surprisingly he gets a significant negative correlation between information asymmetry and lockup length.

The last regression looks at the variable director ownership, in isolation to standard deviation. This regression also supports the theory of moral hazard as a determinant of lockup length for all IPOs. The coefficients for the quartile director ownership dummies are almost exactly the same as in the regression where standard deviation was included. Thus, we can deduce that standard deviation and director ownership, the measurements for information asymmetry and moral hazard, do not have a significant impact on each other (see table 13 for correlation matric).

Since the standard deviation variable was far from significant in any of the three regressions, and that the correlation between standard deviation and director ownership is only 0.1054 (see table 13), we can conclude that the imputation used for the 13 observations, does not seem to have affected the outcomes of the regressions to a large extent.

6.3.2 Regression Results for Subsamples

	Small IPOs		Large IPOs		Alternative exchange		NASDAQ		Low Dir. Own.		High Dir. Own.	
	High Information Asymmetry		Low Information Asymmetry		High Information Asymmetry		Low Information Asymmetry		Low Moral Hazard		High Moral Hazard	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Standard deviation	0.143	0.97	0.092	1.06	-0.125	-0.73	0.004	0.06	0.056	0.20	-0.029	-0.34
Dir Own 2 (low)	-0.022	-0.50	0.058*	1.79	0.012	0.31	0.038	1.22				
3	0.096**	2.12	0.101**	2.03	0.029	0.96	0.090**	2.01				
4 (high)	0.052	0.86	0.048	0.73	0.051	1.19	0.055	1.19				
Log(Marke value)	-0.044	-0.72	0.130	1.12	-0.026	-1.01	0.119***	3.03	0.055	1.43	-0.034	-0.74
High-Tech	0.117***	2.81	-0.022	-0.55	0.018	0.60	0.058**	2.24	0.056	1.59	0.013	0.25
NASDAQ	-0.032	-0.53	0.072	1.12					-0.023	-0.44	0.073	0.96
Director Ownership									0.844	0.62	0.396*	1.95
Observations	60		61		94		87		46		46	
R-squared	0.2006		0.1803		0.0442		0.2120		0.0961		0.1084	

Table 11

Regression results for our subsamples. Small IPOs (high information asymmetry) are companies smaller than 300 million SEK (<0.33 percentile) and large IPOs (low information asymmetry), are companies bigger than 1655 million (>0.67 percentiles). NASDAQ (low information asymmetry) is firms that raise money on the main exchange in Sweden and alternative exchange (high information asymmetry) is companies that raise money on NGM or one of the MTF:s. Low director ownership (low moral hazard) is quartile 1 of insider holdings and high director ownership (high moral hazard) is quartile 4 of insider holdings.

* Significant at 10%

**Significant at 5%

***Significant at 1%

In table 11 we present the results for our multiple regressions on our subsamples. Standard deviation is insignificantly different from zero in both high information asymmetry subsamples, thus we can reject H2. These results are in line with Hoque's (2014) findings, who did not find any support for the information asymmetry hypothesis. In contrast, Yung & Zender's (2010) findings supported that in the high asymmetric information samples, asymmetric information is a driver of lockup length and is positively correlated with longer lockups.

In the moral hazard subsamples, it was not possible to use quartile dummies for director ownership. Instead we used the continuous variable for director ownership. In the high moral hazard subsample, we find support that moral hazard is a driver of lockup length, the higher director ownership, the longer the lockup length. This support our hypothesis H1b. The

coefficient for director ownership is 0.396 in the high moral hazard subsample, implicating an increase of director ownership by one percent increases lockup length by 0.486 percent (see Appendix D for calculation). Yung & Zender (2010) and Hoque (2014), also identifiy director ownership as a determinant of the lockup length in the moral hazard subsample.

6.4 Robustness tests

6.4.1 Multicollinearity and correlation matrices

In order to ensure the validity of the data, several robustness tests were performed. Table 12 demonstrates that multicollinearity does not seem to be an issue in the regression for the full sample. All variables have a low VIF and we can conclude that multicollinearity is not a problem in the model. Multicollinearity tests were conducted on all subsamples (Appendix C) and the tests did not find multicollinearity in any of the subsamples.

Full Sample	
Variables	VIF
Director Ownership	1.14
Standard Devaition	1.07
Log Market Value	1.87
High-Tech	1.19
NASDAQ & Prestigious Underwriters	1.98
Mean VIF	1.45

Table 12

Variance inflation factors for the full sample.

Table 12 shows the correlation between the independent variables in the full sample regression. The only variables which have a high correlation, was NASDAQ and Log Market Value, which is natural since in general more mature and large firms get listed on NASDAQ. All the other variables seem to have an accepted level of correlation.

	Director Ownership	Standard Deviation	Log Market Value	NASDAQ	High-Tech
Director Ownership	1.0000				
Standard Deviation	0.1054	1.0000			
Log Market Value	-0.2295	-0.1899	1.0000		
NASDAQ	-0.3400	-0.1676	0.6674	1.0000	
High-Tech	0.0363	0.2157	-0.3339	-0.3199	1.0000

Table 13

Correlation matric for the full sample.

7 Conclusion

There has been a scientific discussion about the reasons for using lockup agreements. Lately, the focus has been primarily on information asymmetry and moral hazard. We have, similarly to Yung & Zender (2010) and Hoque (2014), hypothesized that these frictions are not mutually exclusive, but one is more dominant to some firms. Our findings show that moral hazard is correlated with longer IPO lockup lengths, but we find no evidence for asymmetric information. This is in line with prior research based on UK data but differs from research based on US data. Moreover, we can conclude that moral hazard exhibits a diminishing effect on lockup length. However, Young & Zender identified a large clustering in their data which we also could see in our data. None of our results provide an explanation for this phenomenon, hence we concur with Yung & Zender who called it an "unresolved puzzle".

Additionally, we also conjectured that cornerstone investors could mitigate the problem of asymmetric information. We found no evidence for this theory. However, since we did not find support for information asymmetry as a driver of lockup length in our sample, the role of cornerstone investors should not be ruled out yet, it would be a premature conclusion.

Furthermore, it has been suggested that different IPO environments may be the reason for different results in different countries. IPO environment entails many different aspects such as regulations and procedures. This includes aspects like when company information is disclosed, the degree of standardization, how active the IPO market is, and the maturity of firms getting listed. Prior research has not specified how important each difference is. Our research has contributed to shed some light on the more dominating reasons for the different outcomes depending on the specific features of the IPO environment. The Swedish IPO environment, which we have studied, is a mix of the UK and US, hence we could discern the more important factors. The results from our study indicate that the standardization of lockup length cannot solely explain the different results from research done on UK data and US data. Both Sweden and the US have large clustering in IPO lockup lengths, despite this, lockup lengths are not associated with the same frictions. This points to the difference in when information is disclosed during the lockup and how long the lockup lengths are. It is plausible that the quiet period in the US make post-IPO investors more vulnerable to asymmetric information prior to the IPO. Additionally, European firms are on average older when getting listed than US firms. This could also amplify the relevance of information asymmetry for US IPOs since European

correspondents have more time to show a proven concept of their business and hence, could be perceived as more stable. Finally, the US has a larger share of high-tech firms which is usually harder for investors to evaluate and are thus also more affected by information asymmetry.

8 References

Avanza, *Vilka krav uppstår på ett börsnoterat företag?*, last updated November 2016, Available from: https://www.avanza.se/lar-dig-mer/avanza-akademin/borsintroduktioner-emissioner-foretagshandelser/vilka-foretag-far-gora-en-borsnotering.html?fbclid=IwAR01jHplMO7Kf5Ax4DUD7PtiEMWYdahDl-RZYn-_0zywMkmtAPiW2_weIbs (Accessed 6 May 2020).

Barron, O. E., Byard, D., Kile, C., & Riedl, E. J. (2002). High-Technology Intangibles and Analysts' Forecasts. *Journal of Accounting Research*, 40 (2), 289-312. Doi: 10.1111/1475-679X.00048

Beatty, R. P., & Ritter, J. R. (1986). Investment banking, reputation, and the underpricing of initial public offerings. *Journal of Financial Economics*, 15 (1-2), 213-232. Doi: 10.1016/0304-405X(86)90055-3

Bradley, J. B., Jordan, B. D., Ritter, J. R., & Wolf, J. G. (2004). The IPO Quiet Period Revisited. *Journal of Investment Management*, 2 (3), 1-11.

Brau, J. C., Lambson, V. E., & McQueen, G. (2005). Lockups Revisited. *Journal of Financial and Quantitative analysis*, 40 (3), 519-530. Doi: 10.1017/S002210900000185X

Brav, A., Gompers, P. A. (2003). The Role of Lockups in Initial Public Offerings. *The Review of Financial Studies*, 16 (1), 1-29. Doi: 10.1093/rfs/16.1.0001

Brealey, R., Leland, H. E., & Pyle, D. H. (1977). Informational Asymmetries, Financial Structure, and Financial Intermediation. *The Journal of Finance*, 32 (2), 371-387. Doi: 10.1111/j.1540-6261.1977.tb03277.x

Bubna, A., & Prabhala, N. (2014). Anchor Investors in IPOs. Working Paper at the NSE-NYU Stern School of Business Initiative for the Study of Indian Capital Markets.

Carter, R., & Manaster, S (1990). Initial Public Offerings and Underwriter Reputation. *The Journal of Finance*, 45 (4), 1045-1067. Doi: 10.1111/j.1540-6261.1990.tb02426.x

Chen, C. R., & Mohan, N. J. (2001). Information content of lock-up provisions in initial public offerings. *International Review of Economics & Finance*, 10 (1), 41-59. Doi: 10.1016/S1059-0560(00)00070-8

Courteau, L. (1995). Under-Diversification and Retention Commitments in IPOs. *Journal of Financial and Quantitative analysis*, 30 (4), 487-517. Doi: 10.2307/2331274

Dambra, M., Field, L. C., & Gustafson, M. T. (2015). The JOBS Act and IPO volume: Evidence that disclosure costs affect the IPO decision. *Journal of Financial Economics*, 116 (1), 121-143. Doi: 10.1016/j.jfineco.2014.11.012

Derrien, F., & Kecskes, A. (2007). The Initial Public Offerings of Listed Firms. *The Journal of Finance*, 62 (1), 447-479. Doi: 10.1111/j.1540-6261.2007.01212.x

Hoque, H. (2014). Role of asymmetric information and moral hazard on IPO underpricing and lockup. *Journal of International Financial Markets, Institutions and Money*, 30, 81-105. Doi: 10.1016/j.intfin.2014.02.001

Lev, B., June (2004). Sharpening the Intangibles Edge. *Harvard Business Review*, 109-116.

Lowry, M. (2003). Why does IPO volume fluctuate so much? *Journal of Financial Economics*, 67 (1), 3-40. Doi: 10.1016/S0304-405X(02)00230-1

Newbold, P., Carlson, L. W., & Thorne, M. B. (2013). Heteroscedasticity. *Statistics for business and economics*, 8th ed., 577-581. England: Pearson.

Ritter, J. R. (1991). The Long-Run Performance of initial Public Offerings. *The Journal of Finance*, 46 (1), 3-27. Doi: 10.1111/j.1540-6261.1991.tb03743.x

Ritter, J. R. (2003). Differences between European and American IPO Markets. *European Financial Management*, 9 (4), 421-434. Doi: 10.1111/1468-036X.00230

Rock, K. (1986). Why New Issues Are Underpriced. *Journal of Financial Economics*, 15 (1-2), 187-212. Doi: 10.1016/0304-405X(86)90054-1

Samdani, T. (2019). Anchor-backed IPOs, reported earnings, and heterogeneous investors' beliefs. *Journal of corporate Finance*, 59, 72-87. Doi: 10.1016/j.jcorpfin.2017.05.002

Statista, *Number of IPOs in the United States from 1999 to 2019*, Released December 2019, Available from: https://www.statista.com/statistics/270290/number-of-ipos-in-the-us-since-1999/?fbclid=IwAR2MJtgM1Ui2vocUghbMecOv7QRdsW7HXs4fiGOdUg_MHC0FzcPb1rdQmdI (Accessed 6 May 2020).

Statista, *Number of IPOs listed on London Stock Exchange in the United Kingdom (UK) from 1st quarter 2016 to 4th quarter 2019, by market*, Released January 2020, https://www.statista.com/statistics/325218/uk-lse-ipos-numbers/?fbclid=IwAR38AiVfNIMbOJFR4pqiTLt1DPjRP21I8B0qNf8WcHVW1DjNh6BPujNOfx0 (Accessed 6 May 2020).

Thomson Reuters Eikon (2020)

Thomson Securities Data Corporation (2020)

Welch, I. (1989). Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings. *The Journal of Finance*, 44 (2), 421-449. Doi: 10.1111/j.1540-6261.1989.tb05064.x

Yahoo, Available from: https://finance.yahoo.com (Accessed 7 April 2020)

Yung, C., & Zender, J. F. (2010). Moral hazard, asymmetric information and IPO lockups. *Journal of Corporate Finance*, 16 (3), 320-332. Doi: 10.1016/j.jcorpfin.2009.12.004

9 Appendices

Appendix A

To analyze whether our variable Log Lockup Days experienced skewness we conducted a Jarque-Bera test where we reject the null hypothesis that the log lockup days distribution is normal. Hence, we can conclude that the distribution of the variable is skewed.

Table A1: Jarque-Bera test

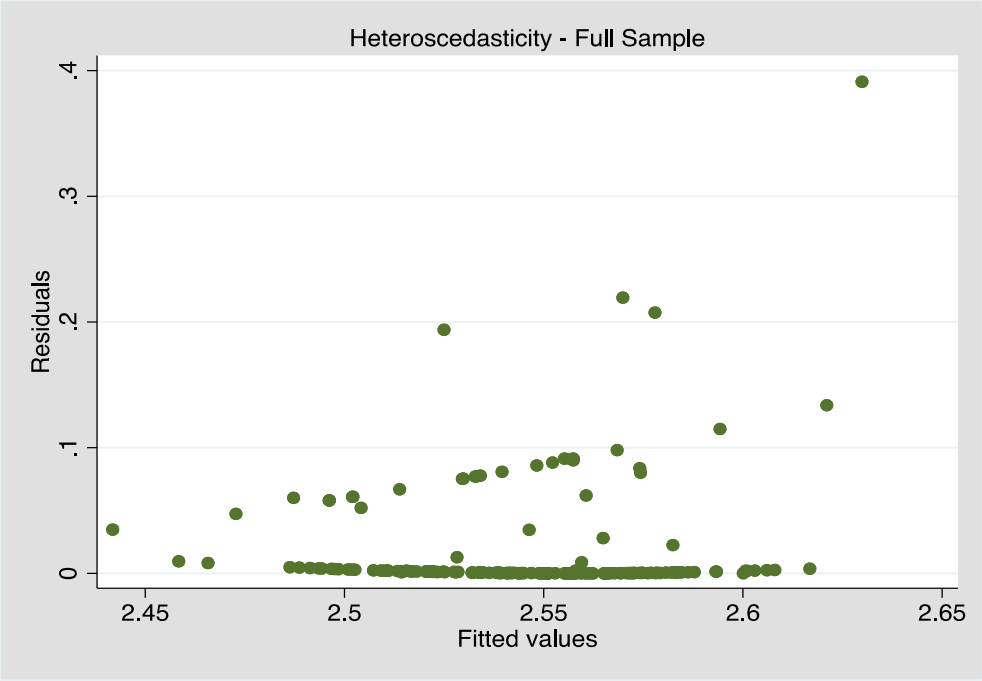
				joint	
Variable	N	Pr(Skewness)	Pr(Kurtosis)	chi2(2)	Prob>chi2
Log Lockup Days	181	0.0006	0.0000	32.33	0.0000

Note: Pr(Skewness) is t-statistics for the sample skewness. Pr(Kurtosis) is t-statistics for the sample kurtosis.

Appendix B

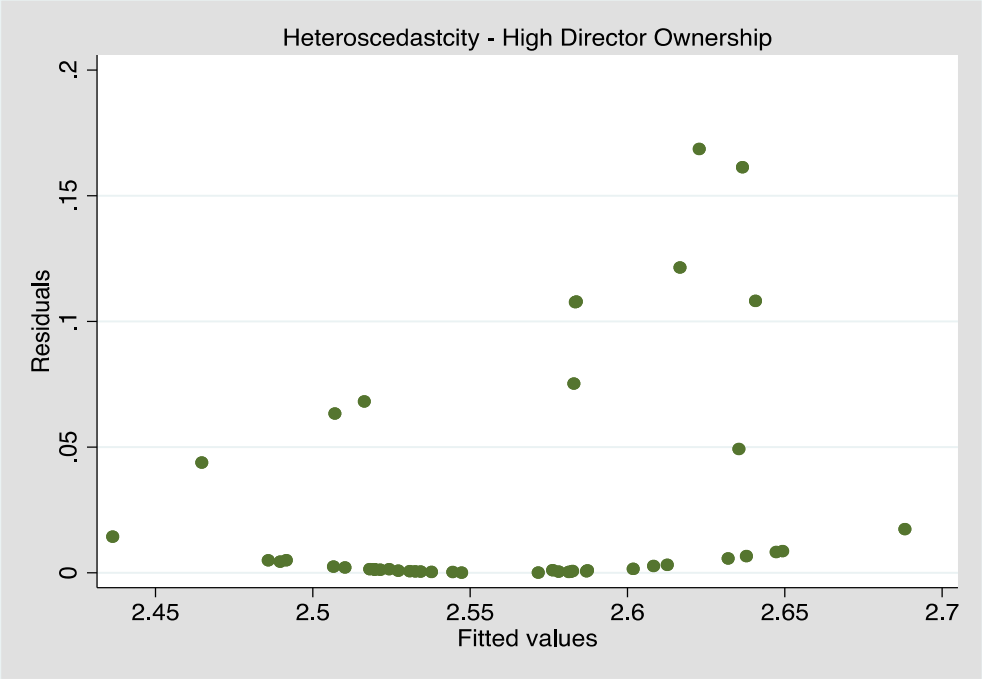
In order to determine if the sample was subject to heteroskedasticity, we plotted the residuals and the fitted values to look for patterns of heteroskedasticity. An OLS regression is based on the assumption of homoskedasticity, and if that assumption is violated, one can use robust standard errors.

Table B1: Heteroscedasticity plot on the total sample



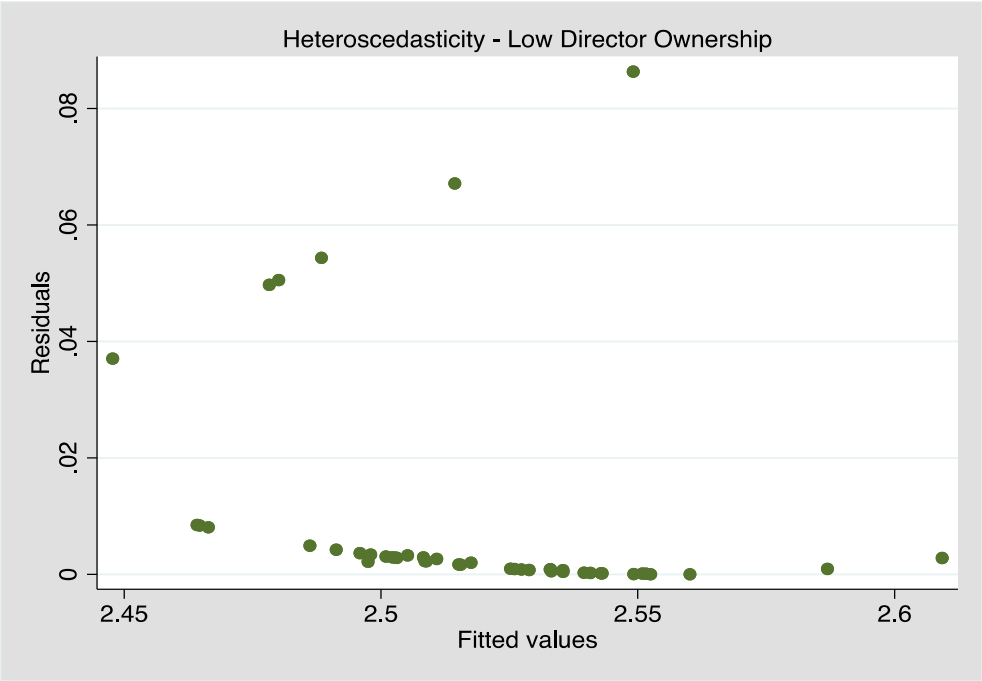
Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression.

Table:B2: Heteroscedasticity plot on High Director Ownership sample



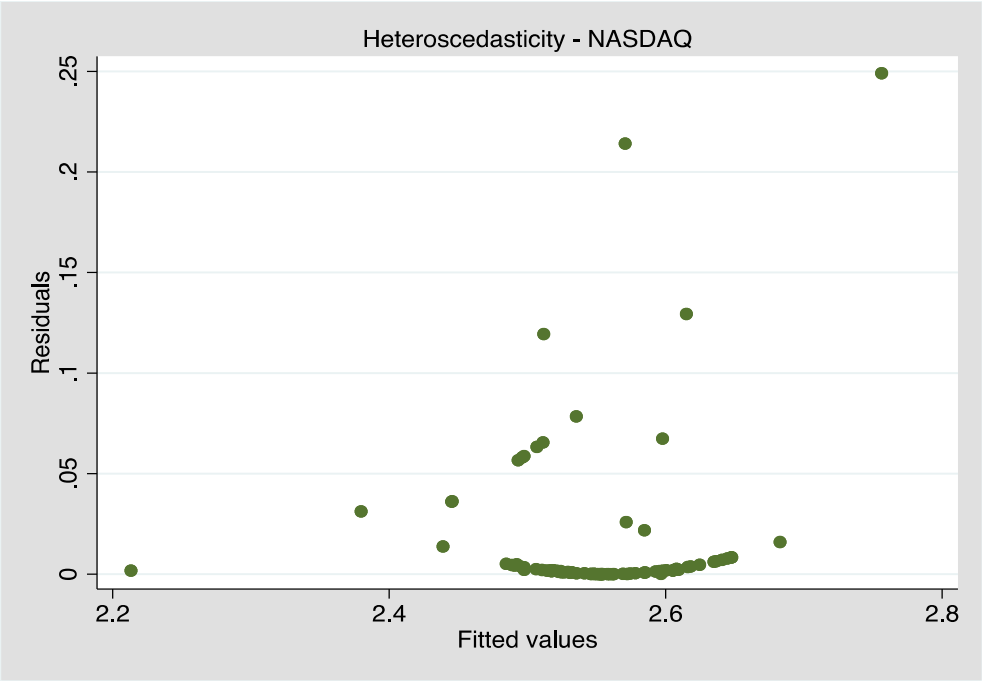
Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression.

Table B3: Heteroscedasticity plot on Low Director Ownership sample



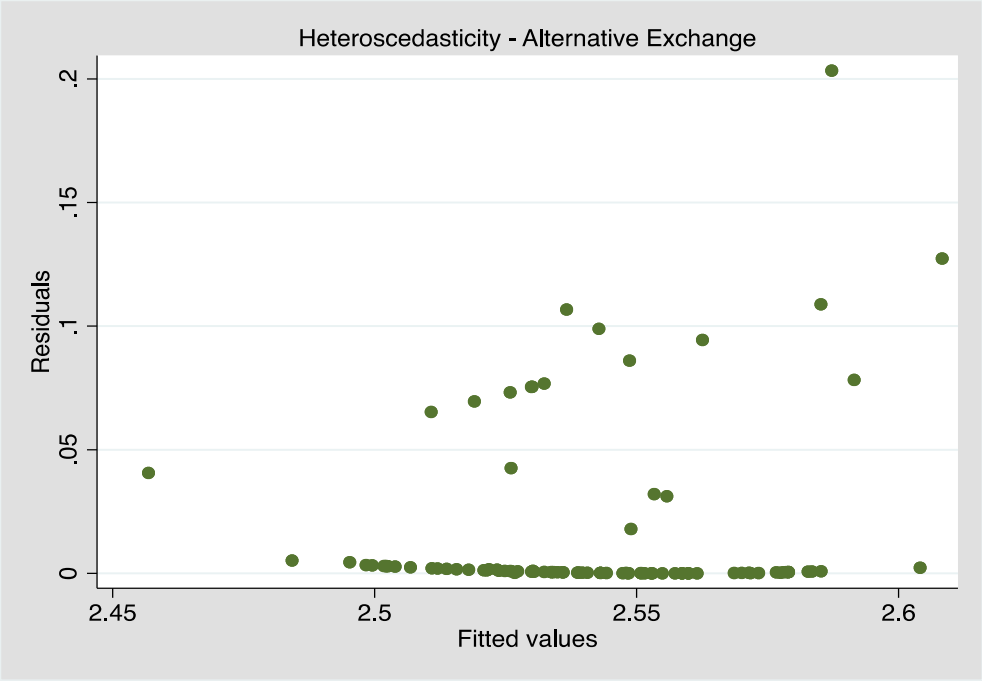
Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression.

Table B4: Heteroscedasticity plot on Nasdaq sample



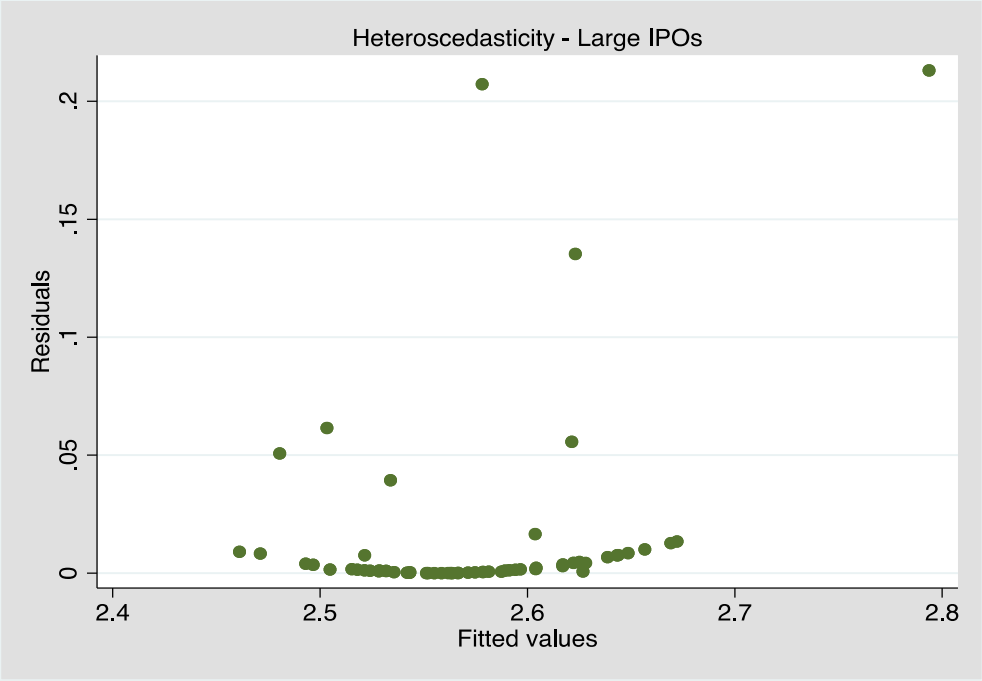
Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression.

Table B5: Heteroscedasticity plot on Alternative Exchange sample



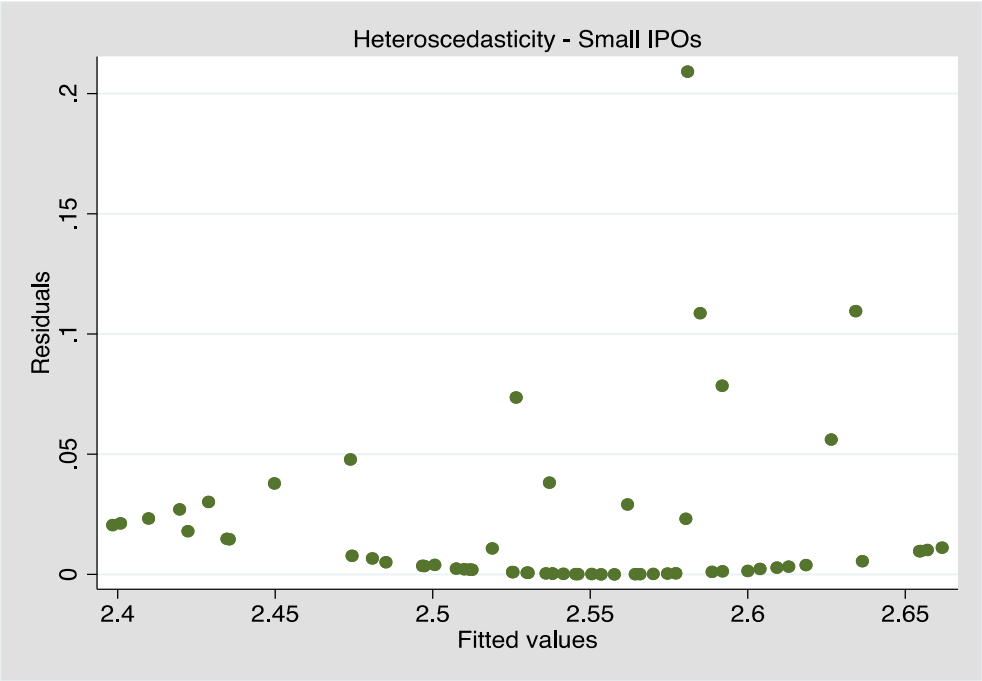
Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression

Table B6: Heteroscedasticity plot on Large IPOs sample



Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression

Table B7: Heteroscedasticity plot on Small IPOs sample



Note: Residuals are from the OLS regression and fitted values are the predicted values from the regression

Appendix C

In addition to the VIF table calculated previous on the full sample, we tested all the subsamples for multicollinearity. No signs of multicollinearity were found.

Table C1: Variance inflation factors for the full sample.

	Small IPOs	Large IPOs	Alternative Exchange	NASDAQ	Low director ownership	High director Ownership
Variables	VIF	VIF	VIF	VIF	VIF	VIF
Director Ownership	1.08	1.39	1.02	1.09	1.05	1.06
Standard Deviation	1.09	1.22	1.05	1.17	1.59	1.13
Log Market Value	1.14	1.05	1.05	1.06	2.35	1.78
High-Tech	1.09	1.16	1.03	1.16	1.42	1.23
NASDAQ	1.11	1.32			2.01	1.85
Mean VIF	1.10	1.23	1.04	1.12	1.68	1.41

Appendix D

Since our dependent variable is in log, we exponentiate the coefficient to calculate the percent change in our dependent variable, for a one percent change in our independent variable. The following formula was used:

$$\left(e^{coefficient} - 1\right) \times 100$$