RETENTION OF EQUITY

CAN IT MITIGATE THE HIDDEN COSTS IN INITIAL PUBLIC OFFERINGS?

SARA ENGSTRÖM

MAJA ÄNGERUD

Bachelor Thesis

Stockholm School of Economics

2019

Retention of Equity: Can It Mitigate the Hidden Costs in Initial Public Offerings?

Abstract:

It has been argued that the reason to include lockup agreements when going public is to alleviate the inefficiencies inherent to the IPO market. The hidden costs of asymmetric information and moral hazard have been proposed as the driver of the lockup length as well as the reason for the poor long-term performance of IPOs. In this thesis, we examine 2091 IPOs issued between 2000 and 2015, and hypothesize that asymmetric information and moral hazard are non-mutually exclusive problems. However, firms will exhibit a comparative exposure to one of the problems, which should consequently affect the long-term performance and the use of lockup agreements. We find evidence of the problems being non-mutually exclusive, and that all firms on average underperform long-term. However, there is no evidence of a relative difference in long-term performance between firms in regards to their relative exposure to asymmetric information and moral hazard. We also find that lockup agreements have experienced a homogenization over time. Rather than being driven by moral hazard and information asymmetry, the underlying rationale for the lockup length has merely become the mimicking of a standard. What used to be a contractual feature designed to mitigate the hidden costs inherent to going public, it seems as if lockup agreements have essentially become a purposeless IPO term.

Keywords:

IPO, Lockup Agreement, Long-Term Performance, Moral Hazard, Asymmetric Information

Authors:

Sara Engström (23894)
Maja Ängerud (23912)

Tutor/Examiner:

Marcus Opp, Associate Professor, Swedish House of Finance (Tutor)
Adrien d'Avernas, Assistant Professor, Swedish House of Finance (Examiner)

Acknowledgments:

We would like to thank Marcus Opp for his guidance throughout the research process. Furthermore, we would like to thank Swedish House of Finance for providing the data essential to this research. Lastly, we would like to express our gratitude to Chuck Huber for his is imperative STATA knowledge, without which we would have been lost.

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

Contents

1. Introduction

For many years researchers have sought to find the rationale for the use of lockup agreements in initial public offerings (IPO). Despite the broad consensus with Myers and Majluf (1984) and the adverse selection problem they identify within the process of going public, the results from the numerous studies on what drives the lockup length are inconclusive. Although several explanations have been suggested, most studies verify that either asymmetric information or moral hazard act as such drivers. Research supporting the notion that management and early investors retain part of a firm's equity to signal quality to new investors, and thus reducing the effects of information asymmetry, include Leland and Pyle (1977), Courteau (1995), and Field and Hanka (2001). Meanwhile, others are of the firm belief that the retention of equity is driven by moral hazard, and that this retention mitigates agency costs and incentivizes management to act in accordance with the shareholders' best interest (Gao & Siddiqi, 2012; Brav & Gomper, 2003). A few studies attempt to bring nuance to the discussion by offering perspectives where both asymmetric information and moral hazard could explain the reason to include lockup agreements in the IPO process. Yung and Zender (2010) suggest that some firms indeed use the lockup agreement as a signaling device. However, there will also exist firms that are more acutely exposed to moral hazard problems, that consequently choose the lockup length as to mitigate the associated agency costs. Most research has focused on the price reaction at the expiration of the lockup period, but in recent papers this has been suggested as unfitting if one wishes to empirically show the effects of moral hazard (Gao & Siddiqi, 2012). If firms indeed retained equity for a longer time because they experienced more severe moral hazard problems, the agency costs would not start deteriorating firm value until after the lockup period had expired. The full effect of this deterioration could not be expected to materialize already at the expiration date. Therefore, measuring the long-term performance should shed some additional light on this particular driver of the lockup length.

In this thesis, we draw from the two more recent papers by Gao and Siddiqi (2012) and Yung and Zender (2010). By combining the work of these authors, the long-term performance is utilized to test if both asymmetric information and moral hazard could be the reason to include lockup agreements in the IPO process. The costs inherent to these two problems should be non-mutually exclusive, but one problem should be the driver of the lockup length. In addition to explaining the underlying rationale for lockup agreements, we also direct effort towards a broader examination of how long-term performance differs depending on what problem a firm has comparative exposure to. The contribution to the field consists of applying the theorization of two separate papers and using a more up-to-date IPO data sample than previous research. Through the collection of 2091 IPO observations from 2000 to 2015, we provide an updated analysis of the long-contested rationale for lockup agreement and the long-term performance of IPOs.

We hypothesized that comparative exposure to either moral hazard or asymmetric information should be a determinant for the long-term performance of firms since the cost of asymmetric information and moral hazard occur at different points in time. Venture capital (VC) backing, underwriter prestige, and firm size, are proxies for asymmetric information that enable the market to include the cost of asymmetric information in the pricing decision (Yung & Zender, 2010; Megginson & Weiss, 1991). However, there are no available proxies for moral hazard, which should prohibit the market to work efficiently. The deterioration of firm value caused by agency costs will be most severe after the expiration date of the lockup agreement, i.e. when the initial investors and managers are allowed to sell the shares subject to the agreement (Gao & Siddiqi, 2012). This cost will affect the owners of the company at that point in time, i.e. the shareholders. Meanwhile, the cost of asymmetric information has already been accounted for at the time of the issue. If moral hazard causes firm value deterioration long-term, while asymmetric information does not, the long-term performance should be worse for firms with a comparative exposure to moral hazard. However, we find no evidence of such a relative difference. Nonetheless, we find evidence of long-term underperformance, regardless of exposure to moral hazard and information asymmetry, suggesting that no firm is solely exposed to one of the two problems.

Asymmetric information and moral hazard exist in all firms, but it was hypothesized that the relative exposure to these problems should be a determinant for the use of lockup agreements. More severe moral hazard problems should entail a longer lockup period, and thus be negatively correlated with long-term performance. Irrespectively of the severity of asymmetric information, the length of the lockup period should be uncorrelated with long-term performance. The results indicate that there is no correlation between the lockup-length and the long-term performance, regardless of exposure to moral hazard and information asymmetry. This indicates that moral hazard is not the driver of lockup length, but that asymmetric information could be. However, we suggest that there has been a homogenization of the lockup-lengths over time, which in turn imply that the underlying rationale is neither moral hazard problems nor information asymmetry. Instead, firms seem to set the same lockup length as their peers, a result of a general standardization of IPO terms. As shown in previous research, lockup agreements are believed to have had historical importance in the mitigation of the cost of asymmetric information and moral hazard. However, the homogenization of these agreements has left them redundant.

2. Literary Review and Hypothesis Development

2.1. Initial Public Offerings Reviewed

An IPO is the process of selling stock to the public for the first time. It offers the firm better access to capital and enhances liquidity (Berk & Demarzo, 2014). Ritter and Welch (2002) suggest that the reason firms go public is both the desire to raise capital, but also a way for founders and early shareholders to cash out some of the wealth invested in the firm. Further, they stress the fact that an IPO includes extensive interaction with the market which entails increased complexity and costs for the issuing firm. When a firm goes public, the management, founders and early shareholders typically have more information about the firm than the outside investors. Consequently, the IPO process is subject to adverse selection problems (Myers & Majluf, 1984). This includes the value and quality of the firm, and how the management will behave post-IPO. The different characteristics of an IPO, e.g. underpricing, can to some extent mitigate these problems (Hoque, 2014). The reason for underpricing is also a debated topic, but there is a consensus that it effectively decreases asymmetric information, e.g. since only high-quality firms can afford to issue their stock at a discount (Ritter & Welch, 2002).

2.2. Lockup Agreements

The role of lockup agreements, and how it is used to mitigate the hidden costs inherent to going public, has also been well covered by research. The focus has been to decide whether lockup agreements are set up to mitigate asymmetric information or moral hazard problems. Some additional theories exist, e.g. that lockup agreement are used as a device for the underwriting bank to extract further compensation from the issuer (Brav & Gomper, 2003). However, reducing information asymmetry and agency costs have been the prime focus of previous research.

Having a lockup agreement prevents the issuing security holders from selling their remaining shares for a specified period, typically 180 days (Aggrawal, Krigman & Womack, 2001). The lockup agreement is made between the issuing firm and the underwriters, and in the US, lockup agreements are not commanded by law, and thus not regulated by SEC or any other insider trading regulation (Brav & Gomper, 2003; Bradley et al., 2001). The number of shares subject to the lockup agreement is substantial, often greater than the amount not subject to the agreement. For this reason, the structure of the agreement, as well as the activity at lockup expiration, has proven to have a significant influence on the market price of the stock (Bradley et al., 2001). As mentioned, the reason for using lockup agreements have been subject to a great deal of scientific effort, however, the results are inconclusive.

2.2.1. Asymmetric Information and the Theory of Signaling

One explanation for the use of a lockup agreement in an IPO is to signal firm quality (Leland & Pyle, 1977; Brau, Lambson & McQueen, 2005). Courteau (1995) describes how it is difficult for firms to convince investors, who have limited knowledge of the issuing firm, to pay the "true" value for the shares issued, and they claim that this is driven by information asymmetry. Most companies face problems regarding the information asymmetry between managers and shareholders (Myers & Majluf, 1984). The managers typically have more accurate information regarding the value of the company and its equity. Signaling firm quality is a way to reduce the effects of this information asymmetry. Asymmetric information problems are particularly present when issuing stock for the first time since non-public companies do not face as strict disclosure requirements as public companies do (Atiase, Bamber & Freeman, 1988). Consequently, the asymmetric information gap is bigger before and at the time the firm is going public, compared to when the company is public.

It is argued that lockup agreements are used as a way of signaling firm quality to the public, as insiders of the firm agree not to sell personal shares and commit to the entity for a specified period (Brau, Lambson & McQueen, 2005). This action is costly for the individual subject to the lockup agreement since it limits the ability to hold a fully diversified portfolio. For owners of a low-quality firm, this cost will be higher. Assuming the same level of risk, the low-quality firm has a greater chance of loss. For this reason, the use of lockup agreements should be a more attractive tool to signal firm quality for high-quality firms (Courteau, 1995). There will be a trade-off for high-quality firms as they wish to set the lockup length long enough to make it too costly for low-quality firms to mimic, but short enough to minimize the risk of holding a non-diversified portfolio. That is, insiders of a high-quality firm lockup their shares to the extent that they are not clustered with low-quality firms (Yung & Zender, 2010).

In addition to using a lockup agreement, firms can adopt other methods to signal firm quality. Using a reputable underwriter has been shown to reduce asymmetric information and thus act as a signal of firm quality (Beatty & Ritter, 1986). It has also been shown that if the IPO is backed by a VC firm similar effects arise (Megginson & Weiss, 1991). Like underwriters, VC firms have an incentive to maintain a certain reputation and therefore the presence of a VC firm is a positive signal towards outsiders (Yung & Zender, 2010). As mentioned, signaling firm quality is a way to manage asymmetric information, and Beatty and Ritter (1986) point out that the size of a firm affects the information asymmetry as well. Larger firms typically have lower information asymmetry problems because a firm's assets should become more transparent and easier to value, as the firm grows. The need to signal firm quality should thus be lower for larger firms. In addition to signaling firm quality, asymmetric information problems can be alleviated by offering a discount to the investors, i.e. underpricing of the stock (Hoque, 2014).

2.2.2. Agency Costs and the Alleviation of Moral Hazard

Another suggested reason for using a lockup agreement in an IPO is as a tool to reduce agency costs (Brav & Gomper, 2003). Agency costs affect most companies where managers are not the sole owners of the company. The costs arise when managers do not act in the best interest of the shareholders but instead act to maximize their personal wealth or other personal interests. Due to the presence of agency costs, and the fact that ownership of the company is shifted, issuing an IPO imposes moral hazard problems. This shift implies a reduction of the risks of the initial owners as new shareholders take on a part of the risk. The expression of moral hazard was first used in the context of insurance (Goolsbee, Levitt & Syverson, 2016). Moral hazard occurred when excessive risks were taken by the insured party, increasing the risk of the insurance company. The IPO can be seen as an insurance because of the risk shifting from initial owners to new investors. In an insurance context, moral hazard is avoided by using coinsurance. In an IPO, the moral hazard problems are argued to be addressed when using lockup agreements (Brav & Gomper, 2003). Brav and Gomper (2003) call this a commitment device to alleviate moral hazard problems and claim that this is the most reasonable explanation for the usage of lockup agreements. Since the insiders of the firm commit to the firm by holding the stock, the interest of shareholders and managers are better aligned.

While VC backing, a prestigious underwriter, and the size of the firm alleviate the problems with asymmetric information, the implications for agency problems are not quite as clear (Yung & Zender, 2010). An underwriter can verify the valuation of assets, but not as easily verify that managers have incentives corresponding to those of its shareholders. Yung and Zender (2010) therefore suggest that underwriters mitigate the information asymmetry problems more relative to the problems of moral hazard. Similar reasoning is applicable to the size variable. A larger firm is more transparent on average, but it does not have to imply that the management's future actions are more aligned with shareholders' expectations. Further, Field and Hanka (2001) and Bradley et al. (2001) illustrate how VC backed firms experience a bigger drop in share price at the expiration date of the lockup agreement, than non-VC backed firms. For these firms, going public is often a procedure in which VC firms convert their initial investment into cash i.e. "cashing out". Therefore, VC backed firms can be interpreted as having larger agency problems, as early investors will not stay with the firm post-IPO, ensuring a good future performance. In contrast to asymmetric information problems, moral hazard cannot be alleviated through underpricing of the stock (Hoque, 2014).

2.2.3. Non-Mutually Exclusive Problems

Most research conducted on lockup agreements seek to prove that either asymmetric information or agency problems is the reason for lockup agreements (Gao & Siddiqi, 2012). Yung and Zender (2010) instead suggest that the assumption of these two theories being mutually exclusive is incorrect. In their research, firms are split into two sub-groups based on what problem is more acute. They argue that both problems are inherent to an IPO situation, but a firm will have a relatively higher exposure to one of them, i.e. a comparative exposure. Based on VC backing, underwriter prestige, and size of the firm, Yung and Zender (2010) divide firms with more asymmetric information exposure into one group (i.e. small sized, non-VC backed, and non-prestigious underwriter) and the rest into another group, which are expected be relatively more exposed to moral hazard problems. They conduct tests on the sub-samples separately, and find that both asymmetric information and agency problems determine the use of lockup agreements.

2.3. Long-Term Performance

One of the most researched anomalies within IPO market efficiency is the long-term performance. Numerous studies have been conducted, and most of these show that IPOs on average underperform the market (Haman, Chalmers & Fang, 2017). Ritter (1991) explains how the procedure employed when measuring long-term performance has a great impact on the results received. For example, the choice of benchmark index, return measures, and what firms to include in the analysis will affect the obtained result. Some indices might have performed above or below the market for a certain period, and some firms might be of particularly low quality, or have been delisted during the estimated period and thus heavily affect the average performance of the sampled firms. In a later article, Ritter and Welch (2002) describe how high-quality risk-adjusted performance measures are not yet available. This implies that it remains unclear to what magnitude IPOs underperform in the long-run. However, there is a broad consensus that firms do underperform the market in the three subsequent years of the IPO.

2.3.1. IPO Market Inefficiencies

At the expiration date, the individuals who have been affected by the lockup agreement are allowed to sell their shares. Field and Hanka (2001) researched the price effect on the market at the expiration date of the lockup period and concluded that IPOs challenge the theory of market efficiency. The efficient market hypothesis state that all investments entail a zero net present value. Investments with equivalent risk should experience the same return, and the market forecasts this risk through assessment of the available information of a security (Berk & DeMarzo, 2014). Field and Hanka (2001) find that there is a significant drop in the market price the day of the expiration, and further show that this drop is inconsistent with the idea of market efficiency. They show that the abnormally negative returns are partly due to a decrease in the demand curve and the worse-than-expected insider sales, i.e. reasons that point towards the fact that the market does not correctly anticipate the events at the expiration date. If the theory of market efficiency was true, there should be no reaction of the sorts found by Field and Hanka (2001) nor in any of the other extensive studies of expiration date effects e.g. Brav and Gomper (2002) and Bradley et al. (2001). Under the condition of an efficient market, the market would be able to incorporate the information available into the pricing of the IPO. As previously mentioned, the idea of market efficiency has also been challenged by Ritter (1991) and his findings related to the long-term performance of IPOs. Shiller (1990) further explores the idea of the rational expectations model in the pricing of equity and sheds light on the flaws of the model that ultimately affects the market prices.

2.3.2. Lockup Agreements and Long-Term Performance

Gao and Siddiqi (2012) conducted a study with the intention to explain the reason for lockup agreements by relating the length of the lockup period to the long-term performance. Since most previous research has focused on explaining the rationale for lockup agreements based on the effects on the stock price around the expiration date, this more recent addition to the field offers new points of comparison. Gao and Siddiqi (2012) suggest that if signaling is the reason for longer lockup periods, then this should entail a long-term performance not significantly different from normal return. If agency cost is the reason for longer lockup periods, then firms with more severe agency problems will have longer lockup periods. This would be manifested as an abnormally negative long-term performance since these agency costs would deteriorate firm value in the long-run. By analyzing the performance over a three-year period following the issue, a substantial effect of the potential deteriorated firm value will be captured. Gao and Siddiqi (2012) reject signaling and find support for agency costs being the most prominent reason for the various lockup lengths.

2.4. Hypothesis Development

For all firms issuing their stock for the first time, problems with both asymmetric information and moral hazard will exist. However, some firms will have a more acute problem with asymmetric information, while others will have a more acute problem with moral hazard (Yung & Zender, 2010). Both information asymmetry and moral hazard problems will incur costs for the issuing firm but in different ways. The costs occur at different points in time and the market differs in how efficiently it can account for these costs. The most frequently used proxies for asymmetric information are firm size, underwriter prestige, and VC backing. However, there are no comparable proxies for moral hazard. Additionally, asymmetric information problems, unlike moral hazard, can be alleviated through underpricing (Hoque, 2014). In the pricing of an IPO, the market participants use the information asymmetry proxies to conduct more substantiated pricing decisions, and the market will be better able to account for these costs in the pricing of the IPO. Therefore, firms mitigate the problem with asymmetric information either through underpricing of their stock or retaining a portion of the equity, resulting in a cost in the form of an under-diversified portfolio (Yung & Zender, 2010; Courteau, 1995). Either way, the cost is inflicted right away.

In contrast, due to the lack of proxies for moral hazard, the market participants will not be able to take these costs into account in the pricing of the IPO to the same extent. As mentioned, it is not possible for firms to alleviate moral hazard problems using underpricing (Hoque, 2014). They can, however, use lockup agreements to try to convey outside investors that they will behave in a way that is aligned with shareholder expectations. This gives rise to an immediate cost through an under-diversified portfolio. However, at the expiration of the lockup period, those who were subject to the lockup agreement are free to sell their shares, and the moral hazard problems reappear (Gao & Siddiqi, 2012). Because agency costs could not be mitigated using underpricing at the issue, the costs are now paid by the owners of the firm - the shareholders. The inability for the market to correctly anticipate all costs in IPOs has been proposed in the work by Field and Hanka (2001), where they discard the theory of an efficient market in an IPO setting. In this thesis, we propose that moral hazard is one reason for this market failure, and hypothesize that firms with comparatively more severe moral hazard problems will perform worse long term than the firms with comparatively higher information asymmetry.

Hypothesis 1a: For firms comparatively more exposed to moral hazard problems, long-term performance should be abnormally negative as agency cost will deteriorate firm value over time.

Hypothesis 1b: For firms comparatively more exposed to asymmetric information problems, long-term performance should not deviate from the normal return as these cost are inflicted at the issue date.

Gao and Siddiqi (2012) suggest that firms with longer lockup periods are subject to more severe agency costs. For the firms with agency costs as their primary problem, longer lockup periods should correspond to higher agency costs deteriorating firm value following the lockup expiration. The aspects of asymmetric information should be incorporated in the pricing of the IPO, irrespectively of its severity, and the length of the lockup period should not affect long-term performance.

Hypothesis 2a: For firms comparatively more exposed to moral hazard problems, the lockup length should correlate negatively with the long-term performance.

Hypothesis 2b: For firms comparatively more exposed to asymmetric information problems, the lockup-length should be uncorrelated with the long-term performance.

3. Method

3.1. Data Collection

The initial sample was constructed using Thomson Securities Data Corporation (SDC), the most commonly used database in IPO research (WRDS, 2019). This sample consisted of 3545 new issues of US stock from 2000 to 2015. Limiting the sample, and consequently the research, to the US was mainly due to the fact that lockup agreements are rather homogenous and standardized in this market. Hoque (2011) testifies of the many regional differences within Europe when it comes to regulatory restrictions when issuing stock. This makes it difficult to compound IPO data from different markets without extensively controlling for these differences. Additionally, there is large number of IPOs taking place in the US which makes the sample size suitable. The SDC database was also used to retrieve necessary IPO features such as the issue date, length of the lockup period, and other aspects related to the control variables of the regressions.

The historical return of each observation was retrieved from the Thomson Reuters Eikon database. Due to some minor limitations in retrieving return data for all the observations, the sample was filtered to only include IPOs with this information available in the Eikon database. We excluded all security types but common shares and the sample was also slightly adjusted for other anomalies. When excluding observation from the initial sample in relation to these adjustments, the sample shrank to 2091 observations included in the final regressions and other statistical tests. As explained by Ritter (1991), the choice of which firms to include in the data heavily affects the results obtained. There is a risk that the firms eliminated from the data set, due to the difficulties of finding historical returns, were overly represented by firms of either low quality or firms that were delisted shortly after the IPO. This could imply that the data set was biased towards better performing firms. Therefore, the data set might inhabit, on average, higher return than the population.

In order to calculate any abnormal return for the sample the S&P 500 value-weighted index and the S&P 500 equal-weighted index were used as benchmarks. The price of the indices, as of the issue date, as well as three years after the issue date, was collected for every individual observation from the Eikon database. The S&P 500 was chosen due to its general acceptance as a proxy for the market return in the US (Berk & DeMarzo, 2014). Ritter (1991) stresses how the choice of benchmark index can affect the result. Ritter (1991) exemplifies this by criticizing a study that used the NASDAQ Composite index for a period when this index performed worse than its counterparts. However, the S&P 500 indices, as they represent the 500 biggest companies in the US, were deemed to be the best market proxies available.

The calculation of abnormal return exploited the market-adjusted return model in which the returns of the IPO firms were compared to the three-year buy-and-hold return of the indices (Strong, 1992). There were several other approaches available, such as the CAPM model and other multifactor models. However, using the CAPM model was constrained by the limitation of historical beta values available in the Eikon database, and the market-adjusted return model displayed the characteristics necessary to derive the abnormal return from the observed IPO returns.

3.2. Variables

3.2.1. Dependent Variable

The dependent variable in the regressions was abnormal long-term performance. There are two commonly used approaches when calculating abnormal returns, cumulative abnormal returns and buy-and-hold abnormal returns. In line with the advocacy by Barber and Lyon (1996), the long-term performance in this thesis was estimated by the three-year buy-and-hold return of the stock following the IPO. It was defined in the Eikon database as follows:

$$BHR_{observation} = \frac{P_{3\,years\,post-issue} - P_{offer}}{P_{offer}} + Dividend \tag{1}$$

The abnormal return was defined as the difference between the return of the observation and the three-year buy-and-hold return of the benchmark indices. The three-year buy-and-hold return of the indices was calculated as follows:

$$BHR_{index} = \frac{P_{3\,years\,post-issue} - P_{at\,offer\,date}}{P_{at\,offer\,date}} \tag{2}$$

There is no dividend in equation 2 since the prices of the S&P 500 indices were already adjusted for dividends. The abnormal return, the dependent variable in the regressions, was calculated as follows:

$$BHAR = BHR_{observation} - BHR_{index} \tag{3}$$

3.2.2. Independent Variable

The independent variable in four out of six regressions was the length of the lockup period, measured in days. In the data set retrieved from SDC, most firms had recorded using lockup agreements in the process of going public. Where there was no such data recorded in SDC it was assumed that no lockup agreement existed and that the lockup length was zero. The assumption was made due to the fact that there were no observations that had explicitly zero days as the lockup length.

In two out of six regressions, the independent variable was a dummy variable related to the sub-samples. The observation received a value of 1 if it was relatively more exposed to moral hazard problems and 0 if it was relatively more exposed to information asymmetry. This independent variable was created to measure any relative difference between the sub-groups. See section 3.3 for the full methodology of the sub-sample creation.

3.2.3. Control Variables

Previous studies have shown that other variables than lockup-length affect the long-term performance of an IPO (Ritter & Welsh, 2002). In this thesis, the following was included in the regression: initial return, size of the firm, if the firm was a high-tech company, and the certification effect of being backed by an esteemed underwriter, VC firm or auditor. Additionally, a variable related to the year of the issue was included in the regression. By including these variables in the regression, the results were controlled for effects that, if not included, would have lowered the reliability of the findings.

Three out of these control variables were constructed as dummy variables. One dummy variable was a high-tech industry dummy, where the company received a value of 1 if their primary business was related to the high-tech industry and 0 if it was not. A second dummy variable was a VC backing dummy, where 1 equaled being VC backed and 0 being non-VC backed. VC backed firms and high-tech related businesses were distinguished based on the data retrieved from SDC, where this information was given for each IPO. In line with Gao and Siddiqi (2012), the last dummy variable was related to the auditors of the firm. If the firm used one of the top five ranked auditing firms the company received a value of 1, and 0 if it did not. The top five auditing firms were identified as KPMG, PricewaterhouseCoopers (PwC), Ernst & Young (EY), Deloitte & Touche, and Arthur Andersen.

In addition to these dummy variables, a control variable related to the reputation of the underwriter was created since the prestige of the underwriter has been proven to positively correlate with long-term performance (Carter, Dark & Singh, 1998). Loughran and Ritter (2004) created an underwriter ranking system based on that of Carter and Manaster (1990). This ranking system was available for download on Warrington College's website and was matched with the underwriter information in the data set retrieved from SDC (Ritter, 2019). The scale of this system was 1 through 9, with 1 being the least prestigious underwriter, and 9 the most prestigious underwriter.

Moreover, a control variable related to the size of the firm was constructed. The size ranking was created by addressing a number, ranging from 1 to 7, with 1 being the smallest in size, and 7 the largest in size. The rank was given based on the firm's total assets before the issue, a variable included in the original data set from SDC.

Finally, a control variable related to the underpricing was included in the regression. If the initial return takes on positive values, it can be interpreted as an underpricing of the stock. The initial return was calculated as follows:

$$IR = \frac{P_{closing\ price\ of\ first\ trading\ day} - P_{offer}}{P_{offer}} \tag{4}$$

3.3. Sub-Sample Creation

As mentioned, Yung and Zender (2010) examine asymmetric information and moral hazard as non-mutually exclusive drivers of the lockup length, and their approach is to divide the total sample into two sub-samples depending on the proposed driver of the lockup length. In this thesis, we exploited the sample splitting used by Yung and Zender (2010). During the data construction, the total sample was divided into two sub-groups, based on the predictors; VC backing, prestige of underwriters and firm size. These predictors have proven to be useful proxies of the degree of asymmetric information in a firm. If a firm is VC backed, large, and uses a prestigious underwriter in the process of going public they have less exposure to asymmetric information. Additionally, studies have shown that being backed by a VC firm can imply increased agency costs since it is common for VC firms to "cash out" as the stock is issued (Bradley et al., 2001). Furthermore, Yung and Zender (2010) argue that underpricing is a useful diagnostic tool since it exists because of asymmetric information, and is not affected by commitment issues. Therefore, after the sub-sample division, they control that the average underpricing differs between their sub-samples and that the sub-group relatively more exposed to information asymmetry underprice more. To ensure that the sub-samples were constructed in alignment with the work of Yung and Zender (2010), we too compared the average underpricing of the sub-samples.

In the construction of the two sub-samples, firms with an underwriter with a ranking equal to or above eight, and a size rank of at least four was defined as one sub-sample. Additionally, if the issuing firm was backed by a VC firm, which approximately 600 of the 2091 firms where, they were also included in this sub-sample. These were the firms for which moral hazard was the primary problem. The rest of the firms constituted the second sub-sample, where the most acute problem was asymmetric information. The sub-samples consisted of 1070 and 1021 observations respectively.

As mentioned, a dummy variable related to the sub-sampling was included in the regressions. However, regressions were also conducted on the sub-samples separately.

3.4. Regressions and Statistical Tests

A weighted least square (WLS) regression was performed and resembling the paper by Gao and Siddiqi (2012), the regressions were estimated as follows:

$$\begin{aligned} BHAR_i = \beta_0 &+ \beta_1 Lockup\ Days_i + \beta_2 Initial\ Return_i + \beta_3 Size_i \\ &+ \beta_4 High - Tech_i + \beta_5 UW\ Ranking_i + \beta_6 VC\ Backed_i \\ &+ \beta_7 Auditor_i + \beta_8 Moral\ Hazard_i + \beta_9 Year_i + \varepsilon_i \end{aligned} \tag{5}$$

$$\begin{aligned} BBHAR_i = \beta_0 &+ \beta_1 Lockup\ Days_i + \beta_2 Initial\ Return_i + \beta_3 Size_i \\ &+ \beta_4 High - Tech_i + \beta_5 UW\ Ranking_i + \beta_6 VC\ Backed_i \\ &+ \beta_7 Auditor_i + \beta_8 Year_i + \varepsilon_i \end{aligned} \tag{6}$$

The WLS regression works similarly to the classical ordinary least squares (OLS) regression. The difference lies in how the observations are weighted. It is a method that works better on data sets that exhibit some degree of heteroscedasticity, i.e. when the error terms differ in size. Our total sample, as well as both sub-sample, exhibited heteroscedasticity (see Appendix A). Since an OLS gives the error terms equal weights the observations with bigger differences have a greater impact on the regression than the observations with smaller. The WLS regression corrects for this problem by applying lower weights to the large error terms (Newbold, Carlson & Thorne, 2013).

In addition to the regression analysis, other statistical tests were performed to examine if and how abnormal return on average differed from zero. The following tests were applied; Johnson's skewness adjusted t-test, calculation of the 95 percent confidence interval of the median abnormal return, and quantile regression. Furthermore, robustness tests were performed on the regressions to examine the reliability of the obtained results.

4. Results

4.1. Sample Statistics

Table 1 illustrates the basic outline of the data sample. Consistent with previous research, the initial return is on average positive, suggesting that stocks are underpriced when issued on the market for the first time (Ibbotson, 1975; Brau & Fawcett, 2006). The mean initial return is higher for the asymmetric information sub-sample compared to the moral hazard sub-sample. This indicates that the sub-sample division was made accurately since underpricing is recognized as a diagnostic tool for information asymmetry (Yung & Zender, 2010). However, both sub-samples display positive initial returns, which indicates that both sub-samples experience information asymmetry and that the problems are, in fact, non-mutually exclusive.

The two benchmarks used to measure abnormal return was an equal-weighted index and a value-weighted index. There is a difference between mean and median abnormal return, regardless of benchmark, which suggests that the observations are positively skewed. One trait inherent to stock returns is that it has a limited downside, but unlimited upside. Stock prices can plummet to zero but can increase by well beyond a hundred percent. The fact that mean abnormal returns are positive can suggest two things; either that the observed IPOs have performed abnormally well three years after the issue, or that there are a few observations with large returns, heavily impacting the mean calculation. Further examination shows that the total data sample of 2091 observations include less than 90 observations that have a positive return greater than 200 percent, matched against both the value-weighted and the equal-weighted index. These observations, in turn, range from 200 percent to more than 1280 percent, which consequently induces a skewness in the data set.

The median abnormal return, however, is negative regardless of benchmark index. This implies that at least half of the observed IPOs underperformed long-term. Previous research supports that IPOs on average underperform long-term (Ritter, 1991). Further tests were conducted on the abnormal return figures to determine whether the underperformance was statistically significant in the obtained sample.

Table 1: Sample statistics

	Total Sample			Asymmetric Information			Moral Hazard		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
Lockup Days	2086	147	180	1019	133	180	1067	160	180
UW Ranking	2091	7,6	9	1021	6,8	8	1070	8,4	9
Offer Price	2091	14,2	14	1021	13,7	15	1070	14,6	14
Initial Return	2091	39%	2%	1021	61%	0%	1070	17%	9%
Value-Weighted Abnormal Return	2091	10%	-17%	1021	14%	-16%	1070	6%	-20%
Equal-Weighted Abnormal Return	2091	1%	-25%	1021	5%	-23%	1070	-3%	-30%

Note: N is the number of observations. Lockup Days is the length of the lockup period presented in days. UW Ranking is a ranking of the underwriter of the IPO. Offer Price is the price of the stock in the IPO. Initial Return is first day return of the stock. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value-weighted index. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal-weighted index. Total Sample, Asymmetric Information, and Moral Hazard refers to the sample being used.

Further, the sample statistics illustrate how the average initial return for the total sample is 39 percent for the sampled years. This is higher than illustrated by Gao and Siddiqi (2012). The discrepancy is assigned to the somewhat extreme initial returns seen in the latter part of the sample, years 2011 to 2012 and 2014 to 2015, as shown in table 2. The study conducted by Gao and Siddiqi (2012) did not include IPOs for those years, wherefore comparing means is difficult. However, similarities in the data characteristics have been found for the earliest years of the sample. Again, comparing the obtained sample with the sample used by Gao and Siddiqi (2012), there is a reasonable resemblance regarding the observed number of IPOs being conducted between 2000 and 2003. The existing variation can be assigned to the difference in methodology of matching the IPO data with return figures. Gao and Siddiqi (2012) employed the CRSP database, and our data set was constructed using Eikon. In our sample, the observations without available return data were excluded, creating a certain selection bias different from that of Gao and Siddiqi (2012). Many of the patterns expected, and documented in previous research, such as a drop in the IPO activity post-crisis are also captured in our data set. In table 2 it is shown that the number of observations greatly decreases after the burst of the IT bubble in 2000/2001, and after the financial crisis in 2007/2008.

Table 2: Yearly distribution statistics

Years	N	Not 180 (%)	High -tech (%)	Auditor (%)	UW Ranking	Lockup Days	VC Backed (%)	Initial Return (%)	Value-Weighted Abnormal Return (%)	Equal-Weighted Abnormal Return (%)
2000	234	52	84	95	8.0	89	68	40	-11	-40
2001	85	32	34	92	8.1	123	28	4	56	34
2002	92	33	28	92	8.3	121	22	-1	31	7
2003	79	10	33	91	7.6	164	28	5	-6	-22
2004	165	7	40	90	7.9	170	36	7	16	6
2005	149	4	31	76	7.4	168	21	-4	0	0
2006	153	9	39	68	7.6	167	34	-1	-2	-3
2007	185	12	38	65	7.9	161	35	-4	16	8
2008	27	11	22	70	7.9	167	26	-15	26	8
2009	58	29	33	90	8.4	130	19	-6	-7	-17
2010	112	17	32	76	7.7	149	32	-5	8	1
2011	111	28	37	63	6.5	130	28	77	26	22
2012	130	19	38	64	7.1	148	30	60	98	90
2013	190	17	44	70	7.4	153	33	10	-15	-15
2014	204	11	58	69	7.3	161	45	239	-7	-4
2015	117	9	56	62	7.5	162	46	51	-18	-13
Total	2091	19	45	77	7.6	147	37	39	10	1

Note: N is the number of observations. Not 180 is the percentage of IPOs not having a lockup length of 180 days. High-Tech is the percentage of firms operating within a high-tech industry. Auditor is the percentage of firms using one of the top 5 auditors. UW Ranking is the mean underwriter ranking. Lockup Days is the mean lockup length, presented in days. VC Backed is the percentage of firms being venture capital backed. Initial Return is the mean first day return of the stock. Value-Weighted Abnormal Return is the mean abnormal return benchmarked against the S&P 500 value weighted index. Equal-Weighted Abnormal Return is the mean abnormal return benchmarked against the S&P 500 equal weighted index.

As shown in table 2, there seems to be a homogenization of lockup lengths. This is consistent with the research by Field and Hanka (2001). Over the course of the sampled years, the percentage of firms using a lockup length different from 180 days is decreasing. Table 3 illustrates roughly the same statistics as table 2, apart from it being grouped in relation to the lockup lengths. The firms using 180 days when going public constitute 1559 observations of the total 2091. This further indicates a homogenization in the number of lockup days. Moreover, this group of firms is more often high-tech firms, using one of the top five auditors, and are more often VC backed.

Table 3: Lockup length distribution statistics

Lockup Days	N	High-Tech	Auditor	UW Ranking	Lockup Days	VC Backed	Initial Return	Value-Weighted Abnormal Return	Equal-Weighted Abnormal Return
<180	466	34%	61%	6.4	14	22%	149%	27%	13%
=180	1559	49%	83%	8.1	180	42%	8%	3%	-3%
>180	66	32%	42%	5.9	319	17%	-1%	46%	38%
Total	2091	45%	77%	7.6	147	37%	39%	10%	1%

Note: N is the number of observations. High-Tech is the percentage of firms operating within a high-tech industry. Auditor is the percentage of firms using one of the top 5 auditors. UW Ranking is the mean underwriter ranking. Lockup Days is the mean lockup length, presented in days. VC Backed is the percentage of firms being venture capital backed. Initial Return is the mean first day return of the stock. Value-Weighted Abnormal Return is the mean abnormal return benchmarked against the S&P 500 value weighted index. Equal-Weighted Abnormal Return is the mean abnormal return benchmarked against the S&P 500 equal weighted index.

In the method section 3.2.2, we explained how the number of lockup days was assumed to be zero when no lockup period was recorded in the data retrieved from SDC. This can be perceived as inducing a certain selection bias. However, at closer examination of table 3, this bias is perceived as negligible. As mentioned, Courteau (1995) describes how it is difficult to convince investors, with limited knowledge of a firm's value and quality, to pay the "true" value of a firm in an IPO. To communicate the value of a firm, the issuer can either retain a part of the firm's equity, i.e. undertake costs in the form of an under-diversified portfolio, or through issuing the stock at a discount. The issuing firm can use one of the methods or a combination of the two so that the costs equal the magnitude of the information asymmetry problem at hand. If the issuing firm chooses to alleviate the cost only through retention of equity, they do not need to underprice. The opposite is true for underpricing. As seen in table 3, the firms with a lockup period shorter than 180 days have an average initial return of 149 percent, indicating that they give large discounts to investors. In contrast, the firms with lockup periods greater than 180 days have on average an initial return of -1 percent, indicating that they do not issue their stock at a discount. This implies that the recorded lockup agreements from SDC follow the patterns of previous research and that the assumption made in the method section does not induce any drastic bias errors.

4.2. Testing Abnormal Return

To test hypotheses 1a and 1b, the mean abnormal return was first examined using a t-test. As mentioned in the summary statistics section, the data set inhabits a skewness. Skewness and kurtosis tests were performed on the data, and the data set exhibited both (see Appendix B). The Johnson t-test was employed, due to it being adjusted for skewness. The result, as illustrated in Appendix C, is that the null hypothesis of the mean being zero cannot be rejected, regardless of benchmark employed. Furthermore, the Johnson t-test was conducted on the individual sub-samples with similar results, i.e. it cannot be proven that the mean return of either of the sub-samples deviates from normal returns.

However, when the sample is skewed it is argued that the median offers a better view than the mean (Newbold, Carlson & Thorne, 2013). Furthermore, the sample does not meet the prerequisite of normal distribution assumed in a t-test, and therefore the t-test presents uncertain results at best (see Appendix B). Instead, the confidence interval of the medians was studied, where no assumptions are made about the distribution of the data. As shown in table 4, the 95 percent confidence intervals for the median of both sub-samples, using both benchmarks, lie below zero. That is, both firms relatively more exposed to moral hazard and asymmetric information have abnormally negative returns in the long-run. Therefore, we reject hypothesis 1b but accept hypothesis 1a. In other words, it is shown that firms relatively more exposed to moral hazard have abnormally negative returns in the long-run but it cannot be concluded that firms relatively more exposed to information asymmetry experience normal returns. This further indicates that the problems are non-mutually exclusive. However, the firms comparatively exposed to moral hazard have lower median abnormal returns, suggesting that the deterioration of firm value is greater for these firms, compared to those relatively more exposed to asymmetric information. This could be interpreted to cohere with the notion that the comparative exposure has an implication for the magnitude of the underperformance. However, as the confidence intervals are overlapping the statistical significance of this interpretation can be questioned. The confidence intervals of the median abnormal return for the total sample also lie below zero. This is consistent with previous research on the long-term performance of IPOs, i.e. the rejection of the theory of an efficient market, and that IPOs on average underperform long-term (Ritter, 1991).

Table 4: Calculation of binominal exact 95 % confidence intervals of median abnormal return

Benchmark/Sample	Variable	N	Percentile	Centile	-- Binom. Exact -- [95% Conf.	Interval]
Equal-Weighted Benchmark, Total Sample	Abnormal Return	2091	50	-25.39%	-30,02%	-22,34%
Value-Weighted Benchmark, Total Sample	Abnormal Return	2091	50	-17.39%	-21.89%	-13.64%
Equal-Weighted Benchmark, Asymmetric Information	Abnormal Return	1021	50	-23.16%	-28.32%	-18.50%
Value-Weighted Benchmark, Asymmetric Information	Abnormal Return	1021	50	-16.15%	-21.61%	-9.79%
Equal-Weighted Benchmark, Moral Hazard	Abnormal Return	1070	50	-29.81%	-36.17%	-22.88%
Value-Weighted Benchmark, Moral Hazard	Abnormal Return	1070	50	-19.53%	-26.83%	-14.00%

Note: Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample, Asymmetric Information, and Moral Hazard refers to the sample being used. N is the number of observations. Centile is the median.

An additional way of examining the median abnormal return is using quantile regression. A quantile regression is a regression model that makes no assumption about the distribution of the data. Consistent with the confidence interval calculations in table 4, the quantile regressions illustrate how the median return is negative for the total sample and both sub-samples, regardless of benchmark. Additionally, the moral hazard sub-sample displays a lower median abnormal return than the asymmetric information sub-sample. A complete summary of the quantile regressions can be found in table D1 (see Appendix D).

The tests performed on the median abnormal return suggest that IPOs underperform long-term. Further the tests indicate that there is a relative difference in the long-term performance of firms, depending on what problem the firm has comparative exposure to. However, as the confidence intervals were overlapping, it is of interest to further examine this in a regression. That is, the regressions are used to determine if this indication holds in a more extensive statistical examination. Moreover, the regressions examine if the correlation between lockup length and long-term performance differs across the sub-samples and more particularly if the comparative exposure is a determinant for the use of lockup agreements.

4.3. Regression Results

4.3.1. Previous Research

The regressions on the total sample, as shown in table 5, does not depict many of the patterns described in previous research. Houge et al. (2001) find that there is a negative correlation between long-term performance and initial return. The regression results coincide with their findings, but at an insignificant level. Therefore, it cannot be rejected that the coefficients are different from zero. Additionally, extensive research has been conducted on third-party certifications (Megginson & Weiss, 1991; Beatty & Ritter, 1986). In contrast to these findings, the regressions on the total sample suggest that being VC backed negatively correlates with long-term performance if benchmarked against the value-weighted index. Underwriter ranking and using one of the top five auditing firms both display insignificant coefficients in the regressions on the total sample, regardless of benchmark.

4.3.2. Relative Performance of Sub-Samples

The regressions on the total sample, against both benchmarks, illustrate how the sub-sample dummy, i.e. belonging to the moral hazard sub-sample, has an insignificant effect on abnormal return. In other words, being comparatively exposed to moral hazard problems, as opposed of being comparatively exposed to asymmetric information problems, has a no effect on the future performance. When examining the medians of the sub-samples, it was shown that both sub-samples experienced abnormally negative returns, while it was hypothesized that only firms relatively more exposed to moral hazard would. Despite the deviation from hypothesis 1b, the median abnormal returns in the calculated confidence intervals indicated that there was an aspect of diminishing firm value related to being relatively more exposed to moral hazard problems. However, this is not verified by the moral hazard dummy variable in the regressions. This consequently lowers the reliability of the implied difference in performance between the two sub-samples. If there is a correlation between long-term performance and the comparative problem inhabited by a firm, this correlation is too weak to appear in this more extensive statistical examination.

Table 5: Regression results

	Total Sample		Asymmetric Information		Moral Hazard	
VARIABLES	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return
High-Tech	-0.0357	0.124	0.0809	0.109	-0.0358	-0.0721
	(0.0690)	(0.0765)	(0.161)	(0.175)	(0.111)	(0.106)
Auditor	0.0162	-0.0736	0.000752	0.141	-0.185	-0.117
	(0.0769)	(0.0774)	(0.0918)	(0.111)	(0.117)	(0.110)
UW Ranking	-0.0344	-0.0354	-0.0613*	-0.0861**	0.0568	0.0427
	(0.0297)	(0.0315)	(0.0364)	(0.0371)	(0.0390)	(0.0406)
Lockup Days	0.00133***	0.000711	0.000846*	0.000444	0.00213**	0.00127
	(0.000403)	(0.000544)	(0.000481)	(0.000703)	(0.000833)	(0.000780)
VC Backed	-0.203	-0.330*			-0.337**	-0.322**
	(0.171)	(0.179)			(0.167)	(0.161)
Size	0.0412	-0.000659	0.0523	0.0431	-0.0472	-0.0539
	(0.0308)	(0.0338)	(0.0479)	(0.0542)	(0.0611)	(0.0596)
Initial Return	-0.00335	-0.00357	-0.00426	-0.00371	-0.0192	-0.0269
	(0.00829)	(0.00766)	(0.00876)	(0.00803)	(0.0883)	(0.0878)
Year	0.00896	-0.0140**	-0.0389***	-0.0468***	0.00915	-0.00415
	(0.00657)	(0.00686)	(0.0110)	(0.0132)	(0.00830)	(0.00802)
Moral Hazard	0.123	0.304				
	(0.181)	(0.188)				
Constant	-0.104	0.334	0.535	0.860**	-0.354	0.0826
	(0.265)	(0.279)	(0.338)	(0.342)	(0.419)	(0.430)
Observations	2,086	2,086	1,019	1,019	1,067	1,067
R-squared	0.015	0.006	0.022	0.025	0.029	0.018

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: High-Tech is dummy variable related to if the firm operates within the high-tech industry. Auditor is a dummy variable related to if the firm uses one of the top 5 auditor. UW Ranking is a variable presenting the prestige of the underwriter. Lockup Days is the lockup length, measured in days. VC Backed is a dummy variable related to if the firm is VC backed. Size is a ranking of the size of the company. Initial Return is the first day return of the stock. Year is a calendar year variable. Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample, Asymmetric Information, and Moral Hazard refers to the sample being used.

4.3.3. Lockup Agreements

As seen in table 5, regressions were conducted to examine if the lockup length affects the long-term performance of the sub-samples differently. The lockup days coefficient was insignificantly different from zero in both sub-samples, when measured against the value-weighted benchmark. When measured against the equal-weighted benchmark, both sub-samples exhibited significant but small coefficients. The coefficients of approximately 0.0008 for the asymmetric information sample, and 0.0021 for the moral hazard sample indicate a negligible correlation between the lockup length and the long-term performance. Additionally, since a significant correlation could only be found when using one out of the two benchmarks, the evidence of a causal relationship is weakened. That is, it cannot be proven that the length of the lockup period is correlated with long-term performance, regardless of exposure to moral hazard or information asymmetry. The regressions further suggest that lockup length is positively correlated with long-term performance across the total sample, using the equal-weighted benchmark. The coefficient of 0.0013 is significant but small. Consequently, the positive effect on abnormal return from setting a longer lockup period can be perceived as trivial, unless the length of the lockup period undertakes extreme values.

The hypothesis was that if asymmetric information was the driver of the lockup length, the lockup days variable would be uncorrelated with long-term performance. In contrast, if moral hazard was the driver of the lockup length, the lockup days variable would be negatively correlated with long-term performance. Therefore, we reject hypothesis 2a, but accept hypothesis 2b. That is, moral hazard does not seem to be the driver of the lockup length. Even though the moral hazard sample exhibited a significant coefficient in one of the regressions, this coefficient was positive. If the lockup period would in fact undertake extreme values, i.e. a very long lockup period, this would imply that longer lockup periods benefit future performance and that longer lockup periods are not synonym with more severe agency costs. Therefore, it is concluded that moral hazard is not a driver of the use of lockup agreements.

It was displayed in the sample statistics that there is an increase in the percentage of firms setting the lockup length to exactly 180 days, suggesting a homogenization related to the use and length of lockup agreements. The regressions on the sub-samples lead to the acceptance of hypothesis 2b, i.e. that the lockup length is uncorrelated with long-term performance in the asymmetric information sub-sample. The small coefficient found in one of the regressions is perceived as insufficient evidence of a correlation between lockup length and long-term performance. However, the homogenization of lockup agreements suggest that firms set the same lockup length as their peers, rather than adjusting the length to reduce information asymmetry or agency costs. Thus, the causality of the regressions and their suggestion that asymmetric information could be the driver of the lockup length can be questioned. The homogenization rather suggest that this contractual feature is simply not important anymore. There has been a change in the rationale over time, and since 180 days is such a widespread standard today, the underlying reason, a topic previously subject to much scientific effort, has become irrelevant. Field and Hanka (2001) suggest that IPO terms have been subject to standardizations at large. They illustrate this general standardization by comparing their findings on lockup period standardizations with the standardization of the underwriter spread found by Chen and Ritter (2000). The underwriter spread has normalized around 7 percent, as lockup periods have normalized at 180 days, and this overall signalizes that the contractual features of an IPO have no particular rationale other than that of "best practice".

4.4. Robustness Tests

4.4.1. Multicollinearity and Correlation Matrices

Table 6: Variance inflation factors

	Total Sample		Asymmetric Information		Moral Hazard	
	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return	Equal-Weighted Abnorma l Return	Value-Weighted Abnormal Return
VARIABLES	VIF	VIF	VIF	VIF	VIF	VIF
Moral Hazard	10.03	9.17				
VC Backing	9.27	8.52			4.52	4.59
High-Tech	1.56	1.58	1.08	1.05	2.03	2.00
Size	1.48	1.42	1.15	1.16	4.51	4.53
Year	1.22	1.10	1.21	1.20	1.19	1.14
Lockup Days	1.22	1.11	1.19	1.06	1.20	1.16
Auditor	1.20	1.11	1.24	1.21	1.14	1.12
UW Ranking	1.11	1.13	1.10	1.14	1.28	1.28
Initial Return	1.02	1.03	1.03	1.04	1.06	1.07
Mean VIF	3.12	2.91	1.14	1.12	2.12	2.11

Note: Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample. VC Backed is a dummy variable related to if the firm is VC backed. High-Tech is dummy variable related to if the firm operates within the high-tech industry. Size is a ranking of the size of the company. Year is a calendar year variable. Lockup Days is the lockup length, measured in days. Auditor is a dummy variable related to if the firm uses one of the top 5 auditors. UW Ranking is a variable presenting the prestige of the underwriter. Initial Return is the first day return of the stock. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample, Asymmetric Information, and Moral Hazard refers to the sample being used.

As shown in table 6, the data set is exposed to some multicollinearity problems. In the regressions conducted on the total sample, including the dummy of being subject to comparatively more acute moral hazard problems, the multicollinearity is particularly high. The moral hazard dummy is expected to be highly correlated with the variables used in its construction. The calculated variance inflation factors suggest that the moral hazard dummy only correlates with VC backing, and not the other variables used in its construction, i.e. size and underwriter ranking. To control for multicollinearity, variables with the highest correlation with each other could be excluded from the regression model. Multicollinearity is not perceived as a problem when it only affects the control variables (Voss, 2004). This is true for all sub-sample regressions, wherefore these were not controlled for in relation to multicollinearity.

Table 7: Correlation matrix against equal-weighted abnormal return

e(V)	High-Tech	Auditor	UW Ranking	Lockup Days	VC Backed	Size	Initial Return	Year	Moral Hazard	Constant
High-Tech	1.0000									
Auditor	-0.2030	1.0000								
UW Ranking	0.0725	-2249	1.0000							
Lockup Days	0.0725	-0.0065	0.0396	1.0000						
VC Backed	-0.1519	0.1509	-0.0346	-0.0562	1.0000					
Size	0.2094	0.1884	-0.0797	-0.1294	0.3135	1.0000				
Initial Return	-0.0257	-0.0069	0.1260	0.0712	-0.0083	-0.0136	1.0000			
Year	-0.0257	0.1579	0.0006	-0.3809	0.1070	0.0762	-0.0277	1.0000		
Moral Hazard	-0.0846	-0.1273	-0.0225	0.0315	-0.9113	-0.4572	0.0010	-0.0805	1.0000	
Constant	-0.1263	-0.0733	-0.8918	-0.1582	-0.0722	-0.1877	-0.1296	-0.1471	0.1221	1.0000

Note: High-Tech is dummy variable related to if the firm operates within the high-tech industry. Auditor is a dummy variable related to if the firm uses one of the top 5 auditor. UW Ranking is a variable presenting the prestige of the underwriter. Lockup Days is the lockup length, measured in days. VC Backed is a dummy variable related to if the firm is VC backed. Size is a ranking of the size of the company. Initial Return is the first day return of the stock. Year is a calendar year variable. Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample.

Table 8: Correlation matrix against value-weighted abnormal return

e(V)	High-Tech	Auditor	UW Ranking	Lockup Days	VC Backed	Size	Initial Return	Year	Moral Hazard	Constant
High-Tech	1.0000									
Auditor	-0.1007	1.0000								
UW Ranking	0.0553	-0.2446	1.0000							
Lockup Days	-0.0013	0.0172	-0.0248	1.0000						
VC Backed	-0.1597	-0.0826	-0.0262	-0.0500	1.0000					
Size	0.2206	0.0906	-0.0535	-0.1241	0.3368	1.0000				
Initial Return	-0.0230	-0.0110	0.1440	0.0600	-0.0005	-0.0038	1.0000			
Year	-0.0061	0.1076	-0.0446	-0.2546	-0.0144	-0.0192	-0.0331	1.0000		
Moral Hazard	-0.1024	-0.0885	-0.0333	0.0327	-0.9005	-0.4712	-0.0038	-0.0039	1.0000	
Constant	-0.6267	-0.0179	-0.8718	-0.1976	-0.0491	-0.1778	-0.1484	-0.1273	0.1152	1.0000

Note: High-Tech is dummy variable related to if the firm operates within the high-tech industry. Auditor is a dummy variable related to if the firm uses one of the top 5 auditor. UW Ranking is a variable presenting the prestige of the underwriter. Lockup Days is the lockup length, measured in days. VC Backed is a dummy variable related to if the firm is VC backed. Size is a ranking of the size of the company. Initial Return is the first day return of the stock. Year is a calendar year variable. Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample.

The correlation matrices, table 7 and 8, illustrate which variables were correlated with each other in the total sample. A correlation lower than the absolute value of 0.5 is usually applied to decide whether variables have an acceptable correlation with each other (Newbold, Carlson & Thorne, 2013). As shown by table 7 and 8, the moral hazard dummy does in fact strongly correlate with VC backing. Again, it does not seem to correlate with underwriter ranking or size in neither table.

4.4.2. Excluding Variables

To target the multicollinearity issue in the model, additional regressions on the total sample were conducted. These regressions excluded the VC backed variable as it was the only variable subject to correlation with the moral hazard dummy. As displayed in table E2 (see Appendix E), the multicollinearity was eliminated. Furthermore, the output of the regressions now indicates that a comparative exposure to moral hazard problems negatively correlates with long-term performance, as shown by table E1. However, the coefficients are insignificant.

5. Implications and Conclusions

We hypothesized that asymmetric information and moral hazard are non-mutually exclusive problems, and that firms will exhibit both. However, firms will have a comparative exposure to one of the problems, and this comparative exposure should be a determinant of both long-term performance and the use of lockup agreements.

The result from testing the abnormal return is consistent with previous research on IPOs and long-term performance. We find evidence that rejects the theory of an efficient market in the context of IPOs. In other words, there is evidence that IPOs on average underperform in the three years following the issue. Furthermore, we find that firms underperform long-term, regardless of exposure to asymmetric information and moral hazard. Underpricing, as a determinant of asymmetric information problems, seem to be inherent to both sub-groups as well. This supports the notion that the problems are, in fact, non-mutually exclusive and that firms exhibit both. However, it cannot be proven that there is a relative difference in long-term performance between the sub-samples. In other words, we reject our hypothesis and claim that the comparative exposure is not a determinant for future performance of firms.

The hypothesis that the comparative exposure is a determinant for the use of lockup agreements, was based on the fact that the costs of the two problems occur at different points in time. Agency costs causes firm value deterioration long-term, while asymmetric information problems should be accounted for already at the issue. Therefore, the length of the lockup period should be uncorrelated with long-term performance for firms with a comparative exposure to asymmetric information. Meanwhile, firms can be interpreted as having more severe moral hazard problems as the lockup length increases. For firms comparatively exposed to moral hazard, this translates into a negative correlation between lockup length and long-term performance. However, we find no correlation between lockup length and long-term performance, regardless of the comparative exposure inhabited by a firm. This suggests that comparative exposure to moral hazard is not a determinant for the use of lockup agreements. We cannot reject that asymmetric information is a driver of lockup length. However, our results suggest that lockup agreements have experienced a significant homogenization over the years, and this is in line with previous research. As a result of the overall standardization, using lockup agreements to signal firm quality seems futile as well. If all firms set the same lockup length, we strongly question if lockup agreements signal anything to the market anymore.

Even though we find that lockup agreements have become standardized to the point of becoming meaningless, our work sheds light on the adverse selection problems inherent to going public. We proposed that moral hazard should be one reason for the IPO market inefficiencies. However, we could not show that the comparative exposure to moral hazard and information asymmetry has any implications for future performance. Consequently, it remains a mystery how the market continues to fail when accounting for these hidden costs and what problem is actually liable for the shortcomings of the IPO market. Leaving the rationale of lockup agreements behind, future research should be aimed at unraveling how asymmetric information and agency costs affect the process of going public, and if there are any proxies that can be used to assess the severity of moral hazard. Effort should also be directed at the development of new contractual features of IPOs that can unmask the hidden costs of firms and by extension ensuring a more efficient market.

6. References

Aggarwal, R. K., Krigman, L., & Womack, K. L. (2002). Strategic IPO underpricing, information momentum, and lockup expiration selling. *Journal of Financial Economics, 66*(1), 105-137. doi:10.1016/S0304-405X(02)00152-6

Atiase, R. K., Bamber, L. S., & Freeman, R. N. (1988). Accounting disclosures based on company size: Regulations and capital markets evidence. *Accounting Horizons, 2*(1), 18-26.

Barber, B. M., & Lyon, J. D. (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics, 43*(3), 341-372. doi:10.1016/S0304-405X(96)00890-2

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

Berk, J., & DeMarzo, P. (2014). Advantages and Disadvantages of Going Public. *Corporate finance* (3rd ed., pp 812-813). Boston: Pearson.

Berk, J., & DeMarzo, P. (2014). The Efficient Market Hypothesis Versus No Arbitrage. *Corporate finance* (3rd ed., pp 300). Boston: Pearson.

Bradley, D. J., Jordan, B. D., Yi, H. -., & Roten, I. C. (2001). Venture capital and ipo lockup expiration: An empirical analysis. *Journal of Financial Research, 24*(4), 465-493. doi:10.1111/j.1475-6803.2001.tb00826.x

Brau, J. C., & Fawcett, S. E. (2006). Initial public offerings: An analysis of theory and practice. *Journal of Finance, 61*(1), 399-436. doi:10.1111/j.1540-6261.2006.00840.x

Brau, J. C., Lambson, V. E., & McQueen, G. (2005). Lockups revisited. *Journal of Financial and Quantitative Analysis, 40*(3), 519-530.

Brav, A., & Gompers, P. A. (2003). The role of lockups in initial public offerings. *Review of Financial Studies, 16*(1), 1-29. doi:10.1093/rfs/16.1.0001

Carter, R. B., Dark, F. H., & Singh, A. K. (1998). Underwriter reputation, initial returns, and the long-run performance of IPO stocks. *Journal of Finance, 53*(1), 285-311. doi:10.1111/0022-1082.104624

Carter, R. B., & 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, H. -., & Ritter, J. R. (2000). The seven percent solution. *Journal of Finance, 55*(3), 1105-1131. doi:10.1111/0022-1082.00242

Courteau, L. (1995). Under-diversification and retention commitments in ipos. *Journal of Financial and Quantitative Analysis, 30*(4), 487-517. doi:10.2307/2331274

Field, L. C., & Hanka, G. (2001). The expiration of IPO share lockups. *Journal of Finance, 56*(2), 471-500. doi:10.1111/0022-1082.00334

Gao, F., & Siddiqi, M. A. (2012). The rationale for IPO lockup agreements: Agency or signaling. *Review of Pacific Basin Financial Markets and Policies, 15*(3) doi:10.1142/S0219091512500130

Goolsbee, A., Levitt, S., & Syverson, C. (2016). Adverse Selection When the Buyer Has More Information: Insurance Market. *Microeconomics* (2st ed., pp 623-624) W.H. Freeman & Co Ltd

Haman, J., Chalmers, K., & Fang, V. (2017). IPO lockups, long run returns, and growth opportunities. *Journal of International Financial Markets, Institutions and Money, 49*, 184-199. doi:10.1016/j.intfin.2017.05.002

Hoque, H. (2011). The choice and role of lockups in IPOs: Evidence from heterogeneous lockup agreements. *Financial Markets, Institutions and Instruments, 20*(5), 191-220. doi:10.1111/j.1468-0416.2011.00169.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*(1), 81-105. doi:10.1016/j.intfin.2014.02.001

Houge, T., Loughran, T., Suchanek, G., & Yan, X. (2001). Divergence of opinion, uncertainty, and the quality of initial public offerings. *Financial Management, 30*(4), 5-23. doi:10.2307/3666256

Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal of Financial Economics, 2*(3), 235-272. doi:10.1016/0304-405X(75)90015-X

Loughran, T., & Ritter, J. (2004). Why has IPO underpricing changed over time? *Financial Management, 33*(3), 5-37.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *The Journal of Finance, 46*(3), 879-903. doi:10.1111/j.1540-6261.1991.tb03770.x

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187-221. doi:10.1016/0304-405X(84)90023-0

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

Newbold, P., Carlson, L. W., & Thorne, M. B. (2013). Multiple regression analysis application procedure. *Statistics for business and economics* (8th ed., pp. 529-530). England: Pearson.

Newbold, P., Carlson, L. W., & Thorne, M. B. (2013). Using numerical measures to describe data. *Statistics for business and economics* (8th ed., pp. 63-64). 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. (2019). Warrington Collage of Business. *Underwriter Rank 1980-2015.* URL: https://site.warrington.ufl.edu/ritter/ipo-data/ [Reviewed: 2019-04-13]

Ritter, J. R., & Welch, I. (2002). A review of IPO activity, pricing, and allocations. *Journal of Finance, 57*(4), 1795-1828. doi:10.1111/1540-6261.00478

Shiller, J. R. (1990). Speculative prices and popular models. *Journal of Economic Perspectives, 4*(2), 55-65.

Strong, N. (1992). Modelling abnormal returns: A review article. *Journal of Business Finance & Accounting, 19*(4), 533-553. doi:10.1111/j.1468-5957.1992.tb00643.x

Thomson Reuters Eikon (2019)

Thomson Securities Data Corporation (2019)

Voss, S.D. (2004) Multicollinearity, *University of Kentucky*, URL: http://www.uky.edu/~dsvoss/docs/multic.pdf [Reviewed: 2019-05-13]

WRDS (2019) Guide to IPO Databases and Research, *Wharton University of Pennsylvania*, URL:https://wrds-www.wharton.upenn.edu/pages/support/research-wrds/research-guides/wrds-guide-ipo-databases-and-research/ [Reviewed: 2019-04-19]

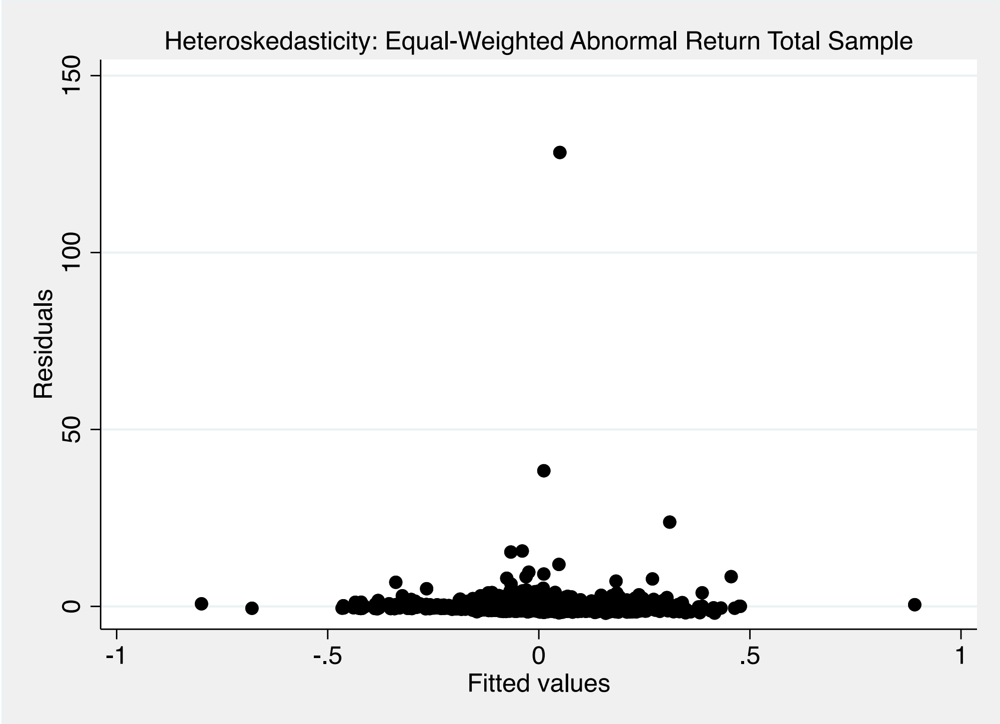
Yung, C., & Zender, J. F. (2010). Moral hazard, asymmetric information and IPO lockups. Journal of Corporate Finance, 16(3), 320-332. doi:10.1016/j.jcorpfin.2009.12.004

7. Appendices

Appendix A

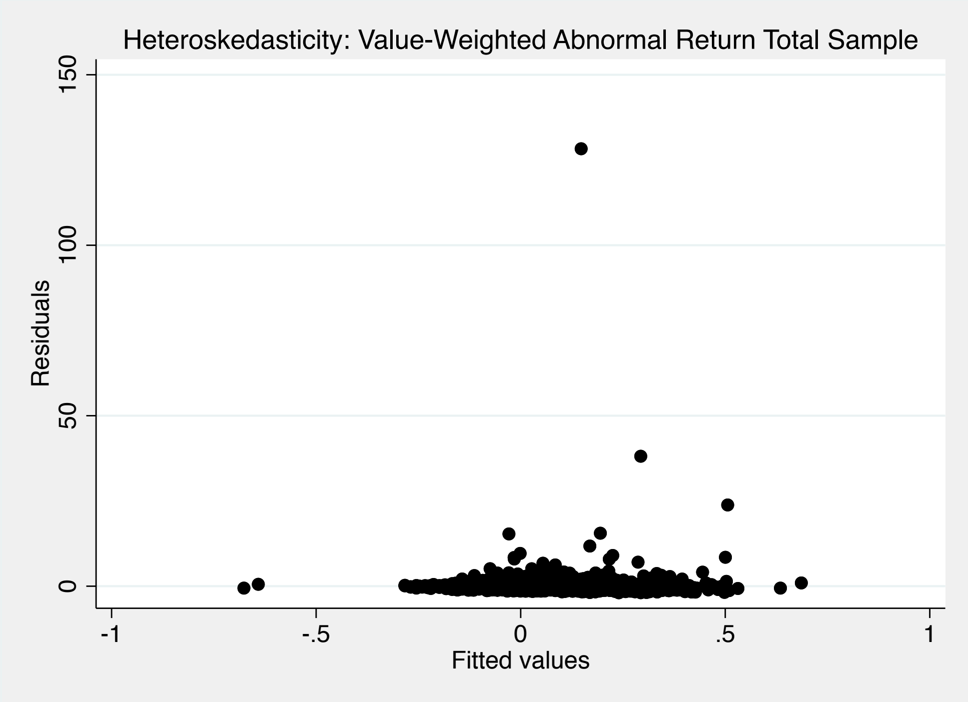
A test on the homoscedasticity of the sample was performed to decide on the proper regression analysis to use. To be able to use an OLS analysis the population must have a constant variance. As shown in the graphs below, the sample was subject to heteroscedasticity and therefore a WLS regression analysis was used instead.

Graph A1: Heteroscedasticity plot on total sample against equal-weighted benchmark



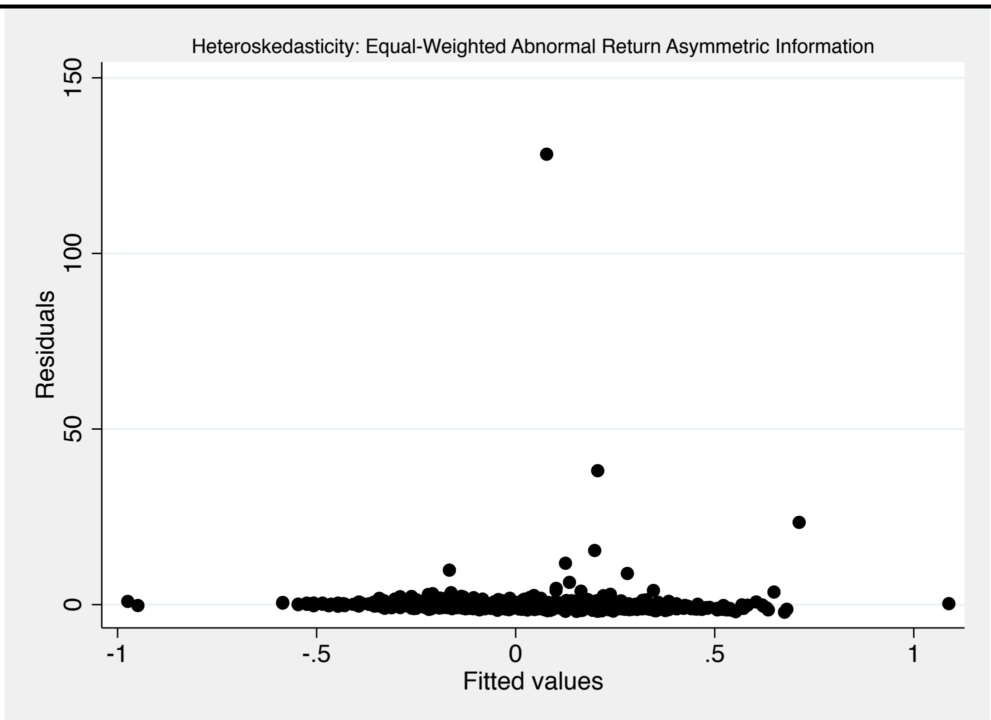
Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Graph A2: Heteroscedasticity plot on total sample against value-weighted benchmark



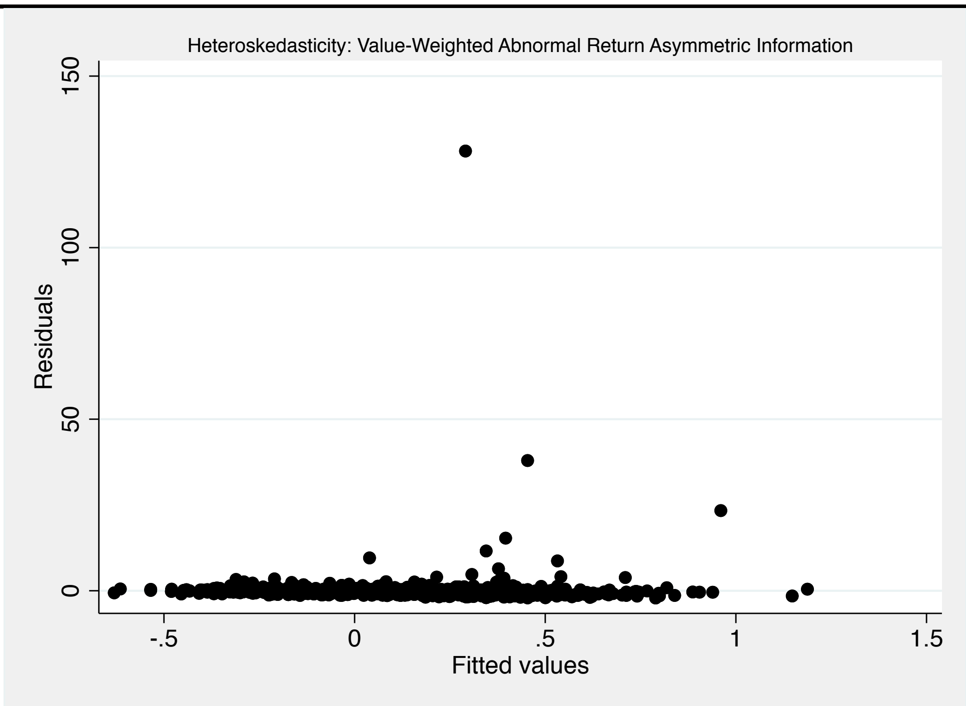
Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Graph A3: Heteroscedasticity plot on asymmetric information sample against equal-weighted benchmark



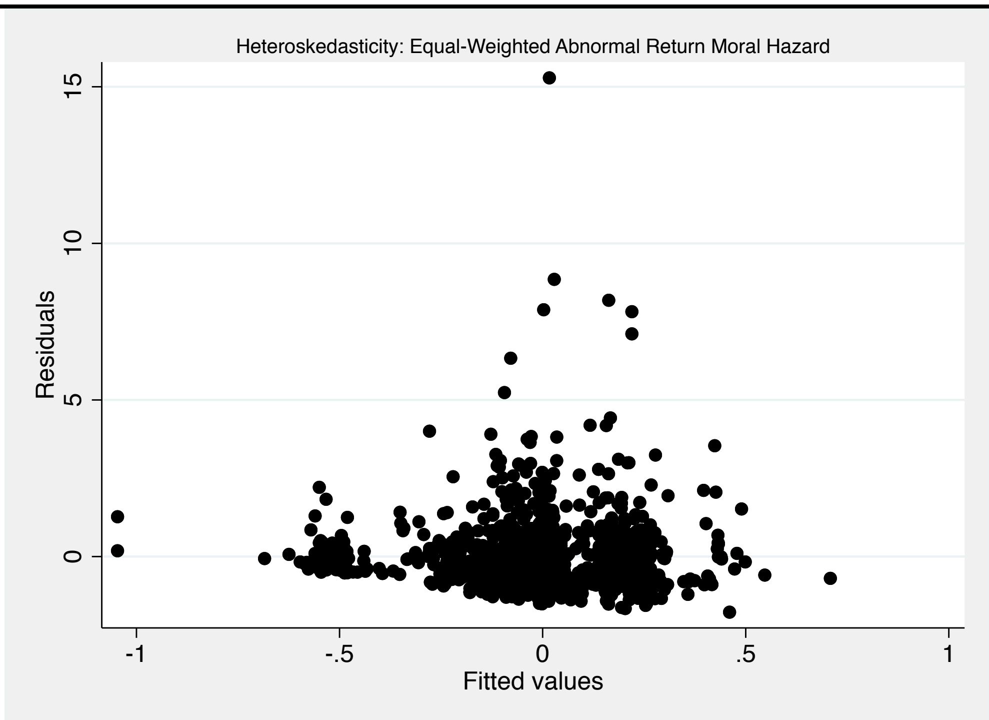
Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Graph A4: Heteroscedasticity plot on asymmetric information sample against value-weighted benchmark



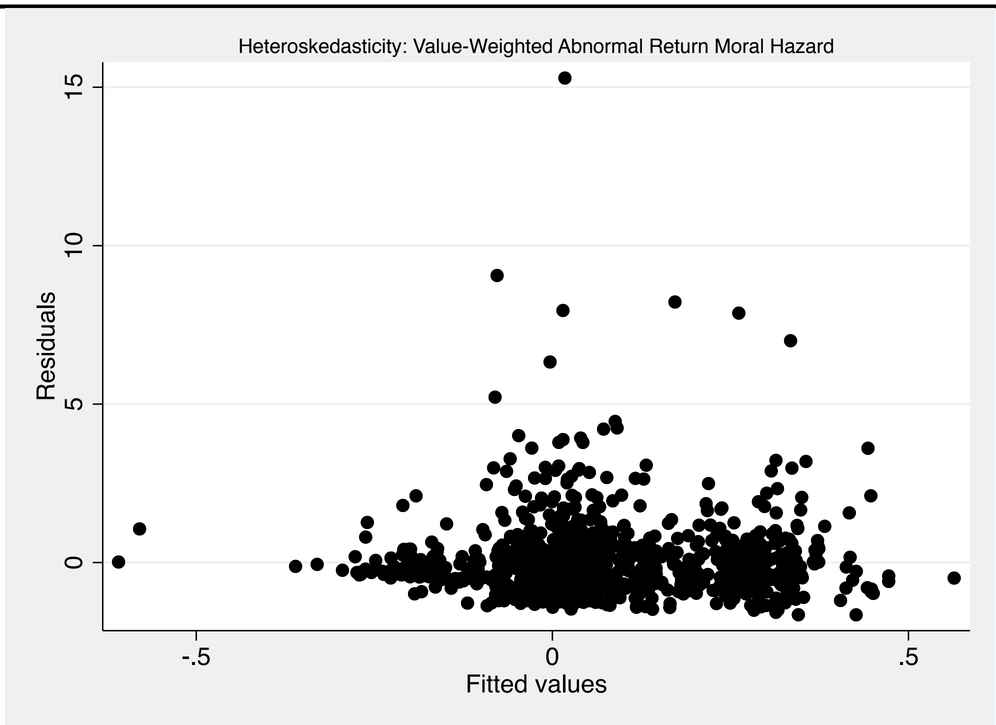
Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Graph A5: Heteroscedasticity plot on moral hazard sample against equal-weighted benchmark



Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Graph A6: Heteroscedasticity plot on moral hazard sample against value-weighted benchmark

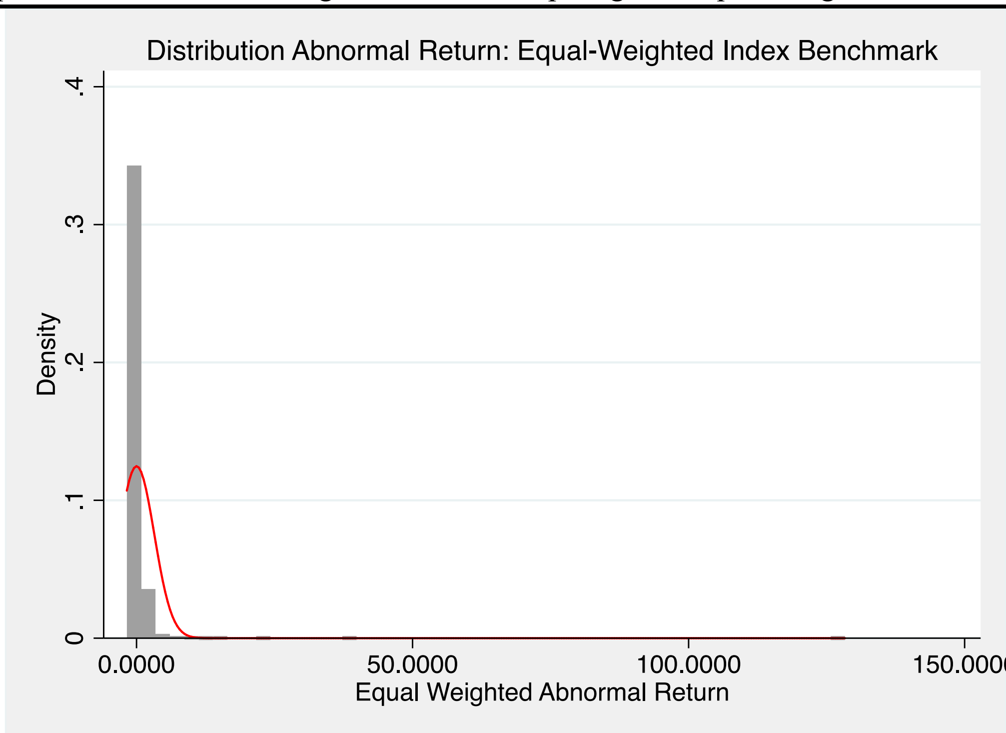


Note: Residuals are the residual from the WLS regression. The fitted values are the predicted values from the WLS.

Appendix B

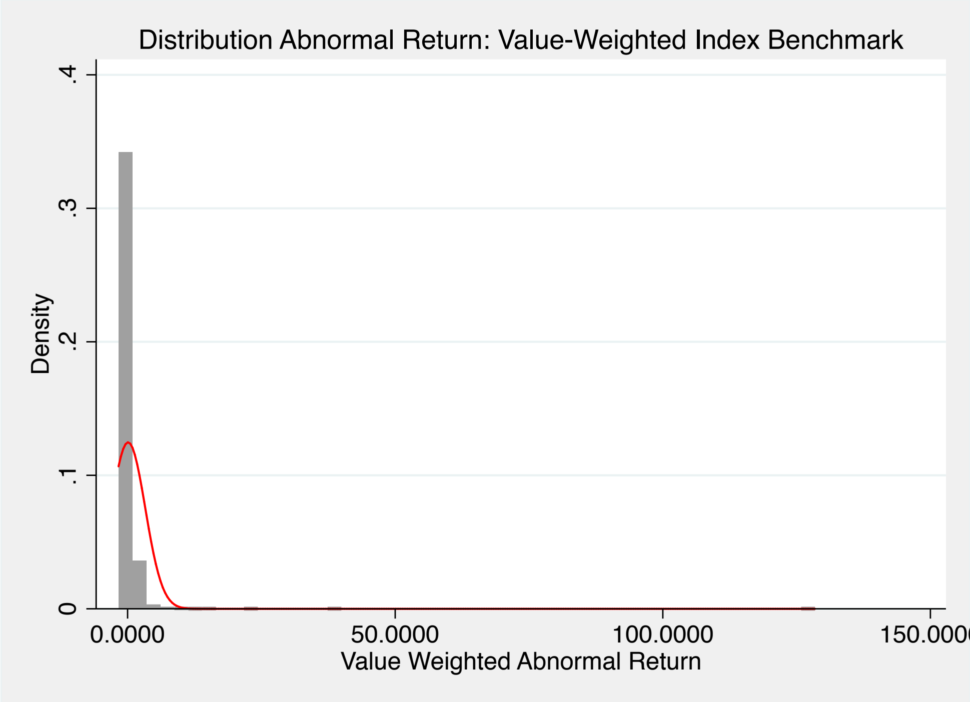
The first step in examining the distribution of abnormal return was to plot histograms with a fitted distribution. As shown in the graphs below, the data set inhabits a skewness.

Graph B1: Distribution histogram on total sample against equal-weighted benchmark



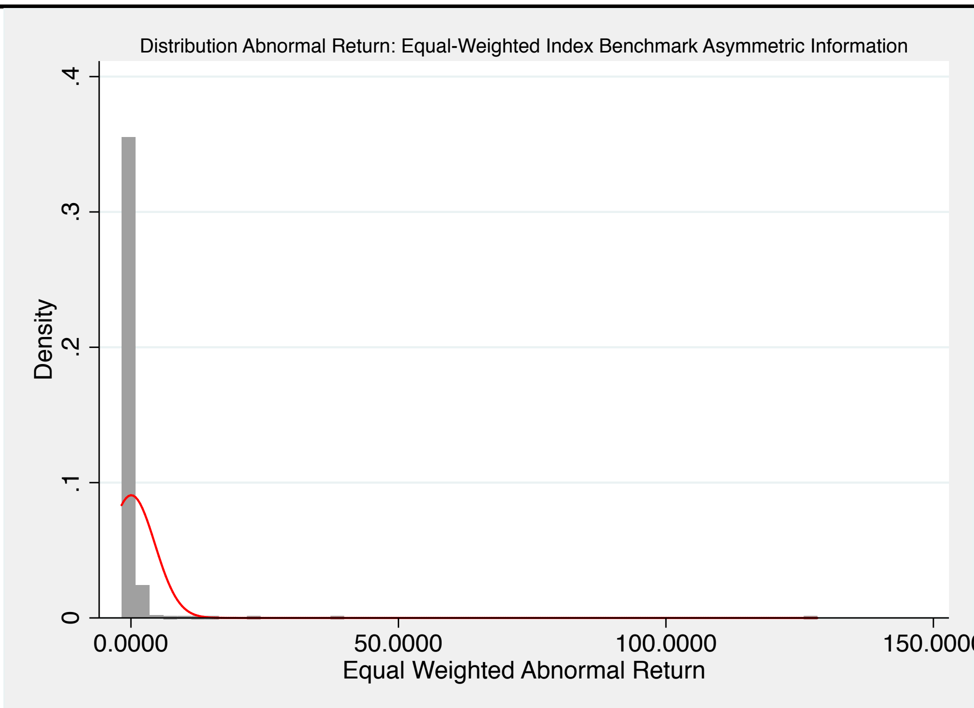
Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

Graph B2: Distribution histogram on total sample against value-weighted benchmark



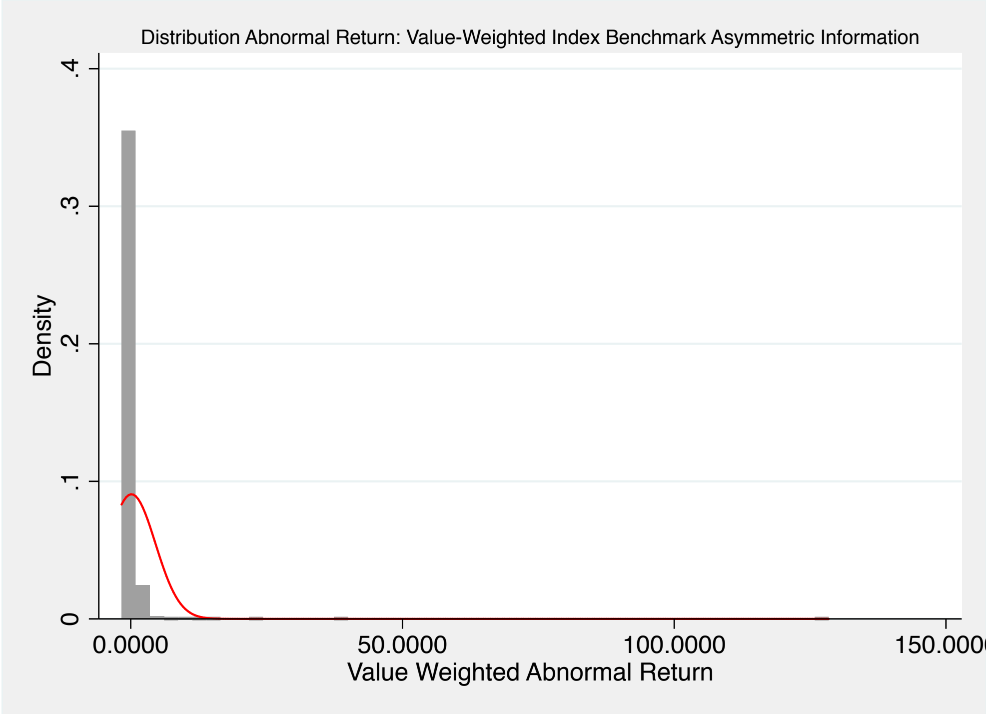
Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

Graph B3: Distribution histogram on asymmetric information sample against equal-weighted benchmark



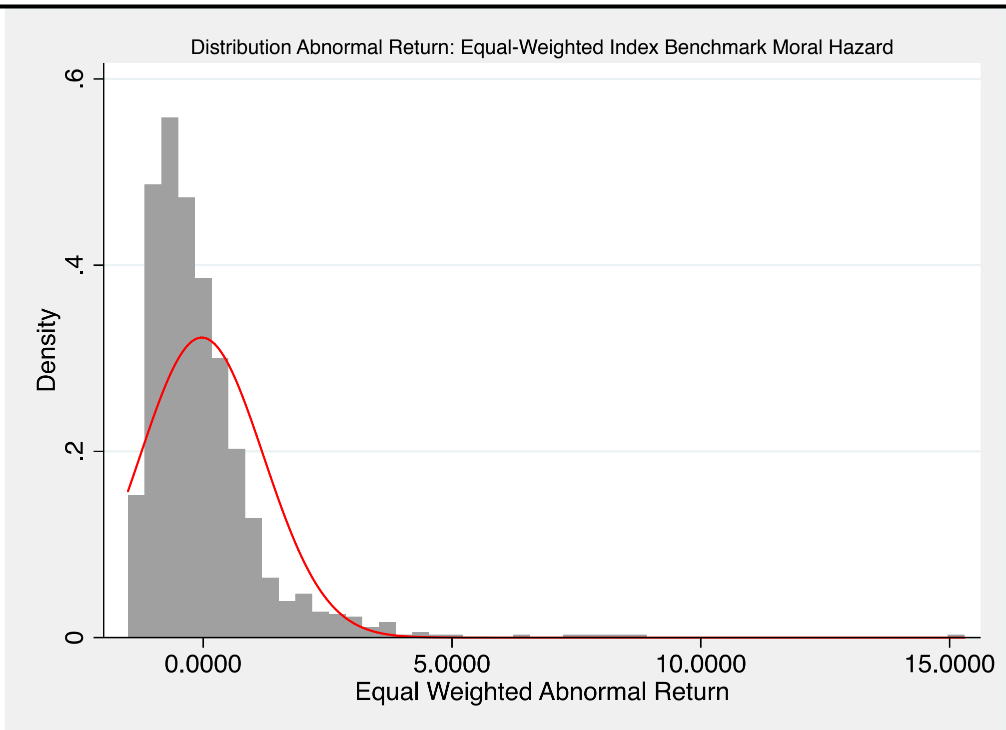
Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

Graph B4: Distribution histogram on asymmetric information sample against value-weighted benchmark



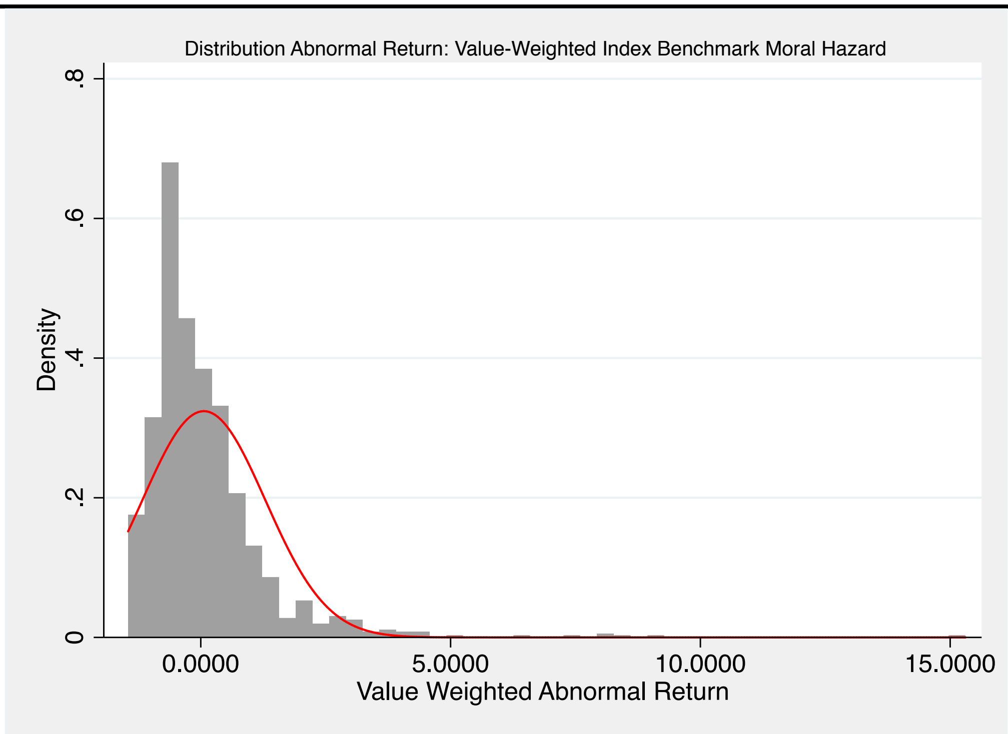
Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

Graph B5: Distribution histogram on moral hazard sample against equal-weighted benchmark



Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

Graph B6: Distribution histogram on moral hazard sample against value-weighted benchmark



Note: Density is the frequency in which there are observation with a certain abnormal return. The red line is the fitted distribution of the data set.

To further test the distribution of the abnormal return skewness and kurtosis (Jarque-Bera) test was performed on the total sample. As shown in table B1, the null hypothesis of abnormal return being normally distributed is rejected for both benchmarks.

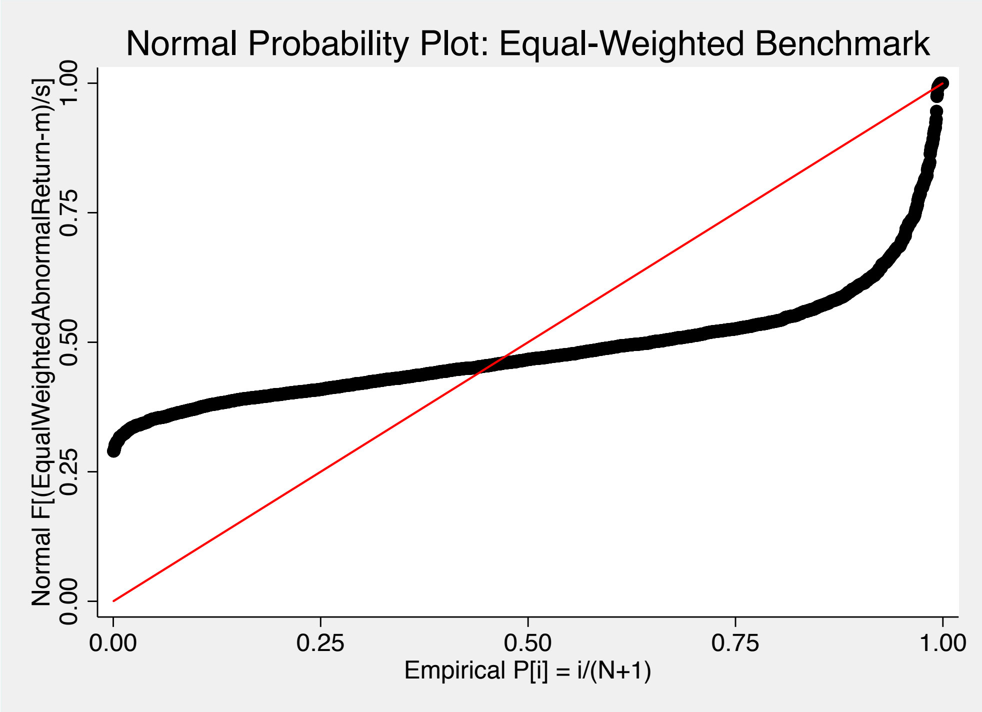
Table B1: Skewness and kurtosis test (Jarque Bera)

				joint	
INDEX	N	Pr(Skewness)	Pr(Kurtosis)	chi2(2)	Prob>chi2
Value-Weighted Abnormal Return	2091	0.0000	0.0000	5666.21	0.0000
Equal-Weighted Abnormal Return	2091	0.0000	0.0000	5666.66	0.0000

Note: N is the number of observations. Pr(Skewness) is t-statistic for the sample skewness. Pr(Kurtosis) is a t-statistic for the sample kurtosis. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index.

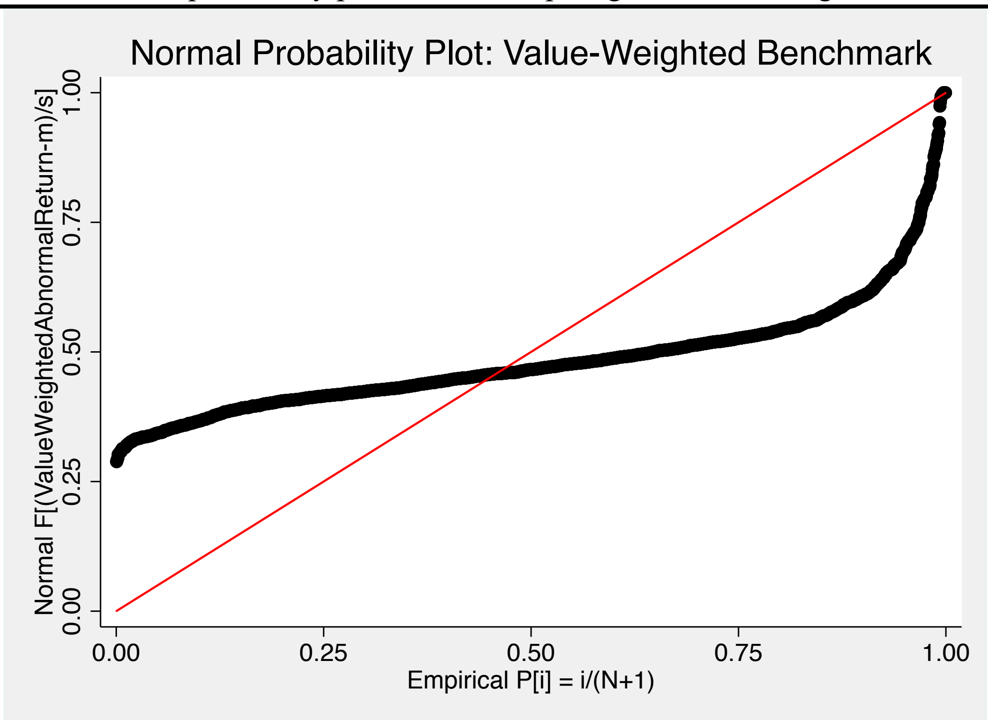
As a final test of the distribution of abnormal return, the normal probability plot was made for the total sample. As seen in graphs B7 and B8 the sample has thinner tails than expected by a normally distributed sample.

Graph B7: Normal probability plot of total sample against equal-weighted benchmark



Note: The red line is the theoretical normal distribution. The deviations from the red line exhibited by the black graph should be interpreted as deviation from normal distribution.

Graph B8: Normal probability plot of total sample against value-weighted benchmark



Note: The red line is the theoretical normal distribution. The deviations from the red line exhibited by the black graph should be interpreted as deviation from normal distribution.

Appendix C

Since abnormal return exhibited a skewness, a johnson skewness adjusted t-test was performed. Table C1 to C6 illustrates how the null hypothesis, of the mean abnormal return being different from zero, cannot be rejected.

Table C1: Johnson t-test of mean value-weighted abnormal return

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Value-Weighted Abnormal Return	2 091	9.85%	6.99%	319.86%	-3.87%	23.57%

Ho: mean = 0
t1 = 1.41 With 2090 d.f.
Pr > t = 0.1575

Ho: mean = 0
t2 = 1.41 With 2090 d.f.
Pr > t = 0.1575

Note: Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index.

Table C2: Johnson t-test of mean equal-weighted abnormal return

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Equal-Weighted Abnormal Return	2091	1.25%	6.99%	319.79%	-12.5%	14.96%

Ho: mean = 0
t1 = 0.18 With 2090 d.f.
Pr > t = 0.8576

Ho: mean = 0
t2 = 0.18 With 2090 d.f.
Pr > t = 0.8576

Note: Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index.

Table C3: Johnson t-test of mean value-weighted abnormal return, asymmetric information

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Value-Weighted Asymmetric Information	1021	13.72%	13.77%	440.14 %	-13.31%	40.75%

Ho: mean =0
t1 = 1.00 With 1020 d.f.
Pr > t = 0.3177

Ho: mean = 0
t2 = 1.00 With 1020 d.f.
Pr > t = 0.3177

Note: Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index.

Table C4: Johnson t-test of mean equal-weighted abnormal return, asymmetric information

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Equal-Weighted Asymmetric Information	1021	-5.45%	13.76%	439.83 %	-21.56%	32.46%

Ho: mean =0
t1 = 0.4 With 1020 d.f.
Pr > t = 0.6911

Ho: mean = 0
t2 = 0.4 With 1020 d.f.
Pr > t = 0.6911

Note: Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index.

Table C5: Johnson t-test of mean value-weighted abnormal return, moral hazard

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Value-Weighted Moral Hazard	1070	6.16%	3.76%	123.11%	-1.23%	13.54%

Ho: mean =0
t1 = 1.66 With 1069 d.f.
Pr > t = 0.0968

Ho: mean = 0
t2 = 1.66 With 1069 d.f.
Pr > t = 0.0967

Note: Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index.

Table C6: Johnson t-test of mean equal-weighted abnormal return, moral hazard

VARIABLE	N	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Equal-Weighted Moral Hazard	1070	-2.76%	3.78%	123.78%	-10.19%	4.66%

Ho: mean = 0
t1 = -0.72 With 1069 d.f.
Pr > t = 0.4705

Ho: mean = 0
t2 = -0.72 With 1069 d.f.
Pr > t = 0.4706

Note: Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index.

Appendix D

To test if the median abnormal return was significantly different from zero a quantile regression was performed on abnormal return, for all samples, measured against all benchmarks. As seen in table D1, the coefficient is consistently negative at the 1 percent level.

Table D1: Quantile regressions of median abnormal return

	Equal-Weighted Total Sample	Value-Weighted Total Sample	Equal-Weighted Asymmetric Info	Value-Weighted Asymmetric Info	Equal-Weighted Moral Hazard	Value-Weighted Moral Hazard
	Constant	Constant	Constant	Constant	Constant	Constant
Coefficient	-25.39%	-17.39%	-23.16%	-16.15%	-29.48%	-19.25%
Std. Err.	1.98%	1.88%	2.54%	2.30%	3.37%	3.15%
t	-12.85	-9.26	-9.11	-7.02	-8.74	-6.11
P>t	0,000	0,000	0,000	0,000	0,000	0,000
[95% Conf.	-29.26%	-21.07%	-28.15%	-20.66%	-36.10%	-25.43%
Interval]	-21.51%	-13.71%	-18.17%	-11.63%	-22.86%	-13.07%

Note: Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample, Asymmetric Information, and Moral Hazard refers to the sample being used in the quantile regression. Coefficient is the median abnormal return.

Appendix E

To correct for the multicollinearity found in the sample, an additional regression was conducted on the total sample. In this additional regression, the variable VC Backed was removed, due to it being correlated with the Moral Hazard dummy variable. The regression can be seen in table E1.

Table E1: Regression results excluding correlated variables

	Total Sample	
VARIABLES	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return
High-Tech	-0.0482	0.102
	(0.0683)	(0.0756)
Auditor	0.0300	-0.0619
	(0.0761)	(0.0772)
UW Ranking	-0.0356	-0.0369
	(0.0297)	(0.0315)
Lockup Days	0.00130***	0.000661
	(0.000402)	(0.000544)
Size	0.0526*	0.0203
	(0.0292)	(0.0319)
Initial Return	-0.00343	-0.00358
	(0.00829)	(0.00767)
Year	0.00980	-0.0142**
	(0.00653)	(0.00686)
Moral Hazard	-0.0718	-0.00767
	(0.0744)	(0.0818)
Constant	-0.127	0.309
	(0.264)	(0.279)
Observations	2,086	2,086
R-squared	0.015	0.005

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: High-Tech is dummy variable related to if the firm operates within the high-tech industry. Auditor is a dummy variable related to if the firm uses one of the top 5 auditors. UW Ranking is a variable presenting the prestige of the underwriter. Lockup Days is the lockup length, measured in days. Size is a ranking of the size of the company. Initial Return is the first day return of the stock. Year is a calendar year variable. Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample refers to the sample being used in the regressions.

After the removal of the highly correlated variable, the multicollinearity of the regression was tested again. In table E2, the variance inflation factors of the regression are illustrated. Notably, the multicollinearity has been eliminated.

Table E2: Variance inflation factors excluding correlated variables

	Total Sample	
	Equal-Weighted Abnormal Return	Value-Weighted Abnormal Return
VARIABLES	VIF	VIF
Moral Hazard	1.70	1.73
High-Tech	1.52	1.54
Size	1.34	1.26
Lockup Days	1.22	1.11
Year	1.21	1.10
Auditor	1.17	1.10
UW Ranking	1.11	1.13
Initial Return	1.02	1.03
Mean VIF	1.29	1.25

Note: Moral Hazard is a dummy variable related to if the firm belongs to the moral hazard sub-sample. High-Tech is dummy variable related to if the firm operates within the high-tech industry. Size is a ranking of the size of the company. Lockup Days is the lockup length, measured in days. Year is a calendar year variable. Auditor is a dummy variable related to if the firm uses one of the top 5 auditors. UW Ranking is a variable presenting the prestige of the underwriter. Initial Return is the first day return of the stock. Equal-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 equal weighted index. Value-Weighted Abnormal Return is the abnormal return benchmarked against the S&P 500 value weighted index. Total Sample refers to the sample being used in the tests.