THE IMPACT OF LOCKUP PERIOD ON SURVIVAL, LONG-RUN PERFORMANCE AND EARNINGS MANAGEMENT OF IPOS IN UK

by

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ABSTRACT

This thesis examines the impact of lockup length on three important issues related to initial public offerings (IPOs) on Main Market of London Stock Exchange (LSE). First, we investigate the effect of lockup length on the survival of IPOs following five years after the issue. Our results show that IPOs with longer lockups have higher survival rates and longer survival time compared to IPOs with shorter lockups. Comparing the reasons of delisting from market, we find that IPOs with longer lockups are less likely to delist due to bankruptcy and other negative delisting reasons. The results from our survival models suggest that a 12-month increase in median lockup length increases the survival time by 27 percent, an effect which is statistically and economically significant. Second, a comparative analysis of long-run performance over three years after IPO reveals that IPOs with longer lockups have superior performance relative to IPOs with shorter lockups. These results are consistent across different benchmarks and factor models in both event-time and calendar-time analysis. Furthermore, longer lockup length is a statistically significant predictor of better long-run stock return performance using buy-and-hold returns. We also find negative abnormal returns around lockup expiry. The negative returns tend to be concentrated in IPOs with shorter lockups. Finally, we analyse the association between lockup length and the level of earnings management. We document a statistically significant inverse relationship between earnings management and lockup length. Longer lockups effectively reduce earnings management and this result is invariant to adjustments for potential endogeneity of lockups and alternative proxy for earnings management. Overall evidence suggests that longer lockups tend to be associated with longer survival, superior performance and lower earnings management.

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CHAPTER 1 INTRODUCTION

Initial public offerings (IPOs) frequently feature agreements which are commonly termed as lockup (or lockin). A lockup is a contract between the shareholders of an issuing firm and the underwriter (or sponsor) taking the company public. The lockup agreement provides that initial shareholders (insiders and managers) will not directly or indirectly sell all or some portion of their shares for a certain period after the IPO without prior written consent of the underwriter. These agreements are generally voluntary and are not regulated by the securities regulatory authorities but could be mandatory requirement for listing in case of certain countries and/or segments of the market. The detailed terms of lockup and its expiry are clearly stated in IPO prospectus for the information of investors. Although voluntary in nature, lockups are taken as an important aspect of going public process and market participants place trust in these agreements.[1]

The IPO prospectuses usually cite that the purpose of lockups is to create an orderly market in the shares of a new company so that the market is not flooded by insiders' shares immediately after the IPO. Moreover, a large volume of new shares in the early days after the listing might hamper the price stabilisation efforts by underwriters (Aggarwal, 2000) and may also obscure the true value of the IPO shares. A review of the academic literature on IPO lockups, however, indicates that lockups serve much more important purposes than just creating an orderly market. Previous literature focusing on the presence and divergence in length of lockups suggests two main motivations for their use: quality signalling and commitment device.

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[1]Recently, Association of British Insurers (ABI) expressed its concerns regarding the early release of lockups by underwriters. ABI emphasised that investors rely significantly on lockups because they regulate the supply of shares in new company and are, therefore, relevant to price formation (ABI, 2014).

The signalling explanation for the use of lockups suggests that lockups signal issuer quality and reveal insiders' private information about the future prospects of issuing firm. Issuing firms are subject to high information asymmetry between the firms' insiders and outside investors. IPO issuers can mitigate this information asymmetry by accepting and committing to longer lockups. As lockups restrict insiders' selling ability for some time after IPO and impose illiquidity and non-diversification costs on insiders, they represent a credible signalling mechanism. Given the significant costs associated with longer lockups and fear of discovery of true value of issuing firms in the market after IPO, only high quality firms will accept longer lockups and signal their quality via lockup length. Insiders in low quality companies with marginal prospects will not accept longer lockups as mimickers in low quality firms are likely to be hurt more due to the significant costs of lockups. Previous studies have shown with theoretical models (Courteau, 1995, Brau et al., 2005) and empirical evidence (Arthurs et al., 2009, Karpoff et al., 2013, Yung and Zender, 2010) that longer lockups mitigate information asymmetry and signal the quality of issuing firms.

A competing explanation for the use of lockups suggests that (longer) lockups represent a commitment solution to the agency or moral hazard problem in issuing firms. Commitment explanation assumes that quality of the issuing firm is known ex ante, however, the actions of insiders in the aftermarket are not known. Insiders may oversell the prospects of their firms in the offering document causing issuing firms to be overvalued. After the IPO, insiders may cash out immediately and leave investors with overvalued shares. Therefore, insiders in issuing firms subject to large moral hazard problem are more likely to accept longer lockups to assuage the investors' concerns by showing that their ability to take advantage by informed trading immediately after listing is reduced. Over time, the true quality of firm will be revealed through regulatory filings, analyst following and public trading. Lockups help to align the interests of insiders and investors by requiring the insiders to hold shares for certain post-issue period and let the true market value of the firm be revealed. Thus, lockups act as a commitment device to solve moral hazard in issuing firms in the aftermarket. Empirical evidence in the literature provides support to the commitment explanation of the lockups (Brav and Gompers, 2003, Yung and Zender, 2010).

Irrespective of the motivation (signalling or commitment) for use of (longer) lockups, it is clear that lockups play an important role in going public process at the time of IPO and both of these motivations have received empirical support. The extant literature, however, paid relatively little attention to the importance and impact of lockups in the post-IPO period. This thesis relates the length of lockup to three different aspects of IPOs: survival of IPOs in the aftermarket, long-run performance of IPOs and earnings management at the time of IPO. Although, these aspects of IPOs have been extensively researched in the previous literature, none of these studies directly link lockup length to these important aspects of IPOs. We argue that examination of lockup features in relation to the survival, performance and earnings management is important and timely due to at least three reasons, discussed below.

Firstly, the focus of IPO lockup literature has been on the motivations of presence and length of lockups at the time of IPO. However, there has been very little attempt to discover the impact of lockup features on issuing firms in the post-IPO period. For example, the previous literature on IPO long-run performance has paid no attention to lockup characteristics in explaining the long-run IPO performance. Moreover, although studies have examined lockup expiry returns to find variables which could predict cross-sectional performance differences around lockup expiry, these studies have ignored the length of lockup itself in such examination. In this thesis, we build on the signalling and moral hazard reduction role of lockups at the time of IPO and argue that lockup length could explain the survival of IPOs in the aftermarket and long-run IPO performance. More specifically, we examine the impact of lockup length on the survival and long-run stock performance in chapter 4 and 5. There is vast body of literature which shows that insiders in issuing firms engage in opportunistic earnings management at the time of equity issuance to get higher valuations and appropriate more funds for their firms and themselves (DuCharme et al., 2001, Rangan, 1998, Teoh et al., 1998a). A related strand in the earnings management literature documents the positive impact of presence and reputation of Venture Capitalists (VCs), prestige of underwriters and auditors, independent boards and audit committees (Morsfield and Tan, 2006, Lee and Masulis, 2011, Brau and Johnson, 2009, Chen et al., 2013, Klein, 2002, Osma, 2008) in restraining earnings management at the time of IPO. However, this literature has largely ignored the role of lockup length in deterring earnings management. Moreover, IPO firms with higher earnings management at the time of IPO are associated with poor long-run stock performance and higher chances of failure (Teoh et al., 1998a, Alhadab et al., 2015). As longer lockups bind insiders with IPO firm for a longer period of time after listing, insiders in firms with longer lockups will restrain earnings management. Based on the signalling and moral hazard reduction role of lockups, we predict better quality reporting and lower earnings management in IPOs with longer lockups. We empirically test this prediction in chapter 6.

Secondly, the Main Market of London Stock Exchange (LSE) provides a unique setting to test the implications of signalling and commitment hypothesis of lockups on the performance, survival and earnings management of IPOs. Unlike some other leading European markets such as France and Germany (Goergen et al., 2006b), lockups are completely voluntary for firms listed on Main Market of LSE. Yet, most of the firms go public with lockups in place on Main Market (Ahmad and Jelic, 2014) and there is large diversity in terms of lockup length and other characteristics (Espenlaub et al., 2001). Moreover, evidence suggests that lockups are substantially longer for LSE Main Market IPOs (Espenlaub et al., 2001, Hoque, 2011) compared to the standardised 180 days lockups observed in US markets (Field and Hanka, 2001, Yung and Zender, 2010). Prior research on IPO lockups has mainly focused on US markets and evidence mainly supports the commitment device hypothesis for lockups (Brav and Gompers, 2003, Cline et al., 2014, Gao and Siddiqi, 2012). The relatively shorter lockups in US may not mitigate the information asymmetry to a large extent as little mandated information is disclosed between the IPO and expiry of lockups (Brau et al., 2004). Chapter 3 provides a detailed comparison of IPO lockups in US and UK with examples. The implications of previously observed signalling and commitment explanations in US may not be applicable to the UK IPOs due to the large diversity in UK lockups. Furthermore, apart from a positive effect at the time of IPO, the impact of longer lockup may also extend to the post-IPO performance of the UK IPOs.

Finally, a recent government report (Kay, 2012) has raised concerns regarding the short termism of listed companies in UK. The short term focus fails to promote long term performance, investment and growth. Kay (2012) suggests misalignment of the incentives as one of the reasons for the alleged short termism in UK equity markets and recommends that directors' remuneration and incentives should be linked to sustainable long term performance. More specifically, Kay proposes that long term performance incentives should be provided in the form of company shares locked-in until the retirement of directors. Moreover, recently some institutional investors in the public companies have also argued in favour of lengthening executives' incentive schemes in order to reduce the temptation for short term financial performance at the expense of long term growth and performance of the listed companies

(BBC, 2013).[2] We argue that the examination of lockup length and its impact on long term performance and survival of issuing firms is important to inform this debate, at least partially.

Motivated by the paucity and need of research on lockups and their relation to post-IPO performance, unique nature of lockups on LSE Main Market and recent debate on alleged short termism, we examine the role of lockup length in three important aspects of IPOs mentioned above. This thesis consists of seven chapters including the introduction, a chapter on institutional differences in UK and US IPO lockups, literature review chapter, three empirical essays and a conclusion chapter. The remainder of the thesis is structured as follows.

In chapter 2, we briefly review the differences between UK and US IPO lockups documented in prior literature. First, the requirements of lockups on both segments of LSE, Main Market and Alternative Investment Market (AIM), are reviewed. Second, we provide examples of lockups from IPO prospectuses in US and UK to highlight diversity of UK IPO lockups in terms of their types.

Chapter 3 critically reviews the literature, both theoretical and empirical, on IPO lockups, survival of IPOs in the aftermarket, long-run performance of IPOs and earnings management in IPOs. This review shows that the current research on lockups focuses mainly on the motivations of lockups at the time of going public and abnormal return performance around the expiry of lockups. Although prior research identifies that lockup represents a contracting solution to the information asymmetry and agency problem at the time of offering, there is paucity of research on the role of lockups in post-IPO survival and performance. Moreover,

[2]In a review of 300 UK's largest listed companies, Fidelity Worldwide Investments (one of the biggest investor in European companies) found that 238 companies had no long term share based plan or had a too short time frame. Moreover, Fidelity also announced to start voting against executive pay schemes unless executives are made to hold (lock up) shares for longer than three years before cashing in (BBC, 2013).

prior studies have largely ignored the impact of lockup in deterring earnings management around IPOs.

Chapter 4 presents first empirical essay and investigates the impact of lockup length on the post-issue survival of IPOs in UK. Our sample consists of 580 IPOs listed on Main Market from 1990-2006. We define survivors as IPOs which remain listed independently on the market and no-survivors as the ones which are delisted due to mergers and acquisitions, administration and liquidations and other negative delisting reasons. We find that IPOs with longer lockups have consistently higher survival rates over one, three and five post-IPO years compared to IPOs with shorter lockups. The results further indicate that median survival time for IPOs with longer lockups is significantly higher than those with shorter lockups. Finally, we use survival analysis in our multivariate settings and find that lockup length is a significant predictor of better survival in the aftermarket. Our results are robust to a number of estimation models, heterogeneity of issuing firms and alternative definition of variables.

In chapter 5, we examine the long-run stock performance of IPOs and relate it to the length of the lockup period for a sample of 268 IPOs. Apart from one recent study by Gao and Siddiqi (2012), prior literature has not considered lockup length as a predictor of long-run IPO performance. Gao and Siddiqi (2012) find that long-run IPO performance is negatively related to lockup length for a sample of US IPOs and suggest that lockups are used to control agency problems (moral hazard) instead of signalling IPO quality. We argue that these results might not be generalizable to the UK or other non-US markets due to the significant institutional differences between US and UK as discussed earlier (and in detail in chapter 2). The results from chapter 5 confirm our arguments. Contrary to the results of Gao and Siddiqi (2012), we find that longer lockup IPOs exhibit superior long-run performance over three years after IPO compared to the shorter lockup IPOs. We use both event-time and calendar-time approach to evaluate the long-run performance differences between IPOs with shorter lockups and longer lockups. Our results are consistent over a number of performance benchmarks and weighting sachems in event-time analysis and over different factor models in calendar-time analysis using both ordinary least squares (OLS) and weighted least squares (WLS) regressions. Results from our multivariate analysis show that lockup length is significantly and positively related to the three year post-IPO abnormal returns. In addition, we also examine abnormal returns around lockup expiry and find that negative performance in different windows around lockup expiry is concentrated in IPOs with shorter lockups. Taken together, this evidence shows that longer lockups are related to better stock return performance in the long-run and our findings are consistent with the view that IPO firms signal their higher quality through longer lockups.

In chapter 6, we ask the question that whether longer lockups constrain earnings management at the time of IPO by examining the association between lockup length and the level of earnings management in IPO fiscal year. We contend that with significant liquidity and portfolio non-diversification costs, longer lockups remove insiders' incentives for earnings management to avoid potential wealth losses at lockup expiry. Consistent with this argument, we document a significant negative relationship between earnings management and lockup length. Longer lockups effectively reduce earnings management and this result is invariant to adjustments for potential endogeneity of lockups and alternative proxy for earnings management. Overall, our evidence suggests that lockup length acts as an important constraint to opportunistic earnings management around equity issues.

Chapter 7 concludes the thesis. We recap the objectives of the research, summarise the key findings in empirical chapters, highlight further contribution and inferences of the research findings, acknowledge the limitations and provide further areas for future research.

CHAPTER 2 UK INSTITUTIONAL FRAMEWORK AND LOCKUP AGREEMENTS

2.1 Introduction

The LSE consists of two market segments: the Main Market (also called Official List) and the Alternative Investment Market (AIM). The admission criteria, ongoing regulations and regulatory regimes for both markets are significantly different. Main Market is primarily for established and larger companies which have satisfied the UK Listing Authority (UKLA) requirements. For listing on Main Market, the companies need to satisfy three criteria: minimum 25% shares in public hands (public float), minimum market capitalisation of £700,000 at admission and three years of trading history. Moreover, there are higher levels of compliance with LSE rules and on-going obligations regarding transparency and disclosure. On the other hand, AIM is targeted towards younger and smaller companies as there are no requirements for minimum market capitalisation, trading history and public float. There are, also, less onerous regulations and fewer continuing obligations for the AIM companies.

Currently, there are no compulsory requirements for lockups on the Main Market listed companies.[3] However, certain types of companies were required to have compulsory lockups before January 2000. For example, mineral and scientific research based companies with less than three years of trading records were required to have compulsory lockups. More specifically, the directors and other key employees were not allowed to sell shares either at the time of IPO or during the first two years following the date of IPO. Similar but less stringent lockup requirements were also in place for substantial shareholders (holding more

[3] However, certain companies on AIM are subject to compulsory lockups. AIM rule 7 stipulates that a business which has not been independent and earning revenues for at least two years must ensure a lockup of one year from admission date for all related parties and employees.

than 10% shares) and other shareholders. Since January 2000, lockup period is not mandatory for these companies following a change of rules. However, mineral, scientific research based and innovative high growth companies with trading records of less than three year are required to include a statement in their IPO prospectus detailing lockup or provide reasons if lockups are absent. The details of rules regarding lockups on Main Market are summarised in Table 2.1 which is adapted from Espenlaub et al. (2001, pp.1244). Rest of this chapter is structured in the following way. We highlight the diversity of UK IPO lockups in section 2.2 by providing examples of lockups from IPO prospectuses. Some examples of lockups from US IPOs are also provided to show the differences between US and UK markets in terms of lockups. Conclusion of the chapter is given in section 2.3.

2.2 Diversity of UK IPO Lockups

There are noteworthy differences between the UK and US markets in terms of lockups and their characteristics. The research on lockups has almost exclusively focused on US market and there are limited studies outside US. Most US studies have reported standardised and homogenous lockups with an average length of 180 days (Field and Hanka, 2001, Mohan and Chen, 2001, Brau et al., 2004).

On the other hand, IPO lockups in UK are heterogeneous and more diverse compared to their US counterparts in many ways (Espenlaub et al. 2001, Hoque, 2011). First, unlike US where almost all IPO lockups are set in terms of absolute expiry dates, lockups in UK can be set in terms of both absolute and relative dates. Absolute expiry lockups specify the expiry at a fixed calendar date or a fixed period after the IPO. Absolute expiry lockups often mention the exact length of lockup period. Relative expiry lockups are set in terms of different corporate events like profit announcements, publication of annual reports, earnings announcements or annual general meetings etc. In case of lockups with relative expiry, the exact length of lockup is hard to calculate ex-ante as the precise timing of the event to which lockup expiry is linked in not known. Second, UK lockups could be single or staggered, where single lockup has one expiry date while a staggered lockups has multiple expiry dates and is gradually released over time during which only a certain percentage of shares may be allowed to sell. Third, lockup period may be different for different types of shareholders such as directors, VCs and other shareholders. Espenlaub et al. (2001) indeed find different lockup lengths for directors and other shareholders. Finally, lockups in UK are substantially longer than US lockups. In this chapter, we discuss different types of UK lockups with examples. The empirical literature on heterogeneity of UK lockups in terms of length is provided in section 3.3 of chapter 3.

In order to appreciate the heterogeneity and complexity of UK IPO lockups, we present below some examples from IPO prospectuses in UK.

2.2.1 Examples of UK IPO Lockup Agreements

As discussed above, UK lockups could be of absolute expiry, relative expiry and finally staggered lockups with multiple expiry dates. Moreover, there could be different lockup periods for different types of shareholders. Following are some examples of lockups from UK Main Market IPOs.

2.2.1.1 Absolute Expiry Lockups

Following are two examples of Absolute expiry lockups which could be set in terms of a fixed calendar date or a fixed period after the IPO.

> *"In order to demonstrate their long-term commitment to Nord Anglia, Kevin McNeany (and certain connected parties) and David Johnson have given undertakings, subject to certain limited exceptions, not to dispose of any of the Ordinary shares which will be held by them upon Admission (amounting to 5,832,409 Ordinary shares, representing 45.4 per cent of the Company's issued ordinary share capital immediately following the*

Placing) for the period until 5 April 1999"(Nord Anglia Education PLC, pp. 8 of prospectus, IPO date: 27/02/1997).

"Following the Placing, the interests of the Directors, their families and trusts will amount in aggregate to 59.1 per cent. of the issued Ordinary share capital of the Company. Under the terms of the placing agreement entered into with Nat West Markets, the executive Directors have agreed, inter alia, not to dispose of any of their Ordinary shares in the period up until the second anniversary of Admission and not to dispose of half of their Ordinary shares for a further year thereafter" (Harvey Nash Group PLC, pp. 20 of prospectus, IPO date: 03/04/1997).

2.2.1.2 Relative Expiry Lockups

Below are examples of a Relative expiry lockup, where the expiry of lockup is linked to certain company announcements or events;

"The Directors, their wives, Credit Suisse and the Vendors have undertaken, subject to certain limited exceptions, not to dispose of any Ordinary Shares they will hold immediately following Admission prior to the publication of the annual report of the Company for the year ending 31 May 1999 without the prior written consent of NatWest Markets" (Monsoon PLC, pp. 62 of prospectus, IPO date: 11/02/1998).

"The Directors and Mr Krikorian have agreed not to dispose of any Ordinary Shares they hold following the Placing prior to the date falling one month after the publication of the audited accounts of the Company for the year ending 31 December, 1997 and during the immediately following period of twelve months not to dispose of Ordinary Shares if to do so would result in the total number of Ordinary Shares disposed of by them and their immediate family, during that period, exceeding 25 per cent. of the aggregate number of Ordinary Shares held by such persons immediately following the Placing"(KBC Advanced Technologies PLC, pp. 59 of prospectus, IPO date:20/03/1997*).*

2.2.1.3 Staggered Lockups

Staggered lockups have multiple expiry dates and are released gradually over a longer period during which certain portion of the equity holding may be sold. Additionally, the staggered lockup could be of absolute or relative expiry dates. Following is an example of a staggered lockup with multiple fixed (Absolute) expiry periods.

> *"Pursuant to the Underwriting Agreement, each of QinetiQ and the Principal Selling Shareholders has agreed that, subject to certain exceptions, they will not, without the prior written consent of the Joint Book runners, during the period commencing on the date of the Underwriting Agreement and ending on the date falling 180 days after the date of Admission, directly or indirectly, issue or sell (as appropriate) or grant any option, right or warrant to purchase or otherwise dispose of any Ordinary Shares.*
>
> *In addition, each of the Executive Directors, certain members of Senior Management and certain other senior employees have entered into lock-up arrangements preventing them from selling Ordinary Shares (subject to certain exceptions) without the prior written consent of the Joint Bookrunners and the Company, during the period commencing on 24 January 2006 and ending (subject to one exception):*
> *(a) in the case of one third of the Ordinary Shares held at Admission, one year after the date of Admission;*
> *(b) in the case of an additional one third of the Ordinary Shares held at Admission, two years after the date of Admission; and*
> *(c) in the case of the remaining one third of Ordinary Shares held at Admission, three years after Admission"(*QinetiQ Group PLC, pp. 73 of prospectus, IPO date: 15/02/2006).

Finally, below is an example of a more complex and staggered lockup with relative expiry dates linked to events in company calendar:

> *"Each of the Directors, the Selling Shareholders (other than Mercury, the Governor and Company of the Bank of Scotland, National Westminster Bank plc and The Royal Bank of Scotland pic) and the Other Shareholder has undertaken to the Sponsor that neither he or it nor any of his or its associates or persons connected with him or it will, except under the Offer and in certain other limited circumstances;*
>
> *(i) before the conclusion of the annual general meeting of the Company at which the Company's accounts for the financial year ending on or first ending after 30 June 2001 are laid (whichever is the earlier), dispose of, or enter into any agreement or arrangement to dispose of, any interest in any shares in the capital of the Company;*
>
> *(ii) after the time specified in paragraph (i) above and until the conclusion of the annual general meeting of the Company at which the Company's accounts for the financial year ending on or first ending after 30 June 2002 are laid (whichever is the earlier), dispose of, or enter into any agreement or arrangement to dispose of, any interest in any shares in the capital of the*

Company which would reduce the number of shares in the capital of the Company registered in the name of, or beneficially owned by, such person to 7 5 per cent. or less of the number of shares so owned or registered immediately following Admission;

(iii) *after the time specified in paragraph (ii) above and until the conclusion of the annual general meeting of the Company at which the Company's accounts for the financial year ending on or first ending after 30 June 2003 are laid (whichever is the earlier), dispose of, or enter into any agreement or arrangement to dispose of, any interest in any shares in the capital of the Company which would reduce the number of shares in the capital of the Company registered in the name of, or beneficially owned by, such person to 50 per cent. or less of the number of shares so owned or registered immediately following Admission; or*

(iv) *dispose of, or enter into any agreement or arrangement to dispose of, any interest in any shares in the capital of the Company without offering such shares to the Company's stockbrokers for placing or otherwise disposing of such shares on a best price and execution basis"* (Dechra Pharmaceuticals PLC, pp. 59 of prospectus, IPO date: 21/09/2000).

2.2.2 Examples of US IPO Lockup Agreements

Following are two examples of US IPO lockups for companies which went public on NASDAQ;

"Each of our executive officers and all of our employees who have either purchased shares of our common stock or received options to purchase shares of our common stock, have entered into stockholder's agreements with us. Under those agreements, the employees agreed not to transfer any shares of our common stock for 180 days following the completion of the offering. There is an exception for transfers to trusts and estates for estate planning purposes and for sales of a pro rata portion of these shares of our common stock in connection with a sale by Ripple wood Partners of its shares of our common stock. In addition, following the completion of the offering and the expiration of the 180-day lock-up period, employee stockholders will have the right to sell shares of our common stock in any registration statements that we file"(Western Multiplex Corporation, pp. 47 of prospectus, IPO date: 31/07/2000).

"In connection with this offering, officers, directors, employees and stockholders, who together hold substantially all of our outstanding stock, stock options and restricted stock units have agreed, subject to limited exceptions, not to directly or indirectly sell or dispose of any shares of our common stock or any securities convertible into or

> *exchangeable or exercisable for shares of our common stock for a period of 180 days after the date of this prospectus (or such earlier date or dates as agreed between us and Morgan Stanley & Co. LLC), and in specific circumstances, up to an additional 34 days, without the prior written consent of Morgan Stanley & Co. LLC on behalf of the underwriters, or are otherwise subject to substantially similar contractual restrictions with us*"(Groupon Inc., pp. 147 of prospectus, IPO date: 04/11/2011).

As discussed above the US lockups are standardised in terms of length and homogeneous in the way they are stated in the IPO prospectus.

2.3 Conclusion

We compare US and UK lockups mainly due to the reason that most of the lockup studies have been conducted on US lockups. It is clearly evident from above discussion and examples of lockups from US and UK that there are striking differences between IPO lockups between the two countries. The lockups are almost standardised and homogenous in terms of their type and length in US. But IPO lockups in UK are much more varied relative to the US ones in terms of their types. Moreover, prior studies have documented that lockups in UK are substantially longer relative to the ones in US (Espenlaub et al., 2001, Ahmad and Jelic, 2014, Hoque, 2011). This fact has important implications for the findings of lockup studies in both countries. US studies mostly favour commitment device hypothesis of lockups and reject the signalling role of lockups in conveying issuer quality (Brav and Gompers, 2003, Gao and Siddiquie, 2012, Cline et al., 2014). Brau et al. (2004) note that due to standardisation and shorter length of lockups in US, lockups might not mitigate information asymmetry to a significant extent and hence might not be a credible signal of issuer quality. Similarly, comparatively shorter lockups might not be effective in mitigating agency problems in the long term and could be detrimental for long-run performance of issuing firms. The observed heterogeneity and longer periods in UK lockups may be more consistent with mitigation of information asymmetry and signalling role of lockups. Similarly, longer lockups ensure that founders and key employees remain with the firm for a longer period and their interests are aligned with the outside investors reducing agency problems. This is likely to have a favourable impact on long-run performance of the issuing firms, particularly in UK.

Table 2.1: LSE Rules Relating to Lockups

Type of company	Type of Shareholder: A. Directors, senior employees and their associates	B. Shareholders holding more than 10%	C. Other shareholders
Panel A: Main Market			
Before January 2000			
Mineral companies with trading records of less than three years	Either: no shares to be sold in the IPO Or: no shares to be sold during the 2 years after the first day of trading	1. Either: no shares to be sold in the IPO Or: no shares to be sold during the 6 months after the first day of trading or the publication of the first semi-annual or annual results. 2. Not more than 40% of their stake within the2 years of first day of trading	Sales must not exceed 20% of the total number of shares
Scientific research based companies with trading records of less than three years	Either: no shares to be sold in the IPO Or: no shares to be sold during the 2 years after the first day of trading	1. Either: no shares to be sold in the IPO Or: no shares to be sold during the 6 months after the first day of trading or the publication of the first semi-annual or annual results. 2. Not more than 40% of their stake within the 2 years of first day of trading	Sales must not exceed 20% of the total number of shares
From January 2000			
Mineral companies, scientific research based companies and innovative high growth company with trading records of less than three years	No minimum lock in period, but lockup statement must be contained in prospectus	No minimum lock in period, but lockup statement must be contained in prospectus	No minimum lock in period, but lockup statement must be contained in prospectus

Source: Table adapted from Espenlaub et al. (2001), pp. 1244

CHAPTER 3 LITERATURE REVIEW

3.1 Introduction

Lockup provisions are present in most of the IPO prospectuses. Lockups prevent insiders of a firm to sell full or some percentage of their equity at the time of IPO for a certain post IPO period. Lockups are not regulated by the regulators and are agreements between the issuers and underwriters (sponsors in UK) of the securities. Although voluntary in general, lockups are mandatory listing requirement in specific markets/countries under certain circumstances.[4] Underwriters insist on lockups to have an orderly market in the newly issued shares. At the time of IPO, insiders sell relatively small percentage of overall equity in the firm and a substantial percentage is withheld. If the insiders are allowed to sell large volumes of shares at the time of IPO or immediately after the IPO, this will flood the market with new shares and adversely affect the market impairing the true value of the IPO firm. The detailed terms of the lockup agreement and the date of lockup expiration are disclosed prominently in the IPO prospectus.

IPO is an ideal opportunity for the pre-issue owners to cash in their holdings. IPO also serves as an exit route for the VCs who want to harvest their investments in portfolio companies. But a lockup will restrict the liquidation of insiders and venture capitalists' holdings at IPO and even some time after the IPO. The important question then is why the corporate insiders commit to a (longer) lockup? This chapter reviews the relevant literature to answer this question. Moreover, we also identify gaps in the existing literature relevant to lockups and discuss our motivations to study lockups with certain aspects of the IPO firms.

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[4] For example see Goergen et al. (2006) for France and Germany and Chong and Ho (2007) for Singapore.

The remainder of the chapter is organised as follows. Section 3.2 reviews theoretical explanations of lockups and empirical literature on the use of lockups. Section 3.3 discusses empirical evidence on length of lockup period. In section 3.4, abnormal return performance around lockup expiry mainly from US and UK is reviewed. Section 3.4 provides evidence on the survival of IPOs. Section 3.5 surveys long-run performance of IPOs in US, UK and in international context along with a brief outline of various reasons for long-run underperformance. Related literature on earnings management in IPOs and mitigating factors is presented in section 3.6. Section 3.7 concludes the chapter and provides rationale for the empirical chapters.

3.2 Motivations of IPO Lockups

Prior research suggests two main (apart from others) explanations behind the presence of lock up agreements. Firstly, lockups serve as a signal of firm quality to mitigate the adverse selection problem caused by the information asymmetry between issuers and investors (Brau et al., 2004, Brau et al., 2005, Arthurs et al., 2009). Secondly, lockups may serve as a "commitment device" to reduce the moral hazard problem after the IPO (Brav and Gompers, 2003). There are also some less popular motivations like rent seeking by underwriters proposed in the literature for lockups.

3.2.1 Lockups as a Signal of Firm Quality

Firms wishing to raise equity through IPO face a greater amount of uncertainty regarding their value. This uncertainty exists due to a large amount of information asymmetry between the issuers and investors of the securities. The insiders of the issuing firms know the real value of their firms. The investors on the other hand have very little information about the true value of issuing firms. This information asymmetry can result in adverse selection because investors are unable to distinguish between the low and high quality firms. The issuers, however, can reduce this information asymmetry by sending signals of their quality to the prospective investors. But for a signal to be credible, it should be costly and reliable. Moreover, a signal should be able to distinguish between the low and high quality firms (Arthurs et al., 2009).

Signalling theory remains an important component of the IPO research due to the information asymmetry between the insiders of issuing firms and potential outside investors at the time of issuing. The IPOs are susceptible to information asymmetry problem due to limited information available about the issuing firms prior to the IPO, no trading history and no news media coverage (Rao, 1993). Owners and managers of IPO firms possess inside and private information about the current and future cash flows and prospects of the firms which is not known to the outside investors. The issuing firms can reduce this information asymmetry by revealing the positive inside information through various signalling mechanisms. Previous research has identified certain signals which IPO firms may use to indicate their quality to the investors in an environment of high asymmetric information. Early studies, such as Leland and Pyle (1977), suggest that higher level of retained equity at the time of offering serves as a signal of quality. Models proposed by Welch (1989), Allen and Faulhaber (1989) and Chemmanur (1993) propose that high quality firms signal their quality by underpricing more at the time of IPO and these firms will be able to recoup the "money left on the table" in subsequent offerings. Similarly, certification by third parties has also been proposed as a signal of firm quality at the time of offering. Presence of reputed underwriters (Carter and Manaster, 1990, Carter et al., 1998, Dong et al., 2011), reputable accounting firm (Michaely and Shaw, 1995), VCs (Megginson and Weiss, 1991, Barry et al., 1990) and reputed VCs (Krishnan et al., 2011) have been found to be the quality certification signals in the earlier literature.

An IPO lockup can also serve as a signalling mechanism to reveal the inherent quality of issuing firms to the potential investors. Arthurs et al. (2009) argue that for a signal to be beneficial, it must be visible and costly or difficult for others to mimic. Lockup as a signal of quality meets both of these criteria. The details about the lockup and expiry date of the lockup are clearly stated in the IPO prospectus. Sometimes, issuing firms particularly emphasise in the IPO prospectus that the lockups show the commitment of insiders to their business[5]. Moreover, lockups are costly because of non-diversification and illiquidity on part of insiders for a certain post IPO period. Only high quality firms with positive information about current and future prospects will be willing to bear the cost of being undiversified for a long period after the IPO. It will be difficult for the low quality firms to commit to a longer lockup as the true quality of the firm will be revealed in the aftermarket. A longer lockup is likely to hurt insiders of poor firms more than the insiders of a high quality firms. Lockup length may prove to be a better and credible signal than the retained ownership as in Leland and Pyle (1977). Insiders can signal quality by retaining a large equity at the time of IPO but they can sell the shares immediately after IPO if restrictions on insiders' sales (lockups) are not in place. In that case, the signalling strategy may not be convincing to investors and the signal might not be effective in communicating the private information of insiders (Gale and Stiglitz, 1989). Courteau (1995) uses the length of holding period (lockup) as a signal of firm value. This commitment to holding period complements the signal provided by retained ownership. Insiders of firms can use lockup length to signal their quality. As lockups are costly signals, only the insiders of high quality firms will be willing to accept longer lock up periods (Brav and Gompers, 2003). Insiders in low quality firms will fear the discovery of true quality (through earnings announcements, regulatory filings, analyst scrutiny etc.) before they can

[5] For example, see the lockup of Nord Anglia Education PLC in section 2.3.1 of chapter 2.

cash out at the expiry of lockups and will not accept longer lockups (Brau et al., 2005). Brau et al. (2005) develop a formal signalling model for lockup length in which insiders of high quality firms' signal "by putting and keeping (locking up) their money where their mouths are". Longer lockups reduce information asymmetry and solve a pre-IPO adverse selection problem by signalling the quality of issuing firm.

3.2.2 Lockups as a Commitment Device

Brav and Gompers (2003) suggest that the lockups mitigate the moral hazard in IPO aftermarket rather than signalling the issuer quality. They argue that the level of information asymmetry regarding the actions of insiders in the aftermarket is critical as they might not act in the best interest of outside investors. Consequently, lockup agreements help to align the interests of insiders and investors in the aftermarket and reduce agency problems. Moreover, the insiders may have hid some negative information regarding the firm value at the time of IPO. With the passage of time this information will become public through regulatory filings and earnings announcements. By accepting longer lockups, the insiders provide evidence that the information about the future prospects of the issuing firms is correct and that they are not over selling the merits of the firm. As the insiders are tied with issuing firms along with investors, any revelation of withheld negative information is likely to hurt insiders more severely due to their illiquid positions. Thus the lockup serves as a bonding mechanism and commitment device to regulate the actions of insiders (Arthurs et al., 2009). Brav and Gompers (2003) argue that holding the quality of issuing firm constant; firms with greater potential of moral hazard are likely to accept longer lockups to assuage the concerns of investors. The commitment explanation suggests that underwriters impose strict (longer) lockups on insiders to mitigate their opportunistic behaviours after the IPO. Empirical evidence regarding signalling and commitment motivations is, at best, mixed and is reviewed in the next section.

3.2.3 Empirical Evidence on Signalling and Commitment Hypothesis

Signalling and commitment have been suggested to be the main reasons behind the presence of lockup provisions in academic literature as discussed above. However, both of these explanations suggest that lockups exist as a mechanism to reduce the risk to the IPO investors. The two studies which examine these motivations separately and come to opposing conclusions are Brav and Gompers (2003) and Brau et al. (2005). Brav and Gompers (2003) find support for the commitment device hypothesis of lockups and reject the signalling explanation for lockups. They argue that younger firms, firms with low cash flow margin and low book-to-market ratio and firms with high risk suffer from greater potential for moral hazard and are likely to accept longer lockups to show their commitment. Their empirical results support the prediction that longer lockups reduce moral hazard after the IPO. On the other hand, Brau et al. (2005) find empirical support for their signalling model of IPO lockups and show that firms with higher degree of information asymmetry and low level of idiosyncratic risk have longer lockups. Moreover, Brau et al. note that some of the proxies used by Brav and Gompers (2003) for commitment hypothesis are also consistent with the signalling hypothesis. Yong and Zender (2010) in a recent study resolve the apparent conflict mentioned in the previous two studies. They argue that asymmetric information and moral hazard are not mutually exclusive motivations and that both of these motivations are dominant for different types of firms. They find results to support their predictions and assert the need to identify the moral hazard and asymmetric information firms separately when examining the motivations for lockups. Two recent studies on the US IPO and SEOs find support for the commitment hypothesis of the lockups. Gao and Siddiqi (2012) use operating and stock return performance after the IPO as a measure of issuing firm quality and relate it with the length of lockup period. They find that longer lockups are related to poor long run performance and conclude that longer lockups are used to mitigate agency problem (commitment hypothesis) and not to signal issuer's quality at the IPO. Cline et al. (2014) study the lockups in SEOs and find that announcement day returns increase with the presence of length of lockup. However, they report that SEO discount and long run performance are not related to the lockup length. They report that their overall findings are consistent with the commitment device hypothesis instead of signalling theory.

Other studies on lockups find empirical evidence to supports either or both of the signalling and commitment motivations. For example, Arthurs et al. (2009) find that longer lockups act as substitute quality signal to reputed underwriter and VC backing for a sample US IPOs. Moreover, longer lockups help to assuage the investor concerns in ventures with high uncertainty in the form of going concern issues and reduce the underpricing for these ventures. Karpoff et al. (2013) find that longer lockups guarantee the quality of new equity issues by reducing information asymmetry and represent a contracting solution to agency problem by deterring opportunistic insider trading in a sample of US seasoned equity offerings (SEOs). Espenlaub et al. (2001), in first ever study of UK IPO lockups, find evidence that is consistent with the commitment device hypothesis at least in case of high tech IPOs on LSE Main Market. They also suggest that issuing firms might use underwriter reputation as a substitute signal of quality to the lockup agreements consistent with the Arthurs et al. (2009). Hoque (2011) examines the heterogeneity and different types of lockups on LSE Main Market and AIM for a sample of 831 IPOs from 1999-2006. The results show a strong evidence of information asymmetry explanation and partial support of the agency (commitment) explanation for the choice of lockups. Ahmad and Jelic (2014) study the survival of LSE Main Market IPO in relation to the lockup period and find that longer lockups predict better survival rate and time for IPOs which is consistent with the signalling hypothesis of IPOs.

The evidence from other markets/countries regarding the motivations for lockups also supports both motivations for lockups. Goergen et al. (2006b) test whether lockup agreements mitigate problems of agency and asymmetric information in France and Germany. Their study is interesting in the sense that both of the countries have requirements of mandatory lockup periods. They find that lockup contracts are not only determined by firm characteristics but also by shareholder type. Their results suggest that firms with higher uncertainty have longer lockup periods and German firms may use the lockup period as a signal of quality as a substitute of underpricing. Bessler and Kurth (2007) investigate German VC backed IPOs and find that there are serious agency problems particularly when banks are also underwriters and VCs. They report lower underpricing and higher long- run performance for non-bank VC IPOs who accepted longer lockup than the minimum required and suggest that longer lockups signal the quality of IPOs. However, extended lockups in case of bank affiliated VC IPOs do not serve as a commitment device, inconsistent with the findings of (Brav and Gompers, 2003). Chong and Ho (2007) study the lockups and earnings forecasts disclosures in Singapore IPOs. They observe longer lockups for firms which are subject to greater asymmetric information and moral hazard in line with Brau et al. (2005) and Brav and Gompers (2003). Moreover the firms with longer lockups make conservative forecast because the longer lockup removes the incentive to make overly optimistic forecast. Their results suggest that lockups act as complement to earnings forecasts, similar to the complementary relation between lockups and retained ownership (Courteau, 1995).

3.2.4 Other Explanations for Lockups

Apart from the signalling and commitment hypothesis, researchers have tried to theorise other explanations for the presence of lockups. Brav and Gompers (2003) propose that lockups may be used by underwriters to extract more compensation from the issuers. The underwriter can allow equity sales before the lockup expiry. The insiders will have to sell the equity using the services of the same underwriter which will bring additional fees for the underwriter. The highly reputed underwriters can impose longer lockups on issuers based on their prestige in the market. Based on this argument, the probability of using the same underwriter for equity issuance (SEO) during the lockup period will be higher. However, Brav and Gompers (2003) find that probability of retaining the same underwriter is not related whether the SEO is within lockup period or not. They conclude that if the lockup is used to extract additional compensation by underwriters, the probability of retaining the same underwriter should have been related to equity issue within lockup period.

3.3 Empirical Evidence on Lockup Length

In this section, we review relevant literature on lockup length observed mainly in US and UK studies. For example, Filed and Hanks (2001) show that 80% of their sample IPOs from 1988 to 1997 have a lockup of 180 day period. Similarly, Brau et al. (2004) also report that 70% of their sample IPOs over 1988-1998 have a 180 day lockup. Brav and Gompers (2003) also find a clustering of lockup periods around 180 days for US issuers. Brav and Gompers report that the 10^{th} and 50^{th} percentile lockups are all 180 days and more than 64% IPOs have lockups of exactly 180 days. Yung and Zender (2010) in a recent study of 4025 US IPOs during the period 1988-2006 confirm that the lockup standardization not only continues but has also intensified after the year 1997. They report median and mode lockup length of 180 days for their entire sample. They also find low dispersion and strong clustering at 180 days for IPOs which are associated with high quality underwriters and VCs. Conversely, UK IPO lockups are substantially different from US IPOs in at least two aspects: length of lockup period and diversity in types of lockup agreements. IPO lockups in UK are much longer compared to the US IPO lockups. Espenlaub et al. (2001) report an average length of 561 days for director's lockups on LSE Main Market, which is much larger than those reported for US issuers. Hoque and Lasfer (2009) find an average lockup length of 365 days for UK IPOs from 1999 to 2006. In a recent study of UK Main Market IPOs, Ahmad and Jelic (2014) find that the mean (median) lockup length for a sample of IPOs from 1990-2006 is 468 (395) days. Table 3.1 reports mean and median lockup length reported in different studies for US and UK markets.

The comparison in Table 3.1 and above discussion clearly provides evidence that there are significant differences in terms of length between US and UK lockups. IPO lockups in UK are substantially longer than their US counterparts.

3.4 Market Reaction at Lockup Expiry

Most of the studies on IPO lockups have concentrated on market returns at the expiry of lockups. The lockup parameters and expiry details are clearly disclosed in the offering prospectus which makes expiry of lockup a completely observable event (Field and Hanka, 2001, Brav and Gompers, 2003). The lockup expiry event is well anticipated and devoid of any new information, there should be no reaction to the expiry of lockup. Although, most US studies have reported significant negative abnormal returns around the lockup expiry dates which is anomalous and against the efficient market hypothesis. For example, Ofek and Richardson (2000) report a 1%-3% permanent drop in price and a 40% increase in volume of shares at expiry of lockups. They, however, provide evidence that due to trading costs and difficulty in shorting new shares, the lockup effect is not arbitrageable. They show empirical evidence that partially supports the long-run downward slopping demand curve explanation for price drop. Bradley et al. (2001) find significant abnormal returns at the expiry of lockups for a sample of 2,529 US IPO firms. They also report that VC backed firms suffer much larger and significant declines which are four times higher than the non-VC backed firms. High tech firms within the VC backed sub sample are even harder hit. Interestingly, firms associated with high quality underwriters also suffer large losses surrounding expiry period. Field and Hanka (2001) provide evidence of significant abnormal returns of -1.5% and increase in trading volume of 40% around the lockup expiry day. They find that abnormal returns cannot be entirely explained by the downward slopping demand curve. Moreover, the VC backed firms suffer almost three times compared to other firms in terms of price decrease and volume increase which also shows that VCs sell more aggressively than other shareholders. Keasler (2001) finds that unrestricted investors sell shares prior to the lockup release which leads to negative abnormal returns. There is also significant increase in the volume of shares at the expiry of lockup date. Garfinkle et al. (2002) examine the impact of lockup provisions on 1193 US IPOs from 1997 to 1999. They find a permanent significant increase of 47.5% in the volume traded after the lockup expiry date. They report highly significant negative returns starting three weeks before the scheduled expiry date suggesting the market anticipation of heavy selling at expiry. Brav and Gompers (2003) report similar negative abnormal returns and permanent increase in volume of shares traded after lockup expiry for US IPOs during 1988-1996. Brau et al. (2004) provide evidence of abnormal and significant negative returns for IPOs around the lockup expiry. They, however, argue that as returns start declining days before the exact expiry date, the decline in price cannot be fully attributed to new shares entering the market as a result of lockup expiry. Yung and Zender (2010) also report significant negative abnormal returns during the two day event window around lockup expiry.

They, nonetheless, find that high reputation of underwriter and larger firm size reduces the volatility of abnormal returns

The results of lockup expiry returns from other markets are not entirely consistent with the US evidence. For example, Espenlaub et al. (2001) examine the lockup expiry returns for IPOs on LSE Main Market for the years 1992-1998. They report abnormal returns in the range of -0.5% to -2.5% around the lockup expiry date although the abnormal returns are not significant in most of the cases. Similarly, Goergen et al. (2006b) find no evidence of significant negative abnormal returns at the expiration of lockups for French and German markets. Finally, Goergen et al. (2010) also fail to find significant abnormal returns at expiry of lockup for the Hong Kong market but report a significant increase in trading volume of shares after lockup expiry. On the other hand, Hoque (2011) find significant negative abnormal returns at lockup expiry for UK IPOs which is consistent with US evidence but is inconsistent with the previous evidence on UK and Continental Europe.

The results of the above mentioned studies show that the findings of negative abnormal returns are not robust across US and other markets. While most of the US studies document significant negative abnormal returns, the studies on rest of the markets (UK, France, Germany and Hong Kong) fail to find evidence of abnormal returns at or around the lock up expiry.

3.5 Survival of IPOs

Going public is one of the most important events in the life of a company. Although there is vast theoretical literature on motivations to go public, there is little empirical evidence to support these theories. Moreover, the empirical evidence on the question of why firms go public is far from a consensus on any single motivation for going public. For example, Pagano et al. (1998) find that companies go public to rebalance their accounts after periods of high growth and investment and not to finance future investment and growth. On the other hand, Kim and Weisbach (2005) find capital raising as an important motive for going public and listing on the stock market. Bancel and Mittoo (2009) find ability to raise capital and enhanced visibility as the most important motives for listing on the market. Although, evidence on reasons to go public remains divergent, raising equity capital is considered to be one of the major motivations to go public (Kim and Weisbach, 2005, Aslan and Kumar, 2011, Bharath and Dittmar, 2010). This view is further supported by the survey evidence reported in Brau and Fawcett (2006) and Bancel and Mittoo (2009).

Post-IPO survival as an independent listed company has important implications for IPO firm and its insiders. Survival is a logical and necessary condition for success and profitability of companies going public with a view to finance their growth prospects. Listing provides easy access to capital markets, visibility among investment community, higher liquidity, pricing efficiency and is associated with lower cost of bank credit. Being public enhances credibility and reputation of a firm and improves its ability to hire key managers through incentives such as stock options (Bancel and Mittoo, 2009). Survival ensures the continuity of listing benefits and represents arguably the most critical benchmark of a company’s operating performance (Hsu et al., 2010). Likewise, stock exchanges and certain other stakeholders (board members and executives, underwriters, auditors, brokers, legal advisors etc.) have their interests linked with the continued listing of a firm on the stock market (Espenlaub et al., 2012). Prior literature has identified firm survival in the long term as a consistent measure of firm performance and a pre-requisite of success in other terms such as market share and profitability (Audretsch and Lehmann, 2005, Welbourne and Andrews, 1996, Suárez and Utterback, 1995). Finally, survival is a primary goal of the firm and represents an unambiguous measure of issuing firm's performance (Chancharat et al., 2012) and nothing could be more real than survival of the firm (Bhattacharya et al., 2011). In the following sections we present empirical evidence on the survival (failure) rates and durations as well as determinants of the survival of IPOs.

3.5.1 Empirical Evidence on Survival of IPOs

In this section, we review the empirical evidence on the survival rates of IPO survival in aftermarket from different countries. The relatively scant literature on IPO survival has almost exclusively focused on the determinants of survival of newly listed firms. Moreover, much of the literature pertains to the US market and is reviewed first. Schultz (1993) examines the survival of unit and shares IPOs for a sample of 797 issuing firms from 1986-1988. He reports that after three years from the date of IPO, the survival rates for share IPOs are 89 percent compared to 59 percent for the unit IPOs. He argues that higher delisting rates for the unit IPOs are a result of agency problems on the part of unit IPO firms. Hensler et al. (1997) report a delisting (failure) rate of 28 percent after five years from the initial listing date for US IPOs from 1975 to 1984. Seguin and Smoller (1997) compare the mortality of low-priced (penny) shares with high-priced shares and find that penny shares are three times more likely to delist from the market for negative reasons than high-priced shares. The five year failure rates for low-priced stocks are 47 percent compared to 17 percent for high-priced shares in sample of 5896 IPOs listed on NASDAQ from 1974 to 1988. Comparing the survival profile of VC backed and non-VC backed IPOs in the US from 1977-1990, Jain and Kini (2000) find higher post-IPO survival rates for the former group. They report that the cumulative failure rates within five years of IPO are 25.5 percent for VC backed IPOs compared with 30 percent for non-VC backed IPOs. Fama and French (2004) examine the characteristics of the newly listed firms in US from 1973-1991 and report that 10 year failure rates for their sample IPOs are

58.5 percent. They suggest that higher delisting rates are mainly due to the increased number of firms with lower profitability and high growth, issuing public equity. Demers and Joos (2007) examine the comparative failure rates for the high-tech and non-tech IPOs listed in US from years 1980 to 2000. They find that non-tech IPOs have higher failure rates of 16.7 percent compared to the 9.2 percent for high-tech IPOs. Demers and Joos further suggest that financial accounting variables, mostly overlooked by previous studies, play important role in assessing failure risk of IPOs. In another, study of US IPOs from 1985-2005, Kooli and Meknassi (2007) report that only 55.18 percent of the issuing firms are listed independently after five years of IPO. They treat acquisitions differently from other delistings and show that 24.59 percent of IPOs in their sample are acquired and 20.23 percent get delisted due to other negative reasons within five years of IPO. Jain and Kini (2008) report a failure rate of 35 percent after 5^{th} anniversary of issuing firms for IPOs issued between 1980 and 1997 in the US. They find that IPO firms with commitment to R&D spending and a diversified product line increase the viability of issuing firms for longer time. Bhattacharya et al. (2010), in a study focusing on internet IPOs, find that 24 percent of internet companies fail within five years of their listing dates. They also report failure rates of 14.3 percent and 18.2 percent for high-tech companies and firms listed on NASDAQ respectively. In a recent study of US IPOs for the period 1980-2003, Chou et al. (2013) show that only 11 percent of their sample IPOs delist within five years of their listing date for performance related problems (liquidations, financial distress, insufficient capital etc.). The reason for comparatively low failure rate reported by Chou et al. is that they do not include mergers and acquisitions in their definition of delisting.

There is paucity of empirical literature on IPO survival outside the US markets. For example, there are a handful of recently published studies on IPO survival for the UK market and failure rates of UK IPOs have been mentioned in some related studies. Gregory et al. (2010), for instance, study the long-run performance of IPOs listed on LSE during 1975-2004. They briefly report the proportion of firms in their sample that are delisted due to 'bankruptcy' over the three and five years after the IPO. Their classification of bankruptcy includes firms delisted due to liquidations or administrative receiverships. They report that five year attrition rates for companies listed on the Main Market and AIM are 3.6 percent and 9.5 percent respectively. Espenlaub et al. (2012) relate survival of AIM IPOs to the reputation of nominated advisors (NOMADS) for a sample of 896 IPOs during 1995-2004. They find that failure rates of IPOs on AIM are 26 percent and 41 percent respectively for three and five post IPO years. They further conclude that delisting rates in their study are comparable to the ones reported for US and Canadian markets. Similarly, Kashefi Pour and Lasfer (2013) study the voluntary delisting from LSE AIM for the period 1995-2009. Although, they do not report the survival or failure rates for their sample IPOs, they show voluntary delisting accounts for 44 percent of their total delisted sample firms. Their findings suggest firms that delist voluntarily come to the market to rebalance their leverage rather than financing their growth opportunities; but these firms leave the market voluntarily when they fail to benefit from listing. Ahmad and Jelic (2014) focus on Main Market IPOs and examine the survival of IPOs in relation to the lockup agreements. Their study is by far the exclusive and comprehensive analysis of IPO survival on the LSE Main market. They report that the five year failure rate for their sample IPOs form 1990-2006 is 31 percent, which is comparable to the US evidence discussed earlier. They also find that survival rates and times of IPOs with longer lockups are consistently better than that those of with shorter lockups.

Although there was a spate of recent studies on survival of IPOs in UK, other non-US markets remain relatively ignored. The other markets with notable IPO survival studies include

Canada, Australia and Taiwan. For instance, Carpentier and Suret (2011) examine the survival of penny stock IPOs on the Canadian stock market for the period 1986-2003. They find that 11.60 percent of their sample IPOs delist within five years following the IPO. They show that the failure rate of penny stocks in Canada is comparatively lower than that of US penny stocks reported in (Bradley et al., 2006). Carpentier and Suret, however, further classify their surviving firms into successful and unsuccessful; where successful surviving IPOs include those which have been transferred to a higher tier market or cross listed in the US exchanges. They find that only about 7% of their sample IPOs can be categorised as surviving successful firms. Chancharat et al. (2012) analyse the survival of Australian new economy (small firms with high growth opportunities) IPOs and relate it to the board structure of these IPOs. Their sample consists of 125 IPOs between 1994 and 2002 and they find that 25.60 percent of their sample IPOs delist from the market within five years of their listing date. They also report that the board independence increases the likelihood of corporate survival. Finally, Yang and Sheu (2006) study the survival of IPOs listed on the Taiwan stock market from 1992 to 2000. They report that 38 out of their 560 sample IPOs do not survive after three years of IPO which equates to a failure rate of 6.7 percent. The relatively lower failure rate is due to the reason that they only consider IPOs delisted due to the negative reasons and do not account for mergers and acquisitions as delisted IPOs. Their results also suggest that likelihood of IPO survival first decreases and then increases with the percentage of insider ownership at the time of listing.

The above discussion summarises survival rates of newly listed firms mainly in the US and other countries including UK, Canada, Australia and Taiwan. The reported failure rates for US market range from 9 percent to 47 percent over five years following the listing. The variation in failure rates is mainly because of different sample periods, different sub-samples (high-tech vs non-tech, VC vs non-VC backed etc.) and difference in definition of survivors and non-survivors. Some studies treat merger and acquisitions as delisted firms (Jain and Kini, 2000) while others treat them separately from survivors or non-survivors (Bhattacharya et al., 2011) or exclude these firms altogether (Hensler et al., 1997). Similarly, failure rates for IPOs in UK range from almost 4 percent to 41 percent after five post-IPO years depending on the segment of the market (Main or AIM) and the definition on non-survivors. In next section, we discuss the determinants of survival (failure) of IPOs in the aftermarket.

3.5.2 Determinants of IPO Survival or Failure

As discussed earlier, much of the literature on survival of IPOs has focused on the determinants of the survival of IPOs. The studies have mainly related pre-IPO and IPO characteristics to the aftermarket survival of issuing firms in order to find what IPO characteristics affect the longevity of IPOs. Each of these predicted determinants examined in the literature is discussed in turn below.

IPO size: The size effect is well documented in the long run performance and survival of IPOs literature. Empirical studies usually proxy firm size by total assets, revenues and market capitalisation of the issuing firms. Size is also used as a proxy of firm risk where larger firms are likely to have less information asymmetry about the value of the firm in the aftermarket (Brav and Gompers, 2003). Moreover, larger IPOs have more resources at hand to deal with the difficult market conditions and withstand the decline in value (Hensler et al., 1997). Firms raising large funds at the time of IPO are presumed to have less uncertainty about their future prospects and are likely to perform better in the long run (Jain and Kini, 2000). Consistent with these arguments, studies have reported a positive relation between IPO size and long-run performance and survival of issuing firms. For example, Ritter (1991) finds that larger IPOs have better long-run performance relative to the smaller IPOs. Goergen et al.

(2007) also report positive impact of firm size on the long run IPO performance. In context of survival, larger IPOs are less likely to fail and have a higher probability of survival (Schultz, 1993, Hensler et al., 1997, Jain and Kini, 1999a, Demers and Joos, 2007). Similar results are reported in the more recent studies on survival of IPOs. For instance, Espenlaub et al. (2012) report a positive impact of size (measured by market capitalisation at offering) on post IPO survival of issuing firms in UK. Espenlaub et al. show that a two-standard deviation increase in the size of IPO results in a 36 percent increase in the survival time for the issuing firm.

IPO Age: Firms established long time ago before the IPO are likely to have more information available about their operations and history. Age of the issuing firm, therefore, represents another proxy of information asymmetry and risk of the issuing firm (Ritter, 1991, Goergen et al., 2006a). Older firms are more established, less speculative and are likely to have stable sources of business relative to the newer firms (Chancharat et al., 2012, Demers and Joos, 2007). Moreover, longevity of issuing firm prior to the IPO provides historical information for investors to assess the risk and future prospects of the firm (Hensler et al., 1997). In line with these arguments, prior researchers have found a positive impact of firm age on post-IPO survival and performance of issuing firms. For instance, Ritter (1991) and Dong et al. (2011) show that IPO age is positively associated with long-run performance of IPOs. Schultz (1993) provides evidence to show that probability of firm failure decreases with increase in the age of issuing firm and Demers and Joos (2007) report that younger firms are more likely to fail. Similar results of a positive relation between IPO age and survival are reported in Hensler et al. (1997) and Espenlaub et al. (2012). For example, Espenlaub et al. (2012) find that a one-standard deviation (2.67 years) increase in the age of issuing firm increases the median survival time by about 35 percent.

IPO Underpricing: The results from literature regarding the relation between initial underpricing and long-run performance/survival are inconclusive. These studies mainly focus on the signalling and uncertainty explanations for the IPO underpricing. According to the signalling explanation, higher underpricing represents higher quality of issuing firms (Allen and Faulhaber, 1989, Grinblatt and Hwang, 1989, Welch, 1989). Signalling hypothesis predicts a positive relation between initial underpricing and post-IPO long-run survival and performance. On the other hand, increased underpricing represents higher ex-ante uncertainty about the firm value (Beatty and Ritter, 1986); leading to a lower survival of IPOs in the aftermarket. The empirical evidence of signalling and valuation uncertainty in relation to the performance and survival of IPOs in the long-run is mixed. For instance, Hensler et al. (1997) find a positive impact of underpricing on survival of IPOs and Álvarez and González (2005) show a positive relation between underpricing and long-run performance. Schultz (1993) reports that likelihood of IPO failure is negatively related to the underpricing at least in the firms' first year of IPO. Demers and Joos (2007) find a lower probability of failure for IPOs with high underpricing in the high-tech sector of their sample IPOs. The results of these studies are in consonance with the predictions of signalling theory of underpricing. On the other hand, Hamza and Kooli (2010) find that higher level of underpricing reduces the probability of survival relative to non-survival, consistent with the valuation uncertainty (higher risk) arguments of (Beatty and Ritter, 1986).

Insider Ownership Retention: In absence of (or very low) ownership stake in the issuing firm, inside managers are likely to engage in non-value maximising transactions resulting in agency costs which might destroy firm value (Jensen and Meckling, 1976). This would lead to poor performance in the post-IPO period, if unabated, resulting in higher failure of issuing firms (Hensler et al., 1997, Jain and Kini, 1999a). According to the signalling theory, a higher percentage of ownership retention at the time of IPO can act as a certification device and signal issuing firm quality (Leland and Pyle, 1977). Accordingly a higher retained ownership by insiders is hypothesised to align the interests of inside managers and outside investors mitigating the agency costs and leading to higher survival of issuing firms. Consistent with the reduction of agency problems for firms with higher proportion of insider ownership, Hensler et al. (1997), Jain and Kini (2008) and Bhattacharya et al. (2010) find a positive impact of higher insider ownership retention on the post IPO survival of issuing firms in the US. Similarly, Espenlaub et al. (2012) show that percentage of equity retention at the time of IPO is positively related to post-IPO survival in the long run for AIM IPOs in UK. Moreover, Yang and Sheu (2006) suggest that increasing insider ownership, particularly of top executives, will reduce agency problems and improve the survival of the issuing firm in the long-run.

Leverage: The level of debt at the time of listing may have important implications for the post IPO performance of the issuing firm. Higher level of debt may result in underinvestment problems and reduced profitability in the years following the IPO. This might lead to higher financial constraints and weak financial health resulting in increased financial risk of the issuing firm. Consequently, the level of financial risk is related to the probability of financial distress (Lee and Yeh, 2004) and firms with higher levels of debt are more likely to go bankrupt (Chancharat et al., 2012). Moreover, financially distressed firms may use mergers and/or takeovers to avoid bankruptcy (Loderer et al., 2009). This would mean a positive relation between the degree of leverage and probability of failure in the aftermarket. Empirical evidence generally supports this conjecture. For instance, Demers and Joos (2007) find that leverage has a significantly positive relation with the likelihood of failure. Similar results are reported by Bhattacharya et al. (2010) for internet IPOs, where leverage is found to be an important determinant of IPO failure. Chancharat et al. (2012) find that Australian IPOs with lower levels of debt are less likely to fail in post-IPO periods. Finally, Kashefi Pour and Lasfer (2013) find that IPOs delisted voluntarily from LSE AIM have significantly higher debt levels at the time of offering relative to their control groups. They also show that IPO companies leave market voluntarily when they fail to rebalance their leverage by issuing additional equity capital.

IPO Activity: The "hot market" phenomenon is well documented in the IPO literature since (Ibbotson and Jaffe, 1975). Hot issue periods are characterised by the greater number of IPOs with higher initial returns (Demers and Joos, 2007). Moreover, Lowry and Schwert (2002) show that more companies tend to go public following periods of high initial returns. Higher market levels present opportunities to firms to issue equity capital at relatively lower costs due to high investor sentiment. This lures low quality firms to issue equity taking advantage of investor sentiment (Coakley et al., 2007a). Consequently, firms going public in hot markets underperform in the long-run which is explained by the "window of opportunity" or overvaluation hypothesis (Loughran and Ritter, 1995, Ritter, 1991). For instance, Ritter (1991) reports long-run IPO performance is negatively related to the annual IPO volume. In line with these arguments, firms going public during hot market periods are expected to be of lower quality and hence more likely to fail (Demers and Joos, 2007). Empirical evidence supports this conjecture and studies have reported lower survival rates and times for IPOs issued in the hot market periods (Hensler et al., 1997, Kooli and Meknassi, 2007, Hamza and Kooli, 2010).

VC/PE Backing: The previous US evidence suggests a positive role of private equity and venture capital on the subsequent performance and survival of IPO firms (Megginson and Weiss, 1991, Jain and Kini, 1995, Jain and Kini, 2000, Bhattacharya et al., 2011). VCs certify the value of IPOs by reducing information asymmetry through employing prestigious underwriters, reputed auditors and eliciting greater interest from institutional investors (Megginson and Weiss, 1991). VCs assist and take active role in management of their portfolio companies even after IPOs (Barry et al., 1990). The certification and monitoring provided by the VCs results in superior post-issue operating performance (Jain and Kini, 1995) and better survival profile for VC backed IPOs (Jain and Kini, 2000). Moreover, reputation of VCs backing the IPO also serves as a signal of better quality issuing firm and results in a higher survival for IPOs backed by reputed VCs (Hamza and Kooli, 2010). Bhattacharya et al. (2011) show that VCs are associated with lower failure rates of IPOs and VCs reduce the failure risk of issuing firms through value added around the public birth of a firm. Recently, Chou et al. (2013) provide further evidence that VC backed IPOs are less likely to delist for performance failure and have higher survival duration relative to non-VC backed ones. However, their further analysis reveals that the better survival rates and higher survival durations is only concentrated in IPOs backed by prestigious VCs and IPOs backed by an ordinary VC have a probability of failure as high as that of non-VC backed IPOs. On the other hand, presence of VCs may be considered as a signal of quality by the potential acquirers, hence increasing the viability of firm as a target and higher delisting likelihood (Vismara et al., 2012, Kooli and Meknassi, 2007). Besides, young VCs may “grandstand” by taking younger and “less mature” companies to public in order to establish their reputation (Gompers, 1996). Lee and Wahal (2004) find higher underpricing for VC backed IPOs and confirm the grandstanding by VCs as suggested by (Gompers, 1996). VC backed IPOs are likely to have higher failure if grandstanding occurs (Chancharat et al., 2012). Likewise, due to multiple agency conflicts and short term goals, VCs may enhance the short term performance of IPO firms at the detriment of long term performance and survival (Fischer and

Pollock, 2004, Arthurs et al., 2008). This would increase premiums to VCs at IPO exit but leaves the issuing firms less viable in the aftermarket. The evidence from US markets generally finds a positive relation between VC backing (and VC reputation) and post-IPO performance and survival. The findings from UK and other markets, however, are less pronounced. For instance, studies on UK IPOs have largely failed to find significant differences between VC and non-VC backed IPOs in terms of their post-issue performance (Coakley et al., 2007a, Jelic et al., 2005, Jelic and Wright, 2011). Likewise, Espenlaub et al. (2012) fail to find any evidence of the impact of VC backing on post-IPO survival of AIM IPOs in the UK. Coakley et al. (2009), however, find evidence for certification role of VCs for UK IPOs during the period of 1985-2003 except for the bubble years of 1998-2000. Finally, Chancharat et al. (2012) report that VC backing is associated with higher failure for Australian IPOs lending support to short term focus/agency problems of VCs.

Sponsor/Underwriter Reputation: The certification role of prestigious underwriters is well documented in the previous literature. Prior evidence suggests that IPOs backed by reputed underwriters are less underpriced consistent with the argument that reputed underwriters are associated with less risky issuing firms (Carter and Manaster, 1990, Megginson and Weiss, 1991). Moreover, Carter et al. (1998) show that IPOs handled by prestigious underwriters have superior performance compared to those handled by less reputed underwriters. As a repeat player in the IPO underwriting market, underwriters have a lot to lose in terms of their reputation from failed IPOs (Hamza and Kooli, 2010) and underwriters try to protect their reputational capital (Beatty and Ritter, 1986). Reputed underwriters are also associated with lower earnings management at the time of IPO, which shows certification of the quality of IPO firm's financial reports (Lee and Masulis, 2011). Jain and Kini (1999b) provide evidence that reputable underwriters provide valuable monitoring services to issuing firms and this monitoring leads to superior operating and investment performance on part of IPOs backed by prestigious underwriters. Dong et al. (2011) show that higher underwriter quality predicts better long-run performance of IPOs and reputed underwriters add value through their marketing, certification and screening services. Consistent with the certification role of underwriters, Schultz (1993) shows that probability of IPO failure is negatively related to reputation of underwriter. Demers and Joos (2007) find that IPOs handled by reputed underwriters have lower probability of failure within five years following the IPO. Jain and Kini (2008) also find a lower probability of failure and higher survival time for IPOs marketed by high prestige underwriters. More recently, Bhattacharya et al. (2011) observe lower mortality rates for IPOs associated with more reputed underwriters. They also report that observed lower failure rates of IPOs backed by more prestigious underwriters are mainly due to their ability of picking good firms to take public. Similar finding are reported by Espenlaub et al. (2012) for the impact of reputed nominated advisors (NOMADs) on the survival of LSE AIM IPOs. They find that IPOs backed by reputed NOMADs have higher survival rates and longer longevity compared to ones backed by other NOMADs. However, there is also some evidence which suggest that (prestigious) underwriters are associated with higher delisting/acquisition rates. For instance, Kooli and Meknassi (2007) find that association of reputed underwriters with IPOs increases the probability of being acquired compared to survival and non-survival. Likewise, Chancharat et al. (2012) show that IPOs in Australia backed by underwriter are 3.36 times more likely to fail relative to IPOs without underwriter backing. They suggest that the reason for this counterintuitive result is the possibility that risky firms are more likely to seek backing by the underwriter.

Industry effect: Some studies on IPO survival have reported differences in survival profile of issuing firms across industries. For example, Hensler et al. (1997) find that IPOs in Optical and Drug industries have longer survival times and IPOs in Computer and data, Wholesale and Airline industries experience shorter time to failure. Kooli and Meknassi (2007) report that being an Internet IPO reduces the likelihood of survival. Carpentier and Suret (2011) show that IPOs belonging to Materials and Energy sectors have lower likelihood of failure relative to other industries for a sample of Canadian issuing firms. Similarly, Chou et al. (2013) find that technology oriented IPOs have higher survival durations and are less likely to delist.

3.6 Long-Run IPO Performance

There is ample anecdotal evidence to suggest that investors in IPOs earn positive returns in the short-run but negative returns in the long-run after equity issuance. The short term positive performance and long-run underperformance are regarded as anomalies or puzzles in the finance literature. The short-run performance of IPOs is termed “underpricing” as shares in newly listed firms’ trade at prices higher than the issue price resulting in positive returns to the initial investors. The underpricing phenomenon is widely documented and is generally accepted as internationally valid. Similarly, literature has widely documented long-run performance across many markets of the world. Academic researchers have sought to explain the underperformance puzzle since the documentation of long-run underperformance by Ritter (1991) for US market. In the next sections we review the empirical evidence of long-run underperformance for US, UK and other international markets as well as the determinants of underperformance.

3.6.1 Long-Run IPO Performance in US

Early results by Ritter (1991) show that IPOs significantly underperform market in three years following the listing. For a sample of 1526 US IPOs from 1975 to 1984, Ritter reports that issuing firms underperform by about 27 percent relative to comparable seasoned firms in terms of size and industry with small offers the worst performers. Loughran (1993) compare the long-run performance of IPOs on NYSE and NASDAQ stock exchanges and find that IPOs on average underperform over six years after listing. The results show that poor performance of NASDAQ firms is primarily due to the low returns on IPO firms. In a subsequent study, Loughran and Ritter (1995) report long-run underperformance not only for IPOs but also for SEOs. For instance, they show that investors in IPOs earn an average return of 5 percent during five years after the IPO while the average return for investors in SEOs stands at 7 percent. Moreover, they use six different benchmarks and their results show that both IPOs and SEOs underperform these benchmarks over the five years period after equity issuance. Rajan and Servaes (1997) report five year long-run underperformance in the range of -17 percent to -47 percent relative to different benchmarks (NYSE/AMEX) for IPOs issued during the years 1975-1987. Carter et al. (1998) find that over a period of three years following the issuance, IPOs underperform the market by about 20 percent. Similarly, Loughran and Ritter (2000) re-examine the IPO underperformance using Fama-French (1993) three-factor models purged for new issues and find that new issues reliably underperform using both weighting schemes (equal and value). Similarly, Ritter and Welch (2002) examine the long-run stock return performance of IPOs in three years following listing in US from 1980 to 2001. They report market adjusted (CRSP value weighted index) returns of -23.4% and style adjusted (seasoned matched firm with closest market capitalisation and book-to-market ratio) returns of -5.1%.

The evidence of long-run underperformance on part of IPOs, however, has not gone uncontested in the literature. For example, Brav and Gompers (1997) cast doubt on the evidence that IPO firms underperform in the long-run. They show that underperformance is sensitive to the benchmark and weighting scheme used. The level of underperformance is significantly reduced when returns are value weighted instead of equal weighted. They also show that underperformance is not exclusive to IPOs and when IPOs are matched to size and book-to-market matched portfolios purged for recent equity issuing firms, the underperformance of IPOs disappears. Small, low book-to-market firms perform worst regardless of whether they are IPOs or not. Brav et al. (2000) document that IPOs perform as well as non-issuing firms matched on size and book-to-market ratio and poor performance is mainly concentrated in small issuing firms with low book-to-market ratios. Gompers and Lerner (2003) examine IPO performance over a long time period from 1935 to 1972 and before the formation of NASDAQ and show that the performance depends on the method used to measure returns. Their results show that IPOs underperform when value weighted buy-and-hold abnormal returns (BHARs) are used. However, they find no underperformance when either value weighted BHARs or cumulative abnormal returns (CARs) are used. Furthermore, IPOs show no underperformance in calendar time analysis using factor models. More recently, Eckbo and Norli (2005) argue that underperformance in IPOs is mainly due to their high stock turnover and low leverage ratios and underperformance disappears after these two factors are accounted for.

More recent evidence from US also shows long-run underperformance of IPO firms. Brau et al. (2012) study the acquisition activity and long-run performance for a sample of 3547 IPOs from 1985 to 2003. They report a market adjusted abnormal return of -25.69 percent and a size and book-to-market adjusted abnormal returns of -10.69 percent after five years following the IPO. They, however, find that IPOs which acquire within one year of going public underperform significantly following the first year whereas non-acquirers do not underperform. Wu and Kwok (2007) examine the long-run performance of domestic vs global IPOs in the US during 1986-1997. They find that both domestic and global IPOs underperform the market index (CRSP value weighted index) on equal as well as value weighting basis. The underperformance is, however, less severe for domestic issuers. Similar, results are reported by Gao and Jain (2011) who examine the long-run performance of founder vs non-founder CEO IPOs. They find that both groups (founder vs non-founder CEO) of IPOs underperform the market adjusted and style adjusted (size and book-to-market) benchmarks for five years after the IPO, although founder CEO IPOs fare better than non-founder CEO IPOs. For example, five year size and book-to-market adjusted BHARs for founder CEO firms are -21.72 percent while the same are -52.88 percent for non-founder CEO firms.

The overall results from the above discussion show that IPOs in US underperform in the long run and this underperformance is consistent over time. However, the results of long-run performance studies could vary depending upon the benchmarks, methodology (event time vs calendar time) and weighting scheme (equal vs value) used. Moreover, studies have uncovered performance differences across different firm and issue characteristics.

3.6.2 Long-Run Performance of IPOs in UK

Studies on the long-run performance in UK broadly confirm the US findings discussed above. To start with, Levis (1993) examines the long-run performance for a sample of 721 UK IPOs issued during 1980-1988. Levis uses three different benchmarks; Financial Times Actuaries All Share Index, Hoare Govett Small Companies Index and a specially constructed All Share Equally Weighted Index to calculate long-run returns. The 36 months cumulative abnormal returns vary from -8.31 to -22.96 percent depending on the benchmark used.

Espenlaub et al. (2000) revisit long-run performance of UK issuing firms over the period 1985-1992 using a sample of 588 IPOs. In doing so, they use a number of alternative benchmarks and calendar time approach. They find that over the first three years after listing, IPOs underperform significantly irrespective of the benchmark used. However, over the five year horizon after the IPO, the underperformance becomes less severe and depends on the benchmark applied. They also report that statistical significance of abnormal returns is even less marked when calendar time approach is used to measure return performance.

In a study of private to public management buyout (MBO) IPOs on LSE during 1964-1997, Jelic et al. (2005) find no evidence of underperformance three years after the IPO date. Moreover, they also report that there are no significant performance differences between VC backed and non-backed IPOs, although IPOs backed by highly reputable VCs tend to be better long term investment relative to the ones backed by less reputable VCs. They attribute their inconsistent (with existing evidence on long-run IPO underperformance) results to the fact that MBO backed IPOs are a different subsample within the IPO population based on their characteristics.

Goergen et al. (2007) also find results which corroborate the underperformance earlier documented by Levis (1993) and Espenlaub et al. (2000). Goergrn et al. report significantly negative returns in the range of -13.17 percent to -21.98 for different benchmarks over three years after the IPO. They also find that small firms perform worst in the long-run which is consistent with the US evidence (Brav and Gompers, 1997, Brav et al., 2000).

Coakley et al. (2008) examine the long-run performance of 571 IPOs on Main Market of LSE during 1985-2003. They report three year mean abnormal return of -1.3 percent over the full sample period but the abnormal return is not significantly different from zero, thus discarding the underperformance hypothesis. However, they find that returns are significantly negative in hot market periods and statistically different from returns in normal markets. Finally they do not find significant differences in long-run performance between VC backed and non-VC backed IPOs.

Gregory et al. (2010) examine the long-run performance of 2499 IPOs on LSE undertaken during the period 1975-2004. Their sample is by far the largest of all studies conducted on UK stock market and covers Main Market, AIM and USM (Unlisted Securities Market). They report significant underperformance which persists between 36 months and 60 months after the listing. They use three benchmarks; equally-weighted size decile portfolio, value-weighted size decile portfolio and size matched control firm. Their results show significant underperformance of IPOs in the range of 31 percent to 69 percent in five post listing years. They, however, find that IPOs on the Main Market experience less severe underperformance and that overall poor performance is mainly driven by AIM and USM IPOs[6]. They also report results for calendar time portfolio approach and their results lack evidence of underperformance, at least, for Main Market IPOs when returns are value weighted. They conclude that IPOs on AIM and USM significantly underperform both in event time and calendar time analysis while underperformance of Main Market IPOs is sensitive to the method employed.

Levis (2011), recently, investigates long-run performance of LSE IPOs during 1992-2005 based on three different groups of issuing firms; PE backed, VC backed and non PE-backed. Consistent with previous evidence on UK IPO underperformance, Levis reports negative abnormal returns across different benchmarks. However, the magnitude of abnormal returns and their statistical significance is lower than those reported in previous studies. For example,

[6] The five year buy-and-hold abnormal returns for equal weighted size decile portfolio, value weighted size decile portfolio and size matched control benchmarks are -19.2%, 9.9% and 35.7% respectively for the Main Market IPOs. Furthermore, abnormal returns for value weighted size decile portfolio are not statistically different from zero.

he shows that abnormal returns vary from -13.46 percent to 13.67 percent for various benchmarks based on equal-weighting basis and negative abnormal returns are only significant in case of FTA benchmark. Moreover, although negative, none of the value weighted returns are significantly different from zero. Surprisingly, he finds that PE backed IPOs outperform significantly across all benchmarks and in both equal and value weighting basis. The three year abnormal returns range between about 14 percent and 29 percent for PE backed IPOs. The poor performance in overall sample is mainly driven by VC backed and non-sponsored IPOs. Finally, none of the alphas in his factor regression models in calendar time approach are negative, suggesting no evidence of long-run underperformance.

In sum, although studies on the US markets find strong evidence of long-run IPO underperformance, the reported results from UK are not conclusive. For example, there are marked differences between performance of IPOs on Main Market and AIM (or now defunct USM) in post-issue periods (Gregory et al., 2010). Moreover, long-run returns are not consistent across event time and calendar time approaches (Levis, 2011) and are dependent on the benchmark applied (Espenlaub et al., 2000). Finally, some researchers fail to find underperformance in long-run altogether for UK IPOs (Coakley et al., 2008, Jelic et al., 2005). This warrants for further investigation of long-run performance of issuing firm in the UK markets.

3.6.3 International Evidence on Long-Run IPO Performance

The IPO long-run underperformance is not exclusive to US and UK markets and has been observed widely in other developed and developing markets in the world. Empirical evidence from developed markets like France, Germany, Japan and Australia clearly shows that IPOs perform poorly in the aftermarket. Similar results of underperformance are reported for other developing markets such as Brazil, China, Thailand and Chile etc. However, there are some markets which seem to defy the established pattern of long-run underperformance of IPOs. For instance, Kim et al. (1995) show that Korean IPOs outperform similar seasoned firms in the post-issue periods. Loughran et al. (1994) report positive three year abnormal returns for Swedish IPOs after the listing date. Finally, IPOs in Thailand and Malaysia also do not show evidence of significant underperformance in the long-run (Allen et al., 1999, Ahmad-Zaluki et al., 2007). Since the findings of IPO long-run underperformance seem to be consistent around the globe, the studies have not been discussed in detail. A summary of findings from international literature regarding long-run IPO performance is presented in Table 3.1.

3.6.4 Long-Run Performance Explanations

Although there is ample evidence to suggest that IPOs underperform in the long-run, the explanations for the persistence of long-run underperformance are less abundant. There are few studies that attempt to explain underperformance theoretically while most of other studies simply attempt to find cross-sectional variations in long-run performance by relating it to various IPO firms and issue characteristics. We briefly discuss below and summarise the literature that attempts to explain the reasons and determinants of long-run underperformance.

3.6.4.1 Theoretical Explanations of Long-Run Underperformance

As mentioned above, the theoretical explanations for poor performance of IPOs in the long-run are scarce. One semi-rational explanation for the underperformance phenomenon is the investors' divergence of opinion proposed by Miller (1977). Miller assumes heterogeneous expectations of investors about the firm valuation under the short sale constraints. IPO shares are bought by the investors who are most optimistic about the future prospects of the firms, resulting in higher prices for IPO shares than their fair prices. With flow of more information about the firm, the divergence of opinion decreases and valuation of shares converge to mean or fair price. The resultant fall in price leads to underperformance in the long-run predicting a negative relation between divergence of opinion and long-run performance. Moreover, riskier firms with large divergence of opinion about their value are even more likely to underperform in the long-run. Ritter and Welch (2002) suggest that this explanation is also consistent with the drop in prices at the time of lockup expiration. The argument of Miller (1977) works best when the number of investors in not large and the public float is small. However, at the time of lockup expiry, market is flooded with released shares causing higher volumes and negative returns. Houge et al. (2001a) find support for Miller's (1977) theory and show that their proxies for greater divergence of opinion are negatively related to poor long-run returns.

Ritter (1991) and Loughran and Ritter (1995) suggest that issuers take advantage of "window of opportunity" and issue shares when investors are irrationally overoptimistic about the future potential of issuers. IPO market is subject to fads that can affect the market prices of shares (Shiller, 1990). The window of opportunity explanation posits that investor optimism during a period will result in large cycles of IPO volume. The issuers have incentive to issue overvalued equity in these periods of market buoyancy taking advantage of investor sentiment. Consequently, IPOs issued in hot periods are likely to be overvalued and of lower quality resulting in long-run underperformance. For example, Ritter (1991) finds that volume of IPO activity is negatively related to the long-run performance of IPOs. Lerner (1994) finds that companies go public near market peaks when equity valuations are high. Similarly, issuers selling shares in the hot market periods underperform severely in the aftermarket (Loughran and Ritter, 1995). Rajan and Servaes (1997) show that analysts are overoptimistic regarding the potential of earnings and long term growth of recent IPOs and IPO frequency is positively related to optimistic growth forecasts. In addition, firms with more optimistic long-run growth projections perform poorly in the aftermarket. In another study, Baker and

Wurgler (2000) also find partial support for the window of opportunity hypothesis and market timing by managers in issuing equity.

3.6.4.2 Firm and Issue Characteristics

Much of the literature on long-run performance of IPOs has attempted to find firm and issue characteristics (variables) that predict long-run performance. In doing so, researchers have also focused on signalling in IPOs and the role of third party certifiers like underwriters, VCs etc. in the going public process. These factors are briefly reviewed in the discussion below.

Ritter (1991) reports that young growth companies are worst performers in the long-run after the IPO. Since then, researchers have consistently reported similar results of poor long-run returns for small and younger firms (Brav and Gompers, 1997, Brav et al., 2000). Brav and Gompers (1997) point to a number of possible reasons for the poor performance on part of small, low book-to-market firms. First, among them, is the possibility of negative impact of unexpected shock to small growth firms in early 1980s. This is consistent with Fama and French (1995), who find that earnings of small firms declined in 1980s but could not recover when those of large firms did. The other reasons include lack of institutional holdings in small firms and higher information asymmetry attached to smaller firms.

Jain and Kini (1994) provide an explanation of the long-run performance using the agency problem. They relate long-run post IPO performance to the ownership retained by the insiders at the time of IPO. They argue that higher ownership retention would predict a better long-run performance of IPOs consistent with the signalling and agency cost hypothesis (Leland and Pyle, 1977, Jensen and Meckling, 1976). They find that post-issue operating performance is positively related to level of equity retention by inside managers. However, Mikkelson et al. (1997) fail to find significant relation between long-run operating performance and the ownership structure. Similarly, Goergen and Renneboog (2007) also find that long-run IPO performance is not related to the control and ownership retention.

Another factor that seems to explain the poor long-run performance in IPOs is the earnings management at the time of offering (Teoh et al., 1998a). Teoh et al. find that firms with aggressive accruals in IPO year experience poor performance in three years after the IPO. They conclude that investors do not fully incorporate the effect of large accruals in pricing of IPOs and could pay a high price for the shares. Discovery of the real value and earnings of the issuers in the post-IPO period leads to loss of optimism and prices are revised downwards leading to poor long-run returns in the aftermarket. Teoh et al. (1998c) also find that opportunistic earnings management in IPOs partially explains the long-run underperformance after the IPO. They find that IPO year abnormal accruals, a proxy of earnings management, explain the performance variation in earnings and stock reruns after the issuance. Rangan (1998) provides similar evidence for SEOs and reports that a one standard deviation increase in the earnings management during offer year leads to a decline of about 10% in the market-adjusted returns in the following year. He concludes that investors overvalue the offerings by extrapolating the earnings growth related with higher earnings management. Subsequent reversal of earnings and poor earnings performance leads to correction of valuation and decline in prices and returns. In a related vein, Purnanandam and Swaminathan (2004) find that IPOs are overpriced compared to the industry peer price multiples for a sample of 2000 IPOs from 1980 to 1997. They further report poor long-run performance for these overpriced IPOs and conclude that investors become optimistic by growth forecasts and pay less attention to profitability in valuation of IPO shares. The earning management and overvaluation are both related to the overconfidence on part of investors and entrepreneurs alike (Ritter and Welch, 2002, Heaton, 2002).

Presence of VCs and PE firms in IPOs has also been examined in the going public process. Prior literature has generally reported positive impact of VC presence on the underpricing and long-run performance of IPOs. For example, VC backed IPOs on average are less underpriced due to the monitoring and certification role of VCs compared to their non-VC counterparts (Barry et al., 1990, Megginson and Weiss, 1991). As VCs maintain their positions in the IPOs long after going public (Barry et al., 1990), their certification and monitoring should result in better performance in the long-run for equity issuers. Consistent with this argument, Brav and Gompers (1997) find that VC backed IPOs outperform non-VC backed IPOs over a five year period after listing on an equal weighted returns basis. Jain and Kini (1995) relate VC backing at the time of IPO with post-issue operating performance and find that VC backed IPOs experience superior operating performance compared to non-VC backed ones. Recently, researchers have focused on the differences between VC and private equity (PE) firms to explain cross sectional performance variations in the VC and PE backed IPOs. For instance, Gompers (1996) develops a 'grandstanding' hypothesis which asserts that young VC in order to establish reputation and raise new funds, bring younger companies to the public market which are more underpriced compared to the companies backed by older VCs. Lee and Wahal (2004), on the other hand, find that VC backed IPOs are more underpriced compared to non-VC backed IPOs once the endogeniety issues of VC financing are addressed. They, however, find support for the grandstanding hypothesis by showing that young VC firms and those with fewer IPOs in the past, rush young and smaller companies to the public market. Along the similar lines, another stream of research has examined the reputation of VC and PE firms in relation to the post-IPO performance of companies they bring to the market (Nahata, 2008). Krishnan et al. (2011b), for example, find that VC reputation, measured by previous market share of VC backed IPOs, is significantly positively related to the long-run performance of

IPOs. They also report that reputed VCs are actively involved in the corporate governance of their companies after the IPO and this involvement positively influences the performance even after controlling the VC selection bias. Much of the evidence discussed above relates to US markets and is conclusive; however, results from other markets are not consistent. For instance, studies on VC backing and performance of IPOs from UK report mixed results regarding the impact of VCs on performance. Jelic et al. (2005) examine private-to-public management buyout IPOs in the UK and fail to find significant differences in performance between VC backed vs non-VC backed IPOs. They, however, find that IPOs backed by reputed VC are better long-term investment compared to those backed by less reputed VCs.

Several studies have examined the reputation of underwriter as a significant predictor of long-run IPO performance. Carter et al. (1998) find that long-run market adjusted returns are less negative for IPOs backed by more reputable underwriters. Moreover, they also report less underpricing for more prestigious underwriters in line with Carter and Manaster (1990). Both of these results are consistent with earlier findings of Michaely and Shaw (1994) who show that IPOs backed by reputable underwriters are less underpriced and perform better in the long-run. Similarly, IPOs backed by highly reputed underwriters also show superior operating performance relative IPOs backed by less reputed underwriters (Jain and Kini, 1999b). Some recent studies report that underwriter reputation continues to be a significant predictor of long-run IPO performance. Dong et al. (2011) examine underwriter reputation and long-run IPO performance in US from 1980 to 2006. They focus on marketing, certification and screening and information production role of underwriters an find that higher underwriter quality predicts superior long-run performance. They further find that marketing and certification and screening are important attributes of underwriter quality in terms of post-issue quality.

Recent literature has documented some other variables and issue characteristics which are significantly related to the performance of IPOs in the long-run. Wu and Kwok (2007), for example, find that global IPOs on US markets show poor long-run performance compared to market as well as the domestic IPOs over three years after issuance. They suggest that investors are optimistic about the future growth of firms engaged in global offerings and these expectations are corrected over time after IPO causing underperformance, which is consistent with the window of opportunity hypothesis. Gao and Jain (2011) examine the long-run performance differences between founder CEO and non-founder CEO IPOs and find weak evidence of superior performance for founder CEO IPOs relative to non-founder ones in general. However, they show significant higher returns for founder CEO IPOs compared to non-founder CEO IPOs in context of high technology firms. Brau et al. (2012) show the impact of acquisition activity on the long-run stock performance for US IPOs from 1985 to 2003. Their results show that acquisition activity within one year of listing is negatively related to stock performance from one through five year holding period following first year. More specifically, they find that three year style adjusted abnormal returns are -15.6 percent for IPOs that acquire within first year of listing while abnormal returns for non-acquirers are 5.9%. Finally, Mudambi et al. (2012) show that for a sample of UK IPOs, firms with higher levels of multinationality outperform domestic firms in long-run; where multinationality is measured as presence in markets outside UK.

3.7 Earnings Management in IPOs

There is a vast body of literature which looks at the motivations of earnings management, mitigating factors in earnings management and methodological issues in calculation of the earnings management. Prior literature provides evidence on motivations of using earnings manipulation such as meeting or beating earnings benchmarks (Degeorge et al., 1999, Dechow and Dichev, 2002), avoiding debt covenant violations (DeFond and Jiambalvo, 1994), increasing initial firm value (DuCharme et al., 2001), around equity offerings (Teoh et al., 1998c, Teoh et al., 1998a, Rangan, 1998). Another stream of research also focuses on identifying the factors or variables which are useful in restraining the earnings management, particularly in IPOs (Morsfield and Tan, 2006, Lee and Masulis, 2011, Brau and Johnson, 2009) and SEOs (Jo et al., 2007). As the focus of this thesis is on IPOs, the discussion of earnings management is limited to the motivations, empirical evidence of earnings management in IPOs and the earnings management mitigating factors in IPOs.

Accrual accounting is a useful tool for investors to assess the underlying economic performance of an entity in a period through the use of basic accounting principles. However, use of accounting accrual creates a difference between reported earnings and actual cash flows. Although, Dechow (1994) suggests that earnings tend to be smoother than cash flows and earnings present better information about economic performance relative to cash flows. Nonetheless, accrual accounting gives managers more discretion in reporting of earnings and managerial choices may obscure real underlying performance. In presence of discretion over adjustment of accruals, it becomes difficult for investors to evaluate that whether reported earnings are appropriate or deceptive. This is clear from the formal definition of the earnings management provided in the literature (Healy and Wahlen, 1999) p.368

> "*Earning management occurs when managers use judgement in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company, or to influence contractual outcomes that depend on reported accounting numbers*"

IPOs are most susceptible to the earnings management due to the unique settings of the event and the presence of information asymmetry between the issuer and investors. There is very little information about the IPO firms before going public. Lack of public information and trading history makes it very difficult for investors to appropriately value the firm. Moreover, there is no media coverage of issuing firm in period before going public (Rao, 1993). Most of the information about issuing firms comes from prospectus, which contains financial information and reported earnings for previous years. However, it is difficult for investors to judge that whether use of accruals reflects the true value of the company appropriately or is deceptive. This provides an opportunity to inside managers of issuing firms to influence offering price of shares through use of accounting choices which are unlikely to be detected. Moreover, insiders in issuing firms have strong incentive to increase the issue price of the offered shares. A high offer price and large proceeds have direct impact on financial position of the firm (in case of primary shares) and wealth of entrepreneurs (in case of secondary shares). By influencing offer price through reported earnings in prospectus, insiders not only can increase proceeds to issuing firm but also their personal wealth as well. In the presence of both incentive and opportunity, insiders in issuing firm are likely to engage in earnings management before IPO. In addition, earning management at the time of IPO is an important concern for the investors who can pay unrealistic price for new shares. The empirical evidence generally supports this conjecture and is reviewed in the next section.

3.7.1 Empirical Evidence on Earnings Management in IPOs

Prior literature has focused on the use of earnings management in the pre-IPO years or during the IPO year. Earnings management is not directly observable and different models have been developed to measure it. Most commonly used proxy for measurement of earnings management is accruals: difference between the reported earnings and cash flow from operations. The models of earnings management separate the non-discretionary and discretionary accruals to detect earnings management; where unusually high discretionary accruals are considered as the evidence of upward (income increasing) earnings management.

Friedlan (1994) examines accounting choices of issuers at the time of IPO. He asserts that accounting based measures are useful and frequently used in non-traded securities (IPO shares before going public). Given the incentives and opportunity to influence offer price as discusses earlier, issuers are likely to engage in upwards earnings management. He finds that issuing firms make income increasing discretionary accruals in the most current financial statements (in prospectus) before going public. In order to provide evidence that abnormal accruals affect valuation of firm at IPO, DuCharme et al. (2001) relate accruals management in the pre-IPO year to the market capitalisation of issuing firm at the IPO. They find a significant positive relation between the initial firm value and their proxies (managed and unmanaged accruals and cash flows) for earnings management. Moreover, they also relate issue year accruals to post-issue operating and stock return performance. Their results show that post-issue market-adjusted returns are negatively related to pre-IPO managed accruals. They suggest that investors become overly optimistic about future prospects of firms which are based on managed earnings and these expectations do not realise in post-IPO periods resulting in declining stock prices. Although, above mentioned two studies find significant evidence of earnings management through aggressive accruals in pre-IPO years, Aharony et al. (1993) find weak evidence of earnings management in year before the IPO. They, however, report that earnings management, to the extent that if any, is higher in small firms and firms with large financial leverage.

A number of other studies have examined the relation between IPO year abnormal accruals and the post-issue stock returns and operating performance. These studies generally argue that issuers manage earnings upwards in pre-IPO years and year of IPO to influence the offer prices. Investors are systematically fooled by these inflated earnings and extrapolate earnings growth associated with earnings management resultantly overvaluing the issuing firms. In aftermarket, reversal of abnormal discretionary accruals causes decline in earnings disappointing market and driving valuation of these firms down. This suggests a negative relation between the level of discretionary accrual around IPO and the post-issue stock return as well as operating performance of the issuing firms. Empirical evidence generally supports these arguments. Teoh et al. (1998a) find higher earnings management in IPOs relative to non-issuing firms. They also report that unusually higher discretionary accruals in IPO year predict significant negative performance in three years after the IPO. More specifically, three year stock returns of IPO firms in the most aggressive quartile of earnings management are 20 percent less than those of in the most conservative quartile. Teoh et al. (1998b) report similar finding for SEOs and find that discretionary current accrual are at peak in offer year and decline in years after the offering causing similar pattern in net income. They document a negative relation between pre-issue earnings management and post-issue stock returns and earnings. In a similar study on SEOs, Rangan (1998) shows results which are consistent with (Teoh et al., 1998b). For instance, Rangan documents that a one-standard deviation increase in the discretionary accruals is related with a 10 percent decline in market-adjusted returns. Fan (2007) finds that IPOs have the highest accruals in the year of IPO and these accruals are strong predictor of decline in operating performance in the post-IPO periods. Although results discussed above exclusively relate to US market, evidence from other countries is consistent with US findings. Roosenboom et al. (2003), for example, investigate earnings management for a sample of Dutch IPOs and report evidence of upwards earnings management in first year of IPO but not in pre-IPO years. They also document a negative relation between IPO year discretionary current accruals (a proxy of earnings management) and three year post-IPO stock return performance. Recently, Alhadab et al. (2013) show that IPOs in UK engage in upwards earnings management in the year of IPO and post-issue years. Comparing the Main Market and AIM IPOs, they find that earnings management is more pronounced for AIM IPOs which is a less regulated market segment.

Despite the extensive evidence that equity issuing firms (IPOs, SEOs) engage in upwards earnings management, a spate of recent studies has questioned this evidence (Ball and Shivakumar, 2008, Armstrong et al., 2009, Cecchini et al., 2012). For instance, using a sample of UK IPOs, Ball and Shivakumar (2008) show that IPO firms report more conservatively in the year before IPO due to higher quality reporting and market monitoring of being a public company. Likewise, Armstrong et al. (2009) cast doubt on the earlier evidence of aggressive earnings management in US IPOs. They find no evidence of earnings management as the discretionary accruals in IPO year are not statistically different from zero. They also fail to find relation between the earnings management and issue price, post-issue equity value and insider trading profits for IPOs refuting the incentive argument for upwards earnings management in equity issues. In addition, they report that negative relation between IPO year earnings inflation and post-issue performance is due to cash flow mispricing. Finally, Cecchini et al. (2012) focus on individual accrual account (allowance for uncollectible accounts) instead of total accruals and find that IPOs have conservative allowances leading to lower reported earnings. Moreover, IPO firms record large bad debt (and hence income decreasing) expenses relative to matched non-IPO firms. In sum, these studies provide evidence which is against conventional wisdom that issuing firms opportunistically inflate reported earnings using earnings management.

The literature on earnings management in IPOs has almost exclusively focused on the pre-issue years and the year of equity issuance. However, insiders in IPOs have also incentives to manage earnings around the lockup expiry period (Teoh et al., 1998a). Filling this gap, Wongsunwai (2012) examines the earnings management in IPOs around equity issuance as well as around the lockup expiration. He finds that IPOs engage in accrual and real activities management in period immediately preceding the expiry of lockup but this manipulation is concentrated in IPOs backed by lower quality VCs. Although, Wongsunwai (2012) investigates earnings management around lockup expiry, he does not relate length of lockup period to the level of earnings management either at time of IPO or expiry of lockup.

3.7.2 Mitigating Factors in Earnings Management

There is a growing body of literature examining the mitigating factors or restraints on earnings management by equity issuing firms. This literature has mainly focused on the role of financial intermediaries and other third parties (prestigious underwriters, VCs, reputed auditors etc.) involved in the IPO process and role of corporate governance mechanisms (independent boards, CEO duality, audit committees etc.) in issuing firms (Morsfield and Tan, 2006, Lee and Masulis, 2011, Brau and Johnson, 2009, Chen et al., 2013, Klein, 2002, Osma, 2008). We review below some of the evidence regarding the role of third party monitors in mitigating earnings management in IPOs.

Morsfield and Tan (2006) analyse the earnings management differences between VC backed and non-VC backed sample of US IPOs. They find that VC presence is related to lower abnormal accruals in the year of IPO. Moreover, they also report that lower earnings management in VC backed IPOs partially explains the superior return performance in VC backed IPOs. Brau and Johnson (2009) relate earnings management in IPOs to the presence and prestige of VCs, underwriters, auditors and attorneys as third party certifiers. They show that earnings management is negatively related to presence of reputed underwriters, attorneys, auditors and VCs. Comparing the monitoring and signalling effect of reputed third party certifiers, they conclude that IPO firms select prestigious certifiers to signal their quality at IPO. In a related study, Lee and Masulis (2011) report that VC backing, in general, does not restrain earnings management in IPOs. However, they find that more reputable VCs and underwriters are associated with lower earnings management and matching reputed VCs and underwriters reduces earnings management even further. Wongsunwai (2012) finds similar results and reports that monitoring by high quality VCs restrains earnings management in IPOs and around lockup expiry. More recently, Chen et al. (2013) investigate impact of underwriter reputation on earnings management in Chinese IPOs. They find that reputed underwriters restrict pre-IPO earnings management in non-state owned enterprises issuers only. However, they fail to find any significant impact of underwriter reputation on earnings management in state owned enterprises. Consistent with the evidence from IPOs, Jo et al. (2007) find that underwriter reputation is negatively related to earnings management in SEOs and SEOs with more prestigious underwriters perform better in aftermarket compared to the SEOs with less prestigious underwriters even after controlling for the effect of earnings management.

3.8 Conclusion

This chapter offers a comprehensive review of both theoretical and empirical literature on IPO lockups, survival of IPOs, long-run performance of IPOs and earnings management in IPOs. Theoretical explanations for the use of lockups are briefly presented and discussed. Theoretical literature suggests two important motivations: signalling and commitment for the use of lockups but the empirical results in support of these arguments are not conclusive (Brau et al., 2005, Brav and Gompers, 2003). Moreover, the studies on lockups have mainly used firms and issue characteristics at the time of IPO to test different motivations for the use of (longer) lockups. Regardless of the motivation for lockups, prior research agrees that longer lockups are beneficial for issuing firms at the time of IPO. We extend this literature and explore impact of lockup length on certain IPOs aspects which have not received attention in previous literature. More specifically, we relate lockup length to survival, long-run performance and earnings management in IPOs. We add to the existing IPO and lockup literature by showing that lockup length is an important determinant of IPO survival, performance and earnings management.

Review of literature in section 3.4 shows that evidence on survival of IPOs in UK is scant. Although, there have been couple of recent studies on UK market, they are exclusive to the AIM. There exists no study on survival of IPOs on Main Market of LSE which is one of the world's largest and renowned stock markets. Moreover, research on IPO survival in US has focused on finding the determinants of survival or failure of IPOs on the markets. However, the survey of literature shows that these studies have completely ignored the possible impact of lockup length on post-IPO survival. Given the diverse nature and heterogeneity of lockups on Main Market of UK, lockup length could be an important determinant of aftermarket survival of IPOs. Longer lockup could have important implications for strategic decisions of managers, particularly, in early days of IPO and these decisions might be important for survival of firms in long-run. We attempt to fill this critical gap in literature by examining IPO survival in UK and relating it to lockup length in chapter 4 of this thesis. We make important contribution to the survival literature by providing evidence that lockup length is an important determinant of IPO survival in the long term.

The long-run performance of IPOs has puzzled academic researchers since (Ibbotson and Jaffe, 1975) and this literature has grown considerably after the study of US IPOs by Ritter

(1991). Much of US literature documents that IPOs underperform in the long-run as evidenced in survey of literature in section 3.5.1. Although, studies on UK also provide evidence of long-run IPO underperformance, results from Main Market of UK are not conclusive. For example, Coakley et al. (2008) and Gregory et al. (2010) fail to find significant underperformance of IPOs listed on Main Market. These inconsistent results (in comparison to US and other markets in the world) are intriguing and warrant further investigation. Furthermore, research on determinants of long-run performance has largely ignored lockup length as a potential determinant. Given the lack of attention on the role of lockup length in IPO performance and intriguing evidence from LSE Main Market, we examine long-run performance of IPOs in relation to the length of lockup period in chapter 5. Our study contributes to the extant literature on IPO performance by identifying that lockup length serves as an important signal of post-IPO performance in addition to the existing signals such as VC backing, underwriter reputation etc.

The survey of literature in section 3.6 reveals that there is ample empirical evidence to suggest that IPO firms engage in opportunistic earnings management through abnormal discretionary accruals. Moreover, literature on mitigating factors in earnings management has generally reported positive impact of presence and prestige of third party agents (VCs, underwriters, auditors and attorneys) involved in IPO process on restraining earnings management around IPOs. Other factors examined in prior studies in deterring earnings management include independent boards and audit committees (Klein, 2002, Osma, 2008), presence of institutional investors (Chung et al., 2002) and long-term institutional investors (Hsu and Koh, 2005). Moreover, apart from examining earnings management around IPOs, there has been limited investigation of earnings management around expiry of IPO lockups (Wongsunwai, 2012). However, research on earnings management and its mitigating factors in IPOs has largely ignored the role of lockup length in restraining earnings management around IPO. We fill this gap in literature by examining the role of lockup length in deterring earnings management at the time of IPO in chapter 6 of this thesis. We contribute to the earnings management literature by showing that lockup length could be an important factor in mitigating the opportunistic accruals management at the time of IPO.

Table 3.1 Evidence on Length of Lockup Period (in days)

This table compiles the main studies on IPO lockups in US and UK. The lockup period is in number of days from the date of IPO.

Country	Study	Sample Period	Mean	Median
Unites States	Aggarwal et al.(2002)	1994-1999	188	180
	Arthurs et al.(2009)	1990-1994 2001-2005	220	-
	Bradley et al. (2001)	1988-1997	224	180
	Brau et al. (2004)	1988-1998	230	180
	Brau et al.(2005)	1988-1999	164	-
	Brav and Gompers (2003)	1988-1996	254	180
	Cao et al. (2004)	1995-1999	196	180
	Chen et al. (2012)	1988-2003	214	180
	Field and Hanka (2001)	1988-1997	187	-
	Gao and Siddiqi (2012)	1989-2004	220	180
	Krishnamurti and Thong (2008)	1998-2000	181	180
	Martin (2011)	1996-2006	185	180
	Yung and Zender (2010)	1988-2006	218	180
United Kingdom	Ahmad and Jelic (2014), MM	1990-2006	468	395
	Espenlaub et al. (2001), MM*	1992-1998	561	730
	Hoque and Lasfer (2009), MM and AIM**	1999-2006	391	365
	Hoque (2011) †, MM and AIM	1999-2006	383-714	365-730

* Main Market
**Alternative Investment Market
† Hoque (2011) reports means and medians for different types of lockups: Absolute, Relative, Staggered etc. The reported lockup days are range of mean and median lockup periods across different lockup types.

Table 3.2 Summary of International Evidence on IPO Long-Run Performance

Country	Study	Period	Sample Size	Long-run Performance (%)	
				3 Year	5 Year
Australia	Lee et al. (1996)	1976-1989	266	-51.3	-30.9
Brazil	Aggarwal et al. (1993)	1980-1990	62	-47.0	---
Canada	Kooli and Suret (2004)	1991-1998	445	-9.4	19.2
Chile	Aggarwal et al. (1993)	1982-1990	36	-23.7	---
China	Chan et al. (2004)	1993-1998	609	-19.77	---
France	Luleux and Murzyka (1997)	1988-1992	56	-29.2	---
Germany	Ljungqvist (1997)	1970-1993	180	-12.1	---
	Stehle et al. (2000)	1960-1992	187	-5.0	---
Greece	Thomadakis et al. (2012)	1994-2002	254	-31.4	---
Japan	Cai and Wei (1997)	1971-1992	180	-27.0	---
Korea	Kim et al. (1995)	1985-1988	169	+91.6	---
Malaysia	Ahmad-Zaluki et al. (2007)	1990-2000	454	-14.2 to 17.9	---
Spain	Álvarez and González (2005)	1987-1997	52	-28.2	-21.0
Sweden	Loughran et al. (1994)	1980-1990	162	+1.2	---
Switzerland	Kunz and Aggarwal (1994)	1983-1989	42	-6.1	---
	Drobetz et al. (2005)	1983-2000	109	-1.7	-26.2
Thailand	Allen et al. (1999)	1985-1992	150	+10.0 to +27.5	---
Turkey	Bildik and Yilmaz (2006)	1990-2000	244	-84.5	---
	Kiymaz (2000)	1990-1995	163	+44.1	---

Not all studies mentioned in table have been discussed in the literature review. Moreover, some studies use range of benchmarks, different computational methods and equal as well as value weighting schemes. In these cases, the most representative results are shown in the table above.

CHAPTER 4 LOCKUP AGREEMENTS AND SURVIVAL OF IPO FIRMS[7]

4.1 Introduction

Going public firms are plagued by two major problems; information asymmetry and moral hazard at the time of IPOs. The higher uncertainty coupled with the potential agency problems results in higher discounts in offering prices and less wealth appropriation by IPO firms, which could be detrimental to their long term growth and survival. The issuing firms can signal their quality in a variety of ways.[8] IPO lockup represents one of the signalling mechanisms and by agreeing to longer lockups, insiders can signal quality and survival prospects of their firms.

Lockups prevent insiders of firms from selling whole or some percentage of their equity during a certain post-IPO period. Lockups are voluntary agreements between firms' insiders and underwriters, yet evidence shows that most of the firms go public with lockups in US and UK[9]. Even for markets which require compulsory minimum lockups (France, Germany etc.), insiders' lockup periods exceed the minimum required (Goergen et al., 2006b). The extant literature on the motivations of lockups suggests that lockups signal issuing firm's quality and serve as a "commitment device" between insiders and outside investors. Not evidenced earlier, however, is the fact that lockups could predict long term survival of issuing firms.

[7] A revised version of this chapter was published in the Journal of Business Finance and Accounting (Ahmad and Jelic, 2014).
[8] Quality signals might include; higher ownership retention (Leland and Pyle,1977), reputed underwriters (Carter and Manaster, 1990), backing by venture capital (Megginson and Weiss, 1991), reputable accounting firm (Titman and Trueman (1986), Michaely and Shaw (1995)), underpricing (Allen and Faulhaber, 1989) and voluntary earnings forecasts (Clarkson et al., 1992).
[9] For US evidence see Field and Hanka (2001), Mohan and Chen (2001), Brav and Gompers (2003) and Yung and Zender (2010). For UK evidence see Espenlaub et al., (2001) and Hoque (2011).

A number of studies (Schultz, 1993; Hensler et al., 1997; Jain and Kini, 2000; Hamza and Kooli, 2010; Bhattacharya et al., 2011; and Espenlaub et al., 2012) have examined the determinants of IPO survival. However, the question of whether lockup period affects or improves survival of IPOs has remained an unexplored area. In this study, we focus on the role of lockup length in the survival of 580 LSE Main Market IPOs during the period of January 1990 to December 2006. We report survival rates and delisting reasons for sample IPOs by tracking them until the end of December 2011. Our analysis utilizes hand collect data on the types and length of lockups committed by the issuing firms. Finally, we use survival analysis that enables us to investigate the determinants of IPO survival focusing on the length of lockups.

We find that 69% of the sample firms survive for at least 5 years, and median survival time is 92 months. We also find a relatively larger percentage of PEVC (Private Equity or Venture Capital) backed IPOs and use of absolute expiry (calendar dates or specific period) lockups after the bubble years of 1999-2000. Focusing on reasons of delisting, we find that mergers and acquisitions account for 25% out of 31% delisting (failure) rate across different delisting reasons during the first five years after IPO. Over the full sample and tracking period (1990-2011), 56% of the firms were delisted due to mergers and acquisitions (M&A).

The results suggest that firms going public with longer lockup periods exhibit higher survival rates (and times) in general. We find that lockup length is positively and significantly related to the survival of issuing firms. For instance, results from our sensitivity analysis show that a 12 months increase in median lockup period increases the (median) survival time of sample firms by 24 months. Overall, the results lend support to our hypothesis that longer lockups improve the survival of issuing firms. Our results also suggest a significant negative impact of PEVC backing on the IPO survival.

Our research adds further weight to the strand of literature that argues that lockup length signals issuing firms' quality and helps to reduce moral hazard in aftermarket.

Rest of the chapter is structured as follows. In section 4.2, we provide a summary of the related literature and develop testable hypotheses. Section 4.3 presents the data and methodology. Section 4.4 presents the univariate analysis and survival and delisting rates for sample IPOs. Estimation results for our main survival model are presented in section 4.5. In section 4.6, we test for robustness of our results and perform some further analysis. Finally, section 4.7 concludes the paper.

4.2 Related Literature and Hypotheses Development

There is an extensive body of literature (mainly focused on US markets) on the determinants of long term survival of IPOs[10]. There is, however, a notable paucity of research on survival of UK IPOs. Recently, studies have examined the survival of UK buyouts and IPOs in different contexts. Jelic (2011) examines longevity of UK buyouts and different exit routes including the IPO exits on both markets of LSE, but the study does not examine survival of buyouts after the IPO exit. Espenlaub et al. (2012) study IPOs on second board market, AIM, of LSE focusing on the role of Nomads (Nominated Advisors). Vismara et al.(2012) examine and compare financial performance and delistings of European's second and main board markets including LSE. They briefly report the delisting activity and reasons for delistings among different countries, and between upper and lower tier markets. We study IPOs on main board market (Main Market) of LSE for following reasons. First, due to its higher and stringent listing requirements, Official List attracts more established and mature companies which are signinficantly different from young and growing companies usually listed on the

[10] For example, Schultz (1993), Hensler et al.(1997), Jain and Kini (2000), Demers and Joos (2007), Hamza and Kooli (2010) and Bhattacharya et al. (2011) study the survival of IPOs in the US. Simialrly, Chancharat et al. (2012) and Carpentier and Suret (2011) study IPOs on Austrailian and Canadian markets respectivley.

AIM. Second, although volunatry in nature, most of the IPOs on Main Marker go public with lockups in place. Moreover, lockups of Main Market IPOs are relatively longer and are more diverse in terms of their characteristics (Espenlaub et al., 2001). However, IPO frims on AIM which have not been independent and earning revenues for atleast two years, are required to have compulsory lockups for related parties and employees.[11] We therefore formulate empirical predictions for the determinants of IPO survival focusing on lockup length.

4.2.1 IPO Lockup Length and Survival

Leland and Pyle (1977) develop a signalling model and show that fraction of retained ownership by insiders conveys a quality signal to the outsiders. Insiders in high quality firms can retain greater fraction of ownership after IPO to show confidence in their firms. However, if the insiders can sell shares immediately after the IPO, ownership retention signal may not be credible (Gale and Stiglitz, 1989). Courteau (1995) uses length of holding period (lockup) as a signal of firm quality. The commitment to holding period complements the signal provided by retained ownership. Entrepreneurs also use longer lockups to add credibility to their earnings forecasts (Chong and Ho, 2007). A lockup is a costly mechanism because it comes at a cost of illiquidity and non-diversification on the part of insiders' portfolios. Since the information about the true value of the firm will be revealed over a period of time after IPO, insiders will share the risk of negative information revelation during lockup period along with the investors. Lockup imposes penalty on insiders for hiding negative information about the value of firm and serves as a commitment mechanism to regulate insiders' actions (Brav and Gompers, 2003). High quality firms with better growth prospects and survival may not find longer lockup periods problematic. Conversely, issuing firms with poor future prospects

[11] AIM Rule 7, where related parties include directors, substantial shareholder and their associates.

and lower quality may not afford to have such longer lockups because their low quality will be revealed during that period before they can cash out.

Previous evidence supports the signalling role of lockups (Brau et al., 2005; Goergen et al., 2006b; Bessler and Kurth, 2007; Arthurs et al., 2009). For example, Arthurs et al.(2009), for a sample of US venture IPOs find that lockup period acts as a signal of firm quality when other quality signals (venture capital backing, prestigious sponsor etc.) are not available. Moreover, they suggest that longer lockups help ventures with negative information to increase wealth appropriation at the time of IPO, which in turn could be critical for their future survival. Brav and Gompers (2003) and Yung and Zender (2010) suggest that higher quality firms are likely to accept longer lockups to reduce the agency problems of IPO.

While most of the US studies report homogeneous and standardised lockups, evidence from other markets is not consistent. US studies have consistently reported average lockup period of 180 days (Field and Hanka, 2001; Mohan and Chen, 2001; Brau et al., 2004). The most significant differences in terms of lockup characteristics and length are, however, observed between US and UK markets. Espenlaub et al. (2001) report average lockup length of 561 days for directors of issuing firms which is much higher compared to 180 days for US firms. Likewise, Hoque (2011) in a recent study of IPO lockups on both (Main and AIM) markets of LSE, reports heterogeneity in terms of lockup length and types. For example, the average lockup length varies from 383 days to 714 days among different lockup types for IPOs listed between years 1999 and 2006. The evidence presented so far clearly indicates that firms in UK go public with significantly longer lockups in place.

Length of lockup may affect decision making of managers after the IPO depending on their locked equity stakes (Arthurs et al., 2009). Jain and Kini (2008) find that strategic investment decisions like the extent of R&D spending, capital expenditure and advertising at the time of IPO affect the post-issue operating performance and survival of the IPO firms. Similarly, strategic decisions in early post-IPO period by managers, particularly in the areas of resource expansion, significantly affect survival of issuing firms (Chandy and Sivasubramaniam, 2011). It is suggested that the post-IPO strategic decisions of inside managers with longer lockups may have positive impact on performance and survival of IPOs. Given the significant role of lockup length at the time of IPO and post-IPO period, we hypothesise that IPO survival is positively related to lockup length.

4.2.2 Control Variables

Section 3.4.2 of chapter 3 provides a detailed discussion of the determinants of IPO survival identified in previous studies. We briefly review these determinants here and control for them in our analysis.

Prior literature generally suggests a positive impact of size and age of issuing firm on its post-IPO performance and survival (Schultz, 1993, Demers and Joos, 2007, Jain and Kini, 1999a, Ritter, 1991). Larger firms have less information asymmetry and more resources to deal with difficult market conditions. Moreover, firms with long operating history are less speculative and more established compared to newer firms. Insider ownership retention and underpricing have been suggested as the signals of quality (Leland and Pyle, 1977, Allen and Faulhaber, 1989). Hensler et al. (1997) show that higher underpricing and insider equity retention have a positive effect on survival of IPOs in aftermarket. Previous literature shows that high quality underwriters bring better quality companies to market which are likely to have better performance and higher survival following the IPO (Carter et al., 1998, Demers and Joos, 2007, Bhattacharya et al., 2011). Companies going public in hot issue markets are likely to perform poorly and have higher failure rates (Ritter, 1991, Demers and Joos, 2007, Kooli and

Meknassi, 2007). Likewise, issuing firms with higher levels of debt face more financial constraints and are more likely to delist (Bhattacharya et al., 2010, Chancharat et al., 2012, Kashefi Pour and Lasfer, 2013). Literature also shows that backing by VC and/or PE is also an important determinant of IPO survival; however, the results are not consistent. On one hand, VC backed IPOs are likely to have better survival profile due the certification, better monitoring and value added by VC/PE investors (Jain and Kini, 2000, Bhattacharya et al., 2011, Chou et al., 2013). On the other hand, due to short term focus and agency conflicts of VCs, IPOs backed by VCs may experience higher failure rates (Chancharat et al., 2012). Moreover, VC backing may be a signal of quality which could attract acquirers leading to higher delisting rates for VC backed IPOs due to mergers and acquisitions (Vismara et al., 2012, Kooli and Meknassi, 2007). Finally, consistent with Hensler et al. (1997) and Espenlaub et al. (2012), we also control for industry sectors.

4.3 Data and Methodology

4.3.1 Data and Sample Construction

Our sample consists of IPOs on LSE Main Market between January 1990 and December 2006. LSE is the Europe’s biggest and one of the world’s largest stock markets. For example, LSE in year 2005 only, saw 354 IPOs with offering value of €18.6bn, more than the US exchanges combined.[12] The data for IPO activity from 1998-2006 is available from LSE website. LSE data includes firm names, issue price, market capitalisation on admission, industry and admission date. For IPOs between 1990 and 1997, we begin with listings in Thomson One Banker and Perfect Filings database during the period. We find 724 IPOs on

[12] PriceWaterhouseCoopers (2006), ‘IPO Watch Europe—Review of the year 2005’

Main Market excluding IPOs on USM and AIM.[13] Panel A of Table 2.2 describes the filters we use to construct our final sample of IPOs. We exclude investment trusts, venture capital trusts (VCTs), privatisations, re-admissions, non-UK firms and firms with missing data and IPO prospectuses. This leaves us with a final sample of 378 IPOs during 1990-1997[14]. According to the LSE data, 686 IPOs were listed on Official List during the period of 1998-2006. We repeat the same filtration process as earlier to get a final sample of 202 IPOs during 1998-2006. Our final sample consists of 580 IPOs for the whole period of 1990-2006. We use Perfect Filings to collect IPO prospectuses. We hand collect most of our variable from the prospectuses including lockup information, sponsors, insider ownership, incorporation date (for calculating age of firm), market capitalisation, industry and PEVC backing. For relative expiry lockups, we use Perfect Filings to find the corporate announcement dates and the exact lockup expiry.[15] The data for initial returns is obtained from DataStream. The dates and reasons of delisting of IPOs are obtained from London Share Price Database (LSPD). The dates and delisting reasons of sample IPOs are further cross-referenced with Perfect Filings database.[16]

Out of full sample, 517 (89%) IPOs have lockups in place for at least one class of shareholders. However, IPOs in certain industry sectors before year 2000 were subject to compulsory lockups if they do not meet certain criteria.[17]

Panel B of Table 4.2 presents descriptive statistics of the variables used. Sample IPOs have an average lockup length of 15.39 months (468 days) and lockup length is measured as the

[13] Gregory et al. (2010) report 629 IPOs excluding investment trusts, financial trusts and banks on the Official List for the same time period 1990-1997.
[14] Our sample for period 1990-1997 is comparable to Coakley et al. (2007), who report 327 sample IPOs for 1990-1997 after the similar filtration process.
[15] In case of relative lockup expiry, the expiry date of lockup is specified in relation to other company events like announcement of results, publication of accounts etc. (Espenlaub et al.,2001)
[16] We also use UK IPO data from Jelic (2011).
[17] For details, see Espenlaub et al.(2001) p.1242

difference between IPO date and lockup expiration date. However, there is substantial variation in lockup length across sample firms with a minimum lockup of 2 months and a maximum of 41 months. This provides support to our earlier discussion in chapter 3 which shows lockups in UK are quite diverse and heterogeneous in terms of their length. The average size (market capitalisation) of IPO firms at the time of listing is £259.16m. There is also a large variation in terms of the market capitalisation of IPOs with a minimum of just £1.05m and a maximum of £7725m. Firms list with an average age of 17.36 years at the time of IPO, where age is defined as number of years between the IPO date and the date company was established.[18] The oldest firm was established about 102 years before the IPO. The issuing firms experience average initial returns of 11.18% during the sample period. Insiders retain an average (median) of 24.71% (19.79%) of the post-IPO equity stake in sample issuing firms. The average market share of sponsors, measured as a percentage of total IPOs underwritten, is 2.99% with a maximum of 15.38%. PEVC backed IPOs are 51.4% of the total sample. The average initial return of all IPOs in three months prior to the firm's IPO month is 13.32% with the highest return of 64.42% exhibited in first quarter of year 2000. Sample IPOs have a mean leverage ratio of 0.37.

[Insert Table 4.2 about here]

Table 4.3 breaks down IPO frequency by year of listing and by industry (based on FTSE Global Classification System). The IPO frequency fluctuates greatly across the sample period. The highest percentage (18%) of IPOs was listed in year 1994. Moreover, 71% of the IPOs are listed between 1990 and 1998 and listing activity falls after the bubble period of 1999-

[18] We take company establishment date as reported in the "introduction/historical background" section of the prospectus.

2000.[19] Most of our sample IPOs originated from Cyclical Services (general retailers, support services, Leisure and hotels, media and transport) and Information Technology industries. IPOs from Cyclical Services consistently show higher proportions across the sample years. IPOs in Information Technology are, however, clustered in years 1994 and 2000. Cyclical Services, Information technology and Non-Cyclical Consumer Goods jointly share about 61% of the sample IPOs.

[Insert Table 4.3 about here]

4.3.2 Methodology

A number of studies have used survival analysis for studying post-IPO survival and determinants of long term survival of issuing firms (Hensler et al., 1997; Jain and Kini, 2000 & 2008; Carpentier and Suret, 2011, Jelic, 2011; and Espenlaub et al., 2012). Survival analysis is preferred over the conventional statistical methods (linear regression, binary dependent variable models etc.) due to a number of benefits. For example, ordinary least square (OLS) regression cannot handle censored observations, which is a unique characteristic of survival data (Jenkins, 2005). Censoring occurs when the event of interest (delisting of IPOs) has not yet occurred by the end of study or experiment. In our case, sample IPOs which are still trading (listed) by the end of December 2011 are right censored. Moreover, the binary dependent regression models (logit, probit etc.) do not take into account the timing of the events (when the event for each observation occurs). On the other hand, survival analysis not only allows for censoring and different time horizons, it can also handle the time dependent variables.

[19] This is partly due to exclusion of a large number of IPOs of Investment trusts, VCTs, ADRs and non-UK firms for the period 1998-2006 as detailed in Panel-A of Table 2.

In our analysis, survivors are defined as the IPO firms which remain listed on the market or transfer to another market. Consistent with this definition, non-survivors are IPOs which are delisted from the market due to administration/liquidation, mergers and acquisitions, permanent suspension or any other reasons. Our decision to treat market transfers as survivors is consistent with Espenlaub et al. (2012) and Vismara et al. (2012). On the other hand, treating mergers and acquisitions as non-survivors is also consistent with Jain and Kini (2000) and Chancharat et al. (2012), although M&A may not always be a negative delisting or death.

The survival rates of the sample IPOs are estimated using the Kaplan-Meier (KM) method. The KM estimator is a non-parametric maximum likelihood method and is defined as (see Clark et al.,2003)

$$S(t_j) = S(t_{j-1})\left(1 - \frac{d_j}{n_j}\right) \qquad (4.1)$$

Where $S(t_j)$ is the probability of being listed at time (month) t_j, $S(t_{j-1})$ is the probability of being listed at time t_{j-1}, n_j is the number of IPOs listed just before the time t_j (also called risk set at t_j), d_j is the number of IPOs delisted at time t_j.

We use log rank test for testing the statistical differences in KM survival curves between various groups (across issue years and industries) and subsamples (lockup length). We also compare the median survival times across different groups and subsamples. Median survival time is the point in time at which survival probability is 0.5 (Kleinbaum and Klein, 2005). Clark et al. (2003) state that median survival time is the widely used measure instead of mean as survival data are often skewed and rarely normally distributed. In context of our analysis, median survival time is the time in months when cumulative survival rate for sample IPOs has dropped to 50% (half of the IPOs have been delisted). Following Espenlaub et al. (2012), we use minimum survival time when the median survival time cannot be estimated (when cumulative survival rate stays above 50% by the end of study period).

Although we use parametric (models that allow hazard to change over time) survival model as our main model for analysis, we also show robustness of our results by using semi-parametric (models with a constant hazard rate) model. Our survival model is implemented in the Accelerated Failure Time (AFT) form, which assumes that the effect of predictors is multiplicative on the survival time. The model is commonly expressed in log-linear form with respect to survival time as (see Bradburn et al.,2003)

$$\mathrm{Ln}(\mathrm{T_j}) = \beta_0 + \beta_1 \mathrm{X}_1 + \beta_2 \mathrm{X}_2 + \cdots + \beta_p \mathrm{X}_p + \varepsilon_j \qquad (4.2)$$

where $\beta_0, \dots, \beta_p$ are parameters to be estimated, $X_1, \dots, X_p$ are covariates, and ε_j is the error term with a specific distributional form which determines the regression model. AFT models being the parametric models require specific underlying distribution (weibull, gamma, lognormal etc.). Akaike's Information Criterion (AIC) can be used to distinguish between different non-nested parametric models (Allison, 2010). The likelihood-ratio test or Wald test can be used to discriminate between the nested models. We compare different parametric models based on the AIC and the results show that lognormal is most appropriate model with the lowest AIC value[20].

AFT models measure the direct effect of covariates on survival time which makes the interpretation of results easier because the parameters measure the effect of covariates on the median survival time. In AFT models the covariate effects are assumed to be multiplicative and constant on the time scale; the covariate impacts on survival time by a constant

[20] The AIC values for exponential, Weibull, lognormal, log-logistic and generalised gamma models are 1323.17, 1266.55, 1219.72, 1224.56 and 1222.02 respectively.

(acceleration) factor. Survival time is extended or contracted by the relative constant factor. The marginal effect of the covariates is measured by the exponentiated coefficients,$\exp(\beta_i)$, called time ratios. A positive coefficient on covariate implies a time ratio of greater than 1 and means that increase in covariate prolongs the survival time (time to delisting). On the other hand a negative coefficient on the covariate results in a time ratio below 1 and indicates that increase in covariate is associated with lower survival time (delisting occurs quickly).

We estimate the following specific model where natural logarithm of the time to delist (survival time) is presented as a linear function of the covariates:

$$\mathrm{Ln}(\mathrm{T_j}) = \beta_0 + \beta_1 Lockup\ Period + \beta_2 Ln(Size) + \beta_3 Ln(Age) + \beta_4 Initial\ Returns + \beta_5 Insider\ Ownership + \beta_6 Sponsor\ Reputation + \beta_7 Hot\ Issue\ Returns + \beta_8\, Leverage + \beta_9\, PEVC + \beta_{10}\, Industry\ Dummies + \varepsilon_j \qquad (4.3)$$

Where $\mathrm{Ln}(\mathrm{T_j})$ is natural logarithm of time to delisting or survival time and covariates are as defined in Table 4.1. *Lockup Period* is the length of lockup measured in months from date of IPO to lockup expiry date. *Ln (Size)* is the natural logarithm of market capitalisation of IPO at offering price in £millions. *Ln (Age)* is natural logarithm of the number of years between IPO date and the date company was established. *Initial Return* is the difference of first day closing price and offer price as percentage of offer price. *Insider Ownership* is the percentage of post-IPO equity retained by the firms' insiders. *Sponsor Reputation* for each sponsor is measured as the number of IPOs sponsored in the year prior to the IPO as a percentage of total IPOs in that year. *PEVC* is a dummy variable coded one for IPOs backed by PE or VC and zero otherwise. *Hot Issue Returns* is a proxy for market hotness and is defined as the average of initial returns of all IPOs issued in three months prior to the month of IPO. *Leverage* is the ratio of total liabilities divided by the sum of total assets and IPO proceeds.

We include dummies for industry sectors based on the FTSE Global Classification as outlined in Table 4.1 using “non-cyclical services” sector as the base.

[Insert Table 4.1 about here]

4.4 Results

4.4.1 Characteristics of Sample Firms and Lockup Types

The numbers and percentages of PEVC backed IPOs and the types of lockups across sample years are provided in panel A and B of Table 4.4. According to Panel A, PEVC backed IPOs range from 40% to 66% of the total sample during the years 1990-2000. However, the percentage of PEVC backed IPOs remains comparatively higher from year 2001 onwards with a peak of 94% in the year 2004. Panel B shows the types of lockups at the time of IPO. We distinguish between three types of lockups; absolute date expiry, relative date expiry and combination of both types. As discussed in chapter 2, absolute date expiry lockups are set in terms of clear calendar dates or fixed period of time after IPO and usually provide the exact length of the lockup. Lockups with relative expiry dates specify the expiry in relation to some corporate events of the company such as announcements of results or publication of company accounts etc. Finding the exact lockup period and expiry date in case of relative expiry date lockups is difficult, if not impossible.[21] The third type is a combination of the other two types and may spread over more than one period (staggered lockup). Analysis from panel B indicates notable difference in the use of absolute and relative date expiry lockups in years before and after 2000. Lockups with relative expiry dates are popular choice in the years 1990-1999, accounting for 33% to 95% of all lockups types. However, issuing firms increasingly use absolute lockups or combined lockups from year 2000 onwards. For instance,

[21] We first collect the type of relative event (corporate announcement) of relative date lockups from the IPO prospectus and then use PI Navigator to find the exact date of that event to find the length of lockup period.

all lockups in year 2003 and 75% of the lockups in years 2005 and 2006 are with absolute expiry dates.

[Insert Table 4.4 about here]

4.4.2 Survival Rates and Times

The cumulative survival rates for 1 to 5 post-IPO years across listing years and industry sectors are shown in Table 4.5 (panel A and B) along with the median survival time. Results for full sample are presented in panel C. This table is based on Kaplan Meier (KM) method which is a non-parametric approach of survival analysis (discussed in methodology section). The 1 year survival rate for sample IPOs is 99% which falls to 69% after 5 years of listing. This translates into a 31% delisting rate after 5 years of IPO and is comparable to the recent findings of (Vismara et al., 2012) who report 5 year delisting rates of 20-28% for Europe's main markets. The survival rates across listing years also vary considerably. 1-year survival rates remain 100% except for years 1994, 1999 and 2000. The lowest survival rates are observed for firms listed in year 2001 with half of the IPOs delisted by 5th year after the listing. Firms listed in years 2002 and 1991 have the highest survival rates at 93% and 89% respectively. However, the differences in survival rates across years are statistically insignificant (chi^2:20.52, p-value: 0.198). The survival rates across industries show relatively less variation with minimum 5 year survival rate of 62% for Non-Cyclical Services. Highest survival rate of 76% is observed for the Resources sector. However, similar to the issue years, survival rates across industry sectors are also insignificant with a chi^2 value of 4.71 (p-value: 0.789).[22]

[22] We conduct Log Rank test for testing equality of survival rates. The log rank test (a large sample chi-square test) uses the observed and expected failure over the comparison groups (Kleinbaum and Klein, 2005).

The last column of Table 4.5 shows median survival time for full sample (panel C); across issue years (panel A) and industry sectors (panel B). Median survival time is widely used measure in survival analysis and means the time at which the survival probability is 0.5. The median survival time for our sample IPOs is 92 months (half of the IPOs survive for 92 months or less). The median survival time, however, varies substantially across the listing years. Similar to the lowest survival rates, the median survival time is lowest for IPOs issued in year 2001. Firms listed in year 1991 experience the highest median survival time where 50% of the firms survive for 136 months or less. We report minimum survival times for years 2002, 2003, 2004 and 2006 where the delisting probability has not dropped below 0.5 by the end of study period (December 2011). Comparison of the median survival time across industries shows that the highest survival time of 155 months is observed for "Resources" while firms in "Non-Cyclical Services" experience the lowest survival time of 79 months.

[Insert Table 4.5 about here]

Table 4.6 shows a break-down of survival rates and time by different lockup lengths. Panel A divides lockup length in two groups; lockups greater than median and lockups less than median length. The survival rates and median survival times are reported across different industry sectors over the two lockup length groups. IPOs with lockups greater than median exhibit consistently higher 1, 3 and 5-yaer survival rates compared to the IPOs with lockups less than median. For instance, 5-year survival rate for IPOs with lockups greater than median lockup is 72 % relative to 67% for IPOs with lockups less than median. Similarly, survival rates for IPOs with lockups greater than median are higher for most of the industry sectors relative to IPOs with lockups less than median. The median survival time of 87 months for IPOs with lockups lower than median is less than 92 months reported for IPOs with lockups greater than median. Panel B provides survival rates and times of full sample over three different lockup lengths; up to 12 months, 13 to 24 months and lockups greater than 24 months. Consistent with the results in Panel A, survival rates are consistently higher for IPOs with longer lockup lengths. For instance, IPOs with lockups greater than 24 months experience 5-year survival rate of 77% which is higher than 67% observed for IPOs with lockups up to 12 months. Comparing the median survival time, we find that IPOs with lockups greater than 24 months have 52 months higher median survival time compared to IPOs with lockups up to 12 months (140 vs. 88). The log rank test also rejects the equality of survival rates across three lockup length groups at 5% significance level. Overall, results from table 4.6 lend strong support to our hypothesis that longer lockups are positively related to IPO survival.

[Insert Table 4.6 about here]

4.4.3 Delisting Reasons and Failure Rates

In Table 4.7, we report delisting reasons across different industry sectors over two time periods. Panel- A shows the numbers and percentages of survivors and delisted firms across different delisting reasons and industry sectors during the first five years after the IPO. Panel- B gives the numbers and percentages of survivors and delisted firms over the full sample and tracking period of 1990-2011. Survivors are the firms that continue to trade as of December 31, 2011 or transfer to other markets (exclusively to AIM in our case). The main delisting reasons are Mergers & Acquisitions (M&A), Administration/Liquidation (including receivership and voluntary liquidations) and other delisting reasons (permanent suspension/cancellation of trading, other reasons etc.) Out of overall 31% delisting (failure) rate, M&A accounts for 25% within 5 years after the IPOs. Only 32% of all the firms listed on LSE Main Market during 1990-2006 are still listed by the end of December 2011. Administration/liquidation, receivership and cancellations account for just 6% of the delisting rate during first 5 years after IPO and 12% for the full sample period. Lowest M&A delistings are observed for the “Resources” sector. A relatively higher percentage of firms in non-cyclical services sector are delisted due to administration/liquidation compared to the other sectors. Over the full sample years, more than 60% of the firms in Basic Industries and Financial sectors are delisted due to M&As.

[Insert Table 4.7 about here]

Table 4.8 exhibits failure rates across delisting reasons and different lockup periods. Panel A shows 1, 3 and 5-year failure rates across different delisting reasons for IPOs with lockups greater than and less than median lockup length. Panel B displays failure rates for three categories of lockup lengths; up to 12 months, 13 to 24 months and lockups greater than 24 months across different delisting types. The 1, 3 and 5 year post-IPO failure rates due to mergers and acquisitions are not much different across various lengths of lockup, although failure rates decrease with increase in the length of lockup. However, there are striking differences in failure rates for more negative delisting reasons (administration/ liquidations and other delisting). The failure rates for longer lengths of lockup are consistently lower than the failure rates for shorter lockups across the administration/ liquidations and other delisting reasons. For example, none of the IPOs with lockups longer than 24 months were delisted due to administration/ liquidations and other delisting reasons. These results provide further support to our conjecture that longer lockups signal firm’s quality and better survival prospects of the issuing firms.

[Insert Table 4.8 about here]

4.4.4 Univariate Analysis of Survivors and Non-Survivors

Table 4.9 provides univariate analysis and comparison of survivors and non-survivors. Although the average lockup length of survivor IPOs is higher by 0.689 months (about 21 days) as compared to the Non-Survivors, the difference is not statistically significant. Moreover, both survivors and non-survivors have the same median lockup period. The survivor IPOs are much larger in terms of their size (measured as market capitalisation at offering price) in comparison to the non-survivor IPOs and the differences in their means and medians are highly significant. The survivor IPOs have higher age, higher initial returns and higher levels of insider ownership compared to the non-survivors but the differences are not statistically significant. The leverage levels and proxies for sponsor reputation and hot issue markets are similar and statistically insignificant across the survivor and non-survivor IPOs. However, there is a higher proportion of PEVC backed IPOs among the non-survivors compared to the survivors and the differences are highly significant, showing a negative impact of PEVC backing on the post IPO survival. The only significant industry effect is in Resources sector where a higher percentage is among the survivors. Although Table 4.7 shows higher survival rates and times for lockups with longer periods, the differences between survivors and non-survivors are not significant in terms of lockup length in Table 4.9.

[Insert Table 4.9 about here]

Table 4.10 shows correlations between the variables used in the survival regressions. The survival/longevity of the IPO firms is positively and significantly correlated with the lockup length. The survival time is also positively correlated with the age and insider ownership of the issuing firms. The negative correlation between the leverage, PEVC, hot issue returns and sponsor reputation suggest shorter survival for IPOs with higher levels of leverage, issued in hot market periods and backed by PEVC and reputed sponsors. Although there are significant correlations between some of the variables, the correlations are not high enough to cause the problem of multicollinearity.

[Insert Table 4.10 about here]

4.5 Multivariate Analysis-Determinants of Survival

In this section we discuss determinants of IPOs based on our survival analysis. We employ Accelerated Failure Time (AFT) model with lognormal density distribution as the baseline survival function based on the Akaike Information Criterion (AIC). The estimation results from the AFT model are presented in Table 4.11. We present both the coefficient estimates and the time ratios along with the associated p-values. Time ratios are the exponentiated coefficients, exp (β), where β is the coefficient in AFT model. A time ratio or "acceleration factor" has the effect of stretching or contracting the survival time as a function of changes in covariates. A time ratio of above (below) one for an independent variable would mean a positive (negative) impact on the time to delist (survival time). Overall, our model exhibits reasonable explanatory power, measured by pseudo R^2 and statistically significant likelihood ratio.

4.5.1 Lockup Length

The results from Table 4.11 show a positive impact of lockup period on survival time. The coefficient of lockup variable is positive and highly significant with a p-value of 0.006. The time ratio of 1.020 associated with lockup period means that for one unit (a month) increase in lockup period, survival time increases by a factor of 1.020 or by 2%. The results provide strong support for our hypothesis that longer lockups predict better survival of IPOs in the aftermarket.

4.5.2 Results for Control Variables

The results regarding IPO size and its impact on post IPO survival are in with line prior literature which suggests that larger IPOs are likely to survive longer and have higher survival rates. We find a beneficial but small effect of size on aftermarket survival in line with widely documented size effect in earlier studies (Ritter, 1991; Schultz, 1993). A one percent increase in the size of IPO increases the survival time by a mere 0.1 %. Age of firm at the time of IPO has positive and significant impact on survival of issuing firms. Post issue survival time increases by 0.12% for one percent increase in the age of firm. The coefficient of initial returns shows a positive sign but it is statistically insignificant. Higher ownership retention by the insiders positively affects the survival of IPOs. However, the coefficient is weakly statistically significant with a small effect on survival; a one percent increase in insider ownership increases survival time by 0.4%. The insignificant coefficient of sponsor reputation shows that underwriter reputation does not affect survival and this result is not consistent with recent evidence by Bhattacharya et al. (2011) and Espenlaub et al.(2012) for US and UK AIM IPOs. The coefficient of hot issue returns is negative and statistically significant. The survival time decreases by 0.8% for a one percent increase in the hot issue returns. The results also show a negative but statistically insignificant effect of leverage on IPO survival. Surprisingly, we find that backing by PEVC significantly reduces the survival time of the issuing firms. The estimated time ratio for the variable PEVC is 0.826 which indicates that the survival time for IPOs backed by PEVC reduces by around 17.4% compared to IPOs without PEVC backing. Similarly, results from our marginal analysis suggest that predicted median survival time decreases by 18 months for PEVC backed compared to non-PEVC backed IPOs at means of all other variables. These results are counterintuitive and inconsistent with the earlier findings. Our results are partly in line with the finding of Kooli and Meknassi (2007) and Vismara et al. (2012) who show that PEVC backed IPOs have higher probability of being acquired and delisted.[23] PEVC backed firms may be more attractive to potential acquirers due to the positive impact of PEVC backing. An alternate explanation could be the short term focus and grandstanding (Gompers, 1996) by the PEVC providers which may be deleterious for the survival. For example, Jelic (2011) shows that a significant number of PE backed buyouts in UK exit early via IPOs. Our results, however, contradict with the findings of Jain and Kini (2000) for US IPOs.

Lastly, we find positive and significant (although weak) industry effect on survival time of issuing firms in Resources sector which have much higher survival probability compared to the firms in base category of Non-Cyclical Services. These results are supported by our earlier analysis in Table 4.5 and 4.7. The results about significant industry effects are consistent with the findings reported in Hensler et al.(1997) and Carpentier and Suret (2011) for US and Canada respectively.

Summing up, the results of survival analysis show that IPO firms with longer lockups have higher probability to survive and longer survival times. The positive effect of size, age and insider ownership and negative impact of hot markets on IPO survival is consistent with the earlier survival studies. Interestingly, firms backed by PEVC have shorter survival times and are likely to delist earlier than the non-PEVC backed firms. We fail to find significant impact of sponsor reputation on the post IPO survival. Our results regarding the impact of PEVC and sponsor reputation on IPO survival are rather counterintuitive and inconsistent with earlier UK evidence reported by Coakley et al. (2009).

[Insert Table 4.11 about here]

[23] This is plausible as most of the delistings in our sample are due to mergers and acquisitions.

4.5.3 Sensitivity of Survival Time Due to Changes in Lockup Length

Next, we perform a sensitivity analysis of the predicted median survival time in response to changes in lockup period based on the coefficient estimates from table 4.11. The results of sensitivity or simulations of survival time are reported in table 4.12. The table shows expected survival time, absolute change in months and percentage change in expected survival time when median lockup period changes first by one month and then by quarterly intervals up to twelve months. We evaluate predicted survival time at median (13 months) of lockup and means of all other variables resulting in a base median survival time of 89 months after IPO.[24] All changes to survival time are calculated relative to this base survival time.

The results show a significant impact of increase in lockup period on survival time. An increase of 12 months in the median lockup length causes an increase of 24 months in the post IPO survival time (median survival time increases from 89 to 113 months). This translates into about 27% increase in the median survival time of the issuing firms. Similarly a decrease of 12 months in the median lockup length causes a 21% decline in the median survival time. Similar but stronger results were observed when mean instead of median of the lockup period was used in the analysis.

[Insert Table 4.12 about here]

4.6 Robustness of Results

4.6.1 Constant Hazard, Heterogeneity and Clustering

In order to check robustness of our results, we estimate a Cox proportional hazard model with the same covariates. Cox model makes no assumption about the underlying statistical distribution and the baseline hazard function is estimated non-parametrically. Table 4.13

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[24] The analysis was conducted using the "margins" command in Stata 12.

shows that our main results remain robust to the choice of Cox model except the insider ownership variable and Resources sector which are no more statistically significant. We also account for unobserved heterogeneity (frailty) in our model which may have been caused by omitted variables or measurement errors (Jenkins, 2005). The introduction of frailty in survival model takes into account the fact that all the issuing firms in our sample might not be homogenous in terms of their delisting hazard. We re-estimate our AFT model with frailty which is introduced as an unobservable multiplicative effect and the results are reported in Table 4.14.Again, we find that our results are quantitatively and qualitatively similar to the ones reported earlier in Table 4.11.[25] We also consider our results adjusting for cluster standard errors as we have high number of IPOs in some of the sample years. The results of cluster adjusted AFT model are presented in Table 4.15 and are robust to clustering based on IPO frequency in different years.

[Insert Table 4.13 about here]

[Insert Table 4.14 about here]

[Insert Table 4.15 about here]

4.6.2 Institutional Changes Regarding Compulsory Lockups

Firms in certain industry sectors were required to have compulsory lockups for listing on LSE prior to year 2000. For example, directors and other senior employees of mineral companies with less than three years of trading history were subject to compulsory lockups for two years after the IPO. Similar restrictions were applicable to scientific research based companies between years 1993 and 2000. Lockups are not obligatory for these companies since January

[25] The p-value for likelihood ratio test of H_0: $\theta = 0$ is 0.145, where θ is frailty parameter.

2000 but they have to include a statement in their prospectus about lockups.[26] We, therefore, test for robustness of our results to the institutional changes in lockup requirements. First, we exclude mineral and scientific research based companies floated before year 2000 from our sample and results are presented in Table 4.16. Second, we exclude all companies with exact two years of lockups from our sample and present results in Table 4.17. Our main inferences are robust to excluding both types of sample firms.

[Insert Table 4.16 about here]

[Insert Table 4.17 about here]

4.6.3 Alternative Measurement of Explanatory Variables

Next we check the robustness of results to different measurements and definitions of some of the explanatory variables. A number of studies have reported positive impact of sponsor (underwriter) reputation on the long term performance and survival of IPOs (Carter et al., 1998; Bhattacharya et al., 2011). However, we find this variable to be insignificant in our analysis. We use different variations of our proxy for measuring sponsor reputation. First, we employ a measure of sponsor reputation similar to the one used by Jelic (2011) for PE firm reputation. The sponsor reputation is calculated as equally weighted average of rank scores based on the (i) number of IPOs sponsored and (ii) the amount sponsored in £ millions during the sample period as a lead sponsor. Sponsor Reputation is a dummy variable coded one for IPOs sponsored by the Top10 sponsors and zero otherwise. Second, we follow the sponsor reputation measure used by Derrien and Kecskés (2007) for UK market which includes the 15

[26] Similar rules are applicable to innovative high growth companies since January 2000. For a detail of regulatory changes regarding compulsory lockups, see Espenlaub et al.(2001) pp.1242-1243

global investments banks.[27] Our results are economically and statistically robust to the new measures of sponsor reputation as shown in Table 4.18.

[Insert Table 4.18 about here]

4.6.4 Logistic Regression Estimation

Finally, as discussed in the methodology section, although binary dependant regression models (logit or probit) predict the failure event, these models do not account for the time at risk. We use survival models as our main method of analysis, however, in order to compare our results with alternative econometric techniques; we use binary logistic regression with the same variables as used in our main model 4.3. In case of logistic regression, dependant variable is a dummy variable coded one for firms delisted within 5 years after listing and zero otherwise. Results of logistic regression are presented in Table 4.19. Consistent with our earlier results, lockup length is significantly negatively related to the probability of delisting within 5 years following the IPO. The results regarding the control variables are also similar to the previous results in survival models.

In conclusion, our main results in Table 4.11 are robust to variations in econometric techniques, various survival models and measurement of variables.

4.7 Conclusion

Prior research has documented a positive impact of lockup agreements in the going public process. The empirical evidence suggests that lockups can signal quality of issuers and help to reduce the moral hazard problem. The innovative aspect of our study is that it explores the relationship between lockups and the survival likelihood of IPO firms. We argue that lockup characteristics at the time of going public have the potential to influence the time and

[27] For details of Global Investment Banks, refer to Derrien and Kecskes (2007), footnote 11, p. 460

occurrence of post-issue failure. Survival is the primary aim of firms and represents an unambiguous metric of performance (Chancharat et al., 2012). Using firm survival as our performance measure, we focus on the role of lockup length in explaining the post-IPO firm survival. We control for a number of other determinants of IPO survival identified in literature.

We find that 5 year survival rate for our sample IPOs is 69% and the median survival time is 92 months. The survival time and rates vary significantly across different lockup lengths and firms with longer lockups have higher survival rates and durations in general. Our analysis of the delisting rates of sample firms reveals that mergers and acquisitions account for the 25% of the 31% failure (delisting) rate during the first five years after the IPO. Over the full sample period of 1990-2006, 56% of the firms were delisted due to mergers and acquisitions. Administrations and liquidations, considered to be more negative delistings, only account for 4% of the firms delisted within 5 years after the IPO.

Our empirical results, utilising the Accelerated Failure Time (AFT) model, indicate a statistically and economically significant effect of lockup length on the post-issue survival of IPOs. We find that, ceteris paribus, a 12 month increase in median lockup period increases the (median) survival time from 89 months to 113 months. Our results also support the positive impact of firm size, age and insider ownership on the post-IPO long term survival. We, however, report a significantly negative effect of PEVC backing on the survival of issuing firms. The results from our simulations suggest that the predicted median survival time decreases by 18 months for PEVC backed compared to Non-PEVC backed IPOs. Our results show some significant and positive industry effects on IPO survival. Unlike the previous documented evidence, we do not find significant effect of sponsor reputation and initial returns on the IPO survival. Finally, our results are robust to different survival estimation techniques, heterogeneity and alternative specification of variables.

Our research presents useful insights both to the issuers and the investors, who are equally interested in the survivability of IPOs. While the issuing firms can increase probability of their survival by committing to longer lockups, the investors can also gauge the long term prospects of the IPOs in terms of their survival from the information about lockup in IPO prospectuses.

Table 4.1 Definitions of Variables

Variable	*Definition*	*Data Source*
Lockup Period	Length of Lockup period in months.	IPO Prospectus, PI Navigator
Size	Size is the market capitalisation at the offering price in £ millions.	London Stock Exchange, IPO Prospectus
Age	Age has been calculated as the difference (in years) between the date of IPO and the date company was founded.	IPO prospectus
Initial Returns	First day closing price minus offer price divided by the offer price; in percentage	London Stock Exchange, DataStream
Insider Ownership	Insider (directors and officers) ownership at the time of IPO; in percentage.	IPO Prospectus
Sponsor Reputation	The reputation of sponsor is measured as the number of IPOs sponsored by a sponsor as a percentage of the total number of IPOs during the year prior to the IPO year, following Goergen et al. (2006) and Espenlab et al. (2012).	London Stock Exchange, IPO Prospectus
PEVC	A categorical variable that takes the value of one if the IPO is backed by Private Equity or Venture Capital, and Zero otherwise.	IPO Prospectus
Hot Issue Returns	Average initial returns to all IPOs issued during the three months prior to the month of IPO, following Espenlaub et al. (2012).	London Stock Exchange
Leverage	Total liabilities divided by the sum of total assets and issue proceeds at the date of IPO, following Demers and Joos (2007).	IPO Prospectus
Survtime	The number of months between the IPO date and the delisting date.	London Share Price Database
Industry Dummies	Binary Industry dummies based on the FTSE Global Industry classification indicating companies in Basic Industries Cyclical Consumer Goods Cyclical Services Financials General Industrials Information Technology Non-Cyclical Consumer Goods Non-Cyclical Services Resources	London Stock Exchange, IPO Prospectus

Table 4.2 Sample Selection and Descriptive Statistics

Panel A describes the selection filters and data limitations for our full sample of IPOs during 1990-2006. We estimate number of listings for the period 1990-1997 form Thomson One Banker & PI Navigator. The data for listing activity for the period 1998-2006 is from LSE website. We eliminate investment trusts, venture capital trusts (VCTs), re-admissions, Global/American Depository Receipts (G/ADRs), privatisations, market transfers, listings by non-UK firms and firms with missing prospectuses and other data. Panel B shows the descriptive statistics of sample IPOs. The variables are defined in Table 4.1. Variable Age is measured in years rounded up to the next highest full year.

Panel A: Sample Selection

From 1990-1997		
Total estimated number of LSE Main Market Listings	724	
-Less: Investment Trusts, Venture Capital Trusts(VCTs),re-admissions, privatisations , market transfers and firms with missing data and prospectuses	- 346	
Equals: Sample IPOs from 1990-1997		**= 378**
From 1998-2006		
Total number of listings on LSE Main Market	686	
-Less: Listings by non UK firms	- 130	
-Less: Investment Trusts, Investment Entities, foreign listings, VCTs, missing data etc.	- 354	
Equals: Sample IPOs from 1999-2006		**= 202**
Total Sample IPOs from 1990-2006		**= 580**

Panel B: Sample Descriptive Statistics

Variables	**Mean**	**Median**	**Standard Deviation**	**Min**	**Max**
Lockup Period (Months)	15.391	13	6.213	2	41
Size (£ millions)	259.157	64.726	712.280	1.050	7725
Age (Years)	17.360	11	18.172	1	102
Initial Returns (%)	11.176	6.935	18.994	-51.880	139.100
Insider Ownership (%)	24.705	19.790	21.609	0	80.900
Sponsor Reputation (%)	2.991	2.080	3.211	0	15.380
Hot Issue Returns (%)	13.322	11.590	10.310	-14.430	64.420
Leverage	0.370	0.351	0.233	0	1.398
PEVC	0.514	1	0.500	0	1

Table 4.3 Sample IPOs by Industry and Year of Listing

This table presents the distribution of 580 sample IPOs by year of listing and across Industry sectors based on FTSE Global Classification system.

Year	Basic Industries	Cyclical Consumer Goods	Cyclical Services	Financials	General Industrials	Information Technology	Non-Cyclical Consumer Goods	Non-Cyclical Services	Resources	Total	%
1990	0	1	4	0	1	0	1	0	2	9	1.6%
1991	0	1	5	2	0	0	1	0	0	9	1.6%
1992	2	4	9	0	4	2	2	0	0	23	4.0%
1993	9	2	12	9	7	5	14	0	3	61	10.5%
1994	10	11	28	17	6	16	12	2	3	105	18.1%
1995	7	6	14	2	8	2	6	1	2	48	8.3%
1996	7	5	25	4	5	7	8	4	1	66	11.4%
1997	5	4	21	5	3	7	6	3	3	57	9.8%
1998	1	0	19	2	3	0	7	1	1	34	5.9%
1999	0	0	6	3	1	9	1	3	1	24	4.1%
2000	0	0	14	6	1	34	7	2	1	65	11.2%
2001	0	0	3	0	0	1	0	2	0	6	1.0%
2002	0	0	6	2	0	1	2	0	3	14	2.4%
2003	0	0	1	1	0	1	0	0	3	6	1.0%
2004	0	2	7	1	1	2	2	2	0	17	2.9%
2005	2	0	4	2	0	1	5	1	1	16	2.8%
2006	1	0	7	4	1	1	4	0	2	20	3.4%
Total Sample	44	36	185	60	41	89	78	21	26	580	100%
%	7.6%	6.2%	31.9%	10.3%	7.1%	15.3%	13.4%	3.6%	4.5%	100%	

Table 4.4 Sample IPOs by Year of Listing, PEVC backing and Type of Lockup

This table shows the composition of our sample in terms of PEVC backing and the types of lockups. Panel A breaks down the sample IPOs separately for PEVC and non-PEVC backing across listing years. Panel B reports numbers and percentages of IPOs across listing years for each lockup type. Absolute date expiry lockups are set in terms of clear calendar dates or certain period of time after the IPO and usually give the exact length of the lockup period. The relative date expiry lockups specify the expiry in relation to some corporate events like preliminary results announcements or publication of company accounts etc. Combination represents cases where both types are combined over different periods or different types of shareholders.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Panel A: PEVC Backing																	
PEVC Backed #	3	4	14	40	50	25	29	23	18	10	31	4	9	2	16	10	10
Non-PEVC Backed #	6	5	9	21	55	23	37	34	16	14	34	2	5	4	1	6	10
PEVC Backed %	33	44	61	66	48	52	44	40	53	42	48	67	64	33	94	63	50
Non-PEVC Backed %	67	56	39	34	52	48	56	60	47	58	52	33	36	67	6	38	50
Panel B: Lockup Type																	
Absolute Expiry #	4	1	1	15	25	11	18	15	16	9	41	3	9	6	9	12	15
Relative Expiry #	2	5	18	35	61	30	38	30	15	12	19	2	5	0	4	0	3
Combination #	0	0	0	5	5	0	1	0	1	1	4	1	0	0	4	4	2
Absolute Expiry %	67	17	5	27	27	27	32	33	50	41	64	50	64	100	53	75	75
Relative Expiry %	33	83	95	64	67	73	67	67	47	55	30	33	36	0	24	0	15
Combination %	0	0	0	9	5	0	2	0	3	5	6	17	0	0	24	25	10

Table 4.5 Kaplan Meier Survival Rates

This table shows the cumulative survival rates for sample IPOs calculated using the Kaplan Meier (KM) method for each of 1 to 5 years after IPO. Based on the survival rates, we also show the median survival times in months (Median ST). Median ST indicates the number of months after which half of the sample IPOs have been delisted (the cumulative survival rate has dropped below 50%). The survival rates and median survival times are reported separately for listing years (Panel A), industry sectors (Panel B) and for full sample (Panel C). In Panel A, figures in parenthesis show the minimum survival times calculated following Espenlaub et al. (2012). Minimum Survival Time (ST) is the time remaining from the issue year until the end of the study period (December 2011) and shows that cumulative survival rates up to the end of December 2011have not yet dropped below 50%.

	Full Sample						
Panel A:		Cumulative Survival Rates (%)					
Issue Year	**Obs**	**1 Yr**	**2Yrs**	**3 Yrs**	**4Yrs**	**5 Yrs**	**Median ST**
1990	9	100	100	89	89	78	109
1991	9	100	100	89	89	89	136
1992	23	100	96	96	87	78	92
1993	61	100	95	92	82	75	88
1994	105	98	93	90	81	68	85
1995	48	100	90	81	69	63	75
1996	66	100	92	82	73	68	105
1997	57	100	88	79	74	67	106
1998	34	100	88	68	65	55	71
1999	24	96	92	87	83	83	99
2000	65	98	92	75	69	63	75
2001	6	100	100	83	83	50	51
2002	14	100	100	93	93	93	(111)
2003	6	100	100	100	100	67	(98)
2004	17	100	94	88	76	76	(87)
2005	16	100	88	75	56	56	71
2006	20	100	100	95	95	85	(61)
Panel B: Industry							
Basic Industries	44	100	95	84	80	73	85
Cyclical Consumer Goods	36	100	100	89	75	64	75
Cyclical Services	185	99	93	84	76	67	99
Financials	60	97	95	87	72	65	82
General Industrials	41	100	88	83	78	70	90
Information Technology	89	100	91	84	80	72	95
Non-Cyclical Consumer Goods	78	99	91	82	76	73	92
Non-Cyclical Services	21	100	86	81	67	62	79
Resources	26	100	96	92	92	76	155
Panel C: Full Sample							
Total	**580**	**99**	**93**	**84**	**77**	**69**	**92**

Table 4.6 Kaplan Meier Survival Rates stratified by Lockup Length

This table shows the cumulative survival rates for 517 IPOs with lockups only calculated using the Kaplan Meier (KM) method for 1, 3 and 5 years after the IPO. Based on the survival rates, we also show the median survival times in months (Median ST). Median ST indicates the number of months after which half of the sample IPOs have been delisted (the cumulative survival rate has dropped below 50%). The survival rates and median survival times are reported by dividing the IPOs into below and above median lockup length across industry sectors (Panel A) and in Panel B for three different lockup lengths; 0-12 months, 13-24 months and greater than 24 months. Panel B also shows the results of log rank test to assess the statistical significance of differences between survival curves across lockup lengths.

Panel A: Kaplan Meier Survival Rates by Median Lockup Length

	Lockup > Median					**Lockup < Median**				
		Cum. Survival Rates (%)					Cum. Survival Rates (%)			
Industry	**Obs**	**1Yr**	**3Yrs**	**5Yrs**	**Median ST**	**Obs**	**1Yr**	**3Yrs**	**5Yrs**	**Median ST**
Basic Industries	19	100	79	63	93	17	100	94	88	107
Cyclical Consumer Goods	15	100	100	79	75	17	100	82	53	66
Cyclical Services	80	100	89	67	93	81	99	81	70	102
Financials	23	96	87	74	92	25	96	84	56	64
General Industrials	24	100	83	75	101	11	100	82	64	79
Information Technology	35	100	83	71	88	50	100	84	71	98
Non-Cyclical Consumer Goods	39	100	85	77	99	36	100	81	69	75
Non-Cyclical Services	10	100	80	70	79	11	100	82	55	71
Resources	12	100	100	92	161	12	100	83	56	91
	257	**100**	**87**	**72**	**92**	**260**	**99**	**83**	**67**	**87**

Panel B: Kaplan Meier Survival Rates by Lockup Length

Lockup Length		Cumulative Survival Rates (%)					
	Obs	**1Yr**	**2Yrs**	**3Yrs**	**4Yrs**	**5Yrs**	**Median ST**
0-12 Months	231	99	94	83	74	67	88
13-24 Months	255	100	91	86	79	71	90
> 24 Months	31	100	94	90	87	77	140

Log Rank Test for Equality of Survivor Function	
Chi-Square	5.95
P-value	0.050

Table 4.7 Reasons of Delisting by Industry

This table shows the post-IPO state of sample firms segmented by industry sectors during first five years after IPO (Panel A) and across the full sample and tracking period (Panel B). The numbers and percentages show the survivor firms and those delisted due to M&A, Administration/Liquidation and Other reasons. Survivors are defined as firms which are listed by the end of study period (December 2011) or transferred to another market.

	Basic Industries	Cyc. Cons. Goods	Cyc. Services	Financials	General Industrials	Info. Tech.	Non-Cyc. Cons. Goods	Non-Cyc. Services	Resources	#	%
Panel A: **First Five Post-IPO Years**											
Survivors	32	23	125	39	29	65	57	13	20	403	69%
	73%	64%	68%	65%	71%	73%	73%	62%	77%		
Mergers & acquisitions	12	11	50	19	10	17	15	6	4	144	25%
	27%	31%	27%	32%	24%	19%	19%	29%	15%		
Administration & Liquidation	0	2	9	1	2	2	5	2	0	23	4%
	0%	6%	5%	2%	5%	2%	6%	10%	0%		
Other reasons	0	0	1	1	0	5	1	0	2	10	2%
	0%	0%	1%	2%	0%	6%	1%	0%	8%		
Panel B: **Full sample Period (1990-2011)**											
Survivors	15	8	56	18	15	29	21	8	15	185	32%
	34%	22%	30%	30%	37%	33%	27%	38%	58%		
Mergers & acquisitions	28	21	106	38	24	44	46	9	8	324	56%
	64%	58%	57%	63%	59%	49%	59%	43%	31%		
Administration & Liquidation	1	6	15	2	2	9	8	4	1	48	8%
	2%	17%	8%	3%	5%	10%	10%	19%	4%		
Other reasons	0	1	8	2	0	7	3	0	2	23	4%
	0%	3%	4%	3%	0%	8%	4%	0%	8%		
Total	**44**	**36**	**185**	**60**	**41**	**89**	**78**	**21**	**26**	**580**	**100%**

Table 4.8 Delisting (Failure) Rates for IPOs by Reasons of Delisting and Different Lockup Lengths

This table shows the failure rates, using the Kaplan-Meier (K-M) method, for sample firms across different delisting reasons and broken down by below and above median lockup length (Panel A) and three different lockup lengths; 0-12 months, 13-24 months and longer than 24 months (Panel B). The numbers and percentages show the survivor firms and those delisted due to Mergers & Acquisitions, Administration and Liquidation and Other delisting reasons. Survivors are defined as firms which continue to be listed by the end of study period (December 2011) or transferred to another market.

Failure Rates	Mergers and Acquisitions			Administration and Liquidation			Other delisting		
	1 Yr	3 Yrs	5 Yrs	1 Yr	3 Yrs	5 Yrs	1 Yr	3 Yrs	5 Yrs
Panel A: Failure rates by median lockup length									
Lockup < Median (%)	0.77	13.26	25.46	0.00	3.80	6.31	0.00	0.44	3.47
Lockup > Median (%)	0.39	12.16	25.17	0.00	0.79	3.27	0.00	0.43	0.43
Panel B: Failure rates by different lockup lengths									
0-12 Months (%)	0.87	13.20	25.61	0.00	4.28	7.10	0.00	0.50	3.39
13-24 Months (%)	0.39	12.65	25.38	0.00	0.80	3.33	0.00	0.43	0.90
> 24 Months (%)	0.00	9.68	22.58	0.00	0.00	0.00	0.00	0.00	0.00

Table 4.9 Univariate Analysis of Survivors and Non-Survivors

This table show the means, medians and standard deviations of the variables defined in Table 4.1 separately for survivor IPOs and non-survivor IPOs. Survivors are defined as firms which are listed by the end of study period (December 2011) or transfer to another market. Non-Survivors are IPO firms which have delisted (failed) by end of December 2011. Equality of means is assessed using a t-test estimated under assumption of unequal variances. Equality of medians is assessed using Man-Whitney two sample test. ***, ** and * indicate levels of statistical significance at 1, 5 and 10% respectively.

	Survivor IPOs 185 Obs			Non-Survivor IPOs 395 Obs				
Variables	Mean	Median	Std Dev.	Mean	Median	Std Dev.	Equality of Means	Equality of Medians
Lockup Period	15.853	13.000	7.301	15.164	13.000	5.601	1.083	0.174
Size	385.196	102.8	816.405	200.126	57.55	650.648	2.936***	4.089***
Age	18.162	11.410	19.823	16.985	10.460	17.359	0.693	0.552
Initial Returns	12.056	6.54	21.491	10.764	7	17.719	0.763	0.031
Insider Ownership	26.217	17.000	24.644	23.997	20.520	20.025	1.071	0.173
Sponsor Repute	3.141	1.900	3.719	2.923	2.250	2.945	0.702	-0.434
Hot Issue Returns	13.366	11.590	10.188	13.301	11.670	10.379	0.071	0.169
Leverage	0.371	0.334	0.249	0.370	0.359	0.225	0.053	-0.523
PEVC	0.427	0	0.496	0.554	1	0.498	-2.880***	
Industry Dummies								
Basic Industries	0.081	0	0.274	0.073	0	0.261	0.324	
Cyclical Consumer Goods	0.043	0	0.204	0.071	0	0.257	-1.286	
Cyclical Services	0.303	0	0.461	0.327	0	0.470	-0.574	
Financials	0.097	0	0.297	0.106	0	0.309	-0.332	
General Industrials	0.081	0	0.274	0.066	0	0.248	0.667	
Information Technology	0.157	0	0.365	0.152	0	0.359	0.151	
Non-Cyclical Consumer Goods	0.114	0	0.318	0.144	0	0.352	-1.012	
Non-Cyclical Services	0.043	0	0.204	0.033	0	0.179	0.62	
Resources	0.081	0	0.274	0.028	0	0.165	2.446**	

Table 4.10 Correlation Matrix

This table provides correlation coefficients across the variables used in regression model specified in equation 3. All variables are defined in Table 4.1.* indicate significance at 5% level or better.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Ln Survtime	1.00																	
2. Lockup Period	0.14*	1.00																
3. Ln (Size)	-0.01	-0.17*	1.00															
4. Ln (Age)	0.12*	-0.01	0.00	1.00														
5. Initial Returns	-0.01	-0.05	-0.01	-0.10*	1.00													
6. Insider Ownership	0.06	0.13*	-0.22*	0.01	0.10*	1.00												
7. Sponsor Reputation	-0.03	0.01	0.21*	0.11*	-0.04	-0.08	1.00											
8. Hot Issue returns	-0.06	-0.05	0.04	0.02	0.03	-0.26*	0.11*	1.00										
9. Leverage	-0.10*	-0.07	0.16*	-0.12*	0.13*	0.07	-0.07	0.06	1.00									
10. PEVC	-0.02	-0.03	-0.01	0.24*	-0.19*	-0.11*	0.05	0.08	-0.23*	1.00								
11. Basic Industries	0.02	0.00	-0.07	0.09*	-0.05	0.02	0.04	0.06	-0.03	0.07	1.00							
12. Cyc. Cons. Goods	0.01	0.00	-0.13*	0.08	-0.05	0.02	-0.02	0.06	-0.10*	0.08	-0.07	1.00						
13. Cyclical Services	0.02	-0.01	-0.03	0.16*	-0.02	0.06	0.04	-0.07	-0.05	0.16*	-0.20*	-0.18*	1.00					
14. Financials	-0.01	0.01	0.13*	-0.08	-0.11*	-0.09*	-0.02	-0.14*	-0.04	0.17*	-0.10*	-0.09*	-0.23	1.00				
15. General Industrials	-0.02	0.01	-0.12*	0.06	0.00	0.00	-0.04	0.03	-0.04	0.01	-0.08	-0.07	-0.19*	-0.09*	1.00			
16. Info. Tech.	-0.03	-0.10*	0.07	-0.20*	0.28*	0.11*	-0.03	0.12*	0.20*	-0.33*	-0.12*	-0.11*	-0.29*	-0.14*	-0.12*	1.00		
17. Non-Cyc. Cons. Goods	0.00	0.08	-0.01	-0.01	-0.08	-0.09*	0.00	0.08	0.03	-0.12*	-0.11*	-0.10*	-0.27*	-0.13*	-0.11*	-0.17*	1.00	
18. Resources	0.03	0.04	0.06	-0.05	-0.09*	-0.07	0.01	-0.06	0.00	-0.04	-0.06	-0.06	-0.15*	-0.07	-0.06	-0.09*	-0.08*	1.00

Table 4.11 Accelerated Failure Time (AFT) Estimation Results

This table shows the estimation results of Accelerated Failure Time (AFT) model. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). All variables are defined in Table 4.1. Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	***Coeff.***	***P-value***	***Time Ratio***
Lockup Period	0.020***	0.006	1.020
Ln (Size)	0.097***	0.008	1.102
Ln (Age)	0.117**	0.020	1.124
Initial Returns	0.001	0.573	1.001
Insider Ownership	0.004*	0.090	1.004
Sponsor Reputation	-0.016	0.253	0.984
Hot Issue Returns	-0.008**	0.047	0.992
Leverage	-0.096	0.638	0.908
PEVC	-0.192**	0.040	0.826
Industry Dummies			
Basic Industries	0.404	0.138	1.498
Cyclical Consumer Goods	0.157	0.569	1.170
Cyclical Services	0.153	0.500	1.165
Financials	-0.085	0.735	0.918
General Industrials	0.192	0.479	1.221
Information Technology	0.143	0.553	1.154
Non-Cyclical Consumer Goods	0.156	0.518	1.169
Resources	0.583*	0.058	1.791
Constant	3.548***	0.000	
Log-likelihood	-566.380		
LR(Prob.>chi)^2	40.21***		
Pseudo R^2	0.113		
Time at Risk	47065.9		
N	509		

Table 4.12 Sensitivity of Survival Time to Changes in Median Lockup Period

This table shows the actual, absolute and percentage change in the predicted median survival time as the lockup length varies by multiples of 1 to 12 months, holding all other variables at their mean values. The changes to the predicted median survival time are calculated relative to the base predicted survival time at median of lockup and means of all other independent variables. At median (13 months) of lockup and means of all other independent variables, the predicted median survival time equals 89 months. This table is based on AFT coefficient estimates in Table 10.

Variable	**+ 12**	**+ 9**	**+ 6**	**+ 3**	**+ 1**	**Median Lockup**	**- 1**	**- 3**	**- 6**	**- 9**	**- 12**
Expected Survival Time (months)	113	106	100	94	91	89	87	84	79	75	70
Absolute Change (months)	24	17	11	5	2		-2	-5	-10	-14	-19
Percentage Change (%)	26.7	19.4	12.5	6.1	2.0		-1.9	-5.7	-11.1	-16.2	-21.0

Table 4.13 Cox Proportional Hazard Model Results

This table shows the estimation results of Cox Proportional Hazard model. All variables are defined in Table 4.1. The hazard ratio is calculated as the exponential of coefficient estimate, exp (β). A hazard ratio of above (below) one indicates that increase in the explanatory variable increases (reduces) the failure rate. Pseudo R^2 were estimates as $R^2 = 1 – Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	***Coeff.***	***P-value***	***Hazard Ratio***
Lockup Period	-0.024***	0.006	0.976
Ln (Size)	-0.120***	0.009	0.887
Ln (Age)	-0.116*	0.097	0.890
Initial Returns	0.000	0.885	1.000
Insider Ownership	-0.003	0.293	0.997
Sponsor Reputation	0.020	0.248	1.021
Hot Issue Returns	0.014**	0.013	1.014
Leverage	0.013	0.963	1.013
PEVC	0.295**	0.019	1.343
Industry Dummies			
Basic Industries	-0.500	0.18	0.606
Cyclical Consumer Goods	0.016	0.965	1.016
Cyclical Services	-0.192	0.534	0.825
Financials	0.164	0.628	1.178
General Industrials	-0.222	0.539	0.801
Information Technology	-0.151	0.638	0.860
Non-Cyclical Consumer Goods	-0.097	0.764	0.907
Resources	-0.684	0.123	0.504
Log-likelihood	-1883.000		
LR(Prob>chi)^2	38.98***		
Pseudo R^2	0.093		
Time at Risk	47065.9		
N	509		

Table 4.14 Accelerated Failure Time (AFT) Estimation Results with Frailty

This table shows the estimation results of Accelerated Failure Time (AFT) model with frailty. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). All variables are defined in Table 4.1. Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively

Variables	***Coeff.***	***P-value***	***Time Ratio***
Lockup Period	0.021***	0.007	1.020
Ln (Size)	0.101***	0.007	1.106
Ln (Age)	0.126**	0.013	1.134
Initial Returns	0.002	0.488	1.002
Insider Ownership	0.004*	0.071	1.004
Sponsor Reputation	-0.017	0.245	0.983
Hot Issue Returns	-0.008*	0.059	0.992
Leverage	-0.124	0.550	0.883
PEVC	-0.181*	0.055	0.834
Industry Dummies			
Basic Industries	0.403	0.143	1.496
Cyclical Consumer Goods	0.193	0.489	1.213
Cyclical Services	0.158	0.492	1.171
Financials	-0.081	0.751	0.922
General Industrials	0.199	0.466	1.221
Information Technology	0.151	0.537	1.163
Non-Cyclical Consumer Goods	0.182	0.457	1.200
Resources	0.602**	0.050	1.827
Constant	3.548***	0.000	30.792
Likelihood-ratio test of theta=0: $chibar^2(01) = 1.12$			Prob.>=$chibar^2 = 0.145$
Log-likelihood	-565.821		
LR(Prob.>chi)^2	40.25***		
Pseudo R^2	0.097		
Time at Risk	47065.9		
N	509		

Table 4.15 Accelerated Failure Time (AFT) Model with Cluster Adjusted Standard Errors

This table shows the estimation results of Accelerated Failure Time (AFT) model with cluster adjusted standard errors on the basis of number of IPOs in each year. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). All variables are defined in Table 4.1. Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	***Coeff.***	***P-value***	***Time Ratio***
Lockup Period	0.021**	0.025	1.021
Ln (Size)	0.097**	0.013	1.102
Ln (Age)	0.117***	0.000	1.124
Initial Returns	0.001	0.408	1.001
Insider Ownership	0.004	0.111	1.004
Sponsor Reputation	-0.016	0.279	0.984
Hot Issue Returns	-0.008***	0.000	0.992
Leverage	-0.096	0.669	0.908
PEVC	-0.192*	0.095	0.826
Industry Dummies			
Basic Industries	0.404	0.137	1.497
Cyclical Consumer Goods	0.157	0.585	1.170
Cyclical Services	0.153	0.591	1.165
Financials	-0.085	0.803	0.918
General Industrials	0.192	0.554	1.211
Information Technology	0.143	0.563	1.154
Non-Cyclical Consumer Goods	0.156	0.635	1.169
Resources	0.583	0.115	1.791
Constant	3.548***	0.000	34.731
Log-likelihood	-566.381		
Pseudo R^2	0.111		
Time at Risk	47065.9		
N	509		

Table 4.16 Accelerated Failure Time (AFT) Model Excluding IPOs in Mineral and Scientific Research based companies before Year 2000

This table shows the estimation results of Accelerated Failure Time (AFT) model excluding all IPOs in mineral and scientific research based companies before year 2000. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). All variables are defined in Table 4.1. Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	***Coeff.***	***P-value***	***Time Ratio***
Lockup Period	0.018**	0.012	1.019
Ln (Size)	0.091**	0.015	1.095
Ln (Age)	0.110**	0.034	1.116
Initial Returns	0.001	0.522	1.002
Insider Ownership	0.004	0.127	1.004
Sponsor Reputation	-0.015	0.278	0.985
Hot Issue Returns	-0.009**	0.046	0.991
Leverage	-0.077	0.715	0.926
PEVC	-0.194**	0.044	0.823
Industry Dummies			
Basic Industries	0.406	0.139	1.501
Cyclical Consumer Goods	0.156	0.574	1.169
Cyclical Services	0.156	0.494	1.169
Financials	-0.082	0.747	0.921
General Industrials	0.191	0.483	1.211
Information Technology	0.148	0.543	1.159
Non-Cyclical Consumer Goods	0.187	0.451	1.205
Resources	0.650	0.128	1.915
Constant	3.614***	0.000	37.124
Log-likelihood	-542.169		
LR(Prob.>chi)^2	34.36***		
Pseudo R^2	0.109		
Time at Risk	44634.9		
N	485		

Table 4.17 Accelerated Failure Time (AFT) Model Excluding IPOs with Two Year Lockups

This table shows the estimation results of Accelerated Failure Time (AFT) model excluding all IPOs in mineral and scientific research based companies before year 2000. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). All variables are defined in Table 4.1. Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	***Coeff.***	***P-value***	***Time Ratio***
Lockup Period	0.020**	0.013	1.020
Ln (Size)	0.098***	0.009	1.103
Ln (Age)	0.115**	0.027	1.122
Initial Returns	0.001	0.646	1.001
Insider Ownership	0.005**	0.050	1.005
Sponsor Reputation	-0.015	0.286	0.985
Hot Issue Returns	-0.010**	0.024	0.990
Leverage	0.001	0.997	1.001
PEVC	-0.150	0.127	0.861
Industry Dummies			
Basic Industries	0.342	0.229	1.407
Cyclical Consumer Goods	0.026	0.925	1.027
Cyclical Services	0.054	0.819	1.055
Financials	-0.223	0.391	0.801
General Industrials	0.044	0.873	1.045
Information Technology	0.027	0.914	1.027
Non-Cyclical Consumer Goods	0.007	0.979	1.007
Resources	0.432	0.205	1.541
Constant	3.602***	0.000	36.656
Log-likelihood	-516.534		
LR(Prob.>chi)^2	38.06***		
Pseudo R^2	0.106		
Time at Risk	42437.67		
N	463		

Table 4.18 Accelerated Failure Time (AFT) Model for Alternative Measures of Sponsor Reputation

This table shows the estimation results of Accelerated Failure Time (AFT) model or alternative measures of sponsor reputation. Top 10 UW is a dummy variable coded 1 for top 10 sponsors based on reputation measure of Jelic (2011) and 0 otherwise. UWREP_DandK is a dummy variable coded 1 for top 15 global investment banks as in Derrien and Kecskés (2007) for UK and 0 otherwise. All other variables are defined in Table 4.1. The Lognormal density distribution was selected based on the Akaike (1974) Information Criterion (AIC). Time ratios are the exponentiated coefficients, exp (β), and measure the extent to which changes in covariates accelerate or decelerate the occurrence of event (delisting). A time ratio of above (below) one indicates that increase in the covariate increases (reduces) the survival time. Pseudo R^2 were estimated as $R^2 = 1 - Lu/Lo$; where *Lu* corresponds to the last log-likelihood number before the convergence and *Lo* corresponds to the first log-likelihood number at the start of the iteration. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	*Coeff.*	*P-value*	*Time Ratio*	*Coeff.*	*P-value*	*Time Ratio*
Lockup Period	0.019***	0.007	1.020	0.019***	0.007	1.020
Ln (Size)	0.098**	0.010	1.103	0.090**	0.013	1.094
Ln (Age)	0.113**	0.026	1.119	0.113**	0.025	1.120
Initial Returns	0.001	0.557	1.001	0.001	0.555	1.001
Insider Ownership	0.004*	0.084	1.004	0.004*	0.080	1.004
Top 10 UW	-0.061	0.525	0.940			
UWREP_DandK				0.014	0.875	1.014
Hot Issue Returns	-0.008**	0.050	0.992	-0.008*	0.057	0.992
Leverage	-0.116	0.573	0.891	-0.103	0.615	0.902
PEVC	-0.195**	0.036	0.823	-0.198**	0.034	0.821
Industry Dummies						
Basic Industries	0.396	0.147	1.486	0.392	0.151	1.480
Cyclical Consumer Goods	0.159	0.564	1.173	0.164	0.552	1.179
Cyclical Services	0.156	0.492	1.169	0.153	0.499	1.166
Financials	-0.064	0.798	0.938	-0.066	0.794	0.936
General Industrials	0.207	0.445	1.230	0.202	0.457	1.223
Information Technology	0.153	0.528	1.165	0.144	0.552	1.155
Non-Cyclical Consumer Goods	0.161	0.505	1.175	0.157	0.518	1.170
Resources	0.587*	0.057	1.798	0.582*	0.059	1.790
Constant	3.530***	0.000	34.119	3.536***	0.000	34.339
Log-likelihood	-566.829			-570.218		
LR(Prob.>chi)^2	39.31***			32.53**		
Pseudo R^2	0.111			0.111		
Time at Risk	47065.9			47065.9		
N	509			509		

Table 4.19 Logistic Regression Estimation Results

This table shows the estimation results of binary Logistic model. The dependant variable is a dummy variable equal to one if the IPO firm delisted within five years of its IPO and zero otherwise. Regression Coefficients, P-values of Wald test and Odds ratios are provided, where Odds ratios are exponentiated coefficients. All variables are defined in Table 4.1. ***, ** and * indicate the statistical significance at 1%, 5% and 10% respectively.

Variables	*Coeff.*	*P-value*	*Odds Ratio*
Lockup Period	-0.050***	0.007	0.951
Ln (Size)	-0.611***	0.000	0.543
Ln (Age)	-0.155	0.247	0.856
Initial Returns	0.002	0.808	1.001
Insider Ownership	-0.001	0.924	0.999
Sponsor Reputation	0.005	0.899	1.004
Hot Issue Returns	0.030**	0.021	1.031
Leverage	-0.545	0.294	0.580
PEVC	0.353	0.162	1.423
Industry Dummies			
Basic Industries	-1.217*	0.089	0.296
Cyclical Consumer Goods	-0.485	0.537	0.616
Cyclical Services	-0.729	0.234	0.482
Financials	0.490	0.411	1.633
General Industrials	-0.946	0.200	0.388
Information Technology	-0.408	0.546	0.665
Non-Cyclical Consumer Goods	-0.564	0.395	0.569
Resources	-1.425*	0.054	0.240
Constant	5.399***	0.000	221.348
Log Likelihood	-244.161		
LR chi^2 (17)	69.99		
Prob. > chi^2	0.000		
McFadden's R^2	0.125		
ML (Cox-Snell) R^2	0.128		
Cragg-Uhler (Nagelkerke) R^2	0.193		
N	509		

CHAPTER 5 LONG-RUN PERFORMANCE OF IPOS: THE ROLE OF LOCKUPS

5.1 Introduction

Long-run underperformance of IPOs has been well documented in the literature. Ritter (1991) and Loughran and Ritter (1995) document a strong underperformance for US IPOs over a three and five year period following the issuing dates. Levis (1993) and Espenlaub et al. (2000) report similar results for IPOs on the UK markets. Similar phenomenon has also been observed for other markets around the world.[28] There is, however, also evidence to suggest that long-run underperformance is not an IPO effect per se and underperformance is concentrated in the small firms with low book-to-market ratios (Brav et al., 2000). Similarly, there are studies which document long-run IPO performance differences based on certain IPO characteristics. For example, Brav and Gompers (1997) report that VC backed IPOs outperform non-VC backed IPOs, at least, on an equal weighting return basis. Carter et al. (1998) report less severe underperformance for IPOs handled by more prestigious underwriters/sponsors. Gao and Jain (2011) find that founder led IPOs perform better in the long-run than non-founder led IPOs in case of high technology IPOs. While Krishnan et al. (2011b) find a positive impact of VC reputation on the long run IPO performance, Levis (2011) reports that PE backed IPOs perform better than the VC backed and other IPOs for UK market in three years following the IPOs. Other characteristics related to the long-run performance in the literature include firm age, size, initial price multiples, global offerings, equity retention by insiders and multinationality of issuing firm (Ritter, 1991, Purnanandam and Swaminathan, 2004, Wu and Kwok, 2007, Goergen et al., 2007, Mudambi et al., 2012). Despite these and other studies, the sources of long-run performance differences in IPOs

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[28] See Table 3.2 in chapter 3.

remain unresolved. In this chapter, we relate the long run performance of IPOs to the length of lockup. Specifically, we evaluate the impact of lockup length in explaining three years stock return performance following IPO and also abnormal return performance around the lockup expiry dates.

In this study, using long-run stock return performance after IPO and abnormal returns around lockup expiry as a measure of quality, we examine whether there is a significant difference in quality between IPOs with longer lockups and shorter lockups. Prior research on IPO lockups suggests two main motives for lockups: signal of quality and commitment device to reduce moral hazard. Moreover, evidence also suggests that IPOs experience significant negative abnormal returns around the expiry of lockups. We argue that if longer lockups signal quality of issuing firm, then IPOs with longer lockups should exhibit superior long-run performance. Over time, positive inside information and true value of the firm signalled by longer lockup should be realised and reflected in the stock price. Similarly, if longer lockups are used as a commitment device to minimise moral hazard then this should result in better long-run performance due to the mitigated agency costs. Likewise, if longer lockups are indicative of better issuer quality and reduced agency problem, IPOs with longer lockups should have better return performance around the lockup expiry period. Insiders of high quality firms with positive inside information about future prospects of firms are less likely to sell shares at lockup expiry. Moreover, insider sales in high quality firms around lockup expiry are more likely to be for portfolio diversification reasons instead of trading on private information. Based on these arguments, we try to answer two important questions. First, do IPOs with longer lockups experience superior post issue long-run performance? Second, do IPOs with longer lockups show better performance around lockup expiry period?

We test the above predictions on a sample of 268 IPOs with lockups from 1995-2006 on the LSE Main Market. Following is the summary of main findings of our analysis. First, we document that our full sample of IPOs significantly outperforms the market index and control firms based on size and size and book-to-market basis using equally weighted buy-and-hold abnormal returns (BHARs). Using value weighted BHARs, however, greatly reduces the outperformance and statistical significance of the abnormal returns, yet, BHARs for two and three years holding periods are still positive. These results are not consistent with the widely documented long run underperformance of IPOs in the literature (Ritter, 1991, Loughran and Ritter, 1995). Second, we compare BHARs between IPOs with lockups longer than median and IPOs with lockups shorter than median. We find that IPOs with lockups longer than median consistently perform better than IPOs with lockups shorter than median on both equal and value weighting basis. We find similar results when IPOs are grouped on the basis of top and bottom quartile of their lockup length instead of the median. The BHARs of IPOs in top quartile of lockup length are constantly higher than IPOs in bottom quartile of lockup length irrespective of the weighting scheme used. Moreover, we find similar results when wealth relatives are used as a measure of long-run performance instead of the BHARs. Third, we check robustness of our results by employing a calendar-time portfolio approach and compare abnormal returns of IPOs grouped on the basis of median lockup length cut off and top and bottom quartile of lockup length. Comparing the abnormal returns of IPOs grouped on the basis of median length, we find weak evidence that IPOs with lockups longer than median outperform IPOs with lockups shorter than median as the results depend on the choice of model and portfolio period. However, results for IPO groups based on top and bottom quartile of lockup length are more clear-cut as calendar-time abnormal returns are consistently higher for IPOs in top quartile compared to the IPOs in the bottom quartile. We obtain similar results when WLS regressions instead of OLS are used in calendar-time approach. Fourth, our cross-sectional regression analysis reveals that lockup length significantly predicts the post-issue long-run performance of IPOs. Our results suggest that longer lockups are positively related to the long-run performance and these results are robust to the different benchmarks and period of performance measurement. Finally, we analyse the stock returns around the lockup expiry for full sample of IPOs and sub-samples of IPOs based on median cut off and top and bottom quartiles of lockup length. Our results show no significant abnormal returns for shorter expiry windows of 5 and 3 days around the lockup expiry date. The abnormal returns for relatively longer windows (41 and 21 days) around lockup expiry are, however, significantly negative across all the models used. The returns are also negative and significant in immediate post lockup expiry periods. Comparing the abnormal returns between IPOs with longer lockups and shorter lockups, we find significant evidence to suggest that the severe underperformance around lockup expiry resides in shorter lockup IPOs. We further analyse the abnormal returns around lockup expiry between VC and non-VC backed IPOs and find that our previous results are robust even for VC and non-VC backed samples.

Collectively, our evidence strongly supports the signalling hypothesis for IPO lockups. Our findings suggest that insiders in high quality IPO firms signal their quality by accepting longer lockups which in turn is related to superior post-IPO performance in long-run. Longer lockups ensure that founding entrepreneurs and key employees and managers remain with IPO firm for a long time after the firm has gone public. Additionally, the interests of these insiders are closely aligned with those of investors and continued monitoring and presence of these insiders adds value to the firm. Moreover, lack of significant negative performance around lockup expiry on part of IPOs with longer lockups further complements the signalling role of lockups.

During the period of this research, two related papers have emerged on US markets with some contradictory results to ours. Gao and Siddiqi (2012), for example, use long-run operating and stock return performance as a measure of firm quality and relate it to the lockup length for a sample of US IPOs. They find a negative relation between long-run stock performance and lockup length and conclude that longer lockups are used to control agency problem and do not signal firm quality.[29] We, however, contend that there are significant differences in US and UK lockups in terms of their length as discussed in chapter 2 and 3. The diversity in UK lockups may have different implications in terms of signalling or commitment hypothesis compared to the US markets. Based on these institutional differences between US and UK, we argue that UK market provides more fertile ground to test the relationship between lockup length and post IPO long term performance. Moreover, substantially longer lockups in UK IPOs may act as a more credible quality signal relative to standard and shorter lockups in US markets.

This study makes important contributions to the IPO lockups literature and long-run IPO underperformance literature. Prior research has identified that lockups signal quality and help to reduce uncertainty of firms at the time of IPO (Arthurs et al., 2009, Brau et al., 2005, Goergen et al., 2006b), we show that lockups not only reduce uncertainty about issuing firm at the time of IPO but they also predict issuing firm quality in the long run measured as stock return performance. Our study is also related to the strand of literature that identifies factors affecting long-run IPO performance. We suggest that lockup length could potentially explain long-run IPO performance in addition to the VC backing and reputation (Brav and Gompers, 1997, Krishnan et al., 2011a), underwriter reputation (Carter et al., 1998), founder CEOs (Gao and Jain, 2011) and management quality (Chemmanur et al., 2014) etc.

[29] Similarly, Cline et al. (2014) fail to find evidence that (longer) lockups signal quality in terms of superior long-run performance for Seasoned Equity Offerings (SEOs) in the US.

The rest of the chapter is organised in the following way. Section 5.2 briefly reviews the related literature and develops testable predictions. Section 5.3 presents data, sample construction and the methodology. Empirical results and discussion are provided in section 5.4. In section 5.5, we present analysis on the lockup expiration returns. Finally, section 5.6 gives the conclusion of the chapter.

5.2 Related literature and Testable Predictions

There is ample evidence to suggest that IPOs underperform in the long run compared to the market or matched seasoned firms. Detailed review of the literature on long-run underperformance has been presented in chapter 3. However, literature also suggests that the underperformance does not seem to be evenly distributed across firms and can be differentiated on the basis of some IPO and issue characteristics. For example firm age, size, risk, founder CEO, global offerings, multinationality of IPO and earnings management in IPOs etc. have been studied in the previous literature and found to have predictive power for the long-run IPO performance (Ritter, 1991, Gao and Jain, 2011, Wu and Kwok, 2007, Mudambi et al., 2012, Teoh et al., 1998a). Research on the role of third party certification has also documented positive impact of this certification on long-run performance of IPOs. VC backing (Brav and Gompers, 1997) and backing by reputed VCs (Krishnan et al., 2011) improves the long run performance of IPOs. Levis (2011) reports that IPOs backed by private equity outperform IPOs backed by VCs and other IPOs in the UK. IPOs underwritten by more reputed underwriters perform better than those underwritten by less reputed underwriters (Carter et al., 1998, Dong et al., 2011, Chan et al., 2008). Similarly, long run performance differences could be related to the signalling theories of IPO. Signalling by underpricing and retained ownership is among the prominent signalling models (Allen and Faulhaber, 1989, Grinblatt and Hwang, 1989, Welch, 1989). High quality firms underprice more in order to signal their better quality and in long-run underpricing is positively related to the stock return performance (Álvarez and González, 2005). Leland and Pyle (1977) develop a model in which insiders signal quality of their firm by retaining large equity stakes. However, this signal might not be credible as the insiders can sell overvalued shares immediately following the IPO (Gale and Stiglitz, 1989). Courteau (1995) proposes that lockup length works as a mechanism to signal quality and private information and complements the signal provided by equity retention.

Prior research suggests two main motives for lockups in equity offerings: signalling theory and commitment theory. Under the signalling theory, longer lockups reduce information asymmetry prevalent between insiders and outside investors of an IPO firm. Due to the significant illiquidity and non-diversification costs associated with longer lockups, insiders of only high quality firms will accept longer lockups to signal their positive inside information. Consistent with the arguments of Courteau (1995), Brau et al. (2005) develop a model and find empirical support for the signalling theory. The lockup length may also act as a substitute quality signal when other signals of quality (VC and reputed underwriter backing) are not present (Arthurs et al., 2009). Furthermore, Arthurs et al. (2009) find that ventures with going concern issues can reduce money left on the table by accepting longer lockups. Similarly, Chong and Ho (2007) find that lockups act as signal and add credibility to earnings forecasts in IPO prospectuses for a sample of IPOs in Singapore. In a recent study on UK IPOs, Ahmad and Jelic (2014) find that lockups predict long term survival of IPOs in the aftermarket whereby longer lockups are related to higher survival rates and time for IPOs. The commitment hypothesis, on the other hand, suggests that longer lockups are used by insiders of firms subject to severe agency or moral hazard problems. By accepting longer lockups, insiders in these firms reassure investors that managers have little incentive to engage in informed trading following IPO and wealth expropriation from the outside investors. Brav and Gompers (2003) support the commitment hypothesis and find that longer lockups are used to reduce moral hazard in IPOs. In a recent study of SEO lockups, Cline et al. (2014) find that lockups are used as a commitment mechanism to reduce moral hazard and support commitment hypothesis. The empirical evidence for signalling and commitment devise hypotheses is, at best, mixed.

5.2.1 Lockup Length and Long-Run IPO Performance

We argue that the signalling hypothesis predicts a superior long-run performance for IPOs with longer lockups. Given that a longer lockup is costly signal in terms of illiquidity and potential wealth losses for insiders, only insiders in high quality firms with positive information about the true future value of the firm will accept longer lockups. This true value will be revealed over time in the market and should have a positive impact on the stock return performance of the firm. Moreover, longer lockups also ensure that founding entrepreneurs, key managers and employees remain with the firm for a longer period of time and their contribution will add more value to firm's performance. A superior performance on part of IPOs with longer lockups compared to IPOs with shorter lockups would provide support to the signalling explanation of lockups. Likewise, if longer lockups are in place to reduce agency problem, then IPOs with longer lockups should show better long-run performance due to the reduced agency costs in the post-IPO market. Given the beneficial impact of diverse and longer lockups in UK, we predict that lockup length is positively related to long-run stock return performance.

5.2.2 Lockup Expiration Performance

Market reaction to the expiry of lockups has also received considerable attention in the literature. Studies, mainly from US markets, have documented significant negative abnormal returns around lockup expiry day (Field and Hanka, 2001, Bradley et al., 2001, Brav and Gompers, 2003). These findings are puzzling as information regarding the lockups and lockup expiry date is disclosed in IPO prospectus well before the actual expiry date and the expiry event is devoid of informational content. Studies outside the US markets, however, have failed to find significant negative abnormal returns around the lockup expiry (Espenlaub et al., 2001, Goergen et al., 2006b)

Insiders in IPOs firms are free to sell shares after lockup expiry, although evidence suggests that insiders could be released from lockups even before expiry (Brav and Gompers, 2003, Hoque and Lasfer, 2009). However, insiders are not likely to sell shares if they think that share price will go higher in future (Maremont et al., 2000). On the other hand, corporate insiders are more likely to sell shares at lockup expiration if they possess negative information about firms' future prospects and valuation. Consequently, the trading behaviour of insiders' at lockup expiry may provide market with important information about future prospects of the IPO firm and may affect its return performance after the lockup expiration. Prior literature (Chen et al., 2012, Hoque and Lasfer, 2015) suggests "portfolio diversification or liquidity needs" and "information selling" as the main reasons for insider sales at lockup expiry.[30] If insider sales are motivated by portfolio diversification or liquidity needs, then these trades may not convey any inside information and do not necessarily affect return performance after lockup expiry. Conversely, insider trades based on negative private information are likely to convey bad news and affect the return performance after lockup expiry. Chen et al. (2012) find that insider sales by top executives following lockup expiry are negatively related to long-run performance of IPOs supporting the information selling hypothesis. Based on the

[30] It would be very difficult to infer the intent or motivation of insider sales at lockup expiry. The insiders may not give any reason or motive for their sales and even if they declare the motive, it would be hard to verify that. We can only observe the action (whether insiders sell at the expiry of lockup and how much they sell) but not the motive of selling. Prior studies (Chen at al., 2012, Hoque and Lasfer, 2015) have used return performance after the lockup expiry as a proxy of information content of the insider sales.

above arguments, we assert that if longer lockups signal better quality and reduce moral hazard, then insiders' in IPOs with longer lockups are less likely to sell shares and engage in informed trading at the time of lockup expiry.[31] It is also more likely that the insiders in IPOs with longer lockup sell shares due to portfolio diversification reasons and their trades around lockup expiry do not convey any information about the future prospects of IPO firm. If the portfolio diversification argument for IPOs with longer lockups is correct, then insider selling around lockup expiry does not necessarily result in weaker return performance around and after lockup expiry. On the contrary, trading around lockup expiry by insiders of low quality firms with shorter lockups might reveal information about the future prospects of the firm. The insiders of low quality firms with shorter lockups are more likely to be involved in informed trading predicting a weak stock return performance around and after lockup expiry. Following Chen et al. (2012) and Filed and Hanka (2001), we examine return performance around and after lockup expiry for shorter and longer lockup IPOs. As longer lockups signal better firm quality and insiders' commitment, we predict that IPOs with longer lockups show better performance at lockup expiry relative to IPOs with shorter lockups.

5.3 Data and Methodology

5.3.1 Data and Sample Construction

Our sample consists of UK IPOs that went public on LSE Main Market between January 1995 and December 2006. We obtain initial sample of issuing firms from new issues list available from LSE website for the period 1998-2006[32]. For years 1995-1997, issuing firms have been identified from Thomson One Banker and Perfect Filings database. In line with the existing

[31] Due to lack of data on insider sales, I am unable to examine the actual sales by insiders at the lockup expiry.
[32] http://www.londonstockexchange.com/statistics/new-issues-further-issues/new-issues-further-issues.htm LSE reports all new and further issues on monthly basis. But the details of Main Market IPOs are only available from January 1998 onwards.

IPO literature, we exclude all financial firms (SIC code 6xxx) including investment trusts and venture capital trusts (VCTs), utility firms (SIC code 49xx), foreign issuers, re-admissions and firms with missing prospectuses. After applying these filters, there are only 19 firms from 1995 to 2006 which reported no lockup provision in their IPO prospectuses. As the sample of no lockup firms is very small, we do not attempt to compare the performance differences between firms with lockups and without lockups and these firms are excluded from the sample. Our final sample consists of 268 IPOs with lockups reported in their prospectuses. We use Perfect Filings database to download IPO prospectuses and hand collect variables such as lockup and its duration, insider ownership, VC backing, underwriter, company founding date etc. Relevant financial variables for IPO and control firms are from WorldScope database and from IPO prospectuses when information is missing in WorldScope. Finally, data on stock prices is collected from DataStream.

Table 5.1 presents yearly distribution of sample IPOs from 1995 to 2006 (Panel A) and distribution of sample IPOs across industry sectors based on two-digit SIC codes (Panel B). We also show the descriptive statistics of lockup period in months across sample years and industry. Panel A shows the highest number of sample IPOs in year 2000, which accounts for one fifth of the total sample. The earlier years of our sample period also account for large number of IPOs. For example IPOs in years 1995, 1996 and 1997 account for about 38% for the total IPOs. However, the IPO activity dropped after year 2000 mainly due to the dotcom crisis. The mean lockup period for the sample is 15 months but there is large variation in mean lockup length across sample years. The longest mean lockup length is observed for IPOs that went public in years 1997 and 2001. The mean lockup length across sample years decreases after year 2000 with a mean length of 10 months in year 2003. An inspection of median lockup length reveals that median lockup period converges to 12 months particularly in later years of sample period. In fact, seven out of twelve sample years have a median lockup period of 12 months.

In panel B of Table 5.1, we observe that a large portion (28%) of our IPO sample is from “Computer equipment and services” sector. Other industry sectors with highest IPO frequency are “Retail”, “Engineering and management services” and “Chemical products” accounting for about 21% of the total sample. There is large variation in terms of average lockup length across different industry sectors. For instance, IPOs in “Transport” sector have a mean lockup period of 11 months while IPOs in the “Scientific instruments” and “Paper and paper products” sectors have average lockup periods of 19 months. Similar pattern is observed for median length and dispersion (Std. dev.) of lockup period across industry sectors. Overall, results from Table 5.1 indicate that lockups in UK are quite heterogeneous in terms of their length across different industries and times.

[Insert Table 5.1 about here]

5.3.2 Methodology

5.3.2.1 Event-Time Approach: Buy-and-Hold Abnormal Returns and Wealth Relatives

Following previous IPO literature, we use BHARs to measure the long-run performance of our sample IPOs. BHARs are an advantageous method for IPO performance because they capture the return which an investor can earn over the long run and are more representative of an investor experience (Kothari and Warner, 1997, Barber and Lyon, 1997). In order to show robustness for our results, we use three different benchmarks as well as equal and value weighting for calculating BHARs. For each sample IPO, the listing day is defined as event day zero and each IPO is tracked for one, two and three years from the day after the IPO (event day). Consistent with previous literature (Loughran and Ritter, 1995, Brau et al., 2012), a month is defined as 21 trading days, with 252 days in a year, 504 days in two years and 756 days in three years. The BHAR of an IPO is calculated on a daily basis as;

$$BHAR(t_1, t_2) = \prod_{t=t_1}^{t_2}(1 + R_{it}) - \prod_{t=t_1}^{t_2}(1 + R_{bt}) \qquad (5.1)$$

Where R_{it} the daily is return of firm i on the date t and R_{bt} is the return on the respective benchmark on the same date. The holding period begins with the day after the IPO is listed (t_1) and ends on t_2 where t_2 is earlier of the end of one year (252 days), two years (504 days) or three years (756 days) window. If a sample firm delists before the end of holding period, the returns from respective benchmark are included from the delisting date until the end of tracking period (one, two or three years). This procedure doesn't change the weight of each of the remaining IPOs and the sample size also remains the same for the whole tracking period. For each holding period, we compute both equal weighted and value weighted average BHARs for full sample and different sub-samples. For value weighted average BHARs, weight is the relative market capitalisation of an IPO at the offer.

To measure benchmark returns, we use three alterative benchmarks. Our first benchmark is the market return where we use value weighted market index. FTSE Allshare index is used as a proxy for the market return. Second, we use a non-issuing control firm matched on the size of IPO as a benchmark. Size is defined as market capitalisation of sample firm at the end of IPO month. For selecting a size matched control firm, we obtain market capitalisation of all firms (excluding sample firms) listed on LSE from London Share Price Database (LSPD) at the end of every month when we have a corresponding IPO issue firm in that month. A size matched control firm is the firm with the closest but higher market capitalisation to the corresponding IPO firm. This is because the market capitalisation of the IPOs is expected to increase in the post-IPO period. Our final benchmark is a size and book-to-market (BM) matched control firm based on the method of Barber and Lyon (1997). For size and BM matched control firm, we first select a sub set of all non-issuing listed firms (excluding the sample firms) with a market capitalisation within ±30% of the market capitalisation of the issuing firm in the month of IPO. This subset is selected from the firms used in our previous benchmark (size matched). Next, the selected firms are ranked according to their book-to-market ratios measured in IPO year. The control firm is a firm with the closest book-to-market ratio to that of the sample IPO firm. If a matching firm delists before the end of holding period, the next matched firm is included after the delisting date of original matched firm.

We employ a skewness-adjusted t-test in order to mitigate the problem of positively skewed long run abnormal returns following Lyon et al. (1999) as:

$$T_{skewness-adjusted} = \sqrt{N}\left[S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6N}\hat{\gamma}\right] \quad (5.2)$$

where

$S = \frac{\overline{BHAR}(t_1,t_2)}{\sigma(BHAR)}$, $\hat{\gamma} = \frac{\sum_{i=1}^{n}[BHAR_i(t_1,t_2) - \overline{BHAR}(t_1,t_2)]^3}{N\sigma(BHAR)^3}$ and N is the number of firms in the sample.

In addition to using BHARs as a performance measure, we also adopt wealth relative (WR) as a performance measure in line with previous IPO studies (Ritter, 1991, Brav and Gompers, 1997). We compute wealth relatives for one year, two years and three years using the three benchmarks discussed earlier for full IPO sample and different sub-samples based on lockup length. In accordance with Ritter (1991), the wealth relatives are estimated as:

$$WR = \frac{1 + average\ \ BHR\ for\ IPO\ firms}{1 + average\ BHR\ for\ benchmark} \quad (5.3)$$

where BHR is the average buy-and-hold return on one, two or three year relevant portfolio of IPO firms and the respective benchmarks. A wealth relative greater than 1 indicates that the

IPO portfolio outperforms the relevant benchmark while a wealth relative of less than 1 indicates that the IPO portfolio underperforms the relevant benchmark. Similarly, a higher wealth relative for a sub sample of IPOs relative to the other sub sample implies better performance for the former sub sample.

5.3.2.2 Calendar-Time Factor Model Regressions

We also use calendar time factor regressions as a further robustness test of our results. Fama (1998) and Mitchell and Stafford (2000) strongly recommend the monthly calendar time approach for measuring the long term abnormal performance. First, monthly returns in calendar time are less susceptible to the bad model problem. Second, monthly portfolios take into account the cross-sectional dependence among the sample firms which could allow better statistical inferences. Third, portfolio returns do not compound spurious abnormal returns which could lead to biases over the longer event windows.

In our calendar time models, we form an equally weighted portfolio of each of the two types of IPOs. Our first type of portfolios is based on the median length of lockup period. In this type we divide IPOs in two groups of portfolios: IPOs with lockups less than median lockup period and IPOs with lockups greater than the median lockup period. In second type, IPOs are divided into two groups based on their quartiles of lockup length. More specifically, IPOs with lockup period in bottom quartile (12 months) are grouped together and in other group IPOs with lockups in top quartile (18 months) are grouped together. Based on each type and group, we develop time series of monthly returns of IPOs which occurred in the previous T months (where T equals 12, 24 or 36 months). For example, a 12 monthly portfolio is composed of monthly returns of all firms (for different subsamples as described above) that had an IPO in the previous 12 months. Because this approach requires a 12 month look back window, our monthly portfolio formation starts in January 1996 and extends to December 2007[33]. So, in all of these portfolios, the number of monthly observations is 144.

We use three regression models to test abnormal performance of IPOs in different sub samples after the issue. Our first model is standard Capital Asset pricing Model (CAPM), second is Fama and French (1993) three factor model, and third is Carhart (1997) four factor model which is an extension of Fama and French (1993) model.

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + \varepsilon_t \quad (5.4)$$

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + \varepsilon_t \quad (5.5)$$

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + mUMD_t + \varepsilon_t \quad (5.6)$$

where

R_{pt} = the monthly return on an equal-weighted calendar time portfolio of IPOs of different sub-samples (based on median lockup length and top and bottom quartiles) in month t;

R_{ft} = the monthly return on three month Treasury Bills in month t;

R_{mt}= the total return on FTSE Allshare index in moth t; thus, $R_{mt} - R_{ft}$ is the market risk premium;

SMB_t= the difference in the returns of small stocks and big stocks in month t;

HML_t= the difference in returns of high book-to-market stocks and low book-to-market stocks in month t;

UMD_t= the difference in returns of high and low momentum stocks in moth t;

α = the intercept term, which provides the mean monthly abnormal return on the calendar time portfolio.

[33] Our sample starts in January 1995 and ends in December 2006. Similarly, for a 24 month portfolio, monthly portfolio formation starts in January 1997 and extends to December 2008. For 36 monthly portfolios, we start monthly portfolio formation in January 1998 and include monthly returns (starting from January 1998) of all firms which had an IPO in previous 36 months. This portfolio extends to December 2009.

A positive and significant intercept term, alpha, in the above models can be interpreted as outperformance of a sub sample of IPOs. The above stated models estimated with OLS technique could suffer from potential hetroskedasticity problem because the number of firms is unequal and keep changing every month due to the rolling nature of monthly portfolios. In order to solve this problem and for robustness of results, we also estimate all the above models using WLS. The number of firms in each monthly portfolio is used as weights in the WLS regressions. The monthly factors for UK are from Gregory et al. (2013)[34].

5.3.2.3 Cross Sectional Regressions of Long-Run IPO Performance

This section conducts further analysis to test whether post-IPO long-run performance is related to lockup length after controlling for other firm and offer characteristics that may be attributed to long-run performance. Consistent with Chen et al. (2012), following regression models are estimated;

$$LBHR = \alpha + \beta_1 Lu\ Months + \beta_2 VC + \beta_3 UW\ Reputation + \beta_4 Ln(\ Assets) + \beta_5 Insider\ Ownership + \beta_6 Ln(Age) + \beta_7\ IR + \beta_8\ ROA + \varepsilon \quad (5.7)$$

$$LBHAR = \alpha + \beta_1 Lu\ Months + \beta_2 VC + \beta_3 UW\ Reputation + \beta_4 Ln(\ Assets) + \beta_5 Insider\ Ownership + \beta_6 Ln(Age) + \beta_7\ IR + \beta_8\ ROA + \varepsilon \quad (5.8)$$

Where $LBHR$ is defined as ln(1+IPO firm's 1, 2 or 3 years BHR) and $LBHAR$ is IPO firm's $LBHR$− ln(1+ benchmark's 1,2 or 3 years BHR). The benchmarks are as discussed earlier; market return (FTSE Allshare index), a size matched control firm, and a size and BM matched control firm. Our primary variable of interest is *LU Months* and is measured as the length of lockup

[34] http://business-school.exeter.ac.uk/research/areas/centres/xfi/research/famafrench/files

period in months. *VC* is a dummy variable and equals one for IPOs backed by VC/PE, and zero otherwise. *UW Reputation* is a continuous variable representing the reputation of underwriters and is measured as percentage of IPOs sponsored by an underwriter in the year prior to IPO. *Ln (Assets)* is the natural log of assets before IPO in £ millions and is a proxy for the size of IPO. *Insider Ownership* is the percentage of equity retained by the insiders. *Ln (Age)* is the natural log of the age of IPO measured in years from initial founding date to the IPO date. *IR* is the initial return (underpricing) calculated as the percentage difference between offer price and first day closing price. Finally, ROA is return on assets calculated as earnings before extraordinary items divided by total assets in year before the IPO.

The inclusion of the above mentioned control variables in our regression models are motivated from the previous literature on long-term performance of IPOs. For example, VC backing may act as certification of IPO quality and has the potential to improve long term performance through improved governance, increased institutional investor interest and greater analyst coverage (Megginson and Weiss, 1991, Brav and Gompers, 1997, Suchard, 2009). Similarly, IPOs backed by reputed underwriters perform better in the long run due to better screening, certification of quality and marketing by prestigious underwriters (Carter et al., 1998, Dong et al., 2011). We include age and size of the firm to control for the size and age effect of IPOs in line with the previous literature (Gao and Jain, 2011, Wu and Kwok, 2007, Ritter, 1991). Following Goergen et al. (2007) and Thomadakis et al. (2012), we also include equity retained by insiders at the time of IPO in our regression analysis. We include underpricing (first day returns) in regressions models because prior literature documents a negative relation between the underpricing and long term performance (Ritter, 1991, Houge et al., 2001b). Finally, we include ROA as a proxy of pre-IPO operating performance of the issuing firms following Gao and Jain (2011).

5.4 Empirical Results

5.4.1 BHARs and Wealth Relatives (WRs)

In Table 5.2, we report the one, two and three years BHARs for full sample and for portfolios of IPOs with lockups greater than and less than the median lockup length. Results are presented using all three benchmarks (market return, size matched and size and BM matched control firm) adopted in this study. Moreover, we report both equal weighted and value weighted BHARs to draw a comparison between the weighting schemes. We find that our sample IPOs consistently outperform the market index over the one, two and three year holding periods when returns are equal weighted, as reported in Panel A. The returns for one, two and three years are 15.56%, 31.36% and 36.98% respectively and these returns are significantly different from zero at the 1% significance level. Even when size and size and BM matched benchmarks (Panel B and C) are used, the returns are positive and statistically significant for at least one year holding period. Moreover, the magnitude of the returns decreases when we use size or size and BM matched firms. Similarly, significance levels of returns over different holding periods vary across the three benchmarks. For example, only one year returns are significant in size matched benchmark, while both one year and two years abnormal returns are significant when size and BM matched benchmark is used. Our results for full sample are in contradiction to previous studies which document significant IPO underperformance over the long-run for US and UK markets (Loughran and Ritter, 1995, Ritter, 1991, Espenlaub et al., 2000) but are consistent with the recent findings of Gregory et al. (2010) and Coakley et al. (2008) for LSE Main Market. These results for full sample of IPOs are, however, different in at least three ways when value weighting is used. First, one year abnormal returns become negative across all the benchmarks indicating underperformance relevant to the benchmarks. For example, we report a negative size and

BM adjusted return of -8.42% for the first year after the IPO. Second, although the mean abnormal returns for two and three years are positive across all three benchmarks, their magnitude is less than that of equal weighted returns. Finally, none of the mean abnormal returns are significant using the value weighting scheme. This still is consistent with our previous finding of a lack of significant underperformance for our sample IPOs, in case of equal weighted abnormal returns. Moreover, our results of a reduced degree and significance of abnormal long run performance when using value weighting are consistent with previous IPO literature (Brav et al., 2000, Brav and Gompers, 1997, Gao and Jain, 2011, Wu and Kwok, 2007).

Next, we discuss the abnormal performance differences between our portfolios of IPOs. We stratify full sample IPOs in two portfolios based on median lockup length (12.34 months) of our full sample as discussed in previous section. First portfolio comprises of all IPOs with lockups longer than median lockup length and second portfolio consists of all IPOs with lockups shorter than median lockup length. Columns 3-7 of Table 5.2 present mean BHARs for these two portfolios. A comparison of the two portfolios reveals that IPOs with lockups longer than median length consistently perform better than IPOs with lockups shorter than median length across all three benchmarks and for all holding periods (except three year returns for size and BM matched firms). For instance, the one year equal weighted abnormal return for IPOs with lockups longer than median are significantly different from zero at 1% level and are 24.13%, 24.63% and 19.66% respectively for market adjusted, size matched and size and BM matched firms. On the other hand, one year equal weighted BHARs for IPOs with lockups shorter than median are 6.99%, -1.63% and 3.43% respectively for three benchmarks and are not significantly different from zero. This shows that although IPOs with lockups shorter than median do not significantly underperform, IPOs with lockups longer than median have higher abnormal returns and significantly outperform their respective benchmarks. Similar pattern is observed for two and three year holding periods across all the benchmarks. When we compare the value weighted returns, the performance difference between our portfolios is even more pronounced. The abnormal returns of IPOs with lockup longer than median are consistently higher than the returns of IPOs with lockups shorter than median for all the benchmarks and holding periods. Moreover, four out of the nine value weighted BHARs for IPOs with lockups longer than median are significantly different from zero, which is also in contrast with the full sample as none of the value weighted returns for full sample are statistically significant. For IPOs with lockups shorter than median, four out of nine value weighted BHARs are negative and one year BHAR for size matched benchmark is also statistically significant, which show significant underperformance relative to the benchmark. These results also show that underperformance in case of value weighting for full sample is mainly driven by poor performance of IPOs with lockups shorter than median. Our overall results from Table 5.2 show that portfolio of IPOs with lockups longer than median outperforms the various benchmarks used in this study. On the other hand, IPOs with lockups shorter than median have some negative BHARs although statistically insignificant (except for one year BHAR in case of size matched benchmark), and these BHARs are generally lower than BHARs of other portfolio (IPOs with lockups longer than median). In sum, IPOs with lockups shorter than median do not perform as well as IPOs with lockups longer than median and there is also evidence of underperformance relative benchmarks in case of former IPO portfolio.

[Insert Table 5.2 about here]

In order to further check the robustness of our results, we form two portfolios of IPOs based on bottom and top quartile of lockup length. More specifically, we combine all IPOs with lockups in the top quartile (18 months) of lockup duration in one portfolio. In the next portfolio, we combine all IPOs with lockups in the bottom quartile (12 months) of lockup duration. So our two portfolios are respectively, IPOs with lockups longer than 18 months and IPOs with lockups shorter than or equal to 12 months. In Table 5.3, we compare long-run performance of these two portfolios based on three benchmarks already discussed. Again, results are presented for both equal weighting and value weighting. We would expect stronger and more robust performance differences between these two portfolios (compared to the earlier cut off based on median lockup length) as the lockup duration difference between the two portfolios has been further widened. In line with our expectation, we find that performance differences between our two portfolios (based on quartile cut offs) are even more pronounced. IPOs with lockups longer than 18 months consistently outperform the relevant benchmarks and the BHARs for this portfolio are significantly different form zero in most of the cases (7 out of 9 BHARs are significant at 1% or 5% level). For example, we observe a 60.12% statistically significant abnormal return for two years holding period when a size matched firm is used a benchmark. Similar, pattern emerges when value weighting is used. All the returns (across benchmarks and for different holding periods) are positive and two and three year returns for size and BM matched benchmark are significantly different from zero. For IPOs with lockups less than or equal to 12 months, we find that although these IPOs do not underperform the relevant benchmarks, the returns are not significantly different from zero with the exception of three year BHAR for market adjusted benchmark. Again value weighting reduces the size of BHARs and almost half the returns turn negative although statistically insignificant, except one year return for size matched benchmark which is significantly negative. Overall, we find evidence of superior long run performance on the part of IPOs with longer lockups relative to the IPOs with shorter lockups, with the caveat that the significance of results depends on the weighting scheme and the choice of benchmark.

[Insert Table 5.3 about here]

Table 5.4 presents results of wealth relatives for full sample and different sub samples based on median lockup length and top and bottom quartiles of lockup length. The wealth relatives of full sample for different holding periods are above one across three benchmarks which shows that overall IPO sample outperforms the relevant benchmarks. A comparison of wealth relatives between IPOs with lockups longer that median and IPOs with lockup shorter than median shows that the wealth relatives for former group are consistently higher than the latter group. Similar results are observed for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months, which further supports that longer lockup IPOs perform better than the shorter lockup IPOs. Moreover, these results are also consistent with the results of BHAR reported in Table 5.2.

[Insert Table 5.4 about here]

5.4.2 Factor Regression Models

In Table 5.5, we report the results of CAPM, Fama and French (1993) three factor model and Carthart's (1997) four factor model using OLS for monthly portfolios of IPOs with lockups longer than median and IPOs with lockups shorter than median. The results for a 12-, 24- and 36-month portfolio are reported in panel A, B and C respectively. As discussed in the methodology section, a 12-, 24- ad 36-month portfolio includes all the IPOs which occurred during the last 12, 24 and 36 month respectively. In Panel A, we find that the coefficient of intercept (alpha) is positive and statistically significant in all three models for IPOs with lockups longer than median. Similarly, for IPO with lockups shorter than median, the alpha is positive in all three models but significant only in three- and four-factor models. Moreover, the magnitude of alpha is higher for IPOs with lockups longer than median for CAPM and four-factor models than IPOs with lockup shorter than median but lower in case of three-factor model. These results suggest a weak evidence of better return performance for IPOs with longer lockups compared to shorter lockups in case of 12-month portfolio. The results for a 24-month portfolio are reported in Panel B of Table 5.5. We find that the intercept is positive, although insignificant, in all models for IPOs with lockups longer than median. For IPOs with lockups shorter than median, the intercept term is negative for CAPM model but it is positive for three-and four-factor models. We, however, find that intercept terms for IPOs with lockup longer than median are consistently higher than that for IPOs with lockups shorter than median, which shows better performance for the former group of IPOs. Panel C of Table 5.5 reports the results of a 36-month portfolio. We find that the intercept term is positive in all models for both groups of IPOs and none of these intercepts are statistically significant. Unlike the results for 12-and 24-month portfolios, there is no evidence of superior performance on part of IPOs with longer lockups compared to the IPOs with shorter lockups.

[Insert Table 5.5 about here]

In order to test for the robustness of our results, we re-estimate all the factor regression models in Table 5.5 using the WLS regressions. The results of WLS regressions are presented in Table 5.6. Similar to the OLS results for 12-month portfolio, in panel A we find that IPOs with lockups longer than median outperform the IPOs with lockups shorter than median when CAPM is used, although the intercept term is not statistically significant in either of these two portfolio groups. However, results from other two models (FF3F and FF4F) show significant intercept terms and better performance for IPOs with lockups shorter than median compared to the IPOs with lockups longer than median. However, results for 24-month portfolio in panel B clearly indicate IPOs with lockups shorter than median perform poorly as compared to the IPOs with lockups longer than median as the intercept term is negative in all three models and significant in case of CAPM. On the other hand, intercept term is only negative in case of CAPM and positive, although statistically insignificant, for other two models for IPOs with lockups longer than median. The results from Panel C for 36-month portfolio also show a better performance for IPOs with lockups longer than median as intercept terms in all three models are positive and higher than that of IPOs with lockups shorter than median.

[Insert Table 5.6 about here]

Overall results from Table 5.5 and 5.6 show a weak evidence of better performance on the part of the IPOs with lockups longer than median compared to the IPOs with lockups shorter than median. Although statistically insignificant, the mean monthly returns measured by intercept terms for 24- and 36-month portfolios of IPOs with lockups longer than median are positive and higher than the intercept terms of IPOs with lockups shorter than median. The results for 12-month portfolio are, however, inconsistent for some models as IPOs with lockups longer than median underperform as compared the IPOs with lockups shorter than median. But this is consistent with our earlier discussion that dividing IPOs on the basis of median might not show strong performance differences between IPOs with lockups longer than and shorter than median lockup length.

In order to provide more robust evidence of our earlier results, we next divide IPOs on the basis of quartile of their lockup length. We compare the performance of IPOs in the bottom quartile of their lockup length with the IPOs from top quartile of lockup length. Effectively, our first portfolio consists of IPOs with lockups longer than 18 months (top quartile) and our second portfolio consists of all IPOs with lockup shorter than or equal to 12 months (bottom quartile). We believe that dividing IPOs based on the quartiles of their lockup length would provide more robust results for performance differences between longer and shorter lockup

IPOs. The results of OLS regression models for both groups of IPOs are presented in Table 5.7 using three models earlier discussed. Evaluating the results of 12-month portfolio from Panel A of table 5.7, we find that the intercept terms of IPOs with lockup longer than 18 months are statistically significant and consistently higher than the intercepts of IPOs with lockups shorter than or equal to 12 months. For IPOs with lockups shorter than or equal to 12 months, the intercepts are significant for three and four factor models while insignificant for the CAPM model. These results clearly indicate that IPOs with longer lockups perform better than IPOs with shorter lockups for a 12-month calendar portfolio. Similar results are observed for a 24-month portfolio in Panel B where, the intercept term is positive and statistically significant in two out of three models for IPOs in longer lockup group. Further, the size of intercept terms is larger relative to those for IPOs in shorter lockup group. For IPOs in shorter lockup group, all intercept terms are statistically insignificant and positive in two out of three models. Finally, for 36-month portfolio for IPOs in both groups, there is clear evidence that IPOs in longer lockup group consistently perform better than IPOs in shorter lockup group. For instance, intercepts in all three models for IPOs in longer lockup groups are positive, statistically significant and consistently higher relative to the intercepts for IPOs in the shorter lockup group. On the other hand, although positive, only one out of three intercepts in shorter IPO group is significant at 10% level. In Table 5.8, we re-estimate all models using the WLS regressions for IPOs with lockups longer than 18 months and IPOs with lockups shorter than or equal to 12 months. Consistent with earlier results reported in Table 5.7, we find that IPOs in longer lockup group show superior performance than IPOs in shorter lockup group using WLS regressions. For example, intercept terms for IPOs in longer lockup group are consistently higher than those in shorter lockup group across all models and portfolio formation periods (12-, 24 and 36-months). The intercept terms are significant in six out of nine regression models for IPOs in the longer lockup group. However, for IPOs in the shorter lockup group, the intercepts are positive in five out of nine models but significant only in two models.

[Insert Table 5.7 about here]

[Insert Table 5.8 about here]

The overall results from our factor models provide evidence that IPOs with longer lockups generally perform better than IPOs with shorter lockups using different factor models and portfolio formation periods. When IPOs are divided into two portfolio groups based on their median lockup length, IPOs with lockups longer than median have higher excess returns relative to IPOs with lockups shorter than median for 24- and 36-month portfolios. The results for 12-month portfolio, though, depend on the model used. We, therefore, find weak evidence of superior long run post-IPO performance for longer lockup IPOs relative to shorter lockup IPOs when median cut-off is used. However, when IPO are grouped on the basis of top and bottom quartiles of lockup length, we find that the intercept terms for IPOs with lockups in the top quartile (longer than 18 months) are consistently positive and significant irrespective of the factor model, weighting scheme or the portfolio period. On the other hand, intercept terms for IPO with lockups in the bottom quartile (shorter than or equal to 12 month) are mostly negative and statistically insignificant. As such, we find strong evidence to suggest that IPOs with longer lockups show better post-IPO performance relative the IPOs with shorter lockups for calendar time factor model regressions. Moreover, these results are consistent with our earlier analysis using event-time approach.

5.4.3 Cross-Sectional Regressions of Long-Run Performance

Next, we conduct a multivariate analysis to further test the robustness of our results. We use raw IPO return (BHR), market adjusted BHAR, size matched firm adjusted BHAR and a size and BM matched firm adjusted BHAR as the dependant variables in our different model specifications. We run regression models using one, two and three year returns respectively in all models.

In Table 5.9, we present the descriptive statistics of all variables used in the cross-sectional regressions. The mean (median) length of lockup period is 15.205 (12.367) months for our sample of IPOs. More than half (56.3%) of the IPOs have venture capital/private equity backing. The average market share of the underwriter based on the number of IPOs sponsored in the preceding year is 2.36%. The mean pre-IPO year total assets for sample IPOs are £195.451 million with a median of just £22.637 million. Due to the highly skewed distribution of total assets, we use natural log of total assets in all our regression models. Insiders retain an average of 24.646% of post-IPO equity in IPO firms. The average age of the issuing firm is 15.73 years with a median of 9.56 years, where age is measured as difference in years between the IPO date and company founding date. IPO firms experience an average first day returns of 12.017% over the sample period. The ROA for the sample is -25.7% with a median value of 7.00%.

[Insert Table 5.9 about here]

Table 5.10 reports the results of regression models when raw log returns (LBHRs) are used for one, two and three post-IPO years. Consistent with our earlier findings using event time and calendar time methodology, length of lockup is positively and significantly related to the long-run performance of IPOs irrespective of the holding period used. Among other control variables, ROA is significant in all three models showing that profitability at the time of IPO is a significant predictor of the post-IPO stock return performance and is consistent with the findings of Gao and Jain (2011). Assets, our proxy for size of the firm is positive and significant in model (2) and (3) indicating that large firms are likely to perform better after the IPO. Age of the IPO firm is also a significant predictor of the post-IPO return performance. For instance the coefficient of Age is positive for all three models and statistically significant for two and three year holding period reruns, consistent with other studies (Dong et al., 2011, Ritter, 1991). The coefficients of VC and UW Reputation are negative but statistically insignificant showing the negative impact of VC backing and reputed underwriters on the post-IPO long run performance.

[Insert Table 5.10 about here]

Regression results for the abnormal returns (LBHARs) using market adjusted, size matched control firm and a size and BM matched control form benchmarks are presented in Tables 5.11,5.12 and 5.13 respectively. Moreover, we estimate the regressions for one, two and three year holding period abnormal returns. Consistent with our prediction, lockup length is positively and significantly related to the abnormal log returns in all three holding periods and across all the benchmarks. For instance, coefficient of *Lu Months* is significant at either 1% or 5% in Table 5.11 and 5.12. Using size and BM matched benchmark reduces the statistical significance of results in Table 5.13, yet *Lu Months* is significant at 10% for one and two year holding period returns and significant at 5% for the three year holding period. Overall, we find a consistent evidence to suggest that the length of lockup has a positive impact on post-IPO long-run performance of IPOs and our results are robust to the choice of holding period and benchmark. The results regarding other control variables are also consistent across the different regression models. ROA, for example, has a consistently positive and significant coefficient across all the regressions. Similarly, size measured by the log of total assets has a positive impact on two and three year holding period abnormal returns with a varying levels of statistical significance. The coefficient of age is also positive and significant at least for market adjusted and size matched firm adjusted benchmarks. Rest of the control variables are generally insignificant across different model specifications.

[Insert Table 5.11 about here]

[Insert Table 5.12 about here]

[Insert Table 5.13 about here]

5.5 Lockup Expiry Returns

5.5.1 Methodology

In this section, we analyse return performance of sample IPOs around lockup expiry day by conducting a standard event study. The lockup expiry day is taken as day zero, and cumulative average abnormal returns (CAARs) are calculated over several short and long windows around the lockup expiry day. We calculate CAARs for 41 days (-20, +20), 21 days (-10, +10), 5 days (-20, +2) and 3 days (-1, +1) around the lockup expiry day following existing studies on market reaction to lockup expiration (Field and Hanka, 2001, Brav and Gompers, 2003, Espenlaub et al., 2001). We also calculate abnormal returns on the day of lockup expiry (day 0) and for two post lockup expiry windows of 9 days (+2, +10) and 19 days (+2, +20).

Prior studies on market reaction to the lockup expiration have mostly used a single model approach to calculate the abnormal returns. For example, Field and Hanka (2001) and Brav and Gompers (2003) use a market-adjusted model to calculate the abnormal returns around lockup expiry day[35]. Market-adjusted model is easy to implement in the sense that it does not require any model parameters to be estimated from the pre-event return data. Brau et al. (2004) use a market model with the CRSP equal weighted index as the proxy for market return. As the market model requires model parameters to be estimated from pre-event data, Brau et al. (2004) use data beginning at 90 days prior and ending at 11 days prior to the lockup expiry for calculating the estimated betas. Similar models have been used in the lockup expiry return analysis in the UK studies. For instance, Hoque and Lasfer (2009) and Hoque (2011) use market-adjusted and market model respectively for UK IPOs. Unlike these studies, we use a multi model approach to examine the market reaction around lockup expiry day in order to provide more robust results. We calculate abnormal returns for the IPOs relative to three different models. Our first model is the simple market-adjusted model, where return on FTSE Allshare index is used as a proxy for market return. Our second model is a standard CAPM model and third model is Fama and French (1993) three factor model. As these two models require estimation of the model parameters from the pre-event data, we use an estimation window starting at 240 days prior to and ending at 21 days prior to the lockup expiry date for our main 41 day event window.[36] Due to the longer lockup length for UK IPOs, we are able to use this long estimation window for most of our IPO sample[37]. Below we explain the calculation for abnormal returns, cumulative average abnormal returns and the estimation of expected or normal returns using three models described earlier.

The Abnormal Return (AR_{it}) for individual security and event date is defined as the difference between the realised return and the expected return;

[35] Filed and Hanka (2001), however, also use market model and raw returns analysis but don not report the results for these models.

[36] Similarly, the estimation window for 21 day event window is -240 to -11 days relative to lockup expiry and so on for rest of the shorter windows.

[37] There are only 17 IPOs for which we use shorter estimation window as their lockup period is shorter than the 240 day estimation window.

$$AR_{it} = R_{it} - E(R_{it}) \qquad (5.9)$$

Cumulating the abnormal returns across time gives the cumulative abnormal return;

$$CAR_i(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} AR_{it} \qquad (5.10)$$

The cross-sectional average for cumulative abnormal returns is;

$$CAAR_i(\tau_1, \tau_2) = \frac{1}{N} \sum_{i=1}^{N} CAR_i(\tau_1, \tau_2) \qquad (5.11)$$

We use three commonly employed models in literature to estimate expected or normal return $E(R_{it})$: market-adjusted model, CAPM and Fama and French (1993) three factor model (FF3F). For market-adjusted model, we use FTSE Allshare index to proxy the daily market returns. For CAPM and FF3F, we use -240 to -21 days relative to the lockup expiry day (0) as the estimation window to estimate model parameters.

More specifically the Abnormal Return (AR_{it}) is calculated as;

For market-adjusted model;

$$AR_{it} = R_{it} - R_{mt} \qquad (5.12)$$

Where R_{it} the daily is return on security i on day t and R_{mt} is the daily return on FTSE Allshare index on day t.

For CAPM;

$$AR_{it} = R_{it} - \left[R_{ft} + \hat{\beta}_i(R_{mt} - R_{ft})\right] \qquad (5.13)$$

Where R_{ft} is the return on three month Treasury bill on day t and β_i is the CAPM beta estimated by an OLS time series regression of daily excess returns $(R_{it} - R_{ft})$ of security i on the market risk premium $(R_{mt} - R_{ft})$ over the estimation period (-240 to -21 days).

For Fama and French (1993) three factor model;

$$AR_{it} = R_{it} - \left[R_{ft} + \hat{\beta}_i\left(R_{mt} - R_{ft}\right) + \hat{\gamma}_i(SMB_t) + \hat{\delta}_i(HML_t)\right] \qquad (5.14)$$

where β_i, γ_i and δ_i are estimated by OLS regression of security $i's$ daily excess return on the daily market excess return, size and book-to-market factors over the estimation period. SMB_t and HML_t are Fama and French size and book-to-market factor returns where SMB_t is the small minus big portfolio return on day t and HML_t is the high minus low book-to-market portfolio return on day t. The daily return factors are from Gregory et al. (2013).

The cross-sectional t-test of the CAAR is calculated as:

$$T_{cross} = \frac{CAAR(\tau_1,\tau_2)}{\hat{\sigma}_{CAAR_\tau}} \qquad (5.15)$$

Under the null hypothesis, the CAAR is equal to zero. The variance estimator for this statistics is based on the cross-section of abnormal returns:

$$\hat{\sigma}_{CAAR(\tau_1,\tau_2)} = \frac{1}{N(N-d)} \sum_{i=1}^{N} [CAR_i(\tau_1,\tau_2) - CAAR(\tau_1,\tau_2)]^2 \qquad (5.16)$$

5.5.2 Results and Discussion

Table 5.14 presents the results of event study around the lockup expiry for full sample of IPOs using different windows discussed earlier. The mean CAAR and t-statistic are presented for market-adjusted model, CAPM and Fama and French three factor model. We find that our sample IPOs experience negative returns around wider lockup expiry windows of 41 (-20, +20) and 21 (-10, +10) days. These results are statistically significant for market-adjusted and CAPM models. For instance, mean CAARs of -3.49% and -1.97% are observed for 41 and 21 day windows using the CAPM and both returns are statistically significant at 5% and 10% levels respectively. Similarly, we find significant negative returns for post lockup expiry windows of (+2, +10) and (+2, +20) days across all the models. Our results provide evidence of poor performance around wider lockup expiry windows. However, we do not find poor performance in our sample around the shorter lockup expiry windows. For example, the CAARs for 3 (-1, +1) and 5 (-2, +2) day windows around the lockup expiry are generally positive although statistically insignificant across different models. Moreover, average CAARs on the day of lockup expiry (day 0) are also positive but statistically insignificant. This shows that sample IPOs do not perform poorly for the shorter windows around the lockup expiry. Our results for short lockup expiry windows are inconsistent with the earlier documented evidence for the US and UK markets (Field and Hanka, 2001, Brav and Gompers, 2003, Hoque and Lasfer, 2009). For example, Field and Hanka (2001) report a significant abnormal return of -1.5% for 3 day window around the lockup expiration date for US IPOs. The lack of negative performance around the shorter lockup expiry windows in our IPOs is, however, consistent with the findings of Espenlaub et al. (2001) for UK IPOs. Although, Espenlaub et al. (2001) report negative CAARs around shorter lockup expiry windows, none of their abnormal returns are significantly different from zero. Overall, we find significant negative performance for wider windows (41 and 21 days) around lockup expiry, though our results for shorter lockup expiry windows exhibit lack of negative performance for sample IPOs which is inconsistent with earlier reported evidence (as discussed above).

[Insert Table 5.14 about here]

Next, we divide our sample IPOs in groups based on their lockup length and examine their performance around lockup expiry. In line with our earlier analysis on long-run performance in previous section, IPOs are grouped on the basis of median as well as top and bottom quartile of lockup period. In Table 5.15, we compare mean CAARs for IPOs with lockups longer than median and IPOs with lockups shorter than median for different windows using market-adjusted, CAPM and FF3F models. The results reveal that IPOs with lockups shorter than median experience significant negative CAARs around lockup expiry dates. For instance, the mean CAARs for 41 and 21 days around lockup expiry for IPOs with lockups shorter than median range from -5.89% to -3.17% across all models. Moreover, these CAARs are statistically significant at 1% or 5% level for different models. On the other hand, for IPOs with lockups longer than median, mean CAARs range from -1.51% to 1.87% for 41 and 21 day windows around lockup expiry and none of these CAARs are significantly different from zero. Similar results are reported for post lockup expiry windows (+2, +10 and +2, +20) where we find high negative and significant CAARs for IPOs with lockups shorter than median compared to IPOs with lockups longer than median. We observe similar results for shorter windows around lockup expiry as mean CAARs are higher for IPOs with lockups longer than median relative to IPOs with lockups shorter than median although none of these CAARs are statistically significant. However, inconsistent with other event windows, CAARs for IPOs with lockups shorter than median are higher compared to the CAARs for IPOs with lockups longer than median. Overall, most of the CAARs for market-adjusted and FF3F model are positive for IPOs with lockups longer than median for most of the event windows. For instance, we observe positive CAARs for six out of seven event windows in case of FF3F model and four out of seven event windows in case of market-adjusted model for IPOs with lockups longer than median. As such, based on event study results from Table 5.15, we find evidence that IPOs with shorter lockups experience significant negative returns around lockups expiry date relative to IPOs with longer lockups where returns are insignificantly negative or positive. Furthermore, returns for IPOs with longer lockups are consistently larger than that of IPOs with shorter lockups. Our results clearly suggest that IPOs with longer lockups experience better return performance around lockup expiry in line with our expectation.

[Insert Table 5.15 about here]

In Table 5.16, we provide a comparison of return performance of IPOs with lockup longer than 18 months versus IPOs with lockups shorter than or equal to 12 months around different lockup expiry windows. Consistent with our results in Table 5.15, IPOs with longer lockups continue to show superior performance than IPOs with shorter lockups. It is also important to note that the negative performance on part of IPOs with lockups shorter than or equal to 12 months has become more severe compared to the results in Table 5.15[38]. For example, using FF3F model in Table 5.16, the mean CAARs for two sub-samples of IPOs for 41 day window are 2.97% (lockups >18 months) and a statistically significant -4.93% (lockups ≤ 12 months) compared to 1.87% (lockups > median) and significant -4.69% (lockups < median) in Table 5.15. We also find that most of the CAARs for IPOs with lockups longer than 18 months are positive although insignificantly different from zero[39]. Whereas, the mean CAARs are mostly negative and significantly different from zero at least for wider event windows around lockup expiry in case of IPOs with lockup shorter than or equal to 12 months.

[Insert Table 5.16 about here]

Overall, results from Table 5.15 and 5.16 provide a strong evidence of better return performance around lockup expiry for IPOs with longer lockups relative to IPOs with shorter lockup. The results also reveal that the significant negative returns performance around wider lockup expiry windows (41 and 21 days) and for post-lockup expiry windows (+2, +10 and +2, +20) in full sample (Table 5.14) is mainly driven by IPOs with shorter lockups. Finally, our results are robust to choice of different expected return models and shorter and wider windows around lockup expiry.

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[38] It is expected because in Table 5.16 we are comparing the performance of IPOs in two extreme quartiles of lockup length (top and bottom quartile).

[39] However, the CAARs for 5 day window (-2, +2) are 2.01 and statistically significant at 10% in FF3F model for IPOs with lockups longer than 18 months.

5.5.3 Robustness of the Results on Lockup Expiry Returns

Prior research on return performance around lockup expiry provides evidence that VC/PE backed IPOs exhibit severe negative performance compared to the non VC/PE backed IPOs. Field and Hanka (2001), for example, find that the three-day abnormal return in VC backed firms is three times larger than in non VC backed companies (-2.3% vs -0.8%). They attribute this severe negative performance to more aggressive selling by venture capitalists at the time of lockup expiry. Similarly, Brau et al. (2004) argue that VCs are less likely to hold their shares in long-run than other insiders and find a negative relation between the VC presence and abnormal returns around lockup expiry. Bradley et al. (2001) also report that losses around lockup expiry in their sample are concentrated in VC backed IPOs. Espenlaub et al. (2003) report similar results for the UK IPOs and find that CAARs for VC backed IPOs are lower than that of non-VC backed IPOs for most of their short event windows around lockup expiry day. In order to provide more robustness for our results, we extend the analysis in Tables 5.15 and 5.16 and further classify IPOs into VC backed and non-VC backed. In panel A of Table 5.17, we first classify IPOs based on their VC/PE backing status and then within each sub-sample IPOs are further divided into two groups: IPOs with lockups shorter than median and IPOs with lockup longer than median. Panel B reports the comparative CAARs for IPOs with lockups longer than 18 months and IPOs with lockups shorter than or equal to 12 months for each of the VC backed and non-VC backed IPOs. We find that IPOs with lockups shorter than median have significant lower returns compared to IPOs with lockups longer than median regardless of their VC backing status. IPOs with longer lockups consistently perform better around lockup expiry in both VC backed and non-VC backed sub-samples. The results from Panel B show the similar performance differences between IPOs with lockups longer than 18 months and IPOs with lockups shorter than or equal to 12 months across both VC backed and non-VC backed sub-samples. IPOs with lockup shorter than or equal to 12 months are the worst performers regardless of their VC/PE backing status. A comparison of the IPOs in the longer lockup groups across VC and non VC backed IPOs reveals that most of the CAARs for different event windows are positive although none of the CAARs in these groups are significantly different from zero. This shows that longer lockups reduce negative performance in VC as well as non-VC backed IPOs alike. On the other hand, comparing IPOs in shorter lockup groups across VC and non-VC backed IPOs shows that most of the CAARs for different event windows are negative and statistically significant. Results regarding the level of underperformance between VC and non-VC backed IPOs with shorter lockups are, however, inconsistent and depend on the model used. Finally, results also show that there are more statistically significant negative CAARs in VC backed sample relative to non-VC backed sample in shorter lockup groups. This suggests that VC backed IPOs with shorter lockups suffer more compared to the non VC backed IPOs. In sum, results from Table 5.17 provide evidence that longer lockups help to reduce negative return performance around lockup expiry even in VC backed IPOs and lend more robustness to our earlier analysis.

[Insert Table 5.17 about here]

5.6 Conclusion

The literature on lockup agreements has largely focused on the motivations of lockups at the time of IPOs and market reaction to the expiry of the lockups. Two competing hypothesis for the existence of (longer) lockups are suggested in the prior literature. Signalling hypothesis argues that longer lockups signal firm quality, while commitment hypothesis suggest that longer lockups help to reduce moral hazard or agency problem. However, the role of lockups beyond IPO and particularly in relation to the long run post-IPO performance has received little attention. Recently two studies have attempted to fill this gap by relating lockup length with post issue performance of IPOs and SEOs in US. Both the studies find support for the commitment hypothesis and suggest that lockups are not indicative of issuer quality.

In this study, we argue that there are significant institutional differences in US and UK in terms of lockups and the relation between lockup length and post- IPO long-run performance merits further investigation. The relatively longer and diverse lockups in UK compared to the US markets may serve as a more credible signal of quality and a prolonged involvement and monitoring of insiders may also reduce agency problems resulting in better long-run performance of IPOs. Therefore, we predict that lockup length is positively related to post-IPO long-run performance. Furthermore, we also expect that IPOs with longer lockups show better return performance around lockup expiry compared to IPOs with shorter lockups.

Using both event-time and calendar-time approaches to long-run IPO performance, we document several interesting results. We find that, in contrast to the extant literature on IPO underperformance, our sample IPOs outperform the benchmarks, at least on equal weighted return basis in event time analysis using BHARs and wealth relatives. A comparative analysis of BHARs between IPOs with longer lockups and shorter lockups reveals that IPOs with longer lockups consistently perform better than IPOs with shorter lockups irrespective of the benchmark and weighting scheme. Similar results are observed when long-run performance is measured on the basis of wealth relatives. Comparing long-run performance in calendar-time approach using different factor models and regression techniques also reveals that portfolios of IPOs with longer lockups consistently earn higher abnormal returns relative to that of shorter lockups. Our cross-sectional regressions provide further support to these results and we document a positive and significant relation between lookup length and long-run IPO performance. These results clearly suggest that lockup length signals firm quality which is evident from superior long-run performance on the part of IPOs with longer lockups and provide support to our prediction.

We also analyse stock return performance around lockup expiry dates for IPOs with longer and shorter lockups. Our results show that IPOs with shorter lockups experience significant negative abnormal returns around relatively longer expiry windows. On the other hand, abnormal returns for IPOs with longer lockups, although negative, are statistically insignificant. These results are robust to different models specifications and sub-samples of VC and non-VC backed IPOs. These results provide further support to our expectation that high quality IPOs are less likely to suffer negative performance around lockup expiry.

Our study adds to the literature on determinants of long run IPO performance and shows that lockup length is an important yet relatively ignored factor in long run performance studies. Although one can argue that in a rational and efficient market, the signalling effect of lockups should be quickly absorbed in the valuations and there should not be performance differences between shorter and longer lockup IPOs. However, our evidence suggests that investors do not fully understand and incorporate the true value of longer lockup signal instantaneously but only gradually over time (as the positive information is realised in terms of firm performance). This would imply higher future stock returns for firms with longer lockups.

Table 5.1 Sample Distribution

This table presents distribution of sample IPOs across years and industry groups. Panel A presents sample distribution and Lockup period in months across offer years. Panel B gives the industry distribution of sample IPOs and Lockup period. The mean, median and standard deviation of lockup period in months is shown across offer years and industry sectors.

Panel A: Time distribution

			Lockup Months		
Year	Freq.	%	Mean	Median	Std. dev.
1995	27	10.07	18	16	7
1996	40	14.93	17	16	5
1997	36	13.43	19	18	6
1998	27	10.07	15	14	6
1999	18	6.72	14	12	5
2000	54	20.15	12	12	5
2001	6	2.24	19	20	6
2002	12	4.48	11	12	4
2003	5	1.87	10	12	3
2004	15	5.60	13	12	3
2005	14	5.22	15	12	7
2006	14	5.22	15	12	7
Total	**268**	**100**	**15**	**12**	**6**

Panel B: Industry (SIC) distribution

				Lockup Months		
Industry	Two-digit SIC	Freq.	%	Mean	Median	Std. dev.
Oil and Gas	13	10	3.73	16	13	7
Paper and Paper Products	24-27	7	2.61	19	12	11
Chemical Products	28	17	6.34	18	17	6
Electronic Equipment	36	13	4.85	12	12	3
Scientific Instruments	38	13	4.85	19	17	8
Communications	48	16	5.97	12	12	5
Durable Goods	50	15	5.60	15	15	4
Computer Equipment and Services	35,73	75	27.99	15	12	6
Engineering and Management Services	87	20	7.46	17	16	6
Retail	53,54,56,57,59	20	7.46	14	13	5
Eating and Drinking Establishments	58	6	2.24	15	13	5
Transportation	37,39,40-42,44,45	6	2.24	11	12	3
All Others		50	18.66	15	13	6
Total		**268**	**100**	**15**	**12**	**6**

Table 5.2 Buy-and-Hold Abnormal Returns

This table presents the one, two and three-year buy-and-hold abnormal returns (BHAR) for full sample and IPOs stratified by the median lockup length. The sample consists of 268 IPOs with lockups between 1995 and 2006 on LSE Main Market. The equal weighted (EW) and value weighted (VW) buy-and-hold abnormal returns are reported using three benchmarks; market index (FTSE AllShare) in Panel A, Size matched firms in Panel B, and Size and Book to Market (BM) matched firms in Panel C. For value weighted returns, weights are based on the market capitalisation of the IPOs. The holding period begins from 1st day after the day of issuance. The skewness adjusted test statistics are reported within brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Holding	Full Sample		Lockup > Median		Lockup < Median	
Period	EW (%)	VW (%)	EW (%)	VW (%)	EW (%)	VW (%)
Panel A: Market Return						
One Year	15.56***	-6.50	24.13***	9.72	6.99	-10.15
	[3.54]	[-1.10]	[3.68]	[1.34]	[1.22]	[-1.43]
Two Years	31.36***	9.11	43.47***	28.79**	19.25	4.68
	[3.29]	[0.85]	[3.24]	[2.03]	[1.42]	[0.37]
Three Years	36.98***	18.22	43.09***	35.01**	30.87	14.44
	[3.22]	[1.42]	[2.97]	[2.35]	[1.61]	[0.74]
Panel B: Size Matched Firms						
One Year	11.50**	-9.35	24.63***	11.66	-1.63	-14.09*
	[2.09]	[-1.42]	[3.24]	[1.45]	[-0.20]	[-1.70]
Two Years	19.16	4.48	37.77**	31.87*	0.54	-1.70
	[1.46]	[0.35]	[2.02]	[1.69]	[0.09]	[-0.02]
Three Years	19.65	10.97	27.98	36.6*	11.33	5.19
	[1.26]	[0.69]	[1.31]	[1.71]	[0.53]	[0.29]
Panel C: Size and BM Matched Firms						
One Year	11.55**	-8.42	19.66**	3.04	3.43	-11.00
	[1.98]	[-1.31]	[2.06]	[0.32]	[0.52]	[-1.45]
Two Years	24.84**	4.68	35.87**	18.1	13.81	1.65
	[2.35]	[0.43]	[2.33]	[1.13]	[0.97]	[0.18]
Three Years	18.01	15.63	9.16	16.95	26.86	15.33
	[1.36]	[1.17]	[0.52]	[0.95]	[1.40]	[0.79]

Table 5.3 Buy-and Hold Abnormal Returns for Different Lockup Lengths

This table presents the one, two and three-year buy-and-hold abnormal returns (BHAR) for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months. The sample consists of 268 IPOs with lockups between 1995 and 2006 on the LSE Main Market. The equal weighted (EW) and value weighted (VW) buy-and-hold abnormal returns are reported using three benchmarks; market index (FTSE AllShare) in Panel A, Size matched firms in Panel B, and Size and Book to Market (BM) matched firms in Panel C. For value weighted returns, weights are based on the market capitalisation of the IPOs. The holding period begins from the 1st day after the day of issuance. The skewness adjusted test statistics are reported within brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Holding Period	Lockup > 18 months		Lockup ≤ 12 months	
	EW (%)	VW (%)	EW (%)	VW (%)
Panel A: Market Return				
One Year	38.52***	14.05	7.26	-10.14
	[3.91]	[1.23]	[1.25]	[-1.40]
Two Years	55.07***	20.82	20.98	5.02
	[2.62]	[0.91]	[1.54]	[0.39]
Three Years	44.32**	25.42	33.14*	14.9
	[1.97]	[1.08]	[1.72]	[0.75]
Panel B: Size Matched Firms				
One Year	42.35***	15.6	-1.63	-14.11*
	[3.90]	[1.26]	[-0.20]	[-1.67]
Two Years	60.12**	25.68	1.36	-1.49
	[2.58]	[1.02]	[0.13]	[-0.01]
Three Years	39.99	29.8	12.5	5.49
	[1.51]	[1.11]	[0.57]	[0.31]
Panel C: Size and BM Matched Firms				
One Year	27.16***	14.26	3.47	-11.03
	[2.82]	[1.45]	[0.51]	[-1.43]
Two Years	38.9**	39.69**	14.88	1.89
	[2.01]	[2.06]	[1.03]	[0.19]
Three Years	29.55	40.78*	28.11	15.6
	[1.28]	[1.76]	[1.45]	[0.79]

Table 5.4 Wealth Relatives for Full Sample and Different Lockup Lengths

This table reports the one, two and three-year Wealth Relatives for full sample, sub-sample stratified by the median lockup length, and IPOs with lockups greater than 18 months and IPOs with lockups less than and equal to 12 months. The sample consists of 268 IPOs with lockups between 1995 and 2006 on LSE Main Market. The equal weighted Wealth Relatives are reported using three benchmarks; market index (FTSE AllShare) in Panel A, Size matched firms in Panel B, and Size and Book to Market (BM) matched firms in Panel C. The holding period begins from the 1st day after the day of issuance.

Holding	Wealth Relatives				
Period	Full Sample	Lockup > Median	Lockup < Median	Lockup > 18 months	Lockup ≤ 12 months
Panel A: Market Return					
One Year	1.15	1.22	1.07	1.35	1.07
Two Years	1.28	1.37	1.19	1.46	1.20
Three Years	1.33	1.35	1.30	1.36	1.33
Panel B: Size Matched Firms					
One Year	1.10	1.23	0.99	1.40	0.99
Two Years	1.16	1.31	1.00	1.53	1.01
Three Years	1.15	1.20	1.09	1.31	1.10
Panel C: Size and BM Matched Firms					
One Year	1.11	1.17	1.03	1.32	1.03
Two Years	1.21	1.29	1.13	1.36	1.14
Three Years	1.14	1.25	1.06	1.27	1.22

Table 5.5 OLS Calendar Time Portfolio Regressions for Lockups Stratified by Medians

This table presents regression results of calendar-time monthly abnormal returns using Capital Asset pricing Model (CAPM), Fama and French (1993) three factor model (FF3F) and Carhart (1997) extension of Fama and French (1993) model (FF4F). For each calendar month, return on a 12-, 24 and 36-month portfolio is calculated for IPOs with lockups greater than median and IPOs with lockups less than median. The ordinary least square (OLS) time series regressions in each model are estimated with portfolio excess return as dependant variable, where portfolio excess return is the return on a 12-, 24- or 36-month portfolio of IPOs minus the risk free return. The Intercept shows the average monthly abnormal return on each portfolio. (R_m - R_f) is the excess return on the market portfolio, SMB is the difference in the returns of portfolios of small and large stocks, HML is the difference in the returns of portfolios of high and low book-to-market stocks and UMD is the difference in returns of portfolios of high and low momentum stocks. The factors are from Gregory et al. (2013). The t-statistics are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Lockup > Median			Lockup < Median		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel A: 12 months Portfolio						
Intercept	0.0124*	0.0146**	0.015**	0.0103	0.015***	0.0137**
	[1.90]	[2.85]	[2.49]	[1.50]	[2.88]	[2.49]
R_m - R_f	1.055***	0.956***	0.947***	1.409***	1.264***	1.292***
	[6.32]	[6.65]	[6.29]	[7.68]	[9.20]	[9.01]
SMB		0.621***	0.618***		0.652***	0.657***
		[3.47]	[3.44]		[4.03]	[4.05]
HML		-0.605***	-0.625***		-1.081***	-1.011***
		[-4.37]	[-3.59]		[-8.19]	[-6.17]
UMD			-0.027			0.094
			[-0.20]			[0.71]
Adj. R^2	0.24	0.44	0.45	0.29	0.61	0.62
Panel B: 24 Month Portfolio						
Intercept	0.0036	0.0042	0.0076	-0.0017	0.0009	0.0007
	[0.57]	[0.73]	[1.30]	[-0.30]	[0.23]	[0.16]
R_m - R_f	0.924***	0.843***	0.777***	1.140***	1.063***	1.068***
	[6.30]	[6.30]	[5.73]	[8.37]	[10.38]	[10.12]
SMB		0.781***	0.753***		0.731***	0.733***
		[4.70]	[4.57]		[5.84]	[5.82]
HML		-0.277**	-0.471***		-0.765***	-0.751***
		[-2.02]	[-2.88]		[-7.29]	[-5.90]
UMD			-0.271**			0.019
			[-2.11]			[0.19]
Adj. R^2	0.22	0.36	0.40	0.32	0.62	0.63

Table 5.5: Continued.

	Lockup > Median			Lockup < Median		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel C: 36 Month Portfolio						
Intercept	0.0015	0.0001	0.0009	0.0054	0.0061	0.0083
	[0.29]	[0.02]	[0.18]	[0.88]	[1.20]	[1.60]
$R_m - R_f$	0.702***	0.586***	0.562***	0.986***	0.906***	0.841***
	[6.02]	[5.26]	[4.85]	[7.07]	[7.60]	[6.86]
SMB		0.644***	0.624***		0.762***	0.711***
		[4.92]	[4.68]		[5.51]	[5.11]
HML		-0.551	-0.118		-0.581***	-0.751***
		[-0.50]	[-0.86]		[-4.90]	[-5.17]
UMD			-0.080			-0.217**
			[-0.78]			[-1.98]
Adj. R^2	0.21	0.31	0.34	0.26	0.49	0.51

Table 5.6 WLS Calendar Time Portfolio Regressions for Lockups Stratified by Medians

This table presents regression results of calendar-time monthly abnormal returns using Capital Asset pricing Model (CAPM), Fama and French (1993) three factor model (FF3F) and Carhart (1997) extension of Fama and French (1993) model (FF4F). For each calendar month, return on a 12-, 24 and 36-month portfolio is calculated for IPOs with lockups greater than median and IPOs with lockups less than median. The weighted least square (WLS) time series regressions in each model are estimated with portfolio excess return as dependant variable, where portfolio excess return is the return on a 12-, 24- or 36-month portfolio of IPOs minus the risk free return. The number of firms in each portfolio every month is used as the weight. The Intercept shows the average monthly abnormal return on each portfolio. (R_m - R_f) is the excess return on the market portfolio, SMB is the difference in the returns of portfolios of small and large stocks, HML is the difference in the returns of portfolios of high and low book-to-market stocks and UMD is the difference in returns of portfolios of high and low momentum stocks. The factors are from Gregory et al. (2013). The t-statistics are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Lockup > Median			Lockup < Median		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel A: 12 months Portfolio						
Intercept	0.0059	0.0108**	0.0126***	-0.0001	0.0136**	0.0151***
	[1.14]	[2.49]	[2.70]	[-0.01]	[2.56]	[2.72]
R_m - R_f	0.889***	0.811***	0.790***	1.747***	1.360***	1.318***
	[6.50]	[7.02]	[6.74]	[9.32]	[9.93]	[9.11]
SMB		0.765***	0.743***		0.453***	0.459***
		[5.44]	[5.23]		[2.72]	[2.75]
HML		-0.454***	-0.546***		-1.114***	-1.185***
		[-3.67]	[-3.59]		[-9.23]	[-8.23]
UMD			-0.118			-0.101
			[-1.03]			[-0.91]
Adj. R^2	0.25	0.48	0.49	0.37	0.68	0.69
Panel B: 24 Month Portfolio						
Intercept	-0.0042	0.0005	0.0032	-0.0102*	-0.0045	-0.0004
	[-0.87]	[0.13]	[0.83]	[-1.71]	[-1.00]	[-0.09]
R_m - R_f	0.789***	0.711***	0.677***	1.425***	1.184***	1.097***
	[7.07]	[8.36]	[7.95]	[9.77]	[10.89]	[9.72]
SMB		0.926***	0.889***		0.736***	0.729***
		[8.79]	[8.45]		[5.65]	[5.69]
HML		-0.283***	-0.444***		-0.747***	-0.907***
		[-3.17]	[-3.92]		[-7.31]	[-7.52]
UMD			-0.203**			-0.227*
			[-2.25]			[-2.40]
Adj. R^2	0.26	0.58	0.60	0.40	0.68	0.69

Table 5.6: Continued.

	Lockup > Median			Lockup < Median		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel C: 36 Month Portfolio						
Intercept	0.0055	0.0032	0.0044	-0.0037	-0.0021	0.0016
	[1.16]	[0.79]	[1.11]	[-0.65]	[-0.47]	[0.35]
$R_m - R_f$	0.692***	0.625***	0.570***	1.201***	1.047***	0.937***
	[6.30]	[6.63]	[6.03]	[9.02]	[10.10]	[8.69]
SMB		0.692***	0.681***		0.813***	0.794***
		[6.07]	[6.09]		[6.25]	[6.26]
HML		-0.071	-0.265**		-0.503***	-0.708***
		[-0.96]	[-2.55]		[-5.19]	[-6.02]
UMD			-0.229**			-0.272***
			[-2.61]			[-2.93]
Adj. R^2	0.22	0.43	0.45	0.36	0.62	0.64

Table 5.7 OLS Calendar Time Portfolio Regressions for Lockups Stratified by Top and Bottom Quartile of Lockup Length

This table presents regression results of calendar-time monthly abnormal returns using Capital Asset pricing Model (CAPM), Fama and French (1993) three factor model (FF3F) and Carhart (1997) extension of Fama and French (1993) model (FF4F). For each calendar month, return on a 12-, 24- and 36-month portfolio is calculated for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months. The ordinary least square (OLS) time series regressions in each model are estimated with portfolio excess return as dependant variable, where portfolio excess return is the return on a 12-, 24- or 36-month portfolio of IPOs minus the risk free return. The Intercept shows the average monthly abnormal return on each portfolio. (R_m - R_f) is the excess return on the market portfolio, SMB is the difference in the returns of portfolios of small and large stocks, HML is the difference in the returns of portfolios of high and low book-to-market stocks and UMD is the difference in returns of portfolios of high and low momentum stocks. The factors are from Gregory et al. (2013). The t-statistics are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Lockup >18 month			Lockup ≤ 12 Months		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel A: 12 months Portfolio						
Intercept	0.0192***	0.0196***	0.022***	0.0109	0.0155***	0.0142**
	[3.08]	[3.71]	[3.92]	[1.57]	[2.98]	[2.57]
$R_m - R_f$	0.951***	0.764***	0.803***	1.421***	1.274***	1.304***
	[5.85]	[6.22]	[5.72]	[7.74]	[9.28]	[9.11]
SMB		0.765***	0.760***		0.652***	0.658***
		[4.47]	[4.45]		[4.03]	[4.06]
HML		-0.411***	-0.527***		-0.079***	-1.006***
		[-3.24]	[-3.34]		[-8.19]	[-6.14]
UMD			-0.160			0.100
			[-1.23]			[0.76]
Adj. R^2	0.23	0.47	0.49	0.29	0.61	0.61
Panel B: 24 Month Portfolio						
Intercept	0.0094	0.0101*	0.0131**	-0.0019	0.0017	0.0015
	[1.41]	[1.80]	[2.28]	[-0.17]	[0.40]	[0.34]
$R_m - R_f$	0.868***	0.758***	0.692***	1.147***	1.071***	1.074***
	[5.29]	[5.65]	[5.01]	[8.40]	[10.42]	[10.15]
SMB		0.971***	0.953***		0.733***	0.734***
		[5.97]	[5.90]		[5.84]	[5.81]
HML		-0.427***	-0.597***		-0.766***	-0.755***
		[-3.29]	[-3.70]		[-7.29]	[-5.91]
UMD			-0.223*			0.016
			[-1.75]			[0.16]
Adj. R^2	0.18	0.46	0.47	0.33	0.63	0.63

Table 5.7: Continued.

	Lockup >18 month			Lockup ≤ 12 Months		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel C: 36 Month Portfolio						
Intercept	0.0115**	0.0107**	0.0125**	0.0061	0.0068	0.0089*
	[1.98]	[2.01]	[2.27]	[0.99]	[1.35]	[1.72]
$R_m - R_f$	0.705***	0.604***	0.566***	1.006***	0.927***	0.487**
	[5.18]	[4.81]	[4.39]	[7.18]	[7.75]	[7.02]
SMB		0.798***	0.784***		0.765***	0.717***
		[5.16]	[5.06]		[5.52]	[5.13]
HML		-0.056	-0.162		-0.589***	-0.748***
		[-0.44]	[-1.06]		[-4.95]	[-5.14]
UMD			-0.149			-0.205*
			[-1.23]			[-1.86]
Adj. R^2	0.16	0.31	0.33	0.26	0.49	0.50

Table 5.8 WLS Calendar Time Portfolio Regressions for Lockups Stratified by Top and Bottom Quartile of Lockup Length

This table presents regression results of calendar-time monthly abnormal returns using Capital Asset pricing Model (CAPM), Fama and French (1993) three factor model (FF3F) and Carhart (1997) extension of Fama and French (1993) model (FF4F). For each calendar month, return on a 12-, 24- and 36-month portfolio is calculated for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months. The weighted least square (WLS) time series regressions in each model are estimated with portfolio excess return as dependant variable, where portfolio excess return is the return on a 12-, 24- or 36-month portfolio of IPOs minus the risk free return. The number of firms in each portfolio every month is used as the weight. The Intercept shows the average monthly abnormal return on each portfolio. (R_m - R_f) is the excess return on the market portfolio, SMB is the difference in the returns of portfolios of small and large stocks, HML is the difference in the returns of portfolios of high and low book-to-market stocks and UMD is the difference in returns of portfolios of high and low momentum stocks. The factors are from Gregory et al. (2013). The t-statistics are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively

	Lockup >18 month			Lockup ≤ 12 Months		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel A: 12 months Portfolio						
Intercept	0.0122**	0.0154***	0.0182***	0.0003	0.0141**	0.0155***
	[2.13]	[3.35]	[3.75]	[0.04]	[2.64]	[2.77]
R_m - R_f	0.798***	0.732***	0.709***	1.759***	1.373***	1.333***
	[5.15]	[5.77]	[5.61]	[9.38]	[10.02]	[9.20]
SMB		0.873***	0.843***		0.453***	0.459***
		[5.81]	[5.61]		[2.72]	[2.75]
HML		-0.379***	-0.536***		-1.114***	-1.181***
		[-3.01]	[-3.44]		[-9.24]	[-8.21]
UMD			-0.204*			-0.095
			[-1.69]			[-0.86]
Adj. R^2	0.19	0.48	0.50	0.38	0.68	0.69
Panel B: 24 Month Portfolio						
Intercept	-0.0051	0.0001	0.0029	-0.0093	-0.0035	0.0004
	[-1.00]	[0.03]	[0.75]	[-1.55]	[-0.80]	[0.09]
R_m - R_f	0.710***	0.624***	0.591***	1.453***	1.208***	1.119***
	[5.67]	[7.14]	[6.79]	[9.89]	[11.05]	[9.84]
SMB		1.044***	1.005***		0.727***	0.721***
		[9.67]	[9.38]		[5.54]	[5.59]
HML		-0.346***	-0.522***		-0.756***	-0.916***
		[-3.85]	[-4.54]		[-7.39]	[-7.60]
UMD			-0.219*			-0.228**
			[-2.39]			[-2.40]
Adj. R^2	0.20	0.62	0.63	0.41	0.68	0.69

Table 5.8: Continued.

	Lockup >18 month			Lockup ≤ 12 Months		
	CAPM	FF3F	FF4F	CAPM	FF3F	FF4F
Panel C: 36 Month Portfolio						
Intercept	0.0011*	0.0075*	0.0089**	-0.0032	-0.0015	0.0022
	[1.96]	[1.70]	[2.08]	[-0.55]	[-0.32]	[0.47]
$R_m - R_f$	0.699***	0.638***	0.574***	1.221***	1.068***	0.958***
	[5.98]	[6.23]	[5.67]	[9.13]	[10.23]	[8.80]
SMB		0.688***	0.682***		0.817***	0.799***
		[5.54]	[5.67]		[6.23]	[6.24]
HML		-0.036	-0.287**		-0.506***	-0.706***
		[-0.46]	[-2.61]		[-5.16]	[-5.95]
UMD			-0.296***			-0.267***
			[-3.17]			[-2.85]
Adj. R^2	0.21	0.40	0.44	0.36	0.62	0.64

Table 5.9 Descriptive Statistics for Variables used in Regression Models

This table presents descriptive statistics of variables used in the regression analyses. *LU Months* is the length of lockup period in months. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *Assets* is the total assets before IPO in £ millions. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Age* is IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO.

Variable	Mean	Median	First Quartile	Third Quartile	Std. Dev.
LU Months	15.205	12.367	12.000	18.000	6.022
VC	0.563	1.000	0.000	1.000	0.497
UW Reputation (%)	2.360	2.410	1.030	3.185	1.377
Assets	195.451	22.637	9.575	100.643	570.040
Insider Ownership (%)	24.646	19.800	5.370	40.850	21.980
Age (years)	15.727	9.558	5.808	16.790	18.277
IR (%)	12.017	7.974	1.460	17.522	18.019
ROA	-0.257	0.070	-0.080	0.170	1.380

Table 5.10 Cross-Sectional Regressions of BHR of IPO Firms

This table presents the results of cross-sectional ordinary least squares (OLS) regressions for raw buy-and-hold returns (BHRs) of IPOs. The dependant variables are *LBHR1*=ln(1+IPO firm's 1-year BHR), *LBHR2*=ln(1+IPO firm's 2-year BHR) and *LBHR3*=ln(1+IPO firm's 3-year BHR) respectively. *LU Months* is the length of lockup period in months. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *Assets* is the natural log of total assets before IPO in £ millions. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Age* is the natural log of IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO. The t-values in brackets are corrected using hetroskedasticity consistent standard errors (White, 1980). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Raw Log Returns		
Variables	LBHR1 (1)	LBHR2 (2)	LBHR3 (3)
LU Months	0.029***	0.040***	0.046***
	(3.80)	(3.08)	(3.30)
VC	-0.072	-0.040	0.115
	(-0.69)	(-0.23)	(0.61)
UW Reputation	-0.016	-0.018	-0.075
	(-0.46)	(-0.33)	(-1.10)
Assets	0.026	0.084*	0.107*
	(0.83)	(1.79)	(1.92)
Insider Ownership	-0.001	-0.004	-0.004
	(-0.47)	(-0.89)	(-0.89)
Age	0.039	0.206***	0.312***
	(0.86)	(2.64)	(3.03)
IR	0.003	-0.001	-0.002
	(1.18)	(-0.11)	(-0.44)
ROA	0.173***	0.284***	0.246***
	(2.96)	(4.73)	(3.31)
Constant	-0.577**	-1.489***	-1.959***
	(-2.17)	(-3.34)	(-4.04)
N	268	268	268
Adjusted R^2	0.139	0.180	0.177
F-Statistic	4.206	8.928	7.519
Prob. (F-Statistic)	0.000	0.000	0.000

Table 5.11 Cross-Sectional Regressions of Market Adjusted BHAR of IPO Firms

This table presents the results of cross-sectional ordinary least squares (OLS) regressions for market adjusted buy-and-hold abnormal returns (BHARs) of IPOs. The dependant variables are *LBHAR1*=IPO firm's *LBHR1*–ln(1+market index 1-year BHR), *LBHAR2*=IPO firm's *LBHR2*–ln(1+market index 2-year BHR) and *LBHAR3*=IPO firm's *LBHR3*–ln(1+market index 3-year BHR) respectively, where market index is the FTSE Allshare index. *LU Months* is the length of lockup period in months. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *Assets* is the natural log of total assets before IPO in £ millions. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Age* is the natural log of IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO. The t-values in brackets are corrected using hetroskedasticity consistent standard errors (White, 1980). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Abnormal Log Returns-Market Adjusted		
Variables	LBHAR1 (1)	LBHAR2 (2)	LBHAR3 (3)
LU Months	0.023***	0.029**	0.031**
	(3.08)	(2.42)	(2.44)
VC	-0.062	-0.026	0.102
	(-0.63)	(-0.17)	(0.59)
UW Reputation	-0.008	-0.005	-0.057
	(-0.25)	(-0.10)	(-0.92)
Assets	0.026	0.092**	0.110**
	(0.92)	(2.16)	(2.24)
Insider Ownership	-0.001	-0.002	-0.001
	(-0.37)	(-0.45)	(-0.36)
Age	0.030	0.157**	0.242**
	(0.68)	(2.13)	(2.57)
IR	0.004*	0.001	-0.000
	(1.75)	(0.27)	(-0.07)
ROA	0.157***	0.242***	0.183**
	(2.98)	(4.34)	(2.56)
Constant	-0.552**	-1.427***	-1.777***
	(-2.23)	(-3.43)	(-4.05)
N	268	268	268
Adjusted R^2	0.118	0.146	0.127
F-Statistic	3.569	7.427	5.586
Prob. (F-Statistic)	0.001	0.000	0.000

Table 5.12 Cross-Sectional Regressions of Size Adjusted BHAR of IPO Firms

This table presents the results of cross-sectional ordinary least squares (OLS) regressions for size-matched firms' adjusted buy-and-hold abnormal returns (BHARs) of IPOs. The dependant variables are *LBHAR1*=IPO firm's *LBHR1*–ln(1+size matched firm's 1-year BHR), *LBHAR2*=IPO firm's *LBHR2*–ln(1+ size matched firm's 2-year BHR) and *LBHAR3*=IPO firm's *LBHR3*–ln(1+ size matched firm's 3-year BHR) respectively. *LU Months* is the length of lockup period in months. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *Assets* is the natural log of total assets before IPO in £ millions. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Age* is the natural log of IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO. The t-values in brackets are corrected using hetroskedasticity consistent standard errors (White, 1980). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Abnormal Log Returns-Size Adjusted		
Variables	LBHAR1 (1)	LBHAR2 (2)	LBHAR3 (3)
LU Months	0.030***	0.042***	0.043***
	(3.32)	(2.82)	(2.66)
VC	-0.086	0.003	0.180
	(-0.74)	(0.02)	(0.84)
UW Reputation	0.018	0.023	-0.034
	(0.47)	(0.36)	(-0.49)
Assets	0.051	0.146***	0.185***
	(1.45)	(2.71)	(2.98)
Insider Ownership	0.000	0.002	0.002
	(0.02)	(0.42)	(0.46)
Age	0.006	0.154	0.251**
	(0.12)	(1.65)	(2.23)
IR	0.004	-0.001	-0.003
	(1.13)	(-0.16)	(-0.48)
ROA	0.162***	0.250***	0.179*
	(2.83)	(3.04)	(1.71)
Constant	-0.734**	-1.874***	-2.316***
	(-2.39)	(-3.71)	(-4.26)
N	268	268	268
Adjusted R^2	0.110	0.139	0.126
F-Statistic	3.173	5.185	5.126
Prob. (F-Statistic)	0.002	0.000	0.000

Table 5.13 Cross-Sectional Regressions of Size and BM Adjusted BHAR of IPO Firms

This table presents the results of cross-sectional ordinary least squares (OLS) regressions for size and book-to-market (BM) matched firms adjusted buy-and-hold abnormal returns (BHARs) of IPOs. The dependant variables are *LBHAR1*=IPO firm's *LBHR1*−ln(1+size and BM matched firm's 1-year BHR), *LBHAR2*=IPO firm's *LBHR2*−ln(1+ size and BM matched firm's 2-year BHR) and *LBHAR3*=IPO firm's *LBHR3*−ln(1+ size and BM matched firm's 3-year BHR) respectively. *LU Months* is the length of lockup period in months. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *Assets* is the natural log of total assets before IPO in £ millions. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Age* is the natural log of IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO. The t-values in brackets are corrected using hetroskedasticity consistent standard errors (White, 1980). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Abnormal Log Returns-Size and BM Adjusted		
Variables	LBHAR1 (1)	LBHAR2 (2)	LBHAR3 (3)
LU Months	0.014*	0.023*	0.028**
	(1.66)	(1.80)	(2.00)
VC	-0.088	-0.084	0.054
	(-0.82)	(-0.50)	(0.28)
UW Reputation	-0.017	-0.000	-0.025
	(-0.45)	(-0.01)	(-0.33)
Assets	-0.006	0.058	0.094*
	(-0.19)	(1.18)	(1.67)
Insider Ownership	-0.001	0.000	0.002
	(-0.29)	(0.04)	(0.49)
Age	0.003	0.012	0.065
	(0.06)	(0.13)	(0.54)
IR	0.002	-0.004	-0.003
	(0.54)	(-0.70)	(-0.55)
ROA	0.230***	0.277***	0.196***
	(5.38)	(5.36)	(3.28)
Constant	-0.081	-0.651	-1.112**
	(-0.28)	(-1.42)	(-2.28)
N	268	268	268
Adjusted R^2	0.127	0.100	0.055
F-Statistic	4.661	6.240	4.000
Prob. (F-Statistic)	0.000	0.000	0.000

Table 5.14 Lockup Expiry Returns for Full Sample

This table presents Cumulative Average Abnormal Returns (CAARs) over different event windows around the lockup expiry for full sample of IPOs from 1995-2006. Abnormal returns are calculated using three benchmarks; Market Returns (daily return on FTSE Allshare index around event windows), Capital Asset Pricing Model (CAPM) and a Fama and French (1993) three factor model (FF3F). The estimation window for CAPM and FF3F models is -240 days to -21 days prior to lockup expiration (day 0) and simple ordinary least regressions (OLS) are used. The daily factors are from Gregory et al. (2013). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Market Return		CAPM		FF3F	
Period	Mean CAAR (%)	T-Stat	Mean CAAR (%)	T-Stat	Mean CAAR (%)	T-Stat
Day (-20,+20)	-3.7	-2.579**	-3.49	-2.333**	-1.41	-0.886
Day (-10,+10)	-2.44	-2.172**	-1.97	-1.742*	-0.82	-0.719
Day (-2,+2)	-0.01	-0.019	0.08	0.127	0.39	0.643
Day (-1,+1)	0.47	0.972	0.44	0.911	0.66	1.427
Day (0 , 0)	0.18	0.788	0.15	0.687	0.27	1.287
Day (+2,+10)	-2.27	-3.382***	-1.97	-2.923***	-1.47	-2.183**
Day (+2,+20)	-3.32	-3.394***	-2.79	-2.724***	-1.87	-1.734*

Table 5.15 Lockup Expiry Returns for Lockups Stratified by Medians

This table presents average Cumulative Average Abnormal Returns (CAARs) over different event windows around the lockup expiry for IPOs with lockups greater than median and IPOs with lockups less than median. Abnormal returns are calculated using three benchmarks; Market Returns (daily return on FTSE Allshare index around event windows), Capital Asset Pricing Model (CAPM) and a Fama and French (1993) three factor model (FF3F). The estimation window for CAPM and FF3F models is from -240 days to -21 days prior to lockup expiration (day 0) and simple ordinary least regressions (OLS) are used. The daily factors are from Gregory et al. (2013). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Period	Lockup > Median		Lockup < Median	
	Mean CAAR (%)	T-Stat	Mean CAAR (%)	T-Stat
Panel A: Market Return				
Day (-20,+20)	-1.5	-0.862	-5.89	-2.598**
Day (-10,+10)	0.05	0.039	-4.94	-2.755***
Day (-2,+2)	0.69	0.959	-0.71	-0.716
Day (-1,+1)	0.89	1.515	0.04	0.049
Day (0 , 0)	0.04	0.115	0.32	1.009
Day (+2,+10)	-0.58	-0.691	-3.96	-3.855***
Day (+2,+20)	-2.09	-1.628	-4.55	-3.089***
Panel B: CAPM				
Day (-20,+20)	-1.51	-0.814	-5.65	-2.429**
Day (-10,+10)	-0.26	-0.190	-4.03	-2.232**
Day (-2,+2)	0.66	0.891	-0.6	-0.616
Day (-1,+1)	0.71	1.165	0.16	0.216
Day (0 , 0)	-0.04	-0.147	0.42	1.363
Day (+2,+10)	-0.46	-0.547	-3.49	-3.334***
Day (+2,+20)	-1.53	-1.145	-4.05	-2.614***
Panel C: FF3F				
Day (-20,+20)	1.87	0.87	-4.69	-2.02**
Day (-10,+10)	1.7	1.25	-3.17	-1.77*
Day (-2,+2)	1.28	1.76*	-0.51	-0.53
Day (-1,+1)	1.09	1.86	0.25	0.34
Day (0 , 0)	0.03	0.11	0.53	1.25
Day (+2,+10)	0.11	0.13	-3.08	-3.02***
Day (+2,+20)	-0.26	-0.17	-3.59	-2.34**

Table 5.16 Lockup Expiry Returns for Lockups Stratified by Different Lockup Lengths

This table presents average Cumulative Average Abnormal Returns (CAARs) over different event windows around the lockup expiry for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months. Abnormal returns are calculated using three benchmarks; Market Returns (daily return on FTSE Allshare index around event windows), Capital Asset Pricing Model (CAPM) and a Fama and French (1993) three factor model (FF3F). The estimation window for CAPM and FF3F models is from -240 days to -21 days prior to lockup expiration (day 0) and simple ordinary least regressions (OLS) are used. The daily factors are from Gregory et al. (2013). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Period	Lockup ≥ 18 months		Lockup ≤ 12 months	
	Mean CAAR (%)	T-Stat	Mean CAAR (%)	T-Stat
Panel A: Market Return				
Day (-20,+20)	-0.93	-0.436	-6.09	-2.650***
Day (-10,+10)	0.59	0.307	-5.04	-2.777***
Day (-2,+2)	1.02	0.860	-0.68	-0.680
Day (-1,+1)	0.74	0.744	0.06	0.08
Day (0 , 0)	0.23	0.659	0.32	1.009
Day (+2,+10)	-0.8	-0.724	-4.25	-4.096***
Day (+2,+20)	-1.74	-0.950	-4.62	-3.097***
Panel B: CAPM				
Day (-20,+20)	-0.45	-0.198	-5.86	-2.488**
Day (-10,+10)	0.71	0.380	-4.14	-2.262**
Day (-2,+2)	1.21	1.028	-0.57	-0.576
Day (-1,+1)	0.73	0.720	0.19	0.252
Day (0 , 0)	0.05	0.146	0.44	1.411
Day (+2,+10)	-0.49	-0.452	-3.62	-3.424***
Day (+2,+20)	-0.56	-0.303	-4.11	-2.618***
Panel C: FF3F				
Day (-20,+20)	2.97	1.049	-4.93	-2.103**
Day (-10,+10)	2.72	1.427	-3.49	-1.927*
Day (-2,+2)	2.01	1.697*	-0.49	-0.512
Day (-1,+1)	1.32	1.355	0.27	0.367
Day (0 , 0)	0.15	0.426	0.52	1.327
Day (+2,+10)	0.08	0.073	-3.2	-3.101***
Day (+2,+20)	0.66	0.311	-3.64	-2.338**

Table 5.17 Lockup Expiry Returns by VC Backing and Different Lockup Lengths

This table presents average Cumulative Average Abnormal Returns (CAARs) over different event windows around the lockup expiry for sub-samples; VC backed and non-VC backed IPOs. CARs for IPOs with lockups greater than median and IPOs with lockups less than median within each sub-sample are reported in Panel A. Panel B reports the CARs for IPOs with lockups greater than 18 months and IPOs with lockups less than or equal to 12 months within each sub-sample. Abnormal returns are calculated using three benchmarks; Market Returns (daily return on FTSE Allshare index around event windows), Capital Asset Pricing Model (CAPM) and a Fama and French (1993) three factor model (FF3F). The estimation window for CAPM and FF3F models is from -240 days to -21 days prior to lockup expiration (day 0) and simple ordinary least regressions (OLS) are used. The daily factors are from Gregory et al. (2013). ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Panel A

Period	VC Backed		Non VC Backed	
	LU > Median	LU < Median	LU > Median	LU < Median
	Mean CAAR (%)	Mean CAAR (%)	Mean CAAR (%)	Mean CAAR (%)
1. Market Return				
Day (-20,+20)	-2.2	-6.66**	-2.53	-6.91*
Day (-10,+10)	1.16	-5.08**	-2.4	-5.78*
Day (-2,+2)	0.8	-1.19	0.33	-0.25
Day (-1,+1)	0.52	-0.19	1.23	0.25
Day (0 , 0)	-0.05	0.59	0.12	-0.07
2. CAPM				
Day (-20,+20)	-1.7	-5.78**	-0.89	-5.46
Day (-10,+10)	1.43	-3.83*	-1.52	-4.18
Day (-2,+2)	0.79	-1.1	0.72	0.19
Day (-1,+1)	0.27	0.12	1.23	0.24
Day (0 , 0)	-0.24	0.70	0.01	0.04
3. FF3F				
Day (-20,+20)	1.41	-3.6	2.42	-6.2
Day (-10,+10)	2.9	-2.65	0.36	-4.37
Day (-2,+2)	1.35	-0.75	1.3	-0.17
Day (-1,+1)	0.69	0.45	1.6	1.65
Day (0 , 0)	-0.03	0.83	0.11	0.30

Table 17: Continued.

Panel B

Period	VC Backed		Non VC Backed	
	LU > 18 Months	LU ≤ 12 Months	LU > 18 Months	LU ≤ 12 Months
	Mean CAAR (%)	Mean CAAR (%)	Mean CAAR (%)	Mean CAAR (%)
1. Market Return				
Day (-20,+20)	-1.61	-6.78**	-2.2	-7.25*
Day (-10,+10)	0.88	-5.22**	-0.75	-5.85*
Day (-2,+2)	2.1	-1.17	-0.18	-0.22
Day (-1,+1)	1.03	-0.16	0.31	0.27
Day (0 , 0)	0.25	0.60	-0.60	-0.08
2. CAPM				
Day (-20,+20)	-1.23	-5.89**	0.28	-5.82
Day (-10,+10)	0.95	-3.94*	0.62	-4.29
Day (-2,+2)	1.9	-1.07	0.58	0.22
Day (-1,+1)	0.71	0.16	0.74	0.26
Day (0 , 0)	0.15	0.73	0.50	0.03
3. FF3F				
Day (-20,+20)	2.37	-3.7	3.54	-6.65*
Day (-10,+10)	3.09	-2.77	2.37	-4.49
Day (-2,+2)	2.91	-0.72	1.24	-0.15
Day (-1,+1)	1.55	0.49	1.18	-0.03
Day (0 , 0)	0.21	0.86	-0.40	0.10

CHAPTER 6 DO IPO LOCKUPS CONSTRAIN EARNINGS MANAGEMENT?

6.1 Introduction

Prior research has documented that earnings management is pervasive around IPOs. IPO provides both "opportunity" and "incentive" to manage earnings and make financial statements look as strong as possible. The opportunity exists in the form of high degree of information asymmetry between insiders and investors of newly public firm. Moreover, accrual accounting system under the Generally Accepted Accounting Principles (GAAP) provides managerial discretion to change accounting policies and reported financial statements prior to the IPO (Armstrong et al., 2009, Ball and Shivakumar, 2008, Teoh et al., 1998a). Insiders typically hold large fraction of equity in the firm before going public and IPO is the first opportunity for a company's insiders and initial investors to realize the value of their investment in the company. The incentives for issuing firms to manage earnings upwards include higher issuing prices and large post IPO equity valuations. Consistent with this argument, DuCharme et al. (2001) find that pre-IPO earnings management is related to the initial firm value.

Earnings management has also been shown to have negative implications for the post-issue long term operating and return performance of IPOs and SEOs (Rangan, 1998, Teoh et al., 1998a, Teoh et al., 1998b). These studies find that IPOs and SEOs manage earnings upwards at the time of equity offerings. The reversal of managed earnings in the post-IPO periods results in declining earnings creating disappointment in the market and revising stock prices and valuations downwards. Recent evidence also shows that IPOs associated with higher earnings management are also more likely to delist due to performance failure (Li and Zhou, 2006, Alhadab et al., 2015). This evidence suggests that earnings management around public offerings has severe negative consequences for the wealth of firms' insiders depending on their ability to sell shares at IPO (secondary shares) or in periods immediately after IPO. Firms' insiders, however, retain large equity shares at IPO to signal firm quality (Leland and Pyle, 1977). IPO lockups, on the other hand, restrict insiders of issuing firms from selling their equity for a certain post-issue period. Prior research has documented an extensive use of compulsory and voluntary lockups in IPOs (Brav and Gompers, 2003, Espenlaub et al., 2001, Field and Hanka, 2001, Goergen et al., 2006b, Hoque, 2011, Yung and Zender, 2010). Therefore, the incentives to manage earnings are likely to persist in the months following IPO due to lockup period (Teoh et al., 1998a, Wongsunwai, 2012).

While the motivations for the use of lockups in IPOs have been examined extensively, the linkage between a firm's choice of lockup length and earnings management remains unexplored. The main aim of this chapter is to document the relation between earnings management at the time of IPO and firms' choice of lockup length. Prior literature (Arthurs et al., 2009, Brau et al., 2005, Brav and Gompers, 2003, Goergen et al., 2006b, Yung and Zender, 2010) argues that lockups signal firm quality and also act as a commitment device to alleviate moral hazard in newly public firms. We extend the existing literature by testing to determine if the lockup period also decreases the extent of earnings management in IPO process. We argue that a longer lockup is a costly commitment by IPO insiders which has severe negative consequences for firm's insiders in case of poor post-IPO operating and stock return performance. We maintain that firms with longer lockups avoid aggressive accounting accruals (earnings management) because of potential wealth losses at lockup expiry in the form of lower stock prices caused by earnings reversals and poor performance in post-IPO periods. Specifically, we expect a negative relation between lockup length and the level of earnings management by IPO firms. In addition to testing for correlation between lockup length and earnings management, we also address the endogeneity problem as the choice of lockup length may not be exogenous.

Overall empirical results support our predictions. Based on a sample of UK IPOs from 1995 to 2006, we find a strong negative correlation between the lockup length and earnings management in the fiscal year of IPO. This inverse relation remains robust after addressing the possible endogeneity problem between lockup period and earnings management. These findings are consistent with the literature that shows that lockups signal firm quality and act as a commitment device to reduce moral hazard in IPO firms (Brau et al., 2005, Brav and Gompers, 2003, Yung and Zender, 2010).

Our study makes important contribution to both lockup and earnings management literature. Although, there has been some examination of earnings management around lockup expiry (Wongsunwai, 2012), the question of whether lockup period could restrain earnings management around IPOs has remained unanswered. We also add to the literature that documents positive impact of reputed third party certifiers (underwriters, auditors, attorneys) and venture capitalists in IPO/SEO process (Brau and Johnson, 2009, Chen et al., 2013, Jo et al., 2007, Lee and Masulis, 2011, Morsfield and Tan, 2006) by showing that lockup period could serve as alternative/complementary mechanism for reducing earnings management around IPOs.

The rest of this chapter is organised as follows. Section 6.2 reviews the related literature and provides the testable predictions. Section 6.3 provides details of sample, data sources and measure of earnings management. Descriptive statistics are provided in section 6.4. In section

6.5, we discuss model specifications and regression results. Section 6.6 provides results of our robustness tests. Finally, section 6.7 concludes the chapter.

6.2 Related Literature and Hypothesis

6.2.1 Earnings Management Around IPOs

A growing body of literature has examined the use of accounting accruals to inflate earnings around public offerings. The IPO process is susceptible to upwards earnings management due to high information asymmetry and insiders' opportunistic incentives at the time of public offering. Scarcity of publicly available information and lack trading history and news media coverage create information asymmetry between the issuers and investors at the time of IPO. IPO prospectus provides much of the information to investors including the operating and earnings information for mostly three pre-IPO years. However, Accounting Principles Board Opinion 20 allows managers discretion over changes in accounting policies and restatement of reported financial results retroactively before going public. This gives managers opportunity to manage accruals in order to strengthen earnings and to make their financial results look as strong as possible. The insiders of issuing firms have incentives to boost earnings through accruals in the IPO process to ensure that offerings are fully subscribed and priced higher to realise larger proceeds. Underwriters base their pricing of shares on reported earnings of prospective IPO firms and price-earnings multiples of listed firms in the same industry (Teoh et al., 1998c). Issuing price of the IPO firm has direct and immediate impact on the post-offering valuation of the firm and wealth of firms' insiders (including large cash proceeds in case of higher percentage of secondary shares sold). Consistent with this argument, a number of studies suggest that insiders of issuing firms manipulate earnings to get higher offer prices and valuations (DuCharme et al., 2001, Teoh et al., 1998a, Dechow and Skinner, 2000).

Prior literature has identified that earnings management prior to and during the offering year has severe negative consequences for the post-issue IPO and SEO stock returns and operating performance (Rangan, 1998, DuCharme et al., 2001, Teoh et al., 1998a, Teoh et al., 1998b, Teoh et al., 1998c). These studies have found that issuing firms exhibit unusually high levels of income increasing abnormal accruals in the period around equity offerings. Furthermore, abnormal accruals during the offer year predict post-issue long term stock and operating underperformance. Teoh et al. (1998a), for example, find that IPO firms in the most aggressive quartile of earnings management experience 20 percent lower aftermarket stock returns than issuing firms in the most conservative quartile of earnings management. Examining the post-IPO earnings performance, Teoh et al. (1998c) report that high issue year unexpected current accruals predict future earnings underperformance. Similarly, Rangan (1998), Teoh et al. (1998b) and Cohen and Zarowin (2010) find evidence of abnormal accruals around equity offerings and show a negative relation between earnings management and long run post-issue operating and stock return performance for SEOs. The collective evidence from these studies suggests that investors are fooled by earnings inflation at the time of offerings and markets initially overvalue firms with higher level of accounting accruals (Sloan, 1996). The subsequent earnings reversal in post-IPO periods leads to earnings declines and poor operating performance. The disappointed investors revalue firms downwards causing poor long term stock returns. The poor long run stock and operating performance due to earnings management might result in failure and delisting of IPO firms. Li and Zhou (2006) and Alhadab et al. (2015) find evidence consistent with this argument and show that IPO firms with higher levels of earnings management are more likely to delist for performance failure and have lower survival rates.

Rangan (1998) concludes that pre-offering insiders of issuing firms benefit from overvaluation of share prices that is caused by the abnormal accruals (earnings management). This would benefit those pre-offering shareholders who are able to sell most of their shares at IPO or in the immediate periods after IPO. However, it is known that firms' insiders and initial investors (venture capital/private equity providers) do not sell large portions of their equity at the time of IPO mainly due to two reasons. First, inside managers might retain large equity stakes to signal firm's quality in order to reduce information asymmetry surrounding the issuing firm (Leland and Pyle, 1977). Moreover, VCs rarely complete a full exit by selling their shares at the time of IPO and continue to hold substantial equity stakes for many years after the IPO (Barry et al., 1990, Gompers and Lerner, 2002). Secondly, lockup agreements restrict the sale of shares by insiders and VCs for a certain post-IPO period[40]. Teoh et al. (1998a), therefore, suggest that the incentives for managing earnings are also present in the post-IPO periods.

6.2.2 Lockup Agreements and Earnings Management

Prior research in constraints of earnings management around equity offerings has largely focused on the role of third party certifiers (VCs, underwriters, auditors) in reducing earnings management around IPOs. Morsfield and Tan (2006), for example, find lower IPO year earnings management in US IPOs backed by VCs. Lee and Masulis (2011) report that reputed underwriters and VCs significantly reduce earnings management in IPOs. Brau and Johnson (2009) find a significant negative relation between earnings management and prestigious third party certifiers (auditors, underwriters, attorneys and VCs).Similarly, Wongsunwai (2012) find that companies backed by lower quality VCs report higher quarterly abnormal accruals in

[40] A standardised lockup period of 180 days is more common in US (Field and Hanka, 2001; Mohan and Chen, 2001; Baru et al., 2004). Evidence from UK, however, shows the use of more diverse and longer lockups (Espenlaub et al., 2001; Hoque, 2011).

the periods leading up to the lockup expiration. However, none of these studies have focused on the role of lockup length in constraining earnings management by IPO firms. Extant literature on IPO lockups suggests that lockup reduce information asymmetry by signalling firm quality and also work as bonding mechanism in post-IPO periods to reduce moral hazard. Brau et al. (2005) find empirical support for their prediction that the insiders of better quality firms commit to longer lockup to signal their quality. Arthurs et al. (2009) report similar findings for US venture IPOs and find that lockups signal quality and reduce valuation uncertainty for ventures with negative information. Brav and Gompers (2003), on the other hand, find support for bonding role of lockups to alleviate moral hazard in aftermarket. Specifically, they show that firms associated with greater potential for moral hazard use longer lockups as a commitment device to assuage the concerns of investors. A lockup is a costly mechanism because it creates liquidity cost and non-diversification on the insider's portfolios (Arthurs et al., 2009). The longer the lockup period, the higher will be the liquidity and non-diversifications costs. Brav and Gompers (2003) argue that firm quality will be revealed in post-IPO period through regulatory filings, news stories and analyst coverage and any negative information would hurt insiders in the same way as outside investors. Taken together, this evidence suggests that lockup length could affect the insiders' incentives of managing earnings around IPOs. The predictions of both signalling and commitment hypotheses of lockups could explain association between lockup length and earnings management. Firstly, if firms signal their quality by accepting longer lockups, they will avoid aggressive accruals management and damage the quality signal by resorting to poor financial reporting. Secondly, if firms reduce moral hazard by committing to longer lockups, then lockup length will mitigate agency conflicts and restrict earrings management. Finally, empirical evidence shows that aggressive earnings management is related to poor earnings performance and negative stock returns in post-IPO periods (DuCharme et al., 2001, Rangan, 1998, Teoh et al., 1998a). The insiders of firms with longer lockups are subject to more wealth losses due to lower stock prices at the expiry of lockup. We predict that insiders of firms with longer lockups will not engage in aggressive earnings management to avoid substantial wealth losses at lockup expiry. As a result, firms selecting longer lockups are less likely to engage in earnings management. Hence, we hypothesise a negative relation between lockup length and earnings management.

6.3 Data and Measurement

6.3.1 Sample and Data Sources

Our sample consists of UK IPOs that went public on Main Market of LSE between January 1995 and December 2006. We exclude all financial firms (SIC code 6xxx) including investment trusts and venture capital trusts (VCTs), utility firms (SIC code 49xx), re-admissions, non-UK firms and firms with missing prospectuses and necessary data for calculating discretionary accruals[41]. The IPO firms reporting no lockup provision in their IPO prospectus are also excluded from our sample[42]. Thus, our final sample consists of 268 IPOs with lockups reported in their prospectuses. The issuing firms are identified from new issues list available from LSE website for the period 1998-2006. For years 1995-1997, we identify IPOs from Thomson One Banker and Perfect Filings database. Information on issue price, market capitalisation, date of IPO etc. is collected from these sources. We use Perfect Filings database to get IPO prospectuses and hand collect variables such as lockup type and duration, insider ownership, VC backing, underwriter, company founding date etc. Relevant financial

[41] This is consistent with the prior literature. For example, Lee and Masulis (2011) and Jo et al. (2007) state that financial and utility firms have significantly different disclosure requirement due to regulated industries and nature of their accruals might be different from other industrial firms.

[42] After applying earlier filters, there were only 19 firms from 1995 to 2006 which reported no lockup provision in their IPO prospectus.

variables for IPO and control firms are from WorldScope database and from IPO prospectuses when information is missing in WorldScope. Finally, data on stock prices is collected from DataStream.

6.3.2 Measure of Earnings Management

We use discretionary accruals from a cross-sectional modified Jones model (Dechow et al., 1995) as our proxy of earnings management. Our focus is on working capital accruals because they are more likely to be manipulated by the managers of issuing firms (Teoh et al., 1998a). Consistent with prior US and UK studies (Peasnell et al., 2005, Teoh et al., 1998a), the normal (expected) working capital accruals of an IPO firm *i* in IPO fiscal year are estimated using the following cross-sectional OLS regression:

$$\frac{WCA_i}{TA_i} = \alpha_0 \left(\frac{1}{TA_i}\right) + \alpha_1 \left(\frac{\Delta\, REV_i}{TA_i}\right) + \varepsilon_i \qquad (6.1)$$

Where WCA is working capital accruals measured as change in non-cash current assets minus the change in current liabilities, ΔREV is change in revenue,TA is total assets in year before the IPO, α_0 and α_1 are regression coefficients and ε_i is the regression residual. The model is estimated separately for each year and each two-digit SIC industry category for all available non-IPO firms.[43] The variables are scaled by lagged total assets to reduce the hetroskedasticity and the cross sectional approach controls for the industry-wide fluctuations in the economic conditions that impact accruals (Teoh et al., 1998c). We require at least ten industry-year observations in a two-digit SIC industry for estimation purposes.[44] Using the estimated coefficients from equation 6.1, the non-discretionary (expected) working capital accruals for sample IPO firms are as follows:

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[43] We exclude all observations within five years of an IPO from each year and two-digit SIC industry combination following Armstrong et al. (2009).
[44] All variables are winsorized at 1% and 99% to prevent the influence of extreme values.

$$NDWCA_i = \hat{\alpha}_0\left(\frac{1}{TA_i}\right) + \hat{\alpha}_1\left(\frac{\Delta REV_i - \Delta REC_i}{TA_i}\right) \qquad (6.2)$$

ΔREC is change in receivables during the year and $\hat{\alpha}_0$ and $\hat{\alpha}_1$ are estimates of α_0 and α_1 respectively obtained from equation 6.1. ΔREC is included to control for the credit sales manipulation by the issuers (Dechow et al., 1995).

Discretionary working capital accruals (*DWCA*) are measured as:

$$DWCA_i = \frac{WCA_i}{TA_i} - NDWCA_i \qquad (6.3)$$

For robustness of our results, we also calculate total accruals using a cash flow statement approach following Hribar and Collins (2002).

6.4 Descriptive Statistics

Table 6.1 provides sample distribution across issue years (panel A) and industry groups (Panel B) along with the summary statistics for DWCA, our proxy for earnings management. Panel A reports the frequency distribution of IPOs for the sample period from 1995 to 2006. IPO frequency ranges from a mere 1.87% in year 2003 to 20.15% in year 2000. The bubble period (1999-2000) accounts for about 27% of the sample IPOs and just over three quarters of the sample IPOs went public in years 1995-2000 which shows the negative impact of bubble period on market listings after year 2000[45]. Panel A also shows the DWCA as a percentage of lagged total assets across issue years. DWCA for year 2006 have the lowest mean and median respectively at -6.5% and -6.2% indicating very conservative accruals management. However, IPOs issued in years 2003 and 2004 show aggressive accruals management with mean DWCA at 19.5% (median=11.9%).

[45] This drop in IPO frequency is also partly due to the exclusion of a large number of financial IPOs from our sample for the period 1998-2006.

Panel B (Table 6.1) reports IPO frequency based on industry sectors measured by two-digit SIC codes and shows that IPOs are more frequent in computer equipment and services sectors comprising of almost 28% of the sample .Other industry sectors having large number of IPOs include engineering and management services, retail, and chemical products. Together with computer equipment and services, these three industry sectors account for 49% of the sample. Among industry sectors, transportation has the lowest mean DWCA at -18% (median= -7.8%) and two other industry portfolios (durable goods and engineering and management services) have mean (median) negative DWCA indicating conservative earnings management. IPOs in high tech industries such as computer equipment and services and electronic equipment exhibit aggressive accruals management with mean (median) DWCA at 12% (9%) and 11.1% (9.7%) respectively consistent with the earlier findings of (Brau and Johnson, 2009).

[Insert Table 6.1 about here]

Panel A of Table 6.2 presents the descriptive statistics of variables used in the regression analysis for full sample of 268 IPOs. The mean and median values of DWCA for full sample are 0.051 and 0.033 respectively. These statistics suggest that issuing firms, on average, boost their earnings by around 5% of beginning assets in the IPO year and are comparable to prior research on IPO earnings management (Brau and Johnson, 2009, Morsfield and Tan, 2006, Teoh et al., 1998a).[46] The IPO firms go public with an average (median) period of 15.205 (12.367) months, measured as number of month from IPO date until the lockup expiry date. There is high dispersion (σ =6.02 months) and significant clustering at 12 and 24 months lockups. The median lockup length of over 12 months in our sample is strikingly different from median lockup of 6 months consistently reported in US studies (Brav and Gompers,

[46] For example Morsefield and Tan (2006) and Brau and Johnson (2009) report mean (median) discretionary current accruals of 5.13% (4.12%) and 7.6% (2.4%) respectively for US IPOs.

2003, Field and Hanka, 2001, Mohan and Chen, 2001, Yung and Zender, 2010). This is also consistent with the heterogeneity and diversity of UK lockups reported by (Espenlaub et al., 2001, Hoque, 2011). The IPOs experience average initial returns (IR) of 12.017% during the sample period. The mean (median) market share of underwriter based on number of IPOs underwritten in preceding year is 2.36% (2.41%) with a maximum of 4.99% (not reported) for a single underwriter. More than half (56.3%) of the sample IPOs are backed by VCs/private equity providers, and insiders (directors and officers) retain an average 24.65% of the post IPO equity. The mean value of total assets (Assets) for issuers in their pre-IPO year is £ 195.451 million with a median value of assets is £22.637 million[47]. The median values of return on assets (ROA) and operating cash flows (OCF) deflated by lagged total assets are 0.07 and 0.09 respectively. IPO firms list with an average age of 15.727 years and have a mean long term debt to total assets ratio (Leverage) of 0.251.

In panel B of Table 6.2, we break down DWCA by different lockup periods; up to 12 months, 13-18 months and longer than 18 months. Consistent with our prediction, IPOs with longer lockups do not aggressively manage accruals. For example, the mean (median) values of DWCA for IPOs with shorter lockups (12 months or less) are 6.93% (4.69%) and statistically significant. IPOs with lockups longer than 18 months, on the other hand, have insignificant mean (median) DWCA of 1.16% (-0.32%). Comparing the three lockup period groups, we observe that DWCA are a decreasing function of lockup length. In addition, the mean and median differences in DWCA between the shortest (up to 12 months) and the longest (more than 18 months) lockups are statistically significant. These results suggest that the existence of heterogeneity in lockup length results in different levels of earnings management by the issuing firms.

[47] Due to high skewness in this variable, we use log of total assets in all of our tests.

[Insert Table 6.2 about here]

We report bivariate correlations in Table 6.3 among the variables used in this study. The upper triangle shows Spearman correlations and the lower triangle presents Pearson correlations of the variables. These correlation coefficients are within normal range suggesting that our model is not affected by the multicollinearity problems.[48] Notably, there is a significant negative correlation between lockup period (*Lu Months*) and discretionary working capital accruals (DWCA) indicating that lockup length is inversely related to earnings management.

[Insert Table 6.3 about here]

6.5 Model Specifications and Empirical Results

6.5.1 OLS Regressions of Earnings Management

The univariate tests so far have shown an inverse relation between lockup length and earnings management. In this section, we empirically test this relationship using multivariate analysis. Our aim is to answer the question of whether longer lockups can effectively restrain earnings management in IPO firms. We employ the following OLS model specification:

$$DWCA_i = \beta_0 + \beta_1 Lu\ Months + \beta_2 \mathrm{IR} + \beta_3 Insider\ Ownership + \beta_4 Ln(Total\ Assets) + \beta_5 Ln(Age) + \beta_6 ROA + \beta_7\ OCF + \beta_8\ Leverage + \beta_9 UW\ Reputation + \beta_{10} VC + Industry\ Dummies + Year\ Dummies + \varepsilon_i \quad (6.4)$$

Where *DWCA* is our proxy for earnings management obtained from equation (6.3) and *Lu Months* is the length of lockup period in months. A negative coefficient for *Lu Months* is

[48] We also check the variance inflation factors (VIFs) for our regression analysis to ensure that our model is not significantly affected by multicollinearity. In our tests, the VIFs of all the explanatory variables are less than 3.87.

consistent with our hypothesis that longer lockups constrain aggressive earnings management. We also control for additional variables in the model, following prior literature.

Prior research suggests that aggressive earnings management is associated with higher underpricing (DuCharme et al., 2001, Teoh et al., 1998a). Francis et al. (2012), however, find that conservative accrual management tend to increase the underpricing for IPOs in general and for technology IPOs, in particular. Thus, to control for the effect of underpricing, we include initial returns (*IR*) calculated as percentage difference between offer price and first day closing price. A significant association between equity retention by insiders and earnings management has been documented in the literature (Fan, 2007, Larcker et al., 2007, Warfield et al., 1995). Accordingly, we include *Insider Ownership* measured as the percentage of post-IPO ownership retained by insiders. Large and old firms are less likely to be involved in aggressive accruals management due to close scrutiny by the stock analysts and established management and accounting systems (Lee and Masulis, 2011). We include natural logarithm of *Total Assets* and *Age* of firms in the model to control for the possible size and age effect, where Age is in years from initial founding date to IPO date. Further, we control for the influence of firm performance on earnings management by adding return on assets (*ROA*) to the model, following previous studies (Kothari et al., 2005, Lee and Masulis, 2011). Firms with strong operating cash flow performance have lower incentives to engage in accruals management (Dechow et al., 1995, Becker et al., 1998). Therefore, *OCF*, operating cash flow scaled by lagged total assets, is used to control for cash flow performance. Highly levered firms may resort to aggressive earnings management when they are close to violation of debt covenants (DeFond and Jiambalvo, 1994). We control leverage by including long term debt to assets ratio (*Leverage*) as the proxy for leverage in our model. Morsfield and Tan (2006) and Hochberg (2012) find that VC backing significantly reduces earnings management in IPOs due to VC certification and monitoring. In addition, previous research also suggests that reputed underwriters effectively reduce earnings management in equity issuing firms (Chen et al., 2013, Jo et al., 2007, Lee and Masulis, 2011). Thus, we control for the monitoring effect of VC and underwriter reputation in our model by adding a VC dummy (*VC*) and *UW Reputation* variable, where *UW Reputation* is measured as percentage of IPOs sponsored by an underwriter in the year prior to IPO. Finally, we also include year and industry dummies to control for the possible time and industry effects.

Table 6.4 presents OLS regression estimates where dependant variable is discretionary working capital accruals (*DWCA*) as percentage of lagged total assets based on modified Jones model. Columns (1) to (4) show different model specifications based on how we include third party financial intermediaries (VC and UW Reputation) and industry and year controls separately. In column (5), we include all control variables and both industry and year controls. In all of the regression models, the coefficient for *Lu Months* is significantly negative (coefficient=-0.028 to -0.041) with varying level of statistical significance depending on model specification. The results suggest that lockup length can effectively reduce earnings management by IPO issuers and are consistent with our earlier univariate analysis.

Next, we discuss results regarding our control variables in the regression models. The variables *IR*, *Insider ownership* and *Ln (Age)* are statistically insignificant in all the regressions. The significant negative association of firm size (measured by total assets) is consistent with the argument that earnings management is more likely to be detected in large firms due to close scrutiny by market participants (Lee and Masulis, 2011) and large firms being politically sensitive (Watts and Zimmerman, 1978). The variable *OCF* has a significant inverse relation with earnings management implying that firms with strong cash flow performance have lower incentives for managing accruals (Dechow et al., 1995).The significant positive coefficient on *ROA* is in contrast to the hypothesis that firms with low profitability have higher incentives to manage accruals (Lee and Masulis, 2011). A possible explanation for this result is that an expected growth in sales and income would result in increased working capital accruals to support such growth, and is consistent with the findings of Kothari et al. (2005), that the discretionary accruals have positive correlation with firm performance. The coefficient of *Leverage* is significantly negative and inconsistent with the avoidance of debt covenant violation argument (DeFond and Jiambalvo, 1994). However, high leverage may induce active monitoring by the creditors resulting in negative relation between leverage and earnings management (Lee and Masulis, 2011). Our results, thus, support the creditor monitoring argument.

Contrary to the monitoring effect of quality underwriters in restraining earnings management proposed by Lee and Masulis (2011), we find that reputed underwriters are associated with significant earnings management. However, our results are consistent with Agrawal and Cooper (2010), who find no evidence of financial reporting quality certification by reputed underwriters and suggest that underwriters' revenue generation concerns outweigh their concerns about reputation. Finally, regression results show a positive but insignificant sign on VC dummy predicting higher earnings management in VC backed IPOs. Our result is inconsistent with recent studies (Hochberg, 2012, Morsfield and Tan, 2006) in finding a negative relation between VC presence and earnings management. A potential explanation is the VC moral hazard problem, where VCs may ignore earnings quality and encourage earnings manipulation to improve short term performance and to achieve higher valuations. Similarly, VCs may grandstand (Gompers, 1996) and bring younger companies with low quality financial reporting and higher earnings management to public market.

In summary, results from Table 6.4 are consistent with our hypothesis that longer lockups significantly reduce earnings management in IPO firms.

[Insert Table 6.4 about here]

6.5.2 Endogeneity of Lockup Length and Earnings Management

6.5.2.1 Two-Stage Least Squares Instrumental Variable (2SLS-IV) Regressions

Up till now, our results have shown that lockup length is negatively associated with earnings management and suggest that lockup length significantly reduces earnings management. In our tests, we have assumed that firms with longer lockups choose not to manage earnings aggressively (and firms with shorter lockups manage earnings aggressively). However, the association between lockup length and earnings management may suffer from endogeneity problem as the choice of lockup length may not be exogenous. Firms with conservative earnings management may decide to have longer lockups. To address the possible endogenous choice of lockup, we employ a two-stage least squares (2SLS) method. In the first stage, we use following OLS model to regress lockup length on a set of variables which are likely to affect the choice of a longer lockup[49]

$$Lu\ Months = \theta_0 + \theta_1 Bubble\ Dummy + Controls \qquad (6.5)$$

$Lu\ Months$ is length of lockup period in months, $Bubble\ Dummy$ is our instrumental variable (IV) coded one for IPOs in years 1999-2000 and zero otherwise, and $Controls$ are all variables previously used in regression model in equation 6.4. We argue that *Bubble Dummy* is a good IV for lockup duration due to mainly two reasons. First during hot market periods, investors' exuberance makes them less concerned about the information asymmetry problem

[49] We use OLS specification in both stages because dependant variables in equations of both stages are continuous variables.

due to high market sentiment and optimism in general. As lockups are used to reduce information asymmetry, there is less need for firms to commit to longer lockups. Secondly, prior studies (Brau et al., 2005, Brav and Gompers, 2003) on lockups suggest that better quality firms use longer lockups to distinguish themselves from poor quality firms. On the other hand, bubble period is associated with listing of lower quality firms taking advantage of market sentiment in bubble periods (Coakley et al., 2007, Ljungqvist et al., 2006). Taken together, this evidence suggests a strong correlation between bubble dummy and lockup length and supports our choice of bubble dummy as an IV for lockup period. We find that *Bubble Dummy* is correlated with *LU Months*, but not with *DWCA*.[50]

In second stage, predicted values from equation 6.5 are used as a proxy for *LU Months* in the following regression:

$$DWCA = \alpha_0 + \alpha_1 Lu\ Months_{\_hat} + Controls \qquad (6.6)$$

Equation (6.6) is similar to OLS model (6.4) except that in equation (6.6), we use predicted value of *LU Months* from first stage regression model (6.5).

The results of 2SLS model are presented in Table 6.5. In the first stage regression, *Bubble Dummy* is significantly negatively related to *LU Months* indicating that issuers are less likely to accept longer lockups in bubble periods. Consistent with our hypothesis, results from second stage regression show a significant negative association between *DWAC* and *LU Months.* The Hausman test rejects the null of exogeneity of *LU Months* at 5% level (p-value=0.033), indicating the possible endogeneity of lockup period. Results regarding the control variables are also consistent with our earlier analysis. To conclude, the results from Table 6.5 show that longer lockups effectively reduce earnings management even after

[50] The Pearson correlation coefficient between *Bubble Dummy* and *LU Months* is -0.239 and significant at 1% level, while the coefficient between *Bubble Dummy* and *DWCA* is -0.014 and statistically insignificant.

addressing the possible endogeneity of lockup length. In next section, we use different model specification to test simultaneous determination of lockup length and earnings management.

[Insert Table 6.5 about here]

6.5.2.2 The Simultaneous Determination of Lockup Length and Earnings Management

In this section, we address the possible simultaneous relationship between lockup length and the level of accruals management before IPO. Our previous tests, implicitly assumed that lockup length is decided first which in turn helps to reduce the level of earnings management. But the decision about length of lockup period and the level of earnings management may be taken concurrently and firms may employ a strategic mix of both. We use system of equations with *DWCA* and *LU Months* modelled as a function of each other, and a set of control variables. This approach also helps in testing the direction of causality between lockup length and earnings management. To test the simultaneous relationship, we follow Chahine and Goergen (2011)[51] and use a three-stage least squares (3SLS) approach. More specifically, the system of equations is as follows:

$$\begin{aligned} LU\ Months = {} & \beta_0 + \beta_1 DWCA + \beta_2 IR + \beta_3 Insider\ Ownership + \beta_4 Ln(Total\ Assets) \\ & + \beta_5 Ln(Age) + \beta_6 UW\ Reputation + \beta_7 VC + \beta_8 Leverage \\ & + \beta_9 Bubble\ Dummy + Industry\ Dummies \\ & + \varepsilon_1 \qquad (6.7) \end{aligned}$$

[51] Chahine and Goergen (2011) use 3SLS to test the simultaneous relationship between IPO performance and VC board membership.

$$DWCA = \beta_0 + \beta_1 Lu\ Months + \beta_2 IR + \beta_3 Insider\ Ownership + \beta_4 Ln(Total\ Assets) + \beta_5 Ln(Age) + \beta_6 UW\ Reputation + \beta_7 VC + \beta_8\ Leverage + \beta_9 ROA + \beta_{10} OCF + Industry\ Dummies + \varepsilon_2 \quad (6.8)$$

All the variables are as defined earlier. *Bubble Dummy* appears only in lockup length regression and is instrument for *LU Months*, and *ROA* and *OCF* appear in earnings management regression as instruments for *DWCA*. Rest of the variables are common for both equations.

Table 6.6 presents the results of system of simultaneous equations. The results in model (1) show that *Lu Months* is negative and significant in earnings management regression whereas the coefficient of *DWCA* is insignificant in lockup length regression. The results lend support to our conjecture that lockup length causes reduction in earnings management and not vice-versa. In model (2), following Jo et al. (2007), we exclude insignificant variables from both equations to cure the weak instruments problem. Again, the results are qualitatively similar to model (1) and weak instruments problem does not affect our earlier findings.

[Insert Table 6.6 about here]

The combined results from Table 6.5 and Table 6.6 show that our inferences relating to negative association between lockup length and earnings management continue to hold after addressing the possible endogeneity of lockup length and joint determination problem (simultaneity).

6.6 Robustness Tests for Alternative Measurement of Earnings Management

In this section, we check robustness of our findings by employing an alternative measure of earnings management. Hribar and Collins (2002) report that working capital accruals are biased when calculated using the balance sheet data, primarily due to events like mergers and acquisitions or discontinued operations. We use cash flow based modified Jones model suggested by Hribar and Collins (2002) to estimate total accruals[52].

We re-estimate all models specifications (OLS, 2SLS-IV and simultaneous equations) using discretionary total accruals (*DTAC*) as a proxy of earnings management. Results of robustness tests are presented in Table 6.7. In all models, the coefficient of *LU Months* is negative and significantly related with *DTAC*. The results from robustness tests suggest that endogeneity is not a serious problem in our sample thus confirming our earlier findings that lockups tend to reduce earnings management in IPO firms.

[Insert Table 6.7 about here]

[52] We run following regression on all non-IPO two-digit SIC code firm and year combinations using total accruals:

$$\frac{TAC_i}{TA_i} = \alpha_0\left(\frac{1}{TA_i}\right) + \alpha_1\left(\frac{\Delta\, REV_i}{TA_i}\right) + \alpha_2\left(\frac{PPE_i}{TA_i}\right) + \varepsilon_i$$

Where $TAC_i = Net\ Income - Cash\ Flow\ from\ Operations,\ PPE_i$ is gross property, plant and equipment

The coefficient estimates from above equation are used to estimate non-discretionary total accruals (*NDTAC*) for all IPO firms in each year and industry combination as follow:

$$NDTAC_i = \hat{\alpha}_0\left(\frac{1}{TA_i}\right) + \hat{\alpha}_1\left(\frac{\Delta REV_i - \Delta REC_i}{TA_i}\right) + \hat{\alpha}_2\left(\frac{PPE_i}{TA_i}\right)$$

Discretionary total accruals (*DTAC*) are measured as:

$$DTAC_i = \frac{TAC_i}{TA_i} - NDTAC_i$$

6.7 Conclusion

Earnings management around equity offerings has been widely documented in the prior research. Similarly, research has also shown that aggressive earnings management around equity offerings has severe negative consequences for post-issue operating and stock return performance and survival of issuers. The incentives of managing earnings are large if insiders of issuing firms are able to sell larger equity stakes at public offering or immediately after the offering. Lockup, a formal agreement between underwriter and IPO firm insiders, prevents pre-IPO shareholders from selling their equity for certain period after the IPO. A lockup not only "forces insiders to put their money where their mouth is but to keep it there as well" (Brau et al., 2005, pp.529). Poor post-IPO performance related with aggressive earnings management around offering will result in larger wealth losses for insiders of firms with longer lockups. Accordingly, insiders of firms with longer lockup have incentive to constrain earnings management to protect wealth losses after lockup expiry. We predict a significant negative association between lockup length and earnings management.

Based on a sample of 268 UK IPOs with lockups during 1995 and 2006, we find that lockup length is negatively related to earnings management in the year of IPO. We interpret these results to mean that firms with longer lockups have lower incentives for managing earnings around IPO given the considerable costs associated with longer lockups in post-IPO period. We continue to observe the negative impact of lockup length on earnings management even after adjusting for the possible endogeneity of lockup length or the simultaneous determination of lockup length and earnings management. The results from simultaneous equations also suggest that the direction of causality flows form lockup length to earnings management and not vice-versa. Our results from all model specification are also robust to measuring earnings management from cash flow approach using total accruals as proxy for earnings management.

This paper makes important contribution to the literature that deals with the constraints of aggressive earnings management. Prior research documents a positive impact of reputed third party certifiers (VCs, Underwriters, auditors) and certain corporate governance mechanisms (independent boards, audit committees) in reducing earnings management by equity issuers. We add to this literature by showing that lockups can effectively work as an alternative mechanism in reducing earnings management. Our research has also important implications for practitioners and regulators, who perceive earnings management as pervasive and problematic (Dechow and Skinner, 2000). Investors in IPO stocks can infer the level of earnings management from lockup length which is clearly indicated in issuing prospectus. Similarly, regulators can consider longer lockups as an effective tool for restraining earnings management at the time of IPO which could lead to lower overvaluation of companies listing on the market.

Table 6.1 Sample Distribution

This table presents distribution of sample IPOs across years and industry groups. Discretionary working capital accruals (DWCA) are estimated using the cross-sectional modified Jones model. Panel A presents sample distribution and DWCA across offer years, while Panel B gives the industry distribution of sample IPOs and DWCA.

Panel A: Time distribution

			DWCA		
Year	Freq.	%	Mean	Median	Std. dev.
1995	27	10.07	-0.016	-0.012	0.141
1996	40	14.93	0.068	0.028	0.257
1997	36	13.43	0.066	0.026	0.223
1998	27	10.07	0.098	0.049	0.357
1999	18	6.72	0.005	0.046	0.660
2000	54	20.15	0.038	0.058	0.442
2001	6	2.24	0.003	-0.024	0.166
2002	12	4.48	0.063	0.055	0.127
2003	5	1.87	0.195	0.165	0.174
2004	15	5.60	0.119	0.070	0.284
2005	14	5.22	0.109	0.028	0.214
2006	14	5.22	-0.065	-0.062	0.094
Total	**268**	**100**	**0.051**	**0.033**	**0.329**

Panel B: Industry (SIC) distribution

				DWCA		
Industry	Two-digit SIC	Freq.	%	Mean	Median	Std. dev.
Oil and Gas	13	10	3.73	-0.010	0.012	0.140
Paper and Paper Products	24-27	7	2.61	-0.046	0.033	0.220
Chemical Products	28	17	6.34	0.088	0.036	0.262
Electronic Equipment	36	13	4.85	0.111	0.097	0.230
Scientific Instruments	38	13	4.85	0.030	0.033	0.119
Communications	48	16	5.97	-0.017	0.010	0.667
Durable Goods	50	15	5.60	-0.028	-0.025	0.327
Computer Equipment and Services	35,73	75	27.99	0.120	0.090	0.421
Engineering and Management Services	87	20	7.46	-0.003	-0.028	0.210
Retail	53,54,56,57,59	20	7.46	0.011	0.004	0.151
Eating and Drinking Establishments	58	6	2.24	0.042	0.019	0.186
Transportation	37,39,40-42,44,45	6	2.24	-0.180	-0.078	0.280
All Others		50	18.66	0.062	0.001	0.213
Total		**268**	**100**	**0.051**	**0.033**	**0.329**

Table 6.2 Descriptive Statistics

Panel A presents descriptive statistics of variables used in the regression analyses for 268 IPOs from 1995 to 2006. *DWCA* is discretionary working capital accruals based on the modified Jones model. *LU Months* is the length of lockup period in months. *IR* is initial returns calculated as first day closing price minus offer price divided by the offer price. *UW Reputation* is underwriter reputation measured as the number of IPOs sponsored by an underwriter as a percentage of the total number of IPOs during the year prior to the IPO year. *VC* is a dummy variable equal to one if the IPO is backed by venture capital/private equity, and zero otherwise. *Insider Ownership* is percentage of post-IPO equity retained by the directors and officers. *Assets* is the total assets before IPO in £ millions. *Age* is IPO firm age calculated as the difference (in years) between the date of IPO and the date company was founded. *ROA* is earnings before extraordinary items divided by total assets in the year before IPO. *CFO* is operating cash flow divided by total assets in the year before the IPO. *Leverage* is long term debt divided by total assets in the year before IPO. Panel B shows descriptive statistics of DWCA for various lockup length groups and tests of difference in means and medians for selected groups. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Panel A: Descriptive Statistics

Variable	Mean	Median	First Quartile	Third Quartile	Std. Dev.
DWCA	0.051	0.033	-0.044	0.164	0.329
LU Months	15.205	12.367	12.167	18.167	6.022
IR (%)	12.017	7.974	1.460	17.522	18.019
UW Reputation (%)	2.360	2.410	1.030	3.185	1.377
VC	0.563	1.000	0.000	1.000	0.497
Insider Ownership (%)	24.646	19.800	5.370	40.850	21.980
Total Assets	195.451	22.637	9.575	100.643	570.040
Age	15.727	9.558	5.808	16.790	18.277
ROA	-0.257	0.070	-0.080	0.170	1.380
OCF	-0.202	0.090	-0.065	0.211	1.143
Leverage	0.251	0.084	0.004	0.374	0.394

Panel B: Test of difference in means (t-test) and medians (Mann-Whitney test)

		DWCA	
Lockup Length	Obs.	Mean (p-value)	Median (p-value)
A. 0-12 Months	132	0.0693 (0.0298)	0.0469 (0.0001)
B. 13-18 Months	70	0.0530 (0.1034)	0.0108 (0.1811)
C. > 18 Months	66	0.0116 (0.7668)	-0.0032 (0.4154)
Total	268		
t-value $_{C-A}$		1.7194*	
z-value $_{C=A}$			1.784*

Table 6.3 Bivariate Correlations

This table presents Spearman correlations (upper triangle) and Pearson correlations (lower triangle) between variables used in the estimations. All variables are defined in Table 6.2. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	DWCA	LU Months	IR	UW Reputation	VC	Insider Ownership	Ln(Total Assets)	Ln (Age)	ROA	OCF	Leverage
DWCA	1	-0.15**	0.14**	0.12**	-0.10	0.06	-0.06	0.08	0.21***	-0.07	-0.07
LU Months	-0.12**	1	-0.01	0.01	-0.03	0.18***	-0.18***	0.11*	0.12	0.00	0.05
IR	-0.04	-0.03	1	-0.05	-0.01	0.14**	-0.22***	-0.08	0.12***	-0.03	-0.09
UW Reputation	0.07	0.01	-0.04	1	0.08	-0.04	0.09	-0.01	-0.03	-0.05	0.08
VC	-0.06	-0.02	0.00	0.09	1	-0.21***	0.13**	0.00	-0.07	0.09	0.23***
Insider Ownership	0.07	0.14**	0.03	-0.02	-0.31***	1	-0.42***	-0.05	0.32***	0.10	-0.18***
Ln(Total Assets)	-0.01	-0.18***	-0.18***	0.08	0.08	-0.36***	1	0.27***	0.08	0.36***	0.31***
Ln (Age)	0.07	0.08	-0.15**	0.01	-0.01	-0.07	0.29***	1	0.27***	0.30***	0.11*
ROA	0.24***	0.06	-0.11*	-0.06	-0.05	0.08	0.24***	0.27***	1	0.68***	-0.03
OCF	-0.11**	0.04	-0.16***	-0.09	0.02	0.01	0.33***	0.29***	0.84***	1	0.15**
Leverage	-0.08	-0.01	-0.04	0.02	0.19***	-0.14**	0.14**	0.09	0.10*	0.14**	1

Table 6.4 OLS Regression Models for Earnings Management and Lockup Length

This table presents ordinary least squares estimates for 268 IPOs from 1995 to 2006. The dependant variable is earnings management defined as discretionary working capital accruals *(DWCA*) from a modified Jones model. All the variables are defined in Table-2. All tests use white heteroskedasticity robust standard errors. The t-values are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	DWCA				
Variables	1	2	3	4	5
LU Months	-0.039**	-0.041***	-0.030*	-0.040**	-0.028*
	(-2.51)	(-2.62)	(-1.88)	(-2.34)	(-1.65)
IR	0.011	0.0123	0.012	0.011	0.011
	(0.91)	(1.07)	(0.96)	(0.96)	(0.88)
Insider Ownership	-0.007	-0.007	-0.009	-0.005	-0.007
	(-1.47)	(-1.20)	(-1.43)	(-0.81)	(-1.15)
Ln(Total Assets)	-0.241***	-0.262***	-0.282***	-0.257**	-0.290**
	(-2.73)	(-2.87)	(-2.76)	(-2.52)	(-2.41)
Ln(Age)	0.102	0.103	0.174	0.0897	0.153
	(0.83)	(0.86)	(1.36)	(0.72)	(1.16)
ROA	0.890***	0.862***	0.885***	0.855***	0.881***
	(2.80)	(2.70)	(2.84)	(2.62)	(2.74)
OCF	-1.386***	-1.298***	-1.234***	-1.296***	-1.234***
	(-4.37)	(-4.20)	(-3.91)	(-4.14)	(-3.86)
Leverage	-0.302*	-0.341*	-0.381*	-0.326*	-0.371*
	(-1.88)	(-1.96)	(-1.92)	(-1.84)	(-1.77)
UW Reputation		0.293***	0.291***	0.273**	0.292**
		(2.71)	(2.73)	(2.44)	(2.54)
VC		0.008	0.078	0.048	0.103
		(0.03)	(0.25)	(0.15)	(0.32)
Constant	1.889***	1.298**	1.304*	1.158*	1.37
	(3.40)	(2.34)	(1.78)	(1.79)	(1.60)
Industry	No	No	No	Yes	Yes
Year	No	No	Yes	No	Yes
N	268	268	268	268	268
Adj. R-sq	0.239	0.267	0.257	0.244	0.228

Table 6.5 2SLS Regression on Earnings Management

This table presents two stage least squares (2SLS) estimates for 268 IPOs from 1995 to 2006.In the first stage, lockup length is estimated using OLS regression. In second stage, the fitted values of lockup length from the first regression are replaced for lockup period. The dependant variable in the first stage is length of lockup in months (*LU Months*). The dependant variable in second stage is earnings management measured by discretionary working capital accruals (*DWCA)* from a modified Jones model. *Bubble Dummy* equals one for all IPOs during 1999-2000, and zero otherwise. All variables are defined in Table-2. All tests use white heteroskedasticity robust standard errors. The t-values are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

Independent Variables	1st Stage	2nd Stage
LU Months_hat		-0.194**
		(-2.26)
IR	0.003	0.011
	(0.17)	(0.97)
UW Reputation	0.101	0.291***
	(0.43)	(2.64)
VC	-0.487	-0.024
	(-0.62)	(-0.08)
Insider Ownership	0.043**	0.000
	(2.26)	(0.03)
Ln(Total Assets)	-0.719**	-0.368***
	(-2.59)	(-2.89)
Ln(Age)	0.348	0.213
	(0.80)	(1.4)
Leverage	0.096	-0.328
	(0.11)	(-1.48)
Bubble Dummy	-3.895***	
	(-4.18)	
OCF	0.157	-1.225***
	(0.42)	(-4.28)
ROA	-0.189	0.845***
	(-0.75)	(-2.85)
Constant	17.011***	3.615**
	(8.28)	(2.43)
Industry	Yes	Yes
N	268	268
R-Sq.	0.2097	0.1566
F (23,244)	3.59	1.87
Prob. > F	0.000	0.011
Endogeneity test of endogenous regressors:		4.514
	Chi-sq(1) P-val	0.0336
Instrumented	LU Months	

Table 6.6 Simultaneous Equations Model for Earnings Management and Lockup Length

This table reports results of simultaneous relationship between lockup length and earnings management in the system of three stage least squares (3SLS) equations. The sample includes 268 IPOs with lockups from 1995 to 2006. The dependant variables are earnings management defined as discretionary working capital accruals (*DWCA*) from a modified Jones model and the length of lockup period in months (*LU Months*). *Bubble Dummy* equals one for all IPOs during 1999-2000, and zero otherwise. The variables are defined in Table-2. All tests use white heteroskedasticity robust standard errors. The t-values are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively.

	Model (1)		Model (2)	
	Dependant Variable	Dependant Variable	Dependant Variable	Dependant Variable
Independent Variables	LU Months	DWCA	LU Months	DWCA
DWCA	-0.145		-0.022	
	(-0.32)		(-0.06)	
LU Months		-0.198**		-0.178**
		(-2.26)		(-2.44)
IR	0.005	0.011		
	(0.22)	(1.53)		
UW Reputation	0.148	0.293***		0.261***
	(0.51)	(3.12)		(3.05)
VC	-0.487	-0.0257		
	(-0.65)	(-0.09)		
Insider Ownership	0.041**	0.001	0.045***	
	(2.27)	(0.02)	(2.84)	
Ln(Total Assets)	-0.766***	-0.373***	-0.688***	-0.356***
	(-2.95)	(-3.53)	(-2.87)	(-3.69)
Ln(Age)	0.354	0.212		
	(0.79)	(1.19)		
Leverage	0.0204	-0.333		
	(0.02)	(-1.02)		
Bubble Dummy	-3.709***		-3.997***	
	(-3.84)		(-4.47)	
OCF		-1.220***		-1.287***
		(-5.58)		(-6.20)
ROA		0.856***		0.894***
		(5.14)		(5.58)
Constant	17.88***	3.697**	17.71***	3.890***
	(6.72)	(2.39)	(11.80)	(2.68)
Industry	Yes	Yes	Yes	Yes
N	268	268	268	268
R-sq	0.2143	0.1495	0.2066	0.1725

Table 6.7 Robustness Tests for Alternative Measure of Earnings Management

This table presents the results of ordinary least squares (OLS); two stage least squares (2SLS) and Simultaneous Equations model (3SLS) for 268 IPOs from 1995 to 2006. All models use discretionary total accruals *(DTAC)* from a modified Jones model as the proxy for earnings management. *Bubble Dummy* equals one for all IPOs during 1999-2000, and zero otherwise. The variables are defined in Table-2. All tests use white heteroskedasticity robust standard errors. The t-values are in brackets. ***, ** and * represent 1%, 5% and 10% significant levels respectively

	OLS	2SLS (2nd Stage)	Simultaneous Equations	
Variables	DTAC	DTAC	LU Months	DTAC
DTAC			-0.028	
			(-0.06)	
LU Months	-0.003*	-0.016**		-0.016**
	(-1.861)	(-2.24)		(-2.04)
IR	0.001***	0.001**	-0.007	0.001*
	(2.628)	(2.10)	(-0.36)	(1.78)
UW Reputation	0.001	0.002	0.179	0.002
	(0.09)	(0.25)	(0.71)	(0.25)
VC	0.016	0.018	-0.031	0.018
	(0.65)	(0.79)	(-0.04)	(0.69)
Insider Ownership	0.000	0.001	0.029*	0.001
	(0.83)	(1.10)	(1.67)	(1.11)
Ln(Total Assets)	0.001	-0.009	-0.791***	-0.01
	(0.12)	(-1.02)	(-3.64)	(-0.91)
Ln(Age)	0.001	0.012	0.309	0.012
	(0.86)	(0.86)	(0.69)	(0.72)
Leverage	-0.052*	-0.05	0.221	-0.05
	(-1.70)	(-1.56)	(0.25)	(-1.57)
Bubble Dummy			-4.012***	
			(-4.67)	
OCF	-1.049***	-1.046***		-1.045***
	(-24.89)	(-27.48)		(-50.95)
ROA	1.034***	1.035***		1.035***
	(30.07)	(35.44)		(61.87)
Constant	0.075	0.268***	17.195***	0.271**
	(1.31)	(2.68)	(10.31)	(2.07)
Industry	Yes	Yes	Yes	Yes
N	268	268	268	268
R-sq	0.943	0.934	0.1311	0.9364

CHAPTER 7 CONCLUSION

This thesis investigates the role and impact of lockup length on the success of IPOs in UK. Prior literature suggests that longer lockups reduce information asymmetry and hence signal better issuer quality and reduce moral hazard at the time of IPO. However, the focus of this literature has been on finding the motivations for longer lockups. We extend this literature and relate lockup length to three important aspects of IPOs which have received considerable attention in the past literature. A detailed review of the existing literature on IPOs reveals that prior studies have ignored the possible impact of lockup characteristics, particularly lockup length, in explaining the survival, long-run performance and earnings management in IPOs. We argue that given the positive impact of lockup length in signalling better issuer quality and mitigating moral hazard as documented in the literature, lockup length could be an important determinant of IPO survival, performance and earnings management.

We use a sample of IPOs on Main Market of LSE and hand collected data on lockups to test the implications of longer lockups on aftermarket survival, long-run performance and earnings management at the time of IPO. Our choice of Main Market IPOs is motivated by at least two reasons. First, the majority of the research on IPO lockups has focused on US markets and there are only a handful of studies on UK markets. Moreover, chapter 2 identifies that there are significant differences in terms of lockup characteristics between US and UK markets. While lockups in US are virtually standardised at 180 day period, there is large variation in terms of length and other characteristics for lockups in UK. Second, although an important segment of the LSE market, AIM rules require certain companies to have mandatory lockups for listing on AIM. On the other hand, there are no compulsions of lockups for IPOs on Main Market. These two reasons make Main Market an ideal setting to test the implications of longer lockups on three related areas of IPOs mentioned above. To the best of our knowledge, this thesis presents the first attempt to relate lockup length to the survival and earnings management of IPOs.

In the remainder of this chapter, we summarise the main findings from empirical chapters in section 7.1, highlight the contribution and implications of the study in section 7.2 and acknowledge some limitations and suggest further areas for related research in section 7.3.

7.1 Key Empirical Findings

7.1.1 Lockup Agreements and Survival of IPO Firms

Chapter 4 examines the survival of 580 IPOs on the Main Market of LSE issued between 1990 and 2006 and relates the post-IPO survival to the length of lockup period. IPOs are tracked for 5 years following the listings and until December, 2011 for full sample. We define survivors as IPOs which remain listed on the stock market or transfer to another market. Consequently, non-survivors are IPOs which get delisted from the market due to mergers and acquisitions, administration/liquidation and other reasons such as permanent suspension etc. We examine survival profile of IPOs using Kaplan-Meier survival function by dividing IPOs first on the basis of median lockup length and then into three groups; lockup length of 0-12 months, 13-24 moths and greater than 24 months. We find that survival rates of IPOs with longer lockups are consistently higher than those with shorter lockups. Similar results are observed when median survival times instead of rates are analysed. Next, we focus on the delisting reasons and compare the failure rates of IPOs across three delisting categories mentioned above. We observe that failure rates for IPOs with longer lockups are notably lower than IPOs with shorter lockups for more negative delisting reasons like administrations/liquidations and other reasons. This shows that longer lockup IPOs do not die a bad death. For our multivariate analysis, we use accelerated failure time model with lognormal form and control for other determinants of IPO survival documented in the literature. Our results show that lockup length is significantly and positively related to the post-issue survival time of IPOs. More precisely, we document that a 12-month increase in lockup period increases the survival time by more than 24-months. In order to test the robustness of our results we use a number of robustness tests. First, we check the consistency of our results to alternative survival model (cox proportional hazard model), heterogeneity of issuing firms and high IPO activity in certain issue years. Second, we control for the institutional changes in lockup requirements in year 2000 as discussed in chapter 2. Third, we use alternative definitions of some control variables affecting IPO survival. We conclude that our main results remain strongly robust to all these additional tests and are not affected by estimation model, changes in rules regarding lockups and different definitions of some control variables. The findings from this chapter suggest that longer lockups represent a credible signal of issuer quality not only at the time of IPO but also in aftermarket. Moreover, longer lockups could also act as an important incentive realignment mechanism between the inside managers and investors in the long-run.

7.1.2 Long-Run Performance of IPOs: The Role of Lockups

In chapter 5, we investigate long-run stock performance of IPOs in relation to the length of lockup period. Our sample consists of IPOs on LSE Main Market from 1995-2006. In order to analyse three year post-IPO performance, both event-time and calendar-time approaches are used. In event-time approach, we use BHARs utilising three different benchmarks and equal as well as value-weighting scheme. We also calculate wealth relatives using three benchmarks. For calendar-time analysis, different factor models and OLS as well as WLS regression models are used. In order to compare relative performance between short and long lockups, we divide IPOs into two groups: based on median lockup length and on the basis of top and bottom quartile of lockup length. In general, results from event-time analysis show that IPOs with longer lockups have higher BHARs than IPOs with shorter lockups. Using calendar-time portfolio analysis, we find even more striking results showing superior performance on part of IPOs with longer lockups (in top quartile of lockup length) relative to those with shorter lockups (in bottom quartile of lockup length). Results from our multivariate regression analysis are consistent with the event-time and calendar-time analysis. We find that lockup length is positively related to three year raw IPO returns (BHR) and BHARs using all three benchmarks. Finally, we examine the abnormal returns around lockup expiry using CAARs for different windows around lockup expiry. We use three different estimation models for estimating expected returns namely: a simple market return model, CAPM and Fama and French (1993) three factor model. Contrary to the US findings of significant negative abnormal returns on lockup expiry day (Field and Hanka, 2001, Brau et al., 2004), we do not observe significant negative performance in shorter windows (3, 5 days) around lockup expiry and on the day of lockup expiry. These results, however, are consistent with Espenlaub et al. (2001) for UK and Goergen et al. (2006b) for France and Germany. For wider windows (21, 41 days) around lockup expiry, we report significant negative abnormal returns across all estimation models. Moreover, we find that these negative returns are concentrated in IPOs with shorter lockups; IPOs with lockups shorter than median lockup length and IPOs in bottom quartile of lockup length. Previous literature suggests that VC backed IPOs show worst performance around lockup expiry (Bradley et al., 2001, Field and Hanka, 2001). As more than half of our sample IPOs are VC backed, the observed negative performance around lockup expiry may be due to the VC backed sub-sample. In order to check the further robustness of our results, we split sample IPOs on the basis of VC backing and further sub-dividing them into shorter and longer lockup as described above. Our results are consistent with previous evidence and negative abnormal returns are concentrated in IPOs with shorter lockups irrespective of VC backing or not. Overall empirical results from chapter 5 are consistent with the signalling role of lockups which is evident from a positive association between lockup length and three year long-run IPO performance. Moreover, lack of significant negative performance around lockup expiry also shows that higher quality IPOs do not suffer at the time of lockup expiry. These results could also be partly consistent with reduction of moral hazard and agency problems due to longer lockups. The relatively longer lockups in UK might act as a stronger bond and a longer commitment of insiders with the issuing firm might result in better long-run performance.

7.1.3 Do IPO Lockups Constrain Earnings Management?

A vast body of literature reviewed in chapter 3 provides empirical evidence that earnings management is pervasive in IPOs. Similarly, there is no shortage of literature on finding mitigating factors for earnings management in issuing firms. No prior study has, however, considered the role of lockup length in restricting earnings management around IPOs. In chapter 6, we try to fill this gap and aim to answer the question that do lockups constrain earnings management in IPOs? We argue that longer lockups can effectively remove the insiders' incentives to manage earnings at the time of IPO. Lengthy lockups expose insiders to non-diversification costs for a significantly longer period of time. Prior literature shows that issuing firms engaged in aggressive earnings management experience poor post-IPO return performance (Teoh et al., 1998a, Rangan, 1998). If insiders in IPOs with relatively longer lockups engage in aggressive earnings management, they are likely to face the negative financial consequences in the long-run when they will sell their shares. We test our prediction on a sample of IPOs from 1995 to 2006 on LSE Main Market. We observe positive abnormal working capital accruals, our proxy of earnings management, for the full sample of issuing firms. In our univariate analysis, we compare these abnormal accruals across three groups of lockup length: 0-12 months, 13-18 months and longer than 18 months. Results show that magnitude of abnormal accruals decreases with the increase in lockup length. Moreover, abnormal accruals for longer lockup groups are not statistically different from zero. Further results from regression analysis also confirm a significant and negative relation between lockup length and abnormal accruals. Specifically, we find that after controlling for a number of factors affecting earnings management, longer lockups effectively reduce earnings management in the year of IPO. However, it may be argued that this result might suffer from endogeneity as the choice of lockup may not be exogenous. This could give rise to two related issues. First, firms with conservative earnings management may decide to have longer lockups in order to make their financials more credible. Second, as both the lockup length and quality of reported earnings are decided before IPO, these decisions might be taken simultaneously and firms might use a strategic mix of these two mechanisms. In order to check the robustness of our earlier findings, we employ an instrumental variable regression approach and a simultaneous equations model approach using 3SLS. This approach would test the direction of causality between lockup length and earnings management. The results from instrumental variable regression are consistent with our earlier results and show that lockup length has significant inverse relation with the earning management. Furthermore, results from simultaneous equations system also confirm that it is the lockup length which causes reduction in earnings management and the level of earnings management is not a determinant of lockup length. Finally, we also use total accruals as an alternative proxy of earnings management and re-estimate all the earlier regression models. Results show that our inferences regarding the lockups length are consistent and robust to this alternative measure of earnings management. Overall results from chapter 6 show that longer lockups effectively constrain earnings management in IPOs and these results are consistent across different econometric models and alternative measures of earnings management.

7.2 Further Contributions and Inferences

This purpose of this thesis is to extend the existing literature on IPO lockups which has remained focused on the motivations of lockups at the time of offering. In addition to contributing to the lockups literature, we contribute to three widely researched areas in the corporate finance literature: survival, long-run performance and earnings management in IPOs. The thesis contributes to the extant literature in following ways. First, previous studies on lockup motivations use various variables and issue characteristics at the time of IPO to proxy for quality of offerings. We extend this literature and use two important post-issue performance measures (long-run stock returns and aftermarket survival) and relate them with the lockup length. While prior literature suggests that longer lockups signal issuer quality and reduce agency problems at IPO, we provide evidence that longer lockups continue to predict success of issuing firms in the aftermarket. Second, we contribute to the small but growing literature on survival of issuing firms in the aftermarket. The survival literature recognises that survival is an important success metric for companies which come to the market for meeting capital needs. Previous studies, therefore, have tried to find variables with predictive power of survival in the aftermarket. Chapter 4 of this thesis adds to this strand of literature and shows lockup length as an important factor in survival of issuing firms. To the best of our knowledge, no other study has considered lockup length as a determinant of post-IPO survival. Research in this area needs to focus on lockup characteristics and control for the length of lockup in future research. Third, a plethora of literature has examined the long-run performance of issuing firms and it is recognised as an IPO anomaly. The overwhelming literature in this area provides evidence of poor performance after listing in most of the markets around the globe. Contrary to this, we find no evidence of poor performance for our sample IPOs. We argue that the results of long-run underperformance might be sensitive to the sample period and/or market segment (main vs second board). Moreover, we also document that lockup length is an important determinant of the post-issue stock return performance of IPOs. Fourth, we also contribute to the literature on earnings management which has documented that issuing firms opportunistically manage earnings around the equity issuing. Moreover, the research on mitigating factors in earnings management has mainly focused on third party certifying agents and corporate governance mechanisms. We show that lockups length is an effective contractual mechanism to restrain the accrual management in IPOs before going public. Finally, this thesis also contributes to the limited understanding of IPO lockups in UK markets. We exploit the unique features of LSE Main Market and examine the effect of lockup in some important aspects of IPO research. Moreover, we also add to the limited research on survival and earnings management in UK IPOs.

Apart from contribution to the existing academic literature, results in this thesis have broader practical implications for investors, corporate insiders and policy makers alike. Our results regarding the impact of lockup on survival, long-run performance and earnings management suggest that investors ought to pay close attention to the choice of lockup length at the time of IPO. Ex ante, knowledge about the survival likelihood and return performance in the long-run is extremely useful for the investors, particularly long term ones. Our results show that investors can pick IPOs which are a good long term investment by carefully looking at lockup characteristics in IPO prospectuses. Lockup characteristics, particularly the length, could help investors assess the quality of issuing firms in terms of survival and return performance after the IPO. Moreover, academic research suggests stock markets temporarily overvalue the earnings management in equity issuing firms. Investors cannot see through the earnings management at the time of equity issue and could end up paying more for overvalued firms. This would result in poor long term investment. Our results show that longer lockups could guard against investing in overvalued firms. Prospective investors can judge the accounting quality by paying attention to lockup characteristics and this information could signal to investors about the levels of potential earnings manipulation in issuing firms.

Our results are equally important to the entrepreneurs and managers in issuing firms. Academic research shows that longer lockups signal better issuer quality at the time of IPO. Moreover, survey evidence from corporate managers also suggests that a longer lockup acts as a signal of firm value at the time of listing (Brau and Fawcett, 2006). The results in this thesis complement this argument and show that issuers can signal longer survival prospects and better performance in aftermarket through the length of lockup period as well. Furthermore, issuers can also assuage the investors' concerns about the opportunistic accruals manipulation around IPO through longer lockups.

Finally, although this research has remained focused on the role of lockups in various important aspects of the IPO, the results may have implications for policy makers and capital market regulatory bodies. Firstly, the question of long-run survival and success of issuing firms is as important to a stock market as it is to the investors and issuers. Better survival and performance of public companies is one of the success measures for performance and working of a stock exchange. Moreover, it would bolster the issuing activity on a successful stock market raising its reputation and revenues and also capital formation in the wider economy. Secondly, a recent report initiated on behalf of the government in UK raised concerns about the short termism in UK capital market (Kay, 2012). This report identifies misalignment between corporate insiders and investors as a major source of short term focus at the expense of long term sustainable growth. Focusing on corporate manager's remuneration, the report suggests to structure directors' remuneration to be more aligned to the long term business performance. For example, Kay suggests that the directors' performance incentive be paid in the form of shares of the company which are to be held until directors' retirement. More recently, similar concerns about the alleged short termism have also been raised by some institutional investors (BBC, 2013). The institutional investors have argued in favour of lengthening executive's incentive schemes to constrain the myopic behaviour. Our thesis provides empirical evidence that locking-in insiders for a longer period after the listing, improves the long term survival and performance, at least, in IPOs. Our results lend support to these recommendations and policy makers and regulatory bodies may consider lockups as an incentive alignment device between the corporate insiders and investors.

7.3 Limitations and Future Research

The results in thesis are subject to certain limitations which need to be recognised. Nevertheless, these limitations can lead to future research in the related areas. We first discuss some potential limitations of the thesis. First, the results and inferences in empirical chapters of the thesis are drawn from the evidence collected from the different datasets. The validity of results may, to some extent, be sensitive to the sample period, measurement of variables, model specifications and estimation techniques. Moreover, we only use cross sectional data in chapters 5 and 6 and thus have less control over the unobservable IPO characteristics. Second, this thesis relies on the existing theoretical prediction about the use and choice of lockup characteristics and does not attempt to develop any theoretical models. The thesis aims to find empirical support for the existing models in corporate finance using econometrics techniques rather than proving these theoretical explanations. We do not try to address the theoretical issues in this thesis. Finally, we have some limitations specific to the individual empirical chapters. For example, due to data unavailability we do not include any corporate governance variables in empirical analysis which could also affect the survival and performance of issuing firms. Some recent studies have shown that apart from accruals management, issuing firms also engage in real activities management which may be hard to detect (Cohen and Zarowin, 2010). We do not analyse this alternative form of earnings management in chapter 6. Furthermore, we could use only one instrument for lockup period in our instrumental variable regressions which could undermine our results. Finally, in chapter 5 we only use market adjusted, size adjusted and size and book-to-market adjusted benchmarks in event-time analysis, however, recent studies have also utilised industry matched benchmarks.

Finally, the results of this study open up some interesting avenues for future research. There is need to conduct further research on IPO lockups, particularly in different institutional contexts as the role and impact of lockups might be different in different contexts. As briefly mentioned earlier, one such area is the interaction of lockup characteristic with other corporate governance characteristics in newly public firms. Although, we complement the previous research which suggests that lockups are a credible signal of IPO quality, there is need to further examine how issuing firms trade-off among different signals of quality. Lockup is a costly signal and issuers might try to substitute it with some less costly signalling mechanisms. Another area for future research could be the separate examination of exit routes from the market. In chapter 4, we do not differentiate between different delisting reasons in our AFT survival models. However, it would be interesting to investigate these reasons differently using the competing risk survival models. And last but not the least, a promising area for future research would be to examine real activities management alongside the accruals management in equity issuers and relating it to the issuer characteristics at the time of IPO.

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