Lockup Agreements during Equity Issuance

Jinpeng Lv

http://orcid.org/0000-0002-4269-1271 (ORCID)

A thesis submitted

in partial fulfillment of the requirements of the degree of Doctor of Philosophy

Department of Finance

Faculty of Business and Economics

University of Melbourne

August 2017

Abstract

Information in the equity issuance market is highly asymmetric. Issuers have information advantages over investors and underwriters. Under asymmetric information, in the U.S., insiders from issuing companies and the underwriters voluntarily negotiate lockup agreements before the issuance of equity. Lockup agreements restrict insiders from selling their shares during the lockup period. However, underwriters have the right to release some or all of the locked-up shares, allowing insiders to sell their shares early at any time before the lockup expiration. Early sales refer to these insider sales during lockup periods. Lockups commonly exist in both initial public offerings (IPOs) and seasoned equity offerings (SEOs). This thesis investigates both the underwriters' incentives for early releases of locked-up shares during the IPO and the impact of IPO lockups on the decision to include SEO lockups.

First, I study underwriters' incentives for early releases during an IPO. Ten percent of IPOs with lockup agreements have early sales by top executives. Early sales reduce the likelihood that IPO companies switch lead underwriters in their subsequent SEOs. IPO companies with early sales have better post-IPO performance than their counterparts without early sales. I argue that early sales reduce the signaling cost incurred by IPO lockups under asymmetric information. As information resolves after the IPO, good companies exercise early sales and directly benefit from the reduction in the signaling cost, while underwriters benefit from an increase in future business.

Second, I examine the relation between IPO and SEO lockups. I find that

underwriters are more likely to impose SEO lockups on issuers that have IPO lockups. I focus on a sample of issuers that conduct their first SEOs within four years after the IPO. I attribute the positive relation between SEO and IPO lockups partially to high correlations between company characteristics at the times of the IPO and the SEO. However, the commitment level of insiders in the issuing company does not offer an explanation for the positive relation between IPO and SEO lockups. Rather, the positive share price response to the announcement of the change from including lockups at the IPO to waiving lockups at the SEO implies that this change by underwriters conveys good news to the market, consistent with SEO lockups helping to reduce the information asymmetry in the equity issuance market.

Declaration

I certify that:

1. this thesis comprises only my original work towards the Doctor of Philosophy,

2. due acknowledgement has been made in the text to all other material used, and

3. this thesis is fewer than the maximum word limit of 100,000 words in length, exclusive of tables, maps, bibliographies, and appendices.

4. Ms Diane Frances Kolomeitz provided editing service for this thesis in accordance with Standards D and E of the Australian Standards for Editing Practice.

Acknowledgments

I am deeply grateful to my advisory committee members, Garry Twite (primary supervisor), Sturla Fjesme (external supervisor), Neal Galpin, Spencer Martin, Lyndon Moore, and Chander Shekhar, for their extensive discussions, support, and encouragement.

I would like to extend my thanks to all the faculty members and fellow PhD classmates at the Department of Finance, who have lent generous support to my PhD study. In addition, I would like to thank Alon Brav, Stephen Brown, Francois Derrien, Ronald Giammarino, Bruce Grundy, Matthew Gustafson, Michelle Lowry, Roni Michaely, Gordon Phillips, and seminar participants at the 2015 SIRCA Young Research Workshop (YRW), 7th Conference on Financial Markets and Corporate Governance, 2016 Northern Finance Association Annual Meeting, and 2016 Financial Management Association Annual Meeting for their helpful comments.

In addition, I am grateful to Ms Diane Frances Kolomeitz, who has provided professional editing service on an earlier version of this thesis.

Contents

Chapter 1: Introduction

In the U.S. equity issuance market, insiders from issuing companies and underwriters voluntarily negotiate lockup agreements before the issuance of equity. Lockup agreements restrict insiders from selling their shares during the lockup period. However, underwriters have the right to release some or all of the locked-up shares, allowing insiders to sell their shares early at any time before the lockup expiration. Early sales refer to these insider sales during lockup periods. Lockups commonly exist in both initial public offerings (IPOs) and seasoned equity offerings (SEOs). This thesis investigates underwriters' incentives for early releases during the IPO and the impact of IPO lockups on SEO lockups.

In Chapter 2, I present a comprehensive literature review on lockups during equity issuance. Information in the equity issuance market is highly asymmetric, but lockups help to reduce the problems caused by information asymmetry. First, I review information-asymmetry-related puzzles during equity issuance. Previous studies have used information asymmetry between issuers and investors to explain the timing of equity issuance, short-term underpricing, and long-term underperformance. Second, I investigate the literature that explains the existence of lockups. In this literature, the theoretical framework is based on Leland and Pyle (1977). Risk-averse insiders use their willingness to retain equity as a signal of company quality. One implicit assumption in Leland and Pyle (1977) is that insiders have only one opportunity to sell their equity before the resolution of information asymmetry, and lockups, which restrict insider sales, are in line with this assumption of a single sale. Third, I identify two areas for additional research. The first one is the

underwriters' incentives to grant early releases. Previous studies (e.g., Brav and Gompers, 2003; Karpoff et al., 2013) argue that the revelation of good company quality is a critical factor that underwriters consider to release locked-up shares early before lockup expiration. However, the question that remains unanswered is the benefit to the underwriter from early releases. The second area for additional research is the relation between IPO and SEO lockups. Previous studies (e.g., Brau et al., 2005; Karpoff et al., 2013) maintain that information asymmetry is the main reason for the use of lockups; however, to date, the empirical literature has not examined the potential impact of the inclusion of IPO lockups on SEO lockup decisions.

In Chapter 3, I examine why underwriters choose to release locked-up shares, arguing that underwriters use early sales to increase client loyalty and generate more future business. In examining this incentive of underwriters, I focus on an important group of insiders, namely top executives, and find in a sample from 1988 to 2011 that 10% of IPOs with lockup agreements have early sales by top executives. In the subsample of IPO companies that conduct their first SEOs within the four years after the IPO, early sales by top executives reduce the likelihood that IPO companies switch underwriters between the IPO and their subsequent SEOs by 14%. Moreover, I demonstrate that underwriters are concerned about the risk of releasing shares in bad companies. I find that (1) IPO companies with early sales have better post-IPO performance than their counterparts without early sales; and (2) underwriters decide to release locked-up shares based on the market-wide information.

Furthermore, I find a positive relation between early sales and the probability of future SEOs. According to Field and Hanka (2001), underwriters feel pressure to release locked-up shares held by insiders with whom they expect to conduct future business. The probability that an IPO company conducts SEOs is a measure for the potential of future business between insiders and underwriters. Therefore, the positive relation between early sales and the probability of future SEOs demonstrates that underwriters are incentivized to allow early sales. However, the positive relation between early sales and the probability of future SEOs also creates a potential selection bias when I analyze the relation between early sales and underwriter switch. In the test of the relation between early sales and underwriter switch, I use a sample of 1,601 IPOs with SEOs rather than the full sample of 4,270 IPOs. Therefore, I estimate a Heckman model to explore the relation between early sales and underwriter switch in the full sample of 4,270 IPOs. The Heckman model still identifies a significant negative relation between early sales and underwriter switch; therefore, the result that underwriters use early sales to increase client loyalty and future business is robust to the correction of the sample selection bias.

In addition, I investigate two alternative explanations for the channel through which underwriters benefit from early sales. First, underwriters that release locked-up shares could benefit from increased future IPO business. Early sales favor IPO company insiders. Not only IPO companies whose insiders exercise early sales but also those companies that plan to go public would prefer to conduct business with underwriters that grant early releases over those that do not.

Therefore, early sales attract more IPO business for the underwriter. To test this explanation, I check whether early sales increase underwriter ranks. An underwriter rank reflects underwriter reputation and market share in the IPO market. I find that early sales have no significant impact on the underwriter rank. Thus, underwriters derive no benefit from early sales in terms of higher ranks and increased future IPO business. The second alternative explanation is based on rent extraction. Underwriters release locked-up shares in both good and bad companies and could benefit from increased future business brought by bad companies. Releasing locked-up shares in bad companies increases the proportion of bad companies accepting lockup agreements, and the rent is extracted from investors. This explanation in terms of rent extraction leads to two predictions: (1) the performance of IPO companies with early sales is not better than that of IPO companies without early sales; and (2) higher-rank underwriters, considering their high market power, are more likely to release shares in bad IPO companies. However, I find no evidence in support of these two predictions.

In Chapter 4, I examine the relation between IPO and SEO lockups. I find that underwriters are more likely to impose SEO lockups on issuers that have IPO lockups. In a sample of 1,446 issuers that conduct their first SEOs within four years after the IPO, the inclusion of an IPO lockup increases the likelihood of the inclusion of a lockup at the first SEO by 27.3%. I attribute the positive relation between SEO and IPO lockups partially to high correlations between company characteristics at the times of the IPO and the SEO. In addition to IPO lockups, the company size is an important determinant for the inclusion of SEO lockups.

The correlation between market values at the times of the IPO and the SEO is 0.789. The company size measures the level of information asymmetry. Larger companies face less severe problems caused by information asymmetry. Therefore, information asymmetry is a main concern when underwriters decide to include lockups.

In addition to the explanations of similar company characteristics at the times of the IPO and the SEO, I investigate whether the commitment level of insiders in the issuing company explains the positive relation between IPO and SEO lockups. Under the commitment hypothesis, underwriters release locked-up shares during IPO lockup periods in those issuers that have demonstrated diminished moral hazard risk. Obtaining early releases, insiders in issuing companies exercise early sales. If the main role of lockups is to reduce moral hazard problems, issuers with early sales during IPO lockup periods are less likely to have SEO lockups. However, I find no significant relation between SEO lockups and early releases in IPOs. Therefore, the commitment level of insiders in the issuing company does not provide an explanation for the positive relation between IPO and SEO lockups.

Moreover, I identify the impact of IPO lockups on the SEO announcement effect, which confirms that the use of SEO lockups is to reduce information asymmetry. I use the buy and hold abnormal return (BHAR) around the SEO filing day to measure the SEO announcement effect. Given the positive relation between IPO and SEO lockups, 87% of issuers with IPO lockups have SEO lockups, while the remaining 13% of them do not have SEO lockups. The change from including lockups at the IPO to waiving lockups at the SEO conveys good news

to the market. I find that in the subsample of issuers that have IPO lockups, the group without SEO lockups has a higher BHAR around the SEO filing day than the group with SEO lockups (-1.74% vs. -2.36%). This finding is consistent with underwriters reducing information asymmetry between issuers and investors, by conveying news to the market through SEO lockups.

In Chapter 5, I first summarize my research findings. After that, I discuss some possible directions for future research. The first possible direction is to investigate the relation between early sales and future business of mergers and acquisitions (M&As) or IPOs. In Chapter 3, I focus on future SEOs. I acknowledge that future SEOs from IPO companies are one channel of future business from insiders with early sales. Other channels could be future M&As from top executive insiders and future IPOs from the venture capital (VC) firm insiders. The second direction is to examine the relation between the portfolios held by IPO insiders and early sales. In Chapter 3, I assume that insiders, if allowed, always sell more shares after information asymmetry resolves. However, the incentives for insiders to sell more shares are influenced by insiders' portfolios. For example, if a large proportion of an insider's wealth is represented by the shareholding in the IPO company, the insider will have a greater incentive to sell more shares and benefit from early sales.

The third possible direction is to investigate trading strategies based on IPO and SEO lockup decisions. In Chapter 4, I document that the combination of IPO and SEO lockup decisions predicts the SEO announcement effect. Therefore, it is possible to develop trading strategies that exploit the predictability of the SEO

announcement effect. Lastly, I plan to use the instrumental variable analysis to address potential endogeneity concerns, providing additional empirical evidence for the impact of IPO lockup on SEO lockup. A possible instrumental variable is the market-wide illiquidity measure at the time of IPO.

Chapter 2: Literature review

Equity issuance is a complicated process, which creates both opportunities and challenges for issuers and investors. On the one hand, equity issuance allows issuers to access the public equity capital market and provides investors with more investment opportunities. On the other hand, under asymmetric information, equity issuance requires more information disclosure and potentially adds disclosure costs to issuers; at the same time, investors face severe information asymmetry problems when investing in newly issued equity.

Previous studies have used information asymmetry between issuers and investors to explain multiple puzzles arising during equity issuance. The first puzzle is the timing of equity issuance. IPO and SEO volumes fluctuate substantially over time. One explanation for the timing of equity issuance is that issuers issue equity when the intrinsic value of the equity is lower than its market value (e.g., see Lucas and McDonald, 1990; Choe et al., 1993; Schultz, 2003). Another explanation for IPO timing is based on information production. Due to information asymmetry between issuers and investors, issuers bear the cost of producing information for investors. When the cost of information production is lower, companies are more likely to go public (Chemmanur and Fulghieri, 1999).

The second puzzle that arises during equity issuance is underpricing. At the IPO, underpricing is the return from the offer price to the close price of the first trading day. In a sample of 8,254 IPOs from 1980 to 2016, the average first-day return is 17.9% (Jay Ritter's website: `https://site.warrington.ufl.edu/ritter/`). Most explanations for underpricing are based on information asymme-

try, such as winner's curse (e.g., see Rock, 1986; Koh and Walter, 1989; Levis, 1990; Keloharju, 1993; Amihud et al., 2003), information revelation cost (e.g., see Benveniste and Spindt, 1989; Benveniste and Wilhelm, 1990; Cornelli and Goldreich, 2001), principal-agent problem (Loughran and Ritter, 2002 ; Reuter, 2006), signaling device (Ibbotson, 1975; Jegadeesh et al., 1993; Michaely and Shaw, 1994), informational cascades (Welch, 1992), and investor sentiment (Miller, 1977; Ljungqvist et al., 2006).[1]

The third puzzle during equity issuance is long-run underperformance. After the IPO, the average three-year buy-and-hold return (adjusted against the market return) is -18% from 1980 to 2013 (Jay Ritter's website: `https://site.warrington.ufl.edu/ritter/`). One explanation for underperformance is based on investor sentiment (Miller, 1977). Due to information asymmetry, investors have heterogeneous expectations regarding the value of the IPO company. Shortly after the IPO, the stock price of an IPO company is determined by a small group of optimistic investors. The number of optimistic investors decreases over time, and the stock price of the IPO company decreases accordingly. Another explanation for underperformance is the optimistic accounting prior to the IPO (Teoh et al., 1998). Prior to the IPO, companies are eager to look good through optimistic accounting. Utilizing optimistic accounting reports, the market overprices IPO companies at the time of the IPO, which leads to poor long-run performance.

During equity issuance, underwriters play an important role in reducing infor-

[1]Other explanations for underpricing include legal liability (e.g., see Tinic, 1988; Hughes and Thakor, 1992; Hensler, 1995; Lowry and Schwert, 2002), tax avoidance (Rydqvist, 1997), and control retention (Brennan and Franks, 1997; Pagano et al., 1998).

mation asymmetry. Their committed roles include equity price, share allocation, and price stabilization(Ritter and Welch, 2002; Ellis et al., 2000). An interesting feature of the underwriting contract between issuers and underwriters that has become more common in the past decades is the lockup agreement. In the U.S., lockup agreements are voluntarily negotiated between underwriters and insiders in the issuing companies and restrict insiders from selling their shares during the lockup period. In the remainder of this chapter, I review the literature on lockup agreements during equity issuance. First, I investigate the rationale for lockups theoretically and empirically. After that, I discuss the motivation for my research on lockups.

2.1. Theoretical framework: Use of lockups

To explain the use of IPO lockups, previous studies (e.g., see Brav and Gompers, 2003; Brau et al., 2005; Yung and Zender, 2010) build on the theoretical framework developed by Leland and Pyle (1977).

In Leland and Pyle (1977), under asymmetric information, risk-averse entrepreneurs use their willingness to retain equity as a signal of their project values and company quality. In the context of an IPO, IPO company insiders use the number of shares they retain in the IPO company to signal the company quality. Under asymmetric information, such a signal is costly because, in equilibrium, risk-averse insiders have to retain more equity than they would hold under full information.

The model in Leland and Pyle (1977) yields a separating equilibrium, in which

equity retention signals the company quality. An implicit assumption to derive the separating equilibrium is that insiders have only one opportunity to sell equity before the market identifies the true quality of the company. The assumption of a single sale is important. Without it, insiders in bad companies can retain equity initially to mimic their counterparts in good companies and then sell more of their equity at the price of good companies. Therefore, a separating equilibrium does not always exist. If insiders have a second opportunity to sell their shares on the secondary market shortly after the IPO, pooling equilibria dominate the separating equilibrium even if the separating equilibrium exists (Gale and Stiglitz, 1989).

Similar to Gale and Stiglitz (1989), Courteau (1995) gives the insiders opportunities to sell their shares after the IPO. In order to yield a separating equilibrium as Leland and Pyle (1977) illustrate, Courteau (1995) introduces the concept of lockups.[2] In the IPO prospectus, insiders commit not to sell their shares for a certain period. During the commitment period, more information is revealed regarding the company quality.[3] Therefore, bad companies bear higher costs than good companies during the commitment period, and the model in Courteau (1995) yields a separating equilibrium.

While Courteau (1995) discusses the multiple information resolution processes during lockup periods with predetermined lockup lengths, Brau et al. (2005) incorporate the relation between the lockup length and the information resolution

[2]Courteau (1995) does not use the exact word of "lockups" but "voluntary commitments" beyond the minimum holding period.

[3]When no information on the company quality is revealed during the commitment period, the model in Courteau (1995) yields the same result as Gale and Stiglitz (1989), and there is no separating equilibrium.

process into their model. In Brau et al. (2005), when the degree of information asymmetry is lower, the company quality is more likely to be revealed during a shorter period. A shorter lockup length is costly enough to distinguish between good and bad companies. Therefore, the higher the degree of information asymmetry, the longer the lockup length.

2.2. Empirical evidence: Use of lockups

Signaling

Brav and Gompers (2003) test three potential explanations for the existence of lockups. The first explanation is a direct implication from the theoretical framework in Leland and Pyle (1977). IPO companies use lockups to signal their quality. Based on the signaling hypothesis, Brav and Gompers (2003) argue that better companies would agree to longer lockups in exchange for higher offer prices at the IPO or subsequent SEOs. Using a sample of 2,871 IPOs over the period 1988-1996, Brav and Gompers (2003) do not find empirical support for this signaling hypothesis. First, Brav and Gompers (2003) use the offer price revision to measure the impact of the lockup signal on the offer price. Following the signaling hypothesis, IPO companies with longer lockup lengths have higher quality, so their offer prices are more likely to be revised upward compared to the midpoint of the initial offer range. However, empirical results suggest that IPO companies with positive price revisions are associated with shorter lockup lengths. Second, Brav and Gompers (2003) examine the impact of the lockup signal on the probability of SEO. Following the signaling hypothesis, IPO companies with longer lockup

lengths signal their higher quality, so they are more likely to issue SEOs to benefit from the revelation of their quality. However, Brav and Gompers (2003) find that IPO companies with longer lockup lengths are less likely to issue SEOs. Therefore, the empirical results of Brav and Gompers (2003) do not support the signaling hypothesis.

Commitment

A second potential explanation for the existence of lockups in Brav and Gompers (2003) is that lockups serve as a commitment device to alleviate moral hazard problems. Under asymmetric information, managers in the aftermarket might not act in the best interest of shareholders. If managers are free to sell their shares shortly after the IPO, they are more likely to shirk their responsibilities and take advantage of investors who purchase shares at the IPO. Lockups ensure that managers remain committed to company operations after the IPO. Based on the commitment hypothesis, Brav and Gompers (2003) argue that those IPO companies that, ex ante, suffer a greater potential for moral hazard problems would require longer lockups. Brav and Gompers (2003) use the company size, venture capital (VC) involvement, and underwriter reputation to measure the potential for moral hazard problems. Companies with larger size, reputable underwriters, or venture backing are unlikely to take advantage of outside investors; therefore, the potential for moral hazard problems is smaller. Brav and Gompers (2003) find support for the commitment hypothesis: companies with larger sizes, VC involvement, and reputable underwriters have shorter lockups on average.

Compensation extraction

The third potential explanation for the use of lockups is based on the compensation extraction. In a typical lockup agreement, underwriters have the right to release locked-up shares before lockup expiration. Underwriters can use such a right to extract additional compensation from IPO companies. IPO companies whose insiders want to sell their shares earlier than lockup expiration need to generate additional compensation for underwriters. For example, IPO companies can conduct block transactions or SEOs through underwriters. Based on the compensation extraction hypothesis, Brav and Gompers (2003) argue that underwriters with greater market power tend to impose longer lockups on IPO companies to extract compensation. However, the empirical results in Brav and Gompers (2003) suggest that reputable underwriters tend to impose shorter lockups on IPO companies, which does not support the compensation extraction hypothesis. In addition, Brav and Gompers (2003) examine a couple of channels through which underwriters can extract compensation from IPO company insiders. First, potential income from transaction fees only makes a very small contribution to the revenue of underwriters. Second, issuance of an SEO during the lockup period has no significant impact on the probability that IPO companies switch lead underwriters in their SEOs. Therefore, underwriters do not extract additional compensation from IPO company insiders through either transactions or SEOs.

Reconciliation of signaling and commitment explanations

Brav and Gompers (2003) propose three hypotheses on the existence of lockups, but they find the empirical support for only one of the three. Namely, underwriters use lockups as a commitment device to alleviate moral hazard problems. The empirical results in Brau et al. (2005) are similar to those in Brav and Gompers (2003). Larger companies, VC-backed companies, and companies with reputable underwriters and auditors have shorter lockups. Moreover, Brau et al. (2005) examine the relation between different types of equity issuance and lockup lengths. First, compared to SEOs, IPOs have longer lockups. Second, equity issuances by investment funds and utility companies have shorter lockups.

Although the empirical results in Brau et al. (2005) are similar to those in Brav and Gompers (2003), the former argue that their empirical results support the signaling hypothesis rather than the commitment hypothesis proposed by the latter. First, Brau et al. (2005) challenge the implications of the signaling hypothesis in Brav and Gompers (2003), which claims that better companies would agree to longer lockups to signal their quality so that they could receive positive price revisions at the IPO or be more likely to succeed in the SEO market. The positive relation between lockup length and price revision is based on a sequential design of IPO contract: (1) underwriters propose a range for the offer price; (2) IPO companies use lockups to signal their quality; (3) investors express their interests in the equity to be issued; and (4) underwriters revise the offer pricing. However, the sequence of deciding the offer price range before the lockup length is not definite. IPO companies spend many months to several years seeking underwriters

and preparing the initial prospectus. It is possible that underwriters and IPO companies together decide on the offer price range and the lockup length simultaneously. Therefore, the price revision after the initial prospectus is not necessarily a result of signaling by means of lockups. Brau et al. (2005) also argue that the positive relation between the lockup length and the follow-on SEO probability is not an implication of lockup signaling. According to Brav and Gompers (2003), IPO companies with longer lockup lengths signal their higher quality, so they are more likely to issue SEOs to benefit from the revelation of that quality. However, according to Gale and Stiglitz (1989), nature must have a chance to reveal the company quality during the lockup period. Therefore, investors do not need to use lockup lengths as a signal to estimate the company quality at the time of the SEO, and the positive relation between the lockup length and the follow-on SEO probability does not support the signaling hypothesis.

Second, Brau et al. (2005) discuss shortcomings of the commitment explanation in Brav and Gompers (2003), according to which, lockups encourage insiders not to shirk their responsibilities and to focus on value-enhancing activities. One of the most serious shortcomings of this explanation is that lockup lengths are short. The typical IPO lockup length is 180 days, and the typical SEO lockup length is 90 days. If, ex ante, an insider wants to shirk his/her duties, the cost for him/her to temporarily commit to the company during a 180 day (or 90 day) lockup period is low. Moreover, this temporary commitment by insiders who want to shirk during short lockup periods has little impact on the value of the newly listed companies. In the commitment explanation, both the cost and benefit of a lockup are low.

Lastly, Brau et al. (2005) conclude that their empirical results as well as those in Brav and Gompers (2003) support the signaling hypothesis rather than the commitment hypothesis. All the variables used in Brav and Gompers (2003) to measure the requirements for a commitment device also measure the degree of information asymmetry, such as company size, VC involvement, and underwriter reputation. Since both the cost and benefit of a lockup are low according to the commitment hypothesis, the positive relation between the lockup length and those variables that measure the degree of information asymmetry is more likely to provide support for the signaling hypothesis.

Based on similar empirical results, Brav and Gompers (2003) argue in favor of the commitment hypothesis, while Brau et al. (2005) contend that the empirical evidence is more aligned with the signaling hypothesis. Motivated by Brav and Gompers (2003) and Brau et al. (2005), Yung and Zender (2010) aim to resolve the conflict between the signaling hypothesis and the commitment hypothesis.

Yung and Zender (2010) argue that the signaling hypothesis and the commitment hypothesis are not mutually exclusive. All IPO companies suffer both adverse selection and moral hazard problems. However, in some IPOs, the adverse selection problem is the dominant consideration in the inclusion of lockups; in others, the primary purpose of lockups is to mitigate the moral hazard problem. Yung and Zender (2010) separate all IPOs into two subsamples based on the dominant considerations in the use of lockups. Empirically, they use the company size and the underwriter reputation to separate the sample into two subsamples. In the subsample of smaller IPOs or IPOs with less reputable underwriters, the

adverse selection problem dominates. In the subsample of larger IPOs or IPOs with more reputable underwriters, the moral hazard problem dominates.

This sample bifurcation leads to different predictions on the correlations between lockup lengths and key variables. First, Yung and Zender (2010) examine the correlation between lockup lengths and underpricing. In the subsample where the adverse selection problem dominates, the lockup length and underpricing exhibit a positive correlation, because the higher degree of information asymmetry leads to both longer lockup length and higher underpricing. In the subsample where the moral hazard problem dominates, the lockup length and underpricing are not correlated, because the degree of information asymmetry has an impact on underpricing but not on lockup length. Yung and Zender (2010) find that the correlation between lockup length and underpricing is 0.152 and significant in the subsample of smaller IPOs, but this correlation becomes insignificant in the subsample of larger IPOs.

A second correlation that Yung and Zender (2010) examine is between lockup lengths and post-IPO insider ownership. In the subsample where the moral hazard problem dominates, underwriters use a combination of signals through equity retention and lockups to add costs to IPO company insiders and control the moral hazard problem. The signal through equity retention and the signal through lockups substitute for each other. Therefore, the lockup length and the post-IPO insider ownership exhibit a negative correlation. In the subsample where the adverse selection problem dominates, company quality determines equity retention, while the degree of information asymmetry determines the lockup length. There-

fore, the lockup length and the post-IPO insider ownership are not correlated. Yung and Zender (2010) find that the correlation between the lockup length and the post-IPO insider ownership is -0.094 in the subsample of larger IPOs, but this correlation becomes insignificant in the subsample of smaller IPOs.

In addition, Yung and Zender (2010) perform regression analyses on the determinants of lockup lengths. Following the arguments based on the sample bifurcation, the measurements for information asymmetry determine lockup lengths in the subsample of smaller IPOs but not in the subsample of larger IPOs. Yung and Zender (2010) use the time-series volatility of the stock price in an IPO company as a proxy for information asymmetry. The time-series volatility is measured as the standard deviation of residuals from a market model during a time window of 70 days before lockup expiration. A potential endogeneity problem exists when the lockup length and the post-IPO insider ownership are jointly chosen. Yung and Zender (2010) use the pre-IPO insider ownership as the primary instrument for the post-IPO insider ownership and run a two-stage regression. Consistent with expectations, in the second-stage regression, the coefficient of volatility is significantly positive in the subsample of smaller IPOs but not in the subsample of larger IPOs.

SEO lockups

While previous studies focus primarily on IPO lockups, Karpoff et al. (2013) argue that information asymmetry is the central reason for lockups using data on 2,579 SEOs over the period 1996-2006. Karpoff et al. (2013) make five contributions to

the general understanding of lockups.

First, Karpoff et al. (2013) document that the percentage of SEOs with lockups is 93.8%, which is lower than the percentage of IPOs with lockups (96.6%). Moreover, SEO lockups are shorter than IPO lockups. The SEO lockup length has become standardized at 90 days, while the IPO lockup length has become standardized at 180 days. Information asymmetry problems are smaller during SEOs than during IPOs. Compared to IPOs, the lower percentage of equity issues with lockups and the shorter lockup lengths during SEOs suggest that information asymmetry is the central reason for lockups.

Second, Karpoff et al. (2013) find that a single measure of information asymmetry between company insiders and outside investors is the primary determinant of SEO lockup lengths. Karpoff et al. (2013) construct the single measure of information asymmetry using the factor analysis on a number of frequently used variables in previous studies. Five frequently used variables are negatively related to information asymmetry, including company size, time since IPO, number of analysts, tangible assets, and number of prior stock offers. In companies with higher values for these variables, outside investors have a better understanding of company values, and any informational advantage of company insiders over outside investors is lower. Therefore, these variables are negatively related to information asymmetry. On the other hand, three variables are positively related to information asymmetry, including bid-ask spread, return volatility, and abnormal accrual. The bid-ask spread and return volatility reflect the level of uncertainties of outside investors with respect to company values. In addition, larger abnormal accruals

suggest that the company financial statements are less informative. Therefore, these three variables are positively correlated to information asymmetry. A drawback of including all eight of these variables in regression analysis is that it induces an attenuation bias in the estimated coefficients, because some of these variables are highly correlated. Therefore, Karpoff et al. (2013) construct a single measure of information asymmetry using the factor analysis on these eight variables. The eigenvalue for the first factor is 1.93, and the signs of factor loadings of all eight variables are consistent with the predictions. The company size has the largest factor loading, followed by the return volatility and time since IPO.

Third, Karpoff et al. (2013) find that the use of lockups reduces both underwriter spreads and underpricing. Information asymmetry increases underwriter exposure to the risk of underwriting overvalued SEOs. Underwriters have several measures at their disposal to reduce or offset this risk, including the application of longer lockups, larger underwriter spreads, and higher underpricing. These three measures complement each other. When one of the three (e.g., lockup length) increases, the other two decrease. In simple correlations, the use of lockups is positively related to both underwriter spreads and underpricing. Karpoff et al. (2013) argue that such positive relations are driven by the endogenous problem, because the use of lockups, underwriter spreads, and underpricing could be jointly determined. Karpoff et al. (2013) use the underwriter's law firm and the market-wide illiquidity measure as instruments for the use of lockups. In the instrumental variable regression analyses, the use of lockups is negatively related to both underwriter spreads and underpricing.

Fourth, Karpoff et al. (2013) document a positive relation between the post-SEO stock price performance and the likelihood of early releases. Under a typical lockup agreement, underwriters have the right to release the locked-up shares any time before lockup expiration. When post-SEO stock prices perform better, underwriters are less likely to underwrite over-valuated SEOs. Therefore, underwriters are more likely to release the locked-up shares. A one-standard-deviation increase in the cumulative return over five days after the SEO increases the likelihood of early releases by 2.8%.

Fifth, Karpoff et al. (2013) analyze abnormal stock returns around lockup expiration and find that the abnormal return of SEOs with early releases is higher than the abnormal return of SEOs without. In the SEOs with early releases, the average abnormal return over a three-day period centered on the expiration date is 0.80%; however, in the SEOs without early releases, the average abnormal return is negative. This finding is consistent with the view that information asymmetry is the central reason for lockups. Under information asymmetry, investors react positively to early releases, because underwriters are more likely to release locked-up shares in under-valuated companies.

Summary of empirical results

Table 2.1 summarizes a list of determinants of lockup lengths investigated in previous studies. The previous studies that have investigated the determinants of lockup lengths have obtained similar empirical results.

First, all four studies find that the lockup length is negatively related to the

Table 2.1: Determinants of lockup length

B&G stands for Brav and Gompers (2003). BLM stands for Brau et al. (2005). Y&Z stands for Yung and Zender (2010). KLM stands for Karpoff et al. (2013). "+" indicates a positive correlation between the lockup length and the variable. "-" indicates a negative correlation between the lockup length and the variable. * indicates that the variable coefficient is significant at a level of at least 10%.

Variable	B&G	BLM	Y&Z	KLM
VC-backed	-*		-*	
Company (or issuance) size	-*	-*	-*	-*
Insider holding	+		+*	+
Book-to-market ratio	-*			
Cash flow margin	-			
Underwriter reputation	-*	-*	-*	-
Primary shares	+		+*	+
Shares offered	+			
Unit		+*		
Investment fund		-*		
Regulated utility		-*		
High-tech		-	-*	
Auditor reputation		-*		
Idiosyncratic risk		-*		
Net selling				+*
Accelerated SEOs				-*
Leverage				+*
Share turnover				-*
Return on asset				+
Time since IPO				-*
Number of analysts				-*
Tangible assets				-*
No. of prior stock offers				-*
Bid-ask spread				+*
Return volatility			+*	+*
Abnormal accruals				+*

company (or issuance) size and the underwriter reputation. Second, three of four studies document that the lockup length is positively related to the insider holding and primary shares. Third, two of the four studies investigate the following determinants of lockup lengths: (1) VC-backed, a dummy variable indicating

whether an IPO company is VC-backed; (2) high-tech, a dummy variable indicating whether the company is in the high-tech industry; (3) return volatility. The lockup length is negatively related to VC-backed and high-tech but positively related to return volatility.

Previous studies have investigated three hypotheses for the existence of lockups: signaling, commitment, and compensation extraction. No study has provided empirical evidence in support of the compensation extraction hypothesis. Moreover, with similar empirical results, some previous studies support the signaling hypothesis, while others support the commitment hypothesis. However, these two hypotheses are not mutually exclusive. First, as Yung and Zender (2010) pointed out, all companies suffer both adverse selection and moral hazard problems under asymmetric information. Second, both hypotheses could be derived from the theoretical framework of Leland and Pyle (1977). Based on Leland and Pyle (1977), lockups are used to distinguish between good and bad companies. During lockup periods, the arrival of new information on company quality is necessary for the existence of lockups (Gale and Stiglitz, 1989; Courteau, 1995). Without considering the actions of company insiders, the purpose of lockups is to reduce the adverse selection problem. However, the commitment of company insiders is a key performance measure for company quality. Insiders in bad companies with a relatively lower level of commitment than good companies have incentives to hinder the revelation of new information about the quality of their company through temporary "non-shirking" actions. Therefore, when one accounts for the commitment of company insiders, the use of lockup is to reduce the moral hazard

problems. Empirically, it is difficult to distinguish between the signaling hypothesis and the commitment hypothesis, unless one can directly measure the incentives of company insiders before, during, and after lockup periods.

2.3. Motivation

Following on from the literature review on lockups, I have identified two areas for additional research. First, the underwriters' motivation for early releases is not clear. Previous studies (Brav and Gompers, 2003; Karpoff et al., 2013) argue that the revelation of good company quality is a critical factor that underwriters consider when deciding whether to release locked-up shares before lockup expiration. However, the question that remains unanswered is what benefits accrue to the underwriter from early releases before lockup expiration. In the absence of such benefits, it is unlikely that early releases would be observed. Therefore, in Chapter 3, I examine the underwriters' incentives for early releases.

Second, the relation between IPO lockups and SEO lockups is not clear. Based on previous studies (Leland and Pyle, 1977; Brau et al., 2005; Karpoff et al., 2013), underwriters decide whether to include lockups based on the information asymmetry between company insiders and outside investors. The projects that companies intend to finance with equity suffer different degrees of information asymmetry. Prior to the SEO, underwriters acquire new information on projects. However, underwriters may only partially incorporate the new information.[4] In

[4]Previous studies (Hanley, 1993; Lowry and Schwert, 2004; Edelen and Kadlec, 2005; Hoberg, 2007; Kutsuna et al., 2009) have documented that underwriters only partially adjust offer price in light of new information.

the circumstance where underwriters only partially adjust their lockup decisions to new information arriving between the IPO and the SEO, the IPO lockup decision will have an impact on the SEO lockup decision. Therefore, in Chapter 4, I explore the relation between IPO lockups and SEO lockups.

Chapter 3: Why are some locked-up shares released early?

3.1. Introduction

In the U.S., initial public offering (IPO) company insiders and the underwriter of the IPO voluntarily negotiate a lockup agreement before the IPO. The lockup agreement restricts insiders from selling their shares during the lockup period, which typically lasts for 180 days after the IPO. However, the underwriter has the right to release some or all of the locked-up shares and to allow insiders to sell their shares early at any time before the lockup expiration. Early sales refer to these insider sales during lockup periods. For the period from 1988 to 2011, I observe early sales in 18% of IPOs with lockup agreements. I examine why underwriters choose to release locked-up shares, arguing that underwriters use early sales to increase client loyalty and accordingly generate more future business from their clients. I focus on an important group of insiders, namely top executives, and find that early sales by top executives reduce the likelihood that IPO companies switch underwriters in their subsequent SEOs by 14%.

The theoretical framework of this study is based on Leland and Pyle (1977): IPO company insiders use the number of shares they retain in the IPO company to signal company quality. Such a signal is costly under asymmetric information because, in equilibrium, risk-averse insiders have to retain more equity than they would want to hold under full information. In Leland and Pyle (1977), an implicit assumption is that entrepreneurs have only one opportunity to sell equity

before the information resolution when the market reveals the true quality of the company. The lockup agreement, which restricts insider sales, is in line with this assumption of a single sale. Ideally, the information resolution time should be equal to the lockup length. However, the IPO lockup length is predetermined at the announcement of the IPO; on the other hand, the time needed for information resolution is uncertain. This mismatch between the predetermined lockup length and the uncertain information resolution time imposes additional costs on IPO companies for two reasons. First, if the lockup length is too short, bad IPO companies are incentivized to mimic good companies by retaining the same level of equity. Therefore, the same lockup agreements are accepted by a mix of good and bad IPO companies. In equilibrium, underwriters need to underprice IPOs to compensate investors for the proportion of bad companies. Second, if the lockup length is too extended, the period of the lockup can exceed the information resolution time and increase the under-diversification cost on IPO companies. Because the lockup length is determined at the time of the IPO, after the IPO underwriters can reduce the additional under-diversification cost by releasing locked-up shares during the lockup period.

While deciding to release locked-up shares, underwriters evaluate the trade-off between the reduction in the under-diversification cost and the risk of releasing shares in bad companies. Both underwriters and company insiders need to benefit from early releases. Insiders directly benefit from early releases through the reduction in the under-diversification cost. The benefit to underwriters from granting insiders early releases is the generation of more future business from those insiders.

However, underwriters assume risk when releasing shares in bad companies. When bad companies, ex ante, perceive a higher probability of obtaining early releases, they are more incentivized to mimic good companies in terms of equity retention and lockup length. Releasing shares in bad companies increases the proportion of bad companies in the IPO market and induces higher underwriting cost, which in turn negatively impact underwriters' future business. I argue that in deciding whether to release locked-up shares, underwriters carefully evaluate the company quality, seeking to grant only good companies early releases.

To investigate the benefit that underwriters receive from insiders with early sales, I test whether IPO companies with early sales by top executives are less likely to switch underwriters during their subsequent SEOs. Krigman et al. (2001), Brav and Gompers (2003), and Ljungqvist and Wilhelm (2005) also use the underwriter switch to measure client loyalty and future business. I estimate a probit model using a sample of 1,601 IPOs that have an SEO within the first four years after the IPO. I compute the average marginal effect of early sales on underwriter switch. For IPO lockups without early sales, the average predicted likelihood of underwriter switch is 43%; for IPO lockups with early sales, the average predicted likelihood of underwriter switch is 29%. Hence, early sales by top executives reduce the likelihood of underwriter switch by 14%.

To investigate the quality of IPOs with early sales, I test whether IPO companies with early sales perform better than their counterparts without early sales. I examine the relation between early sales and various performance measures, including short-term buy-and-hold return from the IPO to the lockup expiration,

long-term buy-and-hold return from the IPO to three years after the IPO, the probability of being delisted within four years after the IPO, and the probability of being delisted for negative reasons. The results of all tests are consistent with underwriters seeking to grant only good companies early releases. For example, the short-term return of IPOs with early sales is 0.184, while the short-term return of IPOs without early sales is -0.044. The difference in the short-term return between IPOs with and without early sales is different from zero at the 1% significance level.

Given the positive relation between early sales and IPO company performance, I further investigate whether underwriters apply their own private information to the decisions on early releases. If underwriters release locked-up shares based on their informational advantages over investors, early sales signal the good quality of IPO companies to outside investors and have a positive impact on the IPO company's post-early-sale performance. However, such private information may not always be accurate, and underwriters' application of private information increases the risk of releasing locked-up shares in bad companies. I decompose the short-term return into two components: the return from the IPO to the day before the earliest sale during the lockup period and the return from the earliest sale to lockup expiration. To measure the return from the earliest sale to lockup expiration in the control sample of IPO companies without early sales, I perform the matched sample analysis. I match the sample based on the lockup length, issuance time, industry, and market value. I find that the return until the earliest sale is a critical driver for early sales, but early sales have no significant impact

on the return after the earliest sale. This finding suggests that underwriters make use of market-wide information to identify good companies.

The negative relation observed between early sales and underwriter switch has demonstrated the benefit that underwriters obtain from early sales. According to Field and Hanka (2001), underwriters feel pressure to release locked-up shares held by insiders with whom underwriters expect to conduct future business. The probability that an IPO company conducts SEOs is a measure for the potential of future business between insiders and underwriters. I find a positive relation between early sales and the probability of future SEOs, which demonstrates underwriters' incentives to allow early sales.

However, the positive relation between early sales and the probability of future SEOs also creates a potential selection bias when I analyze the relation between early sales and underwriter switch. In the test of the relation between early sales and underwriter switch, I use a sample of 1,601 IPOs with SEOs rather than the full sample of 4,270 IPOs. Therefore, I estimate a Heckman model to explore the relation between early sales and underwriter switch in the full sample of 4,270 IPOs. The significant negative relation between early sales and underwriter switch identified by the Heckman model provides additional evidence for underwriters' incentives from early releases. The probit model demonstrates that underwriters directly benefit from the increased future business if IPO companies conduct SEOs. The Heckman model demonstrates that early sales increase client loyalty in the full sample including the IPOs without SEOs. Even if the subsample of IPOs without SEOs had conducted SEOs, IPO companies with early sales would still

be less likely to switch underwriters than their counterparts without early sales.

In addition, I investigate two alternative explanations for the channel through which underwriters benefit from early sales. First, underwriters that release locked-up shares could benefit from more future IPO business. Early sales favor IPO company insiders. Not only IPO companies whose insiders exercise early sales but also those companies that plan to go public would prefer to conduct business with underwriters that grant early releases rather than with those that do not all else being equal. Therefore, early sales attract more IPO business for the underwriter. To test this explanation, I check whether early sales increase underwriter ranks. An underwriter rank reflects underwriter's reputation and market share in the IPO market. I find that early sales have no significant impact on the underwriter rank. Underwriters cannot benefit from early sales in terms of higher ranks and increased future IPO business.

Second, underwriters could release locked-up shares in both good and bad companies in order to benefit from increased future business obtained from bad companies. In this study, I contend that underwriters are concerned about the risk of releasing shares in bad companies and seek to release shares only in good companies after information resolution. An alternative to this explanation of information resolution is rent extraction, where underwriters do not consider information resolution but release shares in any IPO company that promises to bring increased future business to the underwriters. Releasing locked-up shares in bad companies would increase the proportion of bad companies accepting lockup agreements, and the rent is extracted from investors. The explanation of rent extraction would lead

to two predictions: (1) the performance of IPO companies with early sales is not better than that of IPO companies without early sales; and (2) higher-rank underwriters, considering their high market power, are more likely to release shares in bad IPO companies. However, I find no evidence in support of these two predictions; therefore, I conclude that the empirical results of this study are more consistent with the explanation of information resolution leading to early sales.

This paper makes two contributions to the existing literature. The first contribution is to investigate the underwriter's incentive to allow early sales. Brav and Gompers (2003) and Karpoff et al. (2013) find that returns after equity issuance are positively related to early releases. I am interested not only in the conditions under which underwriters release locked-up shares but also in the channels through which underwriters benefit from early sales. Field and Hanka (2001) point out that underwriters feel pressure to release insiders, especially when those insiders include venture capital (VC) firms, with whom the underwriters expect to conduct future business. In this study, I add to Field and Hanka (2001) by focusing on a different group of insiders, top executives. I find that when underwriters release locked-up shares during IPO lockups, (1) the IPO companies are more likely to issue SEOs within the four years after the IPO; (2) the time between the IPO and the first SEO is shorter; and (3) the IPO companies are less likely to switch underwriters during the first SEO.

The second contribution is to examine client relationships within the underwriting business. Reuter (2006) and Nimalendran et al. (2007) find that those investors who generate more stock-trading commissions for underwriters are more

likely to receive favorable IPO allocations from underwriters. Bharath et al. (2007) find that the IPO company is more likely to choose an underwriter that has provided the company with loan service before the IPO. Krigman et al. (2001), Brav and Gompers (2003), and Ljungqvist and Wilhelm (2005) investigate why IPO companies switch underwriters in their SEOs. They find that underwriter reputation and CEO satisfaction are important factors when IPO companies decide to switch underwriters. In this study, I identify early sales as another factor that affects underwriter switch.

3.2. Hypothesis development

In the U.S., the IPO lockup is a voluntary agreement between the IPO company and the IPO underwriter. Under a typical lockup agreement, all insiders in the IPO company agree not to, "directly or indirectly, sell, offer, contract to sell, make any short sale, pledge or otherwise dispose of any shares of common stock or any securities convertible into or exercisable for or any rights to purchase or acquire common stock" (Brav and Gompers, 2003). However, the lead underwriter(s) may, in his/her (their) sole discretion, choose to release any or all of the shares that are subject to the lockup agreement at any time prior to the expiration of the lockup period without notice.

Previous studies (e.g., Courteau, 1995; Brav and Gompers, 2003; Brau et al., 2005) use Leland and Pyle (1977) to explain the existence of lockups. Based on Leland and Pyle (1977), IPO company insiders use the number of shares they retain in the IPO company to signal company quality. Such a signal is costly

under asymmetric information because in equilibrium, risk-averse insiders have to retain more equity than they would hold under full information. In Leland and Pyle (1977), an implicit assumption is that entrepreneurs have only one opportunity to sell equity before the information resolution, when the market reveals the true quality of the company. This assumption of a single sale is important. Without it, entrepreneurs in bad companies can initially retain equity to mimic their counterparts in good companies and then sell more of their equity at the price of good companies. The assumption of a single sale ensures that the signal that entrepreneurs send to the market through equity retention is credible. In the context of the IPO, the lockup agreement is in line with the assumption of a single sale. Lockups prevent insiders from selling their shares before the market reveals the true quality of the IPO company.

Ideally, the information resolution time should be equal to the lockup length. As soon as information is resolved, insiders sell more shares and reduce their equity retention to the level that they would hold under full information. However, the IPO lockup length is predetermined at the announcement of the IPO, while the time needed for information resolution is uncertain (Figure 3.1A). Under asymmetric information, an underwriter enters the same lockup agreement with IPO companies which look identical to the underwriter. The underwriter only knows the distribution of resolution time of these companies, while insiders know the information resolution time of their own companies.

Compared to the ideal situation where the information resolution time is equal to the lockup length, the mismatch between the predetermined lockup length

and the uncertain information resolution time imposes additional costs on IPO companies for two reasons. First, if the predetermined lockup length is too short, a large group of IPOs expect their information resolution time to be longer than the predetermined lockup length. Bad companies with longer information resolution time have greater incentives to mimic good IPO companies. Therefore, IPOs that accept the same lockup agreement are a mix of good and bad companies, and the proportion of bad companies is determined by the distribution of the information resolution time and the lockup length. Underwriters and investors are able to estimate the proportion of bad companies. In equilibrium, underwriters need to underprice IPOs to compensate investors for the proportion of bad companies. On the other hand, if the predetermined lockup length is too long, the information resolution time in a large group of IPOs is shorter than the predetermined lockup length. The period of the lockup in excess of the information resolution time is not necessary to identify IPO company quality but does impose additional under-diversification cost on the IPO companies (Leland and Pyle, 1977). While underwriters cannot directly reduce the cost of underpricing when the lockup length is too short, they can reduce the additional under-diversification cost by releasing the locked-up shares early prior to the lockup expiration.

During the IPO process, underwriters need to make two decisions: (1) inclusion of lockups and (2) early releases (Figure 3.1B). The focus of this study is not on the determinants for lockups but the considerations for early releases. I follow the previous studies (e.g., Courteau, 1995; Brav and Gompers, 2003; Brau et al., 2005) and attribute the lockup decision to information asymmetry. Conditional

on the existence of lockups, I investigate the underwriter's considerations for early releases.

While deciding whether to release locked-up shares, underwriters evaluate the trade-off between the reduction in the under-diversification cost and the risk of releasing shares in bad companies. Based on the benefit and the cost of early releases, I develop the two hypotheses in this study. Insiders directly benefit from early releases through the reduction in the under-diversification cost. Underwriters benefit from early sales when they receive more future business from insiders to whom they grant early releases. Field and Hanka (2001) point out that underwriters feel pressure to release locked-up shares held by insiders with whom the underwriters expect to conduct future business. Krigman et al. (2001), Brav and Gompers (2003), and Ljungqvist and Wilhelm (2005) use underwriter switch to measure client loyalty and future business. Underwriter switch is a dummy variable, which is equal to one if an IPO company switches the lead underwriter in its first SEO.[5] The first testable hypothesis I offer is thus:

H1: IPO companies with early sales are less likely to switch underwriters during their SEOs.

On the other hand, in term of the cost of early releases, underwriters face the risk of releasing shares in bad companies. When insiders in bad companies are able to obtain early releases from underwriters and sell their shares before the revelation of their company quality, bad companies have greater incentives

[5]Future SEOs from the IPO companies are one of the most important channels of future business from insiders. Other channels could be future M&As from top executive insiders and future IPOs from the VC firm insiders. However, in this study, I use underwriter switch in the first SEO to demonstrate the impact of early sales on client loyalty and future business.

to mimic good companies at the IPO. In this situation, the proportion of bad companies will be greater than that at equilibrium in the situation without early releases. Underwriters could further underprice IPOs to compensate investors for the greater proportion of bad companies. However, if underwriters further underprice IPOs, they add costs to IPO companies. If underwriters do not further underprice IPOs, they add costs to investors. In either case, releasing shares in bad companies induces more cost during the IPO, which in turn impacts underwriters' future business. I argue that during the decision to release locked-up shares, underwriters carefully evaluate the company quality and seek to grant only good companies early releases. Therefore, I form the second hypothesis:

H2: IPO companies with early sales have better performance than their counterparts without early sales.

The alternative hypothesis of H2 is that IPO companies with early sales have no better performance than their counterparts without early sales. This alternative hypothesis implies that underwriters decide on early releases without considering the quality of IPO companies. All else equal, reputable underwriters are more likely to release locked-up shares due perhaps to their larger market share and greater reputation, thus they are less dependent on specific clients for future business and have more to lose from improper/incorrect early releases.

3.3. Data

In this study, I use the Thomson Financial Securities Data Company (SDC) new issues database to identify an initial sample of IPOs in the U.S. over the period

of 1988-2013. Following previous studies on lockups (e.g., Field and Hanka, 2001; Brav and Gompers, 2003; Yung and Zender, 2010; Chen et al., 2012), I exclude several special classes of IPOs, such as closed-end funds, real estate investment trusts (REITs), American depository receipts (ADRs), carveouts, etc. I further exclude "penny stocks" with an offer price below \$5. To perform empirical tests, I require IPO companies to have daily returns data available from the Center for Research in Security Prices (CRSP) and financial statement data available from Compustat. This requirement further reduces the sample. Moreover, I focus on IPOs with lockups. As a result, the final sample consists of 4,270 IPOs with lockup agreements.

Early sales

The early sale data is obtained from the Thomson Reuters Insider Filing Data Feed (IFDF). The IFDF records the insider trading activities as reported on Forms 3, 4, 5, and 144 with line-by-line details. In this study, I focus on insider sale activities marked as "S" in the IFDF, which include open market and private sales of non-derivative or derivative securities. All these activities are restricted during the lockup period under a standard lockup agreement. I exclude the amended transactions and problematic records (CLEANSE = A or S). Insider sales during lockup periods are early sales, and 32% (= 1380/4270) of IPOs have early sales.

Furthermore, I follow the data reduction process in Brav and Gompers (2003) and exclude insider sales when the aggregate sales on a given day exceed the reported share volume from CRSP. The data reduction process in Brav and Gompers

(2003) helps to separate early sales caused by early releases from those caused by overallotment options (OAOs). In this study, I focus on the early sales when the underwriter releases shares locked-up under the lockup agreement. Karpoff et al. (2013) notice that underwriter exercices of OAOs could be a reason for early sales. It is empirically difficult to separate early sales caused by early releases from those caused by OAOs. This study faces that very challenge. The data reduction process in Brav and Gompers (2003) helps to exclude OAO early sales. In a typical OAO agreement, the underwriter has the option to purchase an additional 15% of the shares issued at the IPO at the offer price (Aggarwal, 2000; Ellis et al., 2000). When an underwriter exercises OAOs, insiders usually file Form 4 on the same day, and the aggregate sales on a given day exceed the reported share volume from CRSP. The data reduction process in Brav and Gompers (2003) thereby helps to exclude OAO early sales. When I follow Brav and Gompers (2003) and reduce data, the percentage of IPOs with early sales becomes 18% (= 756/4270).[6]

Alternative to the data reduction process in Brav and Gompers (2003), I use the sale transaction time and price to exclude OAO early sales. In the first alternative, I exclude early sales in the first week after the issuance day. Karpoff et al. (2013) contend that early sales that occur more than one week after the equity issuance are unlikely to be related to OAOs. In the second alternative, I exclude early sales whose transaction prices are equal to or lower than the offer prices. When insiders file Form 4, they report either the offer price or the offer price net the gross spread per share as the transaction price. The underwriter receives a

[6]This percentage of IPOs with early sales is comparable to 16% (= 429/2746) in Brav and Gompers (2003) and 17% (= 54/334) in Field and Hanka (2001).

gross spread on OAO shares, so some insiders consider that the underwriter purchases their shares at the price of the offer price net the gross spread per share. Therefore, early sales with sale prices equal to or lower than the offer price are likely to be OAO early sales. On the other hand, early sales with sale prices greater than the offer price are unlikely to be OAO early sales. I repeat all analyses in the samples that include OAO early sales and that use different methods to exclude OAO early sales. The empirical results are qualitatively similar.

I further exclude early sales not by top executives. In this study, I focus on the future business of SEOs. Top executives play an important role in selecting underwriters for SEOs. First, I identify top executives based on IFDF. IFDF classifies all insiders into four levels according to hierarchy. Insiders with the highest hierarchy include chairman of the board, chief executive officer, chief operating officer, general counsel, and president. Initially, I identify these five types of insiders as top executives. Second, based on previous studies (e.g., Seyhun and Bradley, 1997 and Chen et al., 2012), I add officer-directors, chief financial officers, vice presidents, and controlling persons to the set of top executives.[7] As a result, I find that 10% (= 446/4270) of IPOs have early sales by top executives.

Table 3.1 reports the total number of IPOs, percentage of IPOs with lockup length equal to 180 days, percentage of IPOs with early sales, number of early sale transactions, and early sale size. I use the total shares outstanding to standardize the early sale size. I split the sample by the issuance year. Consistent with Field and Hanka (2001) and Karpoff et al. (2013), the lockup length becomes

[7]Although different studies have slightly different definitions of top executives, I repeat all analyses based on the different definitions, and the empirical results are qualitatively similar.

more standardized at 180 days over the sample period. In 1988, only 34.8% of lockup lengths are 180 days, while in each year from 2008 to 2011, over 90% of lockup lengths are 180 days. In the full sample, the percentage of IPOs with early sales by top executives is 10%. This percentage varies from year to year over the sample period. Generally, when the number of IPOs in a given year is larger, the percentage of IPOs with early sales is also higher. The larger number of IPOs in a given year indicates a hotter IPO market. In a hotter IPO market, the post-IPO stock price of an IPO company is more likely to be high and send a signal of good quality. Therefore, the underwriter is more likely to release locked-up shares and allow early sales. On the other hand, a smaller number of IPOs in a given year is associated with a lower percentage of IPOs with early sales. For example, in both 2001 and 2008, the numbers of IPOs are smaller and the percentages of IPOs with early sales are lower compared to their neighboring years. The smaller numbers of IPOs and the lower percentages of IPOs with early sales in 2001 and 2008 are consistent with the identification of business contractions by the National Bureau of Economic Research (NBER). According to the NBER, most months in 2001 and the entire year in 2008 experience business contractions.

The distribution of the number of transactions is right-skewed. The mean of early sale transactions is 4.2, whereas the median is 2. Likewise, the early sale size also has a right-skewed distribution, with the mean equal to 0.0163 and the median equal to 0.0067. These two right-skewed distributions indicate that a small number of IPOs have extensive early sales with a large number of transactions. Similar to the percentage of IPOs with early sales, early sale transactions and the

early sale size fluctuate over time, such as when these two measures both drop to very low levels in 2008.

[Place Table 3.1 here]

Table 3.2 reports early sale characteristics. The sample consists of 1,893 early sale transactions. The early sale size is the number of early sale shares divided by the total shares outstanding in the IPO company. The early sale time is the number of days from the IPO to the early sale divided by the lockup length in days. The early sale price is the relative price change from the offer price to the sale price. The mean of the transaction size is 0.0038, but the median is 0.0007. Many early sale transactions (at least 25%) have a very small size (< 0.0001). The mean transaction time is 0.4901. The 25% percentile of early sale time is 0.1111, which is equal to 20 days in the typical situation when the lockup length is 180 days. Figure 3.2 plots the cumulative frequency of the time of the earliest sale in an IPO. The time of the earliest sale is a proxy for the time when an underwriter releases locked-up shares. The release time has a similar distribution to early sale time: 200 of 446 IPOs have a release time shorter than 0.1222. That is because more than half of IPOs only have one or two early sales. The mean of the early sale price is 0.6210.

[Place Table 3.2 here]

[Place Figure 3.2 here]

Descriptive statistics

Table 3.3 reports descriptive statistics for 4,270 IPOs. Variable definitions are in Appendix A. Panel A reports statistics of dummy variables and uses z-tests to compare the two groups of IPOs with and without early sales. VC-Backed IPOs and high-tech IPOs are more likely to have early sales. IPOs with early sales are more likely to have an SEO within four years after the IPO. This suggests that underwriters assess the probability of future business when they make decisions to release locked-up shares. IPOs with early sales have a lower delisting probability than their counterparts without early sales, but the difference is not significant.

Panel B reports statistics of continuous variables and uses t-tests to compare the two groups of IPOs with and without early sales. IPOs with early sales offer fewer shares, higher price revision, higher underpricing, and higher short-term and long-term returns. The differences in these variables between the IPOs with and without early sales are consistent with my second hypothesis on company performance. Based on Leland and Pyle (1977), good IPO companies tend to retain more equity at the IPO. During lockup periods, good companies reveal their quality and are more likely to receive early releases. After lockup expiration, IPO companies with early sales continue to perform better than their counterparts without early sales.

In addition, underwriters of IPOs with early sales have higher ranks than those without early sales. However, the rank changes of IPOs with early sales are smaller than those without early sales. The smaller rank changes of IPOs with early sales have two possible explanations. First, the market punishes underwriters for early

sales. Second, underwriters of IPOs with early sales have higher ranks, but the underwriter rank is bounded at 9. The room for the underwriter rank improvement in those IPOs with early sales is more limited.

[Place Table 3.3 here]

3.4. Underwriter switch

In this section, I test the first hypothesis that IPO companies with early sales are less likely to switch underwriters during their SEOs. I assert that underwriters grant insiders early releases to generate more future business from those insiders. Krigman et al. (2001), Brav and Gompers (2003), and Ljungqvist and Wilhelm (2005) use underwriter switch to measure client loyalty and future business. Following these studies, I define the underwriter switch as a dummy variable, which is equal to one if an IPO company switches the lead underwriter in its first SEO.

In Table 3.4, Panel A compares variable statistics between switchers and non-switchers. The sample is 1,601 IPOs that have an SEO within the first four years after the IPO, and 943 of them do not switch their lead underwriters during their SEOs. Panel B reports regression results on the relation between early sales and underwriter switch. In the probit regression, the dependent variable is *Dum Switch*, indicating whether an IPO company switches its underwriter during the SEO. The key explanatory variable is *Dum Early Sale*, indicating whether early sales by top executives occur. The coefficients of *Dum Early Sale* are significantly negative across all four models.

[Place Table 3.4 here]

I compute the average marginal effect of *Dum Early Sale* on *Dum Switch*. Based on the results in Column (1), when *Dum Early Sale* = 0, the average predicted likelihood of an underwriter switch is 43%; when *Dum Early Sale* = 1, the average predicted likelihood of an underwriter switch is 29%. Early sales by top executives reduce the likelihood of an underwriter switch by 14%. In Column (2), the interaction term, *Dum Early Sale * Time of Earliest Sale*, has a positive coefficient. The later the underwriter releases locked-up shares, the smaller the reduction in signaling cost, so IPO companies are more likely to switch underwriters. However, the coefficient of this interaction term is not significant. In addition, *Months from IPO to SEO* has a significant positive coefficient. The likelihood of underwriter switch is higher, the longer the time between the IPO and the SEO, which is consistent with previous studies (James, 1992; Krigman et al., 2001; Brav and Gompers, 2003). In Column (3), which includes *Months from IPO to SEO* as an independent variable, the coefficient of *Dum Early Sale* becomes less significant. That is because *Dum Early Sale* is also a strong predictor for *Months from IPO to SEO*. The correlation between *Dum Early Sale* and *Months from IPO to SEO* is high.

The coefficients of *Log(Expected Proceed)*, *Price Revision*, and *Rank Change* are also significant. Their directions are consistent with Krigman et al. (2001) and Brav and Gompers (2003). The logarithm of the expected proceeds from the IPO and the price revision in the IPO are negatively related to the likelihood of underwriter switch. The price revision reflects the unexpected component of IPO

proceeds. The larger the IPO proceeds, the less likely an IPO company switch its underwriter. IPO companies are more likely to switch underwriters when SEO underwriters have higher ranks (higher *Rank Change*), because issuers are more likely to "trade up" in terms of underwriters. Coefficients of the other variables are insignificant in most models.

Overall, I find that IPO companies with early sales are less likely to switch underwriters during subsequent SEOs.

3.5. Company performance

In this section, I test my second hypothesis that IPO companies with early sales have better performance than their counterparts without early sales. Underwriters face the risk of releasing shares in bad companies. Releasing shares in bad companies induces higher cost during the IPO process. I argue that during the decision to release locked-up shares, underwriters carefully evaluate the company quality and seek to grant only good companies early releases.

Table 3.5 reports regression results on the future performance of IPO companies. I examine the relation between early sales and various performance measures, such as short-term buy-and-hold return, long-term buy-and-hold return, probability of being delisted within four years after the IPO, and probability of being delisted for negative reasons.[8] The short-term return is the return from the IPO to lockup expiration, while the long-term return is the return from the IPO to two years after the IPO. Both returns are adjusted against CRSP value-weighted

[8]When the delisting code from CRSP starts with "4" or "5" (liquidations or dropped), the company is considered to be delisted for negative reasons.

market return. Columns (1) and (2) report regression results of OLS models, while Columns (3) and (4) report regression results of probit models. *Dum Early Sale* is positively related to short-term and long-term returns but negatively related to the likelihood of being delisted. IPO companies with early sales not only have higher short-term and long-term returns but also are less likely to be delisted. The coefficients of *Dum Early Sale* in Columns (3) and (4) are not significant. However, the significantly positive relations between early sales and short-term and long-term returns in Columns (1) and (2) suggest that underwriters carefully evaluate the company quality. Underwriters tend to grant good companies early releases.

[Place Table 3.5 here]

Given the positive relation between early sales and IPO company performance, I further investigate whether underwriters apply their own private information to their decisions on early releases. The private information may not always be accurate. Companies that underwriters identify to be good based on their private information could be considered bad eventually by the market. Therefore, underwriters' application of their private information increases the risk of releasing locked-up shares in bad companies. If underwriters know the quality of IPO companies better than investors, underwriters release locked-up shares based on their informational advantages over investors. Observing early sales, investors infer that IPO companies with early sales are good. Therefore, early sales have a positive impact on IPO company performance. On the other hand, if underwriters do not have information advantages or do not apply them, underwriters allow early

sales based on market-wide information that investors also perceive. Therefore, early sales have no significant impact on IPO company performance.

To investigate the impact of early sales on IPO company performance, I decompose the short-term return into two components: the return from the IPO to the day before the earliest sale and the return from the earliest sale to lockup expiration. The purpose of this decomposition is to analyze the relation between early sales and the return from the earliest sale to lockup expiration. However, one difficulty of this analysis is to measure the return from the earliest sale to lockup expiration in those IPO companies without early sales. Therefore, I perform a matched sample analysis. Each IPO company with early sales is matched with an IPO company without early sales. In each matched pair, the return from the IPO to the day before the earliest sale and the return from the earliest sale to lockup expiration are measured over the same time periods relative to the issuance day. I match the sample based on the lockup length, issuance time, industry, and market value. I concentrate on a subsample of IPOs with lockup length equal to 180 days to exclude the impact from different lockup lengths. I further exclude IPOs with early sales on the issuance day. As a result, there are 242 IPOs with early sales in the matched sample analysis. For each of the 242 IPOs, I match a set of IPOs without early sales based on issuance time ($\pm$ 1 year) and industry (same two-digit SIC code). After that, I compute the absolute values of differences in the market value between each of the 242 IPOs with early sales and its matches without early sales. The matches with the smallest absolute differences in the market value are kept for the matched sample analysis.

Table 3.6 reports the results of the matched sample analysis. Panel A compares the performance of IPO companies with early sales and their matched IPO companies without early sales. Consistent with the full sample analysis, IPO companies with early sales have significantly higher *Long-Term Return*, *Short-Term Return*, *Underpricing*, and *Dum SEO*, but lower *Dum Switcher* than their matched IPOs. In addition, *Return until Earliest Sale* is the return from the end of the first trading day to the day before the earliest sale. *Return from Earliest Sale* is the return from the day before the earliest sale to lockup expiration. The difference in *Return until Earliest Sale* is significant, while the difference in *Return from Earliest Sale* is not. Panel B reports regression results on the determinants of early sales. The dependent variable is *Dum Early Sale*. The key explanatory variable is *Return until Earliest Sale*. I use annualized returns because *Return until Earliest Sale* measures returns over different numbers of days in different IPOs. Consistent with previous studies (Brav and Gompers, 2003; Karpoff et al., 2013), *Return until Earliest Sale* is a critical driver for early sales. Panel C reports regression results on IPO performance. The dependent variables include *Long-Term Return*, *Short-Term Return*, and *Return from Earliest Sale (Annualized)*. The key explanatory variable is *Dum Early Sale*. IPOs with early sales have higher short-term and long-term returns than their matched IPOs, but early sales have no significant impact on the return after the earliest sale. This finding further supports the explanation of information resolution. Underwriters identify good IPO companies through high return after the IPO and then allow early sales from insiders in good companies. On the other hand, early sales have no impact on the

company performance. At the time of early releases, underwriters and investors agree on the quality of good companies. Underwriters use market-wide information to identify good companies, and the risk of releasing locked-up shares in bad companies is lower.

[Place Table 3.6 here]

Overall, I find that (1) IPO companies with early sales have better performance than their counterparts without early sales; and (2) underwriters grant early releases based on market-wide information that investors also perceive. Both findings suggest that underwriters are concerned about the risk of releasing locked-up shares in bad companies.

3.6. Prediction of SEOs

The negative relation between early sales and underwriter switch has demonstrated the benefit that underwriters obtain from early sales. According to Field and Hanka (2001), underwriters feel pressure to release locked-up shares held by insiders with whom underwriters expect to conduct future business. The probability that an IPO company conducts SEOs is a measure for the potential of future business between insiders and underwriters. When underwriters perceive a higher probability of future SEOs, they have greater incentives to allow early sales. Therefore, early sales predict the probability of future SEOs.

Table 3.7 reports regression results on the relation between early sales and future SEOs. I find that IPO companies with early sales are more likely to conduct

SEOs within four years after the IPO; moreover, in the IPO companies with early sales, the time between the IPO and the first SEO is shorter. Columns (1) and (2) report regression results of probit models. The sample is 4,270 IPOs, and the dependent variable is *Dum SEO*. Coefficients of *Dum Early Sale* are significantly positive in both models. Coefficients of *Underwriter Rank*, *Gross Spread*, and *Log(Market Value)* are also significant. The probability of future SEOs is higher when the underwriter ranks is higher, gross spread is lower, and market value is larger. The higher underwriter rank, lower gross spread, and larger market value all suggest better quality of IPO companies. Better IPO companies are more likely to conduct SEOs. Columns (3) and (4) report regression results of OLS models. The sample is 1,601 IPOs that have an SEO within the first four years after the IPO, and the dependent variable is *Months from IPO to SEO*. Although the sample used in Columns (3) and (4) is different from that in Columns (1) and (2), all independent variables that have significant coefficients in Columns (1) and (2) still have significant coefficients in Columns (3) and (4). However, the signs of coefficients in Columns (1) and (2) are different from those in Columns (3) and (4). The negative coefficient of *Dum Early Sale* indicates that the time between the IPO and the first SEO is three months shorter in those IPO companies with early sales than in their counterparts without early sales. The positive relation between early sales and the probability of future SEOs suggests that underwriters assess the probability of the future business of SEOs when they decide to allow early sales. Moreover, the negative relation between early sales and the time of the SEO from the IPO suggests that underwriters also assess the timeliness for

their potential future business when deciding on early releases.

[Place Table 3.7 here]

The positive relation between early sales and the probability of future SEOs demonstrates underwriters' incentives to allow early sales. However, this positive relation also creates a potential selection bias problem when I analyze the relation between early sales and underwriter switch. In the test of the relation between early sales and underwriter switch, I use a sample of 1,601 IPOs with SEOs rather than the full sample of 4,270 IPOs. The selection bias exists when IPO companies with SEOs are either more or less likely to switch underwriters than IPO companies without SEOs. Therefore, I estimate a Heckman model to explore the relation between early sales and underwriter switch in the full sample of 4,270 IPOs. In Table 3.8, the dependent variable is *Dum Switch*. For the purpose of comparison, Column (1) reports regression results of a probit model, while Columns (2) and (3) report regression results of a Heckman model. The dependent variable of the selection equation is *Dum SEO*. The main-stage equation only includes those variables whose coefficients are significant in the regressions in Table 3.4. Column (2) uses the maximum likelihood (ML) estimator in Stata and estimates a probit model for the main-stage equation. Note that *athrho* is a function of ρ, the correlation between the error terms in the selection equation and main-stage equation.[9] A large *athrho* suggests a high ρ. A significant positive *athrho* indicates that IPO companies that are more likely to conduct SEOs are more likely to switch underwriters. The coefficient of *Dum Early Sale* is -0.405

[9] $athrho = \frac{1}{2} ln[(1+\rho)/(1-\rho)]$.

in Column (1) but increases to -0.236 in Column (2). Column (3) uses the two-step consistent estimator in Stata and estimates a linear probability model for the main-stage equation. A *lambda* is the coefficient on the inverse Mills ratio (IMR). Similar to *athrho*, *lambda* is also positively correlated with ρ. A significant positive *lambda* indicates that IPO companies that are more likely to conduct SEOs are more likely to switch underwriters. Nevertheless, the coefficient of *Dum Early Sale* is still significantly negative in the main-stage regression.

The negative relation between early sales and underwriter switch identified by the Heckman model using the full sample is not as strong as that identified by the probit model using the subsample of IPOs with SEOs. However, the significant negative relation between early sales and underwriter switch identified by the Heckman model provides additional evidence for underwriters' benefit from early sales. The probit model demonstrates that underwriters directly benefit from the increase in future business of SEOs if IPO companies conduct SEOs. The Heckman model demonstrates that early sales increase client loyalty in the full sample including the IPOs without SEOs. Even if the subsample of IPOs without SEOs had conducted SEOs, IPO companies with early sales would still be less likely to switch underwriters than their counterparts without early sales.

[Place Table 3.8 here]

3.7. Alternative explanations

In this section, I investigate two alternative explanations for the channel through which underwriters benefit from early sales. First, underwriters that release locked-up shares could benefit from increased future IPO business. Early sales favor IPO company insiders. Not only IPO companies whose insiders exercise early sales but also those companies that plan to go public would prefer to conduct business with underwriters that grant early releases rather than with those that do not. Therefore, early sales attract more IPO business. To test the explanation of more future IPO business, I check whether early sales increase underwriter ranks. Underwriter ranks reflect underwriter reputations and market shares in the IPO market. If early sales can attract more IPO business, ranks of underwriters that allow early sales should increase faster than those of underwriters that do not allow early sales. The IPO market rewards underwriters for early releases.

Table 3.9 reports regression results on changes in the underwriter rank. In Columns (1) and (3), the dependent variable is *Rank Change (Two Years)*, the change in the underwriter rank during the two years after the issuance. In Columns (2) and (4), the dependent variable is *Rank Change (Four Years)*. Early sales have no significant impact on underwriter rank. The impact of early sales on underwriter ranks, if there is any, seems negative, which suggests that the market may punish underwriters for early sales. Underwriters cannot benefit from early sales by obtaining higher ranks; therefore, underwriters that release locked-up shares cannot receive increased future IPO business from companies that plan to go public.

[Place Table 3.9 here]

Second, underwriters release locked-up shares in both good and bad companies and could benefit from more future business brought by bad companies. In this study, I argue that underwriters are concerned about the risk of releasing shares in bad companies and seek to release shares only in good companies after information resolution. An alternative to this explanation of information resolution is rent extraction, where underwriters do not consider information resolution but release shares in any IPO company that promises to bring more business to the underwriters. Releasing locked-up shares in bad companies increases the proportion of bad companies accepting lockup agreements, and the rent is extracted from investors. Similar to the explanation of information resolution, the explanation of rent extraction also predicts a negative relation between early sales and underwriter switch. However, the significantly positive relation between early sales and IPO company performance in Table 3.5 is more consistent with the explanation of information resolution than the explanation of rent extraction. Moreover, the explanation of rent extraction requires underwriters to have a great deal of market power to extract the rent from investors. The underwriter market power story predicts that higher-rank underwriters are more likely to release shares in bad IPO companies. However, in the subsample of IPOs with early sales, I find that the correlation between the long-term return and the underwriter rank is 0.1159, with a p-value equal to 0.0143. Therefore, underwriters that release locked-up shares are unlikely to benefit from more future business brought by bad companies.

3.8. Conclusion

In the U.S., IPO company insiders and the underwriter of the IPO voluntarily negotiate a lockup agreement before the IPO. The lockup agreement does not allow insiders to sell their shares during the lockup period, but the underwriter has the right to release locked-up shares before the lockup expiration. The main contribution of this study is to provide an explanation for the underwriter's incentive to release locked-up shares and allow early sales. Underwriters use early sales to increase client loyalty and generate future business. In examining this incentive of underwriters, I focus on an important group of insiders, namely top executives, and find that 10% of IPOs with lockup agreements have early sales by top executives. Early sales by top executives reduce the likelihood that IPO companies switch underwriters between the IPO and their subsequent SEOs by 14%.

I also demonstrate that underwriters are concerned about the risk of releasing shares in bad companies and release shares in good companies only after information resolution. I find that IPO companies with early sales not only have higher short-term and long-term returns but also are less likely to be delisted. Moreover, I perform the matched sample analysis to examine the impact of early sales on company performance. I match the sample based on the lockup length, issuance time, industry, and market value. I find no significant impact of early sales on company performance, which suggests that underwriters decide to release locked-up shares based on market-wide information.

This paper makes two contributions to the existing literature. The first contribution is to investigate the underwriter's incentive to allow early sales. Under-

writers are more likely to receive SEO business when they allow top executives to sell shares during IPO lockup periods. Second, I examine client relationships in the underwriting business, and I identify early sales as an important factor that affects underwriter switch.

In this study, I focus solely on future SEOs. I acknowledge that future SEOs from the IPO companies are one channel of future business from insiders with early sales. Other channels could be future M&As from top executive insiders and future IPOs from VC firm insiders. In future studies, I plan to investigate the relation between early sales and future business of M&As from IPO companies or IPOs from VC firms.

3.9. Tables and figures

Table 3.1: Sample summary

The sample is 4,270 IPOs in the U.S. from 1988 to 2011. The early sale transactions are the number of sale transactions in an IPO company. The early sale size is the total number of early sale shares divided by the total shares outstanding in the IPO company.

Year	Obs	180-Day	IPOs with Early Sales				
		Lockups	(%)	Transactions		Size	
		(%)		Mean	Median	Mean	Median
All	4270	74.22	10.44	4.2	2.0	0.0163	0.0067
1988	66	34.85	10.61	3.1	3.0	0.0177	0.0057
1989	87	43.68	6.90	2.0	2.0	0.0086	0.0040
1990	82	46.34	7.32	3.2	2.5	0.0194	0.0079
1991	216	62.04	17.59	4.2	2.0	0.0135	0.0060
1992	332	67.17	11.45	3.2	2.5	0.0227	0.0088
1993	379	69.39	10.82	3.9	3.0	0.0177	0.0096
1994	348	66.09	12.36	3.5	2.0	0.0191	0.0096
1995	372	75.27	16.13	3.8	2.5	0.0138	0.0050
1996	365	74.52	11.51	3.4	2.0	0.0142	0.0036
1997	328	69.82	10.67	3.7	2.0	0.0164	0.0059
1998	185	69.73	7.57	2.8	1.0	0.0198	0.0161
1999	243	84.36	13.99	2.6	2.0	0.0139	0.0070
2000	156	88.46	5.77	8.2	3.0	0.0127	0.0072
2001	44	72.73	4.55	32.0	32.0	0.0443	0.0443
2002	61	91.80	6.56	2.5	2.0	0.0311	0.0328
2003	64	87.50	9.38	2.7	2.5	0.0130	0.0062
2004	182	85.71	4.40	2.4	1.5	0.0137	0.0091
2005	163	78.53	6.75	4.6	3.0	0.0286	0.0037
2006	169	86.98	7.10	23.3	1.5	0.0136	0.0013
2007	172	88.95	7.56	4.1	3.0	0.0112	0.0042
2008	25	92.00	4.00	2.0	2.0	0.0019	0.0019
2009	40	92.50	12.50	1.6	2.0	0.0133	0.0064
2010	102	93.14	7.84	3.8	2.0	0.0067	0.0042
2011	89	94.38	3.37	4.0	4.0	0.0143	0.0038

Table 3.2: Early sale characteristics

This table reports characteristics of 1,893 early sale transactions in 446 IPOs. The early sale size is the number of early sale shares divided by the total shares outstanding in the IPO company. The early sale time is the number of days from the IPO to the early sale divided by the lockup length in days. The early sale price is the relative price change from the offer price to the sale price.

	Mean	SD	Percentile		
			P25	P50	P75
Size	0.0038	0.0104	0.0001	0.0007	0.0028
Time	0.4901	0.3357	0.1111	0.5576	0.7778
Price	0.6210	1.1277	0.0400	0.3393	0.7583

Table 3.3: Descriptive statistics

The sample is 4,270 IPOs in the U.S. from 1988 to 2011. 446 of them have early sales. Panel A reports statistics of dummy variables and uses z-tests to compare the two groups of IPOs with and without early sales. Panel B reports statistics of continuous variables and uses t-tests to compare the two groups of IPOs with and without early sales. Variable definitions are in Appendix A. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Panel A: Dummy variables

	Full Sample	Without Early Sales	With Early Sales
VC-Backed	0.3995	0.3852	0.5224***
High Tech	0.3052	0.2879	0.4529***
Dum SEO	0.3749	0.3698	0.4193**
Delisting	0.08150	0.08185	0.07848
Negative Delisting	0.03021	0.03190	0.01570*

Panel B: Continuous variables

	Mean	SD	Percentile		
			P25	P50	P75
(Full Sample)					
Time of the Earliest Sale	0.932	0.229	1	1	1
Shares Offered	0.359	0.355	0.234	0.306	0.400
Log(Expected Proceed)	17.40	1.121	16.72	17.32	18.09
Price Revision	-0.00497	0.168	-0.0450	0	0
Underpricing	0.167	0.418	0	0.0797	0.221
Gross Spread	0.0725	0.0106	0.0700	0.0700	0.0700
Underwriter Rank	6.909	2.275	6	8	9
Rank Change (Two Years)	0.0415	0.432	0	0	0
Rank Change (Four Years)	0.387	1.363	0	0	0
Log(Market Value)	18.54	1.218	17.74	18.52	19.35
BM	0.504	3.071	0.204	0.324	0.507
Short-Term Return	-0.0200	0.540	-0.337	-0.0769	0.195
Long-Term Return	-0.109	0.988	-0.702	-0.342	0.162
(Without Early Sales)					
Time of the Earliest Sale	1	0	1	1	1
Shares Offered	0.364	0.371	0.235	0.307	0.403
Log(Expected Proceed)	17.40	1.133	16.71	17.34	18.09
Price Revision	-0.0101	0.167	-0.0500	0	0
Underpricing	0.154	0.401	0	0.0690	0.203
Gross Spread	0.0725	0.0107	0.0700	0.0700	0.0700
Underwriter Rank	6.873	2.295	6	8	9
Rank Change (Two Years)	0.0442	0.446	0	0	0
Rank Change (Four Years)	0.402	1.388	0	0	0
Log(Market Value)	18.53	1.229	17.70	18.51	19.35
BM	0.516	3.238	0.201	0.326	0.519
Short-Term Return	-0.0438	0.499	-0.348	-0.0890	0.176
Long-Term Return	-0.121	0.984	-0.707	-0.357	0.147
(With Early Sales)					
Time of the Earliest Sale	0.350***	0.353	0.0222	0.192	0.689
Shares Offered	0.318***	0.140	0.229	0.297	0.374
Log(Expected Proceed)	17.37	1.017	16.83	17.24	17.84
Price Revision	0.0390***	0.171	0	0	0.125
Underpricing	0.279***	0.529	0.0526	0.172	0.347
Gross Spread	0.0720	0.00886	0.0700	0.0700	0.0700
Underwriter Rank	7.217***	2.066	7	8	9
Rank Change (Two Years)	0.0179	0.284	0	0	0
Rank Change (Four Years)	0.251**	1.118	0	0	0
Log(Market Value)	18.63	1.119	17.97	18.59	19.27
BM	0.396	0.608	0.222	0.318	0.442
Short-Term Return	0.184***	0.780	-0.210	0.0636	0.417
Long-Term Return	-0.00984**	1.014	-0.648	-0.241	0.234

Table 3.4: Early sales and underwriter switch

The sample is 1,601 IPOs that have an SEO within the first four years after the IPO, and 943 of them do not switch their lead underwriters during their SEOs. Panel A compares the descriptive statistics of non-switchers and switchers. I use z-tests to compare dummy variables and t-tests to compare continuous variables. The dependent variable is *Dum Switch*. Variable definitions are in Appendix A. Panel B reports regression results. Associated p-values are based on heteroskedasticity robust standard errors and reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Panel A: Comparison between non-switchers and switchers

	Subsample with SEOs	Non-Switcher	Switcher
N	1601	943	658
Dum Early Sale	0.117	0.144	0.0775***
VC-Backed	0.420	0.433	0.403
High Tech	0.257	0.277	0.229**
Time of the Earliest Sale	0.932	0.913	0.961***
Months from IPO to SEO	16.95	12.93	22.71***
Log(Expected Proceed)	17.71	17.82	17.55***
Price Revision	-0.00361	0.0154	-0.0309***
Rank Change	0.0531	0.0117	0.112***
Underpricing	0.178	0.200	0.147***
Gross Spread	0.0699	0.0691	0.0712***
BM	0.497	0.457	0.555

Panel B: Effect of early sales on underwriter switch

Variables	(1)	(2)	(3)	(4)
Dum Early Sale	-0.384***	-0.543***	-0.224**	-0.385***
	(0.000)	(0.001)	(0.043)	(0.001)
Dum Early Sale		0.362		
** Time of Earliest Sale*		(0.186)		
Months from IPO to SEO			0.0504***	
			(0.000)	
Log(Expected Proceed)	-0.101**	-0.101**	-0.0570	-0.257***
	(0.016)	(0.017)	(0.199)	(0.000)
Price Revision	-0.978***	-0.972***	-0.967***	-0.872***
	(0.000)	(0.000)	(0.000)	(0.000)
Rank Change	0.233***	0.233***	0.184**	0.222***
	(0.001)	(0.001)	(0.011)	(0.006)
BM	0.00994	0.00981	-0.000351	0.0180
	(0.436)	(0.443)	(0.979)	(0.177)
Underpricing	-0.0781	-0.0795	0.108	-0.175
	(0.494)	(0.496)	(0.247)	(0.195)
Gross Spread	8.584	8.515	7.636	3.191
	(0.122)	(0.125)	(0.183)	(0.586)
VC-Backed	-0.0683	-0.0701	-0.0174	-0.222***
	(0.321)	(0.309)	(0.807)	(0.005)
High Tech	-0.0937	-0.0891	-0.0661	
	(0.229)	(0.254)	(0.414)	
Constant	1.050	1.044	-0.606	8.828***
	(0.316)	(0.319)	(0.584)	(0.000)
Year Dummies	No	No	No	Yes
Industry Dummies	No	No	No	Yes
N	1601	1601	1601	1584
Pseudo R^2	0.0416	0.0424	0.161	0.111

Table 3.5: Company performance

The sample is 4,270 IPOs in the U.S. from 1988 to 2011. Columns (1) and (2) report regression results of OLS models. The dependent variables are the short-term buy-and-hold return and long-term buy-and-hold return. Columns (3) and (4) report regression results of probit models. The dependent variables are dummy variables, indicating whether an IPO company is delisted within four years after the IPO and whether an IPO company is delisted for negative reasons. Variable definitions are in Appendix A. Associated p-values are based on heteroskedasticity robust standard errors and reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Variables	(1) Short-Term	(2) Long-Term	(3) Delisting	(4) Negative
Dum Early Sale	0.199***	0.0957*	-0.0490	-0.215
	(0.000)	(0.054)	(0.613)	(0.212)
Shares Offered	-0.105***	-0.138**	0.297**	0.369*
	(0.002)	(0.031)	(0.040)	(0.056)
Underwriter Rank	0.0318***	0.0461***	-0.0183	-0.0890***
	(0.000)	(0.000)	(0.376)	(0.002)
Underpricing	-0.0387*	-0.0866***	-0.175**	-0.177
	(0.077)	(0.009)	(0.035)	(0.102)
Gross Spread	-4.830***	-6.129***	1.359	2.639
	(0.000)	(0.001)	(0.738)	(0.599)
BM	0.00746*	0.00892	-0.128*	-0.315***
	(0.056)	(0.162)	(0.089)	(0.001)
Log(Market Value)	-0.0264**	-0.0432*	0.0476	-0.107
	(0.037)	(0.069)	(0.324)	(0.129)
VC-Backed	-0.0367*	-0.0145	0.0910	0.0839
	(0.055)	(0.705)	(0.184)	(0.395)
Constant	0.430	0.873	-5.486***	-2.509*
	(0.108)	(0.102)	(0.000)	(0.065)
Year Dummies	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes
N	4270	4270	4112	3542
R^2	0.0916	0.0680		
Pseudo R^2			0.0887	0.167

Table 3.6: Matched sample analysis

This table reports results of the matched sample analysis. The sample consists of 242 IPOs with 180-day lockups and early sales, along with their matched counterparts without early sales. I match the sample based on the lockup length, issuance year, industry, and market value. Panel A compares descriptive statistics of IPOs with and without early sales. I use z-tests to compare dummy variables and t-tests to compare continuous variables. Panel B reports regression results on the determinants of early sales. The dependent variable is *Dum Early Sale*. The key explanatory variable is *Return until Earliest Sale (Annualized)*. Panel C reports regression results on the IPO performance. The dependent variables include *Long-Term Return*, *Short-Term Return*, and *Return from Earliest Sale (Annualized)*. The key explanatory variable is *Dum Early Sale*. Variable definitions are in Appendix A. Associated p-values are based on heteroskedasticity robust standard errors and reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Panel A: Comparison of IPOs with and without early sales

	mean	mean	mean
Long-Term Return	-0.086	-0.187	0.014
Short-Term Return	0.172	0.046	0.297
Underpricing	0.245	0.208	0.282
Return until Earliest Sale	0.152	0.053	0.251
Return from Earliest Sale	0.020	-0.014	0.054
Return until Earliest Sale (Annualized)	0.555	-0.049	1.160
Return from Earliest Sale (Annualized)	0.014	-0.165	0.193
Dum SEO	0.421	0.384	0.459
Dum Switcher	0.304	0.366	0.252

Panel B: Determinants of early sales

	(1)	(2)
Return until Earliest Sale	0.0401***	0.0401***
	(0.009)	(0.010)
Shares Offered	-0.382	-0.798
	(0.384)	(0.166)
Underwriter Rank	0.0205	0.0218
	(0.667)	(0.697)
Underpricing	0.314**	0.405**
	(0.038)	(0.017)
Log(Market Value)	-0.0377	-0.116
	(0.608)	(0.364)
VC-Backed	-0.107	-0.142
	(0.382)	(0.329)
Constant	0.636	-2.260
	(0.630)	(0.307)
Year Dummies	No	Yes
Industry Dummies	No	Yes
N	484	449
Pseudo R^2	0.0221	0.0465

Panel C: Early sales and performance

Variables	(1) Short-Term	(2) Long-Term	(3) After Earliest Sale
Dum Early Sale	0.221**	0.200**	0.216
	(0.011)	(0.028)	(0.427)
Shares Offered	-0.642**	-0.355	-1.832*
	(0.035)	(0.397)	(0.078)
Underwriter Rank	0.106***	0.0571	0.00363
	(0.001)	(0.126)	(0.982)
Underpricing	-0.206	-0.0102	0.122
	(0.160)	(0.917)	(0.699)
Gross Spread	-12.03	-29.12	-49.34
	(0.326)	(0.121)	(0.285)
BM	0.336***	0.0442	0.577
	(0.009)	(0.665)	(0.120)
Log(Market Value)	-0.0358	0.0389	-0.450
	(0.754)	(0.684)	(0.243)
VC-Backed	0.0292	-0.0259	-0.0739
	(0.717)	(0.784)	(0.796)
Constant	0.475	0.671	11.35
	(0.863)	(0.759)	(0.173)
Year Dummies	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
N	484	484	484
R^2	0.184	0.225	0.149

Table 3.7: Prediction of future SEOs

Columns (1) and (2) report regression results of probit models. The sample is 4,270 IPOs in the U.S. from 1988 to 2011, and the dependent variable is *Dum SEO*. Columns (3) and (4) report regression results of OLS models. The sample is 1,601 IPOs that have an SEO within the first four years after the IPO, and the dependent variable is *Months from IPO to SEO*. Variable definitions are in Appendix A. Associated p-values are based on heteroskedasticity robust standard errors and reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

	SEO Dummy		Months from IPO to SEO	
	(1)	(2)	(3)	(4)
Variables				
Dum Early Sale	0.136**	0.120*	-3.774***	-3.038***
	(0.037)	(0.078)	(0.000)	(0.000)
Shares Offered	-0.0202	-0.0365	2.507*	1.604
	(0.812)	(0.706)	(0.086)	(0.330)
Underwriter Rank	0.0824***	0.0704***	-0.664***	-0.588***
	(0.000)	(0.000)	(0.002)	(0.006)
Underpricing	0.0356	0.187***	-3.550***	-2.394*
	(0.443)	(0.000)	(0.006)	(0.054)
Gross Spread	-7.436**	-8.983***	8.119	-0.0204
	(0.012)	(0.005)	(0.841)	(1.000)
BM	-0.0000318	0.00365	0.172	0.202
	(0.997)	(0.711)	(0.155)	(0.124)
Log(Market Value)	0.0754***	0.0871**	-0.705**	-1.050**
	(0.003)	(0.011)	(0.044)	(0.026)
VC-Backed	0.0460	-0.00897	-0.340	-0.497
	(0.305)	(0.856)	(0.583)	(0.444)
High Tech	-0.280***		-0.771	
	(0.000)		(0.232)	
Constant	-1.717***	-1.634	35.11***	50.75***
	(0.003)	(0.122)	(0.000)	(0.000)
Year Dummies	No	Yes	No	Yes
Industry Dummies	No	Yes	No	Yes
N	4270	4260	1601	1601
R^2			0.0742	0.196
Pseudo R^2	0.0488	0.104		

Table 3.8: Heckman regression

The sample is 4,270 IPOs in the U.S. from 1988 to 2011. The dependent variable is *Dum Switch*. Column (1) reports regression results of a probit model. Columns (2) and (3) report regression results of a Heckman model. The dependent variable of the selection equation is *Dum SEO*. Column (2) uses the maximum likelihood (ML) estimator and estimates a probit model for the main-stage equation. An *athrho* is a function of ρ, the correlation between the error terms in the selection equation and main-stage equation. A large *athrho* suggests a high ρ. Column (3) uses the two-step consistent estimator and estimates a linear probability model for the main-stage equation. A *lambda* is the coefficient on the inverse Mills ratio (IMR). Variable definitions are in Appendix A. Associated p-values reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Variables	(1)	(2)	(3)
Dum Early Sale	-0.405***	-0.236***	-0.147***
	(0.000)	(0.001)	(0.000)
Log(Expected Proceed)	-0.0888**	0.0273	0.0169
	(0.023)	(0.338)	(0.396)
Price Revision	-0.996***	-0.552***	-0.329***
	(0.000)	(0.000)	(0.000)
Rank Change	0.234***	0.0931**	0.0640***
	(0.002)	(0.013)	(0.004)
Underpricing	-0.0996	-0.0466	-0.0203
	(0.254)	(0.509)	(0.591)
Gross Spread	9.240*	-5.045	-1.781
	(0.066)	(0.173)	(0.459)
Constant	0.742	-1.107	-0.296
	(0.439)	(0.106)	(0.526)
(Selection Equation)			
Shares Issued		0.0247	-0.0249
		(0.755)	(0.779)
Underwriter Rank		0.106***	0.0834***
		(0.000)	(0.000)
Underpricing		0.0430	0.0438
		(0.403)	(0.380)
Gross Spread		-6.808**	-7.411**
		(0.020)	(0.013)
BM		-0.00613	0.000207
		(0.443)	(0.983)
Log(Market Value)		0.0477**	0.0742***
		(0.046)	(0.003)
VC-Backed		0.00635	0.0490
		(0.862)	(0.269)
High Tech		-0.161***	-0.272***
		(0.000)	(0.000)
Constant		-1.436**	-1.691***
		(0.013)	(0.004)
athrho		2.147***	
		(0.000)	
lambda			0.572***
			(0.000)
N	1601	4270	4270
Uncensored		1601	1601
Pseudo R^2	0.0400		
Chi-square	86.64	50.58	54.92

Table 3.9: Changes in the underwriter rank

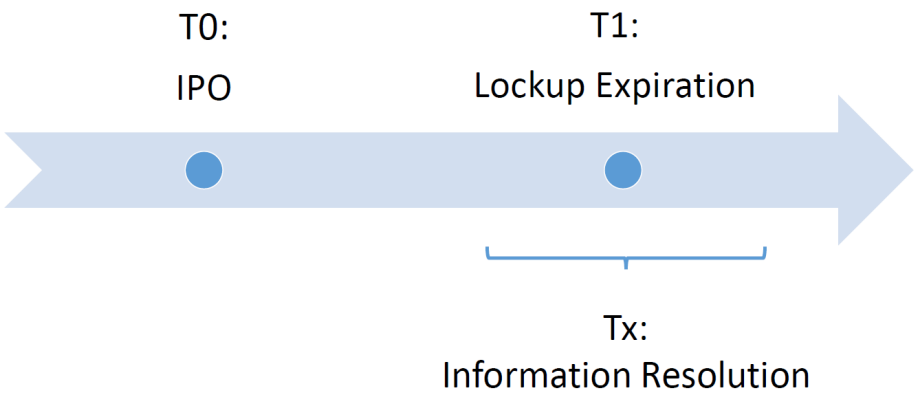
The sample is 4,270 IPOs in the U.S. from 1988 to 2011. In Columns (1) and (3), the dependent variable is *Rank Change (Two Years)*. In Columns (2) and (4), the dependent variable is *Rank Change (Four Years)*. Variable definitions are in Appendix A. Associated p-values are based on heteroskedasticity robust standard errors and reported in brackets. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Variables	(1) Two Years	(2) Four Years	(3) Two Years	(4) Four Years
Dum Early Sale	-0.0247	-0.0906	-0.00773	-0.0282
	(0.125)	(0.106)	(0.627)	(0.579)
Underwriter Rank	-0.0243***	-0.243***	-0.0201***	-0.219***
	(0.000)	(0.000)	(0.002)	(0.000)
Shares Offered	-0.0290*	0.0652	-0.0362*	-0.0817
	(0.081)	(0.534)	(0.054)	(0.394)
Underpricing	0.0153	0.0441	-0.00185	-0.101
	(0.676)	(0.539)	(0.957)	(0.158)
Gross Spread	-0.791	-2.338	-1.571	-2.019
	(0.564)	(0.572)	(0.238)	(0.554)
BM	0.00211	-0.00281	0.00223	0.00560
	(0.135)	(0.726)	(0.147)	(0.479)
Log(Market Value)	0.00973	0.0658***	-0.0198	-0.0284
	(0.174)	(0.002)	(0.110)	(0.329)
VC-Backed	0.0153	-0.0702*	-0.00991	-0.0154
	(0.264)	(0.076)	(0.480)	(0.693)
High Tech	0.00230	0.136***		
	(0.883)	(0.005)		
Constant	0.0885	0.979	0.618**	2.425***
	(0.632)	(0.109)	(0.024)	(0.001)
Year Dummies	No	No	Yes	Yes
Industry Dummies	No	No	Yes	Yes
N	4270	4270	4270	4270
R^2	0.0105	0.133	0.110	0.363

Figure 3.1: Timeline of underwriter's decision on early releases

A: Predetermined lockup expiration length vs. Uncertain information resolution time

At T_0, a company goes to public and enter a lockup agreement with the underwriter. $T_1 - T_0$ is the lockup length, which is determined at the time of IPO. $T_x - T_0$ is the time needed for information resolution, which is revealed by the market after the IPO. $T_x - T_0$ could be smaller than $T_1 - T_0$.



B: Underwriter's decision

During the IPO process, underwriters need to make two decisions: (1) inclusion of lockups and (2) early releases. The focus of this study is not on the determinants for lockups but the considerations for early releases (in the black box).

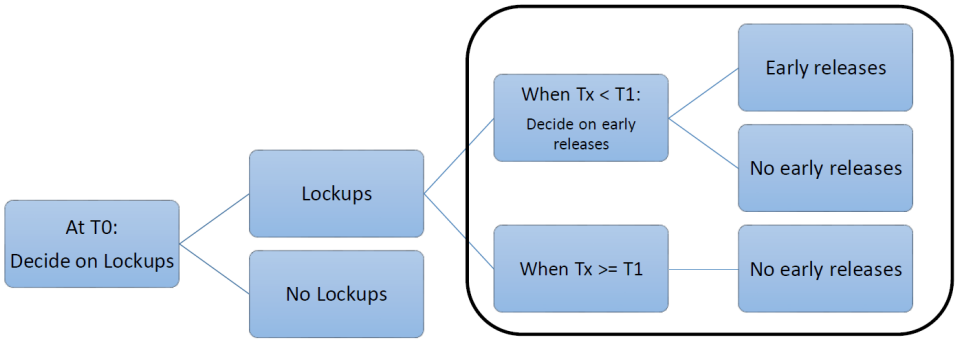
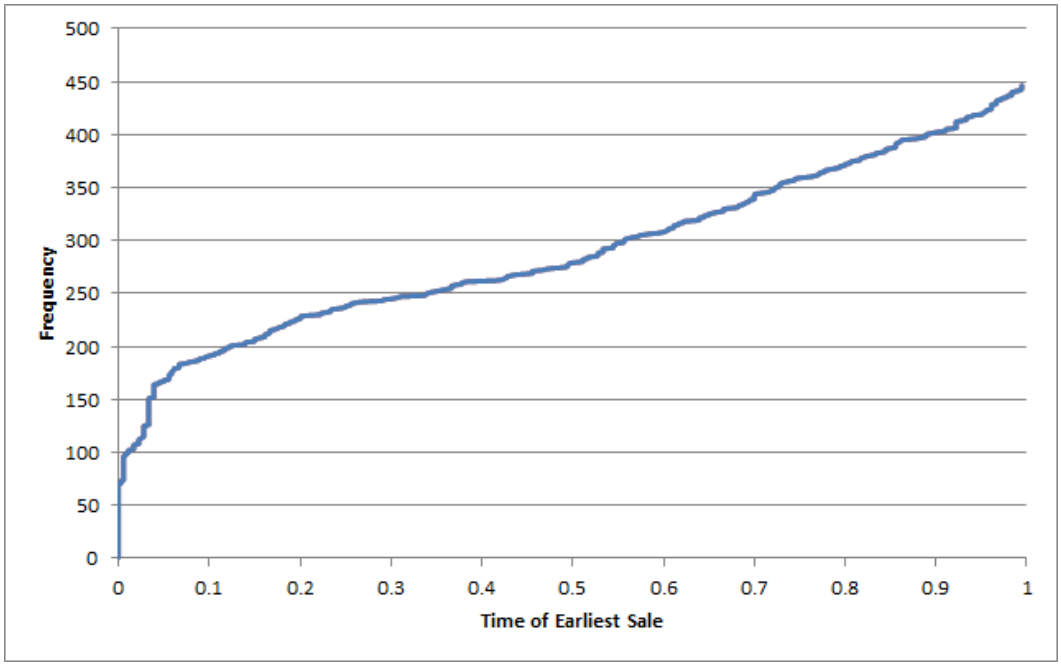


Figure 3.2: Time of the earliest sale

The sample is 446 IPOs with early sales. The time of the earliest sale is the number of days from the IPO to the earliest sale divided by the lockup length.



3.10. Appendix

A: Variable definitions

Variable	Definition
BM	Book to market ratio. I use the first available annual report in Compustat after the IPO to compute both the book value and market value.
Delisting	A dummy variable, which is equal to 1 if an IPO company is delisted within the four years after the IPO.
Dum Early Sale	A dummy variable, which is equal to 1 if an IPO company has early sales by top executives.
Dum SEO	A dummy variable, which is equal to 1 if an IPO company has an SEO within the four years after the IPO.
Dum Switch	A dummy variable, which is equal to 1 if an IPO company switches the lead underwriter during its first SEO.
Gross Spread	The compensation that the underwriters of an IPO make as a fraction of the offer price.
High Tech	A dummy variable, which is equal to 1 if the current IPO is in a high tech industry. Based on Field and Hanka (2001), industries with 3-digit SIC codes of 357, 367, 369, 382, 384, and 737 are considered to be high tech.
Log (Expected Proceed)	Log of expected proceed. I use the shares offered times the midpoint price of the initial filing range to compute the expected proceed.
Log (Market Value)	Log of market value. I use the first available annual report in Compustat after the IPO to compute the market value.
Long-Term Return	The buy and hold return from the IPO to two years after the IPO, adjusted against the value-weighted market return.

(Continued on next page)

Months from IPO to SEO	The number of months from the IPO to the first SEO.
Negative Delisting	A dummy variable, which is equal to 1 if an IPO company is delisted within the four years after the IPO and the delisting code from CRSP starts with "4" or "5" (liquidations or dropped).
Price Revision	The relative change from the mid-point price in the original filing to the offer price.
Rank Change	The difference between the IPO underwriter rank and the SEO underwriter rank.
Rank Change (Four Years)	The change in the IPO underwriter rank from the IPO to four years after the IPO.
Rank Change (Two Years)	The change in the IPO underwriter rank from the IPO to two years after the IPO.
Return from Earliest Sale	The buy and hold return from the day before the earliest early sale to lockup expiration, adjusted against the value-weighted market return.
Return until Earliest Sale	The buy and hold return from the end of the first trading day to the day before the earliest early sale, adjusted against the value-weighted market return.
Shares offered	The number of total shares offered at the IPO divided by the shares outstanding.
Short-Term Return	The buy and hold return from the IPO to lockup expiration, adjusted against the value-weighted market return.
Time of the Earliest Sale	The number of days from the IPO to the earliest sale divided by the lockup length in days.
Underpricing	The return on the first day from the offer price to the closing price.

(Continued on next page)

Underwriter Rank	A ordinal variable on a 0-9 scale with the top rank of 9. The data of underwriter ranks is from Jay Ritter's website (`https://site.warrington.ufl.edu/ritter/`).
VC-Backed	A dummy variable, which is equal to one if the IPO is VC-Backed.

Chapter 4: Lockups in SEOs: Their relation to lockups and early releases in IPOs

4.1. Introduction

In the U.S., the lockup agreement is a voluntary contract between insiders in the issuing companies and the underwriters of equity issuance in both IPOs and SEOs. Previous studies have found empirical support for two explanations for the existence of lockups. Lockups help to reduce moral hazard and adverse selection problems (Brav and Gompers, 2003; Brau et al., 2005; Yung and Zender, 2010; Karpoff et al., 2013). However, to date, the empirical literature has not examined the impact of the existence of IPO lockups on SEO lockup decisions. I find that underwriters are more likely to impose SEO lockups on issuers that have IPO lockups.

In a sample of 1,446 issuers that have SEOs within four years after the IPO, I document a positive relation between SEO and IPO lockups. In the 288 issuers without IPO lockups, 39% have lockups in their first SEOs after the IPO. In comparison, in the 1,158 issuers with IPO lockups, 87% have lockups in their first SEOs after the IPO. I estimate a probit model, with the inclusion of an SEO lockup as the dependent variable and the inclusion of an IPO lockup as the independent variable. Based on the average marginal effect, the inclusion of an IPO lockup increases the likelihood of the inclusion of a lockup at the first SEO by 27.73%.

This study of the relation between IPO and SEO lockups makes three contributions to our understanding of lockup agreements. First, I find that the positive

relation between IPO and SEO lockups is partially driven by the high correlations of company characteristics at the times of the IPO and the SEO. In addition to IPO lockups, the company size is an important determinant for the inclusion of SEO lockups. Company characteristics, such as the book value and market value, do not change significantly within the first four years after the IPO. Similar characteristics indicate that a company is likely to finance similar projects at the times of the IPO and the SEO, and similar projects face a similar level of information asymmetry. According to Leland and Pyle (1977), underwriters make the same lockup decision based on the similar level of information asymmetry.

Second, I investigate whether the commitment level of insiders in the issuing company explains the positive relation between IPO and SEO lockups. Under the commitment hypothesis, underwriters impose lockups on issuers whose insiders have demonstrated high moral hazard risk (Brav and Gompers, 2003). If the main role of lockups is to reduce moral hazard problems, underwriters will impose SEO lockups on the same group of issuers who receive IPO lockups.

To distinguish between the explanations of similar company characteristics and similar insider commitment, I examine the relation between SEO lockups and early releases in IPOs. Under the commitment hypothesis, underwriters release locked-up shares during IPO lockup periods in those issuers that have demonstrated diminished moral hazard risk. Obtaining early releases, insiders in issuing companies exercise early sales. If the main role of lockups is to reduce moral hazard problems, issuers with early sales during IPO lockup periods are less likely to have SEO lockups. However, in a subsample of 1,158 issuers that have IPO lock-

ups, I find no significant relation between SEO lockups and early releases in IPOs. Therefore, moral hazard problems are not the main concern when underwriters decide to include SEO lockups. The commitment level of insiders in the issuing company does not offer an explanation for the positive relation between IPO and SEO lockups.

Lastly, I address the question of information asymmetry. If issuers and underwriters have informational advantages, SEO lockup decisions made by underwriters could signal private information held by underwriters. I investigate the information asymmetry question by examining the impact of IPO lockups on the SEO announcement effect. Given the positive relation between IPO and SEO lockups, one expects that the decision to change the lockup status in the SEO signals investors with respect to underwriters' private information. I use the buy and hold abnormal return (BHAR) around the SEO filing day to measure the SEO announcement effect. I find that in the subsample of issuers that have IPO lockups, the group without SEO lockups has a higher BHAR around the SEO filing day than the group with SEO lockups (-1.74% vs. -2.36%). The change of including lockups at the IPO to waiving lockups at the SEO conveys good news to the market, consistent with the explanation that underwriters apply private information to SEO lockup decisions.

These findings are consistent with the view that lockups help to reduce the information asymmetry in the equity issuance market and guarantee the issuance quality. Underwriters are more likely to impose SEO lockups on issuers that have IPO lockups, in part, because a company faces a similar level of information

asymmetry at the times of its IPO and SEO. However, the commitment level of insiders in the issuing company does not offer an explanation for the positive relation between IPO and SEO lockups. Moreover, the change from including lockups at the IPO to waiving lockups at the SEO conveys good news to the market, consistent with lockups reducing the information asymmetry in the equity issuance market, being the explanation for the existence of lockups.

4.2. Data

In this study, I use the Thomson Financial Securities Data Company (SDC) new issues database to identify an initial sample of IPOs in the U.S. over the period of 1988-2008. I exclude several special classes of IPOs, such as closed-end funds, real estate investment trusts (REITs), American depository receipts (ADRs), unit offers, limited partnerships, and penny stocks (with less than $5 offer prices). To perform empirical tests, I require IPO companies to have daily returns data available from the Center for Research in Security Prices (CRSP) and financial statement data available from Compustat. This requirement further reduces the sample. As a result, the final sample consists of 5,162 IPOs. To investigate the transition of lockup decisions from the IPO to the SEO, I search for SEOs within four years after the IPO, and I find that 1,446 issuers have SEOs within four years after the IPO.

Table 4.1 reports the total number of IPOs and the number of IPOs with SEOs within four years after the IPO. The second column is the number of IPOs; the third column is the number of IPOs with lockups; and the fourth column is the

percentage of companies with IPO lockups equal to 180 days. About 79% of IPOs have lockups, and the lockup length has become standardized at 180 days. In the last few years during the sample period, the percentage of lockups with the 180-day length is about 90%. The fifth column is the number of IPOs with a subsequent SEO within four years after the IPO; the sixth column is the number of SEOs with lockups; and the seventh column is the percentage of companies with SEO lockups equal to 90 days. About 77% of SEOs have lockups, and the lockup length has become standardized at 90 days. In the last few years during the sample period, the percentage of lockups with the 90-day length is about 75%. Table 4.2 presents descriptive statistics of variables used in the empirical analysis. Variable definitions are in Appendix A of this chapter.

[Place Table 4.1 here]

[Place Table 4.2 here]

Figure 4.1 presents a lockup decision tree. The root is 1,446 issuers with at least a subsequent SEO within four years after the IPO. The first level branches report the numbers of issuers with and without IPO lockups. Among the 1,446 issuers with at least a subsequent SEO within four years after the IPO, about 80% have IPO lockups. This percentage is a little higher than that in the initial sample of 5,162 IPOs. Issuers that issue an SEO within four years after the IPO are a little more likely to have IPO lockups. The second level branches report the numbers of issuers with and without SEO lockups. Among the 288 issuers without IPO lockups, 39% have lockups in their first SEOs after the IPO. In comparison, among the 1,158 issuers with IPO lockups, 87% have lockups in their first SEOs

after the IPO. The difference in the percentage of SEOs with lockups between the issuers with and without IPO lockups suggests a positive relation between IPO and SEO lockup decisions.

[Place Figure 1 here]

In the robustness analysis, I further examine the effect of IPO lockup decisions and the lockup decisions of the first SEOs after the IPO on the lockup decisions of the second SEOs. The third level branches report the numbers of issuers with a second SEO. I search for second SEOs within four years after the first IPOs. Overall, about 35% of issuers have second SEOs within four years after their first SEOs. Those issuers that previously have IPO and/or SEO lockups are more likely to have lockups in the second SEOs. The fourth level branches report the number of issuers with and without lockups during the second SEOs. Among the issuers without lockups during their IPOs or their first SEOs, only 17% have lockups in their second SEOs; in comparison, among the issuers with lockups during their IPOs and their first SEO, 79% have lockups in their second SEOs. The large difference in the percentage of issuers with lockups during the second SEOs lends support for the positive relation between IPO and SEO lockup decisions.

4.3. Relation to IPO lockups

In this section, I examine the relation between SEO and IPO lockups. First, I investigate the effect of IPO lockup decisions on the lockup decisions of the first SEOs after the IPO. Table 4.3 presents estimates from four specifications of a

probit model. The dependent variable is *SEO Lockup*, which is equal to 1 if an issuer has an SEO lockup. The key explanatory variable is *IPO Lockup*, which is equal to 1 if an issuer has an IPO lockup. The coefficient of *IPO Lockup* is significantly positive across all specifications. In the most conservative estimate when I include all control variables and fixed effects, the coefficient of *IPO Lockup* is 1.036. Based on the average marginal effect, the inclusion of an IPO lockup increases the likelihood of the inclusion of a lockup at the first SEO by 27.73%.

[Place Table 4.3 here]

Among all control variables, only *Log(Market Value)* has a significant coefficient in both specifications (2) and (4). Consistent with previous studies (Brav and Gompers, 2003; Karpoff et al., 2013), the coefficient of *Log(Market Value)* is negative. Larger issuers have less severe information asymmetry problems, so underwriters are less likely to include lockups. *Log(Days from IPO to SEO)* and *Gross Spread* have significant coefficients in specification (4). Both *Log(Days from IPO to SEO)* and *Gross Spread* reflect the degree of information asymmetry. When *Log(Days from IPO to SEO)* is larger, the time the issuer has been a public company is longer, and the degree of information asymmetry is lower. Therefore, underwriters are less likely to include lockups, and the coefficient of *Log(Days from IPO to SEO)* is negative. On the other hand, the issuer with a higher degree of information asymmetry faces a higher *Gross Spread* (Karpoff et al., 2013). *Gross Spread* reflects the cost of the underwriters' service. When an issuer has a higher degree of information asymmetry, underwriters need to put more effort into the book-building process and bear a higher cost to stabilize the stock price shortly af-

ter the equity issuance. Therefore, underwriters are more likely to include lockups, and the coefficient of *Gross Spread* is positive.

I further investigate the relation between the BHAR before the SEO and SEO lockup decisions. The relation between the BHAR before the SEO and SEO lockup decisions shows whether public information has an impact on SEO lockup decisions. Previous studies (Brav and Gompers, 2003; Karpoff et al., 2013) have documented that the returns after equity issuance are positively related to early releases. These studies argue that the higher the returns, the less severe the problems caused by information asymmetry. Therefore, if public information has an impact on SEO lockup decisions, the BHAR before the SEO would be negatively related to the inclusion of SEO lockups.

In Table 4.3, the coefficient of *BHAR before SEO* is insignificant across all estimates. Moreover, I examine whether a negative relation between the BHAR before the SEO and SEO lockups exist in a subsample conditional on IPO lockups. In Table 4.4, I first add the interaction term of *BHAR before SEO* and *IPO Lockup* to the list of independent variables and repeat the regression analysis in Table 4.3. Second, I split the sample based on the inclusion of IPO lockups and repeat the regression analysis. In Columns (1) and (2), the interaction term has insignificant coefficients; in Columns (3) and (4), *BHAR before SEO* has insignificant coefficients. Therefore, the insignificant relation between the BHAR before the SEO and SEO lockup decisions is consistent with the SEO offer price fully incorporating public information (Altinkilic and Hansen, 2003), implying that public information is not a critical determinant for SEO lockups. This finding is consistent with

the explanation for the use of SEO lockups being the reduction of information asymmetry between issuers and investors.

[Place Table 4.4 here]

When I use continuous variables of lockup lengths in the regression, all results are qualitatively similar. In Table 4.5, the dependent variable is the ratio of SEO lockup length in days over 90 days. The key explanatory variable is the ratio of IPO lockup length in days over 180 days. In Panel A, the distribution of the lockup length at the SEO shares the same percentile values of 25%, 50%, and 75% as the distribution at the IPO; however, the distribution of the lockup length at the SEO has a greater mean and a larger standard deviation. In Panel B, I estimate a Tobit model using 1,446 companies that have at least one subsequent SEO within four years after the IPO. Based on the most conservative estimates in Column (4), when the IPO lockup length increases by 180 days (the ratio of IPO lockup length increases by 1.0), the SEO lockup length increases by 37 days ($\approx$ 0.411 * 90 days).

[Place Table 4.5 here]

In addition, I investigate the effect of the lockup decisions of the IPOs and the first SEOs after the IPO on the lockup decisions of the second SEOs. Table 4.6 presents estimates from ten specifications of a probit model. The dependent variable is *Second Lockup*, which is equal to 1 if an issuer has a lockup during the second SEO after the IPO. The key explanatory variables are *IPO Lockup* and *SEO Lockup*. In all the specifications with *SEO Lockup* as one of the independent

variables, the coefficient of *SEO Lockup* is significantly positive. In specification (10), when I include all control variables and fixed effects, the coefficient of *SEO Lockup* is 0.999. Based on the average marginal effect, the inclusion of a lockup during the first SEO increases the likelihood of the inclusion of a lockup at the second SEO by 29.19%. The effect of the inclusion of an IPO lockup on the inclusion of a lockup in the second SEO is weaker than the effect of the inclusion of a lockup in the first SEO on the inclusion of a lockup in the second SEO. In specification (7), when I include fixed effects, the coefficient of *IPO Lockup* is significantly positive. Based on the average marginal effect, the inclusion of a lockup during the IPO increases the likelihood of the inclusion of a lockup at the second SEO by 21.14%. However, in those specifications where I include both *IPO Lockup* and *SEO Lockup*, both the magnitude and the significance level of the coefficient of *IPO Lockup* decrease. In specification (9), when I include both *IPO Lockup* and *SEO Lockup* and their interaction, the coefficient of *IPO Lockup* becomes insignificant.

[Place Table 4.6 here]

Overall, I find that underwriters are more likely to impose SEO lockups on issuers that have IPO lockups. The positive relation between IPO and SEO lockups is in part driven by the high correlations of company characteristics at the times of the IPO and the SEO. Company characteristics, such as book value and market value, do not change significantly within the first four years after the IPO. In my sample, the correlation between two book values at the times of the IPO and the SEO is 0.826, and the correlation between two market values at the times of the

IPO and the SEO is 0.789. Similar characteristics indicate that a company is likely to finance similar projects at the times of the IPO and the SEO, and similar projects face a similar level of information asymmetry. According to Leland and Pyle (1977), underwriters make the same lockup decision based on a similar level of information asymmetry. Therefore, SEO lockups are positively related to IPO lockups.

However, the relation between the BHAR before the SEO and SEO lockup decisions is insignificant, implying that public information is not a critical determinant for SEO lockups. This finding is consistent with the explanation for the use of lockups, which reduces the information asymmetry between issuers and investors by incorporating underwriters' private information.

4.4. Relation to early releases in IPOs

I attribute the positive relation between SEO and IPO lockups partially to high correlations between company characteristics at the times of the IPO and the SEO. In this section, I investigate whether the commitment level of insiders in the issuing company explains the positive relation between IPO and SEO lockups.

I examine the relation between the SEO lockups and early releases in IPOs using a subsample of 1,158 issuers that have IPO lockups. Under the commitment hypothesis, underwriters release locked-up shares during IPO lockup periods in those issuers that have demonstrated diminished moral hazard risk (Brav and Gompers, 2003). Obtaining early releases, insiders in issuing companies exercise early sales. If the main role of lockups is to reduce moral hazard problems, issuers

with early sales during IPO lockup periods are less likely to have SEO lockups.

In Table 4.7, I compare the means of variables between the two groups of issuers with and without early sales. In the subsample of issuers that have IPO lockups, 996 issuers do not have early sales during IPO lockup periods, while the remaining 162 issuers have early sales. I use z-tests to compare the means of dummy variables and t-tests to compare the means of continuous variables. I find no significant relation between SEO lockups and early releases in IPOs. Moreover, in the group without early sales during the IPO, 86% of issuers have SEO lockups, while in the group with early sales, 89% of issuers have SEO lockups. Early releases in IPOs increase the likelihood of the inclusion of SEO lockups. The insignificant relation between SEO lockups and early releases in IPOs suggests that moral hazard problems are not the main concern when underwriters decide to include SEO lockups.[10]

[Place Table 4.7 here]

The comparison of the other variables leads to same findings as in Chapter 3. First, early sales lead to a lower probability of underwriter switch and predict a shorter period between the IPO and the first SEO. Second, issuers with early sales have better performance after the IPO. Therefore, *BHAR before SEO*, *Price Revision*, and *Underwriter Reputation* are greater in the group with early sales than their counterparts in the group without early sales. Third, *Log(Market Value)* is greater in the group with early sales than in the group without early sales.

[10]I add early sales in IPOs to the set of independent variables and repeat the regression analysis in Table 4.4. The coefficient of early sales is insignificantly different from zero.

Log(Market Value) in the IPO is highly correlated with *Log(Market Value)* in the SEO. Consistent with previous studies (e.g., Brav and Gompers, 2003; Karpoff et al., 2013), the company size indicates the degree of information asymmetry. When the company size is larger, the degree of information asymmetry is lower, and issuers are more likely to receive early releases. Lastly, *BM* is smaller in the group with early sales than in the group without early sales. Underwriters release locked-up shares based on market-wide information. When the market valuation of an issuer is higher, *BM* is lower, and underwriters are more likely to release locked-up shares.

4.5. SEO announcement effect

I find that the relation between the BHAR before the SEO and SEO lockup decisions is insignificant, which indicates that public information is not a critical determinant for SEO lockups. In this section, I further investigate whether underwriters incorporate private information into SEO lockup decisions through the impact of IPO lockups on the SEO announcement effect. I use *BHAR around Filing*, which is the two-day ([0, 1]) buy and hold abnormal return around the SEO filing day, to measure the SEO announcement effect. To examine the impact of IPO lockups on the SEO announcement effect, I divide the full sample into four groups: Group No-No are issuers that have neither IPO nor SEO lockups; Group No-Yes are issuers that don't have IPO lockups but have SEO lockups; Group Yes-No are issuers that have IPO lockups but don't have SEO lockups; Group Yes-Yes are issuers that have both IPO and SEO lockups.

Given the positive relation between IPO and SEO lockups, 87% of issuers with IPO lockups have SEO lockups, while the remaining 13% of them do not have SEO lockups. If underwriters incorporate private information into SEO lockup decisions, the change from including lockups at the IPO to waiving lockups at the SEO conveys good news to the market. On the other hand, 61% of issuers without IPO lockups do not have SEO lockups, while the remaining 39% of them have SEO lockups. The change, from not including lockups at the IPO to including lockups at the SEO, conveys bad information about companies. As a result, the BHAR around the filing day in Group Yes-No is higher than that in Group Yes-Yes, and the BHAR in Group No-Yes is lower than that in Group No-No.

In Table 4.8, Panel A represents the summary statistics. I use t-tests to compare the BHAR between two groups. Consistent with the explanation that underwriters incorporate private information into SEO lockups, the BHAR around the filing day in Group Yes-No (-1.74%) is higher than that in Group Yes-Yes (-2.36%). However, the comparison between Group No-No and Group No-Yes contradicts the explanation of the use of underwriters' private information. The BHAR around the filing day in Group No-Yes (-1.64%) is higher than that in Group No-No (-2.94%). In Panels B and C, I find similar results. Panel B presents estimates of an OLS model using the full sample. The coefficient of *Yes-No* is significantly positive in both columns. On the other hand, the coefficient of *No-Yes* is higher than the coefficient of *Yes-Yes* in both Columns (1) and (2). Moreover, I test the equality of the two coefficients of *No-Yes* and *Yes-Yes*. The p-value is 0.1981 based on coefficients in Column (1) and 0.0702 based on coefficients in Column

(2). Panel C presents estimates using subsamples based on IPO lockups. In the subsample without IPO lockups, the coefficient of *SEO lockup* is positive, but it is insignificant when I include fixed effects in the regression. In the subsample with IPO lockups, the coefficient of *SEO lockup* is negative, and it is more significant when I include fixed effects in the regression.

[Place Table 4.8 here]

Overall, I find empirical support for the use of private information when underwriters make SEO lockup decisions. The BHAR around the filing day in Group Yes-No is higher than that in Group Yes-Yes. However, in the subsample of issuers that do not have IPO lockups, the BHAR around the filing day in Group No-Yes is higher than that in Group No-No. This result is inconsistent with the prediction derived from the use of private information. One possible reason for the inconsistency is in the different probabilities of changing lockup decisions. In the subsample without IPO lockups, 39% of issuers have SEO lockups. In comparison, in the subsample with IPO lockups, 13% of issuers do not have SEO lockups. Therefore, investors are less surprised when they observe an issuer that does not have an IPO lockup but has an SEO lockup (Group No-Yes) than one that has an IPO lockup but no SEO lockup (Group Yes-No). Therefore, the use of private information has a lower impact on the BHAR around the filing day in the subsample without IPO lockups than in the subsample with IPO lockups.

4.6. Conclusion

In a sample of 1,446 issuers that have SEOs within four years after the IPO, I document a positive relation between SEO and IPO lockups. I estimate a probit model and find that the inclusion of an IPO lockup increases the likelihood of the inclusion of a lockup at the first SEO by 27.73%.

This study on the relation between IPO and SEO lockups makes three contributions to our understanding of lockup agreements. First, I find that the positive relation between IPO and SEO lockups is partially driven by the high correlations of company characteristics at the times of the IPO and the SEO. In addition to IPO lockups, the company size is an important determinant for the inclusion of SEO lockups. The correlation between market values at the times of the IPO and the SEO is 0.789. The company size measures the level of information asymmetry. Larger companies face less severe problems caused by information asymmetry. This is consistent with information asymmetry being the main concern when underwriters decide to include lockups. Second, I find no significant relation between SEO lockups and early releases in IPOs. Underwriters release locked-up shares during IPO lockup periods in those issuers that have demonstrated diminished moral hazard risk (Brav and Gompers, 2003). Therefore, an insignificant relation between SEO lockups and early releases in IPOs suggests that moral hazard problems are not the main concern when underwriters decide to include SEO lockups. Third, I identify the impact of IPO lockup decisions on the SEO announcement effect, which indicates that underwriters apply private information to SEO lockup decisions. SEO lockup decisions convey news to the market; therefore, I con-

clude that the use of lockups helps to reduce information asymmetry in the equity issuance market.

In this study, I document and provide explanations for the positive relation between IPO and SEO lockups. To the best of my knowledge, this is the first study that identifies the impact of the inclusion of IPO lockups on the inclusion of SEO lockups. I also find that the combination of IPO and SEO lockup decisions predicts the SEO announcement effect. In future studies, I plan to investigate trading strategies that exploit this predictability of the SEO announcement effect based on IPO and SEO lockup decisions.

4.7. Tables and figures

Table 4.1: Sample summary

The initial sample is 5,162 IPO companies in the U.S. from 1988 to 2008. The second column is the number of companies; the third column is the number of companies with IPO lockups; and the fourth column is the percentage of companies with IPO lockups equal to 180 days. The final sample is 1,446 companies that have at least a subsequent SEO within four years after the IPO. The fifth column is the number of companies with a subsequent SEO; the sixth column is the number of companies with SEO lockups; and the seventh column is the percentage of companies with SEO lockups equal to 90 days.

	IPOs			IPOs with SEOs		
	Number	Lockup	180-Day (%)	Number	Lockup	90-Day (%)
1988	96	67	34.33	21	15	40.00
1989	114	89	42.70	32	28	32.14
1990	113	82	46.34	33	23	30.43
1991	276	218	61.47	85	62	35.48
1992	389	332	67.17	124	104	45.19
1993	491	385	68.31	138	116	45.69
1994	426	354	64.97	120	100	46.00
1995	477	375	74.67	133	104	55.77
1996	448	369	73.71	98	66	69.70
1997	414	333	68.77	78	56	66.07
1998	262	188	68.62	49	18	77.78
1999	414	243	84.36	101	42	69.05
2000	320	156	88.46	60	33	81.82
2001	68	44	72.73	22	16	87.50
2002	65	61	91.80	33	32	84.38
2003	67	65	87.69	34	33	81.82
2004	184	182	85.71	72	71	78.87
2005	165	163	78.53	67	66	87.88
2006	171	169	86.98	68	63	79.37
2007	175	172	88.95	66	56	71.43
2008	27	25	92.00	12	12	75.00
All	5162	4072	72.54	1446	1116	61.11

Table 4.2: Descriptive statistics

This table presents descriptive statistics of variables used in the empirical analysis. Variable definitions are in Appendix A.

	count	mean	sd	p25	p50	p75
Log(Days from IPO to SEO)	1446	5.99	0.70	5.42	5.98	6.56
BHAR before SEO	1446	50.68	66.75	8.04	33.51	72.98
Shares Offered	1446	0.25	0.19	0.15	0.21	0.30
Secondary Shares	1446	0.38	0.37	0.00	0.28	0.73
Gross Spread	1446	5.06	1.28	4.66	5.02	5.71
Log(Market Value)	1446	19.66	1.20	18.85	19.66	20.40
BM	1446	0.35	0.28	0.17	0.30	0.47
Price Revision	1446	0.33	0.47	0.00	0.00	1.00
Underwriter Reputation	1446	0.78	0.41	1.00	1.00	1.00
Underwriter Switch	1446	0.43	0.50	0.00	0.00	1.00
High Tech	1446	0.26	0.44	0.00	0.00	1.00

Table 4.3: Relation to IPO lockups

This table presents estimates from four specifications of a probit model using a sample of 1,446 companies that have at least one subsequent SEO within four years after the IPO. The dependent variable is *SEO Lockup*, which is equal to 1 if a company has an SEO lockup. The key explanatory variable is *IPO Lockup*, which is equal to 1 if a company has an IPO lockup. Variable definitions are in Appendix A. Year dummies are based on SEO dates. Industry dummies are based on two-digit SIC code. In some industries, all issuers have SEO lockups in a certain year; as a result, compared to Columns (1) and (2), Columns (3) and (4) have fewer observations when I include fixed effects. I use the heteroskedasticity robust standard errors to estimate associated p-values. P-values are in brackets, and ***, **, and * represent significance at the 1%, 5%, and 10% levels.

(Continued on next page)

Variables	(1)	(2)	(3)	(4)
IPO Lockup	1.382***	1.233***	1.254***	1.036***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Days from IPO to SEO)		-0.103		-0.235***
		(0.113)		(0.002)
BHAR before SEO		-0.000457		0.000352
		(0.465)		(0.621)
Shares Offered		-0.326		-0.131
		(0.239)		(0.729)
Secondary Shares		0.0776		-0.216
		(0.536)		(0.162)
Gross Spread		0.0546		0.118*
		(0.281)		(0.084)
Log(Market Value)		-0.191***		-0.210***
		(0.001)		(0.005)
BM		0.0661		-0.0922
		(0.694)		(0.661)
Price Revision		0.0372		0.0734
		(0.667)		(0.460)
Underwriter Reputation		-0.149		-0.203
		(0.194)		(0.134)
Underwriter Switch		0.0522		0.177
		(0.573)		(0.100)
High Tech		-0.104		0.110
		(0.276)		(0.503)
Constant	-0.273***	4.134***	5.905***	9.341***
	(0.000)	(0.003)	(0.000)	(0.000)
Year Dummies	No	No	Yes	Yes
Industry Dummies	No	No	Yes	Yes
N	1446	1446	1331	1331
Pseudo R^2	0.165	0.197	0.296	0.335

Table 4.4: Impact of BHAR before SEO

This table presents estimates from four specifications of a probit model using a sample of 1,446 companies that have at least one subsequent SEO within four years after the IPO. The dependent variable is *SEO Lockup*, which is equal to 1 if a company has an SEO lockup. The key explanatory variable is *IPO Lockup*, which is equal to 1 if a company has an IPO lockup. Variable definitions are in Appendix A. Year dummies are based on SEO dates. Industry dummies are based on two-digit SIC code. I use the heteroskedasticity robust standard errors to estimate associated p-values. P-values are in brackets, and ***, **, and * represent significance at the 1%, 5%, and 10% levels.

	Full Sample		IPO Lockups	
			Yes	No
	(1)	(2)	(3)	(4)
Variables				
IPO Lockup	1.230***	0.958***		
	(0.000)	(0.000)		
BHAR before SEO	-0.000498	-0.000674	-0.00143	0.000794
	(0.634)	(0.603)	(0.348)	(0.365)
*BHAR * IPO Lockup*	0.0000569	0.00141		
	(0.963)	(0.348)		
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	No	Yes	Yes	Yes
Industry Dummies	No	Yes	Yes	Yes
N	1446	1331	258	951
Pseudo R^2	0.197	0.336	0.459	0.200

Table 4.5: Regression with continuous lockup length

This table presents estimates from four specifications of a Tobit model using a sample of 1,446 companies that have at least a subsequent SEO within four years after the IPO. The dependent variable is *SEO Lockup*, which is the ratio of SEO lockup length in days over 90 days. The key explanatory variable is *IPO Lockup*, which is the ratio of IPO lockup length in days over 180 days. Variable definitions are in Appendix A. Panel A presents the summary statistics of *IPO Lockup* and *SEO Lockup*, while Panel B presents the regression results. Year dummies are based on SEO dates. Industry dummies are based on two-digit SIC code. I use the heteroskedasticity robust standard errors to estimate associated p-values. P-values are in brackets, and ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Panel A: Summary statistics

	count	mean	sd	p25	p50	p75
IPO Lockup	1446	0.85	0.55	0.67	1.00	1.00
SEO Lockup	1446	0.95	0.81	0.67	1.00	1.00

Panel B: Tobit regression

Variables	(1)	(2)	(3)	(4)
IPO Lockup	0.720***	0.502***	0.613***	0.411***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Days from IPO to SEO)		-0.0873**		-0.119***
		(0.020)		(0.002)
BHAR before SEO		0.000132		0.000249
		(0.725)		(0.512)
Shares Offered		-0.251		-0.126
		(0.138)		(0.501)
Secondary Shares		0.145**		-0.0140
		(0.041)		(0.849)
Gross Spread		0.0335		0.0483
		(0.454)		(0.313)
Log(Market Value)		-0.236***		-0.206***
		(0.000)		(0.001)
BM		0.0523		-0.0359
		(0.648)		(0.768)
Price Revision		0.00450		-0.0276
		(0.933)		(0.630)
Underwriter Reputation		-0.149**		-0.169***
		(0.014)		(0.008)
Underwriter Switch		-0.0163		0.0735
		(0.768)		(0.154)
High Tech		-0.133**		-0.0322
		(0.011)		(0.706)
Constant	0.205**	5.533***	2.430***	6.155***
	(0.013)	(0.000)	(0.000)	(0.000)
sigma	0.930***	0.882***	0.865***	0.834***
	(0.000)	(0.000)	(0.000)	(0.000)
Year Dummies	No	No	Yes	Yes
Industry Dummies	No	No	Yes	Yes
N	1446	1446	1446	1446
Pseudo R^2	0.0582	0.0938	0.116	0.143

Table 4.6: Lockup decisions of second SEOs

This table presents estimates from ten specifications of a probit model using a sample of 526 companies that have two SEOs after the IPO. The dependent variable is *Second Lockup*, which is equal to 1 if a company has a lockup during the second. Variable definitions are in Appendix A. Year dummies are based on SEO dates. Industry dummies are based on two-digit SIC code. I use the heteroskedasticity robust standard errors to estimate associated p-values. P-values are in brackets, and ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SEO Lockup	0.950***			1.130***	0.972***	0.981***			0.945***	0.999***
	(0.000)			(0.000)	(0.000)	(0.000)			(0.007)	(0.000)
IPO Lockup		0.614***		0.460*			0.658***		0.341	
		(0.000)		(0.064)			(0.001)		(0.273)	
SEO Lockup			0.738***	-0.380				0.830***	-0.0882	
** IPO Lockup*			(0.000)	(0.265)				(0.000)	(0.831)	
Control Varialbes	No	No	No	No	Yes	No	No	No	No	Yes
Year Dummies	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Industry Dummies	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
N	526	526	526	526	526	387	387	387	387	387
Pseudo R^2	0.0746	0.0271	0.0543	0.0803	0.124	0.219	0.184	0.210	0.222	0.294

Table 4.7: Relation to early releases during IPO lockups

The subsample is 1,158 issuers with IPO lockups. In the subsample, 996 issuers do not have early sales during IPO lockup periods, while 162 issuers have early sales during IPO lockup periods. This table presents the variable means. Variable definitions are in Appendix A. I use z-tests to compare the means of dummy variables and t-tests to compare the means of continuous variables between the two groups of issuers with and without early sales. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

	Subsample	Early Sales	
	with IPO Lockups	No	Yes
	mean	mean	mean
Log(Days from IPO to SEO)	6.02	6.06	5.76***
BHAR before SEO	49.74	46.98	66.65***
Gross Spread	5.14	5.15	5.11
Log(Market Value)	19.48	19.46	19.64*
BM	0.36	0.37	0.30***
Price Revision	0.33	0.31	0.47***
Underwriter Reputation	0.76	0.75	0.81*
Underwriter Switch	0.44	0.46	0.33***
SEO Lockup	0.87	0.86	0.89

Table 4.8: SEO announcement effect

This table presents estimates from various specifications of an OLS model using a sample of 1,446 companies that have at least one subsequent SEO within four years after the IPO. The dependent variable is *BHAR around Filing*, which is the two-day ([0, 1]) buy and hold abnormal return around the filing day. Panel A presents the summary statistics. I use t-tests to compare the BHAR between two groups. Panel B presents estimates using the full sample. The key explanatory variables include dummy variables *No-Yes*, *Yes-No*, and *Yes-Yes*. *No-Yes* = 1 indicates that companies do not have IPO lockups but have SEO lockups. *Yes-No* = 1 indicates that companies have IPO lockups but do not have SEO lockups. *Yes-Yes* = 1 indicates that companies have both IPO lockups and SEO lockups. Panel C presents estimates using subsamples with and without IPO lockups. Year dummies are based on SEO dates. Industry dummies are based on two-digit SIC code. Variable definitions are in Appendix A. I use the heteroskedasticity robust standard errors to estimate associated p-values. P-values are in brackets, and ***, **, and * represent significance at the 1%, 5%, and 10% levels.

Panel A: Summary statistics

		All	SEO lockup		Diff
			No	Yes	
IPO lockup	All	-2.31	-2.38	-2.28	-0.09
	No	-2.43	-2.94	-1.64	-1.30**
	Yes	-2.27	-1.74	-2.36	0.61
	Diff	-0.16	-1.20**	0.72	

Panel B: Full sample

Variables	(1)	(2)
No-Yes	1.618**	1.446**
	(0.016)	(0.047)
Yes-No	1.453**	1.228*
	(0.019)	(0.065)
Yes-Yes	0.877*	0.310
	(0.053)	(0.580)
BHAR before SEO	0.00526**	0.00685***
	(0.035)	(0.010)
Shares Offered	0.0444	0.383
	(0.959)	(0.685)
Log(Market Value)	0.249	0.329*
	(0.105)	(0.092)
BM	1.114**	0.857
	(0.025)	(0.126)
Underwriter Reputation	0.239	0.215
	(0.514)	(0.589)
High Tech	-0.727**	-1.341**
	(0.036)	(0.027)
Constant	-8.760***	-10.63***
	(0.007)	(0.006)
Year Dummies	No	Yes
Industry Dummies	No	Yes
N	1446	1446
R^2	0.0173	0.0797

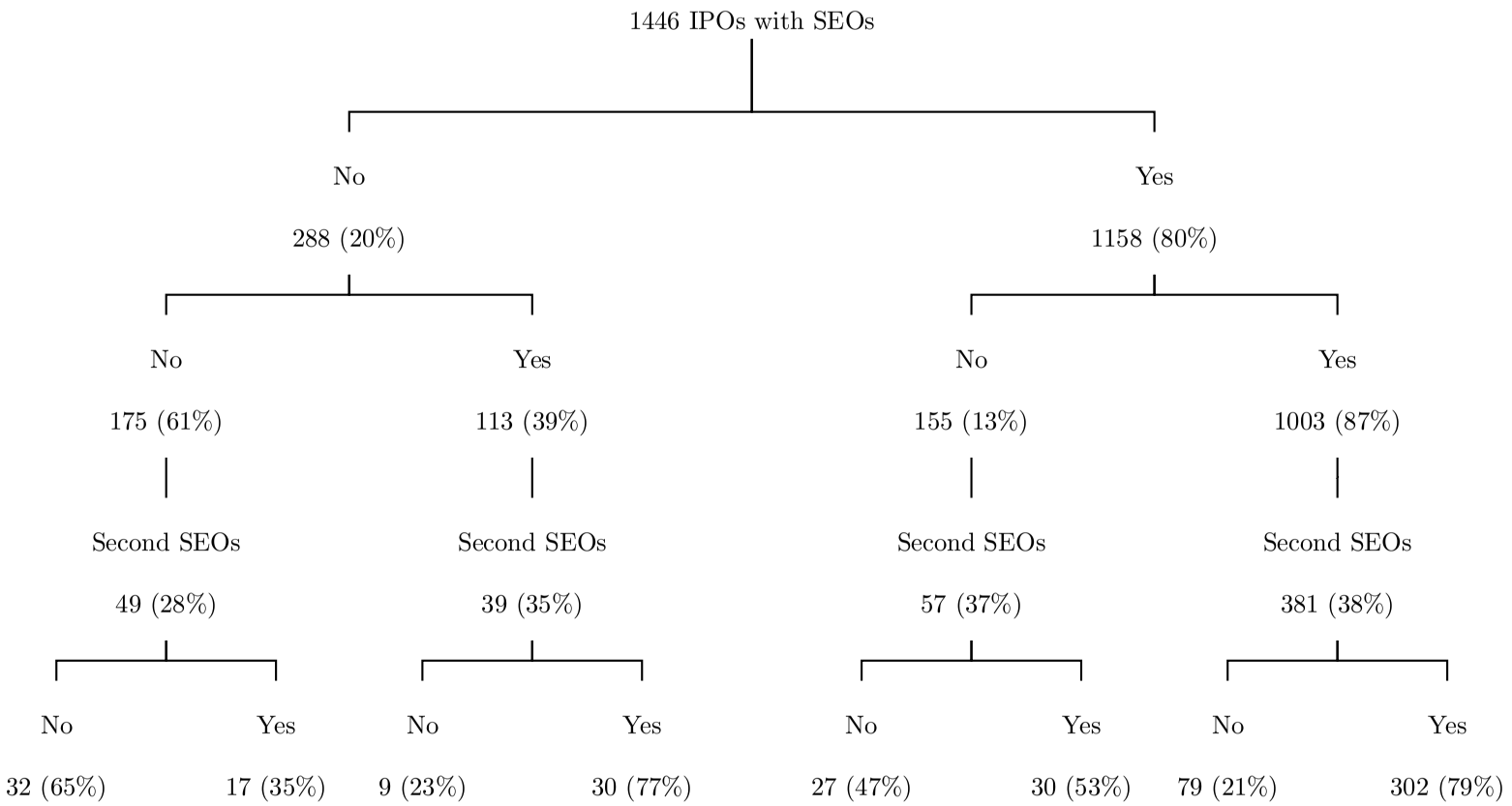
Panel C: Subsamples based on IPO lockups

	Without IPO Lockups		With IPO Lockups	
	(1)	(2)	(3)	(4)
Variables				
SEO Lockup	1.532**	1.111	-0.510	-0.939*
	(0.037)	(0.248)	(0.279)	(0.074)
BHAR before SEO	0.00821	0.00909	0.00471*	0.00589**
	(0.131)	(0.211)	(0.088)	(0.049)
Shares Offered	1.215	0.364	-0.197	0.555
	(0.335)	(0.854)	(0.844)	(0.628)
Log(Market Value)	-0.0371	0.0218	0.372**	0.426*
	(0.899)	(0.963)	(0.037)	(0.066)
BM	2.707**	1.009	0.762	0.545
	(0.011)	(0.634)	(0.168)	(0.368)
Underwriter Reputation	1.550*	1.671	0.0240	0.0329
	(0.090)	(0.222)	(0.952)	(0.940)
High Tech	-1.971**	-2.139	-0.325	-1.020
	(0.014)	(0.129)	(0.403)	(0.142)
Constant	-4.580	-4.572	-9.479***	-8.450*
	(0.456)	(0.622)	(0.008)	(0.084)
Year Dummies	No	Yes	No	Yes
Industry Dummies	No	Yes	No	Yes
N	288	288	1158	1158
R^2	0.0767	0.178	0.0133	0.0960

Figure 4.1: Lockup decision tree

This figure presents a lockup decision tree. The root is 1,446 companies with at least one subsequent SEO within four years after the IPO. The first level branches report the numbers of companies with and without IPO lockups. The second level branches report the numbers of companies with and without SEO lockups. The third level branches report the numbers of companies with a second SEO. The fourth level branches report the number of companies with and without lockups during the second SEO. "No" indicates that IPOs/SEOs do not have lockups; "Yes" indicates that IPOs/SEOs have lockups.

(Continued on next page)


1446 IPOs with SEOs
No
288 (20%)
Yes
1158 (80%)
No
175 (61%)
Yes
113 (39%)
No
155 (13%)
Yes
1003 (87%)
Second SEOs
49 (28%)
Second SEOs
39 (35%)
Second SEOs
57 (37%)
Second SEOs
381 (38%)
No
32 (65%)
Yes
17 (35%)
No
9 (23%)
Yes
30 (77%)
No
27 (47%)
Yes
30 (53%)
No
79 (21%)
Yes
302 (79%)

4.8. Appendix

A: Variable definitions

Variable	Definition
BHAR after SEO	Three-year buy and hold abnormal return from the SEO filing day. We adjust the return against CRSP value-weighted market portfolio return.
BHAR around Filing	Two-day ([0, 1]) buy and hold abnormal return around the filing day. We adjust the return against CRSP value-weighted market portfolio return.
BHAR before SEO	One-year buy and hold abnormal return to the closing price of the last trading day before the SEO. If the time between the IPO and the SEO is less than one year, we calculate the return from the closing price of the first trading day to the closing price of the last trading day before the SEO. We adjust the return against CRSP value-weighted market portfolio return.
BM	Book to market ratio. We use the first available annual report in Compustat after the SEO to compute the book value. Market value is equal to the closing price of the last trading day before the SEO times shares outstanding.
Gross Spread	The compensation that the underwriters of an SEO make as a percentage of the offer price.
High Tech	A dummy variable, which is equal to 1 if the current IPO is in a high tech industry. Industries with 3-digit SIC codes of 357, 367, 369, 382, 384, and 737 are considered to be high tech.
IPO Lockup	A dummy variable, which is equal to 1 if a company has an IPO lockup.
Log (Days from IPO to SEO)	Log of the number of days from the IPO to the SEO.

(Continued on next page)

Log (Market Value)	Log of market value. Market value is equal to the closing price of the last trading day before the SEO times shares outstanding.
No-No	A dummy variable, which is equal to 1 if a company does not have an IPO lockup or an SEO lockup.
No-Yes	A dummy variable, which is equal to 1 if a company does not have an IPO lockup but an SEO lockup.
Price Revision	A dummy variable, which is equal to 1 if the offer price is greater than the midpoint price of the filing range.
Second Lockup	A dummy variable, which is equal to 1 if a company has a lockup during the second SEO.
Secondary Shares	The number of secondary shares divided by the total shares offered at an IPO.
SEO Lockup	A dummy variable, which is equal to 1 if a company has a lockup during the first SEO.
Shares Offered	The number of total shares offered at an SEO divided by the shares outstanding.
Underwriter Reputation	A dummy variable, which is equal to 1 if the underwriter rank is equal to or above 8.
Underwriter Switch	A dummy variable, which is equal to 1 if a company switches the underwriter during the SEO.
Yes-No	A dummy variable, which is equal to 1 if a company has an IPO lockup or does not have an SEO lockup.
Yes-Yes	A dummy variable, which is equal to 1 if a company has both an IPO lockup and an SEO lockup.

Chapter 5: Conclusion

In this chapter, I first summarize my research findings. After that, I discuss some possible directions for future research.

5.1. Summary

In the U.S. equity issuance market, insiders from issuing companies and the underwriter voluntarily negotiate a lockup agreement before the equity issuance. The lockup agreement restricts insiders from selling their shares during the lockup period. However, the underwriter has the right to release some or all of the locked-up shares and to allow insiders to sell their shares early at any time before the lockup expiration. This thesis investigates both the underwriters' incentive for early releases and the impact of IPO lockups on SEO lockups.

In Chapter 2, I present a comprehensive literature review on lockups during equity issuance. Information in the equity issuance market is highly asymmetric, but lockups help to reduce problems caused by information asymmetry. First, I review information asymmetry related puzzles during equity issuance. Previous studies have used information asymmetry between issuers and investors to explain the timing of equity issuance, short-term underpricing, and long-term underperformance. Second, recognizing that a common characteristic of IPO is lockups, I investigate the literature that explains the existence of lockups. In the literature, the theoretical framework is based on Leland and Pyle (1977). Risk-averse insiders use their willingness to retain equity as a signal of company quality. One implicit assumption in Leland and Pyle (1977) is that insiders have only one opportunity

to sell their equity, and lockups are in line with this assumption of a single sale. Third, I identify two areas for additional research. The first one is the underwriters' motivation to grant early releases. The second is the relation between IPO and SEO lockups.

In Chapter 3, I examine why underwriters choose to release locked-up shares, arguing that underwriters use early sales to increase client loyalty and generate more future business. In examining this incentive of underwriters, I focus on an important group of insiders, top executives, and find that 10% of IPOs with lockup agreements have early sales by top executives. Early sales by top executives reduce the likelihood that IPO companies switch underwriters between the IPO and their subsequent SEOs by 14%. Moreover, I demonstrate that underwriters are concerned about the risk of releasing shares in bad companies. I find that (1) IPO companies with early sales have better post-IPO performance than their counterparts without early sales; and (2) underwriters decide to release locked-up shares based on market-wide information.

In Chapter 4, I examine the relation between IPO and SEO lockups. I focus on a sample of issuers that conduct their first SEOs within four years after the IPO. I find that underwriters are more likely to impose SEO lockups on issuers that have IPO lockups, in part, because a company faces a similar level of information asymmetry at the times of its IPO and SEO. The company size measures the level of information asymmetry and is an important determinant for the inclusion of SEO lockups. The correlation between market values at the times of the IPO and the SEO is 0.789. However, I find no significant relation between SEO lockups

and early releases in IPOs. Therefore, moral hazard problems are not the main concern when underwriters decide to include SEO lockups. Moreover, I identify the impact of IPO lockup decisions on the SEO announcement effect, which indicates that underwriters apply private information to SEO lockup decisions. SEO lockup decisions convey news to the market; therefore, the use of lockups helps to reduce information asymmetry in the equity issuance market.

5.2. Future research

The first possible direction is to investigate the relation between early sales and future business of M&As and IPOs. In Chapter 3, I focus on future SEOs. I acknowledge that future SEOs from the IPO companies are one channel of future business from insiders with early sales. Other channels could be future M&As from top executive insiders and future IPOs from the VC firm insiders. Therefore, I plan to investigate the relation between early sales and future business related to M&As or IPOs.

Second, I plan to examine the relation between the portfolios held by IPO insiders and early sales. In Chapter 3, I assume that insiders always sell more shares after information resolution if they are allowed to. However, the incentives for insiders to sell more shares are influenced by insiders' portfolios. For example, if a large proportion of an insider's wealth is represented by the shareholding in the IPO company, the insider will have a greater incentive to sell more shares. Accordingly, the less diversified the portfolio an insider holds, the greater benefit he/she receives from early sales. Therefore, IPO companies whose insiders hold

less diversified portfolios are more likely to bring underwriters increased future business if they are allowed to sell their shares early.

The third possible direction is to investigate trading strategies based on IPO and SEO lockup decisions. In Chapter 4, I document that the combination of IPO and SEO lockup decisions predicts the SEO announcement effect. Therefore, it is possible to develop trading strategies that exploit this predictability of the SEO announcement effect.

Lastly, I plan to use the instrumental variable analysis to address potential endogeneity, providing additional empirical evidence for the impact of IPO lockup on SEO lockup. A possible instrumental variable is the market-wide illiquidity measure at the time of IPO. Karpoff et al. (2013) have used the market-wide illiquidity measure as an instrumental variable to control for the endogeneity of SEO lockup length. Karpoff et al. (2013) argue that the demand for an SEO lockup is positively related to the market-wide illiquidity at the SEO. However, the market-wide illiquidity is unrelated to individual SEO's underwriting fees and underpricing. Based on Karpoff et al. (2013), the demand for an IPO lockup is positively related to the market-wide illiquidity at the IPO. However, the market-wide illiquidity at the IPO is unrelated to the demand for a lockup at the SEO. Therefore, the analysis that uses the market-wide illiquidity as an instrumental variable provides additional empirical evidence for the impact of IPO lockup on SEO lockup.

References

Aggarwal, R. (2000). Stabilization activities by underwriters after initial public offerings. *Journal of Finance*, 55(3):1075–1103.

Altinkilic, O. and Hansen, R. S. (2003). Discounting and underpricing in seasoned equity offers. *Journal of Financial Economics*, 69(2):285–323.

Amihud, Y., Hauser, S., and Kirsh, A. (2003). Allocations, adverse selection, and cascades in IPOs: Evidence from the Tel Aviv stock exchange. *Journal of Financial Economics*, 68(1):137–158.

Benveniste, L. M. and Spindt, P. A. (1989). How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics*, 24(2):343–361.

Benveniste, L. M. and Wilhelm, W. J. (1990). A comparative analysis of IPO proceeds under alternative regulatory environments. *Journal of Financial Economics*, 28(1-2):173–207.

Bharath, S., Dahiya, S., Saunders, A., and Srinivasan, A. (2007). So what do I get? The bank's view of lending relationships. *Journal of Financial Economics*, 85(2):368–419.

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

Brav, A. and Gompers, P. A. (2003). The role of lockups in initial public offerings. *Review of Financial Studies*, 16(1):1–29.

Brennan, M. and Franks, J. (1997). Underpricing, ownership and control in initial

public offerings of equity securities in the UK. *Journal of Financial Economics*, 45(3):391–413.

Chemmanur, T. and Fulghieri, P. (1999). A theory of the going-public decision. *Review of Financial Studies*, 12(2):249–79.

Chen, H.-C., Chen, S.-S., and Huang, C.-W. (2012). Why do insiders sell shares following IPO lockups? *Financial Management*, 41(4):813–847.

Choe, H., Masulis, R., and Nanda, V. (1993). Common stock offerings across the business cycle: Theory and evidence. *Journal of Empirical Finance*, 1(1):3–31.

Cornelli, F. and Goldreich, D. (2001). Bookbuilding and strategic allocation. *Journal of Finance*, 56(6):2337–2369.

Courteau, L. (1995). Under-diversification and retention commitments in IPOs. *Journal of Financial and Quantitative Analysis*, 30(04):487–517.

Edelen, R. M. and Kadlec, G. B. (2005). Issuer surplus and the partial adjustment of IPO prices to public information. *Journal of Financial Economics*, 77(2):347 – 373.

Ellis, K., Michaely, R., and O'Hara, M. (2000). When the underwriter is the market maker: An examination of trading in the IPO aftermarket. *Journal of Finance*, 55(3):1039–1074.

Field, L. C. and Hanka, G. (2001). The expiration of IPO share lockups. *Journal of Finance*, 56(2):471–500.

Gale, I. and Stiglitz, J. E. (1989). The informational content of initial public offerings. *Journal of Finance*, 44(2):469–477.

Hanley, K. W. (1993). The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics*, 34(2):231 – 250.

Hensler, D. A. (1995). Litigation costs and the underpricing of initial public offerings. *Managerial and Decision Economics*, 16(2):111–128.

Hoberg, G. (2007). The underwriter persistence phenomenon. *Journal of Finance*, 62(3):1169–1206.

Hughes, P. J. and Thakor, A. (1992). Litigation risk, intermediation, and the underpricing of initial public offerings. *Review of Financial Studies*, 5(4):709–42.

Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal of Financial Economics*, 2(3):235–272.

James, C. (1992). Relationship-specific assets and the pricing of underwriter services. *Journal of Finance*, 47(5):1865–85.

Jegadeesh, N., Weinstein, M., and Welch, I. (1993). An empirical investigation of IPO returns and subsequent equity offerings. *Journal of Financial Economics*, 34(2):153–175.

Karpoff, J., Lee, G., and Masulis, R. (2013). Contracting under asymmetric information: Evidence from lockup agreements in seasoned equity offerings. *Journal of Financial Economics*, 110(3):607–626.

Keloharju, M. (1993). The winner's curse, legal liability, and the long-run price performance of initial public offerings in finland. *Journal of Financial Economics*, 34(2):251 – 277.

Koh, F. and Walter, T. (1989). A direct test of Rock's model of the pricing of unseasoned issues. *Journal of Financial Economics*, 23(2):251–272.

Krigman, L., Shaw, W. H., and Womack, K. L. (2001). Why do firms switch underwriters? *Journal of Financial Economics*, 60(2-3):245–284.

Kutsuna, K., Smith, J., and Smith, R. (2009). Public information, IPO price formation, and long-run returns: Japanese evidence. *Journal of Finance*, 64(1):505–546.

Leland, H. and Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32(2):371–87.

Levis, M. (1990). The winner's curse problem, interest costs and the underpricing of initial public offerings. *Economic Journal*, 100(399):76–89.

Ljungqvist, A., Nanda, V., and Singh, R. (2006). Hot markets, investor sentiment, and IPO pricing. *The Journal of Business*, 79(4):1667–1702.

Ljungqvist, A. and Wilhelm, W. J. (2005). Does prospect theory explain IPO market behavior? *Journal of Finance*, 60(4):1759–1790.

Loughran, T. and Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies*, 15(2):413–444.

Lowry, M. and Schwert, G. (2004). Is the IPO pricing process efficient? *Journal of Financial Economics*, 71(1):3–26.

Lowry, M. and Schwert, G. W. (2002). IPO market cycles: Bubbles or sequential learning? *Journal of Finance*, 57(3):1171–1200.

Lucas, D. and McDonald, R. L. (1990). Equity issues and stock price dynamics. *Journal of Finance*, 45(4):1019–43.

Michaely, R. and Shaw, W. H. (1994). The pricing of initial public offerings: Tests of adverse-selection and signaling theories. *Review of Financial Studies*, 7(2):279–319.

Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. *Journal of Finance*, 32(4):1151–68.

Nimalendran, M., Ritter, J. R., and Zhang, D. (2007). Do today's trades affect tomorrow's IPO allocations? *Journal of Financial Economics*, 84(1):87–109.

Pagano, M., Panetta, F., and Zingales, L. (1998). Why do companies go public? an empirical analysis. *Journal of Finance*, 53(1):27–64.

Reuter, J. (2006). Are IPO allocations for sale? Evidencefrom mutual funds. *Journal of Finance*, 61(5):2289–2324.

Ritter, J. R. and Welch, I. (2002). A review of IPO activity, pricing, and allocations. *Journal of Finance*, 57(4):1795–1828.

Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics*, 15(1-2):187–212.

Rydqvist, K. (1997). IPO underpricing as tax-efficient compensation. *Journal of Banking & Finance*, 21(3):295–313.

Schultz, P. (2003). Pseudo market timing and the long-run underperformance of IPOs. *Journal of Finance*, 58(2):483–517.

Seyhun, H. N. and Bradley, M. (1997). Corporate bankruptcy and insider trading. *The Journal of Business*, 70(2):189–216.

Teoh, S. H., Welch, I., and Wong, T. (1998). Earnings management and the

long-run market performance of initial public offerings. *Journal of Finance*, 53(6):1935–1974.

Tinic, S. (1988). Anatomy of initial public offerings of common stock. *Journal of Finance*, 43(4):789–822.

Welch, I. (1992). Sequential sales, learning, and cascades. *Journal of Finance*, 47(2):695–732.

Yung, C. and Zender, J. F. (2010). Moral hazard, asymmetric information and IPO lockups. *Journal of Corporate Finance*, 16(3):320–332.