

Seasoned Equity Offerings, Options, and Short Sale Constraints

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Abstract

This paper examines the U.S. stock and options markets from January 1996 to December 2010 to investigate whether and how informed investors establish their option positions during the one week prior to an SEO issuance date. To do this, we employ two measures: the stock price ratio (SPR) and the normalized option trading volume (NOTV). High SPRs, which proxy the extent of synthetic short sale positions, are significantly associated with a persistent price discount, which indicates that informed traders migrate to options markets prior to an issuance date. Even though NOTVs are less informative than SPRs, they seem to increase significantly after October 2007 because of the increase in synthetic short sales due to the strengthening of Rule 105. Even after controlling for a firm's market capitalization and book-to-market ratio, the price discount on an issuance date is shown to be persistent when our two option measures are high. In addition, we find that more informed option trades occur in shelf registered SEOs than in non-shelf registered SEOs.

Keywords: SEOs, short sale constraints, options, stock price ratio, option trading volume

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1. Introduction

Since Easley, O'Hara and Srinivas (1998) suggested that informed investors establish their positions first in options markets to reduce transaction costs and utilize the leverage effect, many researchers have attempted to provide corroborating evidence showing that option prices respond before stock prices to new information (Chakravarty, Gluen, and Mayhew, 2004; Chordia, Roll, and Subrahmanyam; 2005; Schlag and Stoll, 2005; Pan and Poteshman, 2006; Boehmer and Kelly, 2009). In particular, when they are restricted in the stock market due to short sales constraints, options markets may be the best place for negatively informed traders to exploit their information. However, because it is difficult to detect the exact time when negative information is released to the market, most previous literature only investigates whether the changes in option trading volume lead or lag a sharp increase in short sale trades in the stock market (Kang and Park, 2014).

This paper provides more direct evidence that options markets are a habitat for investors with negative information by examining option trades around seasoned equity offerings (hereafter SEOs). Throughout our study, we assume that only informed short seller migrate options markets because manipulative short sellers, despite the short sale constraints, may think that suppressing pressure will be effective only in the stock market due to time constraints, while negative informed option traders may expect to make a profit if their information is reflected in option market regardless of the time when their information is reflected on stock prices. From this perspective, if short sales are effectively restricted due to Rule 105 during the one week period prior to an SEO issuance date, this period provides an ideal condition to confirm whether options

markets are indeed an informed habitat. This period also provides an ideal condition for examining whether the impact of pricing pressure exerted in options can be attributed to manipulative traders or to informed traders. There are two kinds of short sellers: manipulative and informed. If short sellers cover their positions by purchasing new shares at a discount price on an SEO's issuance date, there is an incentive for them to manipulate the price at the issuance date (Gerard and Nanda, 1993; Safieddine and Wilhelm, 1996; Henri and Koski, 2010). Or investors with negative information about an issuance price can also be motivated to construct short sale trades (Altinkikic and Hansen, 2003). If the impact of short sales on the stock price is short (long)- lived, it can be attributed to manipulative (informed) traders. Even though previous studies have tried to evaluate the trading behavior of informed investors prior to an issuance date by examining the stock market, their results are not complete because it is possible that only manipulative short-sellers remain in the stock market and informed investors migrate to the options markets to merely exploit their information. Therefore, in this study, we identify and test several hypotheses about the existence of manipulative and/or negatively informed trading in options markets and about the trading behavior of informed traders during the one week prior to an SEO's issuance date.

To our knowledge, this paper is the first study to investigate the impact of option traders on the price discount that typically occurs on an SEO's issuance date. Previous research related to SEOs limits the activity of traders to the stock market (Lee, 1997). However, we extend the scope of these studies by also including the activity of traders in the options markets. Given that both markets are cohesively connected (Bhattacharya, 1987; Stoll and

Whaley, 1990, Booth, So, and Tse, 1999; Chiang and Fung, 2001, Jayaraman, Frye, and Sabherwal, 2001; Chakravarty, Gluen, and Mayhew, 2004), manipulative or informed trades are possible in both markets. For example, the information known to investors in the stock market will be the same as that of informed investors in options markets. Therefore, with our results, we can suggest a method to utilize measures in option markets to predict the persistency of the price discount after an issuance date. Also, with our results, we can discern more clearly whether the intention of short sellers is to manipulate the price or to merely exploit their information.

This paper examines the U.S. stock and options markets from January 1996 to December 2010 to investigate whether and how investors establish their option positions during the one week prior to an SEO issuance date. To do this, we employ two measures: the stock price ratio (hereafter SPR) and normalized option trading volume (hereafter NOTV). SPR is the daily average log price ratio of the actual stock price to the implied stock price from options during the six days before an issuance date including the issuance date. NOTV is defined as the ratio of option trading volumes for these same six days to option trading volumes during the five days from ten days before the issuance date to six days before. Both measures increase as investors construct synthetic short sale positions or buy puts or sell calls to manipulate stock prices or to exploit their negative information. Although Safieddine and Wilhelm (1996) regard the increase in option open interest as an increase in manipulative trades in options markets, under the assumption that options are not as powerful as stocks for reducing the offer price on an issuance date when there is time constraint, such as upcoming SEO, it is plausible that only informed traders, not

manipulative traders, utilize options. Thus, the observation that SPR and/or NOTV increase before an SEO issuance date can indicate that only informed investors are exploiting their negative information in options markets, and that if manipulative traders do exist, they are active primarily in the stock market.

We sort SEOs according to these two measures and examine cumulative abnormal returns around the issuance dates of SEOs. Additionally, during our sample period, there were several amendments to Rule 105 that reinforced short sale constraints. On October 9th 2007, the Securities and Exchange Commission (SEC) extended Rule 105 to include shelf registered SEOs, which had been previously exempted. In addition, in September 2008, the SEC announced the Emergency Order, which banned naked short sales for all stocks in the U.S stock market. Although the ban was short-lived, because of this ban, the strengthening of Rule 105, and the bearish market after the subprime mortgage crisis, we suspect that the migration of informed short sellers to options markets may have been greater from October 2007 to the end of our sample period. Thus, we perform our experiments on two sub-periods as well as the whole sample period in order to confirm the statistical significance of our empirical results. Lastly, because extant literature reports that the impacts of short selling on the price discount at an issuance date are different depending on the type of issuing shares, i.e., shelf and non-shelf registration, we also test our hypotheses about the impact of option trades on the longevity of the price discount at an issuance date by classifying our sample into shelf and non-shelf registrations.

This paper firstly hypothesizes that informed investors who want to exploit their information migrate to options markets due to Rule 105 and establish synthetic short sale positions or purchase puts or sell calls. Under our hypothesis, negative information impounded in option prices will be manifested as a higher stock price ratio and/or a higher option trading volume and its impact will be long-lived. On the other hand, if investors want to manipulate the offer price at the issuance date rather than exploit negative information, they will remain in the stock market and their impact on the stock price will be short-lived. Thus, under our hypothesis, we conjecture that, if the two option measures increase before the issuance date, the price discount at the offering date will be persistent (H1). Secondly, because the migration of informed investors to options markets will increase as Rule 105 becomes more strengthened, we hypothesize that the positive relation between the persistency of the price discount after an issuance date and the values of SPR and NOTV will be stronger as the rule becomes more strengthened (H2). Because large (small) firms, information of which is released to the market relatively quickly (slowly) and accurately (inaccurately), usually file more shelf (non-shelf) registered SEOs than non-shelf (shelf) registered SEOs (Heron and Lie, 2004), SPR and NOTV may be more (less) associated with the persistency of the price discount after an issuance date for shelf registered SEOs (H3). This hypothesis can be further supported by the following two observations. Since shelf registered SEOs are mostly conducted as overnight offerings, manipulative traders may not have enough time to sell short before an issuance date, while informed investors can establish their positions in options markets at the issuance date. Moreover, Henri and Koski (2010) observe that, for non-shelf registered SEOs, there are more short sale trades prior to an issuance date and the

price discount is not persistent after the issuance date.

In our empirical results, informed investors appear to establish their positions in options markets to exploit their information about the price discount on an issuance date. As SPR and NOTV increase, the price discount is more persistent. Indeed, the decrease in a stock price of the group with the highest SPR and/or the highest NOTV at an issuance date does not rebound during the five days after an issuance date. However, that of the group with the lowest SPR and/or the lowest NOTV rebounds immediately after an issuance date. Consistent with this result, as Rule 105 becomes more restrictive, the relation between the two option measures and the persistency of the price discount becomes more positive. These results corroborate the existing evidence that informed investors migrate to options markets when short sale constraints are binding them. In addition, these results provide new measures for detecting negatively informed option trades before an SEO's issuance date. Moreover, the positive relation between the two option measures and the persistent price discount is more evident in shelf registered SEO's than in non-shelf registered SEOs.

The rest of the paper is organized as follows: Section 2 reviews the previous studies related to the price discount on an issuance date and develops our hypotheses. Section 3 describes the sample and the two option measures. Section 4 presents empirical results and Section 5 concludes.

2. The price discount on an issuance date

Like in the previous literature, we define the price discount on an issuance date as the logarithm of the ratio of the offer price from a lead underwriting company to the stock price on the date prior to the offer date. The price discount can be thought of as due to one of the following two reasons: negative information revealed by an underwriting company through evaluating an SEO firm's fundamental value (Altinkilic and Hansen, 2003) and selling pressure by manipulative short sellers expecting less risky profit by covering their positions by purchasing new shares on an issuance date (Gerard and Nanda, 1993; Safieddine and Wilhelm, 1996; Henri and Koski, 2010). These reasons have been examined extensively in the extant literature. By verifying hypotheses positing which reason among these two is more adoptable, these studies examine investors' trading behavior and their impact on prices around an SEO issuance date. Additionally and more importantly, because it has been known that manipulative short selling is pervasive prior to an issuance date, to find out which reason drives the market, the previous literature mostly utilizes short sale interest or transaction data prior to an issuance date.

Gerard and Nanda (1993) are the first study to theoretically derive the impacts of short sales on the price discount. They divide short sales into two categories: informative and manipulative. In their model, they conclude that the price impact of informed short sales will be smaller than that of manipulative short sales. Employing their theoretical prediction concerning the impacts of these two types of short sales on the price discount, Henri and Koski (2010) examine which purpose, information or manipulation, drives the majority of the short sales prior to an issuance date. They observe that, even though Rule 105 constrains short sales for the five days prior to an issuance date, short sales,

especially manipulative short sales, increase sharply during the short sale restriction period. Moreover, they confirm that these manipulative short sales are executed mainly in non-shelf registered SEOs. Furthermore, consistent with Gerard and Nanda (1993), the price discounts for non-shelf registered SEOs are greater and the stock prices of these firms rebound after an issuance date. Before Henri and Koski (2010), there were few studies examining the motive of short sales prior to an issuance date. Safieddine and Wilhelm (1996) used monthly short interest instead of daily short sale volume, due to the limits of data. By finding concrete evidence showing a significantly abnormal increase in short sale interest before issuing and the negative relation between the amount of short sale interest and the price discount, they stimulated the future studies questioning the purpose of short sales prior to an issuance date. In addition, even though their sample for SEOs with options is very small, 24 cases, they firstly examine options markets to ascertain whether the short sale demand attributed to manipulative reason has migrated to options markets after introducing Rule 10b-21 (the former name of Rule 105). With daily option open interest, they look into the changes in option trading prior to an issuance date and observe, like short sale interest, a sharp increase in open interest prior to the date. They conclude that manipulative short sales affect the price discount and these short sales decreased after the adoption of Rule 10b-21. However, they conjecture that manipulative trades have continued in options markets based on the observation of a significantly negative relation between the amount of open interest and the price discount. Recently, Autore and Gehy (2013) argue that the strengthening of Rule 105 On October 9th 2007 was also effective for reducing manipulative short sales. They also contend that the decrease in short sales reduces the demand for new shares so that it

makes the price discount greater. Collectively, the extant studies appoint manipulative short sellers as a main culprit to raise the price discount. However, compelling their arguments may be, the impact of the SEC's regulation on short sales is still not conclusive. Additionally, their studies focus only the stock market for examining the extent of informed trades.

Our study also examines which type of trades, informed or manipulative, affects the price discount. However, based on a different point of view from the previous studies, we do not assume that the price discount from informed trades is smaller than that from manipulative trades. If information is severely negative, it is plausible that the price discount from the negative information is greater than that from manipulative short sales. In addition, unlike Safieddine and Wilhelm (1996), we do not presume that the increase in option trades prior to an issuance date is caused by migration of manipulative traders from the stock market. We open the possibility of informed trades in options markets based on Easley, O'Hara, and Srinivas (1998). With these assumptions that differ from the previous studies, we hypothesize and test the following reasoning.

H1: If SPR or NOTV which proxy the extent of synthetic short sales increases before the issuance date, the price discount will be persistent.

Additionally, we consider the possibility that the strengthening of Rule 105 suppresses both manipulative and informed short sales, but only informed short sellers migrate to options markets because changes in option prices are not as powerful as changes in

stock prices for reducing the offer price under the assumption that manipulative short sellers are bound by time constraints, i.e. upcoming SEO. Therefore, we hypothesize and check the changes of the impact of informed and manipulative trades on the price discount following strengthening of Rule 105 as follows:

H2: The price discount after an issuance date is more persistent and the values of SPR and NOTV are stronger as Rule 105 becomes more strengthened.

Lastly, as pointed out by Henri and Koski (2010), we expect that manipulative trades will be difficult in shelf registered SEOs because of the very short time period for executing short sales. For instance, if a firm conducting a shelf registered SEO announces the exact issuance date overnight, there is no chance for manipulative short sellers to suppress the stock price because a lead underwriting company determines an offer price based on the closing price of the date prior to an issuance date. Moreover, since Heron and Lie (2004) document that firms conducting shelf registered SEOs are usually large firms which have less information asymmetry, we posit that information impounded in option trades will be revealed in the stock market with a short time lag. Therefore, we hypothesize and examine the impacts of informed and manipulative trades on the price discount of shelf and non-shelf registered SEOs as follows:

H3: The persistency of the price discount after an issuance date and the values of SPR and NOTV are greater in shelf registered SEOs than in non-shelf registered SEOs.

3. Data

3.1 Data specification

We examine SEOs from January 1996 to December 2010 in the U.S. markets, provided by the Securities Data Company (SDC) New Issue database. The sample criteria requires SEOs to be issues of common stocks by U.S. issuers that are listed on NYSE, NASDAQ, or AMEX and exclude firms that only issue secondary shares as well as utility companies (Standard Industrial Classification (SIC) codes between 4910 and 4949), closed-end funds (SIC codes between 6720 and 6739), and real estate investment trusts (REITs) (SIC code 6789). To calculate the cumulative excess returns around the time of SEOs, issuing firms are required to be listed in the CRSP returns file. In addition, because we examine the stock price ratios and option trading volumes ten days before and after an issuance date, only issuing firms of which options are traded during that period are selected. Option data come from OptionMetrics and we use ATM options with maturity less than 60days. The moneyness of options is calculated by dividing the stock price at five days before an issuance date by their exercise prices. Options with the closet moneyness to one are selected. The final sample has 1,111 observations.

3.2 Option measures

To exploit their negative information, informed investors can establish synthetic short positions, which is purchasing an ATM put and selling an ATM call simultaneously. However, unfortunately, we cannot estimate how many synthetic short sale positions are established because even the exchange cannot confirm whether an investor is a synthetic

short seller. Therefore, researchers have developed measures to discover the extent of synthetic short positions by estimating the resultant changes in option prices.

Ofek, Richardson, and Whitelaw (2004) design a measure by calculating the log difference between the implied stock price from options and the actual stock price. For European options, by rearranging the Put-Call Parity equation, the implied stock price can be calculated as follows:

$$S^* = C - P + Ke^{-r\tau} + D \quad (1)$$

where S^* is the implied stock price, and C and P are the call and put prices with the maturity of τ and the exercise price of K , respectively. r is the continuous compounded risk-free rate and D is the present value of realized dividends during the life of the options.

For the American options that we examine in this paper, an early exercise premium should be considered. Following Chen, Diltz, Huang, and Lung (2011), we can rewrite equation (1) as:

$$S^* = C - P + Ke^{-r\tau} + D - EEP_{Call} + EEP_{Put} \quad (2)$$

Where EEP_{Call} and EEP_{Put} are the early exercise premiums for American call and put options, respectively¹.

Besides establishing synthetic short sale positions, informed option traders can buy puts, especially OTM puts, or sell calls. Therefore, to measure these various informed option

¹ These early exercise premiums are calculated by the method of Barone-Adesi and Whaley (1987).

trades, we also employ option trading volumes. However, the size of option trading volume itself may not reveal the amount of information, because some options are actively traded and so have large average trading volume, while others have small average trading volume regardless of the arrival of negative information. Thus, we normalize option trading volumes during the six days before an issuance date including the date by dividing them by option trading volumes during the five days from ten days before the issuance date to six days before. We name this normalized option trading volume as NOTV and calculate it as follows:

$$\text{NOTV}^j = \frac{\sum_{i=-5}^0 \text{OTV}_i^j}{\sum_{i=-10}^{-6} \text{OTV}_i^j} \quad (3)$$

where j denotes a SEO firm, j , and OTV_i^j indicates a daily option trading volume of firm j at day i .

Table 1 reports descriptive statistics of our SEO sample. We report the number of SEOs, proceeds from the SEOs, the price discount at an issuance date, issuing firms' market capitalizations and book-to-market ratios, the stock price ratio at the issuance date, and option trading volumes at the date normalized by dividing them by outstanding shares. For the whole sample period, 3,595 SEOs were issued and 1,111 among them were SEOs conducted by firms with options. Because the first sample period from January 1996 to September 2007 is much longer than the second sample period from October 2007 to December 2010, it is natural that more SEOs were conducted during the first period. Interestingly, non-shelf registered SEOs were conducted twice as often as shelf registered SEOs during the first period, but shelf registered SEOs were issued two times more than non-shelf registered SEOs during the second period. There are no significant differences

in proceeds, market capitalizations, and book-to-market ratios in four groups of SEOs sorted by the period before and after 2007 and the type of issuance. However, the price discounts on issuance dates become much greater after October 2007. For shelf (non-shelf) registered SEOs, the price discount is -2.8% (-3.2%) and significant during the second period. In addition, the stock price ratio on an issuance date is the greatest, 0.031%, for shelf registered SEOs during the second period, which indicates that the actual stock price is higher by 0.031% than the implied stock prices from options. Option trading volume normalized by dividing them by outstanding shares on an issuance date becomes ten times greater after October 2007.

4. Empirical results

Short selling prior to an issuance date may be difficult. Besides high transaction costs and high required credibility, it may be hard to purchase new shares at the date. Therefore, option trading will be the best or more convenient venue to exploit negative information to avoid the difficulties mentioned above. In this section, we firstly examine whether informed traders utilize options, especially synthetic short sale positions, which consist of short positions in ATM calls and long positions in ATM puts. Provided that the increase in synthetic short sale positions is the manifestation of negatively informed trades, the price discount will be higher and should be maintained after the issuance date. Thus, we also examine whether the extent of synthetic short sales or option trades in general is associated with the cumulative excess returns from an issuance date through five days after the date. Secondly, we investigate the impact of the amendments

to Rule 105 on the extents of informed and manipulative trades. Given that manipulative trades are conducted only in the stock market with the purpose of suppressing an issuance price, if manipulative trades are reduced due to the strengthening of Rule 105, the relation between the persistency of the price discount and SPR or NOTV will be stronger. Lastly, we examine whether there is a significant difference in the relation between the persistency of the price discount and SPR or NOTV for shelf and non-shelf registered SEOs. Because of the short time from the announcement of the SEO to its issuance, shelf registered SEOs make it difficult to conduct manipulative trades using short sales. Thus, it is plausible that the relation between the persistency of the price discount and the two option measures will be stronger in shelf registered SEOs than in non-shelf registered SEOs.

4.1 Informed option trades prior to an issuance date.

The price at the issuance date is determined through the evaluation of an SEO firm's fundamental value by underwriting companies. In addition, underwriters need to sell all of the new shares on the issuance date, and so they need to compensate uninformed investors by providing a discount in the issue price due to the winner's curse problem. Therefore, from the information about the firm's value and the demand for new shares, investors can make a profit by transacting shares in the stock market. However, if information about the price at the issuance date is negative, investors cannot fully take advantage of their information in the stock market as much as they want because of short sale constraints. Given the situation with short sale constraints, the best venue will

be options markets, which have little regulation and have almost no limits on the amount of option positions.

To investigate whether negatively informed investors about the price at the issuance date indeed choose options markets, we examine the SPR and NOTV for the six days from five days before an issuance date, in which short sales are restricted by Rule 105, through the issuance date. Because SPR is the log difference between the actual stock price and the implied stock price from options, it increases as investors establish more synthetic short sale positions. Moreover, since merely purchasing puts, especially OTM puts, or selling calls can also be favored by negatively informed investors, we also employ NOTV.

Table 2 exhibits cumulative excess returns from an issuance date to five days later, which are calculated by subtracting CRSP daily volume-weighted returns from the raw stock returns of an SEO firm. The first four rows show the cumulative excess returns of SEO firms sorted by the sign of SPR and the change in SPR from the period of days[-10,-6] to the period of days[-5,0]. For firms with negative SPRs, even though the price discount at an issuance date is significantly negative, -0.012, stock prices after the issuance date rebound and become insignificantly different from the price one day before an issuance date. It is possible, for these firms, that manipulative traders put pressure on stock prices in the stock market by selling short and thus stock prices rebound to the level of their fundamental values after issuance. However, interestingly, firms with positive SPRs, indicating an increase in synthetic short sale positions, show a persistent price discount. Additionally, throughout the whole period from an issuance date to five days after the

date, the cumulative excess returns of firms with positive AND increased SPRs are all significantly negative and stay at the level of the discount price. Thus, we can say that negatively informed investors migrate to options markets and they establish synthetic short sale positions to exploit their information. The last four rows show the cumulative excess returns of firms sorted by NOTV. For all four groups, the price discounts on an issuance date are significantly negative, and the price discount is biggest for the top 25% NOTV group. However, the stock prices rebound during the five days after the issuance date and the cumulative excess returns are all insignificantly different from zero at the fifth day after the issuance date, though the top 25% NOTV group shows persistently negative and significant returns until day 4. Because not all option traders are informed traders, NOTV may be less informative and so less predictive than SPR. For example, less informed or less sophisticated investors can bet on a decrease in the price at the issuance date on the basis of the average discount of the issuance price and makes NOTV less informative.

Figure 1 plots the cumulative excess returns of SEO firms sorted by SPR or by NOTV. As stated in Table 2, negatively informed option trades seem to be manifested with both positive and increased SPRs, while option trading volumes appear to be less informative.

Figure 2 exhibits the trend of daily stock price ratios and option trading volumes normalized by dividing them by a firm's outstanding shares from nine days before to ten days after an issuance date. Unlike Table 1, for simplicity, Figure 2 shows daily stock price ratios and option trading volumes for SEO firms with both positive and increased

SPRs and for SEO firms of which NOTV is in the top 25%. As expected in Table 2 and Figure 1, daily stock price ratios increase until an issuance date and then decrease. On an issuance date, on average, the actual stock price is higher than the implied stock prices from options by about 0.4%. During the six days including the issuance date, in which short sales are restricted, the stock price ratio increases. This high stock price ratio can be attributed to an increase in synthetic short sale positions (or long positions in puts or short positions in calls) established by informed investors migrating to options markets to avoid short sale constraints in the stock market. Daily option trading volumes start to increase from five days before an issuance date and they sharply increase at the issuance date. With the rebound in cumulative excess returns after an issuance date shown in Table 2, the peaked option trading volume at the issuance date may imply that noise traders, who want to make profits based on the common knowledge that the price at an issuance date tends to significantly decrease from the previous day, are crowded into options markets.

4.2 The impact of the amendments to Rule 105

As documented in Henri and Koski (2010), despite Rule 105, manipulative short sales are observed prior to an issuance date. Therefore, to strengthen Rule 105, in which the covering of short sale positions by purchasing new shares was banned only for non-shelf registered SEOs, the SEC, on October 9th 2007, amended the rule to include shelf registered SEOs. In addition, to stabilize the market from the panic caused by the subprime mortgage crisis in the U.S., in September 2008, the Emergency Order

prohibited all naked short sales in the stock market. Even though the Emergency Order was not directly related to SEOs, it effectively eradicated manipulative short sales prior to an issuance date. If these two rules reduce short sales in the stock market prior to an issuance date, we can expect that informed investors further migrate to options markets to exploit their negative information. Thus, the relation between the persistency of the price discount and the two option measures may be strengthened during the period after October 2007.

Table 3 shows the cumulative excess returns of SEO firms sorted by SPR or NOTV as in Table 2, when the sample period is divided into two sub-periods: before and after October 2007. During the first period, before October 2007, only the cumulative excess returns of SEO firms with both positive sign and increased SPRs are significantly negative and persistent. In contrast, after October 2007, SEO firms with either positive or increased SPRs show a significant and persistent price decrease after an issuance date. Additionally, the cumulative excess returns of SEO firms with NOTV in the top 25% are significantly negative and persistent during the five days after an issuance date. Notably, the price discount on an issuance date after October 2007 is about two times greater than that of before October 2007. Autore and Gehy (2013) document that the price discount at an issuance date becomes greater after the amendment to Rule 105. They attribute the increase in the price discount to a decreased demand for new shares on an issuance day. More specifically, they argue that the reduction in short sales due to the strengthening of Rule 105 contributes to the decrease in demand for new shares and to the increase in the price discount. However, given that all stock prices decreased during

that period because of the subprime mortgage crisis, the increase in the price discount might be due to the decrease in the normal level of stock prices, which are denominators in the calculation of the price discount². Moreover, it is hard to explain the increase in the price discount with the reduction in the demand for new shares by short sellers since other investors, especially arbitragers, will take advantage of this temporary price discount due to the temporary lack of liquidity. Furthermore, the increase in the predictability of the two option measures about the persistency of the decrease in stock prices after an issuance date indicates that the amendment to Rule 105 and the Emergency Order effectively prohibit manipulative short sales. Of course, these two rules also reduce short sales by informed traders, but, as our results indicate, these informed investors can migrate to options markets. Therefore, the increase in the percentage of informed option traders even strengthens the relation between the persistent price discount and NOTV. Figure 3 is consistent with the implication of Table 3. Before October 2007, even though the daily stock price ratio started to increase from five days before an issuance date, the increase in the ratio is relatively smaller than that in the ratio after October 2007. The average stock price ratio before October 2007 is around 0.3% and that after October 2007 is almost 0.5%. Moreover, option trading volumes during the five days prior to an issuance date sharply rise after October 2007. The average option trading volumes normalized by dividing them by outstanding shares is nearly 9% at an

²For example, American Airline Group Inc. issued new shares on January 22nd 2007 and on September 22nd 2009. The stock prices at the previous days of those issuing dates were \$40.66 and \$9.03, respectively. Because the issue prices were \$38.7 and \$8.25, respectively, their price discounts are -4.82% and -8.64%, respectively.

issuance date during the period after October 2007, while it is only 1.8% during the previous period.

4.3 The difference between shelf and non-shelf registered SEOs.

Since 1984 when the SEC firstly allowed shelf registered SEOs, which require much simpler procedures for filing SEOs, the frequency of shelf registered SEOs has increased. As shown in Table 1, after October 2007, for firms with options, shelf registered SEOs were issued two times more than non-shelf registered SEOs. Mostly issued as overnight offerings, shelf registered SEOs may have a similar impact as Rule 105 on preventing manipulative short sales prior to an issuance date. However, to date, except Henri and Koski (2010) showing that manipulative short sales seem to be executed more in non-shelf registered SEOs than in shelf registered SEOs, there is no study to examine the difference in the impacts of shelf and non-shelf registered SEOs on trading behavior. With the conjecture that manipulative short sales may be reduced and informed investors will go to options markets in larger numbers in shelf registered SEOs, we examine whether the relation between the persistency of the price discount on an issuance date and the two option measures, SPR and NOTV, is stronger in shelf registered SEOs than in non-shelf registered SEOs.

With the same classification according to SPR and NOTV as the previous tables, Table 4 exhibits the cumulative excess returns of shelf and non-shelf registered SEOs during the six days after an issuance date including the date. Although the price discounts on an

issuance date are significantly negative regardless of the extents of SPR and NOTV and regardless of the type of issuance, only the price discounts of shelf registered SEOs with both positive and increased SPRs are maintained during the five days after the issuance date. Compared with the results in Table 2, the relation between SPR and the persistency of the price discount becomes stronger in that a mere increase in SPR, without considering the sign of SPR, can also be associated with a persistent price discount. However, option trading volumes do not seem to be directly related to the amount of synthetic short sale trades. Regardless of the type of issuance, for the four groups of SEO firms sorted by NOTV, stock prices rebound to the level of the stock prices one day prior to an issuance date. Consistent with our hypothesis, for non-shelf registered SEOs, the relation between the persistency of the price discount and the two option measures is not significant. Given that non-shelf registered SEOs are conducted by relatively small companies (Heron and Lie, 2004) and that the post SEO stock performances are worse in these small companies (Denis and Sarin, 2001), we can infer that negative information is not reflected in the stock prices during the six days after an issuance date including the date due to high information asymmetry. Indeed, as shown in Figure 5, the three year post SEO stock performance is much worse in non-shelf registered SEOs than in shelf registered SEOs. The post SEO stock performance is calculated by subtracting a size and book-to-market benchmark firm's cumulative return from an SEO firm's cumulative return. Under the situation where information is slowly reflected, informed investors may be hesitant to establish positions to exploit their information because they will not be sure of the exact time of information dissemination. If then, manipulation of stock prices will become easier due to the absence of informed traders. Therefore, as we predicted,

manipulative trades will happen more actively in non-shelf registered SEOs than in shelf registered SEOs. Thus, we can say that the rebound of stock prices during the period may be attributed to manipulative short sales in the stock market. In addition, noise option trades can make the relation between the persistency of the price discount and the two option measures insignificant. Figure 4 supports our inference that SPR and NOTV are less informative in non-shelf registered SEOs. For shelf registered SEOs, SPR during the six days from five days before an issuance date to the issuance date is significantly greater and two times bigger than the previous period. On the other hand, the stock price ratio for non-shelf registered SEOs increases by 50% during the period of the five days prior to an issuance date from the value during the period of to the five days from ten days before the issuance date to six days before.

Table 5 shows regression results summarizing our empirical experiments. The cumulative excess returns during the six days starting from an issuance date are the dependant variable We regress the cumulative excess returns on SPR in regression 1, and we add NOTV as an additional independent variable in regression 2. To confirm the impact of the amendment to Rule 105, we add the products of a dummy variable that is one (zero) for the SEOs conducted after (before) October 9th 2007 and the two option measures as independent variables in regression 3. Also, to ascertain whether informed option trades occur more in shelf registered SEOs, we add the products of a dummy variable that is one (zero) for shelf (non-shelf) registered SEOs and the two option measures in regression 4. To control for SEO firms' characteristics, for all regressions, we include their log market capitalizations and book-to-market ratios as independent variables.

Consistent with the previous results, SPR is significantly and negatively related to the cumulative excess return. Even when NOTV or dummy variables that are multiplied by SPR or NOTV are included, SPR is still negatively significant. On the contrary, NOTV seems to be predictive concerning the cumulative excess returns only for the period after October 2007. In regression 2, the coefficient of NOTV is insignificantly negative, -0.360, but, in regression 3, the product of NOTV and a dummy variable that indicates the time period becomes significant and negative, -3.030. In regression 4, which includes SPR and NOTV multiplied by a dummy indicating a shelf registered SEO, the coefficient of the term including SPR multiplied by a period dummy is significant, -1.071. However, the coefficient of NOTV multiplied by a period dummy is insignificant.

In summary, SPRs, which proxy the extent of synthetic short sale positions, are significantly related to the persistency of the price discount. We can infer that informed option traders actively establish synthetic short sale positions prior to an issuance date. In addition, option trading volumes seem to increase significantly after October 2007 because of the increase in synthetic short sales due to the strengthening of Rule 105. Furthermore, more informed option trades occur in shelf registered SEOs than in non-shelf registered SEOs.

5. Conclusion

In the case where negative information is known but short sales are restricted, informed investors may naturally migrate to options markets to exploit their negative information. Because the price discount on an SEO issuance date will be persistent if informed traders establish their positions in options markets, the one week period before an SEO issuance date is ideal for examining whether informed investors indeed choose options markets due to short sale constraints. Thus, by examining SEOs in the U.S. stock and options markets, we verify three hypotheses conjecturing the relation between informed option trades and the persistency of the price discount.

Firstly, we hypothesize that the price discount at an issuance date will be persistent during the five days after the issuance date if trades in the options market are driven by information and not for manipulation. The extent of informed option trades is proxied by stock price ratio (SPR) and normalized option trading volume (NOTV). SPR is the daily average log ratio of the actual stock price to the implied stock price from options for six days before an issuance date including the date. NOTV is the option trading volume ratio calculated by dividing option trading volumes during the six days before an issuance date including the date by option trading volumes for the five days from ten days before the issuance date to six days before. Secondly, we hypothesize that informed option trades will occur more actively and manipulative short sales will be reduced after October 9th 2007 when the SEC strengthened Rule 105. Lastly, we hypothesize that the percentage of informed option traders will be greater in shelf registered SEOs than in non-shelf registered SEOs. Most shelf registered SEOs are overnight offerings, which give manipulative traders much less time to construct short sales, and are conducted by large

companies, which have less information asymmetry than small SEO firms that usually utilize non-shelf registered SEOs.

In our empirical results, for SEO firms with both positive and increased SPRs, the cumulative excess returns maintain their levels on an issuance date during the six days after the issuance date including the date. This evidence is consistent with the hypothesis that informed option traders utilize synthetic short sale positions (or short positions in calls or long positions in puts) to exploit their negative information about the price at the issuance date. Before October 2007, NOTV is not significantly related to the permanent price discount. However, after October 2007, the higher NOTV is, the more significant the cumulative excess returns are. We attribute this to the reduction in short sales in the stock market due to the amendment to Rule 105 and the Emergency Order. In other words, the percentage of informed option traders becomes greater after October 2007. Consistent with our hypothesis, informed option trades prior to shelf registered SEOs seem to occur more actively than those prior to non-shelf registered SEOs. Not only shelf registered SEOs with positive SPRs but also shelf registered SEOs with merely increased SPRs (both negative and positive SPRs) show the persistent price discount during the five days after an issuance date. Our regression results confirm our findings in our event studies. Regardless of the classification of the sample period or the type of issuance, SPR affects the price discount negatively and persistently. NOTV is significant only when it is multiplied by a dummy variable indicating the period after October 2007. Moreover, the coefficient of SPR multiplied by a dummy variable denoting shelf registered SEOs is significantly negative.

In this study, we suggest two measures to detect the extent of informed option trades prior to an SEO issuance date, SPR and NOTV. Next we use these measures to provide direct evidence that negatively informed investors become more active in options markets when they are restricted by short sale constraints, such as the situation under the strengthened Rule 105 and the Emergency Order. In addition, we observe that shelf registration of SEOs also increases the percentage of informed traders in options markets by shortening the period when manipulative short sales can be constructed.

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Table 1. Summary statistics

This table shows the summary statistics about SEOs conducted during our sample period from January 1996 to December 2010. To provide frequency distributions of all SEOs conducted during the period, we also present the SEOs of firms without options as well as SEOs of firms with options. In addition, because our empirical experiments are performed on sub-samples classified by the time period and by the type of issuance, we describe the number of SEOs, proceeds, the price discount on an issuance date, market capitalizations, book-to-market ratios, and the stock price ratio and option trading volumes on an issuance date for four groups of SEOs. Option trading volumes are normalized by dividing them by the firm's outstanding shares. The parentheses below the price discount on an issuance date represent the Wilcoxon signed rank p-values.

	With options				Without options			
	Before the amendments of Rule 105 (October 2007)		After the amendments of October 2007		Before the amendments of Rule 105 (October 2007)		After the amendments of October 2007	
	Shelf	Non-shelf	Shelf	Non-shelf	Shelf	Non-shelf	Shelf	Non-shelf
Number of SEOs	348	622	94	47	354	1,715	256	259
Proceeds (Mil.)	152,261	126,965	139,211	182,175	79,375	70,000	70,000	99,462.5
The price discount at an SEO's issuance date	-0.010 (0.001)	-0.010 (0.000)	-0.028 (0.000)	-0.032 (0.018)	-0.012 (0.000)	-0.011 (0.000)	-0.035 (0.000)	-0.028 (0.000)
Market cap. (Mil.)	1,720,989	1,023,238	1,987,850	2,187,199	616,545	308,179	663,823	852,219
Book-to-Market ratio	0.373	0.416	0.398	0.417	0.406	0.509	0.376	0.409
Stock price ratio at an issuance date (%)	0.003	0.002	0.031	0.002	-	-	-	-
Option trading volume at an issuance date normalized by outstanding shares (%)	0.383	0.291	2.863	3.147	-	-	-	-

Table 2. Cumulative excess returns

This table shows the cumulative excess returns of firms with options conducting SEOs during the period from January 1996 to December 2010. SEOs are classified according to SPR and NOTV. SPR is the average stock price ratio during the six days from five days before an issuance date to the date, which is the log difference between the actual stock price and the implied stock price from options. NOTV is the option trading volume during the six days before an issuance date including the date normalized by dividing it by option trading volume during the five days from ten days before the issuance date to six days before. In the first four rows are SEOs sorted by the sign and the changes in SPR. The change in SPR is calculated by dividing the average SPR by the average daily stock price ratio during the period from ten days before an issuance date to six days before. The significance of the cumulative excess returns are evaluated by the Wilcoxon sign rank p-values and ***, **, and * represent that returns are significant at 0.01, at 0.05, and at 0.10, respectively.

		Days					
		0	1	2	3	4	5
SPR	Negative	-0.013***	-0.009***	-0.004	-0.001	-0.001	0.001
	Positive	-0.012***	-0.012***	-0.012***	-0.010***	-0.008**	-0.009**
	Increased	-0.014***	-0.011***	-0.009***	-0.008**	-0.007*	-0.006
	Positive and increased	-0.014***	-0.015***	-0.015***	-0.014***	-0.013**	-0.014**
NOTV	Bottom 25%	-0.005***	-0.009**	-0.004	-0.002	-0.001	-0.001
	From 25% to 50%	-0.017***	-0.012***	-0.010**	-0.010*	-0.008	-0.007
	From 50% to 75%	-0.009***	-0.008*	-0.005	-0.001	0.001	0.000
	Top 25%	-0.018***	-0.014**	-0.013**	-0.011*	-0.012*	-0.009

Table 3. Cumulative excess returns for the periods before and after October 2007

This table shows the cumulative excess returns of firms with options conducting SEOs during the period from January 1996 to December 2010. SEOs are classified according to SPR and NOTV. SPR is the average stock price ratio during the six days from five days before an issuance date to the date, which is the log difference between the actual stock price and the implied stock price from options. NOTV is the option trading volume during the six days before an issuance date including the date normalized by dividing it by option trading volume during the five days from ten days before the issuance date to six days before. In addition, we divide the whole sample period into two sub-periods: before and after October 2007 when the SEC amended Rule 105. In the first four rows are SEOs sorted by the sign and the changes in SPR. The change in SPR is calculated by dividing the average SPR by the average daily stock price ratio during the period from ten days before an issuance date to six days before. The significance of the cumulative excess returns are evaluated by the Wilcoxon sign rank p-values and ***, **, and * represent that returns are significant at 0.01, at 0.05, and at 0.10, respectively.

		Days						
		0	1	2	3	4	5	
Before October 2007	SPR	Negative	-0.012***	-0.008**	-0.002	0.001	0.000	0.002
		Positive	-0.008***	-0.006**	-0.006	-0.005	-0.003	-0.003
		Increased	-0.011***	-0.008**	-0.005	-0.004	-0.002	-0.003
		Positive and increased	-0.012***	-0.011***	-0.010**	-0.009**	-0.007*	-0.009**
	NOTV	Bottom 25%	-0.004**	-0.007*	-0.002	0.000	0.001	0.001
		From 25% to 50%	-0.017***	-0.011**	-0.008	-0.009*	-0.008	-0.005
		From 50% to 75%	-0.008**	-0.008*	-0.005	-0.001	0.000	-0.001
		Top 25%	-0.011**	-0.004	-0.001	0.000	-0.001	0.002
After October 2007	SPR	Negative	-0.021***	-0.019**	-0.017**	-0.015	-0.013	-0.011
		Positive	-0.038***	-0.046***	-0.050***	-0.044***	-0.042***	-0.041***
		Increased	-0.028***	-0.031***	-0.035***	-0.030**	-0.030**	-0.026*
		Positive and increased	-0.026**	-0.031**	-0.040**	-0.035**	-0.037**	-0.034*
	NOTV	Bottom 25%	-0.012**	-0.020**	-0.017*	-0.017*	-0.019	-0.013
		From 25% to 50%	-0.011	-0.015	-0.027*	-0.026	-0.019	-0.023
		From 50% to 75%	-0.049***	-0.052***	-0.044**	-0.028	-0.023	-0.024
		Top 25%	-0.047**	-0.047**	-0.053**	-0.051**	-0.054**	-0.050**

Table 4. Cumulative excess returns for shelf and non-shelf registered SEOs

This table shows the cumulative excess returns of firms with options conducting SEOs during the period from January 1996 to December 2010. SEOs are classified according to the type of issuing, SPR and NOTV. SPR is the average stock price ratio during the six days from five days before an issuance date to the date, which is the log difference between the actual stock price and the implied stock price from options. NOTV is the option trading volume during the six days before an issuance date including the date normalized by dividing it by option trading volume during the five days from ten days before the issuance date to six days before. In the first four rows are SEOs sorted by the sign and the changes in SPR. The change in SPR is calculated by dividing the average SPR by the average daily stock price ratio during the period from ten days before an issuance date to six days before. The significance of the cumulative excess returns are evaluated by the Wilcoxon sign rank p-values and ***, **, and * represent that returns are significant at 0.01, at 0.05, and at 0.10, respectively.

		Days						
		0	1	2	3	4	5	
Shelf	SPR	Negative	-0.016 ^{***}	-0.014 ^{***}	-0.010 [*]	-0.006	-0.004	-0.004
		Positive	-0.012 ^{***}	-0.018 ^{***}	-0.016 ^{***}	-0.015 ^{***}	-0.013 ^{**}	-0.015 ^{**}
		Increased	-0.012 ^{***}	-0.017 ^{***}	-0.016 ^{***}	-0.013 ^{**}	-0.011 [*]	-0.012 ^{**}
		Positive and increased	-0.011 ^{**}	-0.019 ^{***}	-0.017 ^{**}	-0.015 ^{**}	-0.014 [*]	-0.016 ^{**}
	NOTV	Bottom 25%	-0.006 [*]	-0.016 ^{***}	-0.012 ^{**}	-0.010	-0.009	-0.009
		From 25% to 50%	-0.013 ^{***}	-0.012 ^{**}	-0.015 ^{**}	-0.014 [*]	-0.014 [*]	-0.014
		From 50% to 75%	-0.010 ^{**}	-0.016 ^{***}	-0.009	-0.007	-0.002	-0.004
		Top 25%	-0.025 ^{***}	-0.021 ^{**}	-0.016	-0.011	-0.011	-0.010
Non-shelf	SPR	Negative	-0.012 ^{***}	-0.006	0.001	0.002	0.000	0.004
		Positive	-0.012 ^{***}	-0.007 [*]	-0.009 [†]	-0.008	-0.005	-0.004
		Increased	-0.015 ^{***}	-0.006	-0.004	-0.003	-0.003	-0.002
		Positive and increased	-0.016 ^{***}	-0.011 [*]	-0.012 [*]	-0.011 [*]	-0.010	-0.010
	NOTV	Bottom 25%	-0.006 ^{***}	-0.006	-0.001	0.001	0.001	0.003
		From 25% to 50%	-0.019 ^{***}	-0.012 [*]	-0.006	-0.005	-0.003	0.000
		From 50% to 75%	-0.008 ^{**}	-0.003	-0.003	0.001	0.002	0.003
		Top 25%	-0.013 ^{**}	-0.008	-0.009	-0.008	-0.011	-0.006

Table 5. Regression analysis

This table shows the regression results of the following four equations:

- (1) $r_{[0,5]}^i = \alpha + \beta_1 SPR_i + \beta_7 \log(Size_i) + \beta_8 BM_i + \varepsilon_i$
- (2) $r_{[0,5]}^i = \alpha + \beta_1 SPR_i + \beta_2 NOTV_i + \beta_7 \log(Size_i) + \beta_8 BM_i + \varepsilon_i$
- (3) $r_{[0,5]}^i = \alpha + \beta_1 SPR_i + \beta_2 NOTV_i + \beta_3 SPR_i \times D_{period} + \beta_4 NOTV_i \times D_{period} + \beta_7 \log(Size_i) + \beta_8 BM_i + \varepsilon_i$
- (4) $r_{[0,5]}^i = \alpha + \beta_1 SPR_i + \beta_2 NOTV_i + \beta_3 SPR_i \times D_{period} + \beta_4 NOTV_i \times D_{period} + \beta_5 SPR_i \times D_{shelf} + \beta_6 NOTV_i \times D_{shelf} + \beta_7 \log(Size_i) + \beta_8 BM_i + \varepsilon_i$

$r_{[0,5]}^i$ is the cumulative excess return calculated by subtracting the daily CRSP volume-weighted returns from the raw stock returns of firm i . SPR is the average stock price ratio during the period from five days before to the date. $NOTV$ is the option trading volumes from five days before the issuance date to the date normalized by dividing them by the option trading volume from ten days before the issuance date to six days before. $Size$ is the product of the number of outstanding shares and the stock price prior to the issuance date. BM is the book-to-market ratio of firm i . D_{period} and D_{shelf} are dummy variables that indicate the period after October 2007 and shelf registered SEOs, respectively. The significance of the estimated coefficients are represented with ***, **, and *, which indicate being significant at 0.01, at 0.05, and at 0.10, respectively. The significance is based on two-tailed t-tests.

Regression equation	Estimates							Adj. R ²
	A	β_1	β_2	β_3	β_4	β_5	β_6	
1	-0.047	-1.724***						0.010
2	-0.045	-1.747***	-0.360					0.011
3	-0.047	-1.265***	-0.034	-2.976	-3.030***			0.019
4	-0.047	-1.179**	-0.171	-2.404	-3.150***	-1.071*	0.254	0.019

Figure 1. Cumulative excess returns

This figure exhibits the cumulative excess returns starting from one day prior to an issuance date.

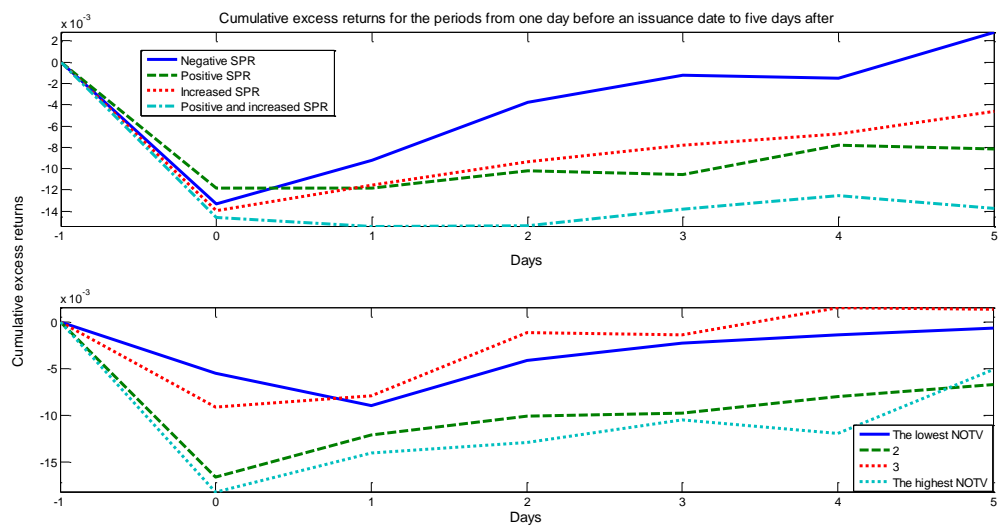


Figure 2. Stock price ratios and option trading volumes

This figure shows, for the period from nine days before an issuance date to ten days after, the daily stock price ratio of SEO firms with both positive and increased SPR and daily option trading volumes of SEO firms with NOTV in the top 25%.

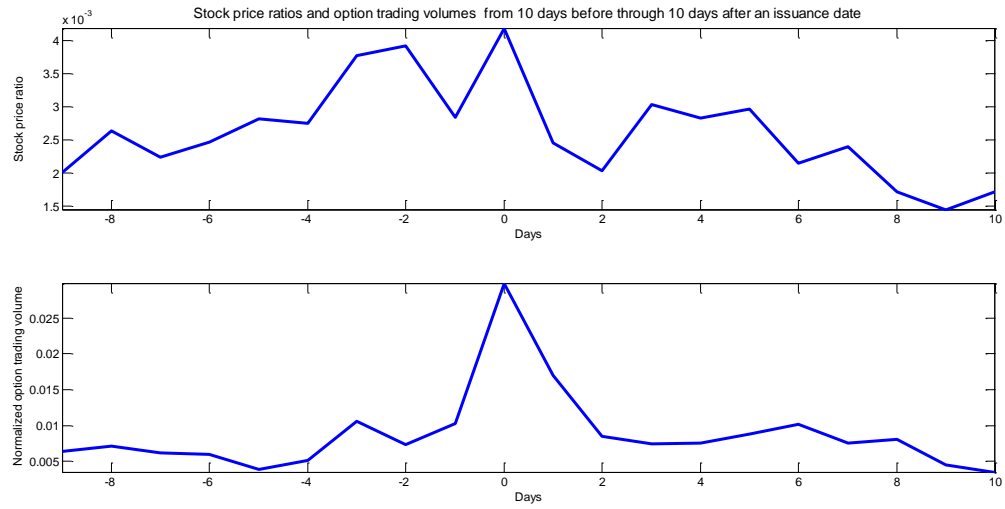
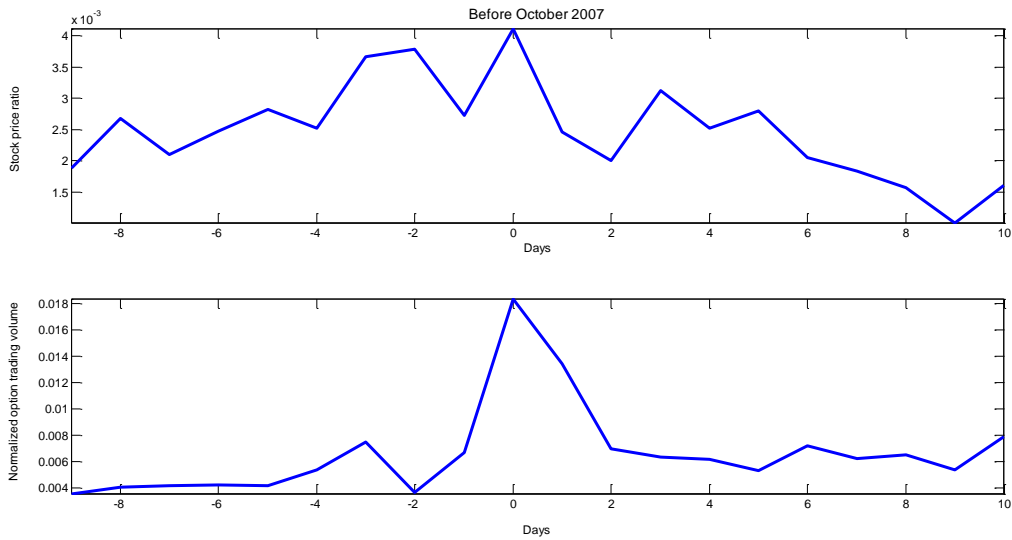


Figure 3. Stock price ratios and option trading volumes for the two periods before and after October 2007

This figure shows, for the period from nine days before an issuance date to ten days after, the daily stock price ratio of SEO firms with both positive and increased SPR and daily option trading volumes of SEO firms of with NOTV in the top 25%. (a) is for SEOs before October 2007 and (b) is for SEOs after October 2007.

(a)



(b)

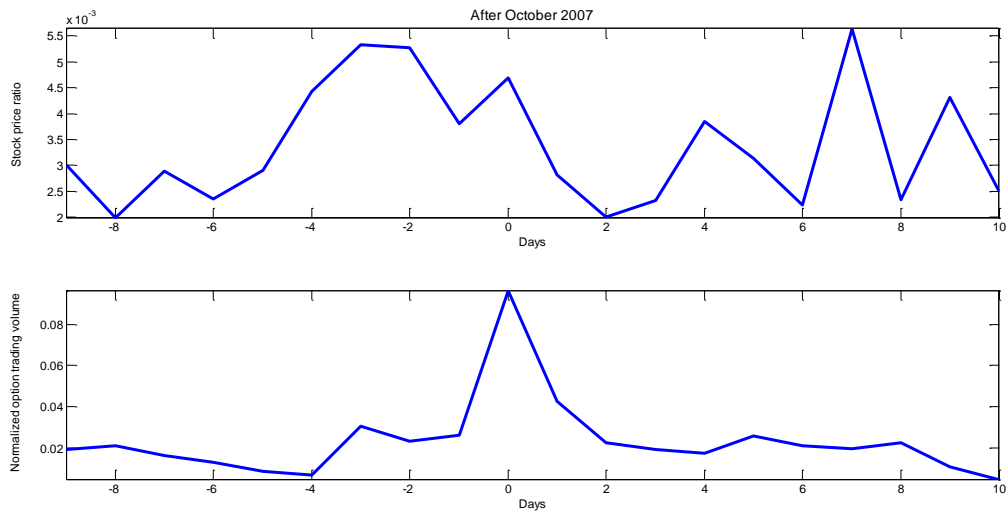
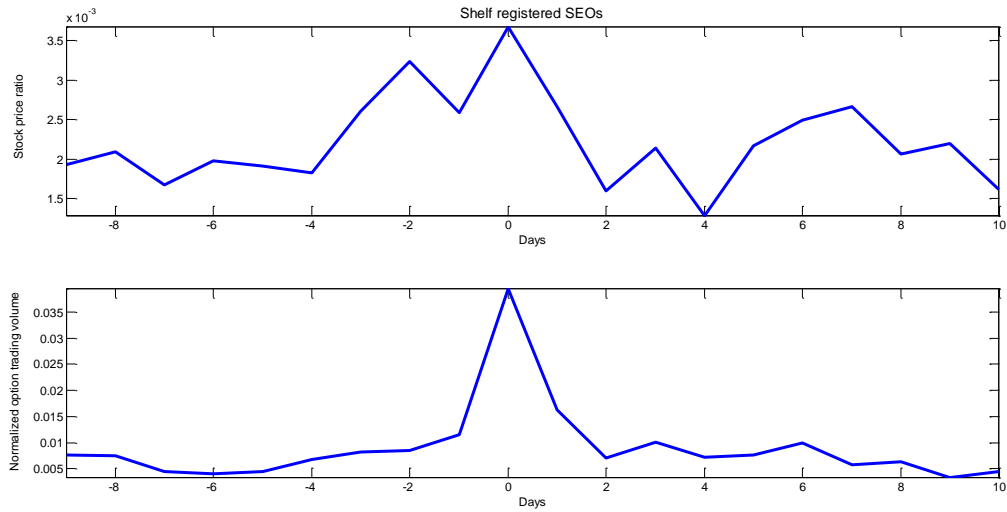


Figure 4. Stock price ratios and option trading volumes for shelf and non-shelf registered SEOs

This figure shows, for the period from nine days before an issuance date to ten days after, the daily stock price ratio of SEO firms with both positive and increased SPR and daily option trading volumes of SEO firms with NOTV in the top 25%. (a) is for shelf registered SEOs and (b) is for non-shelf registered SEOs.

(a)



(b)

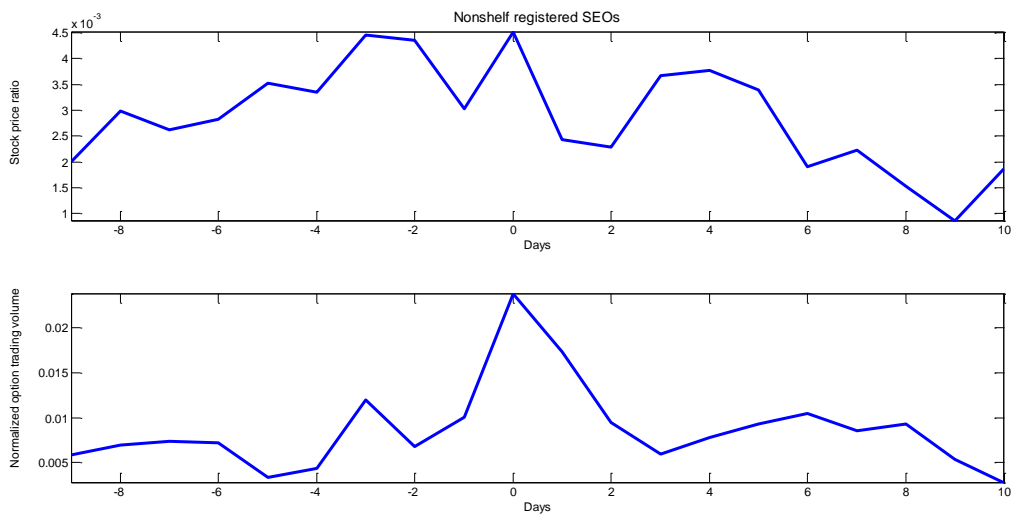


Figure 5. The three year post SEO stock performance

This figure shows the three year post SEO stock performances of shelf registered SEOs and of non-shelf registered SEOs. The stock performances are calculated by subtracting the cumulative returns of a size and book-to-market benchmark firm from the raw cumulative returns of an SEO firm.

