Weekly Options on Stock Pinning

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Abstract

In this paper we analyze the stock pinning effect after the introduction of weekly equity options. We show that stock pinning remains pervasive on the expiration days of monthly options. However, weekly options are different from monthly options in terms of the stock pinning impact. We find significant clustering effect for those weekly options with high volume and large strike price grid. We further explore possible causes for stock pinning on option expiration days. We find evidence for both the time decay of delta hedges hypothesis and the manipulation hypothesis.

Keywords: Stock Pinning, Weekly Options, Clustering, Manipulation
JEL Codes: G10, G12, G14

Introduction

Stock options gain increasing importance in the financial market today. Not only do option prices depend on the underlying stock prices, the introduction of options can also impact the trading of stocks. One of the interactions is the stock pinning effect on option expiration days. That is, minutes before options expire, stock prices are close to or at one of the option strike prices. This tendency for stocks to close at one of the option strike prices on option expiration days (see Harris (1991), Krishnan and Nelken (2001), Ni, Pearson and Poteshman (2005)), together without any important stock-specific news announcements from financial markets, has been referred as the stock pinning effect. This issue of stock pinning effect has attracted a lot of interests from both the academics and industry. A number of researchers study the stock pinning effect in various financial assets. For example, Ap Gwilym and Verousis (2013) find pinning in equity options. Chung and Chiang (2006), Golez and Jackwerth (2012), Schwartz, Van Ness and Van Ness (2004) study clustering in futures. Ohta (2006) analyzes this effect in Japanese equity market. When a stock displays this pinning effect, its movement deviates from random walk, and becomes predictable on option expiration days. It is thus important to have more research on the existence and the cause of the stock pinning effect.

In this paper, we use the recently introduced weekly equity options to further analyze this stock pinning issue. Since June 2010, CBOE has introduced weekly options for certain common stocks. With these weekly options, stock pinning goes from a once-a-month effect (on the expiration days of the monthly options) to a once-a-week effect. It is important to assess whether stock pinning effect occurs on the expiration days of these weekly options as well. This paper fills this void. In addition, with the introduction of decimal quotes, and the prevalence of high frequency trading, it is necessary to reevaluate whether stock pinning is still a wide spread phenomenon.

We show that stock pinning is still pervasive on the expiration days of monthly options after the introduction of weekly options. However stock pinning effect is not significant on the expiration days of weekly options. Part of the reason is that weekly options have smaller trading volumes and open interests than monthly options. Even after we focus only on those weekly options with large trading volumes, the pinning effect is still weaker for weekly options.

Next we study possible causes for stock pinning on option expiration days. Avellaneda and Lipkin (2003) argue that the time decay of delta hedges of long option positions leads to stock pinning. Using the same logic, Golez and Jackwerth (2012) point out that market makers in S&P500 future options market hold net short option positions, and their delta hedging trades cause the future price to move away from option strike price. We find similar evidence supporting this hypothesis in the equity market. The trading volume of at-the-money options on option expiration days has a positive effect on the probability of stock pinning. This shows that the closing of option positions reduces the delta hedges of the market makers, and leads to increasing likelihood of stock pinning.

Another cause for stock pinning is the market manipulation mechanism of Ni, Pearson, and Poteshman (2005). If option market makers hold net short positions, market makers profit the most when the stock price is pinned to a certain strike price. Hence market makers or option sellers have incentive to manipulate the stock price toward option strike price. It is debatable whether these traders have such power to manipulate the price. However, if manipulation does exist, this kind of manipulation would be short lived, and we would observe negative autocorrelation between the returns on the expiration day and the day after the expiration day. We find such negative autocorrelation from the subsample where we observe stock pinning on the option expiration days. Thus we provide some evidence of manipulation in the stock market in connection to option trading activities.

This paper contributes to the literature by extending the literature on stock pinning to weekly options. By analyzing stocks with both monthly options and weekly options, we can achieve a better understanding on how option trading impacts stock trading. We also extend the literature on possible causes for stock pinning effect on option expiration days. We find evidence for both the time decay of delta hedges hypothesis and the manipulation hypothesis. Our study provides interesting implications of the introduction of new option contracts to compliment stock trading.

This paper is organized as follows: Section 2 presents the data, and Section 3 studies the stock pinning effect. Section 4 studies the possible causes for stock pinning. Section 5 concludes the paper.

Data

We obtain the data on stocks with weekly equity options from Market Data Express. The first weekly option of a common stock was introduced by CBOE on June 25, 2010. Our data period ends at the end of 2012. We obtain the expiration dates, strike prices, open interests and trading volumes of the options from the same data source. The stock price information is obtained from CRSP.

We only study common stocks in this study. While CBOE has introduced weekly options for exchange traded funds (ETFs), we do not include those since the price of ETFs depend on other financial assets and the relation between option trading and clustering of ETFs is less clear. We require that the options have reasonable trading volumes and enough weekly options to be included. In particular, we require that sum of the trading volumes of the two at-the-money calls and the two at-the-money puts on the Thursday right before the option expiration to be at least 40. In addition, a stock must have at least 6 weekly option expiration dates to be included in the sample. For any one stock, there are many options with different strike prices traded. In fact, more than 93% of the stocks and expiration dates have strike price grids of 1, 2.5, or 5. Less common grids are 0.5 and 10. There are some other strike prices grids which are results of stock split. In this study, we focus on the stocks and expiration dates where the option strike price grids are 1, 2.5, or 5. Altogether we have 93 common stocks with weekly options traded in the period from 2010 to 2012. We have 6,301 stock-expiration dates, out of which 2,748 are for monthly options and 3,553 are for weekly options.

Stock Pinning Results

Monthly options expire on Saturday after the third Friday of the month. Since there is no trading on Saturday, the closing price on the third Friday of the month is effectively the last traded stock price before option expiration. Weekly options expire on Friday and again the closing price on Friday is the last traded stock price before option expiration. Thus we focus the pinning effect of the closing price on Friday toward existing option strike prices. Following Ni, Pearson and Poteshman (2005), we define the stock pinning dummy (Dpin) to 1 if the stock closes within \$0.125 of a strike price. For example, suppose a stock is traded at around \$400 per share and its options have strike prices from \$200 to \$600 with a grid size of \$5. If the closing price of the stock falls in the range of (394.875, 395.125), (399.875, 400,125), (404.875, 405.125), or any other similar ranges centered on an existing option strike price, we set the dummy variable (Dpin) to 1, and 0 otherwise. We report all our results using \$0.125 for the cutoff point for the definition of stock pinning. That is, we define a stock is pinned to a strike price if the stock close price falls between strike price minus 0.125 and strike price plus 0.125. Our results do not change qualitatively if we use 0.25 as the cutoff point.

For the option expiration day, we select two trading days before the expiration, and two trading days after the expiration to check how the stock price clusters around option strike price on days with no option expiring. We only focus on the two days before and two days after because the introduction of weekly options makes nearly every Friday an option expiration day. The 93 stocks in our sample have different grid sizes of strike prices. Our definition of the stock clustering is that the stock closes within \$0.125 of a strike price. Obviously, a stock with a small strike grid would have a higher probability to have the stock closing with \$0.125 of a strike price than a stock with a large strike grid. For this reason, we report the clustering percentages for different strike grids.

Table 1 reports the fraction of days when the stock close price pins to an option strike price, for option expiration days, as well as days before and after option expiration days. Panel A presents results for all options. Clearly, on option expiration days, it is more likely for the stock to cluster on an option strike price. For example, among all stocks whose option strike prices have grid of \$5, 8.2% of the time the stock pins to an option strike price on option expiration days, while this percentage is never above 6% on the days before and after option expiration days. This result is consistent with Ni, Pearson and Poteshman (2005). Using a most recent data sample, we show that stock clustering effect still exists and the stock close price has a tendency to pin to an option strike price on option expiration days.

Panel B and Panel C studies the monthly options and weekly options separately. We observe that the clustering effect on expiration days of weekly options is not as pronounced as the clustering effect on expiration days of monthly options. While all stocks show somewhat clustering effect to option strike prices, the fraction is much higher for monthly option expiration days. Among all stocks whose option strike prices have grid of $5, 6.9% of the time the stock pins to an option strike price on weekly option expiration days, while 10% of the time the stock pins to an option strike price on monthly option expiration days. On days when no options expire, this percentage stays around 6%. Clearly the expiration of monthly options has a stronger impact on the stock clustering effect. Later, we will investigate this result using regression analysis.

Table 1. *Summary of Stock Pinning on Option Strike Prices*

Panel A. All Options

	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
ExpiringDay - 2	0.163	0.253	0.104	0.059
ExpiringDay - 1	0.159	0.245	0.104	0.059
ExpiringDay	0.186	0.275	0.131	0.082
ExpiringDay + 1	0.161	0.246	0.110	0.060
ExpiringDay + 2	0.159	0.257	0.086	0.051

Panel B. Monthly Options

	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
ExpiringDay - 2	0.178	0.271	0.123	0.057
ExpiringDay - 1	0.159	0.243	0.099	0.061
ExpiringDay	0.202	0.285	0.148	0.100
ExpiringDay + 1	0.163	0.244	0.110	0.058
ExpiringDay + 2	0.160	0.254	0.091	0.047

Panel C. Weekly Options

	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
ExpiringDay - 2	0.150	0.239	0.090	0.060
ExpiringDay - 1	0.159	0.247	0.107	0.056
ExpiringDay	0.174	0.267	0.119	0.069
ExpiringDay + 1	0.160	0.247	0.110	0.062
ExpiringDay + 2	0.159	0.259	0.083	0.054

Table 1 presents the fraction of days when the closing price of a stock falls within $0.125 of an option strike price. We show the fraction on the option expiring day, two days before the expiration, and two days after the expiration. We report results for option strike price grids of 1, 2.5, and 5 respectively, and together (All Grids).

To investigate the possible reasons for stock pinning, we obtain several additional option variables. In particular, we obtain the trading volume of the at-the-money calls and puts on expiration day (VolExp) and the open interest of the at-the-money calls and puts on the day before the expiration day (OpenInt). The open interest is one day before the expiration day because we only have daily data reflecting the information at the close of the trading day. The open interest at the close of the expiration day is in general zero. Given that both the volume and open interest are highly skewed, we use their corresponding logarithms (LogVol and LogOI) in regression analysis. The other variable we obtain is the volatility of the stock. Following Dijk and Martens (2007), we calculate the daily volatility (Sigma) from the trading range of the stock during the day as follows:

$$Sigma = (Log(Price\_high) - Log(Price\_low))^2/(4\ Log(2)) \qquad (1)$$

We multiply the volatility by 100 to make the numbers reasonably scaled. The volatility of the stock on the expiration day (Sigma) is of particular interest to us.

Table 2 reports these variables for the monthly options sample and the weekly option samples separately. We also test whether the difference between the two samples is significant or not. A general theme of Table 2 is that the trading volume and open interest of monthly options are higher than those of weekly options. This result is not surprising given weekly options are introduced more recently and they are typically traded for a short period of time. On the other hand, monthly options

Table 2. *Comparison of Monthly Options and Weekly Options*

	Expiration Dates of Monthly Options			Expiration Dates of Weekly Options				
Variable	Mean	Std	Median	Mean	Std	Median	t-stat	z-stat
Dpin	0.2023	0.4018	0.000	0.1742	0.3794	0.000	-2.84***	-2.84***
VolExp	11,245	26,128	4,255	8,590.8	23,958	2,260	-4.19***	-15.31***
OpenInt	38,657	69,652	17,896	7,663.6	12,626	4,138	-25.98***	-46.47***
Sigma	0.044	0.107	0.019	0.040	0.093	0.017	-1.72*	-3.81***
LogVol	8.3127	1.4601	8.356	7.7388	1.6407	7.724	-14.44***	-15.31***
LogOI	9.8537	1.1439	9.792	8.3035	1.1602	8.328	-52.92***	-46.47***

Table 2 presents the mean (Mean), standard deviation (Std) and median (Median) of option variables from monthly options and weekly options. Option variables include the dummy variable for pinning to a strike price (Dpin), the trading volume of the at-the-money calls and puts on expiration day (VolExp) and its logarithm (LogVol), the open interest of the at-the-money calls and puts on the day before the expiration day (OpenInt) and its logarithm (LogOI), the volatility of the stock on the expiration day (Sigma). The volatility is multiplied by 100. The t-stat tests whether the means between the two samples are significantly different. The z-stat is a Wilcoxon test on whether the medians of the two samples are significantly different. ***, **, * indicate significance at 1%, 5%, and 10% level, respectively
exist for a long time, and they are available for trading for a much longer period. However, we note that weekly options are quite active. The median volume sum of the four at-the-money weekly options (two calls and two puts) is 2,260, about half of 4,255, which is the corresponding median volume of the four at-the-money monthly options. The median open interest of the four weekly options the day before the expiration day is 4,138, about a quarter of 17,896, which is the corresponding number for monthly options.

We run logistic regressions to investigate the impact of option expiration on stock clustering. We include stocks on the days of option expiration, two days before the expiration and two days after the expiration. The dependent variable is Dpin, the dummy variable which is 1 if the closing stock price falls in a small band around an option strike price. Table 1 already shows that the mean of Dpin is greater on option expiration days. Running the regression allows us to test the significance of the impact and the difference between weekly options and monthly options.

Panel A of Table 3 uses the dummy variable indicating the option expiration day (Dexpire) as the only control variable in the logistic regression. We find significant and positive coefficients for Dexpire in the whole sample and in each of three subsamples with different option grids. This result is consistent with the result in Table 1 and existing literature from Ni, Pearson and Poteshman (2005), Ohta (2006), Ap Gwilym and Verousis (2013), etc. The expiration of options contributes positively to the probability of stock clustering on option strike prices.

In Panel B, we change the control variables to two dummy variables: a dummy variable indicating the expiration day of monthly options (Dmonthly), and a dummy variable indicating the expiration day of weekly options (Dweekly). This way we can investigate whether weekly options have the same impact as monthly options. The results show that the expiration of weekly options does not have the same impact as the expiration of monthly options. In the full sample, the coefficient of Dmonthly is 0.282, while the coefficient of Dweekly is 0.098. Although the coefficient of Dweekly is significant at 5% level, it is about a third of magnitude of the coefficient of Dmonthly. In regressions with fixed grid size, the coefficients of Dmonthly are still positive and statistically significant, but the coefficients of Dweekly lose their significance. Only in the subsample where the option grid size equals 2.5, the coefficient of Dweekly is significant at 10% level. The magnitude of Dweekly coefficients is much smaller than Dmontly coefficients. All these results show that weekly options are different from monthly options in terms of the stock clustering impact.

Considering the results from Table 2, one may argue that the reason that weekly options have smaller impact is the lack of trading volume and open interest of these options. If options are listed but there is no investor interest in these options, it would not be surprising for these options to have little impact on stock trading activities. In Panel C, we run the same logistic regression as in Panel B, but in a subsample of those stocks whose option volumes are above the median of the whole sample. This way we only concentrate on those expiration days when the options have attracted large investor interest. The coefficients of Dweekly in these regressions become larger and significant, but they are still smaller than the coefficients of Dmonthly in general. Another interesting observation from Panel C is that the clustering effect appears to be stronger for large option grids. When the option strike price grid is $1, the clustering effect is quite muted. When the option strike price grid is $5, it is significant for both monthly options and weekly options. Hence, while weekly options are in general different from monthly options in the contribution to stock pinning, those weekly options with large volume and investor interest have a big impact on stock pinning.

Possible Reasons for Stock Pinning

Delta Hedging

In this section, we study possible reasons for stock pinning. Avellaneda and Lipkin (2003) argue that the time decay of delta hedges of long option positions leads to stock pinning. For example, suppose an investor who holds long call option positions engages in delta hedge. For long call positions, the delta hedge is negative (a short position of stock). When the stock price is above the option strike, as the call position approaches expiration, the delta hedge needs to be more negative, and approaches -1 at expiration. This means that the investor would have to sell more stocks when the stock price is above the option strike price and this selling pressure may push the stock price down to the strike price. Similarly, when the stock price is below the option strike, as the call position approached expiration, the delta hedge needs to move close to zero. This means that the investor would have to close short position (i.e. buy stocks) when the stock price is below the option strike. This buying pressure would push the stock price higher toward the option strike price. Hence the delta hedges of long option positions would cause pinning.

Table 3. *Logistic Regressions of Stock Pinning around Option Expiration Days*

Panel A. Dependent variable: Dpin				
	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
Dexpire	0.181***	0.128**	0.301***	0.397***
	(4.90)	(2.74)	(3.66)	(3.73)
Constant	-1.654***	-1.096***	-2.191***	-2.807***
	(-93.85)	(-50.56)	(-53.22)	(-50.55)
Pseudo R^2	0.09%	0.05%	0.23%	0.37%
Nobs	30195	14293	8262	7640
Panel B. Dependent variable: Dpin				
	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
Dmontly	0.282***	0.176**	0.444***	0.609***
	(5.56)	(2.73)	(3.93)	(4.43)
Dweekly	0.098**	0.087	0.191*	0.202
	(2.05)	(1.45)	(1.82)	(1.41)
constant	-1.653***	-1.096***	-2.191***	-2.807***
	(-93.85)	(-50.56)	(-53.22)	(-50.55)
Pseudo R^2	0.12%	0.05%	0.29%	0.51%
Nobs	30195	14293	8262	7640
Panel C. Dependent variable: Dpin (Option volume greater than median)				
	(All Grids)	(Grid=1)	(Grid=2.5)	(Grid=5)
Dmontly	0.276***	0.138	0.511***	0.604***
	(4.12)	(1.63)	(3.32)	(3.40)
Dweekly	0.178**	0.145*	0.371*	0.386**
	(2.59)	(1.68)	(1.93)	(2.28)
constant	-1.621***	-1.051***	-2.158***	-2.798***
	(-65.78)	(-35.14)	(-32.31)	(-39.65)
Pseudo R^2	0.15%	0.06%	0.57%	0.61%
Nobs	15093	7357	3049	4687

Panel A presents regression results when the control variable is the dummy variable indicating option expiration day (Dexpire). In Panel B, the control variables include two dummy variables: a dummy variable indicating the expiration day of monthly options (Dmonthly), and a dummy variable indicating the expiration day of weekly options (Dweekly). In Panel C, we run the same logistic regression as in Panel B, but in a subsample of those stocks whose option volumes are above the median of the whole sample. T-statistics are in parentheses. ***, **, * indicate significance at 1%, 5%, and 10% level, respectively.

Golez and Jackwerth (2012) argue that delta hedging market makers are in general net sellers of options, so the delta hedging of these positions would move the stock price away from the option strike price. On the expiration day, if there is a large trading volume of at-the-money options, most of the trading volume would be trades that unwind an existing open position. Thus the net short position of the market maker is reduced and this leads to stock pinning.

The other variable is open interest of the at-the-money options the day before expiration. If sophisticated investors (hedge funds, market makers) are net option sellers, the open interest on the day before expiration indicates the magnitude of hedging positions of the sophisticated investors. The higher the open interest, the larger the hedging position, and the more likely that stock would move away from option strike price.

Table 4 reports logistic regressions to study this cause of stock pinning. Unlike the sample we use in Table 3, we focus on option expiration days only. The dependent variable is Dpin. In Models 1 and 2, we include one independent variable of either volume or open interest at a time. Since volume and open interest are quite skewed, we use the logarithm of volume and open interest instead. In Model 3, we regress on both LogVol and LogOI together. In Model 4, we include all four variables as our control variables. Panel A shows the results using the full sample of all option expiration dates. Panels B, C and D show the results using only options with grids of $1, $2.5, and $5, respectively.

In the full sample, the coefficient of LogVol in all regressions is significantly positive. This is consistent with Golez and Jackworth (2012). The greater the trading volume of at-the-money options on the expiration day, the more likely that the stock closing price pins to an option strike price. The coefficient of LogOI is only significant when it is the only control variable in the regression. When other control variables are included in the regression, the coefficient of LogOI has no significance at all.

When we run regressions for each grid size separately, the coefficient of LogVol is always significantly positive. The coefficient of LogOI turns negative when LogVol is also in the regression. The signs of both coefficients support that the market makers in the option market hold net short position. Large volumes on expiration days represent more of closing option position and cause the delta hedgers to move stock price toward option strike prices. Large open interests lead delta hedgers to move stock price away from option strike prices.

The remaining two control variables in general have expected signs for the regression coefficients. The stock volatility (Sigma) has negative coefficient, indicating that large volatility makes stock pinning less likely. The dummy variable for monthly options (Dmonthly) has positive coefficient. This result is consistent with the observation in the previous section that stock pinning is stronger on expiration days of monthly options that it is on expirations days of weekly options.

Manipulation

Another cause for stock pinning is the market manipulation mechanism of Ni, Pearson, and Poteshman (2005). If option market makers hold net short positions, they would prefer the stock price to pin to a certain strike price. This way, market makers obtain the largest profit. If this is the case, the prices on the expiration days would be manipulated to generate negative autocorrelation between the expiration day and the day after the expiration day.

Note that our sample contains expiration days with stock pinning and expiration days without stock pinning. We further investigate the predictability only focusing on the expiration days with stock pinning. These results are presented in Table 5. In this sample where the stock prices cluster to the