Straddling outside and into earnings

Introduction

An ATM equity long straddle position is delta neutral. If systematic risk is the only factor predicting expected returns, a delta neutral strategy should have an expected return equal to the risk-free rate. In this article we will review the academic literature, finding that not only is this not the case, but that the expected return of a single stock long straddle is time varying, becoming positive close to earnings and negative throughout the rest of the year. In other words, implied volatility is systematically underestimated around earnings and overestimated throughout the year. This article is based on "Anticipating Uncertainty: Straddles around Earnings Announcements" by Chao Gao, Yuhang Xing and Xiaoyan Zhang (2018). References made to other studies are also based on the abovementioned paper. Our objective is to provide the results found by the researchers in a format which can be understood more easily by our readers.

Jump and volatility risk premia

The fact that long straddles on single stocks and equity indexes tend to have statistically significant negative expected return is broadly documented in the academic literature: Coval and Shumway (2001) find that ATM SPX straddles expiring in the following month and held to maturity lose on average 3,15% weekly, with Cremers et al. (2015) and Bollen and Whalley coming to similar conclusions.

While it is true that a long straddle is delta neutral, it is also gamma and vega positive. Cremers et al. (2015) argue that a long straddle can be decomposed in two risk premia: the Volatility and Jump risk premia. Since vega and gamma are decreasing as we get closer to maturity, it is possible, by building a long/short ATM straddle with different maturities, to remain neutral to the former while being exposed to the latter and vice versa. These strategies are used by the authors to build respectively the Volatility and Jump risk premia by going long short on SPX (S&P 500) straddles.

To clarify how these two strategies work: 1) long 1 straddle at T1 2) short y straddles at T2. T is time to maturity and T2>T1. y is set to equalize either the vega or the gamma of the T1 straddle and since both are larger in T2 than in T1, y will always be a number below 1.

The authors find that the Jump risk premium (from the gamma sensitive strategy) has a negative annualized return of -40,89% while the Volatility risk premium (from the vega sensitive strategy) has an annualized return of -9,56%. Notably, the two negative returns are surprisingly very weakly correlated (0.10) on a daily basis, meaning that it is appropriate to separate them.

What is the economic intuition behind this? These risk premia, which can be generalized across asset classes, are negative because investors are willing to get lower expected returns if it means outperforming during either an increase in market volatility or kurtosis.

For the purpose of our article, Jump and Volatility risk premia are relevant, as they make the results of Chao Gao, Yuhang Xing and Xiaoyan Zhang far more puzzling, as we will explain in the later paragraphs.

The straddle into earnings strategy: methodology

Chao Gao, Yuhang Xing and Xiaoyan Zhang (2018) want to investigate the performance of an option strategy which involves opening long straddles on single stocks 3 days before the date in which earnings will be announced. Earnings announcements are nearly always publicly available information and they are associated with high volatilities (Dubinsky and Johannes (2006)). It's not a surprise that implied volatilities tend to rise ahead of earnings, making options more expensive and diminishing the ability to exploit higher incoming volatilities. Following earnings results, implied volatilities tend to rapidly fall.

Nevertheless, the authors build their strategy like this:

1) As is typical with most studies, basic liquidity/price distortion considerations are made, excluding from the analysis data points that do not conform (ex. Stock prices<5, option prices< 0.125).
2) The options purchased are between 10 and 60 days of maturity. If more than one straddle position is possible, they are all purchased and are weighted based on volume, open interest or in an equal manner. The results of the different weightings are similar and are all collected in panel data.
3) Since in the real world a straddle position may not always be possible (as only nearly ATM contracts may trade and skewness might affect delta exposure), the authors build delta neutral straddles, by calibrating the weigh on the call option trough the following formula $\omega = -\left(\frac{DELTA\,put}{DELTA\,call - DELTA\,put}\right)$, where ω is the weight of the call option. The authors also collect the results of the "simple" straddle and the results are similar.
4) The authors then calculate the return of the strategy at different event windows, with T=0 the time at which earnings are announced.

The table below shows the characteristics of the sample taken into consideration:

TABLE 1
Summary Statistics on Options and Stocks

Table 1 reports summary statistics on stock and straddle characteristics, which are computed over a pooled sample across firms/straddles and across time. The sample period is from Jan. 1996 to Dec. 2013. We obtain data from several data sources. Data on stock returns and firm characteristics, accounting data, and earnings announcements are obtained from the Center for Research in Security Prices (CRSP), Compustat, and Institutional Brokers' Estimate System (IBES), respectively. Data on options are from OptionMetrics. We apply filters (1)–(9) to the options data. Moneyness is defined as stock price divided by strike price. We compute open interest for a straddle as the number of contracts outstanding in 100s, summing open interest from both calls and puts in the straddle. Similarly, we compute the daily volume of a straddle as the number of contracts traded in 100s, summing daily volume from both calls and puts in the straddle. Implied volatility for a straddle is the average of implied volatility of calls and puts in the straddle.

	N	Mean	Median	Std. Dev.
Panel A. Stock Characteristics				
Market capitalization (in $millions)	41,940	10,597	2,297	30,434
Book-to-market ratio	41,232	0.470	0.356	0.537
Past 12-month return	41,940	0.113	0.120	0.461
Past 3-month daily return volatility (annualized)	41,940	0.431	0.378	0.231
Past 3-month daily return skewness	41,940	0.052	0.082	1.097
Past 3-month daily return kurtosis	41,940	5.565	3.877	5.065
Panel B. Straddle Characteristics				
Moneyness	76,848	1.011	1.008	0.028
Days to maturity	76,848	38	37	13
Open interest	76,848	2,431	474	7,375
Volume	76,848	401	26	1,800
Implied volatility	76,848	0.474	0.435	0.206

The authors note that the sample seems to be slightly biased towards larger and "value" stocks, while the average straddle in the sample has a 38 days' time to maturity.

Table 2 below displays the results of the strategy applied to multiple event windows. In addition, the authors calculate straddle returns outside of the event windows, which, consistent with previous literature, shows significant negative returns. Panels C and D reference previous literature showing similar results.

TABLE 2

Delta-Neutral Straddle Returns: Pooled Sample

Panel A of Table 2 reports daily, weekly, and monthly returns on all at-the-money delta-neutral straddles. Panels B–D report returns on at-the-money delta-neutral straddles over different windows around earnings announcements, where day 0 is the earnings announcement day. Panel B reports all straddles in our sample. Panels C and D report results on straddles with expected earnings announcement days that coincide with actual announcement days, following an approach outlined by Givoly and Palmon (1982) and extended by Cohen, Dey, Lys, and Sunder (2007), respectively. The sample period is from Jan. 1996 to Dec. 2013. Data on options are from OptionMetrics. We apply filters (1)–(8) to the options data in Panel A, and filters (1)–(9) to the remaining panels. If a stock has more than one pair of at-the-money straddles, we use equal weight, volume weight, or dollar open interest weight straddles at the stock level. The mean holding-period return is computed by pooling across firms and across time. All t-statistics are computed using standard errors clustered by date.

Holding Period	Equal-Weighted Holding Ret.	t-Stat.	Volume-Weighted Holding Ret.	t-Stat.	Dollar-Open-Weighted Holding Ret.	t-Stat.
Panel A. All Delta-Neutral Straddles						
1 day	−0.19%	−5.11	−0.14%	−3.36	−0.20%	−5.30
1 week	−2.12%	−11.92	−2.11%	−10.62	−2.12%	−11.93
1 month	−17.09%	−26.82	−16.19%	−23.35	−17.37%	−26.83
Panel B. At-the-Money Delta-Neutral Straddles around Earnings Announcements						
[−3,−1]	1.90%	16.35	2.18%	16.47	1.95%	16.74
[−3,0]	2.60%	13.92	2.36%	11.28	2.57%	13.76
[−3,1]	1.98%	8.55	1.13%	4.51	1.88%	8.00
[−1,0]	1.88%	16.36	1.55%	11.43	1.86%	15.41
[−1,1]	2.43%	13.39	1.52%	7.37	2.36%	12.22
Panel C. At-the-Money Delta-Neutral Straddles around Earnings Announcements: Givoly and Palmon's (1982) Sample						
[−3,−1]	1.90%	12.94	2.22%	12.95	1.82%	13.11
[−3,0]	2.57%	10.81	2.37%	8.58	3.11%	10.46
[−3,1]	2.03%	6.70	1.42%	4.22	2.84%	6.23
[−1,0]	1.90%	11.71	1.50%	7.89	2.55%	11.01
[−1,1]	2.54%	10.13	1.68%	5.87	3.49%	9.47
Panel D. At-the-Money Delta-Neutral Straddles around Earnings Announcements: Cohen et al.'s (2007) Sample						
[−3,−1]	2.04%	11.07	2.10%	10.24	2.10%	11.18
[−3,0]	2.58%	8.45	2.35%	6.58	2.59%	8.38
[−3,1]	1.41%	4.07	0.55%	1.51	1.44%	3.84
[−1,0]	1.44%	7.20	1.03%	4.47	1.42%	6.64
[−1,1]	1.69%	5.20	0.85%	2.25	1.68%	4.54

The straddle into earnings strategy: explaining the results

Contradicting the idea that straddles consistently have negative returns, and that Jump and Volatility risk premia make them necessarily so, straddles held in all the event windows calculated by the authors show statistically significant positive returns. At this point it is of interest to understand what drives these returns and if such a strategy is tradable or not.

The authors provide multiple hypotheses around what might drive these positive returns. To analyze them, they analyze the cross section of straddle returns with certain characteristics of either the underlying stock or the liquidity of the options. The table below shows the results.

Panel A. Sort on Past High Moments and Jumps

	VOLATILITY		SKEWNESS		KURTOSIS		JUMP_FREQ		JUMP_SIZE	
	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.
Low	1.85%	2.95	2.44%	4.48	1.53%	3.18	2.55%	4.16	3.10%	5.38
2	3.27%	4.98	2.80%	4.57	3.30%	4.72	2.45%	3.80	3.00%	4.31
3	2.89%	4.57	2.83%	4.15	3.28%	5.34	3.73%	6.21	2.82%	5.05
High	4.19%	7.24	4.28%	7.36	4.27%	5.96	3.57%	5.74	3.33%	4.66
High – Low	2.34%	4.03	1.85%	4.90	2.74%	5.39	1.02%	1.37	0.23%	0.39

Panel B. Sort on Past Earnings Surprises

	N_ANALYSTS		|SUE|		|CAR|		var(SUE)		var(CAR)	
	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.
Low	4.67%	5.70	2.49%	3.14	1.83%	2.99	2.11%	2.95	1.12%	1.46
2	3.14%	4.68	3.26%	4.27	2.45%	4.05	2.55%	4.52	2.78%	4.09
3	1.78%	3.34	2.45%	4.40	2.90%	3.86	3.05%	4.63	3.36%	5.88
High	2.12%	3.75	3.80%	5.77	4.27%	7.94	3.25%	4.69	3.95%	7.64
High – Low	−2.55%	−3.35	1.31%	1.89	2.44%	4.71	1.13%	1.37	2.84%	4.47

Panel C. Sort on Past Transaction Costs

	STOCK_SPREAD		STOCK_VOLUME		OPTION_SPREAD		OPTION_VOLUME	
	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.	Holding Ret.	t-Stat.
Low	2.21%	3.50	5.83%	7.07	1.14%	2.28	5.82%	6.11
2	2.65%	4.01	3.07%	5.31	1.82%	3.01	2.68%	4.69
3	3.75%	6.30	2.20%	3.55	3.16%	5.33	1.59%	2.97
High	3.29%	6.12	1.33%	2.05	4.93%	6.74	0.90%	2.27
High – Low	1.08%	1.84	−4.50%	−4.95	3.79%	5.33	−4.92%	−5.42

Panel A and B refer to characteristics of the stock. The stocks, as in many other cases, are divided into quintiles possessing more or less of the evaluated characteristics. Panel A is self-explanatory (JUMP_FREQ and JUMP_SIZE are calculated using methodologies from Lee and Mickland (2008), but for our purposes these two variables are redundant to get the main intuitions which we will soon discuss). Panel B includes a measure of the number of analysts covering the stock, the absolute value of historical earnings surprises and the absolute value of historical abnormal returns on the [-1,1] interval (both measures are calculated on the past 8 quarters), and their respective variances. Panel C shows characteristics concerning the liquidity of options and stocks and are self-explanatory.

Overall, the following trends can be observed: with reference to long straddle returns, firms which experience higher historical moments have higher expected returns, firms which are smaller and less liquid have higher expected returns, and options which are less liquid have higher expected returns.

The best interpretation of these results would be that the typical factors which result in market inefficiency (low liquidity and low coverage of the stock), also seem to affect straddles. In addition, higher historical moments and unpredictability during earnings seem to generate enough noise to make predicting future volatility a harder task, so much so that it will result in underestimation (despite the fact that options on these stocks will higher implied vols). That said, the single best predictor of positive returns is still option liquidity (although even straddles in the top quintile of OPTION_SPREAD show a positive and significant expected return of 1,14%)

With regards to transforming this into a trading strategy, there might be some issues related to liquidity. For example, the volume of the closest ATM November 14th (that is 42 days from the time of writing, close to the median of 38 of the strategy mentioned above) call options on Apple, which currently has the largest market cap in the world is approximately 15k. If we multiply that number by 100 (the size of an option contract) and again by 142 (circa the price of an Apple stock), we get that if all the volume of these trades were to be exercised, we would get merely to 213 million dollars. Apple is arguably the most liquid single stock in the world, yet its volumes on options are a myriad times lower than index options on the SPX. In addition, the strategy has lower expected returns precisely on stocks which are extremely liquid and covered by analysts like Apple. A better option on which to back test the strategy could be Tesla's stocks, which have a liquid options market while retaining significantly higher moments compared to other equities. It is possible, however, that the fact that higher moments of the underlying correspond to higher returns is due to correlation with the liquidity of the options market (the lower, the higher the moments), meaning that in this case backtesting the strategy even on Tesla might fail.

Conclusions

When uncertainty is low, a long volatility strategy has a negative expected return. This is in line with economic theory, as higher volatilities are associated with lower returns, which means that investors should be willing to pay a premium to protect against it. At the same time, ahead of earnings uncertainty, options on single stocks tend to underestimate implied volatility. Further research could be done on whether this underestimation persists on uncertainty events unrelated to earnings announcements (for example the results of clinical trials on biotech stocks) and if this strategy is applicable to the much more liquid equity index markets. From a trader's perspective, this strategy could be used to partially (if imperfectly) offset a short vol position on the broader market.

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