UNIVERSIDAD DEL CEMA
Buenos Aires
Argentina

Serie
DOCUMENTOS DE TRABAJO

Área: Finanzas

TESTING EXCESS RETURNS FROM PASSIVE OPTIONS INVESTMENT STRATEGIES

José P. Dapena y Julian R. Siri

Enero 2017
Nro. 605

ISBN 978-987-96318-3-6
Queda hecho el depósito que marca la Ley 11.723

www.cema.edu.ar/publicaciones/doc_trabajo.html
UCEMA: Av. Córdoba 374, C1054AAP Buenos Aires, Argentina
ISSN 1668-4575 (impreso), ISSN 1668-4583 (en línea)
Editor: Jorge M. Streb; asistente editorial: Valeria Dowding <jae@cema.edu.ar>

Dapena, José Pablo
Testing excess returns from passive options investment strategies / José Pablo Dapena. - 1a ed. - Ciudad Autónoma de Buenos Aires : Asociación Civil Cema. Instituto Universitario, 2017.
10 p. ; 22 x 15 cm.

ISBN 978-987-96318-3-6

1. Economía. I. Título.
CDD 330

TESTING EXCESS RETURNS FROM PASSIVE OPTIONS INVESTMENT STRATEGIES

José P. Dapena y Julian R. Siri*
UNIVERSIDAD DEL CEMA
2016

Abstract

When analyzing options returns, most papers tend to focus on the expected and realized return from strategies where the investors are long on those financial instruments. We conduct a test searching for excess returns on passive options investment strategies resorting to a four factor model, evaluating the case of an investor who launches options and evaluates returns to the light of capital invested in the form of margins requirement. The main point of our research work is to continue the line of research where we evaluate options returns using the metrics with respect to margin requirements.
We find that there are excess returns not explained by the four factor model, which in turn may indicate the strategy generates extra returns, or that the investor going short on options provides insurance to events not captured by the traditional models.

JEL: C1, C3, N2, G11.
Key words: Four factor model, asset pricing, realized returns, option pricing.

---

* The authors' views are of their own and do not necessarily represent those of the Universidad del CEMA. All mistakes are our own. We appreciate comments made at the 2016 World Finance Conference NY.

I. Introduction

The analysis of expected option returns is most acknowledged in the literature from the point of view on the issuer of the option, i.e. the long side of the position.

McDonald (2006) and Rubinstein (1984) establish a formula for the calculation of this expected return, always from the buy side and there are also papers that analyze options realized returns, like Benesh and Crompton (2000), Coval and Shamway (2000), Bondarenko (2003) or also Broadie et. al (2009), where again option returns are in all cases evaluated from comparing the realized option payoff with respect to the original premium paid, which means the buy or long side of the option. In their findings the authors shows from empirical evidence that investor receive less return than what it is predicted by risk measures (and in some cases, authors hypothesize that there are some risks insured not captured by mean variance models).

In a previous paper -Dapena and Siri (2015)- we analyze the issue but with the challenge of seeing options from the seller perspective, and hence providing a different methodology of calculating option returns, by associating option contracts more to an insurance contract, and hence calculating realized returns by comparing the amount of money invested as guarantee with the realized pay offs from the realization of events (where realization of events means that options may end in or out-of the money).

In that paper we restricted our research to near at-the-money (ATM) naked european call and put options written on three major US indexes (Dow Jones Industrial Average, Standard & Poor's 500, Nasdaq 100) in order to evaluate the returns of what we denominate a '*passive*' strategy of selling options and holding the contract open until expiration, where maturities for the selected options were 60, 180 and 365 days.

Once we have premiums and eventual payoffs if a particular option happens to end in-the-money, we estimated the internal rate of return of the contract, by taking the resulting cash flow from evaluating the difference between the inflow value and the outflow value, weighted on different margin metrics (Initial, Average or Maximum Margins requirements).

We obtained that the realized returns of call selling are lower from the realized returns of put selling, which is in line with theory, but we would have expected those returns to be lesser than what we obtained (given that selling ATM calls literally implies going short on the underlying asset). Another insight came from the fact that though there was a difference in the realized rate of return (put's rate of return higher than call's rate of return) the standard deviation of returns was approximately the same, letting us to think it could be the case it becomes much more risk efficient and profitable to sell puts than to sell calls.

II. Proposition

In the previous paper we analyzed the whole package of options available with the characteristics described, with no discrimination about the time of issuance of the options. Hence, even though a distribution of realized returns was exhibited, it was not possible to compare the return of the options from this point of view with the market return.

In this paper we shall go further with the research, establishing a portfolio of options from the selling side, obtaining the realized returns timely ordered, and comparing the returns with a factor model.

a. Options realized returns

There is another article in Summa (2003)[1] analyzing options kept until expiration, and shows three key patterns emerging: (1) on average, three out of every four options held to expiration end up worthless; (2) the share of puts and calls that expired worthless is influenced by the primary trend of the underlying; and (3) option sellers still come out ahead even when the seller is going against the trend.

So we define returns from passive options investment strategies as the payoff obtained from launching options that eventually end up out of the money, and we compare this payoff with the margins requirements needed. One of the main features of our study is that we consider the margin requirements (guarantees) regulatory established as the initial investment committed, and therefore we compare the net payoff with the margin requirements along the life of the contract to obtain a realized return.

In order to establish the daily margin requirements, we use the appropriate formula for broad based index options naked short sale, as detailed in the CBOE Rulebook (CHAPTER XII – Margins[2]). For comparison's sake, we annualized the internal rate of return in the simplest way, by scaling up the period of time until one year, getting as a result an arithmetic annual return rate:

[1] Futures magazine published a study in 2003 (Summa, 2003)
[2]http://wallstreet.cch.com/CBOEtools/PlatformViewer.asp?SelectedNode=chp_1_1&manual=/CBOE/rules/cboe-rules/

$$Annual\ IRR_i^k = IRR_i^k \times \frac{365}{T} \qquad [7]$$

where T is the time to maturity of the option.

To check whether incompleteness issues arise in the queried data, filters are applied for the different maturities (and both filtered as well as non-filtered results are shown). For the case of near to 60 days to maturity, two filters are applied. The first one is to remove options that have less than 50 days to maturity or more than 70 days to maturity. The second one is to remove options that have less than 10 days of trading activity. When moving forward to near 180 days to maturity, the filters are adapted to a range between 160 and 200 days, and 20 days of trading activity. Finally, for the 365 days options, the time-to-maturity range is established between 335 and 395 days, while the number of trading days extends up to more than 40 days.

b. Four factor model

To the purpose of comparison of options returns we should resort to the Carhart (1997) four-factor model (an extension of the Fama–French 1997 three-factor model) including a momentum factor, also known in the industry as the MOM factor (monthly momentum)[3].

This model is commonly used as an active management and mutual fund evaluation model. Three commonly used methods to adjust a mutual fund's returns for risk are: the market model -where the regression intercept in this model is referred to as the "Jensen's alpha"-; the Fama-French three-factor model -where the regression intercept in the model is referred to as the "three-factor alpha"-; and the the Carhart four-factor model -where the intercept is known as the "four-factor alpha"-. A portfolio or an asset has excess returns if it has a positive and statistically significant alpha. The four-factor model for U.S. returns can be portrayed as

$$\left(R_i - r_f\right)_t = \alpha_i + b_i\left(R_M - r_f\right)_t + s_i HML_t + h_i SMB_t + w_i MOM_t + \varepsilon_{it}$$

Where R_i is the return on asset *i* and *t* denotes an specific month, r_f is the risk-free rate, R_M is the market return, *SMB* is the difference between the returns on diversified portfolios of small stocks and big stocks, *HML* is the difference between the returns on

[3] Momentum is the tendency for the stock price to continue rising if it is going up and to continue declining if it is going down. The MOM can be calculated by subtracting the equal weighted average of the highest performing firms from the equal weighed average of the lowest performing firms, lagged one month

diversified portfolios of high book-to-market (value) stocks and low book-to-market (growth) stocks, and *MOM* is the difference between the returns on diversified portfolios of past winners and past losers. In our case R_i should be associated to IRR from [7].

c. Methodology

We define a metric to measure options returns from the seller point of view, write an algorithm that simulates the sale of options and collects premiums of at-the-money european options at ex-ante market real prices (inflow of money to the seller of options), hold these contracts open until the original expiration, calculates the ex-post payoffs (outflow of money for the seller in case the option ends up in the money) and with that data calculating a realized return.

The methodology we followed is again simple as in previous works. We wrote an algorithm in Matlab, to retrieve the relevant data and perform the following calculations. It took the **bid market price** of both the call and put options at a certain moment in time, as a money inflow. By assuming the options is kept open until expiration, we computed the option's payoff at maturity, considering both the settlement price at that time as well as the option already defined strike. This is considered a potential money outflow, depending on the circumstances. If the options ended up in-the-money, there was an outflow of money for the seller which accounts negatively; if the option ended up out of the money, the payoff became zero.

The algorithm retrieves data from an historic data base of market prices to perform the operations and obtain a time series of realized returns. To do that we analyze the value of near at-the-money call and put options written on three main indexes in the US markets for a sufficiently long period of time, and evaluate the net payoffs considering premium prices received and cash flows paid had the options been held until expiration.

Once the realized returns are obtained, monthly investable indices will be constructed, by compounding the daily returns for each option type, given maturity, contemplated margin and averaging the returns for all the underlying assets. Given those new return time series, we are able to contrast them with the mentioned four factors, in an econometric fashion.

III. Results

Given a wide span of alternative returns, due to the fact that there are different maturities as well as ways to calculate the margin requirement (and so the strategies' returns), regressions estimates will be displayed based on a discrimination by put and call options. Results will displayed for both average and maximum margins. They are more representative than initial margins which, given the at-the-money selection, may suffer from a great variation.

Positive, and more statistically significant, excess returns constants can be appreciated on the put options side than in the call options counterparty, consistent with the notion of a positive long-term trend for the underlying indices. Surprisingly though, that alpha decays as the term-to-maturity is extended. One might argue that there's a positive premium for shorter termed put options, as a hedge against uncertainty. Same happens to call options, while decreasing its alpha term with time, only longer termed options show statistically significant negative alpha.

Consistent with options' pricing empirical evidence, longer term derivatives show a lower standard deviation (both for call and put options), with decreasing returns. In the case of call options, the monthly excess of returns turns more negative as time-to-maturity expands. More details can be appreciated in the following tables,

Regression results for monthly passive call-selling strategy

TTM	60	60	180	180	365	365
Margin metric	Max	Average	Max	Average	Max	Average
Excess Return	-0,29%	-0,24%	-0,53%	-0,74%	-0,53%	-0,75%
SD.	4,89%	7,04%	2,70%	4,28%	1,63%	2,97%
Alpha	-0,11%	0,03%	-0,55%	-0,79%	-0,55%	-0,79%
Alpha-t	-0,30	0,06	-1,87	-1,60	**-2,62**	**-2,05**
R_M - R_f	-0,39	-0,57	-0,12	-0,16	-0,045	-0,07
HML	0,16	0,28	0,15	0,25	0,082	0,14
SMB	0,16	0,22	0,19	0,29	0,089	0,16
MOM	-0,03	-0,06	0,05	0,08	0,038	0,06
R^2	0,14	0,15	0,11	0,10	0,08	0,07

Bolded *t*-stats are significant at 95% level.

Regression results for monthly passive put-selling strategy

TTM	60	60	180	180	365	365
Margin metric	Max	Average	Max	Average	Max	Average
Excess Return	1,48%	0,70%	0,71%	0,71%	0,46%	0,37%
SD.	5,56%	14,58%	3,00%	5,62%	1,62%	4,14%
Alpha	1,41%	0,50%	0,75%	0,84%	0,49%	0,40%
Alpha-t	**3,08**	0,41	**2,26**	1,38	**3,90**	0,69
R_M - R_f	0,26	0,62	0,09	0,15	0,048	0,11
HML	-0,26	-0,64	-0,26	-0,50	-0,097	-0,19
SMB	-0,05	-0,34	-0,13	-0,28	-0,046	-0,06
MOM	-0,05	0,04	-0,07	-0,15	-0,029	-0,04
R^2	0,09	0,06	0,12	0,13	0,07	0,05

Bolded *t*-stats are significant at 95% level.

Low R^2 coefficients makes one question the explanatory power of these well-established factors, giving incentives to try additional ones in the quest of explaining the returns for such a simple strategy as the one covered in this paper.

IV. Synthesis

The simplest way of analyzing returns in finance is the relation between the money committed with respect to the money obtained, something easy in traditional assets. In options, the literature calculates returns relating the money committed as premium paid, and the money obtained from the option payoff (or the in between appreciation or depreciation of the value of the option). The literature reports that option buyers tend to earn less return than predicted by standard risk return models. However, the research focusing on studying and calculating expected and realized option returns is mainly biased towards the buyer´s returns. Our main objective in this paper has been to show a different perspective of options themselves from the seller point of view, and a different metric to calculating option realized returns.

What it is left for further studies is to further evaluate the relation between risk and required equilibrium return in options, and to get consensus about how option returns could be well measured (in a way independent of regulation and compliance about margins).

V. References

Arrow, K. J. and Debreu, G. (1954), “Existence of an equilibrium for a competitive economy”. *Econometrica* 22 (3): 265–290

Black, F. and Scholes M. (1973), “The Pricing of Options y Corporate Liabilities”. *Journal of Political Economy* 81 (May-June): 637-659

Bondarenko, O., (2003), “Why are Put Options so Expensive?”. *Quarterly Journal of Finance*, 2014, forthcoming.

Broadie M., Chernov, M. and Johannes, M. (2009), “Understanding Index Option Returns”. *Review of Financial Studies* 22 (11): 4493-4529

Carhart, M. M. (1997). "On Persistence in Mutual Fund Performance". *The Journal of Finance* 52: 57–82.

Cordier J. y Gross M. (2009). *The Complete Guide to Option Selling*. Mc Graw Hill.

Cox, J., Ross, S., and Rubinstein M. (1979), “Option pricing: A simplified approach”. *Journal of Financial Economics* 7, no. 3:229-263

Dapena J.P and Siri J. (2015). Index Options Realized Returns distributions from Passive Investment Strategies. Universidad del CEMA Working paper 580.

Fama, E. F.; French, K. R. (1992). "The Cross-Section of Expected Stock Returns". The *Journal of Finance* 47 (2): 427.

Fama, E. F.; French, K. R. (1993). "Common risk factors in the returns on stocks and bonds". *Journal of Financial Economics* 33: 3.

Hull, J. (1993). *Options, Futures and other Derivative Securities*. Prentice Hall. Second Ed.

McDonald L. (2006), *Derivatives Markets*, 2nd edition, Pearson.

McKenzie, Lionel W. (1959). "On the Existence of General Equilibrium for a Competitive Economy". *Econometrica* 27 (1): 54–71

Merton, R. C. (1973), “Theory of Rational Option Pricing”. *Bell Journal of Economics y Management Science* 4, no. 1: 141-183

Rubinstein M. (1984), "A Simple Formula for the Expected Rate of Return of an Option over a Finite Holding Period". *Journal of Finance* 39:5 (1984): pp. 1503-1509.

Netfci, S. (1996). *An Introduction to the Mathematics of Financial Derivatives*. Academic Press.

Siri J. and Dapena J.P (2014). Comparación entre algoritmos de Ciclos y Modelos de Regime-Switching con aplicación a Estrategias de Inversión. Universidad del CEMA Working paper 540.

Summa J. (2003). Futures magazine.

OCC Rules, Option Clearing Company, 2014.

Appendix A

a. Direct results, for filtered options, with the average margin on the denominator

Call Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0171	0,0367	0,0636
Median	0,0379	0,0248	-0,0647
Standard Deviation	0,2312	0,4042	0,4704
Max	1,0937	1,7043	1,4633
Min	-0,9124	-2,0483	-0,9434
Kurtosis	3,7406	3,6158	2,2130
Skewness	-0,1070	0,1194	0,5055
Average Moneyness	0,9997	1,0002	0,9993
Average TTM	58,99	182,95	362,36
Observations	97.789	32.353	18.112
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

Put Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0867	0,2220	0,2285
Median	0,1382	0,2985	0,3696
Standard Deviation	0,2471	0,3630	0,5103
Max	0,9284	1,2166	1,3094
Min	-1,1442	-1,5572	-1,1102
Kurtosis	7,2407	5,0710	3,1946
Skewness	-1,6938	-1,4213	-1,0563
Average Moneyness	0,9996	1,0000	0,9993
Average TTM	58,99	182,91	362,37
Observations	97.902	32.627	18.097
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

Appendix B: The Data

The market data used to test the passive investment strategy is based on daily observations. The option series were based on the following underlyings: DJX –representing 1/100th of the Dow Jones Industrial Average index-, SPX –the Standard & Poor's 500 index- and NDX –the NASDAQ 100 index-. Both put and call options were considered, based on several layers of rules.

First of all, in order to filter the options, different maturities were set. Short-term options were the ones with approximately 60 days to expiration. Mid-term options had around 180 days to expiration. And finally, long-term options had around 365 days to expiration. Subsequently, an additional filter regarding the trading activity was imposed, leaving only options that had more than 10 days of trading. On the other hand, near at-the-money (ATM) options were considered, given a moneyness ranging between 0.95 and 1.05.

Last, but not least, daily returns of all options entering each category (call or put meeting each filter) are averaged and a rolling return series is constructed against which the factor model is regressed.