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Abstract

Few papers provide research about options returns, and the few available are focused in the analysis from the perspective of the long side of the option contract, i.e. the buyer that pays the price and her expected and realized option return. The main point of our research work is to provide a simple metric to analyze option returns from the perspective of the short side of the contract, the seller, where at the time of the sale of naked options, capital is committed in the form of a guarantee or margin (similar to net worth). We estimate realized returns from passive investment strategies, by assuming puts and calls are kept until the expiration of the maturity. To that purpose we develop an appropriate algorithm which is applied on real historic data.
Our result is a distribution of realized option returns (ex-ante prices and ex-post cash flows whether the options end up in or out-of-the-money with respect to margin requirements) for the seller point of view, as if the seller was an insurer seeking to calculate how profitable the insurance activity is.
From the results we can see that selling puts is more profitable than selling calls, without adjusting for the return of the underlying asset and for the risk free rate of return, something in line with what was expected, but we also find that the risk is approximately the same. We also find that time tends to increase the realized returns, measured everything on annual basis.

JEL: C1, C3, N2, G11.
Key words: Ex post returns, distribution, realized returns, option pricing.

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I. Introduction

One of the main differences between equities and options is that the later have a defined maturity and at some time in the future the contract expires and payoffs occur, which allows to calculate the complete return of holding these contracts. By contrast, in equities returns are measured by comparing the appreciation in equity price and dividends with respect to the original equity price for any period of time.

In options, the scarce literature available analyzes expected and realized option returns from the perspective of the long side of the contract. i.e the buyer, considering the priced paid and the payoffs obtained. The empiric studies available show that buyers of options earn less return that what it is expected from theory according to the risks.

Our objective in this paper is to study and provide empirical evidence and insights about the realized returns of call and put options contracts from the seller point of view, by analyzing the net payoffs of those contracts with respect to the capital committed under the assumption that the contracts are held open until expiration, or in other words, what empirical evidence says about how risky and profitable these contracts are for the seller.

To do so we define a metric to measure options returns from the seller point of view, write an algorithm -which is applied on historic data- that simulates the sale of at-the-money european options and collects premiums at ex-ante market real prices (inflow of money to the seller of options), hold these contracts open until the original expiration –which is our definition of passive investment strategies-, 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.

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.

The algorithm retrieves data from an historic data base of market prices to perform the operations and obtain a distribution of the 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.

The results obtained are useful to broaden discussion about the implications of realized returns for ex ante option pricing. As a result we seek to provide empirical evidence that helps practitioners to assess the ex-ante valuation of options; thus the findings are presented in a fashionable way that allows to understanding the implications for options valuation.

II. Literature

We have found there was not so much literature on this subject. Specific literature refers to Benesh and Crompton (2000) where the authors perform research by analyzing historical return distribution of calls, puts and covered calls for the period 1986-1989, by means of studying the return on a twelve weeks period, finding that evidence allows to delineate the extreme risks and potentially large rewards associated with the purchase of both call and put options.

There was another paper published the same year by Coval and Shamway (2000) where the authors examine expected option returns in the context of classic CAPM theory, obtain estimated betas for such contracts, estimate the expected option returns and then comparing them with the realized returns. Using some weak assumptions, they find that expected call option returns exceed those of the underlying security and increase with the strike price, and expected put options returns are below the risk-free rate and increase with the strike price. They also show that realized returns for the long position are below from those predicted by the CAP model for both calls and puts options, and they also suggest that there might be some additional factor beyond the second moment of the distribution, such as systematic stochastic volatility, priced in option returns. This last evidence may be consistent with the fact that if asset pricing only cared about mean and variance, hence options contracts are redundant given that they are constructed as a linear combination of existing assets.

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.

As it may be seen, the literature studying option returns is very scarce and not much evidence has been provided to better understand the phenomena of how well are options priced from an ex post point of view, even more taking in account the abundance of data

[1] Futures magazine published a study in 2003 (Summa, 2003)

and data processing capacity we now have to perform those studies, and the fact that there is an expiration date.

Another point to take into account is that all the literature falls in an academic bias towards analyzing option returns from the point of view of the buyer side instead from the point of view of the seller side, being the last one of the main features of our work.

III. Options

a. The Value of Options

The standard definition identifies an option as the contract that gives the right, but not the obligation, to buy or sell a particular underlying asset at a specified price during a certain period of time.[2]

The worth of a particular option contract to a buyer or seller is measured by its likelihood to meet their expectations, which means it is determined by whether or not the option is, or is likely to be, in-the-money or out-of-the-money[3] at expiration, and discounting that value to the present. If an option is not in-the-money at expiration, the option is assumed worthless. This relation between the value at the beginning and the value at the end shall be of much importance in the development of the present paper.

The simplest valuation methodology[4] for an option is based mainly in the construction of a replicating portfolio, under the assumption that markets are complete, consisting in a linear combination of the underlying asset and a risk free asset, where weights are chosen to replicate the payoff of the sought option, and hence both assets (the option and the portfolio) must have the same present value.

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[2] A call option is the right to buy an asset; a put option is the right to sell it. The contract offers the buyer the right, but not the obligation, to buy (call) or sell (put) a security or other financial asset at an agreed-upon price (the strike price) during a certain period of time or on a specific date (exercise date). These contracts also have an expiration date which differentiates them to equities. When an option expires, the contract finishes and it pays off or not. From our point of view this is a very insightful observation when comparing with equity, where options have a maturity and only live for a period of time, and are similar to insurance contracts.

[3] A call option is in-the-money if the current market value of the underlying stock is above the exercise price of the option. The call option is out-of-the-money if the stock is below the exercise price. A put option is in-the-money if the current market value of the underlying stock is below the exercise price. A put option is out-of-the-money if its underlying price is above the exercise price.

[4] It has been written extensively and deeply about option pricing, from the original contributions from Black and Sholes (1973) and Merton (1973), building on previous works by Arrow and Debreu (1954) and Mac Kenzie (1959), and after supplemented by Cox, Ross and Rubinstein (1979) and many others.

For a non-paying dividends asset, the famous Black Scholes Merton (BSM) formula for an european call is:

$$c = SN(d_1) - Xe^{-rT}N(d_2) \quad [1]$$

Where c is the value of the call, S is the current value of the underlying asset, X is the price at which the buyer has the right to buy, r is the risk free asset and T is the time to maturity; $N(d_1)$ and $N(d_2)$ shows the cumulative standardized normal distribution to certain points constructed by the use of the previous parameters[5].

The closed formula for the put option is obtained in the same way:

$$p = c - S + Xe^{-rT} \quad [2]$$

These are standard and basic formulas for simple option valuation and their beauty is that they get rid of the risk adjusted expected rate of return by assuming the investors are risk neutral, and markets are complete, and under a synthetic probability distribution the expected is obtained and discounted by using the risk free rate.

However, as we have mentioned before, most of the literature focuses on the ex-ante valuation of options, or on how options should be priced, but we could not find much research evaluating the ex-ante value with the ex-post payoffs.

b. Expected and realized option returns

The literature shows two formulas for the calculation of instantaneous expected option returns[6]. One example is shown in McDonald (2006) where the expected instantaneous option return can be written as:

$$E(r_o) = r_f + \frac{S}{O} * \Delta_o * (E(r_S) - r_f) \quad [3]$$ [7]

[5] For more detail see for instance Hull (1993) or Neftci (1996).
[6] The instantaneous expected return of an option can be easily obtained by using the stochastic differential equation for the pricing of derivatives.
[7] Where $E(r_f)$ = annualized expected instantaneous option return , rf = risk-free rate, $E(r_S)$ = annualized stock return, S = stock price, O = option price), and Δ_o = delta of option.

The other one is shown by Rubinstein (1984) for a call:

$$E(r_o) = \left[\frac{E(\widetilde{C}/h}{C}\right]^{1/h} - 1 \quad [8] \qquad [3]$$

However, as we have mentioned, in the two cases the bias comes from analyzing the option contracts from the buy side, as an investor who goes long in those contracts would do.

The papers that analyze realized returns, like Benesh and Crompton (2000), Coval and Shamway (2000), Bondarenko (2003) or also Broadie et. al (2009) also analyze realized returns from this perspective, where option returns are calculated by comparing the option payoff with respect to the original premium paid.

In all cases the empirical evidence shows that investor receive less return than what it is predicted by risk measures (and in some cases, authors hypothesize that there are some risk insured not captured by models); this perspective can also be understood as <u>option sellers receiving more returns than predicted by the models</u>.

Our main challenge in this paper is to show the seller perspective, and hence a different methodology of calculating option returns, by associating option contracts more to an insurance contract, and hence calculating realized returns by comparing the investment sunk as guarantee with the realized pay offs from the realization of events (where events are that options end in or out-of the money).

c. Options as insurance

It can be said that selling options can be associated to selling insurance. For instance the buyer of car insurance pays a premium every month to an insurance company in order to protect her vehicle. As a result in most cases, the buyer does not suffer an accident (the policy expires "out of the money"), and the insurance company keeps the amount of money originally received as a profit. However, if the owner does happen to be involved in an accident, the insurance company pays her the amount insured (the policy ends up in the money). The premiums charged by insurance companies try to be aligned with the likelihood of having an accident, and companies must maintain a certain amount of money (a guarantee fund or actuarial reserves) to pay out when accidents occur.

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[8] where $E(\check{C}/h)$= is the expected future price the option would have under the BSM formula, where underlying asset S grows at rate m, X grows at rate $r_{f,}$,. H is the holding time of the option, t is maturity, and volatility is calculated as a time to expiration weighted average between market volatility and investor estimate of volatility.

Much of the profit from the insurance management comes from trying to avoid drivers that reckon are prone to accidents, or charging them with higher premiums, and from financial investments made with the guarantee fund.

It could be said that an option seller goes through a similar process. Just as most drivers do not have accidents, many (and perhaps most) of the seller´s options will never end up in the money. However, as in insurance industry, a few bad accidents can hurt the profits. An insurance company, therefore, tries to reduce the likelihood that one of its insured drivers will have an accident by checking a number of factors such as driving record, age of the driver, type of car, etc. An option seller goes through the same process but instead of studying drivers' behavior, the option seller may study the market's "driving record" which is shown by historical tendencies, current and future economic fundamentals, etc. While an insurance company can in no way guarantee that the drivers it selects will not suffer accidents, it can certainly help its business by selecting only drivers who have what it considers a low chance of being in an accident. Thus it can lower its risk and increase its profitability. On the other hand, the insurance company must incorporate capital, both from a business and form a regulatory point of view, in relation to the level of uncertainty and the exposure it is insuring against.

Under the proposition of our paper, we associate the seller of options to the insurance company, collecting premiums when selling the options, incorporating capital in the form of a margin requirement, keeping the options opened until expiration and then paying or not the events insured (whether the options end up in or out of the money) and we want to show her business record by the analysis of historic data.

IV. Proposition, data analyzed and methodology

a. Proposition

Our proposition is to study the realized returns of call and put options for a long period of time, under the assumption they are kept until expiration –denominated passive investment strategy-, to evaluate the results of such a strategy (and hence the probability distribution of realized returns). In terms of the insurance company example mentioned before, what we are going to do is to perform a backward search of results to obtain realized returns from the strategy of selling policies (options) and collecting the premium, comparing the amount received against the amount effectively paid at the end of each contract, and comparing that amount with the margin requirement (capital incorporated by the investor from our perspective).

If we see the sale of options as an equivalent of an insurance company selling policies, as it was previously mentioned, selling a call insures the buyer against an upward movement of the market (the states of the nature where the buyer gets paid for the event), and selling a put insures against a downward movement of the market.

We understand that the strategy of maintaining options until expiration may not be often seen in the capital markets, because investors enter and exits from options and close contracts by means of trading before maturity; however the main insight of our work is to understand how well are option priced from the seller point of view in accordance to the capital invested as margin, collateral o guarantee, and so far we have not seen many empirical studies studying option returns, and no one analyzing options returns from this perspective, by analyzing what would have happened to the issuer of options had investors kept their options until expiration. Even though we do not expect to see such a strategy in practice, getting to know about the distribution of realized returns may help us better understand the value of options and regulation.

b. Data

The data analyzed is obtained from the market prices for european options, traded on the Chicago Board Options Exchange (CBOE), written on three major indexes:

- Dow Jones Industrial Average,
- Standard & Poor's 500,
- Nasdaq 100.

All of them are considered broad based and liquid indexes. This definition influence the way margins are calculated. The period of time to be analyzed is very broad, where available data ranges from January 1996 until July 2013.

We have restricted our research to near at-the-money (ATM) naked call and put options in order to evaluate the returns of what we denominate a '*passive*' strategy of selling options and holding the contract open until expiration.

In addition, the maturities for the selected options were 60, 180 and 365 days. In practical terms, in any given day, options with the nearest time to maturity (with respect to the ones specified) and a degree of moneyness between 0.95 and 1.05 were selected as candidates to conduct the study.

c. Methodology

The methodology we followed is very simple. We wrote an algorithm in Matlab, to retrieve the relevant data and perform the following calculations. The process takes 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.

d. Options returns for the seller

A key innovation of our work is how we measure option returns. As we mentioned before, in the literature realized returns are measured by comparing the payoffs with the premium paid by an option buyer, which reflects the long side of the contract.

Our innovation is to analyze the payoff for the sell side, the one that goes short and "*insures*" the buyer. For this side, the calculation of returns is very simple: the seller sells option contracts, collects premiums, sinks money as guarantee, and then analyzes payoffs according to whether the options contacts end up in or out-of-the-money. As time goes between the initiation and the expiration, in the case the option becomes in-the-money, margin calls are required and more collateral has to be sunk to afford the need of capital. This could be seen as an injection of capital. On the other hand, if the option becomes out-of-the-money as time goes by, this situation frees capital and hence collateral is reduced.

Once we have premiums and eventual payoffs if a particular option happens to end in-the-money, we estimate 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 that are committed for the naked short sale: the initial margin ($Margin_{Initial}$), the average margin ($\overline{Margin}$) and the maximum margin ($Margin_{Max}$) required. On the one hand, for a call the formula is as follows,

$$IRR_i^k = \frac{c_i - (S_T^i - K_i)_+}{Margin_i^k} \qquad [4]$$

Where the subindex *i* refers to the specific option analyzed in terms of dates and strikes, while the supraindex *k* stands for a specific margin type, where:

$$Margin^k \in \{\overline{Margin}, Margin_{Initial}, Margin_{Max}\} \quad [5]$$

It is worth noting that the average margin is calculated as the sum of the daily margins, weighted on the number of trading days between the observed date and the expiration date.

On the other hand, the formula for the put options is

$$IRR_i^k = \frac{p_i - (K_i - S_T^i)_+}{Margin_i^k} \quad [6]$$

Operating in a similar fashion as mentioned previously for the call options (except for the final payoff).

The key component of our work is that we use margin requirements as the denominator for the calculation of option returns. At some point of our research, we have been told by academics to use the value of the underlying asset or the exercise price as denominator for return measure purposes, but we consider this to be an artificial measure of the collateral involved since the real capital sunk is the margin requirement.

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[9]). For the sake of comparison, 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:

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

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

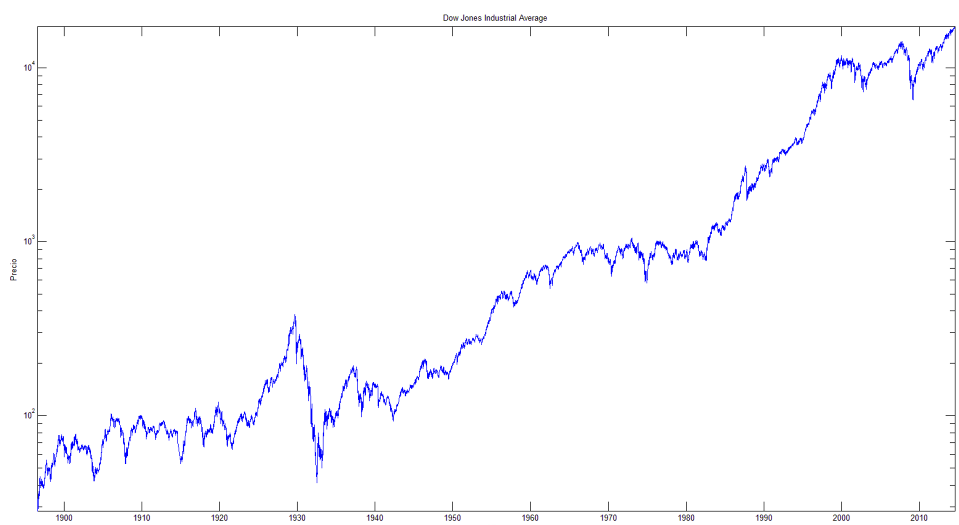
[9] http://wallstreet.cch.com/CBOEtools/PlatformViewer.asp?SelectedNode=chp_1_1&manual=/CBOE/rules/cboe-rules/

time-to-maturity range is established between 335 and 395 days, while the number of trading days extends up to more than 40 days.

V. Results

On a general basis, we expected to find that selling put options had a better payoff than selling calls, as well as selling shorter maturities yield a better (but more volatile) payoff than longer maturities. The first result is consistent with an aggregate index price that historically grows at the annual geometric rate of return of 7.3% with an annual standard deviation in the rate of return is 18.53%, as it can be graphically seen in the following chart showing 118 years of Dow Jones Industrial Average price history (until July 2014).

Graph I



As a common factor for the whole sample, large volatility is experienced, in all maturities, types and indexes. Taking into account the fact that we use three types of margin calculations in order to compute the internal rate of return, we are displaying the results in terms of those different considerations.

The direct return of selling call options, while positive, lags those of put options; as maturity increases, the difference between the two strategies expands. That can be appreciated in tables I and II (which contained summarized data for call and put options, respectively).

Table I

Call Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0170	0,0278	0,0482
Median	0,0376	0,0133	-0,0607
Standard Deviation	0,2347	0,3965	0,4557
Max	1,1649	1,7871	1,4633
Min	-0,9308	-2,0958	-0,9611
Kurtosis	3,8049	3,7521	2,2851
Skewness	-0,1195	0,0704	0,5031
Average Moneyness	0,9997	0,9999	0,9997
Average TTM	59,37	183,11	347,86
Observations	137.759	64.782	31.970
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Table II

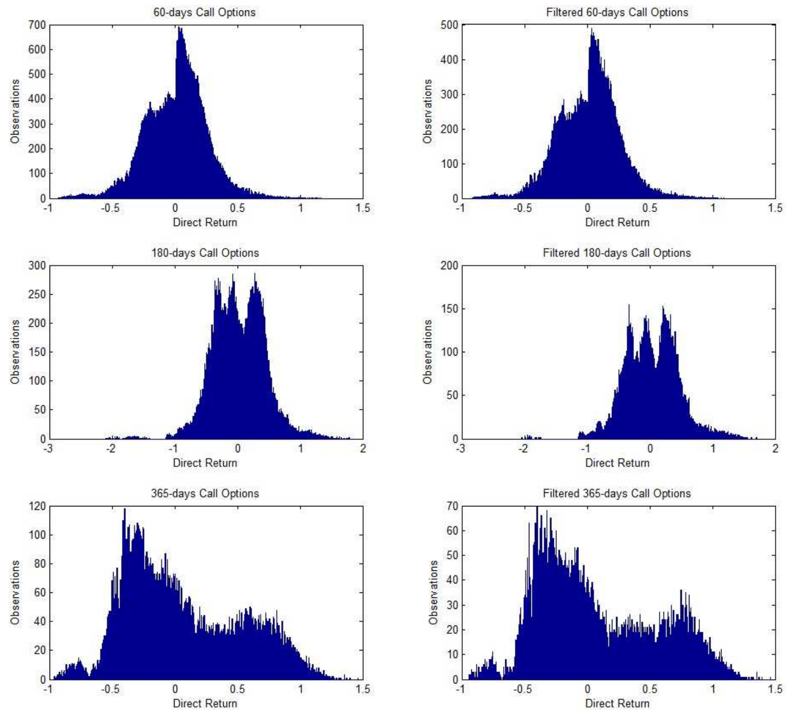
Put Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0870	0,2162	0,2332
Median	0,1369	0,2907	0,3513
Standard Deviation	0,2475	0,3634	0,4646
Max	0,9288	1,2166	1,3094
Min	-1,1600	-1,6267	-1,1102
Kurtosis	7,0743	5,3447	3,6226
Skewness	-1,6281	-1,4860	-1,1449
Average Moneyness	0,9995	0,9997	0,9997
Average TTM	59,37	182,96	347,85
Observations	137.963	65.451	31.959
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

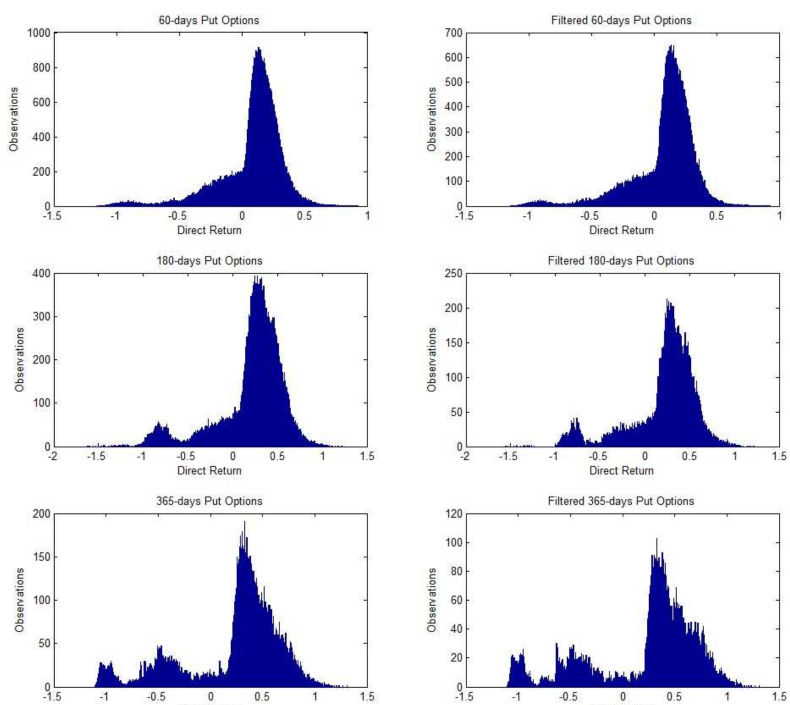
Daily observations

From those tables it can be appreciated that, on average, selling call options have a positive skew, while the case for put options is the opposite. Put options also show significant ‘fat tails’, with kurtosis values of over 7 for the case of near 60 days of time to maturity. Both characteristics are highlighted in graphs II and III.

Graph II



Graph III



If instead of calculating the payoffs with the average margin requirement (to obtain realized returns) we use the maximum margin (throughout the lifespan of the option) as the denominator, results ‘worsen’ slightly, but might turn out to be more realistic in terms of the return on the investment. Given that, in order to reach the expiration date margin calls must be avoided, taking into account the maximum margin penalizes the internal rate of return but express in a greater degree of precision the amount of capital needed at each point for the selling activity to be completed. As shown in tables III and IV, applying this metric, instead of the average margin, results in a thinning of the distribution’s tails and a lower degree of variability.

Table III

Call Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0040	-0,0013	-0,0044
Median	0,0309	0,0093	-0,0478
Standard Deviation	0,1678	0,2435	0,2650
Max	0,4509	0,5554	0,5043
Min	-0,8816	-1,1952	-0,5801
Kurtosis	2,7513	2,7116	1,7698
Skewness	-0,4103	-0,3480	0,1581
Average Moneyness	0,9997	0,9999	0,9997
Average TTM	59,37	183,11	347,86
Observations	137.759	64.782	31.970
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Table IV

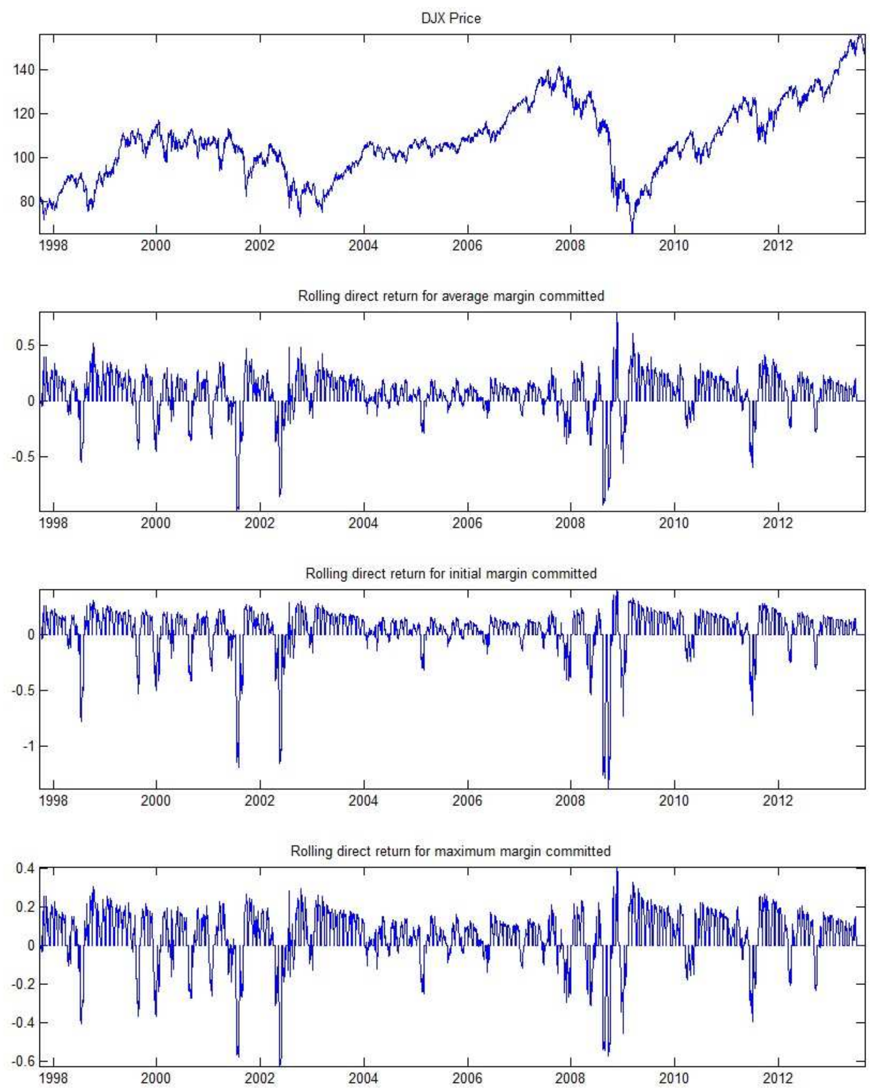
Put Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0650	0,1386	0,1424
Median	0,1090	0,2065	0,2367
Standard Deviation	0,1765	0,2323	0,2779
Max	0,4546	0,5387	0,5778
Min	-0,7537	-1,1448	-0,6585
Kurtosis	5,7764	5,7244	3,3221
Skewness	-1,5727	-1,7416	-1,2529
Average Moneyness	0,9995	0,9997	0,9997
Average TTM	59,37	182,96	347,85
Observations	137.963	65.451	31.959
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

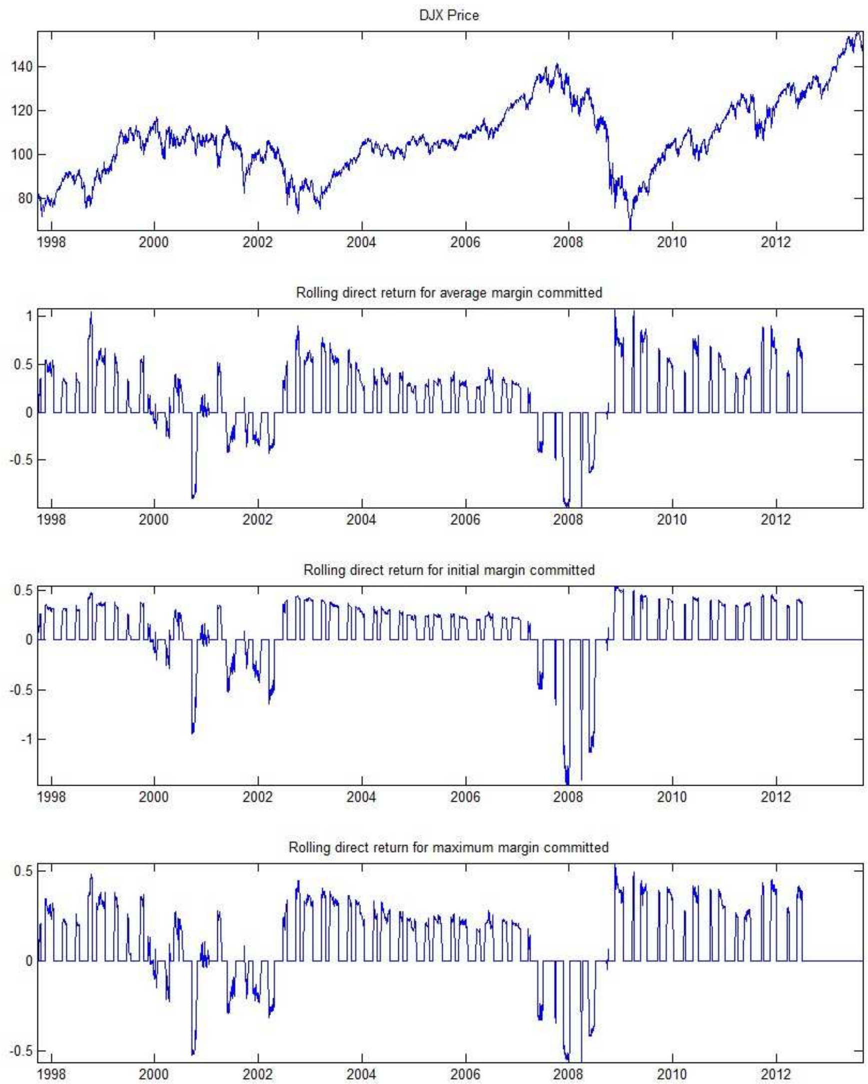
Daily observations

Finally, we present graphs IV and V, displaying in a rolling fashion the IRR for the selling put strategy on a selected index, with maturities of 60 days and 365 days, respectively. One can appreciate that returns are highly dependent on both the underlying index performance, as well as the time to maturity available in the option. The latter concept is highly relevant, as one could expect that markets, in the long run, adjust to their 'natural' rate of return, making viable a strategy of selling puts, and penalizing the opposite strategy (selling calls).

Graph IV



Graph V



For a broader array of empirical results, showing strategy's returns filtered by indexes as well as maturities, appendix A has been included.

VI. Synthesis

The simplest way of analyzing returns in finance is the relation between the money committed or invested with respect to the payoff obtained. 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.

The results obtained are, from our point of view, very insightful and may open further discussion. We see 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 calls implies going short on the underlying asset) and from Graph I we see that the realized appreciation rate of return of the DJIA is greater that the risk free rate of return. Let's remember that the expected option returns are determined by the "valuation" gap between risk-neutral and real world probability measures, and the magnitude of the returns is finally defined by the difference in the location and shape parameters of those distributions. Finer and more precise modelling may help get a grasp of what's happening, considering pricing events such as jumps.

Another insight comes from the fact that from tables I, II, II and IV, though there is a difference in the realized rate of return (put rate of return higher than call rate of return) the standard deviation of returns is approximately the same, letting to think it could be the case it becomes much more risk efficient and profitable to sell puts than to sell calls. The caveat should be made that we have not incorporated in our analysis the risk free rate of return and the index rate of return in order to get an appropriate estimation of equation [2], however it is interesting to see different realized returns with almost the same risk (using only standard deviation as a proxy for that). We find that time tends to increase the realized returns, measured everything on annual basis.

Finally, among our main results we have that we have been able to propose the possibility of using realized returns to feedback the way option valuation is made, to better understand how the prices indeed reflect at the end what is expected to happen, to provide a measure to calculate option returns, and finally to understand how important is margin requirement regulation in that specific measure.

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 an compliance about margins).

VII. References

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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

b. Direct results, with the initial margin on the denominator

Call Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0238	-0,0751	-0,0874
Median	0,0384	0,0140	-0,0657
Standard Deviation	0,2511	0,4273	0,4245
Max	0,4706	0,5903	0,5249
Min	-2,4147	-4,0883	-2,2111
Kurtosis	8,1640	8,8112	3,2792
Skewness	-1,6009	-1,6968	-0,6717
Average Moneyness	0,9997	0,9999	0,9997
Average TTM	59,37	183,11	347,86
Observations	137.759	64.782	31.970
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Put Option Summary Statistics

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0475	0,1150	0,0893
Median	0,1225	0,2416	0,2727
Standard Deviation	0,2716	0,3919	0,4810
Max	0,4568	0,5414	0,5864
Min	-2,4346	-2,2555	-2,1645
Kurtosis	16,1491	10,4835	5,5282
Skewness	-3,0945	-2,7103	-1,8552
Average Moneyness	0,9995	0,9997	0,9997
Average TTM	59,37	182,96	347,85
Observations	137.963	65.451	31.959
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

c. Direct results, for filtered options, with initial margin on the denominator

Call Option Summary Statistics

TTM	60 days	180 days	365 days
Mean	-0,0222	-0,0708	-0,0781
Median	0,0387	0,0259	-0,0693
Standard Deviation	0,2450	0,4286	0,4245
Max	0,4577	0,5596	0,5139
Min	-2,4147	-3,5397	-2,1451
Kurtosis	7,9925	7,0034	3,1754
Skewness	-1,5364	-1,5575	-0,6453
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	0,0478	0,1169	0,0672
Median	0,1236	0,2498	0,2925
Standard Deviation	0,2719	0,3931	0,5312
Max	0,4568	0,5209	0,5864
Min	-2,1938	-2,2555	-1,9516
Kurtosis	15,6333	10,2075	4,6918
Skewness	-3,0736	-2,6741	-1,6814
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

d. Direct results, with the maximum margin on the denominator

Call Option Summary Statistics

TTM	60 days	180 days	365 days
Mean	0,0041	0,0032	0,0024
Median	0,0312	0,0187	-0,0502
Standard Deviation	0,1658	0,2437	0,2676
Max	0,4509	0,5430	0,5013
Min	-0,6360	-1,1266	-0,5801
Kurtosis	2,7035	2,3803	1,7368
Skewness	-0,3952	-0,3133	0,1593
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	0,0653	0,1409	0,1363
Median	0,1102	0,2122	0,2459
Standard Deviation	0,1762	0,2318	0,3015
Max	0,4546	0,4993	0,5778
Min	-0,7537	-1,1448	-0,6585
Kurtosis	5,8781	5,4295	2,9208
Skewness	-1,6100	-1,6924	-1,1450
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

e. Direct results, for filtered options, with the maximum margin on the denominator

Call Option Summary Statistics

TTM	60 days	180 days	365 days
Mean	0,0040	-0,0013	-0,0044
Median	0,0309	0,0093	-0,0478
Standard Deviation	0,1678	0,2435	0,2650
Max	0,4509	0,5554	0,5043
Min	-0,8816	-1,1952	-0,5801
Kurtosis	2,7513	2,7116	1,7698
Skewness	-0,4103	-0,3480	0,1581
Average Moneyness	0,9997	0,9999	0,9997
Average TTM	59,37	183,11	347,86
Observations	137.759	64.782	31.970
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Put Option Summary Statistics

TTM	60 days	180 days	365 days
Mean	0,0650	0,1386	0,1424
Median	0,1090	0,2065	0,2367
Standard Deviation	0,1765	0,2323	0,2779
Max	0,4546	0,5387	0,5778
Min	-0,7537	-1,1448	-0,6585
Kurtosis	5,7764	5,7244	3,3221
Skewness	-1,5727	-1,7416	-1,2529
Average Moneyness	0,9995	0,9997	0,9997
Average TTM	59,37	182,96	347,85
Observations	137.963	65.451	31.959
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

f. Annualized results, by index, with the average margin on the denominator

Call Option Summary Statistics

DJX

TTM	60 days	180 days	365 days
Mean	0,1236	0,1563	0,0726
Median	0,2198	0,2332	-0,0277
Standard Deviation	1,1930	0,6443	0,4497
Max	5,6786	2,2271	1,3426
Min	-4,2798	-1,5140	-0,8761
Kurtosis	3,2184	2,1736	1,9367
Skewness	-0,0582	-0,1007	0,2814
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.204	17.529	11.997
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	60 days	180 days	365 days
Mean	0,1130	0,0302	0,0343
Median	0,2316	-0,0287	-0,0809
Standard Deviation	1,2286	0,7046	0,4885
Max	6,1906	2,5015	1,6992
Min	-4,7930	-1,6014	-1,0934
Kurtosis	3,1517	2,1947	2,4524
Skewness	-0,0134	0,1250	0,5275
Average Moneyness	1,0003	0,9995	0,9998
Average TTM	59,30	179,60	342,92
Observations	66.027	23.976	17.870
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	60 days	180 days	365 days
Mean	0,0537	-0,0063	0,0257
Median	0,2857	-0,0764	-0,1729
Standard Deviation	1,9836	0,9810	0,5436
Max	7,3517	4,2307	1,2664
Min	-6,2848	-4,2600	-0,8422
Kurtosis	3,1695	4,4587	2,2761
Skewness	-0,1490	0,0077	0,6828
Average Moneyness	0,9988	1,0002	0,9976
Average TTM	59,13	184,60	366,18
Observations	37.528	23.277	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,4657	0,3099	0,2356
Median	0,7391	0,4511	0,3332
Standard Deviation	1,3929	0,6859	0,4467
Max	5,5496	1,8972	1,1797
Min	-8,0353	-2,9081	-1,0702
Kurtosis	7,9839	5,2037	3,6595
Skewness	-1,7446	-1,4512	-1,1046
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.177	17.529	11.993
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,4708	0,3471	0,2491
Median	0,7992	0,5356	0,3903
Standard Deviation	1,4921	0,7316	0,4833
Max	5,8423	2,0692	1,4385
Min	-7,9044	-2,6203	-1,2026
Kurtosis	8,8178	4,7880	3,4338
Skewness	-1,9852	-1,4241	-1,1321
Average Moneyness	1,0002	0,9993	0,9998
Average TTM	59,31	179,70	342,91
Observations	66.039	24.073	17.863
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,7193	0,6201	0,3215
Median	1,1181	0,7576	0,5137
Standard Deviation	1,8041	0,7275	0,6116
Max	6,0698	2,7244	1,2131
Min	-8,3911	-3,3182	-1,1034
Kurtosis	5,6785	7,8586	3,4259
Skewness	-1,3913	-1,9192	-1,3283
Average Moneyness	0,9984	0,9998	0,9976
Average TTM	59,13	184,07	366,18
Observations	37.747	23.849	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

g. Annualized results, for filtered options, by index, with average margin on the denominator

Call Option Summary Statistics

DJX

TTM	60 days	180 days	365 days
Mean	0,1200	0,1782	0,0799
Median	0,2183	0,2613	-0,0432
Standard Deviation	1,1834	0,6586	0,4433
Max	5,6786	2,2271	1,3426
Min	-3,6064	-1,5140	-0,6846
Kurtosis	3,1602	2,3189	2,0014
Skewness	-0,0415	-0,0893	0,4462
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.040	8.790	7.147
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	60 days	180 days	365 days
Mean	0,1092	0,0497	0,0574
Median	0,2290	-0,0150	-0,0583
Standard Deviation	1,2170	0,7085	0,4787
Max	6,1906	2,5015	1,4878
Min	-3,6696	-1,6014	-0,9996
Kurtosis	3,1010	2,3311	2,2406
Skewness	0,0192	0,1403	0,4740
Average Moneyness	1,0003	0,9995	0,9994
Average TTM	58,99	181,32	360,30
Observations	47.290	11.867	9.085
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

NDX

TTM	60 days	180 days	365 days
Mean	0,0775	0,0167	0,0261
Median	0,3071	-0,0566	-0,1717
Standard Deviation	1,9384	0,9847	0,5443
Max	7,0638	3,3266	1,2664
Min	-5,8605	-4,0728	-0,8422
Kurtosis	3,1549	3,7925	2,3178
Skewness	-0,1282	0,2502	0,6854
Average Moneyness	0,9987	1,0014	0,9979
Average TTM	58,75	183,59	364,21
Observations	26.459	11.696	1.880
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,4717	0,3131	0,2136
Median	0,7593	0,4629	0,3358
Standard Deviation	1,3894	0,6934	0,4924
Max	5,5496	1,8972	1,1797
Min	-7,5640	-2,1277	-1,0702
Kurtosis	7,9200	4,4248	3,0829
Skewness	-1,7969	-1,2831	-0,9756
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.020	8.790	7.143
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,4772	0,3495	0,2229
Median	0,8096	0,5360	0,3813
Standard Deviation	1,4748	0,7368	0,5034
Max	5,8423	2,0692	1,1964
Min	-7,2463	-1,9389	-1,1214
Kurtosis	8,7531	4,3486	3,1701
Skewness	-2,0270	-1,2834	-1,0685
Average Moneyness	1,0003	0,9993	0,9994
Average TTM	58,99	181,35	360,31
Observations	47.286	11.915	9.074
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,7024	0,6340	0,3398
Median	1,1215	0,7713	0,5160
Standard Deviation	1,7923	0,6919	0,6020
Max	5,7119	2,7244	1,2131
Min	-8,0646	-3,0977	-1,1034
Kurtosis	5,6447	7,6304	3,6624
Skewness	-1,4299	-1,8998	-1,3889
Average Moneyness	0,9984	1,0009	0,9979
Average TTM	58,75	183,42	364,21
Observations	26.596	11.922	1.880
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

h. Annualized returns, by index, with initial margin on the denominator

Call Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0514	0,0047	-0,0536
Median	0,2237	0,2337	-0,0301
Standard Deviation	1,2131	0,6394	0,4206
Max	3,1651	0,9758	0,5915
Min	-7,6283	-3,7657	-1,6729
Kurtosis	4,4175	3,7339	2,4454
Skewness	-0,9845	-0,9950	-0,5484
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.204	17.529	11.997
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0738	-0,1492	-0,1155
Median	0,2381	-0,0301	-0,0859
Standard Deviation	1,2492	0,7431	0,4696
Max	3,0919	1,0656	0,5857
Min	-9,2092	-4,5259	-2,7173
Kurtosis	4,2904	4,0533	4,1429
Skewness	-0,9404	-0,9593	-0,8729
Average Moneyness	1,0003	0,9995	0,9998
Average TTM	59,30	179,60	342,92
Observations	66.027	23.976	17.870
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,3845	-0,2821	-0,1448
Median	0,2960	-0,0839	-0,2259
Standard Deviation	2,2103	1,1210	0,4719
Max	3,2927	1,3611	0,5048
Min	-15,1350	-9,8823	-1,6968
Kurtosis	6,1335	11,1629	2,7728
Skewness	-1,4825	-2,0827	-0,4313
Average Moneyness	0,9988	1,0002	0,9976
Average TTM	59,13	184,60	366,18
Observations	37.528	23.277	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,2709	0,1468	0,0993
Median	0,6717	0,3875	0,2583
Standard Deviation	1,5087	0,7659	0,4603
Max	2,8451	1,0210	0,5852
Min	-12,1098	-3,5083	-1,7548
Kurtosis	14,7890	8,6704	5,6323
Skewness	-2,9326	-2,4452	-1,8751
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.177	17.529	11.993
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,2495	0,1644	0,0988
Median	0,7151	0,4425	0,3056
Standard Deviation	1,7098	0,7965	0,4977
Max	3,1510	1,0778	0,6469
Min	-14,1716	-4,1349	-2,4014
Kurtosis	18,1488	8,4733	5,1423
Skewness	-3,4002	-2,3943	-1,7607
Average Moneyness	1,0002	0,9993	0,9998
Average TTM	59,31	179,70	342,91
Observations	66.039	24.073	17.863
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3830	0,3731	0,1022
Median	0,9483	0,5762	0,3963
Standard Deviation	1,8958	0,7505	0,6363
Max	3,3427	1,2807	0,5892
Min	-14,9248	-5,1125	-1,9002
Kurtosis	13,0617	14,3986	4,3488
Skewness	-2,7122	-3,2520	-1,7424
Average Moneyness	0,9984	0,9998	0,9976
Average TTM	59,13	184,07	366,18
Observations	37.747	23.849	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

i. Annualized returns, for filtered options, by index, with initial margin on the denominator

Call Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0518	0,0122	-0,0484
Median	0,2225	0,2634	-0,0468
Standard Deviation	1,1946	0,6576	0,3896
Max	2,8213	0,9092	0,5168
Min	-6,6759	-3,7657	-1,3625
Kurtosis	3,9110	4,5554	2,1878
Skewness	-0,9163	-1,1988	-0,4187
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.040	8.790	7.147
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0753	-0,1388	-0,0901
Median	0,2356	-0,0158	-0,0613
Standard Deviation	1,2286	0,7541	0,4473
Max	2,8780	0,9547	0,5405
Min	-6,9993	-4,5259	-2,2961
Kurtosis	3,7432	4,9259	3,8029
Skewness	-0,8588	-1,1757	-0,8190
Average Moneyness	1,0003	0,9995	0,9994
Average TTM	58,99	181,32	360,30
Observations	47.290	11.867	9.085
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,3390	-0,2610	-0,1449
Median	0,3185	-0,0639	-0,2195
Standard Deviation	2,1413	1,0502	0,4754
Max	3,0877	1,2265	0,5048
Min	-15,1350	-7,5833	-1,6968
Kurtosis	6,3838	6,1939	2,8287
Skewness	-1,4848	-1,4773	-0,4705
Average Moneyness	0,9987	1,0014	0,9979
Average TTM	58,75	183,59	364,21
Observations	26.459	11.696	1.880
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,2762	0,1412	0,0593
Median	0,6878	0,4048	0,2603
Standard Deviation	1,5136	0,7826	0,5138
Max	2,7357	0,9608	0,5852
Min	-11,2001	-3,4913	-1,7548
Kurtosis	14,2602	8,2619	4,4981
Skewness	-2,9229	-2,3718	-1,6221
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.020	8.790	7.143
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,2589	0,1559	0,0678
Median	0,7241	0,4504	0,2975
Standard Deviation	1,6932	0,8122	0,5223
Max	2,8106	1,0413	0,5834
Min	-13,3442	-3,7999	-2,0413
Kurtosis	17,9202	8,4011	4,7093
Skewness	-3,4000	-2,3844	-1,6611
Average Moneyness	1,0003	0,9993	0,9994
Average TTM	58,99	181,35	360,31
Observations	47.286	11.915	9.074
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3739	0,3831	0,1191
Median	0,9519	0,5893	0,4001
Standard Deviation	1,8913	0,7193	0,6297
Max	2,9202	1,1236	0,5892
Min	-14,9248	-4,8002	-1,9002
Kurtosis	12,7803	15,2271	4,7372
Skewness	-2,7083	-3,3764	-1,8426
Average Moneyness	0,9984	1,0009	0,9979
Average TTM	58,75	183,42	364,21
Observations	26.596	11.922	1.880
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

j. Annualized returns, by index, with maximum margin on the denominator

Call Option Summary Statistics

DJX

TTM	60 days	180 days	365 days
Mean	0,0481	0,0722	0,0161
Median	0,1812	0,1801	-0,0221
Standard Deviation	0,9093	0,4300	0,2752
Max	2,9728	0,9509	0,5597
Min	-3,3495	-1,0692	-0,6312
Kurtosis	2,7538	1,9681	1,7384
Skewness	-0,3493	-0,3888	0,0077
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.204	17.529	11.997
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	60 days	180 days	365 days
Mean	0,0378	-0,0183	-0,0176
Median	0,1917	-0,0253	-0,0663
Standard Deviation	0,9318	0,4673	0,2831
Max	2,9201	1,0255	0,5828
Min	-3,4930	-1,1135	-0,7040
Kurtosis	2,5467	1,8768	1,9289
Skewness	-0,3093	-0,1166	0,1722
Average Moneyness	1,0003	0,9995	0,9998
Average TTM	59,30	179,60	342,92
Observations	66.027	23.976	17.870
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	60 days	180 days	365 days
Mean	-0,0359	-0,0501	-0,0302
Median	0,2294	-0,0576	-0,1273
Standard Deviation	1,3373	0,5674	0,2867
Max	3,2645	1,2833	0,5023
Min	-5,3632	-2,9664	-0,5471
Kurtosis	2,5342	4,2627	1,7892
Skewness	-0,4311	-0,5938	0,3183
Average Moneyness	0,9988	1,0002	0,9976
Average TTM	59,13	184,60	366,18
Observations	37.528	23.277	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3638	0,2113	0,1464
Median	0,5953	0,3328	0,2333
Standard Deviation	1,0163	0,4437	0,2677
Max	2,8308	0,9470	0,5386
Min	-4,5445	-1,5244	-0,6149
Kurtosis	5,9169	4,7709	3,3565
Skewness	-1,5232	-1,5131	-1,2218
Average Moneyness	0,9995	0,9999	0,9998
Average TTM	59,77	185,92	352,00
Observations	34.177	17.529	11.993
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3705	0,2313	0,1517
Median	0,6400	0,3836	0,2595
Standard Deviation	1,0743	0,4766	0,2966
Max	3,1352	1,0423	0,6437
Min	-4,7634	-1,4937	-0,7411
Kurtosis	6,7378	4,5848	3,2223
Skewness	-1,7447	-1,5367	-1,2497
Average Moneyness	1,0002	0,9993	0,9998
Average TTM	59,31	179,70	342,91
Observations	66.039	24.073	17.863
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,4930	0,3811	0,1919
Median	0,8502	0,4973	0,3281
Standard Deviation	1,2779	0,4667	0,3300
Max	3,2277	1,2010	0,5492
Min	-5,7022	-2,7374	-0,5790
Kurtosis	5,4349	10,0773	3,4717
Skewness	-1,5355	-2,4112	-1,4514
Average Moneyness	0,9984	0,9998	0,9976
Average TTM	59,13	184,07	366,18
Observations	37.747	23.849	2.103
Period	Jan-96 / Jul-13	Jan-96 / Feb-13	Jan-96 / Sep-12

Daily observations

k. Annualized returns, for filtered options, by index, with maximum margin on the denominator

Call Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0451	0,0828	0,0164
Median	0,1801	0,1983	-0,0329
Standard Deviation	0,8985	0,4306	0,2595
Max	2,7561	0,8882	0,5097
Min	-2,8094	-1,0593	-0,4943
Kurtosis	2,6294	2,0443	1,6484
Skewness	-0,3493	-0,4499	0,1102
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.040	8.790	7.147
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,0337	-0,0073	-0,0026
Median	0,1900	-0,0139	-0,0477
Standard Deviation	0,9210	0,4606	0,2735
Max	2,7891	0,9055	0,5273
Min	-2,6950	-1,0961	-0,6176
Kurtosis	2,4273	1,9283	1,8137
Skewness	-0,3023	-0,1528	0,1580
Average Moneyness	1,0003	0,9995	0,9994
Average TTM	58,99	181,32	360,30
Observations	47.290	11.867	9.085
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

NDX

TTM	**60 days**	**180 days**	**365 days**
Mean	-0,0158	-0,0385	-0,0300
Median	0,2468	-0,0430	-0,1242
Standard Deviation	1,3057	0,5470	0,2873
Max	3,0023	1,2077	0,5023
Min	-3,9377	-2,4370	-0,5471
Kurtosis	2,4274	2,6195	1,7990
Skewness	-0,4091	-0,2642	0,3008
Average Moneyness	0,9987	1,0014	0,9979
Average TTM	58,75	183,59	364,21
Observations	26.459	11.696	1.880
Period	Jan-96 / Jun-2013	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

Put Option Summary Statistics

DJX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3705	0,2089	0,1278
Median	0,6122	0,3377	0,2317
Standard Deviation	1,0100	0,4522	0,2918
Max	2,7221	0,9395	0,5342
Min	-4,2348	-1,1283	-0,5804
Kurtosis	5,9109	4,3091	2,7836
Skewness	-1,5690	-1,4327	-1,0628
Average Moneyness	0,9996	0,9997	0,9996
Average TTM	59,24	184,31	364,49
Observations	24.020	8.790	7.143
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

SPX

TTM	**60 days**	**180 days**	**365 days**
Mean	0,3770	0,2278	0,1330
Median	0,6464	0,3835	0,2489
Standard Deviation	1,0578	0,4755	0,3042
Max	2,7965	0,9766	0,5506
Min	-4,3357	-1,1696	-0,6684
Kurtosis	6,6465	4,2444	2,9303
Skewness	-1,7658	-1,4585	-1,1618
Average Moneyness	1,0003	0,9993	0,9994
Average TTM	58,99	181,35	360,31
Observations	47.286	11.915	9.074
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

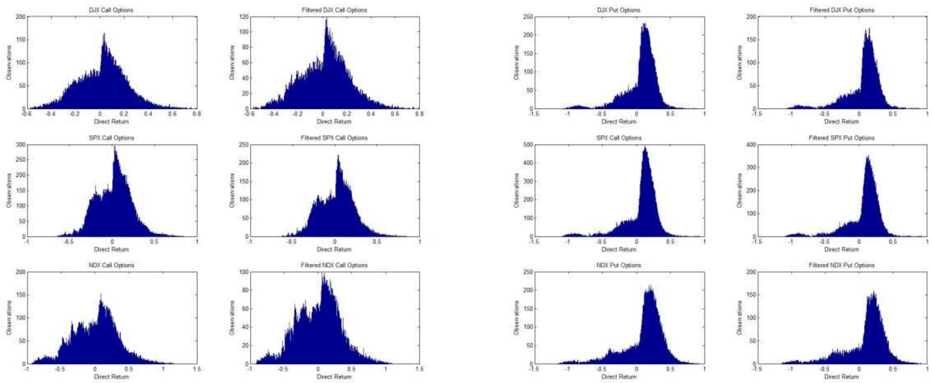
Daily observations

NDX

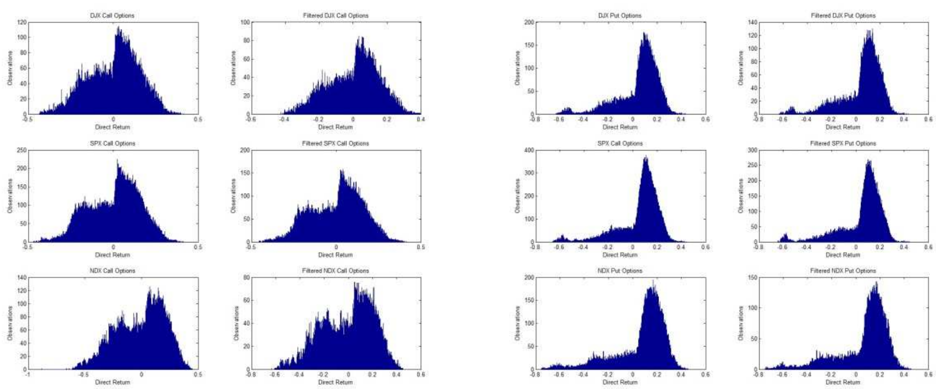
TTM	**60 days**	**180 days**	**365 days**
Mean	0,4855	0,3894	0,2017
Median	0,8557	0,5080	0,3329
Standard Deviation	1,2675	0,4371	0,3263
Max	2,8736	1,1180	0,5492
Min	-5,1955	-2,4322	-0,5790
Kurtosis	5,4196	9,5645	3,7157
Skewness	-1,5668	-2,3963	-1,5227
Average Moneyness	0,9984	1,0009	0,9979
Average TTM	58,75	183,42	364,21
Observations	26.596	11.922	1.880
Period	Jan-96 / Jun-13	Jan-96 / Jan-2013	Jan-96 / Jul-12

Daily observations

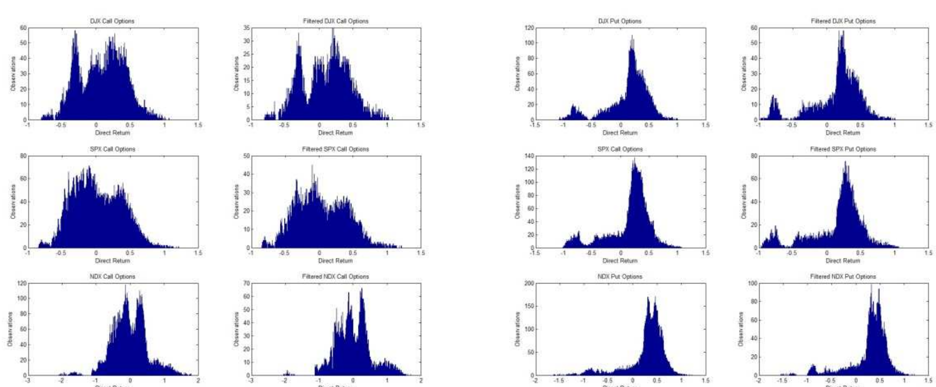
l. Histograms for 60-day filtered options, by index, with average margin on the denominator



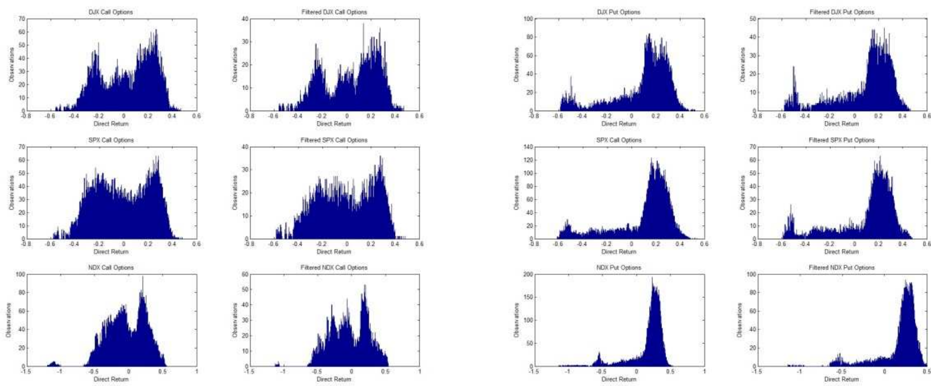
m. Histograms for 60-day filtered options, by index, with maximum margin on the denominator



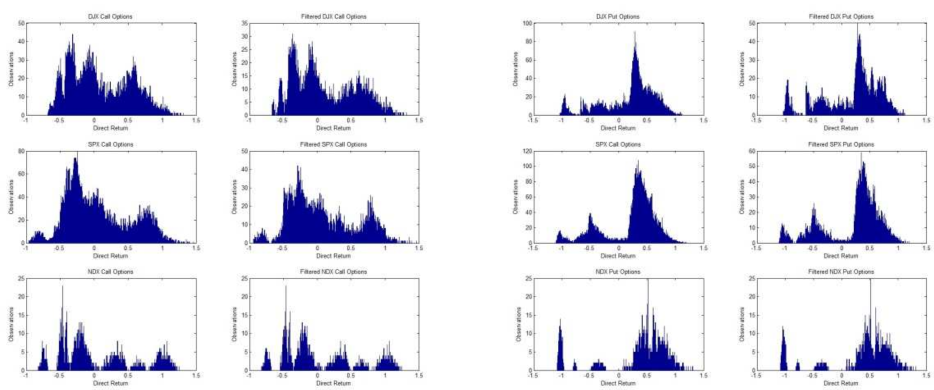
n. Histograms for 180-day filtered options, by index, with average margin on the denominator



o. Histograms for 180-day filtered options, by index, with maximum margin on the denominator



p. Histogram for 365-day filtered options, by index, with average margin on the denominator



q. Histogram for 365-day filtered options, by index, with maximum margin on the denominator