INDICES
OF IMPLIED VOLATILITY AND STRATEGIES WITH OPTIONS
IBEX 35

BME
BOLSAS Y MERCADOS ESPAÑOLES

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INDICES OF IMPLIED VOLATILITY AND STRATEGIES WITH OPTIONS IBEX 35

SUMMARY

This study explains the calculation methodology for strategic indices for the IBEX 35® using the information contained in the IBEX 35® options. On the one hand, indices are calculated related to the implied volatility which provide very valuable information to the participants of the market, and on the other, indices are calculated using classic strategies such as the *Covered Call* (*BuyWrite*) or *Protective Put* with the aim of creating a *benchmark* against which the managers that employ these types of strategies can measure. These types of strategic indices already exist for other indices such as S&P500, EUROSTOXX 50, DAX, etc., however, this study includes a new index, which does not exist, the Short Strangle index. The proliferation of Smart Beta indices, which aim to passively replicate classic active management strategies such as maximising or minimising specific portfolio factors (volatility, dividends, etc.), makes these indices, which have lower volatilities and performances that improve the underlying indices, very useful tools in achieving *alpha*, thereby standing out compared to other types of strategies.

Key words: IBEX 35®, Covered Call, Protective Put, PutWrite, BuyWrite, Strangle, Implied Volatility and Skew.

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1. Methodology for Implied Volatility Indices (VIBEX)

This index consists of reflecting the implied volatility of a theoretical at the money option (ATM) for which there are exactly 30 days remaining until maturity. To do so, options with two different maturities are used, one, which we shall call the Short Maturity has less than 30 days until maturity, whereas the other, which we shall call Long Maturity, has more than 30 days until maturity. The implied volatilities of the Short Maturity and Long Maturity options are calculated in order to obtain the volatilities at exactly 30 days.

	21/07/2017	18/08/2017	15/09/2017
	MAT 1	MAT 2	MAT 3
04/07/2017	17	45	73
05/07/2017	16	44	72
06/07/2017	15	43	71
07/07/2017	14	42	70
08/07/2017	13	41	69
09/07/2017	12	40	68
10/07/2017	11	39	67
11/07/2017	10	38	66
12/07/2017	9	37	65
13/07/2017	8	36	64
14/07/2017	7	35	63
15/07/2017	6	34	62
16/07/2017	5	33	61
17/07/2017	4	32	60
18/07/2017	3	31	59
19/07/2017	2	30	58
20/07/2017	1	29	57
21/07/2017	0	28	56

On 4 July, days remaining until the first three open maturities.

To do this, the prices of the options of the corresponding maturity are used depending on the period to be calculated. In the case of VIBEX, which is a period of exactly 30 days, the first and second maturity options are normally used, but occasionally the third maturity is also used.

Methodology

The methodology is very simple and robust, its objective is none other than to provide a clear and precise indicator of the implied volatility in IBEX 35® options. The usefulness of this indicator lies in the fact that it is participants of the market themselves that estimate an expected volatility of the underlying asset until the maturity date.

The ATM volatility (IBEX Future) of the selected maturities is calculated according to the period (30 days). To do so the following are selected:

- Call strike price just above the price of the future and Put strike price just above the price of the future of the Short Maturity options and Long Maturity options (K +1).
- Skew+ data (Skew up).

MEFF applies a Skew+ (Skew up) for higher strike prices and a Skew- (Skew down) for lower strike prices. The model is linear, it applies Skew up / Skew down in volatility equal to the Skew at distances of 3%.

The procedure used to obtain the implied volatility consists of "inverting" the Black-76 pricing model, in which the unknown factor is the volatility and the premium of the Call or Put traded on the market is the data used. One solution is to apply the iterative "Newton-Raphson" method.

1. The ATM volatility of the Call and Put is calculated:

$$\sigma_{CALL\ (ATM)} = \sigma_{CALL\ (K+1)} + \frac{(PS - K_{K+1}) \times Skew +}{3\% \times PS}$$

$$\sigma_{PUT\ (ATM)} = \sigma_{PUT\ (K+1)} + \frac{(PS - K_{K+1}) \times Skew +}{3\% \times PS}$$

2. The ATM volatility (IBEX Future) is calculated as the average of the ATM Volatility of the Call and Put.

$$\sigma_{FUTURE(ATM)} = \frac{\sigma_{CALL(ATM)} + \sigma_{PUT(ATM)}}{2}$$

3. The ATM volatility (IBEX Future) of the selected maturities is calculated according to the period (30 days). The Forward Volatility is estimated between both maturities and with this data and the short maturity volatility, at 30 days.

$$VIBEX = \sqrt{365/30 \left[\frac{t_{near} \cdot \sigma^2_{near}}{365} + \left(\frac{\frac{t_{next} \cdot \sigma^2_{next} - t_{near} \cdot \sigma^2_{near}}{365}}{t_{next} - t_{near}} \right) \cdot (30 - t_{near}) \right]} \times 100$$

Where:

- σ_{near}: Volatility expressed as a percentage of the short maturity
- σ_{next}: Volatility expressed as a percentage of the long maturity
- t_{near}: the time until maturity in days of the maturity with less than 30 days
- t_{next}: the time until maturity in days of the maturity with more than 30 days

Example:

- Today it is 13 December 2016. The first maturity is on 16th of December 2016, until which there are three days remaining. The second maturity is on 20 January 2017, until which there are 38 days remaining.
- The price of the Future of the First Maturity is 9342.6.
- The price of the Future of the Second Maturity is 9290.
- The implied volatility of the Call K +1 and the Put K +1 are selected for each maturity.
- The skew+ of the short maturity is -1.114 and that of the long maturity is -0.94

Short Maturity		Long Maturity	
CALL K+1	19.30%	CALL K+1	17.19%
PUT K+1	20.68%	PUT K+1	17.07%

For the Short Maturity:

$$\sigma_{CALL\ (ATM)} = 19{,}30 + \frac{(9342{,}6 - 9400)\times(-1{,}114)}{3\%\times 9342{,}6} = 19{,}53$$

$$\sigma_{PUT\ (ATM)} = 20{,}68 + \frac{(9342{,}6 - 9400)\times(-1{,}114)}{3\%\times 9342{,}6} = 20{,}91$$

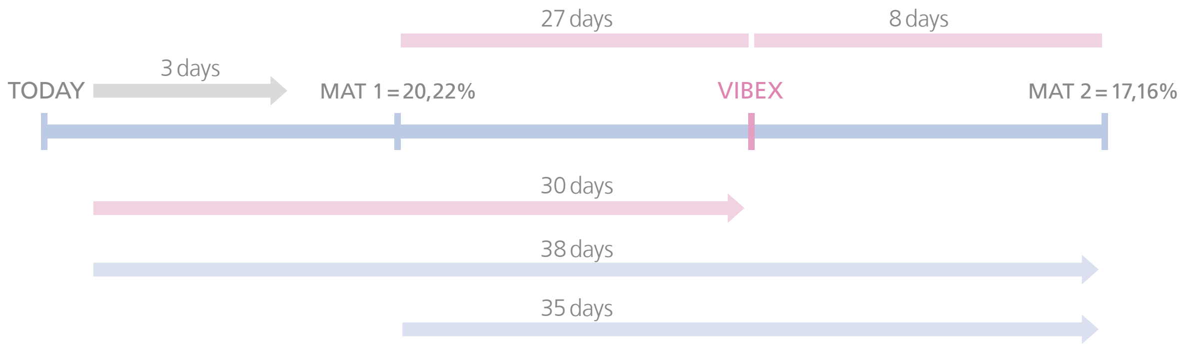
$$\sigma_{FUTURE(ATM)} = \frac{19{,}53\% + 20{,}91\%}{2} = 20{,}22\%$$

For the Long Maturity:

$$\sigma_{CALL\ (ATM)} = 17{,}19 + \frac{(9290 - 9300)\times(-0{,}94)}{3\%\times 9290} = 17{,}22$$

$$\sigma_{PUT\ (ATM)} = 17{,}07 + \frac{(9290 - 9300)\times(-0{,}94)}{3\%\times 9290} = 17{,}10$$

$$\sigma_{FUTURE(ATM)} = \frac{17{,}22\% + 17{,}10\%}{2} = 17{,}16\%$$



$$VIBEX = \sqrt{365/30 \left[\frac{3 \cdot 0{,}2022^2}{365} + \left(\frac{38 \cdot 0{,}1716^2 - 3 \cdot 0{,}2022^2}{365} \Big/ 38-3 \right) \cdot (30-3) \right]} \times 100$$

$$VIBEX = 17{,}24$$

2. Methodology for Skew Volatility Indices (IBEX 35 SKEW)

The Skew volatility measurement is normally a frequently used indicator in the market as an indicator of risk. The volatility skew is defined as the curve that details the volatility of each strike price in the option chain for each maturity. The interpretation of the Skew index is very simple: if it is high, it indicates a steepening of the decreasing Skew (indicating tail risk). A low value indicates that it is levelling out and that the market is calm.

It is typical to measure the Skew Volatility by solving and subtracting the volatility of 95%-105% options, it is a typical practice of the market, which offers a great deal of information to the participants.

The IBEX 35 Skew index is calculated for an implied volatility at 30 days.

Methodology

The methodology is very simple, but at the same time, robust and in line with the current market practices. Basically it consists of the same as the volatility index (VIBEX), but rather than calculate the implied volatility at an ATM strike price (at a future level), a Put strike price 5% below the underlying (the next lowest) and a Put of 5% above the underlying (the next highest) are selected. Then both volatilities are subtracted.

1) A Put strike price 5% below the level of the corresponding Future for both Short Maturity and Long Maturity is selected. The next lowest is selected.

2) A Put strike price 5% above the level of the corresponding Future for both Short Maturity and Long Maturity is selected. The next highest is selected.

3) The volatilities of the Short Maturity and Long Maturity are estimated to calculate the volatility of a 95% Put and a 105% Put of exactly 30 days.

$$PUT_{95\%}30D = \sqrt{365/30\left[\frac{t_{Near}\cdot\sigma^2_{PUT95Near}}{365} + \left(\frac{t_{Next}\cdot\sigma^2_{PUT95next} - t_{Near}\cdot\sigma^2_{PUT95Near}}{365}\Big/ t_{Next} - t_{Near}\right)\cdot(30 - t_{Near})\right]}\times 100$$

$$PUT_{105\%}30D = \sqrt{365/30\left[\frac{t_{Near}\cdot\sigma^2_{PUT105Near}}{365} + \left(\frac{t_{Next}\cdot\sigma^2_{PUT105next} - t_{Near}\cdot\sigma^2_{PUT105Near}}{365}\Big/ t_{Next} - t_{Near}\right)\cdot(30 - t_{Near})\right]}\times 100$$

4) The index is calculated:

$$IBEX\ 35\ SKEW = PUT_{95\%\ 30} - PUT_{105\%\ 30}$$

Example:

- Today it is 13 December 2016. The first maturity is on 16th of December 2016, until which there are three days remaining. The second maturity is on 20 January 2017, until which there are 38 days remaining.
- The price of the Future of the First Maturity is 9342.6.
- The price of the Future of the Second Maturity is 9290.
- The implied volatility of the 95% Put and the 105% Put is selected for each maturity:

105% PUT Short Maturity 9,342.6x(1+5%)=9,809.73 (~9,900).
The next highest Strike.

95% PUT Short Maturity 9,342.6x(1-5%)=8,875.47 (~8,800).
The next lowest Strike.

105% PUT Long Maturity. 9,290x(1+5%)=9,754.5 (~9,800).
The next highest Strike.

95% PUT Long Maturity. 9,290x(1-5%)=8,825.5 (~8,800).
The next lowest Strike.

Short Maturity		Long Maturity	
95% PUT	24.10%	**95% PUT**	19.81%
105% PUT	18.69%	**105% PUT**	15.37%

$$PUT_{95\%}\,30D = \sqrt{\frac{365}{30}\left[\frac{3\cdot 24{,}10^2}{365} + \left(\frac{\frac{38\cdot 19{,}81^2 - 3\cdot 24{,}10^2}{365}}{38-3}\right)\cdot(30-3)\right]} \times 100 = 19{,}92\%$$

$$PUT_{105\%}\,30D = \sqrt{\frac{365}{30}\left[\frac{3\cdot 18{,}69^2}{365} + \left(\frac{\frac{38\cdot 15{,}37^2 - 3\cdot 18{,}69^2}{365}}{38-3}\right)\cdot(30-3)\right]} \times 100 = 15{,}45\%$$

$$IBEX\ 35\ SKEW = PUT_{95\%\ 30} - PUT_{105\%\ 30} = 19{,}92 - 15{,}45 = 4{,}47$$

3. Methodology for Strategic Indices with Options

These types of indices aim to replicate typical strategies that are performed with options, in such a way that any person following this operation can have a benchmark with which to make comparisons.

Any strategy that includes options, as long as it is not leveraged, always has a lower volatility. It is for this reason that these indices are so attractive, because they offer a well balanced binomial yield-risk and a positive *alpha*.

These indices, as we will see below, have been designed with a replica cost, this means that they are not theoretical but rather they have taken into account the characteristics of the underlying strategies in such a manner that they objectively reflect the performance of such strategies consistently carried out over time.

a. IBEX 35 PutWrite

An index that consists of replicating a hypothetical strategy consisting of a portfolio that only invests in 98% Put options on a monthly basis and liquidity at the daily EONIA rate. In other words, the Put option is sold at a strike price 2% out of the money (below the price of the underlying asset). The liquidity plus the premiums earned are invested at the daily EONIA rate. On the day prior to maturity, usually the third Thursday of the month of maturity, the Put options previously sold are bought and resold with a maturity of one month at a strike price of 2% below the current price of the IBEX future of the second maturity, which in two days will become the first maturity.

In order to open and close positions the index takes into account a spread of 3%, with a minimum of 3 points and a maximum of 12 points.

The index will be calculated:

$$IBEX\ 35\ PUTWRITE_t = Liquidity_m - CloCst_t$$

Where:

$$CloCst_t = HR_{Month\ \ Start} \times \left(PUT_{close} + CR_{put}\right)$$

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right]$$

Calculation methodology

1) The day before maturity, usually the third Thursday of the month, the closing price of the 98% Put option is selected. For this, the daily settlement price of the IBEX 35 future of the second maturity is used, which in two days will become the first maturity:

$$K_{98} = FUT.IBEX\,35_{Mat2} \times (1 - 2\%)$$

In the case there is no match, which will be normal, the next lowest strike price is selected.

2) The hedge ratio (HR) is determined, in other words, the number of Put options that make up the nominal of the position in options and the value of the portfolio.

$$HR = \frac{IBEX\,35\ PUTWRITE_{Month\ Close}}{FUT\ IBEX\,35_{Mat2}}$$

3) It is sold at the closing price of the day prior to maturity (normally Thursday) less 3% (replica cost with a minimum of 3 points and a maximum of 12 points), the HR amount of Put options at strike price K_{98}. In addition, the portfolio amount plus what is earned through the sale of Put options is invested at the EONIA interest rate on a daily basis.

$$Liquidity_m = \left[IBEX\,35\ PUTWRITE_{Month\ Start} + \left(HR \times \left(PUT_{Sold\ Start} - CR_{Put}\right)\right)\right] + Liquidity_{m-1}\left[\frac{EONIA \times (days)}{360}\right]$$

$$CR_{put} = Min(Max(3; PUT_{Close} \times 3\%); 12)$$

Where the IBEX 35 PutWrite "Month Start" is the value of the index when its position rolls over, in other words, what the portfolio is worth.

For the other days it would be calculated:

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right]$$

4) The index will be calculated on a daily basis with the closing price of the PUT with the closing cost, in other words, the index is calculated assuming the price at which the position of the options could close:

$$IBEX\,35\ PUTWRITE_t = Liquidity_m - CloCst_t$$

$$CloCst_t = HR_{Month\ Start} \times \left(PUT_{close} + CR_{put}\right)$$

5) The day prior to maturity, normally on the Thursday at market close, the same calculation is carried out, which now means closing the position of the option, and recalculating a hedge ratio (HR) and liquidity received from the new sold options.

$$IBEX\,35\ PUTWRITE_{Close\ Month} = Liquidity_m - CloCst_t$$

6) The hedge ratio is once again calculated as in point 1.

Let's see an example

We begin by calculating the IBEX 35 PutWrite with a base value of 1,000 and a date of 2 January 2007.

By knowing that the price of the IBEX 35 future maturing in January 2007 on 2 January is 14,341, we can calculate points 1) and 2).

$$K_{98} = FUT.IBEX\ 35_{Mat\,2} \times (1-2\%) = 14.341 \times (1-2\%) = 14.054{,}18 \approx 14.000$$

$$HR = \frac{IBEX\ 35\ PUTWRITE_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\,2}} = \frac{1.000}{14.341} = 0{,}06973258$$

Therefore, we select the Put option with a strike price of 14,000 and maturity of January 2007 and we sell the amount of 0.06973258. The closing price on 2 January of the Put option with a strike price of 14,000 is 63 points. Therefore, we can calculate point 3).

$$CR_{put} = Min(Max(3; 3 \times 3\%); 12) = 3$$

$$Liquidity_m = [1.000 + (0{,}06973 \times (63-3))] = 1.004{,}18$$

As can be seen in the previous calculation, as it is the first day the daily remuneration that generates the liquidity is not included, but it is included for the other days, in our case, the EONIA of 2 January 2007 is 3.6% and will be applied to 3 January:

$$Liquidity_{m-1} \times \left[\frac{EONIA \times (days)}{360}\right] \rightarrow 1.004{,}18 \times \left(\frac{3{,}60\% \times 1}{360}\right) = 0{,}1004184$$

Knowing the liquidity and the closing price of the Put option, we can calculate point 4).

$$CloCst_t = HR_{Month\ Start} \times (PUT_{close} + CR_{put}) = 0{,}06973 \times (63+3) = 4{,}6023$$

$$IBEX\ 35\ PUTWRITE_{2/1/2007} = Liquidity_m - CloCst_t \rightarrow 1.004{,}18 - 4{,}6023 = 999{,}5816$$

On a daily basis, the remuneration of the liquidity is included less the closing price of the option with cost. Therefore, on the day prior to maturity, 18 January 2007, the options sold would be rolled over in the following manner:

On 17 January 2007, the liquidity value is 1,005.6711, the EONIA on that day is 3.57%, therefore, the liquidity that we have on 18 January is:

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right]$$

$$Liquidity_{18/01/07\ before\ Roll\ Over} = 1.005{,}6711 \times \left[1 + \frac{3{,}57\% \times (1)}{360}\right] = 1.005{,}7708$$

By rebuying the Put options, which have a value of 1 point, the IBEX PutWrite index would momentarily be:

$$CR_{put} = Min(Max(3;1 \times 3\%);12) = 3$$

$$CloCst_{Old\ options} = HR_{Month\ Start} \times (PUT_{close} + CR_{put}) = 0{,}06973 \times (1+3) = 0{,}2789$$

$$IBEX\ 35\ PUTWRITE_{Close\ Month} = Liquidity_{before\ Roll\ Over} - CloCst_{Old\ Options} = 1.005{,}7708 - 0{,}2789 = 1.005{,}4919$$

Once the position is closed, using the price of the Future of the February maturity (14,286) we recalculate the hedge ratio and the strike price that is going to be selected for the following maturity:

$$K_{98} = FUT.IBEX\ 35_{Mat\,2} \times (1-2\%) = 14.286 \times (1-2\%) = 14.000{,}28 \approx 14.000$$

$$HR = \frac{IBEX\ 35\ PUTWRITE_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\,2}} = \frac{1.005{,}4919}{14.286} = 0{,}0703830$$

Therefore, it is necessary to sell 0.07038 Put options maturing in February at a strike price of 14,000 which have a price of 128 points. Therefore:

$$CR_{put} = Min(Max(3;128 \times 3\%);12) = 3{,}84$$

$$Liquidity_{After\ Roll\ Over} = [1.005{,}4919 + (0{,}07038 \times (128 - 3{,}84))] = 1.014{,}2306$$

The value of the index at its close will be calculated as explained above assuming that the open position is closed, in this case, adding the cost to the closing price of the option:

$$CloCst_{New\ Options} = HR_{Month\ Start} \times (PUT_{close} + CR_{put}) = 0{,}07038 \times (128 + 3{,}84) = 9{,}2792$$

$$IBEX\ 35\ PUTWRITE_{t} = Liquidity_{After\ Roll\ Over} - CloCst_{New\ Options} = 1.014{,}2306 - 9{,}2792 = 1.004{,}9513$$

b. IBEX 35 BuyWrite

This index aims to replicate a hypothetical BuyWrite strategy which consists of having bought the IBEX 35 portfolio (equivalent to the IBEX 35 with Dividends through the purchase of IBEX 35 Futures) and sell the Call of the IBEX 35 with a strike price of 2% out of the money (OTM) on a monthly basis. On the day prior to maturity, usually the third Thursday of the month, the futures and the options roll over at a new strike price of 2% OTM maturing at one month from the level at which the underlying asset is at, which is the IBEX 35 future of the second maturity which in two days will be the first maturity.

Therefore, the strategy adjusts the strike price at which the options are sold on a monthly basis. The liquidity is invested in the EONIA on a daily basis.

In order to open and close positions the index takes into account a spread of 3%, with a minimum of 3 points and a maximum of 12 points. The future rolls over with a cost of 0.5 points for the purchase and another 0.5 points for the sale.

The index will be calculated:

$$IBEX\ 35\ BUYWRITE_t = Liquidity_m - CloCst_t$$

Where:

$$CloCst_t = HR_{Month\ Start} \times \left(CALL_{close} + CR_{call}\right)$$

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right] + \text{Variation Margin}$$

Calculation methodology

1) The day before maturity, usually the third Thursday of the month, the closing price of the 102% Call option is selected. For this, the daily settlement price of the IBEX 35 future of the second maturity is used, which in two days will become the first maturity.

$$K_{102} = FUT.IBEX\ 35_{Mat\,2} \times (1 + 2\%)$$

In the case there is no match, which will be normal, the next highest strike price is selected.

2) The hedge ratio (HR) is determined, in other words, the number of Call options that make up the nominal of the position in options and the value of the portfolio.

$$HR = \frac{IBEX\ 35\ BUYWRITE_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\ 2}}$$

3) It is sold at the closing price of the day prior to maturity (normally Thursday) less 3% (replica cost with a minimum of 3 points and a maximum of 12 points), the HR amount of Call options at strike price K_{102}. The cost of 0.5 for each future bought is added. In addition, the portfolio amount plus what is earned on the sale of Call options, less the cost of the futures, is invested in the EONIA interest rate on a daily basis.

$$Liquidity_m = \left[IBEX\ 35\ BUYWRITE_{Month\ Start} + \left(HR \times \left(CALL_{Start\ Sold} - CR_{Call}\right)\right)\right] + Liquidity_{m-1}\left[\frac{EONIA \times (days)}{360}\right] - (0{,}5 \times HR)$$

$$CR_{call} = Min(Max(3; CALL_{close} \times 3\%); 12)$$

Where the IBEX 35 BuyWrite "Month Start" is the value of the index when its position rolls over, in other words, what the portfolio is worth.

The remainder of the days would be calculated by adding the daily settlement of losses and gains of the futures bought:

$$Liquidity_m = Liquidity_{m-1}\left[1+\frac{EONIA\times(days)}{360}\right]+\text{Variation Margin}$$

$$\text{Variation Margin}_\text{d} = \left(Settle\,\mathrm{Pr}_d - Settle\,\mathrm{Pr}_{d-1}\right)\times HR$$

4) The index will be calculated on a daily basis with the closing price of the Call with the closing cost and the daily settlement of losses and gains in futures, in other words, the index is calculated assuming the price at which the position of the options could close:

$$IBEX\ 35\ BUYWRITE_t = Liquidity_m - CloCst_t$$

$$CloCst_t = HR_{Month\ Start}\times\left(CALL_{close}+CR_{call}\right)$$

5) The day prior to maturity, normally the Thursday at the close of the market, the same calculation is carried out, which now means closing the position of the options and the futures, and recalculating a hedge ratio (HR) and liquidity earned from the new sold options.

$$IBEX\ 35\ BUYWRITE_{Close\ Month} = Liquidity_m - CloCst_t - (0{,}5\times HR)$$

6) The hedge ratio is once again calculated as in point 1.

Let's see an example

We begin by calculating the IBEX 35 BuyWrite with a base value of 1,000 and date of 2 January 2007.

By knowing that the price of the IBEX 35 future maturing in January 2007 on 2 January is 14,341, we can calculate points 1) and 2).

$$K_{102} = FUT.IBEX\ 35_{Mat\,2}\times(1+2\%) = 14.341\times(1+2\%) = 14.627{,}18 \approx 14.700$$

$$RC = \frac{IBEX\ 35\ BUYWRITE_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\,2}} = \frac{1.000}{14.341} = 0{,}06973258$$

Therefore, we select the Call option with a strike price of 14,700 and maturity of January 2007 and we sell the amount of 0.06973258. The closing price on 2 January of the Call option with a strike price of 14,700 is 60 points. Therefore, we can calculate point 3).

$$CR_{call} = Min(Max(3;3\times3\%);12) = 3$$

$$Liquidity_m = [1.000+(0{,}06973\times(60-3))]-(0{,}5\times0{,}06973) = 1.003{,}94$$

As can be seen in the previous calculation, as it is the first day, the daily remuneration that generates the liquidity is not included, nor is the daily settlement of losses and gains, however, the cost of the purchase of the futures is added. The remaining days will include this remuneration, in our case, the EONIA of 2 January 2007 is 3.6% and will be applied to 3 January:

$$Liquidity_{m-1}\times\left[\frac{EONIA\times(days)}{360}\right]\rightarrow 1.003{,}94\times\left(\frac{3{,}60\%\times 1}{360}\right)=0{,}100394$$

Knowing the liquidity and the closing price of the Call option, we can calculate point 4).

$$CloCst_t = HR_{Month\ Start}\times\left(CALL_{close}+CR_{call}\right)=0{,}06973\times(60+3)=4{,}3931$$

$$IBEX\ 35\ BUYWRITE_{2/1/2007}=Liquidity_m - CloCst_t \rightarrow 1.003{,}94-4{,}3931=999{,}5467$$

On a daily basis, the remuneration of the liquidity as well as the daily settlement of losses and gains of the futures is included less the closing price of the option plus cost. Therefore, on the day prior to maturity, 18 January 2007, the options sold and futures sold would roll over in the following manner:

On 17 January 2007, the liquidity value is 1,002.4260, the EONIA on that day is 3.57%, therefore, the liquidity that we have on 18 January is:

$$Liquidity_m = Liquidity_{m-1}\left[1+\frac{EONIA\times(days)}{360}\right]+\text{Variation Margin}$$

$$Liquidity_{18/01/07\ \text{Before Roll Over}}=1.002{,}4260\times\left[1+\frac{3{,}57\%\times(1)}{360}\right]+\left(-32{,}5\times 0{,}06973\right)=1.000{,}2591$$

By rebuying the Call options, which have a value of 1 point, the IBEX BuyWrite index would momentarily be:

$$CR = Min(Max(3;1\times 3\%);12)=3$$

$$CloCst_{Old\ Options}=HR_{Month\ Start}\times\left(CALL_{close}+CR_{call}\right)+\left(0{,}5\times HR_{Month\ Start}\right)=\left[0{,}06973\times(1+3)\right]+\left(0{,}5\times 0{,}06973\right)=0{,}2440$$

$$IBEX\ 35\ BUYWRITE_{Close\ Month}=Liquidity_{Before\ Roll\ Over}-CloCst_{Old\ Options}=1.000{,}2591-0{,}2440=1.000{,}0151$$

Once the position is closed, using the price of the Future of the February maturity (14,286) we recalculate the hedge ratio and the strike price that is going to be selected for the following maturity:

$$K_{102}=FUT.IBEX\ 35_{Mat\,2}\times(1+2\%)=14.286\times(1+2\%)=14.571{,}72\approx 14.600$$

$$RC=\frac{IBEX\ 35\ BUYWRITE_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\,2}}=\frac{1.000{,}0151}{14.286}=0{,}0699996$$

Therefore, it is necessary to sell 0.0699996 Call options maturing in February at a strike price of 14,600 which have a price of 91 points and buy 0.0699996 IBEX 35 futures maturing in February. Therefore:

$$CR_{put} = Min(Max(3; 91 \times 3\%);12) = 3$$

$$Liquidity_{After\ Roll\ Over} = [1.000{,}0151 + (0{,}0699996 \times (91 - 3))] - (0{,}5 \times 0{,}0699996) = 1.006{,}1401$$

The value of the index at its close will be calculated as explained above assuming that the open position is closed, in this case, adding the cost to the closing price of the option:

$$CloCst_{New\,Options} = HR_{Month\ Start} \times (CALL_{close} + CR_{call}) = 0{,}0699996 \times (91 + 3) = 6{,}5799$$

$$IBEX\ 35\ BUYWRITE_t = Liquidity_{After\ Roll\ Over} - CloCst_{New\,Options} = 1.006{,}1401 - 6{,}5799 = 999{,}5601$$

c. IBEX 35 Protective Put

This index aims to replicate a hypothetical Protective Put strategy which consists of having bought the IBEX 35 portfolio (equivalent to the IBEX 35 with Dividends through the purchase of IBEX 35 Futures) and buy the Put option of the IBEX 35 with a strike price of 2% out of the money (OTM) on a monthly basis. On the day prior to maturity, usually the third Thursday of the month, the futures and the options roll over at a new strike price of 2% OTM maturing at one month from the level at which the underlying asset is at, which is the IBEX 35 future of the second maturity which in two days will be the first maturity.

Therefore, the strategy adjusts the strike price at which the options are bought on a monthly basis. The liquidity is invested in the EONIA on a daily basis.

In order to open and close positions the index takes into account a spread of 3%, with a minimum of 3 points and a maximum of 12 points. The future rolls over with a cost of 0.5 points for the purchase and another 0.5 points for the sale.

In order to open and close positions the index takes into account a spread of 3%, with a minimum of 3 points and a maximum of 12 points.

The index will be calculated:

$$IBEX\ 35\ PROTECTIVE\ PUT_t = Liquidity_m + CloCst_t$$

Where:

$$CloCst_t = HR_{Month\ Start} \times (PUT_{close} - CR_{put})$$

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right] + \text{Variation Margin}$$

Calculation methodology

1) The day before maturity, usually the third Thursday of the month, the closing price of the 98% Put option is selected. For this, the daily settlement price of the IBEX 35 future of the second maturity is used, which in two days will become the first maturity.

$$K_{98} = FUT.IBEX\ 35_{Mat\,2} \times (1 - 2\%)$$

In the case there is no match, which will be normal, the next lowest strike price is selected.

2) The hedge ratio (HR) is determined, in other words, the number of Put options that make up the nominal of the position in options and the value of the portfolio.

$$RC = \frac{IBEX\ 35\ PROTECTIVE\ PUT_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\ 2}}$$

3) It is bought at the closing price of the day prior to maturity (normally Thursday) plus 3% (replica cost with a minimum of 3 points and a maximum of 12 points), the HR amount of Put options at strike price K_{98}. The cost of 0.5 for each future bought is added. In addition, the portfolio amount less what is paid for the purchase of Put options, less the cost of the futures, is invested in the EONIA interest rate on a daily basis.

$$Liquidity_m = \left[IBEX\ 35\ PROTECTIVE\ PUT_{Month\ Start} - \left(HR \times \left(PUT_{Bought\ Start} + CR_{Put}\right)\right)\right] + Liquidity_{m-1}\left[\frac{EONIA \times (days)}{360}\right] - (0{,}5 \times HR)$$

$$CR_{call} = Min(Max(3; PUT_{Close} \times 3\%); 12)$$

Where the IBEX 35 Protective Put "Month Start" is the value of the index when its position is rolled over, in other words, what the portfolio is worth.

The remainder of the days would be calculated by adding the daily settlement of losses and gains of the futures bought:

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right] + \text{Variation Margin}$$

$$\text{Variation Margin}_d = \left(Settle\,\mathrm{Pr}_d - Settle\,\mathrm{Pr}_{d-1}\right) \times HR$$

4) The index will be calculated on a daily basis with the closing price of the Put with the closing cost and the daily settlement of losses and gains in futures, in other words, the index is calculated assuming the price at which the position of the options could close:

$$IBEX\ 35\ PROTECTIVE\ PUT_t = Liquidity_m + CloCst_t$$

$$CloCst_t = HR_{Month\ Start} \times \left(PUT_{close} - CR_{put}\right)$$

5) The day prior to maturity, normally the Thursday at the close of the market, the same calculation is carried out, which now means closing the position of the options and the futures, and recalculating a hedge ratio (HR) and liquidity remaining after once again buying the options.

$$IBEX\ 35\ PROTECTIVE\ PUT_{Close\ Month} = Liquidity_m + CloCst_t - (0{,}5 \times HR)$$

6) The hedge ratio is once again calculated as in point 1.

Let's see an example

We begin by calculating the IBEX 35 ProtectivePut with a base value of 1,000 and date of 2 January 2007.

By knowing that the price of the IBEX 35 future maturing in January 2007 on 2 January is 14,341, we can calculate points 1) and 2).

$$K_{98} = FUT.IBEX\ 35_{Mat2} \times (1-2\%) = 14.341 \times (1-2\%) = 14.054{,}18 \approx 14.000$$

$$RC = \frac{IBEX\ 35\ PROTECTIVE\ PUT_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\ 2}} = \frac{1.000}{14.341} = 0{,}06973258$$

Therefore, we select the Put option with a strike price of 14,000 and maturity of January 2007 and we buy the amount of 0.06973258. The closing price on 2 January of the Put option with a strike price of 14,700 is 63 points. Therefore, we can calculate point 3).

$$CR_{call} = Min(Max(3; 3 \times 3\%); 12) = 3$$

$$Liquidity_m = [1.000 - (0{,}06973 \times (63-3))] - (0{,}5 \times 0{,}06973) = 995{,}362$$

As can be seen in the previous calculation, as it is the first day, the daily remuneration that generates the liquidity is not included, nor is the daily settlement of losses and gains, however, the cost of the purchase of the futures is added. The remaining days will include this remuneration, in our case, the EONIA of 2 January 2007 is 3.6% and will be applied to 3 January:

$$Liquidity_{m-1} \times \left[\frac{EONIA \times (days)}{360}\right] \rightarrow 995{,}362 \times \left(\frac{3{,}60\% \times 1}{360}\right) = 0{,}0995$$

Knowing the liquidity and the closing price of the Put option, we can calculate point 4).

$$CloCst_t = HR_{Month\ Start} \times (PUT_{close} - CR_{put}) = 0{,}06973 \times (63-3) = 4{,}1839$$

$$IBEX\ 35\ PROTECTIVE\ PUT_{2/1/2007} = Liquidity_m + CloCst_t \rightarrow 995{,}362 + 4{,}1839 = 999{,}5467$$

On a daily basis, the remuneration of the liquidity as well as the daily settlement of losses and gains of the futures is included less the closing price of the option plus cost. Therefore, on the day prior to maturity, 18 January 2007, the options sold and futures bought would roll over in the following manner:

On 17 January 2007, the liquidity value is 995.8362, the EONIA on that day is 3.57%, therefore, the liquidity that we have on 18 January is:

$$Liquidity_m = Liquidity_{m-1}\left[1+\frac{EONIA\times(days)}{360}\right] + \text{Variation Margin}$$

$$Liquidity_{18/01/07\ \text{Before Roll Over}} = 993{,}8362\times\left[1+\frac{3{,}57\%\times(1)}{360}\right]+(-32{,}5\times 0{,}06973) = 991{,}6685$$

By selling the Put options, which have a value of 1 point, the IBEX 35 ProtectivePut index would momentarily be:

$$CR = Min(Max(3;1\times 3\%);12) = 3$$

$$CloCst_{Old\ Options} = HR_{Month\ Start}\times(PUT_{close} - CR_{put}) - (0{,}5\times HR_{Month\ Start}) = [0{,}06973\times(1-3)] + (0{,}5\times 0{,}06973) = -0{,}0348$$

Please note that it is not possible to sell the option at a negative price, therefore, it takes a value of 0 (zero)

$$IBEX\ 35\ PROTECTIVE\ PUT_{Close\ Month} = Liquidity_{Before\ Roll\ Over} + CloCst_{Old\ Options} = 991{,}6685 - 0{,}0348 = 991{,}633$$

Once the position is closed, using the price of the Future of the February maturity (14,286) we recalculate the hedge ratio and the strike price that is going to be selected for the following maturity:

$$K_{98} = FUT.IBEX\ 35_{Mat2}\times(1-2\%) = 14.286\times(1-2\%) = 14.000{,}28 \approx 14.000$$

$$RC = \frac{IBEX\ 35\ PROTECTIVE\ PUT_{Close\ Month}}{FUT\ IBEX\ 35_{Mat\ 2}} = \frac{991{,}6336}{14.286} = 0{,}0694129$$

Therefore, it is necessary to buy 0.0694129 Put options maturing in February at a strike price of 14,000 which have a price of 128 points and buy 0.0694129 IBEX 35 futures maturing in February. Therefore:

$$CR_{put} = Min(Max(3;128\times 3\%);12) = 3{,}84$$

$$Liquidity_{After\ Roll\ Over} = [991{,}6336 - (0{,}0694129\times(128+3{,}84))] - (0{,}5\times 0{,}0694129) = 982{,}4475$$

The value of the index at its close will be calculated as we have explained above, assuming that the open position is closed, in this case, deducting the cost from the closing price of the option:

$$CloCst_{New\ Options} = HR_{Month\ Start}\times(PUT_{close} - CR_{put}) = 0{,}0694129\times(128-3{,}84) = 8{,}618314$$

$$IBEX\ 35\ PROTECTIVE\ PUT_t = Liquidity_{After\ Roll\ Over} + CloCst_{New\ Options} = 982{,}4475 + 8{,}6183 = 991{,}0658$$

d. IBEX 35 Short Strangle (IVS)

An index that consists of replicating a hypothetical strategy consisting of a portfolio that only invests in the systematic sale of a 98%-102% Strangle a monthly basis and liquidity at the daily EONIA rate. In other words, the Put is sold at a strike price of 2% out of the money (below the price of the underlying asset) and the Call is also sold at 2% out of the money (above the level of the underlying asset). The liquidity plus the premiums earned are invested at the daily EONIA rate. On the day prior to maturity, usually the third Thursday of the month of maturity, the options previously sold are bought and resold with a maturity of one month and a strike price of 2% out of the money, in other words, for the Put options this is 2% below and for the Call options this is 2% above how the IBEX future of the second maturity is trading, which in two days will become the first maturity.

In order to open and close positions the index takes into account a spread of 3%, with a minimum of 3 points and a maximum of 12 points.

The index will be calculated:

$$IBEX\ 35\ IVS_t = Liquidity_m - CloCst_t$$

Where:

$$CloCst_t = HR_{Month\ Start} \times \left(CALL_{close} + CR_{call} + PUT_{close} + CR_{put} \right)$$

$$Liquidity_m = Liquidity_{m-1} \left[1 + \frac{EONIA \times (days)}{360} \right]$$

Calculation methodology

1) The day before maturity, usually the third Thursday of the month, the closing price of the Put 98% and Call 102% option is selected. For this, the daily settlement price of the IBEX 35 future of the second maturity is used, which in two days will become the first maturity.

$$K_{98} = FUT.IBEX\ 35_{Mat\,2} \times (1 - 2\%)$$
$$K_{102} = FUT.IBEX\ 35_{Mat\,2} \times (1 + 2\%)$$

In the case there is no match, which will be normal, the next lowest strike price is selected for the Put and the next highest for the Call.

2) The hedge ratio (HR) is determined, in other words, the number of Put and Call options that make up the nominal of the position in options and the value of the portfolio.

$$RC = \frac{IBEX\ 35\ IVS_{Close\ Month}}{\left(\frac{K_{98} + K_{102}}{2} \right)}$$

3) It is sold at the closing price of the day prior to maturity (normally Thursday) less 3% (replica cost with a minimum of 3 points and a maximum of 12 points), the HR amount of Put options at strike price K_{98} and Call options at strike price K_{102}. In addition, the portfolio amount plus what is earned on the sale of options is invested in the EONIA interest rate on a daily basis.

$$Liquidity_m = \left[IBEX\ 35\ IVS_{Month\ Start} + \left(HR \times \left(CALL_{Sold\ Start} - CR_{call} + PUT_{Sold\ start} - CR_{Put}\right)\right)\right] + $$
$$+ Liquidity_{m-1}\left[\frac{EONIA \times (days)}{360}\right]$$

$$CR_{put} = Min(Max(3; PUT_{Close} \times 3\%); 12)$$
$$CR_{call} = Min(Max(3; CALL_{Close} \times 3\%); 12)$$

Where the IBEX 35 IVS "Month Start" is the value of the index when its position rolls over, in other words, what the portfolio is worth.

For the other days it would be calculated:

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right]$$

4) The index will be calculated on a daily basis with the closing price of the PUT and CALL options with the closing cost, in other words, the index is calculated assuming the price at which the position of the options could close:

$$IBEX\ 35\ IVS_t = Liquidity_m - CloCst_t$$

$$CloCst_t = HR_{Month\ Start} \times \left(CALL_{close} + CR_{call} + PUT_{close} + CR_{put}\right)$$

5) The day prior to maturity, normally the Thursday at the close of the market, the same calculation is carried out, which now means closing the position of the options, and recalculating a hedge ratio (HR) and liquidity received from the new sold options.

$$IBEX\ 35\ IVS_{Close\ Month} = Liquidity_m - CloCst_t$$

6) The hedge ratio is once again calculated as in point 1.

Let's see an example

We begin by calculating the IBEX 35 IVS with a base value of 1,000 and date of 2 January 2007.

By knowing that the price of the IBEX 35 future maturing in January 2007 on 2 January is 14,341, we can calculate points 1) and 2).

$$K_{98} = FUT.IBEX\ 35_{Mat2} \times (1-2\%) = 14.341 \times (1-2\%) = 14.054{,}18 \approx 14.000$$

$$K_{102} = FUT.IBEX\ 35_{Mat2} \times (1+2\%) = 14.341 \times (1+2\%) = 14.627{,}82 \approx 14.700$$

$$RC = \frac{IBEX\ 35\ IVS_{Close\ Month}}{\left(\frac{K_{98}+K_{102}}{2}\right)} = \frac{1.000}{14.300} = 0{,}0699301$$

Therefore, we select the Put option with a strike price of 14,000 and the Call option with a strike price of 14,700, both maturing in January 2007 and we sell the amount of 0.0699301 options. The closing price on 2 January of the Put option at the strike price of 14,000 is 63 points and for the Call option at the strike price of 14,700 it is 60 points. Therefore, we can calculate point 3).

$$CR_{call} = Min(Max(3; 60 \times 3\%); 12) = 3$$

$$CR_{put} = Min(Max(3; 63 \times 3\%); 12) = 3$$

$$Liquidity_m = [1.000 + (0{,}0699301 \times (60 - 3 + 63 - 3))] = 1.008{,}1818$$

As can be seen in the previous calculation, as it is the first day the daily remuneration that generates the liquidity is not included, but it is included for the other days, in our case, the EONIA of 2 January 2007 is 3.6% and will be applied to 3 January:

$$Liquidity_{m-1} \times \left[\frac{EONIA \times (days)}{360}\right] \rightarrow 1.008{,}1818 \times \left(\frac{3{,}60\% \times 1}{360}\right) = 0{,}100818$$

Knowing the liquidity and the closing price of the Call and Put options, we can calculate point 4).

$$CloCst_t = HR_{Month\ Start} \times (CALL_{close} + CR_{call} + PUT_{close} + CR_{put}) = 0{,}0699301 \times (60 + 3 + 63 + 3) = 9{,}0209$$

$$IBEX\ 35\ IVS_{2/1/2007} = Liquidity_m - CloCst_t \rightarrow 1.008{,}18 - 9{,}0209 = 999{,}1608$$

On a daily basis, the remuneration of the liquidity is included less the closing price of the option with cost. Therefore, on the day prior to maturity, 18 January 2007, the options sold would be rolled over in the following manner:

On 17 January 2007, the liquidity value is 1.027,0014, the EONIA on that day is 3.57%, therefore, the liquidity that we have on 18 January is:

$$Liquidity_m = Liquidity_{m-1}\left[1 + \frac{EONIA \times (days)}{360}\right]$$

$$Liquidity_{18/01/07\ Before\ Roll\ Over} = 1.009{,}6749 \times \left[1 + \frac{3{,}57\% \times (1)}{360}\right] = 1.009{,}7750$$

By rebuying the Put and Call options, which have a value of 1 point, and 0 respectively, the IBEX 35 Short Strangle (IVS) index would momentarily be:

$$CR_{put} = Min(Max(3;1\times 3\%);12) = 3$$

$$CR_{call} = Min(Max(3;0\times 3\%);12) = 3$$

$$CloCst_{Old\ Options} = HR_{Month\ Start} \times (CALL_{close} + CR_{call} + PUT_{close} + CR_{put}) = 0,0699301 \times (0+3+1+3) = 0,4895$$

$$IBEX\ 35\ IVS_{Close\ Month} = Liquidity_{Before\ Roll\ Over} - CloCst_{Old\ Options} = 1.009,7750 - 0,4895 = 1.009,2855$$

Once the position is closed, using the price of the Future of the February maturity (14,286) we recalculate the hedge ratio and the strike prices that are going to be selected for the following maturity:

$$K_{98} = FUT.IBEX\ 35_{Mat\,2} \times (1-2\%) = 14.286 \times (1-2\%) = 14.000,28 \approx 14.000$$

$$K_{102} = FUT.IBEX\ 35_{Mat\,2} \times (1+2\%) = 14.286 \times (1+2\%) = 14.571,72 \approx 14.600$$

$$RC = \frac{IBEX\ 35\ IVS_{Close\ Month}}{\left(\frac{K_{98}+K_{102}}{2}\right)} = \frac{1.009,2855}{14.300} = 0,070579$$

Therefore, it is necessary to sell 0.070579 Put options maturing in February at a strike price of 14,000 which have a price of 128 points and buy 0.070579 Call options that have a price of 91 points. Therefore:

$$CR_{put} = Min(Max(3;128\times 3\%);12) = 3,84$$

$$CR_{call} = Min(Max(3;91\times 3\%);12) = 3$$

$$Liquidity_{After\ Roll\ Over} = [1.009,2855 + (0,070579 \times (91 - 3 + 128 - 3,84))] = 1.024,2582$$

The value of the index at its close will be calculated as explained above assuming that the open position is closed, in this case, adding the cost to the closing price of the option:

$$CloCst_{New\ Options} = HR_{Month\ Start} \times (CALL_{close} + CR_{call} + PUT_{close} + CR_{put}) = 0,070579 \times (91+3+128+3,84) = 15,9381$$

$$IBEX\ 35\ IVS_{t} = Liquidity_{After\ Roll\ Over} - CloCst_{New\ Options} = 1.024,2582 - 15,9381 = 1.008,3201$$

4. Characteristics and uses of Volatility Indices

a. VIBEX

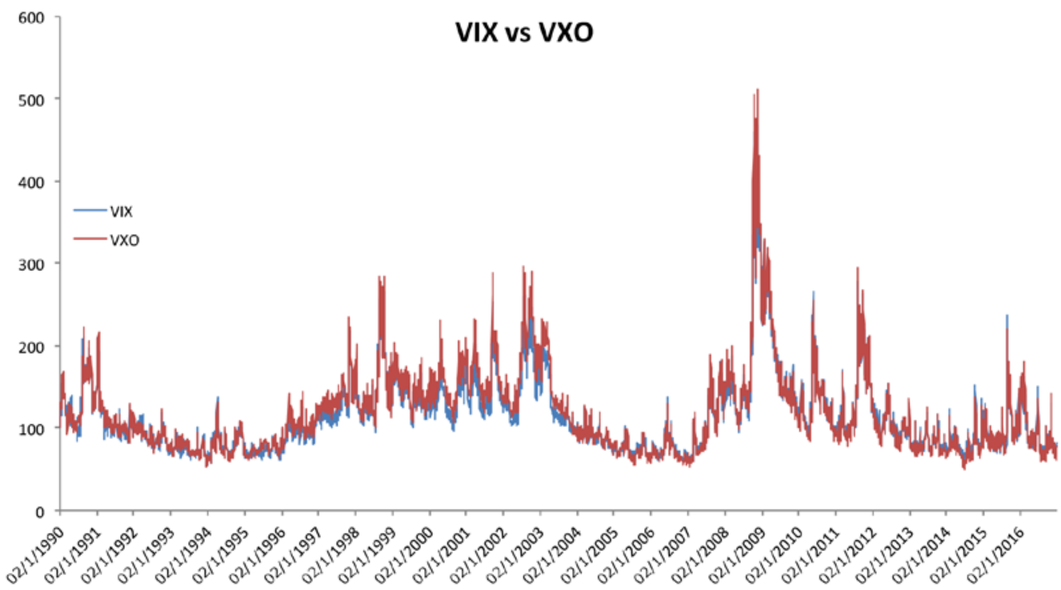
The first to propose a volatility index was Robert Whaley in 1993 in his article "Derivatives on Market Volatility: hedging tools long overdue", published in the Journal of Derivatives.

The VIX index published by CBOE is an index on the implied volatility for the S&P500 index. Originally, in 1993, the VIX was calculated using options from the S&P 100 index, which were more liquid at that time. In 2003, there was a change in the methodology with two significant changes:

- The new method obtained the volatility from a broad spectrum of options of the S&P 500 (all the possible strike prices), not just from ATM options. In addition, it does not use any options pricing model to solve the implied volatility. It weighs the price of the OTM options by the extent of the jump in the strike price divided by the strike price squared and calculates the variance in the prices. In this manner it collects information on Skew. It is a powerful method, but perhaps unnecessarily complex.

- It does not use options from the S&P100 (OEX) index but rather those from the S&P500 (SPX) index.

The original VIX index on the options from the S&P100 index continues to be calculated under the name VXO. We can see on Graph 1 below that the difference between the VIX and the VXO is very small.



Graph 1: VIX vs. VXO. Source: In-house preparation, using data from www.cboe.com.

The VIX has two fundamental uses:

- Volatility Indicator.
- Underlying of Futures and Options. Later we will see how, but this is easily explained.

Nowadays volatility is not only a characteristic of the assets, but is a tradable asset. Traditionally, volatility has been traded using options, with delta neutral adjustments. The problem of investing in volatility through options:

1. It is not within the reach of just anyone An extensive knowledge of options is necessary.

2. This exposure to the volatility is "*Path dependent*", in other words, this investment in volatility depends on the trajectory of the underlying asset. For example, if buying a volatility of 18% and after a few days the volatility is 19%, logic dictates that the position is earning money, but in reality this is not so, it depends on how the underlying asset has moved and the time until maturity.

It is due this second reason that a new type of derivative surged onto the scene in the early years of the 2000s. These were known as second-generation and would solve this problem: *Variance Swaps and Volatility Swaps*. These products have a pure exposure to volatility and have been used for both investing in volatility as well as for using volatility as a hedge. The problem with these Variance Swaps and Volatility Swaps is that they are OTC products. They are not within the reach of everyone and are also relatively complex to understand and manage. In fact, CBOE included *Variance Futures* in its 2012 product catalogue, although it is still in the catalogue, the truth is that it is a product that has not had a lot of success, barely any. EUREX also has these products, and these are barely traded. The reason being it is a product that is relatively complex to understand, but more significantly because there is a much simpler alternative, which is to trade futures directly through VIX (CBOE).

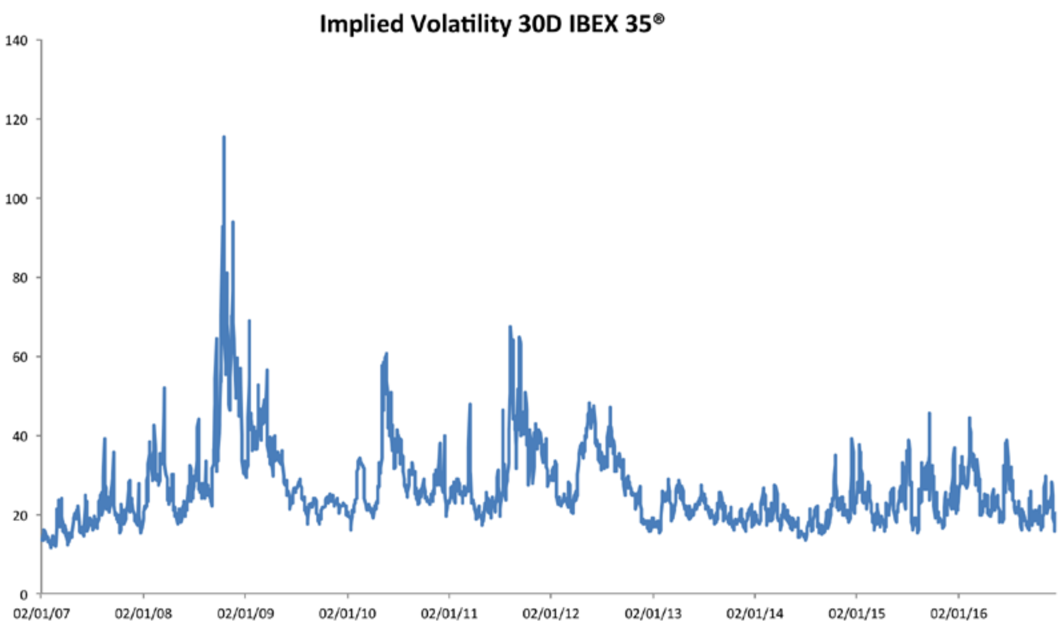
These VIX Futures solve the two above mentioned problems: they are easier to understand and have a pure exposure to volatility. However, they do have an added problem, **the VIX index cannot be replicated**, therefore, a VIX future and the VIX index do not maintain an arbitrary relationship. In the futures markets, we ensure that the price of the future and the price of the underlying asset evolve in the same manner through this arbitrary relationship, the only difference between them being the interest rate and dividends upon maturity. Therefore, the VIX future evolves based on supply and demand, and these market forces do not always evolve in the same manner as the index.

In light of the above, it could be said that the VIX only serves as a volatility indicator, which is no small thing. Our VIBEX index was created with the idea of being a useful indicator for the market, at this time is not an objective to launch volatility derivatives, to do this requires a great many participants in the market prepared to buy and sell to create the prices (there cannot be market makers that arbitrate), and although one cannot know what the future holds, I am afraid that in the short term this is not really feasible. In fact, the VIX was the first index, the original, but since then there have been many volatility indexes such as VSTOXX, VDAX, etc., and not all have futures, for example, there are no VDAX futures. Although there are VSTOXX futures and they are liquid, they are a long way off the figures traded at CBOE.

The purpose of having our own implied volatility index of IBEX 35 options is to offer the market a tremendously powerful indicator which can be used in the active management of a portfolio, including derivatives or not. Furthermore, as we will see later, having a VIBEX at different periods (30, 60, 90 and 180) could provide us with information on the structure of volatility, through the analysis of its movements. It may also be possible to extract very interesting and useful conclusions for managing a portfolio, I repeat, including derivatives or not.

As you have seen, our VIBEX has an extremely simple calculation method and has no similarity with the calculation method for VIX, VTOXX, VDAX, etc. As simple as it may be, it does not lose out in terms of quality, just the opposite, it provides more transparency and power. There are many ways to calculate the implied volatility of the IBEX 35 options and after analysing several of these possibilities we have arrived at the conclusion that it was unnecessary to complicate the calculation as this does not gain additional precision and makes the data less transparent.

The result of performing the calculation explained at the beginning of this study, in the methodology section, is to be able to obtain at all times the implied volatility for the period calculated. For example, in Graph 2 we can observe the VIBEX.



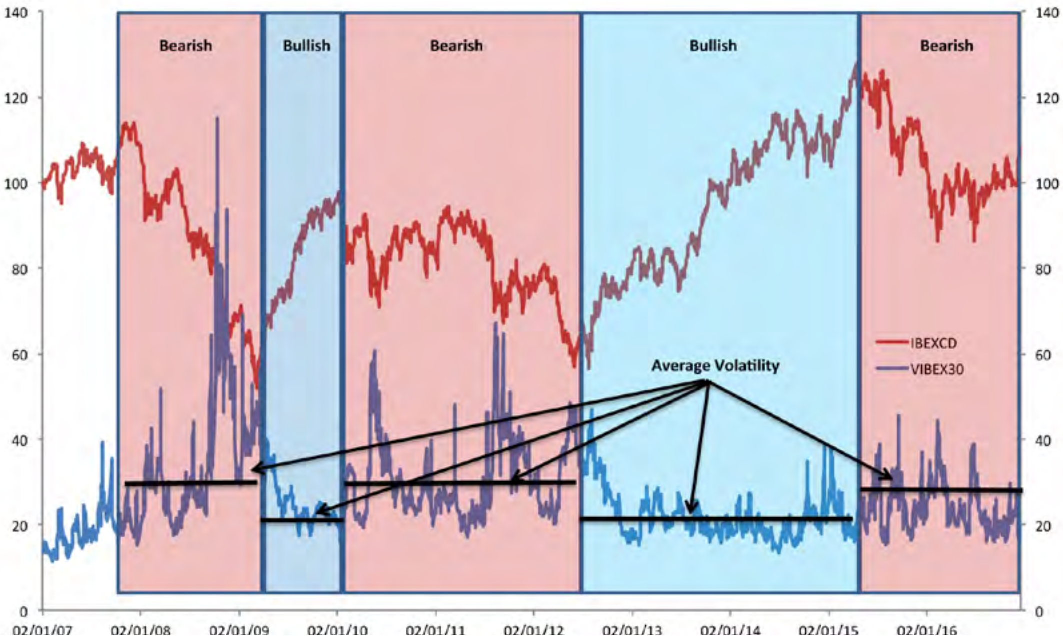
Graph 2: VIBEX historic graph. Source: in-house preparation, using data from www.bolsasymercados.es.

The characteristics of the volatility makes this a particularly useful indicator, among which we can highlight:

- **Persistence**, also referred to as "memory": this presents itself in the autocorrelation.
- **Clusters**: the days of high/low returns tend to be clustered together.
- **Skew**: the impact of returns on volatility is greater in bearish markets than bullish ones. This is particularly evident in equity markets.
- **Mean reversion**: this characteristic is somewhat debatable, or can at least be explained. Robert Engle (Nobel Prize 2003) included this in his ARCH model[3], as experience showed that volatilities tend to revert to the long-term volatility, the mean (unconditional volatility).

This last characteristic is what makes it particularly useful. Volatility, unlike the price of the assets, does not have an upward or downward trend over the long-term, but rather reverts to a mean. Emmanuel Derman in his article on the regimes of volatility[4], spoke of the different behaviour of volatility depending on the period in which it is analysed. Depending on whether the underlying is in an upward or downward period, this mean will be higher or lower as we can appreciate in Graph 3.

3. AutoRegressive Conditional Heteroskedasticity (ARCH).
4. Derman, E (1999), "Regimes of volatility", Quantitative Strategies Research notes, Goldman Sachs, New York, NY. Also in Risk Magazine, April 1999.



Graph 3: IBEX 35 with Dividends vs. VIBEX 30. Source: in-house preparation, using data from www.bolsasymercados.es.

Volatility is the best reflection of the human behaviour in the financial markets, which is widely studied in the area of *Behavioural Finance*. Human beings suffer more with losses compared to the enjoyment received from the gains, this is known as *loss aversion bias*. It is for this reason that when markets drop, they usually do so very violently (increase in volatility) whereas when the markets rise, they do so more slowly, (fall in volatility). In Graph 3 we can see observe that when the underlying asset is in an upward movement, the regime of volatility is low and vice versa when the markets drop.

When there is a shock in the market, whatever the reason may be, the implied volatility literally explodes, but returns back to normal when the market forgets about it. Depending on the importance of the shock, this increase and subsequent decrease in volatility is more or less extensive. As implied volatility is an expectation of volatility, sometimes these shocks are anticipated by the market and reflected in the volatility, in other words, the volatilities increase before the market drops, depending on how the participants of the market perceive the sensations of whether the market is going to rise or fall.

The VIX index is famous because they consider it as the "Fear Gauge". When the implied volatility increases it is indicating "be careful", there might be a fall in the market, as long as the implied volatility is low, it indicates that the participants of the market are calm. This calmness refers to the fact that the vast majority of market participants are usually "long", in other words they are bullish, given that empirical evidence shows that the long-term markets are bullish, although it is clear that this is easily explainable depending on the period.

This is where the VIBEX is particularly useful, when the market is bullish and no shocks of any type are expected the VIBEX remains at low levels, whereas when the market is bearish or a shock is anticipated, it begins to rise. As mentioned earlier, this indicator is very useful whether derivatives are used or not. When the volatility is very low, the most likely is that it will rise, whereas when it is very high it will drop. It also has an asymmetric behaviour, known as timing, and this means that even though we know that the volatility is going to increase, and that subsequently the markets will drop, we do not know when exactly this is going to happen, in other words, the volatility may remain at low levels for quite some time. However, it is very interesting, and it can be seen in Graph 3 how when the volatility explodes, it does not usually last very long, and this can be taken advantage of, and very much so, in the financial markets.

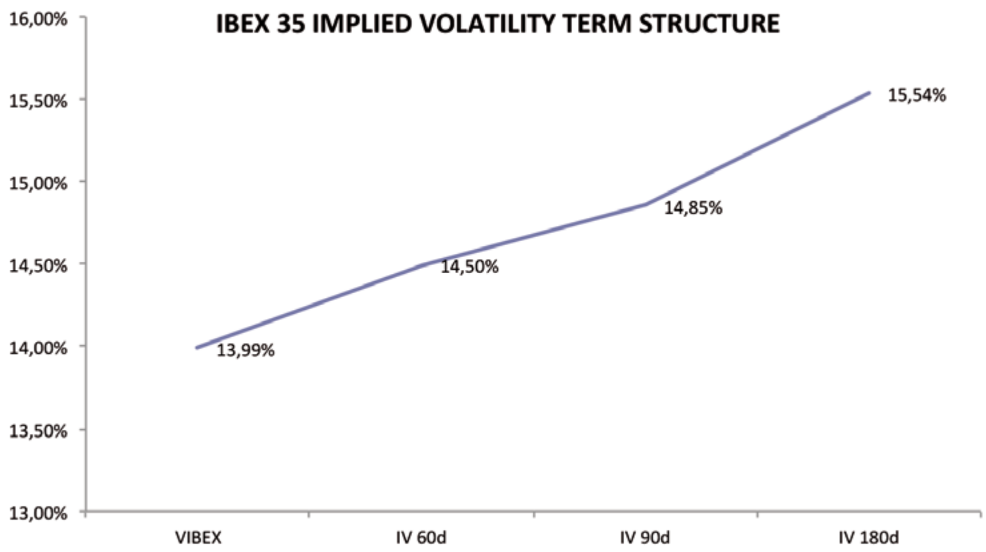
In addition, the VIBEX is calculated at 30 days, however, different volatility indices could also be very easily calculated in the same manner for periods of 60, 90 and 180 days. Thus it is possible to easily obtain the term structure that in turn provides a great deal of information, given that:

- The volatility of a long maturity is more uncertain and therefore more stable (more time to revert to the mean).
- Any increase or decrease in volatility has an effect on the more short-term options because it is expected to continue only in the short-term.
- The liquidity is higher in short maturities.

In a situation of calm in the markets, the term structure of the volatility is usually growing (contango), whereas in a situation of stress, it is usually decreasing (backwardation).

When there is a sharp fall in the underlying asset, it is reasonable to consider a sharp increase in volatility with the subsequent increase of the VIBEX. As this increase in volatility will probably revert back to normal in the short term, the VIBEX and the short-term volatility indices (30 and 60) will be greatly affected, whereas the volatility indices of longer periods (90 and 180), which already had a higher implied volatility, will increase less than the VIBEX and the volatility indices with shorter periods (30 and 60). It is often said that long maturities have sticky volatility, which means it changes less.

Therefore, the observation of the term structure by itself also offers a lot of information.
In Graph 4 we can see the term structure of IBEX 35® options.



Graph 4: Volatility term structure for IBEX Options.
Source: in-house preparation, using data from www.bolsasymercados.es.

b. IBEX 35 SKEW

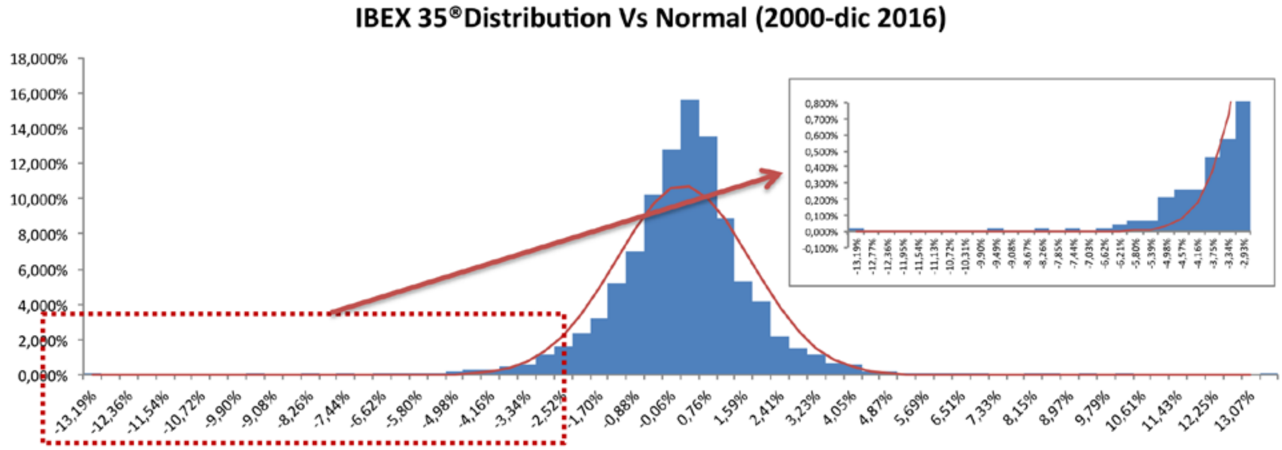
The Skew is the curve that relates the volatility of the whole chain of strikes of the same maturity. As can be seen in table 1, the volatility with which each strike is valued is different.

PURCHASE (CALL) OPTIONS	CLOSING PRICES	LAST CROSS	SESSION MAXIMUM	SESSION MINIMUM	CLOSING VOLATILITY	CLOSING DELTA	VOLUME TRADED	OPEN POSITION
Feb-17 8,000	1,536.00	-	-	-	24.54	1.00	-	3
Feb-17 8,100	1,436.00	-	-	-	23.88	1.00	-	7
Feb-17 8,200	1,337.00	-	-	-	23.22	1.00	-	12
Feb-17 8,300	1,237.00	-	-	-	22.56	0.99	-	8
Feb-17 8,500	1,039.00	-	-	-	21.25	0.98	-	19
Feb-17 8,600	940.00	-	-	-	20.59	0.98	-	33
Feb-17 8,700	842.00	-	-	-	19.93	0.97	-	57
Feb-17 8,800	745.00	-	-	-	19.27	0.95	-	72
Feb-17 8,900	650.00	-	-	-	18.61	0.93	-	8
Feb-17 9,000	556.00	578	578	544	17.95	0.90	8	23
Feb-17 9,100	466.00	450	450	450	17.29	0.86	2	29
Feb-17 9,200	379.00	408	408	352	16.63	0.81	8	128
Feb-17 9,300	298.00	320	320	260	15.97	0.74	36	2,061
Feb-17 9,400	224.00	242	242	168	15.32	0.65	29	194
Feb-17 9,500	159.00	171	178	125	14.66	0.55	124	5,303
Feb-17 9,600	107.00	104	120	83	14.13	0.43	148	245
Feb-17 9,700	67.00	70	74	54	13.69	0.32	77	4,441
Feb-17 9,800	38.00	41	45	27	13.24	0.21	4,083	9,744
Feb-17 9,900	19.00	22	25	17	12.79	0.13	95	368
Feb-17 10,000	8.00	14	14	14	12.35	0.07	5	444
Feb-17 10,100	3.00	6	6	2	11.90	0.03	42	121
Feb-17 10,200	1.00	-	-	-	11.45	0.01	-	33
Feb-17 10,300	-	-	-	-	11.01	-	-	13
Feb-17 10,500	-	-	-	-	10.11	-	-	3

Table 1: Listing bulletin for IBEX 35 options maturing in January 2017.
Source: www.meff.com

One small inconvenience of these option pricing models is that they assume that the returns of the assets are distributed normally (Gaussian distribution) when in reality they are not.

In Graph 5 you can see a Normal distribution and that of the IBEX 35®, if we look closely, the empirical distribution (IBEX 35®) has a greater likelihood of extreme data occurring than indicated by the normal distribution. Furthermore, it can be observed that there are more data in the centre of the distribution and (around the mean), this makes the empirical distribution have more peakedness. Therefore, the "real" distributions of the assets usually have a certain similarity with the Gaussian distribution in normal situations, but there are times when there are extreme movements that have not been contemplated within the possibilities of a Gaussian distribution. It is said that empirical distributions are fat-tailed. In effect, the empirical distributions are leptokurtic, this means they have greater kurtosis, greater peakedness and much fatter tails.



Graph 5: IBEX 35 Distribution vs. Normal Distribution. Source: in-house preparation.

Another characteristic of the distributions is the Skew, in other words, if the tails on the left and on the right are equal. The normal distribution, as we can see in the previous graph is perfectly symmetrical, it could be folded in half and one tail would perfectly match over the other, whereas in the real distribution of the IBEX 35®, this would not be the case.

Therefore, something is reflected here that we have previously seen with the characteristics of the volatility and it is that the market behaves differently when rising and when falling. When the market drops, volatility rises and vice versa.

The likelihood of assets suffering inflated losses over a short period of time are much higher than that indicated by the normal distribution. For example, if the IBEX 35® has volatility of 20% (1.26% daily), according to the normal distribution, a drop of 5% would be expected once every 27,667 sessions, or once every 110 years. We all know that this happens with much more frequency.

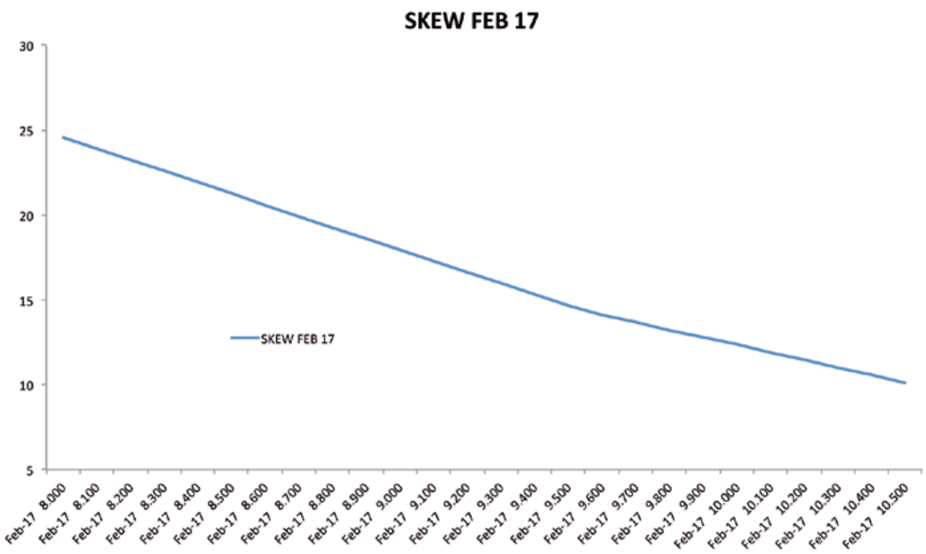
It is important to know that the options markets differ to the spot markets in the number of existing references. The SIBE lists around 133 companies, whereas the MEFF has between 25,000 and 30,000 references registered every day: futures, Calls, Puts, different strike prices, maturities, etc. In other words, on the Spanish Stock Exchange there is a single Santander reference that everyone buys and sells, where the buyer has different expectations to the seller. However, the MEFF has around 1,200 references for Santander. It is impossible for there to be as much interest in all of them for them to be liquid because the buyer wants to find a person with the opposite expectation who wants to sell. The derivatives markets have Market Makers that list all the references in exchange for an incentive. When someone wants to buy an option, the Market Maker sells it and vice versa. The Market Maker then hedges the position in order not to have directional exposure.

Therefore, a derivatives market is conditioned by the Market Makers due to these being the ones who list of the products. These Market Makers are perfectly aware of the characteristics of the volatility and deficiencies of the traditional pricing models in capturing this dynamic and that they might report significant losses.

The market operators make up for this inconvenience in the pricing models by increasing/decreasing the volatility depending on the strike price to be valued and how far this is away from the level of the underlying asset. Furthermore, the peculiarity of the options markets where liquidity is artificially generated by Market Makers, also causes volatility to vary in accordance with the supply and demand for options. This is not a market with hundreds of buyers and sellers, these Market Makers together with the Volatility Traders, which are a minority, are usually the most frequent counterparties in options, and normally take positions because somebody wants to take the opposite position. Although they hedge the position directionally buying or selling the underlying asset, they have a great exposure to the volatility that they have to hedge by creating the volatility Skew.

Given that the Market Makers or Volatility Traders are usually those selling options, their risk in options with a long strike price is much greater. Therefore, it is normal for these operators to transfer this risk to the option price by making it more ·"expensive", so they place a value on the volatility to increase the price of this strike price, thus creating the volatility Skew. There is no formula for determining the volatility Skew, in other words, how much the volatility must be increased by for a specific strike price due to the risk that this has, unless it is the result of supply and demand. In the equity markets the Skew is usually decreasing, therefore the strike prices below the level of the underlying assets are valued with a volatility that is greater than the higher strike prices. This occurs for one reason, normally the market demands Puts at low strike prices when downturns in the market are forecast and they wish to hedge their portfolios (Protective Put). Therefore, it will be the Market Makers and the Volatility Traders that sell these Puts at a higher price. In addition, it is quite normal that other types of operators who do not expect downturns in the underlying asset to offer Calls at higher strike prices in order to obtain a slightly higher return (Covered Call or BuyWrite), the counterparties buy these calls at a slightly lower price. As mentioned, as there is not the same number of buyers and sellers, this excess of demand and supply creates the Skew.

In Graph 6, it can be observed how the Skew of the IBEX 35 is decreasing.



Graph 6: Skew of IBEX 35 options maturing in February 2017.
Source: in-house preparation, using data from www.meff.com

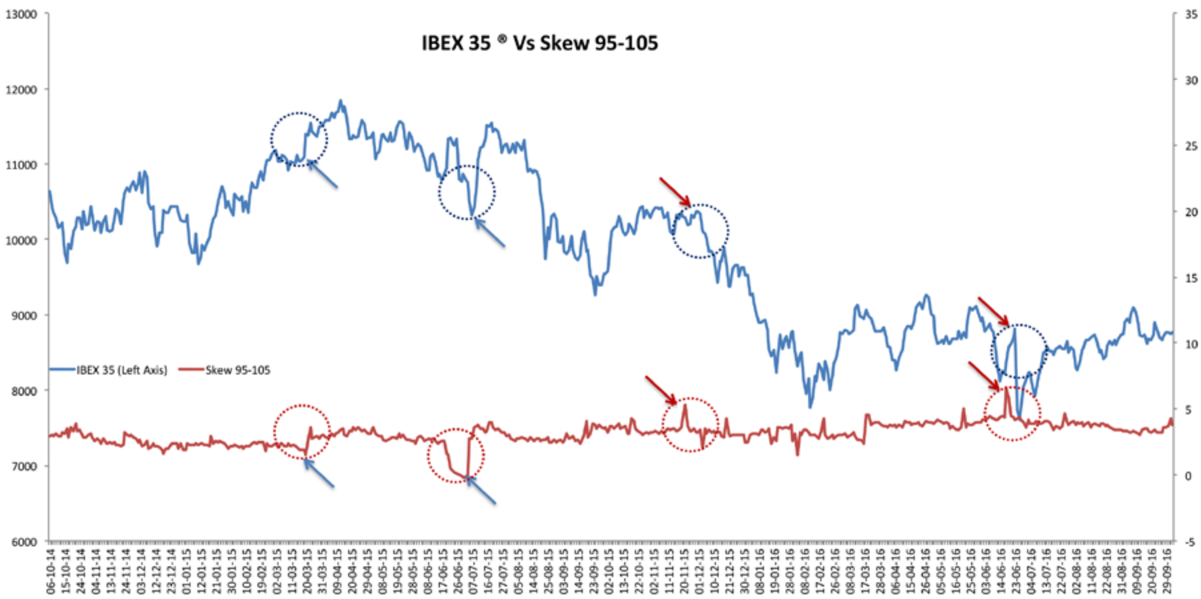
Normally, the volatility Skew is steeper for the short-term options and flatter for the long-term ones. In addition, as we have previously seen, in the event of the uncertainty of quoting long-term volatility, normally the longer the term, the greater the volatility. Each maturity of options has its own volatility Skew, forming what we refer to as Term Structure.

The Skew curve may be steepening or flattening or have parallel shifts upwards or downwards. More significant movements are usually produced in short maturities rather than long. Detecting or anticipating these movements involves detecting the possibilities that the Money Makers (perfectly knowledgeable of the market) are bringing about extreme movements.

Normally, when the markets are calm, the Skew is flat or has very little steepening. If it is detected that the Skew is steepening, this means that the whole market is beginning to buy out of the money Puts to hedge the portfolio and therefore the Market Makers are selling options, at more and more expensive prices to protect themselves from the falls.

Normally, when the whole market hedges itself because it believes that there may be a drop, and there is usually a drop.

The ISKEW index tries to detect these steepenings or flattenings of the Skew curve. In Graph 7 it can be observed how every time the index is unusually low or unusually high, this is reflected in the behaviour of the index.



Graph 7: IBEX 35® index (left axis) and IBEX 35 SKEW INDEX (right axis).
Source: in-house preparation, using data from www.meff.com

The CBOE also has a SKEW index which is calculated in a similar fashion to the VIX, but calculates the third moment of the distribution, which is the skew, (the second is the variance, which is what the VIX calculates). When the Skew index is high this indicates that there is a high likelihood of a tail risk. As with the VIX index and VIBEX, which indicate something similar but are calculated in a different manner, the IBEX 35 SKEW index is calculated completely differently to the CBOE Skew index. The calculation is very simple, but at the same time it is powerful and in line with what usually occurs on the market. The volatility is deducted from an option with a strike price 5% below the underlying asset (95%) and another with a strike price 5% above the underlying asset (105%). As we have seen, normally the volatility of the 95% option is greater than that of the 105% option, therefore the index is usually positive. The more positive, the greater difference between the volatility of both options, in other words, there is more steepening.

When the index is very low, this indicates that the market is calm, allowing the index to rise. When the index is very high, this indicates that the Skew is very steep and that a sharp drop in the market is to be expected.

5. Characteristics and Uses of Strategic Indices with Options

The strategic indices detailed here are indices with the four classic strategies in options. Three of them already have equivalent indices in other markets:

- IBEX 35 BuyWrite
- IBEX 35 PutWrite
- IBEX 35 Protective Put

The fourth index new and there is nothing similar in any other market: the IBEX 35 Short Strangle (IVS).

These strategic indices have two objectives:

- The first is obvious, allow anyone developing classic strategies with options to have a benchmark against which to measure.
- They are indices designed so that Certificates or ETFs can be issued and thereby allow people, who would otherwise not have access, to access these extremely interesting classic strategies with options.

Having an in-depth knowledge of the characteristics of the options is no easy task, it requires effort and dedication, however it does have its rewards as it does grant flexibility in the management that is difficult to reach with other products. There is a multitude of strategies with options that adapt to practically every market situation.

The poor use of these products in the past, especially by managers that abused their leveraged characteristics, generated huge losses which has sadly been blamed on the product. Due precisely to another bias of *Behavioral Finance*, which we frequently come across in the markets: "the successes are mine, but someone else is to blame for the failures". So, when today somebody speaks of derivatives, the words "risk", "leverage" and "complexity" come to mind, all of these being concepts with negative connotations which directly generate rejection. Just the opposite of what should be, given that the strategies with derivatives:

- do not involve leverage of any sort.
- have a lot less risk than spot investments. the Volatilities and Drawdowns are attractively much lower.
- have better returns.

The truth is that with options it is possible to refine and complicate the strategy as much as needed, but there is a series of basic and classic strategies that function very well and are very simple to put into operation. Personally I think that simple things are the ones that work best, there is no need to make life complicated.

Due to the above, the majority of managers and investors who reject the options do so thinking that these involve risky and complicated investments. Throughout this study, we will see how well the simple strategies work compared to their spot alternatives. So, by explaining what these managers are missing out on by not using these, maybe we can encourage the correct use of the derivative products and improve the efficiency of the products they offer retail clients.

In 2006 the CBOE created the first index with these characteristics, the CBOE S&P500 BuyWrite, and in 2007 did the same again with the S&P 500 PutWrite. It has since gone on to create many more strategic indices for different indices such as the Nasdaq, Dow Jones and Russell 2000 and for different strategies such as Butterflies, Combos, Risk Reversals, etc. In the United States they make extensive use of options as a management tool and therefore have a greater need for the strategic indices, some of which are extremely complex. STOXX quickly added the BuyWrite index for the EuroStoxx 50 in 2006 and the EuroStoxx 50 PutWrite in 2009. It has only issued these two indices, which have sadly gone unnoticed, in spite of being indices that systematically beat the EuroStoxx 50 index and with considerably lower volatilities. In Europe, hardly any products have been issued for these indices.

a. Brief overview of options

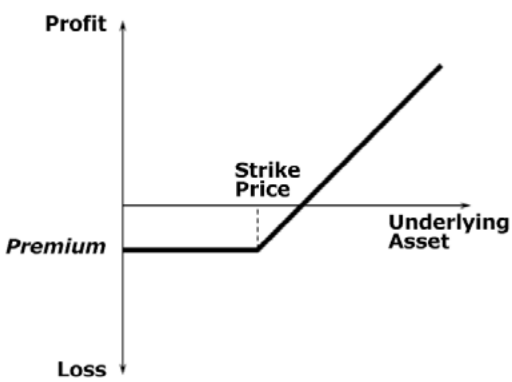
Before discussing these strategic indices, let's briefly review the characteristics of the options in order to establish a context in which to better understand the possibilities of the product.

There are two types of options, Call and Put.

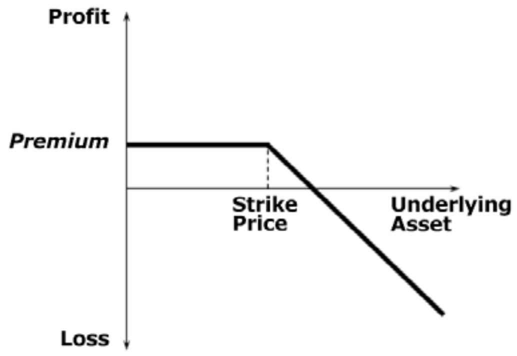
A Call option gives its buyer the right to acquire an underlying asset (shares or index) at a fixed price (strike price) on a future date (maturity date) in exchange for the payment of the premium. The seller of this type of option will have the obligation to sell the underlying asset on the agreed date (provided that the buyer exercises his right) in exchange for the payment of the premium.

The option will be executed, provided that the price of the underlying asset is greater than the strike price. To calculate the point at which the buyer (seller) makes a profit (loss), the amount of the premium paid (earned) should be taken into account.

In Graphs 8 and 9, we can see the risk profiles of a Call buyer and a Call seller respectively.



Graph 8: Risk profile of a Call buyer.
Source: in-house preparation.



Graph 9: Risk profile of a Call seller.
Source: in-house preparation.

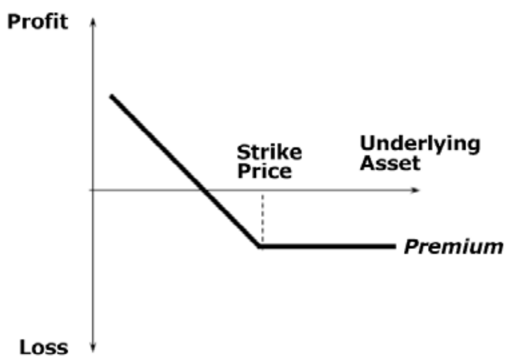
The Call buyer pays a premium and has the right to decide, whereas the seller receives the premium and abides by what the buyer decides. As we can see, the Call purchase has limited losses as it is not possible to lose more than the premium paid, whereas the possible profit is unlimited, whatever the increase of the underlying asset might be. It is therefore a clearly bullish position.

On the other hand, the Seller has its profit limited to the premium received, in the case the underlying asset falls and the buyer does not want to execute. If the underlying asset rises, everything that the buyer is earning will be losses for the seller. The sale, therefore, is a moderately bearish position. I say moderately because it does not matter whether the underlying asset falls by a little or a lot, because he always gains the same, the premium.

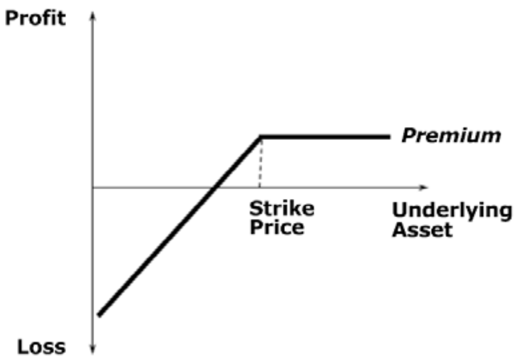
A Put option gives its buyer the right to sell the underlying asset at a fixed price (strike price) on a future date (maturity date) in exchange for the payment of the premium. The seller of this type of option will have the obligation to buy said shares on the agreed date (provided that the buyer exercises his right) in exchange for the payment of the premium.

The option will be exercised provided that the price of the underlying asset is lower than the strike price. To calculate the point at which the buyer (seller) makes a profit (loss), the amount of the premium paid (earned) should be taken into account.

In Graphs 10 and 11, we can see risk profiles of a Put buyer and a Put seller respectively.



Graph 10: Risk profile of a Put buyer.
Source: in-house preparation.



Graph 11: Risk profile of a Put seller.
Source: in-house preparation.

As with the Call, the Put buyer pays a premium and has the right to decide whether to sell or not, whereas the Put seller receives the premium and has the obligation to abide by what the buyer decides.

The Put buyer has a clearly bearish position, given that if the market rises, he shall not exercise his right and only loses the premium, whereas if the market drops, he gains everything that the underlying asset drops by.

The Put seller has a moderately bullish position, given that if the market rises, the buyer will not want to exercise his right and the premium will be received, regardless of whether the market rises a lot or a little. Whereas, if the market drops, he loses everything that the market drops by.

Having explained the basic positions with the options, for someone new to the subject, when asked if they would prefer to take a bullish position with a Call purchase or a Put sale, they normally prefer the Call purchase, because the loss is limited and the gain is unlimited. This is further proof of the bias towards the aversion to losses which, as we have mentioned earlier, Behavioural Finance has shown that we behave in an irrational manner.

As we will see in the strategic indices, the sale of options is one of the best allies for the investor mainly due to two reasons:

1. The earnings from the premium are important. It depends on the volatility, but it can reach 3% cash per month (IRR of 42.58%) without any problem. No matter how much the underlying asset moves against it, it starts with a significant advantage.

2. The investment in options is for a specific time, in our case with the strategic indices it is for one month. Is it rational to think that the market is going to increase or fall without limits in approximately 22 days? It makes no sense to take unlimited positions, because as we will show later there have been months in which the IBEX has increased or dropped significantly, but on very few occasions. In fact, approximately 50% of the months during the life of the IBEX 35®, it has moved between +/-4%.

In addition, the premium of the options quoted on the market, these can be bought or sold at any time. There is no need to wait until maturity. In order to cancel a position in an option, all that needs to be done is to take the opposite position for the same type of option (Call or Put), strike price and maturity.

What makes using options complicated is that their price (premium) not only varies due to changes in the underlying asset, but also due to other variables that the spot investor does not normally monitor, such as volatility, time to maturity, dividends, and interest rates. Actually, the effect of the interest rates and dividends in options with a short maturity, such as our case with options at one month, is barely noticeable unless there is a cancellation of the dividend or a change of payment dates with little prior notice, which sometimes happens but is not common.

In table 2 we can see the different parameters that affect the value of options. The value of the premium is usually broken down into two parts: the intrinsic value and the time value The intrinsic value is the positive difference between the strike price and the underlying asset, which is what would be earned in the case of exercising the option at that time. The time value is what is paid for having the right to decide depending on the likelihood that this option has of earning money in terms of time to maturity and volatility (we have already said dividends and interest rates have little influence on this).

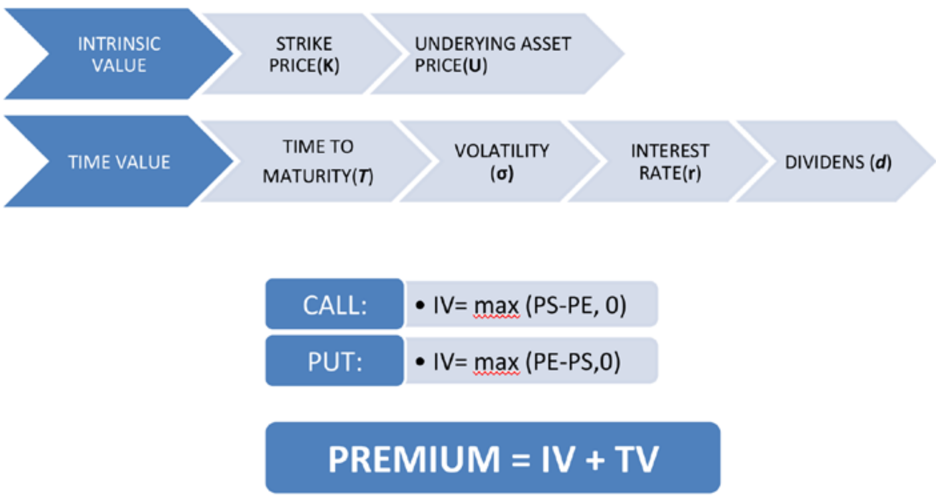
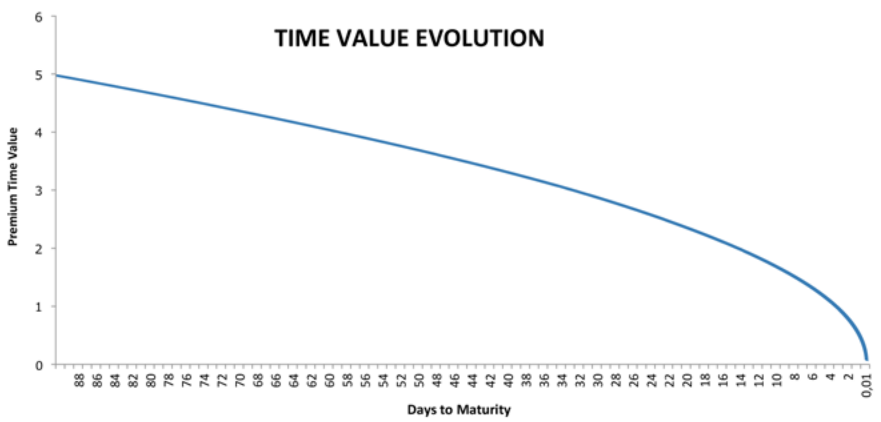


Table 2: Parameters that affect the value of options. Source: in-house preparation.

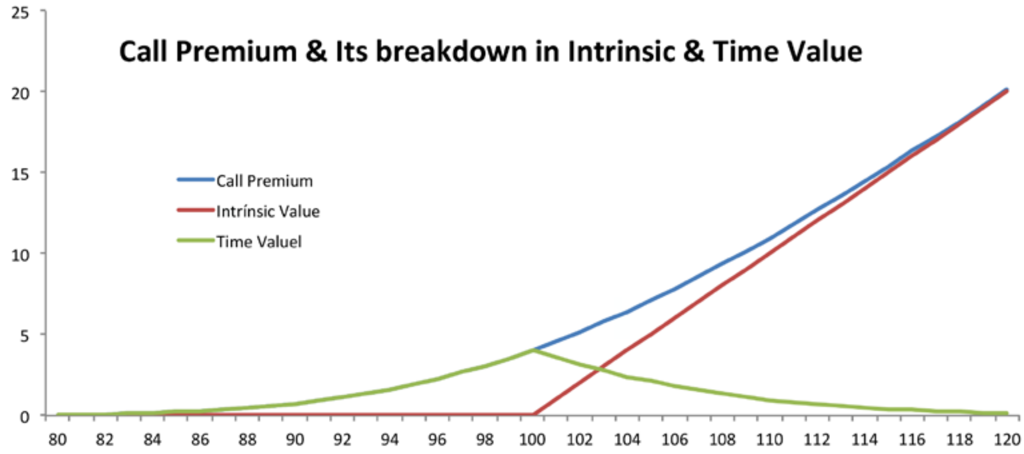
These two components, volatility and time to maturity, are essential for valuing options and are closely related: in order for volatility to become variability in prices there must be time to maturity, and vice versa. For this reason the time value of the options is gradually eroded until it becomes a zero on the maturity date (see Graph 12).



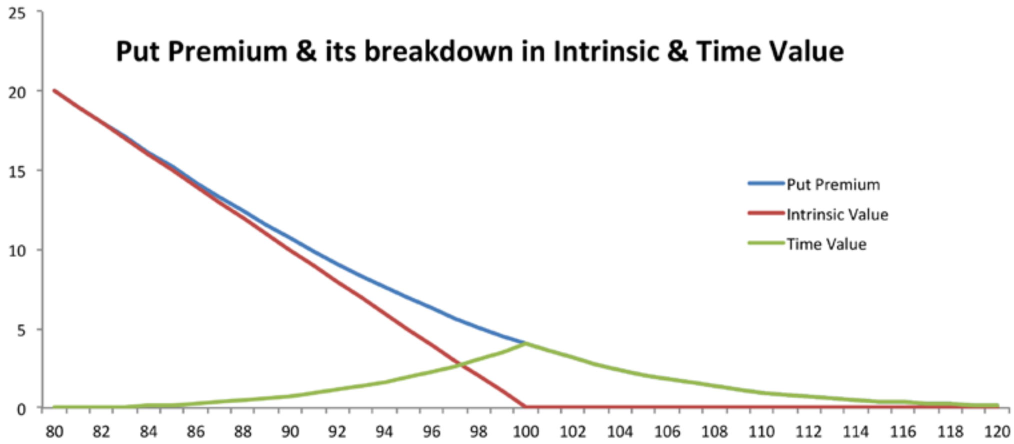
Graph 12: Evolution of the time value of an option. Source: in-house preparation.

It should be noted how the time value decreases faster when there is less time until maturity, given that there is a greater certainty regarding the likelihood of the option being exercised. The greater the uncertainty over it being exercised, the greater the time value and vice versa.

In short, the premium of an option comprises a certain value called intrinsic value and another that is more subjective and related to the likelihood of the option being exercised or not, called time value (see Graphs 13 and 14).



Graph 13: Breakdown of the premium of a Call option. Source: in-house preparation.



Graph 14: Breakdown of the premium of a Put option. Source: in-house preparation.

The selection of the strike price of an option conditions the premium that must be paid for it. For example, having the right to buy an asset at a strike price below the current level of the underlying will be substantially more expensive than acquiring this right at a higher level. In the first case, the option includes both intrinsic value (profit if exercised at the time of its valuation) as well as time value, whereas in the second the whole of the premium is made up of by time value.

The behaviour of the options differs a great deal, depending on their strike price. The strategies to be carried out with them require not only the analysis of whether to buy or sell a Call or a Put, but rather the choice of the strike price and maturity will fully condition the performance of the position.

Therefore, the options are usually classified as:

- *In the Money (ITM)*.
  - In a Call when the price of the underlying asset is quoted above the strike price.
  - In a Put when the price of the underlying asset is quoted below the strike price.

- *At the Money (ATM)*.
  - In both, Call and Put, when the price of the underlying asset matches the strike price.

- *Out the Money (OTM)*.
  - In a Call when the price of the underlying asset is quoted below the strike price.
  - In a Put when the price of the underlying asset is quoted above the strike price.

In addition, as the underlying asset constantly moves and the ATM option may be changing, to refer to the different strike prices it is normal to use Moneyness. As we can see in table 3, a 100% option is an option whose strike price is ATM, whereas a strike price of 98% is an option whose strike price is 2% below the level of the underlying asset, which would be a call at 2% ITM or a put at 2% OTM. As we can see, moneyness is also useful for seeing the extent to which the option is in or out of the money. Thus, a Call with strike price of 102% has different characteristics to a Call of 105%, even though the two options are out of the money and their behaviour is similar, they are certainly different.

CALL ITM/PUT OTM			Underlying Asset ATM		CALL OTM/PUT ITM	
97%	98%	99%	100%	101%	102%	103%
8500	8600	8700	8800	8900	9000	9100

Table 3: Classification of ATM, OTM and ITM options and their *Moneyness (rounded up)*. Source: in-house preparation.

Therefore, in light of the above, the value of the options depends on six different parameters, not only the movement of the underlying asset. We can take a bullish position with options and even with the underlying asset increasing in value still lose money because the other parameters have gone against us.

In table 4 we can appreciate the influence of each parameter.

	MOVEMENT	CALL	PUT
UNDERLYING	↑	↑	↓
	↓	↓	↑
STRIKE PRICE	↑	↓	↑
	↓	↑	↓
VOLATILITY	↑	↑	↑
	↓	↓	↓
TIME TO MAT.	↓	↓	↓
DIVIDENDS	↑	↓	↑
	↓	↑	↓
INT. RATE	↑ Under. Spot	↑	↓
	↑ Under. Future	↓	↓
	↓ Under. Spot	↓	↑
	↓ Under. Future	↑	↑

Table 4: Parameters that influence in the value of options.

In brief, to better see the conditioning factors of the strategies that we will see below:

- When buying or selling a Call or Put, not only is it necessary to look at the underlying asset, but also the volatility. When taking a position in options not only does one think about whether the underlying asset is going to rise or fall, but also how, either abruptly or gradually.

- The increase in volatility causes the premium of the options to increase. The longer the time remaining until the maturity of the option, the greater the increase. Therefore, for the purchase of options the increase in volatility is beneficial and its decrease is harmful.

- The passage of time causes the options to be worth a little less every day. The shorter the amount of time remaining until the maturity of the option, the more it will lose through the passing of the days. This effect from the passage of time is clearly harmful to the buyers of options and beneficial for the sellers of options.

Here's an example of the importance of the speed (volatility) of the movement of the underlying asset. Let's suppose that we are bullish and we take two positions, buying a Call and selling a Put. If the underlying asset increases, which one gains more? This depends on how the underlying asset increases.

Initial situation:

IBEX Future Feb 17	9,313
Strike price	9,300
IBEX 35	9,365
Interest rate	-0.337%
Days to maturity	60
Time (years)	0.1644
Continuous dividend	0.56%
Volatility	25.00%

We buy a Call. Call premium = 375.74

We sell a Put. Put premium = 376.46

If the IBEX 35® future should rise today (with 60 days left until maturity) by 2% to 9,500, the price of the Call would be 479.71 (+27.67%) and the Put 294.34 (+21.81%). As the Put has been sold, 376.46 is received to later pay 294.34, which would generate a profit. Clearly in this situation, the better option is to buy the Call, as this will generate a higher profit, although to be honest, the profit from selling the Put is not bad at all.

Now let's suppose that the same has happened, that the IBEX 35® future from February has increased 2%, but rather than doing so in one day, let's suppose that 40 days have passed and there are 20 days remaining until maturity, here the situation would be completely different. The price of the call is 330.31 (-12.09%), whereas that of the Put is 135.67 (+63.96%). Buying the Call has lost money! How can this be if the underlying asset has increased? Simply because the days have passed and the position has been losing value. The options bought have been negatively affected, but those sold have benefited, and greatly so. We were previously discussing the interesting aspects of selling positions. Even with the limited profits and unlimited losses over a finite period of time, they can only go up or down a certain amount, thus it makes no sense to take unlimited positions!

On the other hand, when one sees such elevated returns such as those mentioned above of +27%, +65%, -12%, etc, one starts thinking about what we mentioned at the beginning: risk, leverage, etc.

I am going to demonstrate with a small example that the use of derivatives does not necessarily involve leverage, in fact, in the strategic indices that we will see below, there is absolutely no leverage.

Beginning with the data from the previous example of buying a Call and selling a Put. Let's suppose that we have a portfolio of €9,365, we are bullish and we propose four alternatives: Purchase a basket of IBEX 35®, Purchase 1 Mini IBEX future, Purchase 1 IBEX Call and Sell 1 IBEX Put.

IBEX Future Feb 17	9,313
Strike price	9,300
IBEX 35	9,365
Interest rate	-0.337%
Days to maturity	60
Time (years)	0.1644
Continuous dividend	0.56%
Volatility	25.00%
Call price 9,300	375.74
Put price 9,300	376.46

After 40 days, the situation is as follows:

IBEX Future Feb 17	9,500
Strike price	9,300
IBEX 35	9,515
Interest rate	-0.337%
Days to maturity	20
Time (years)	0.1644
Continuous dividend	0.56%
Volatility	22.00%
Call price 9,300	306.29
Put price 9,300	110.92

Analysis of the alternatives:

- **Purchase of IBEX Basket**. We have spent all of the €9,365 in buying all the shares that comprise the IBEX 35® at the same weight. We have not taken the fees into account, but it would be an amount to consider. If after 40 days the IBEX 35® has risen to 9,515, this means that the portfolio has earned €150 (+1.6%). Furthermore, over these 40 days the portfolio will have yielded dividends of approximately €37. The profit amounts to €187.

- **Purchase of IBEX 35 Future**. The future is bought at 9,313. Only €900 is paid out as guarantee, the rest of the money remains in the portfolio as liquidity. If after 40 days the future is quoted at 9,500, this means that it has earned €187, in other words, 2.01%. Therefore, it generates exactly the same amount of money. The only difference lies in the fact that for the basket we have spent all the money, whereas for the position in futures €900 is left as guarantee and the remainder of the money remains liquid.

- **Purchase of Call at a strike price of 9,300**. Of the €9,365 that we have, we spend €375.74 (-4.03%) on the purchase of the Call. Therefore, €8,989.26 remains liquid. After 40 days, the Call has a value of €306.29, meaning that not only did it not gain, it has lost €-69.45. These €-69.45 represent -18.48% of the price of the option, however, the portfolio now has a value of €9,295.55, which is a loss of -0.74%. This position is not leveraged, and despite the underlying asset increasing, the position has lost value because it has not risen enough to offset the losses due to the passage of time. If this increase has occurred within a short time, it would have generated gains. This is reason why bought options should be kept in the portfolio for as little time as possible.

- **Sale of Put at a strike price of 9,300**. We earn €376.46 (+4.04%) from the premium for a Put and we deposit €900 as guarantee. The entirety of the portfolio is liquid, the €9,365 plus the €376.46 less the €900 as guarantee (€8,841.46). After 40 days, the Put has a value of €110.92, meaning a gain of €265.54. This amount represents +70.54% of the value of the premium, however, it is 2.83% of the value of the portfolio. This position is not leveraged either. It has gained a bit more than the future, because it is favoured by the passage of time. The inconvenience of this position is that by the premium representing approximately 4%, if over these 40 days the index had increased by more than 4%, this position would "only" have gained 4%. By the same token, if the future had dropped, this position would have lost less.

These sensitivities indicate that not only do changes in the parameter affect us positively and negatively, but also by how much. In other words, if we have a Call, we know that if the volatility drops we lose money, but it is interesting to know how much.

Delta: measures how much the premium of the option varies in the event of unitary variations of the underlying asset. It is positive for a Call (negative for a Put). Its value is between 0 and 1 (or -1). It tends to be 0 when the option is OTM, 0.5 (or -0.5) when it is ATM and 1 (or -1) when it is ITM. It is sometimes expressed as a percentage, in other words, a Delta of 0.5 is also referred to as 50%. For example, if a Call option strike price of 9,300 maturing in February 2017 has a delta of 51.94%, this means that if the underlying varies by one unit, in other words, it changes from 9,313 to 9,314 or to 9,312, the premium of the call will vary by 0.5194. Another definition of Delta is that it measures the likelihood of the option being settled in the money. Therefore, an OTM option with a Delta of 0.3 (or -0.3) has a 30% likelihood of being settled in the money An ITM option with a Delta of 0.7 (or -0.7) has a 70% likelihood of being settled in the money

Gamma: measures how much Delta changes in the event of unitary changes (one tick) in the underlying asset. It is maximum in ATM options and decreases as the money enters and leaves. It is a very small amount, especially when there is a long time until maturity. Care should be exercised with ATM options when there is very little time until maturity, given that the Delta may change very quickly.

Vega: measures how much the premium of the option varies in the event of volatility changes of 100 bp. In other words, if the volatility is at 25%, how much does the option premium gain if the volatility rises to 26% or how much does it lose if it falls to 24%. Vega is usually a large amount in options which have a long maturities and decreases with the passing of the days. It is maximum in ATM options and decreases as the money enters and leaves.

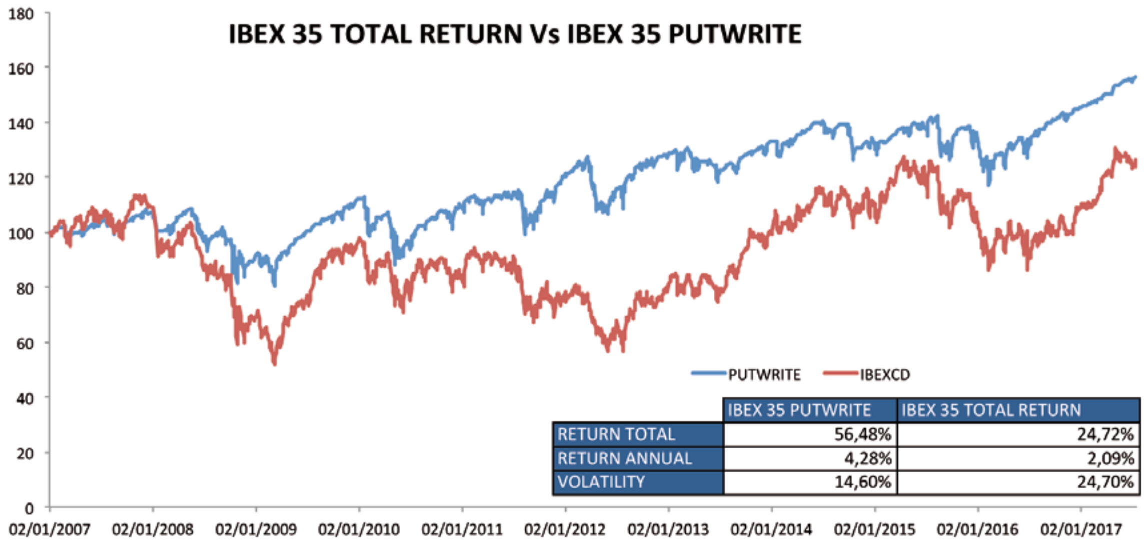
Theta: measures what the option premium loses with the passing of each day. The options which have a long time until maturity have a small Theta and this increases as the date until maturity approaches. Theta is maximum in ATM options and decreases as the money enters and leaves.

b. IBEX 35 PutWrite

This index follows the PutWrite strategy that is also known as *Collateralised Reverse Convertible*. This PutWrite index is a very common strategy and was one of the first strategic indices to be created.

The strategy consists of the sale of a Put maturing at one month with a strike price of 98%. It rolls over on a monthly basis. The assets of the portfolio plus the premium of the options sold are invested at the daily EONIA interest rate. In the calculation of the index, as we have mentioned previously in the methodology section, the costs are taken into account, therefore the performance is completely realistic.

It is a bullish position, which benefits from the decrease in volatility and the passage of time. This position suffers when the underlying asset decreases and volatility increases, which usually go hand-in-hand. When the market drops, it drops a lot less and when it rises, it accompanies the rise quite well. The problem with this position is that it does not accompany the sharp increases of the underlying asset so well. In the long term, it systematically beats the underlying indices. It has a greater return with a volatility that is quite a lot lower.

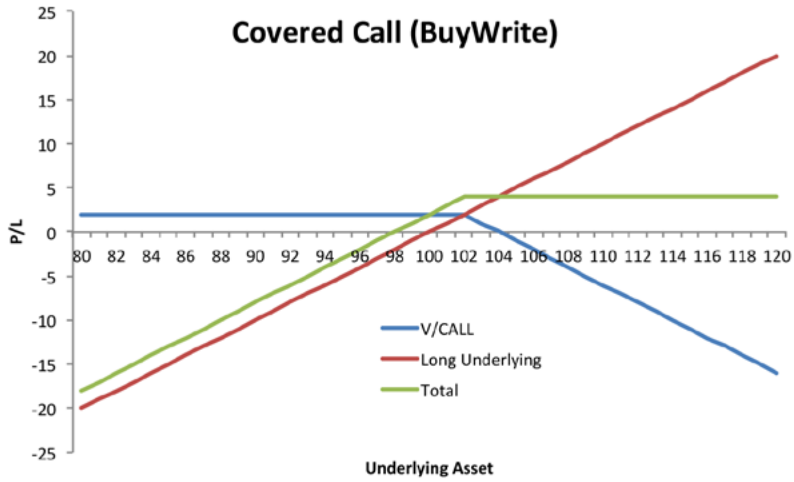


Graph 15: IBEX 35 PutWrite Index vs. IBEX Index With Dividends until 18/7/2017.
Source: In-house preparation.

This strategy usually has variants. In other markets it is the PutWrite that uses ATM options and the one that uses 2% OTM options. After thoroughly analysing both strategies, the ATM variant behaves better only under certain circumstances, with the behaviour of the 2% OTM options being better in the long term, which occurs across all markets.

c. IBEX 35 BuyWrite

It is an index which replicates a very famous strategy which is carried out with options: It is known by different names: "Covered Call", "BuyWrite" or "Call Overwriting". This simplest of strategies consists of adding a Call option sale of 102% maturing at one month to the IBEX 35® Basket (IBEX 35® With Dividends or IBEX 35® Future, as preferred). As we can see in Graph 16, as with the other strategic indices explained, it rolls over on a monthly basis. The resulting strategy has a risk profile similar to that of a Put sale.



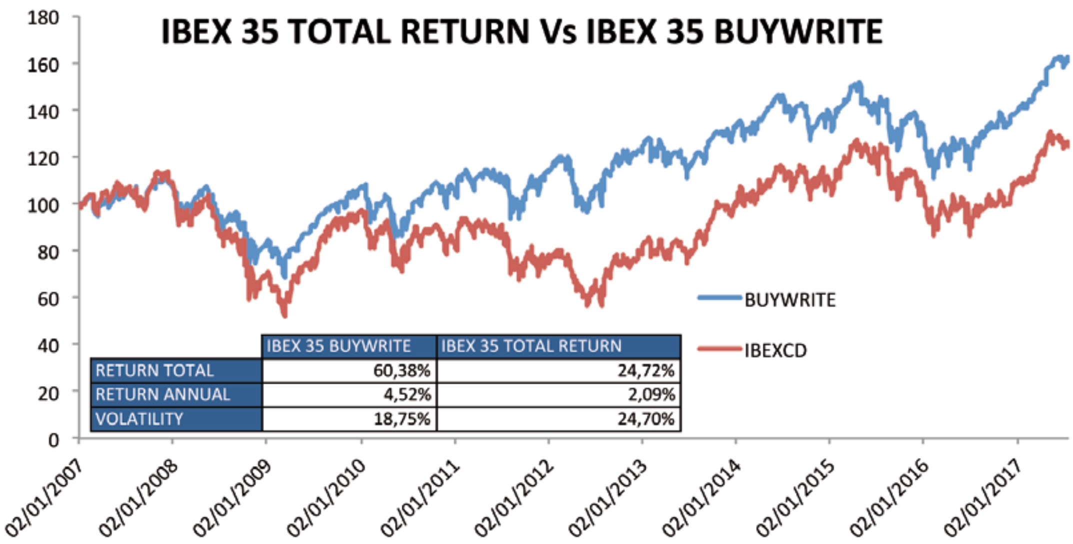
Graph 16: Covered Call strategy. Source: in-house preparation.

This strategy is based on something that we have already touched upon, in a "finite" period the movement of the underlying asset cannot have an "infinite" upward or downward movement.

The managers usually establish a limit to the rise and in exchange pay a premium, this premium allows them to beat the index, against which they are easily measured. This strategy is used a great deal, but I get the feeling that is not usually explained as much.

The monthly increase of the IBEX 35® basket is limited to 2%, in exchange for a premium of between 1% and 3%, depending on the volatility. For example, if we receive a premium of 2%, this means that if the index drops, we will drop the same, less 2% (we improve on the index). If the index increases less than 2% over the month, we beat the index as well, because we gain 2%. The worst-case scenario for this strategy is a sharp increase in the index. This scenario, if we analyse what has happened in the past, occurs on a few occasions.

Graph 17 shows the behaviour of this BuyWrite index compared to the IBEX 35 with Dividends and as can be seen the improvement is evident. It should be noted that the index includes the rolling over costs of the position, therefore, the performance is completely real.



	IBEX 35 BUYWRITE	IBEX 35 TOTAL RETURN
RETURN TOTAL	60,38%	24,72%
RETURN ANNUAL	4,52%	2,09%
VOLATILITY	18,75%	24,70%

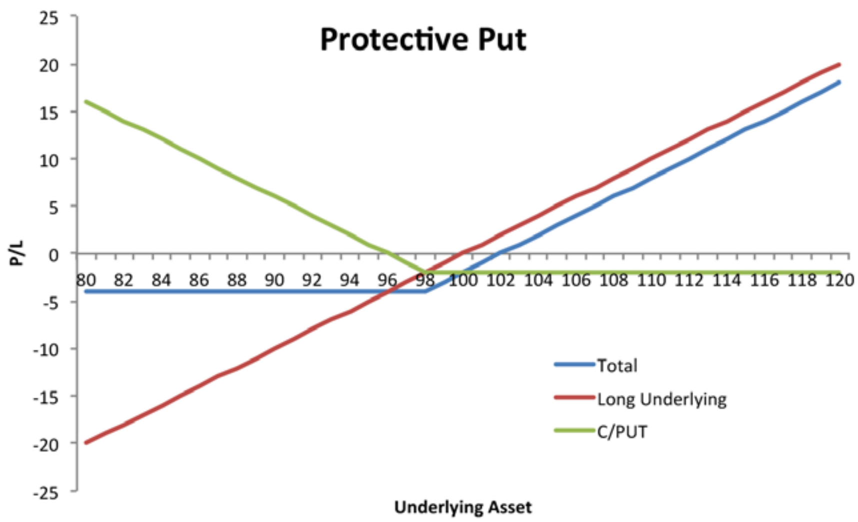
Graph 17: Comparison between the BuyWrite and the IBEX 35 with Dividends until 18/07/2017. Source: in-house preparation.

This index, even though its volatility is much lower than the IBEX 35 with Dividends, it is not as low as the IBEX 35 PutWrite, because it assumes the purchase of an IBEX 35 future.

The BuyWrite increases less during very bullish periods, but falls significantly during bearish periods, this causes it to behave much better than the IBEX 35 with Dividends in the long term.

d. IBEX 35 Protective Put

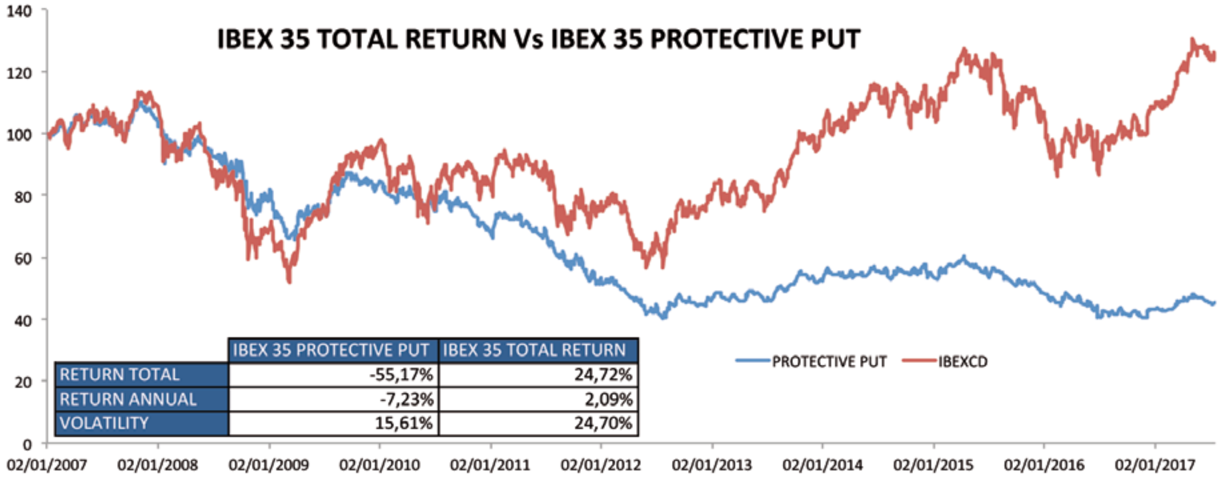
This is another very classic strategy, which consists of adding a 98% Put purchase option maturing at one month to the IBEX 35 basket and rolling it over on a monthly basis. This strategy has many variations, both in the strike price of the Put and the period. As we can see, the resulting strategy has a risk profile similar to that of a Call purchase.



Graph 18: Protective Put strategy.
Source: in-house preparation.

This strategy has the inconvenience of paying a premium every month in order to cover the risk of the drop. It behaves very well when the market effectively drops and does so sharply, but whilst it does not drop, it rises less. If the index increases sharply, it rises less than the index, but it accompanies the increase well. The problem is the monthly small rises and falls, this index does not recover the payment of the premium for the option. As with the previously mentioned indices, the IBEX 35 Protective Put index takes into account the roll over costs of the position of the futures and the Puts, therefore, the performance is completely realistic.

As we can see in Graph, 19, it remains quite far behind when the index increases sharply, but it protects very well against drops.



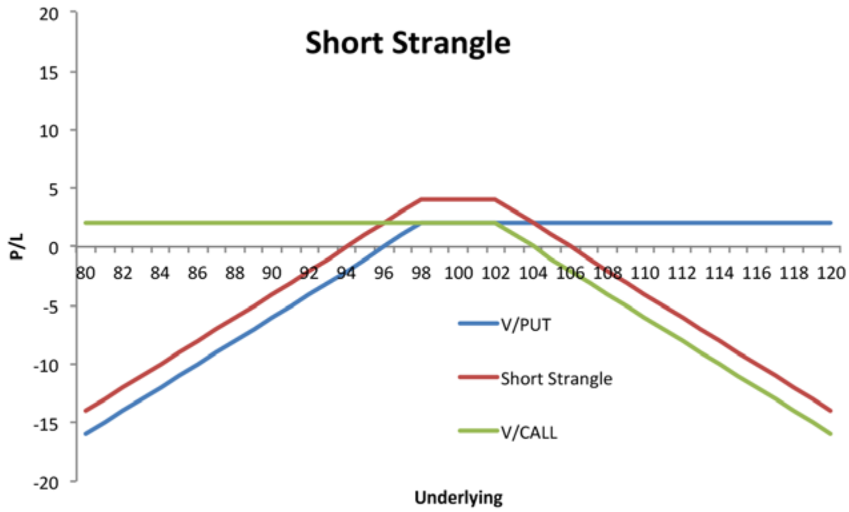
Graph 19: Comparison between IBEX 35 Protective Put and IBEX 35 Index with Dividends until 18/ 7/2017. Source: in-house preparation.

e. IBEX 35 Short Strangle (IVS)

This is an index which does not have any other market and follows a strategy that is as famous as it is simple, a Short Strangle. Also known as a sell strangle. This consists of the simultaneous sale of a 102% Call and 98% Put maturing at one month, and as with the others, it rolls over on a monthly basis. The income from the sale of options when selling is doubly important, depending on the volatility, but is between 2% and 6%. It is important to understand that this strategy is not leveraged, it is simply a strategy that is short of volatility.

The strategy is completely collateralised, the Strangle is sold at the same nominal as the assets, the assets plus the premiums earned are invested at the daily EONIA interest rate. As with the other indices mentioned above, and as defined in the methodology, the IBEX 35 Short Strangle index takes into account the costs, therefore the strategy's performance is completely realistic.

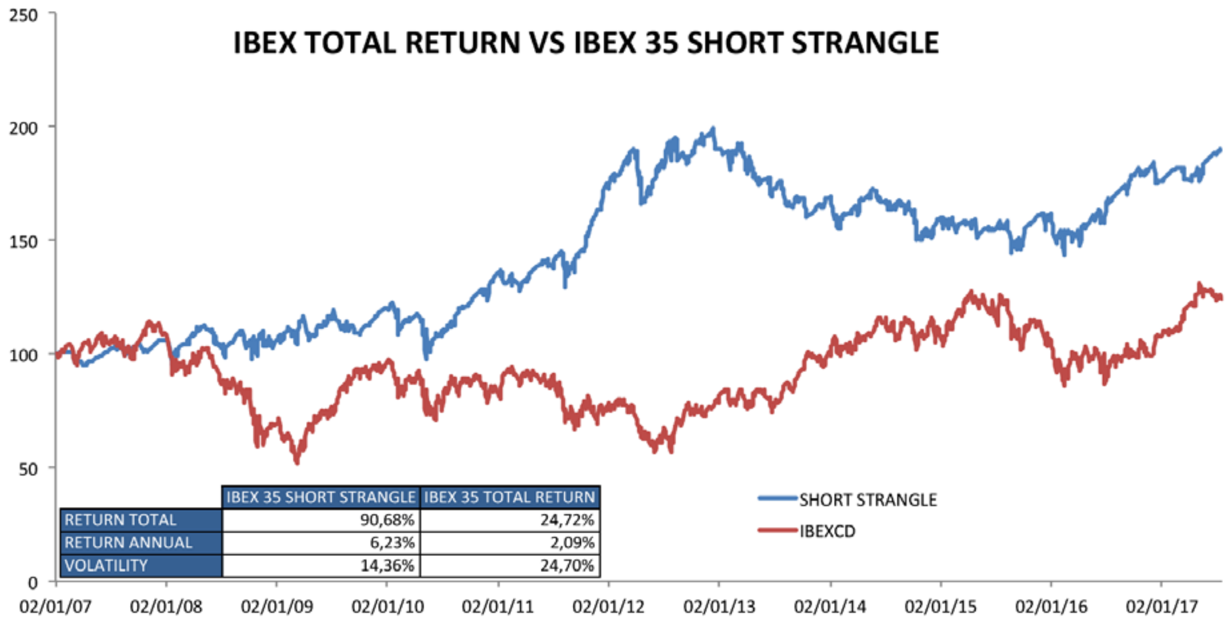
As the volatility and the underlying asset normally move inversely, as we have previously explained, one could say that it is a bullish index. However, the reality is that this is not completely true, this inverse correlation between volatility and the underlying is not perfect. The delta of this strategy is 0, whereas the price of the IBEX future remains between the two strike prices. The inconvenience is that if the market increases significantly during the month this may result in a loss and if it falls a lot during the month this too may also result in a loss. As can be seen in Graph 20 the points from which losses occur will be: strike price of 98% less the amount of premiums and a strike price of 102% plus the amount of premiums. This generates a range of movement of the underlying asset that is fairly wide, between 6% and 10% (4% of the difference between the strike prices, plus the premiums received).



Graph 20: Short Strangle strategy. Source: in-house preparation.

This IBEX 35 Short Strangle index rolls over on a monthly basis and the source of its performance is based on the fact that the monthly index does not normally move very much, given that when it moves a great deal during the month, upwards or downwards, it usually corrects itself somewhat (pullback), which levels out the monthly movement. The worst-case scenario of this index usually occurs when there are brusque movements that occur during the week of maturity, when there is no time for the index to revert.

As we can see in Graph 21, it has behaved better over time than the IBEX 35® Index with Dividends, with a significantly lower volatility.



Graph 21: Comparison between IBEX Short Strangle and IBEX 35 with Dividends until 18/07/2017.
Source: in-house preparation.

This IBEX 35 Short Strangle index benefits a great deal from the passage of time and the stability of the underlying asset, whereas it suffers considerably when the volatility increases and the underlying asset has brusque movements.

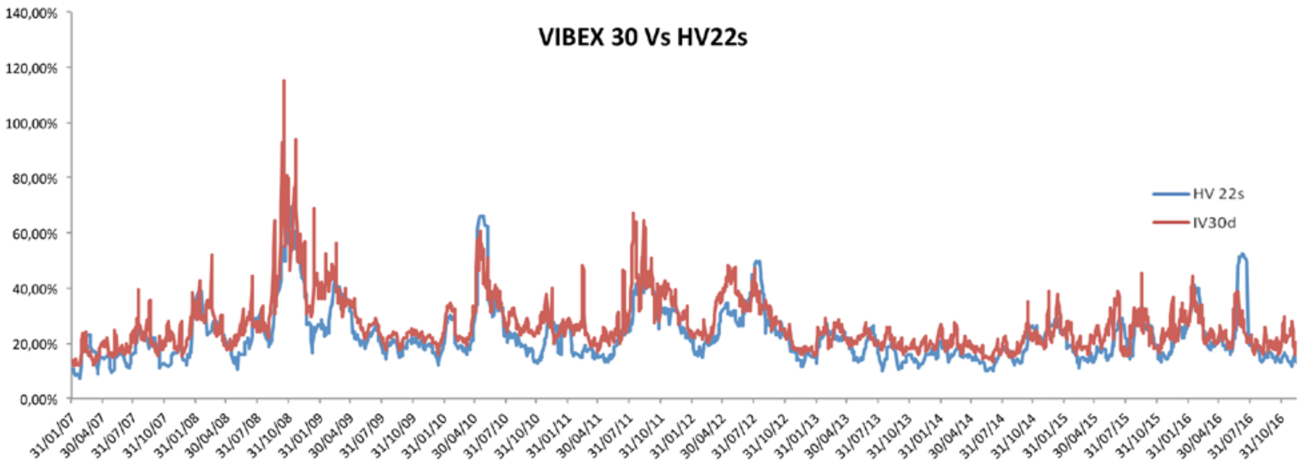
6. Sources of Return of Strategic Indices with Sold Options

Over the years, during which I have studied these indices in depth, I have asked myself about the source of return, as well as its risks on many occasions, and I have analysed their strengths and weaknesses in detail. The question I am going to try and provide an answer to is: Why do these sold options indices have such an extraordinarily good performance?

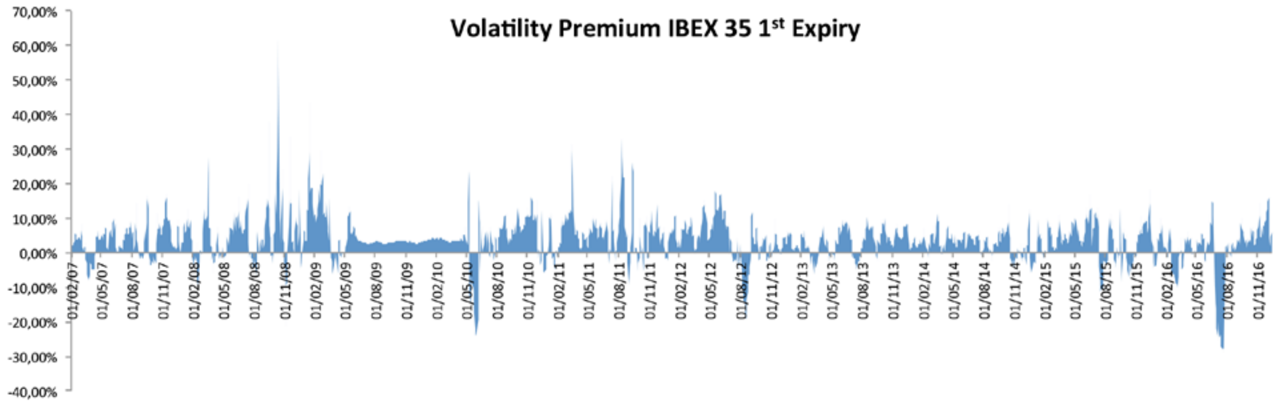
The answer is that there is not just one reason, but several.

The first, and least evident, but very important when all is said and done.

- **The *Volatility Premium* is positive.** In other words, the difference between the implied volatility and the realised volatility is positive, as we can see in Graphs 22 and 23. The volatility at which the options are quoted is the volatility that the underlying asset is expected to have from the moment of valuation until the maturity of the option. In light of this uncertainty and given that selling options has, in principle, more risk than buying them, these are usually listed at a higher volatility than that which effectively later occurs for the index. Therefore, the systematic sale of options causes us to earn this volatility premium on a recurrent basis.



Graph 22: Difference between the VIBEX Index and the realised volatility over 22 sessions (one month). Source: in-house preparation.



Graph 23: *Volatility Premium* of the IBEX 35 options.
Source: in-house preparation.

- **The movement of the IBEX 35® over the month, is limited**. If a simple histogram is created of the frequencies of the IBEX 35® using monthly data from 1992 to June 2017, we have the data from Table 5. During the 306 months since the creation of the IBEX 35®, it has fallen more than 10% in one month during 14 of them and risen by more than 10% in one month during 12. During the majority of the months, throughout nearly 25 years of the IBEX 35®, the index has remained within a set of ranges that makes the income generated through the sale of options very efficient. When selling options and receiving a premium, it is necessary for there to be stability of the underlying asset (within a certain range). Having studied the movement of the IBEX 35® during all its months of life, we can conclude that these ranges generated with the sale of options are reasonable.

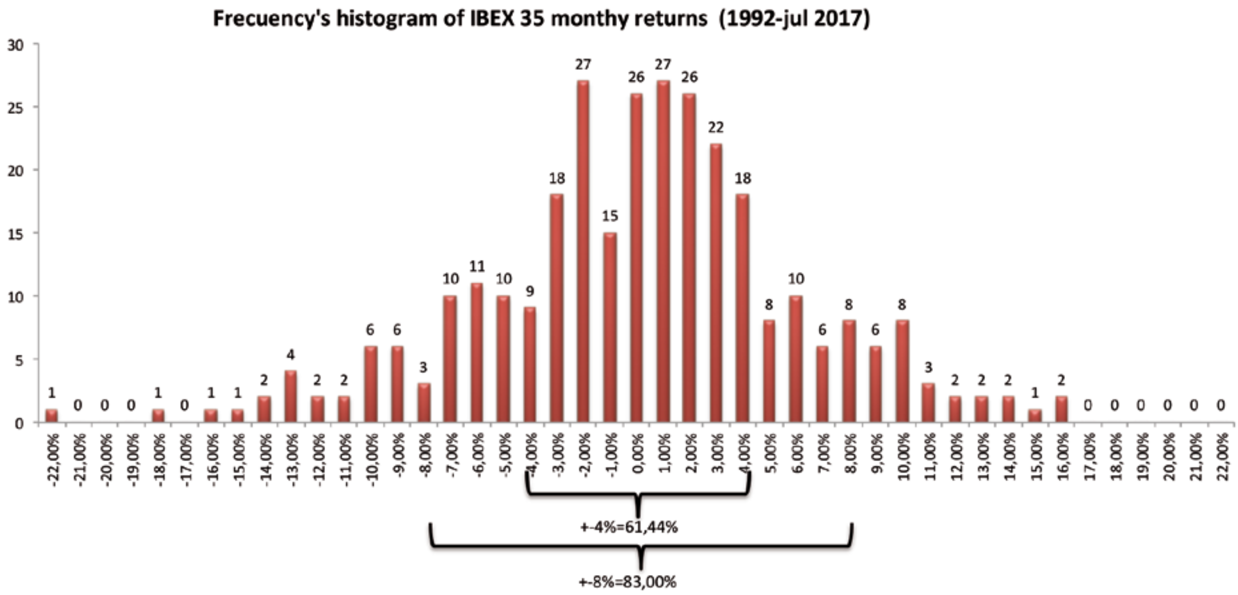


Table 5: Histogram of monthly frequencies 1992-July 2017.
Source: in-house preparation.

• The third reason why the indices of sold options are interesting is because **the passage of time favours the sellers of options**. The time until maturity is one of the factors that affects the value of options. Options lose value for every day that goes by and as the maturity date approaches, they lose more. The selling positions benefit from this, as they receive money every day that goes by, as if it were accrued interest on a bond. For this reason all the indices of sold options are done with a maturity of one month, which have more Theta, to earn more over the passage of time.

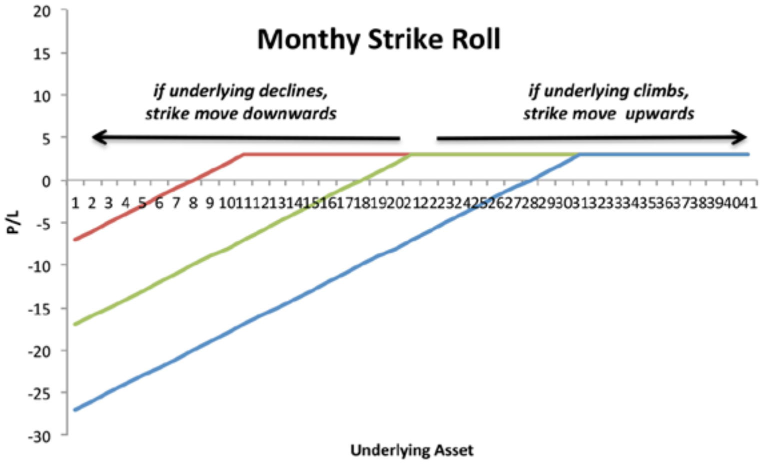
• **In the case of options, the risk is more controlled than the underlying asset**. The reason being that they have a higher delta, this means that they move less when beneficial, but also when harmful. The downward movements, as we have seen, are particularly violent. A fall of a few days may have been preceded by a bullish position and this is when the problem of asymmetric losses occurs. These asymmetric losses are something that is very obvious that everybody knows about, however, not everyone seems to want to place a limit on them. An asset dropping from 10 to 5, loses 50%, however, returning to the original position of 10 means an increase of 100%. See Table 6.

Loss	Recovery
-5%	5.26%
-10%	11.11%
-20%	25.00%
-30%	42.86%
-50%	100.00%
-75%	300.00%

Table 6: Asymmetrical losses. Source: in-house preparation.

If an asset has a high volatility, it is possible to earn a lot of money with it at the right time, but is also possible to lose a lot and if a lot is lost, it is very difficult to recover.

• **Re-strike constant of the positions**. Where options are sold, the gains side is limited and a loss side is left unlimited. As we have previously mentioned this is something that frightens beginners, when in reality all the investments usually have a period of investment, there are no unlimited gains or unlimited losses. The same occurs when options are sold, a monthly maturity is used and as we have seen both the possible losses as well as possible gains are limited. Once the month has passed another option is resold, but the strike price is adjusted. For example, in the IBEX 35 PutWrite index, when the IBEX 35® future of the first maturity is at 10,000, the Put of the first maturity is sold at a strike price of 9,800. If the future that month falls to 9,000 points, the following Put is sold at 8,800. And so forth, the different strike options roll over every month, as we can see in the Graph 24.



Graph 24: Rollover of a Put sold at different strike prices.
Source: in-house preparation.

- **The higher the volatility, in other words, the more the index falls, the more premium that is earned**. The rollover of sold options is very interesting when the underlying asset falls substantially, because even though the position has lost money, when selling the option of the following maturity this is done at very high prices and earns a lot more. As we have mentioned, the shocks to volatility have an effect in the short term, and the situation corrects itself afterwards. Therefore, if the underlying asset drops significantly, a lot more will be earned in the sale of the new options and when the market calms down the volatility will decrease. In Table 7 we can see the premium of 98% Put options at a maturity of one month with several levels of volatility.

Volatility	Premium
10.00%	0.40%
15.00%	0.88%
20.00%	1.40%
25.00%	1.94%
30.00%	2.49%
35.00%	3.04%
40.00%	3.60%

Table 7: Premium of 98% Put with 30 days until maturity for different levels of volatility. Source: In-house preparation.

7. Performance *Data* of the Strategic Indices with IBEX 35® Options

We shall begin by analysing the general dates from the period January 2007 to July 2017. During this period of time there have been bullish and bearish periods of all types. There have been shocks of greater or lesser severity where the volatility has reacted differently: the Bankruptcy of Lehman Brothers, bailouts of Ireland and Cyprus, the Spanish banking sector bailout, China, Russia, etc., therefore, we consider that the selected period is sufficiently extensive and representative in order for the reader to have an idea of the performance that these indices may have in the future.

In table 8 we can see how the strategic indices may have Better or worse performance over the period, but what they do have is, and this is true for them all, less volatility than the IBEX 35® with Dividends (IBEXCD).

We have also calculated the Sharpe Ratio. A simplified version has been used with the accumulated return and without taking into account the interest rate, in order to better compare all the indices given that the binomial return/risk is summarised in a single data. Not only is the return important, but also the amount risk assumed to achieve it. The Sharpe Ratio penalises the return obtained for the volatility. It is clearly observed how many indices that improve the return from the IBEXCD, do so with less volatility, which is even more valuable. We have calculated the Sharpe Ratio:

$$R.Sharpe = \frac{\mathrm{Re}\,turn}{Volatilility}$$

We have also calculated the Calmar Ratio, which functions in the same manner as the Sharpe Ratio, but rather than penalising for volatility, it penalises for DrawDown.

$$R.Calmar = \frac{\mathrm{Re}\,turn}{DrawDown}$$

The DrawDown measures the difference from maximum to minimum over a specific period, normally three years and is a particularly useful metric. It is widely used in the asset management industry in order to know how much would be lost if one had the misfortune to enter into the product at the worst possible moment (maximums) and leave also at the worst possible moment (minimum). This would be bad luck, but sometimes it happens.

Note that instead of three years we have used the whole period, 10.5 years. Whereas a position invested in an IBEX 35® basket would have had to bear a loss of up to 54%, the strategic initiatives with the sales of options have a significantly lower DrawDown. This is perfect proof that these indices have better control over the risk.

It should be noted that the indices whose volatility and DrawDown metrics are more similar to the IBEXCD are the IBEX 35 BuyWrite Index and the IBEX 35® Protective Put index. The reason is that they are invested in the IBEX 35® with Dividends (IBEX 35 Futures).

	Return	Volatility	DrawDown	Sharpe	Calmar
IBEX 35 TOTAL RETURN	24,72%	24,70%	-54,44%	1,0004	0,454033558
IBEX 35 PUTWRITE	56,48%	14,60%	-25,93%	3,8699	2,178061822
IBEX 35 BUYWRITE	60,38%	18,75%	-39,23%	3,2196	1,53927742
IBEX 35 PROTECTIVE PUT	-55,17%	15,61%	-63,97%	-3,5352	-0,862394691
IBEX 35 SHORT STRANGLE (IVS)	90,54%	14,37%	-28,00%	6,3020	3,233230829

Table 8: Performance data, Volatility,DrawDown, Sharpe Ratio and Calmar Ratio for all the strategic indices from January 2007 to July 2017. Source: in-house preparation.

If we analyse this in greater detail, year-on-year, we would have the data in Table 9. It should be noted that the indices appearing in the calculation for the nine years have a very high total return, although they do not beat the IBEXCD every year, it is simply that when they rise, they usually rise less, but when they fall, they also fall less. This way, very interesting returns can be achieved in the long term.

Returns	BUYWRITE	PUTWRITE	PROTECTIVE PUT	SHORT STRANGLE	IBEX TOTAL RETURN
2007	8,72%	6,95%	4,51%	6,15%	8,80%
2008	-23,76%	-15,10%	-23,99%	-0,04%	-36,50%
2009	26,14%	21,75%	2,66%	13,21%	38,27%
2010	-1,07%	-2,68%	-19,20%	13,26%	-14,44%
2011	7,13%	9,95%	-22,90%	27,94%	-8,06%
2012	5,94%	5,24%	-13,66%	10,32%	0,90%
2013	7,24%	3,39%	12,79%	-11,58%	23,48%
2014	4,05%	0,55%	3,14%	-5,33%	10,33%
2015	-4,97%	1,16%	-10,96%	0,43%	-4,27%
2016	7,84%	9,46%	-10,39%	11,56%	5,08%
JUL 2017	14,96%	7,67%	3,58%	7,93%	14,34%

Table 9: Annual returns. Source: in-house preparation.
Green indicates the best performing and red indicates the worst.

Table 10 below details the annual volatilities, where it can be clearly appreciated, thanks to the colours used, how the IBEXCD index is the most volatile every year, and the strategic indices that use it as a base (BuyWrite y Protective Put) are also repeatedly the most volatile.

Volatilities	BUYWRITE	PUTWRITE	PROTECTIVE PUT	SHORT STRANGLE	IBEX TOTAL RETURN
2007	13,76%	9,86%	10,16%	9,65%	16,99%
2008	29,52%	22,48%	24,85%	21,17%	34,62%
2009	15,43%	11,35%	16,59%	13,15%	24,50%
2010	26,01%	23,07%	14,71%	21,54%	30,71%
2011	19,35%	15,38%	16,70%	14,29%	27,41%
2012	18,43%	14,27%	17,33%	13,54%	27,80%
2013	13,79%	10,33%	11,89%	11,17%	18,83%
2014	13,59%	10,12%	13,31%	12,15%	19,13%
2015	17,21%	13,16%	12,09%	13,05%	21,45%
2016	17,63%	12,52%	15,87%	12,07%	24,75%
JUL 2017	27,57%	20,76%	24,38%	21,26%	36,91%

Table 10: Annual volatilities. Source: in-house preparation. Green indicates the index with least volatility and red the most volatile index that year.

In Table 11 we wanted to show the reliability that these strategic indices have had throughout the selected period. Every month options are bought and sold and until the maturity date arrives nothing happens. It is interesting to see what happens at the time of the rollover, in other words, whether they earn or lose money each month.

	Hit	Fail		Hit	Fail
BUYWRITE			IBEX TOTAL RETURN		
Months	84	43	Months	73	54
Percentage of times	66,14%	33,86%	Percentage of times	57,48%	42,52%
Average	3,34%	-5,07%	Average	4,73%	-5,50%
Math Expectation	0,49%		Math Expectation	0,38%	
	Hit	Fail		Hit	Fail
PUTWRITE			SHORT STRANGLE		
Months	95	32	Months	83	44
Percentage of times	74,80%	25,20%	Percentage of times	65,35%	34,65%
Average	2,02%	-4,33%	Average	2,74%	-3,50%
Math Expectation	0,42%		Math Expectation	0,58%	
	Hit	Fail			
PROTECTIVE PUT					
Months	52	75			
Percentage of times	40,94%	59,06%			
Average	3,59%	-3,41%			
Math Expectation	-0,55%				

Table 11: Monthly behaviour of successes and failures.
Source: in-house preparation.

One interesting data from the above table is the mathematical expectation, which we have also calculated in a simplified version:

$$ME = (P_+ \times \mu_+) - (P_- \times \mu_-)$$

Where:

P_+ = Win Probability

μ_+ = Average amount earned

P_- = Loss Probability

μ_- = Average amount lost

In order to consistently earn money in the financial markets over time, the mathematical expectancy must be positive. The figure resulting from the above calculation indicates how much is earned on average for each transaction carried out. If the mathematical expectation is negative then it would be better to dedicate oneself to something else. Using the above formula it is possible to deduce the manners in which this expectation can be positive:

1. Have a much higher success rate than failure rate.
2. If the success rate is similar to or lower than the failure rate, it is necessary that the average amount earned when successful is higher than the average amount lost when failing.

This is the basis of trading, the famous phrase of "cut your losses short, but let your profits run on" is nothing more than a colloquial expression to explain that you need to have a positive mathematical expectation.

For example, we analyse the Mathematical Expectation (ME) of two of the strategic indices, and we see two types of behaviour that generate a positive ME:

1. **The IBEX 35 Short Strangle Index (IVS).** By having a gap between the two strike prices of 4% plus the earned premiums, this makes the distance between the two breakeven points at which point money is lost very wide. Only if during the month the index rises a lot or drops a lot does this generate a failed transaction. As we have previously seen, this occurs on very few occasions, therefore this index has a success rate of 65.35%, earning an average of 2.74%, whereas the times it has lost, the average loss has been -3.5%. The average return is smaller than the average loss, but it is successful more often than it fails, therefore, what generates the positive mathematical expectation is the success rate.

2. **The IBEX Protective Put Index**. This is an index that loses money over the long term, and although the mathematical expectation is negative, this case is worthy of mention due to the behaviour observed in the index, it would be another way of generating positive ME (although in this case it does not). You will notice that it is successful on a few occasions, however, the times it is successful it has a higher return. This is because the IBEX 35® with Dividends has, in net terms, been bullish, and the money spent on the purchase of the Put option to protect the portfolio has been wasted on the majority of occasions, however, when the market falls, it does so sharply and on those few occasions it recovers quite well.

Therefore, there are two methods for generating positive ME: (1) be successful more often than not, although every time money is lost, more money than that earned is lost. The amount of successes compensates for this. (2) It is successful less often than it fails, although when it is successful, a lot more is earned. In this case the percentage of earnings offsets the lack of successes.

We could not end this chapter without mentioning one of the most important aspects of these indices, which is the huge advantage that they offer by being included in a portfolio (one or more of them). It is necessary to talk about correlation.

All the above mentioned indices, in terms of market correlation, can be classified into three groups:

- **Positive Correlation** These are bullish indices such as the IBEX 35 PutWrite, IBEX 35 BuyWrite and IBEX 35 Protective Put. These could be added to the long portfolio in the Spanish market, although it would be best to replace part of the bullish portfolio for these positions. If it is a one off situation, the IBEX 35 Protective Put index could be used, but if it is for a recurring situation, the IBEX 35 BuyWrite or IBEX 35 PutWrite indices would be more appropriate.

- **Low correlation.** The IBEX 35 Short Strangle, as these are short volatility strategies, which at the beginning of the month are at Delta Zero, they have a very low correlation with the market. Just by including this index to the portfolio, as if it were an asset more, it lowers the volatility of the portfolio and improves the total return thanks to the "alpha" that it generates.

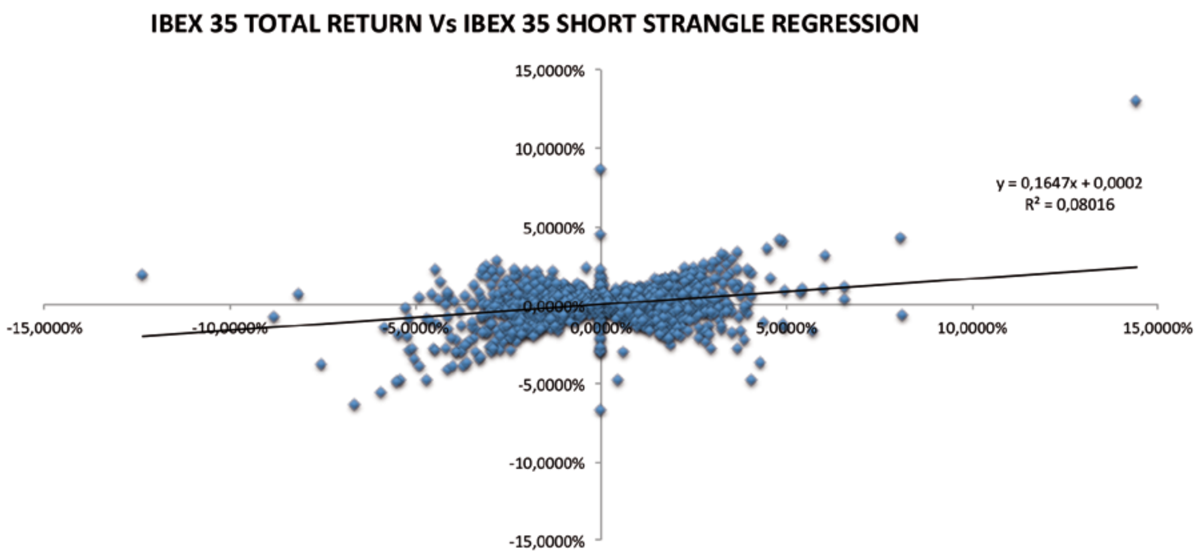
- **Negative Correlation.** The IBEX 35 Short Strangle and the IBEX 35 Protective Put Index have a slight negative correlation, practically zero. It could be said that they have no linear relationship.

Correlation	BUYWRITE	PUTWRITE	PROTECTIVE PUT	SHORT STRANGLE	IBEX TOTAL RETURN
BUYWRITE	100,00%	93,98%	67,50%	63,12%	84,16%
PUTWRITE		100,00%	49,55%	70,78%	77,48%
PROTECTIVE PUT			100,00%	-12,15%	78,47%
SHORT STRANGLE				100,00%	28,31%
IBEX TOTAL RETURN					100,00%

Table 12: Matrix of Correlations for Strategic Indices. Source: In-house preparation.

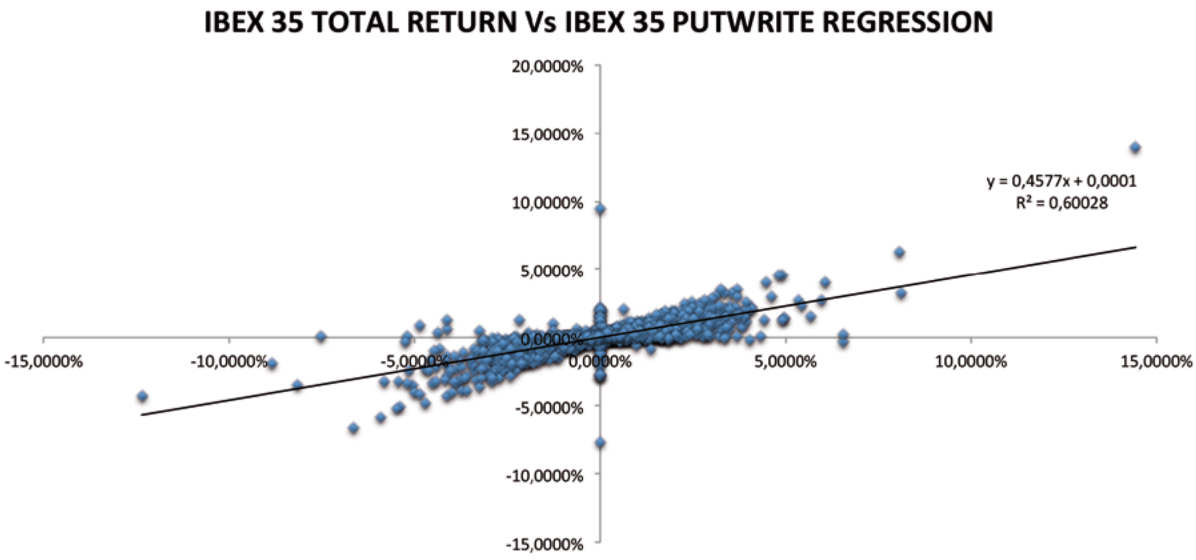
Below follows the graphs that detail the regression of the above mentioned indices with regard to the IBEXCD.

Graph 25 shows an example of an index which has very little relationship with the IBEXCD. In fact, the regression tells us nothing, given that both assets seem to be independent, at least linearly.



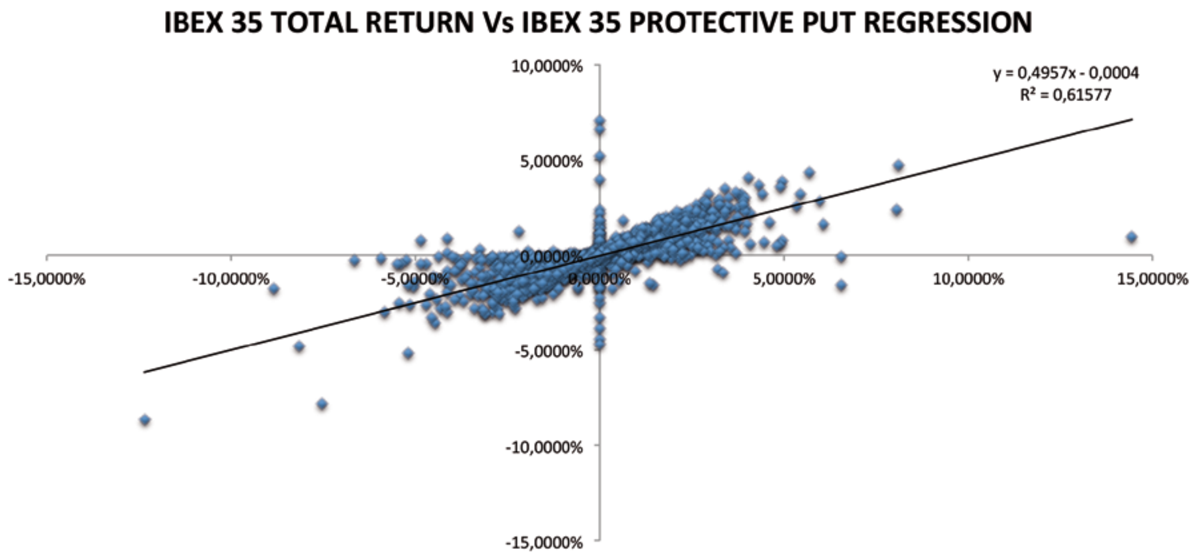
Graph 25: Regression of the IBEXCD and IBEX 35 Short Strangle index. Source: in-house preparation.

Graph 26 shows an example of an index which has a certain positive relationship with the Index. Although the goodness-of-fit coefficient (R2) shows low levels, graphically we can appreciate how the risk is much lower ("Beta" falls from 45.77%) and it generates returns that improve the index on a recurring basis (positive "Alpha").

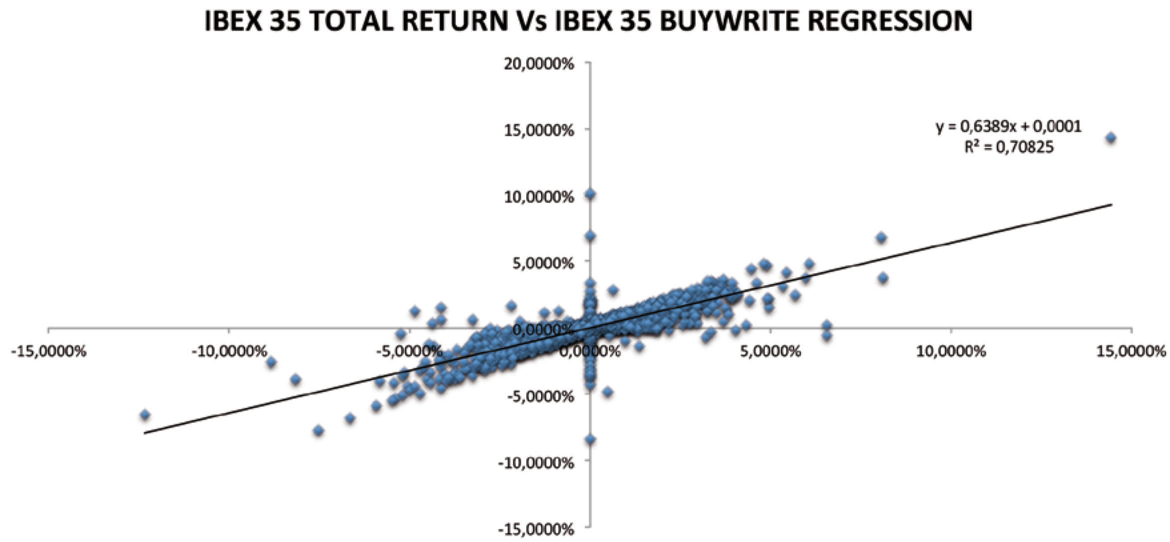


Graph 26: Regression of the IBEXCD and IBEX 35 PutWrite. Source: in-house preparation.

Lastly, two final graphs to represent the IBEX 35 Protective Put and IBEX 35 BuyWrite indices. We can observe in both graphs (Graphs 27 and 28).



Graph 27: Regression of the IBEXCD and IBEX 35 ProtectivePut. Source: in-house preparation.



Graph 28: Regression of the IBEXCD and IBEX 35 BuyWrite. Source: in-house preparation.

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