Hedging Adaptive Put Writing with VIX Futures:
The Affenpinscher Strategy.

Chrilly Donninger
Chief Scientist, Sibyl-Project

Sibyl-Working-Paper, May 2014
Revision 1: 2014-06-18
http://www.godotfinance.com/

*The **affenpinscher** is a terrier-like toy bread of dog. The breed was created to be a ratter, working to remove rodents from kitchens, granaries, and stables.*
They are active, adventurous, curious, and stubborn, but they are also fun-loving and playful. The breed is confident, lively, affectionate towards family members and is also very protective of them.
This dog is mostly quiet, but can become very excited if attacked or threatened, and shows no fear toward any aggressor.
(en.wikipedia.org/wiki/Affenpinscher)

Abstract:
In a previous working paper I analyzed the Austrian and Doberman Pinscher strategy ([1]). The Austrian is an adaptive Put Writing strategy. One hedges the short position with a long Put with a lower strike. The Doberman is more aggressive. The long hedge is omitted. The risk is in both cases reduced by entry and exit conditions. The Affenpinscher uses the same general framework. But the hedging is done with long VIX Futures. There are several VIX Futures available. One selects the VIX Future with the lowest roll-value. The roll-value is a concept developed in [2].
The overall performance of the Affenpinscher is between the Austrian and Doberman Pinscher. The Pinscher strategies have generally an attractive performance. The best choice within the family is a matter of risk appetite.

Revision 1:
Revision 1 extends the historic simulation for the SPX Options till 2014-06-13. As the original parameters are not changed we perform an out of sample test. The attractive properties of the strategy are confirmed. Revision 1 is added before the Conclusion of the original paper. A similar update has been done for the other Pinscher strategies. For comparison of the latest results see [1].

Introduction:
Note: Readers familiar with [1] can skip the introduction.
There is a vast strand of literature about the fact that the implied volatility of S&P-500 index options overestimate the realized volatility of the S&P-500. This relation is only reversed in serious crashes. The majority of this literature is part of the efficient markets debate. The authors try to find an explanation which is consistent with the efficient market dogma. This is from the point of view of a hedge fund quant a theological discussion. The really interesting question is how to exploit this fact.
The most basic strategy is the CBOE S&P 500 PutWrite Index. One writes each 3rd Friday a fully collateralized ATM Put. The Put is kept till expiry on the next 3rd Friday ([3]). It is shown in [4] that the PUT index clearly outperforms the S&P-500 from July 1986 till September 2008. But it should be noted that the final date of this time range is somewhat strange. Although the paper was published in Spring 2009 the investigation stops before the October 2008 massacre.
The group of Prof. Larcher at the University of Linz/Austria has published a series of papers (the most important are [5],[6]) about a practical feasible strategy which survives such events as the 2008 crash. These strategies are also applied in real fund live.

The rules of the Larcher Strategy are:
1) The short Puts are OTM.
2) The short Puts are hedged by a far OTM long Put position. Larcher et. al. mention the possibility of a naked short position. But no results are reported.
3) There are two stop-loss criterion's:
3a) If the underlying moves below K*Strike of the short Put. K is a parameter around 1.0.
3b) The current (mark-to-market) loss of the position is above a given percentage of the available cash. Only this criterion is in the strict sense a Stop-Loss. But practically 3a) is more important. There is of course a close relationship between 3a) and 3b).

There are several measures for OTM. The most simple one is a given percentage of the underlying. A standard setting of the Larcher papers is SPX * 0.98. At of this writing the S&P is at 1872. This would correspond to a strike of 1835 or 1830. Another measure is to scale with the current VIX value. The paper mentions SPX * (1.0 – 0.1*VIX).
Note: The VIX is usually quoted in percent. In the usual quotation the factor should be 0.001.

Another possibility investigated in [5],[6] is to scale with the realized volatility of the last month.

In a recent paper about Covered Call Writing ([7]) and in [1] I used the Black-Scholes delta as the OTM measure. The delta performed consistently better. It is especially for Puts the natural OTM measure. The VIX scaled measure is similar. But the VIX is an (model-free) average over the whole range of options. As the slope of the smile increases in times of troubles, the delta is more up to the point for OTM options trading. In [1] and [7] an additional Stop-Loss and Entry criterion was added. It is based on the Implied-Volatility-Term-Structure IVTS. The IVTS was developed and successfully applied in a series of previous working papers (see [2],[8] and the references herein). It is also applied with success in real trading live of the Sibyl fund. The IVTS is the relation between the short and long-term implied volatility. There are several possible combinations (see [8]). The most simple one is the relation between the 1-month VIX and the 3-month VXV.

```
IVTS(t) = VIX(t)/VXV(t)
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The IVTS is usually smaller than 1.0. But in times of troubles the VIX explodes much faster than the VXV and the value can go up till 1.5. The IVTS was smoothed in [8] with a median-5 filter. This filter removes short (up to 2 days) implied-volatility spikes. This avoids short term whipsaws. The downside is that one reacts too late to market regime transitions. The median-5 filter improved the result in [8] considerable. This is also the case for Put Writing.
A high IVTS marks an unfavorable market regime for a PutWrite strategy. A new position is not entered if the IVTS is above a given threshold. The IVTS is also used as a Stop-Loss criterion. If the IVTS is above the exit threshold (which has to be higher than the enter level) one closes additionally to the conditions 3a) and 3b) the position.
In the Larcher papers the position is entered like for the PUT index each 3rd Friday. Without a Stop-Loss the position is kept till the next 3rd Friday. In case of a premature Stop-Loss one stays till the next regular entry date on the sideline.
In [1] and [7] the position was rolled over already 2 days before on the Wednesday before the 3rd Friday. One reason for this rule was (and is) a technical one. The available time-series contain only data for the close at Thursday. There is no opening-quotation for the 3rd Friday available. Rolling over on Wednesday also seems to be the more realistic trading behavior. Only a fraction of the open positions is kept till expiry.

Hedging with VIX Futures:

In [1] it was noted under "further work": *Another interesting combination could be a short Put and a long VIX Futures position. Instead with a long Put one hedges with VIX Futures. This combination is probably only for the SPX a viable alternative. The motivation of this hedge is that the VIX represents an implied-average. The implied volatility of the far OTM long Put is higher. But VIX futures have their own logic and only an empirical investigation can answer this question.*

The behavior of VIX Futures was studied in detail in [2]. The paper developed the concept of a VIX roll-value. The role value is based on the difference between the VIX Future and the underlying VIX. This value is usually positive, VIX futures trade in normal times in contango. This reverses only in times of troubles. The distance is larger for Futures with longer maturities. If one wants to find the Future with the largest roll-value, one has to normalize the difference. According to [2] the best formula is:

```
R(t) = ((VXF(t) - VIX(t))/VXFVola(t))/TTS(t)   (1)
VXF … VIX Future Price.
TTS … Trading Days till Settle (expiry).
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In (1) the basis is normalized by the volatility of the VIX future.

```
VXFVola(t) = sqrt(sum(DeltaVXF(t-i)^2)/10) i=0...9    (2)
```

The Calvados strategy developed in [2] trades a short Futures position. In this case one selects the Future with the largest roll-value. The Affenpinscher goes the VIX Futures long. One selects the Future with the lowest roll-value to minimize the hedging costs.

Results:

The short position is set exactly like in [1]. The OTM delta of the short Put is -0.22. The closest strike with a delta >= -0.22 is selected. The exit-Factor is 1.01. Once the underlying is below 1.01*strike of the short Put the position is closed. Condition 3b) is set to 15% of the available cash. This condition is never triggered, because the other 2 Stop-Loss rules are stronger. The position is also closed if the median-5 filtered IVTS is above 1.05. The enter threshold is 1.0. A position is not entered if the IVTS is above 1.0. The Pinschers are in the 2008 crash quite alert. The position is closed at 2008-09-11. One stays till 2008-12-15 on the sideline.

The initial cash is 500.000$. This is an arbitrary number used in previous studies. The PutWrite Index and also the Larcher strategies are fully collaterialized. The volume is calculated as

```
Vol =  Cash*K/(Strike*100.0)
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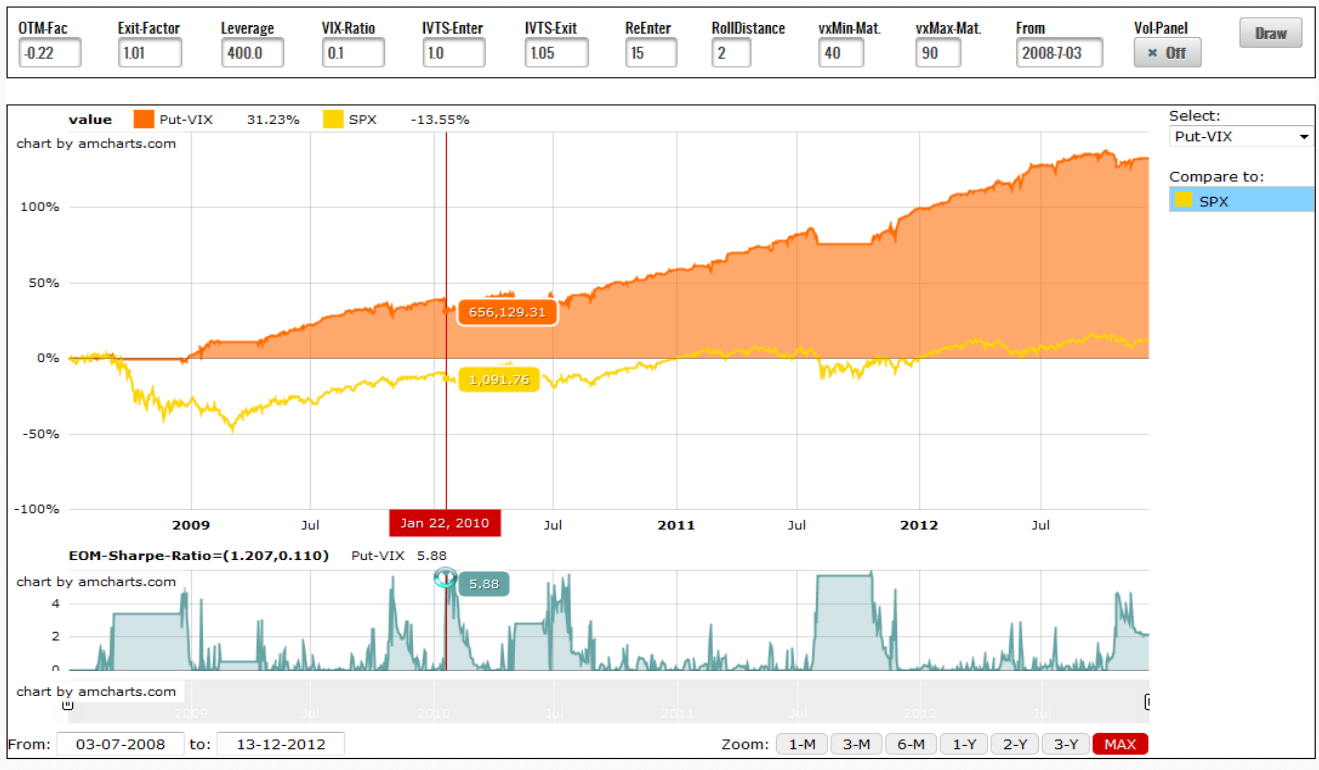
K == 1.0 for a fully collateralized position. One would even survive a naked position if the S&P falls to Zero. Following [1] the current calculations uses a K of 4.0. The Puts are much more OTM. Although the strategy has a quite attractive Sharpe-Ratio, the returns would be for a fully collateralized position not very impressive. The setting K==4.0 corresponds to the leverage which is used in the Sibyl-Fund for already traded positions.

As an additional rule the position is rolled down after a stop loss, if the maturity is larger than 2 weeks. If the maturity is less than 2 weeks it does not pay the fuss and risk. But the IVTS must be – like for the regular rollover – below the enter threshold of 1.0. If the Stop-Loss happens because the IVTS is above 1.05 no roll-down is done. Only the conditions 3a) and 3b) can trigger a roll-down. The roll-down

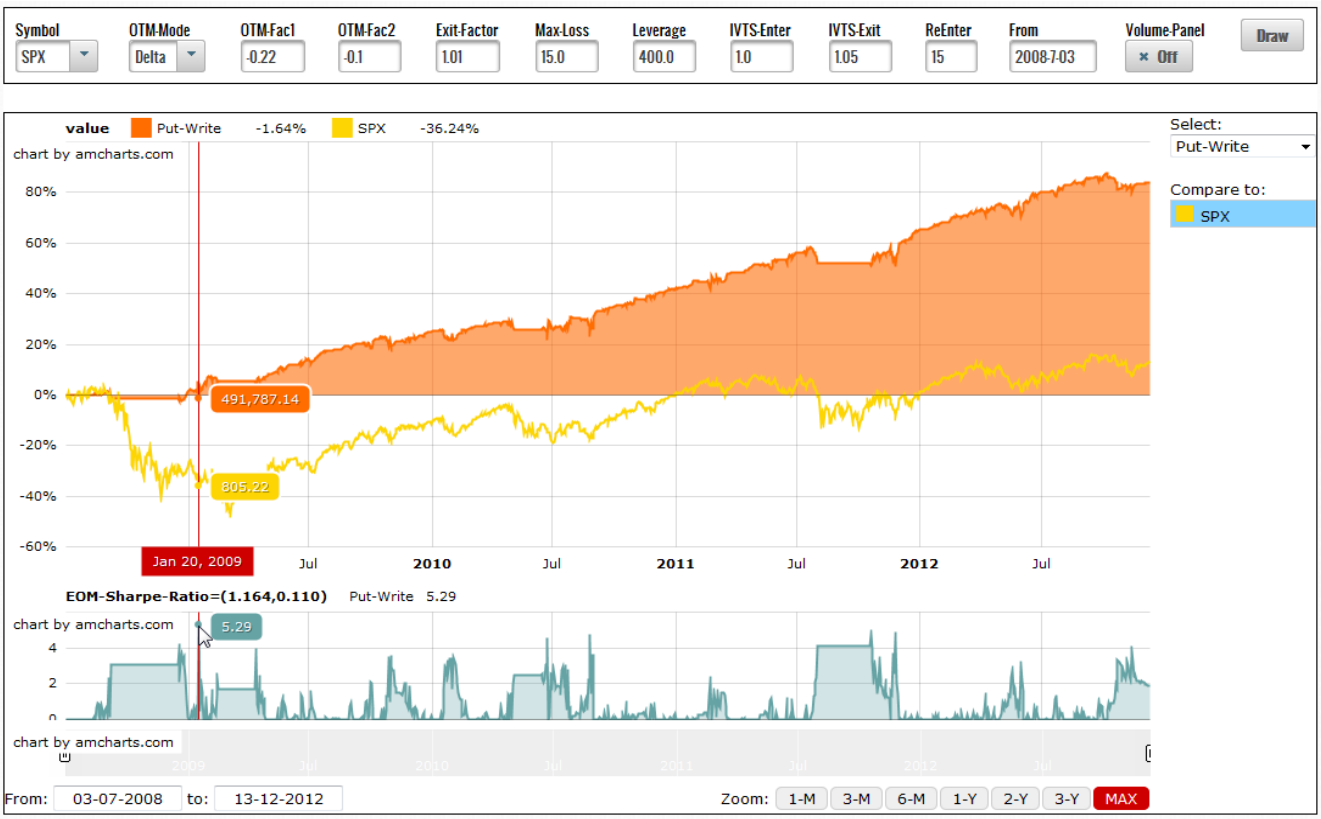
strike is determined as before with the BS-delta. It is due to the shorter maturity closer to the underlying (this depends of course also on the volatility). This demonstrates the superiority of the delta-measure. For the measures used in the Larcher papers one would have to define different OTM factors for the roll-down. This is probably one of the reasons why the roll down is postponed to further studies.

Following [5] and [6] the price of the short option is set to
`2/3*bid + 1/3*ask`
and
`2/3*ask + 1/3*bid`
for the closing long. This models the bid-ask spread. No additional trading costs are taken into account.

In the Austrian Pinscher strategy of [1] one buys for each short Put a long position with a lower strike. In the Affenpinscher one hedges with long VIX Futures. For the historic simulation the ratio of Puts to Futures was set to 10:1. This corresponds directly to the $ Multiplier of 100 and 1000. But there are of course also other ratios possible. The maturity is in the range 40 to 90 calendar days. There is usually a choice between 2 to 3 different Futures.
Graphic-1 shows the performance from 2008-07-13 till 2012-12-11. The time range is dictated by the available data. The results for the other Pinscher start at 2007-12-03. But I had only Futures data from VX_U08 onwards available. Graphic-2 shows for comparison reason the performance of the Austrian Pinscher.
The overall win of the Affenpinscher is 132.5% (83.8%), the Sharpe-Ratio is 1.21 (1.16) and the max. relative Drawdown is 5.9% at 2010-01-22 (5.3% at 2009-01-20). The numbers is parenthesis are for the Austrian. The Austrian had a much smaller drop at 2010-01-22. The S&P-500 was going down gradually. Volatility went up modestly. Volatility explodes only in a sharp crash. The VIX Futures hedge only against this scenario. The IVTS stop-loss is also only triggered in a sharp crash like in Aug. 2011. The movement was also not large enough for the other exit conditions.



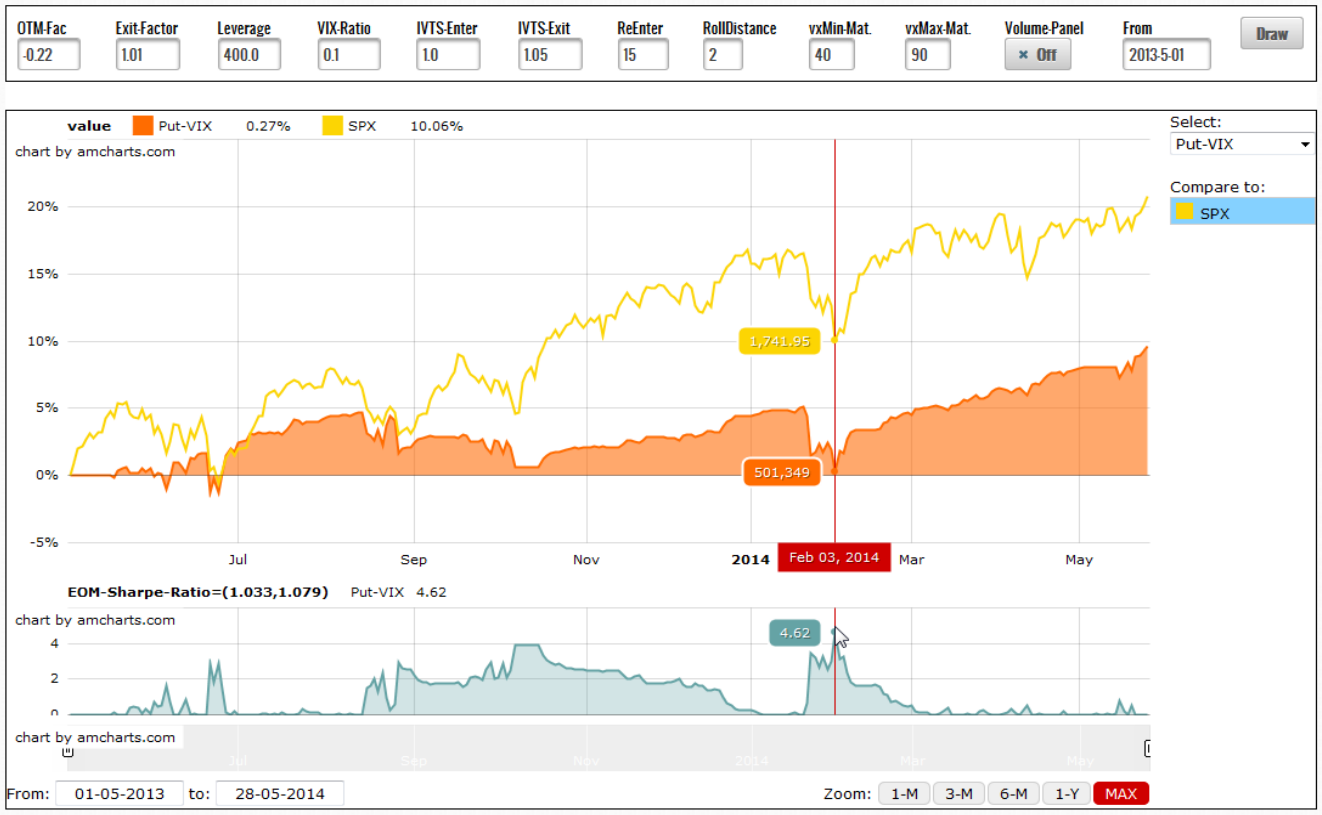
Graphic-1: Affenpinscher (orange) and SPX Index (yellow) from 2008-07-03 till 2012-12-11



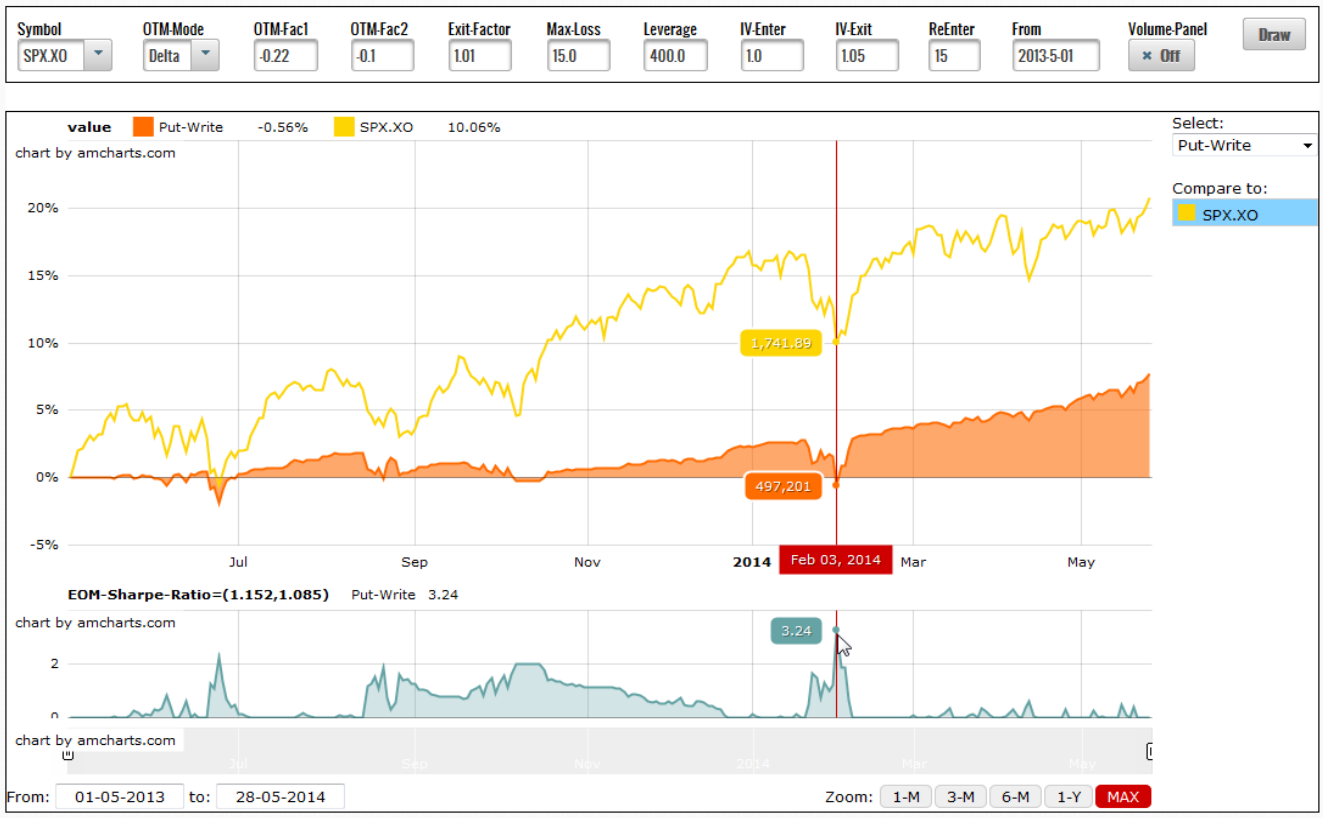
Graphic-2: Austrian Pinscher (orange) and SPX Index (yellow) from 2008-07-03 till 2012-12-11

The HF Affenpinscher:

The historic simulation was so far based on a daily time-series. The exit conditions are only tested at the close. Usually the underlying has already moved (far) below the exit threshold. But it can also happen that the price moves intraday below the threshold and is at the close above. It is very likely that one looses overall some extra money by reacting too late. But this can happen also in real trading live.
The main problem of the previous study is that the SPX time-series ends already in Dec. 2012. I have collected real-time HF-data from IqFeed. Unfortunately this data are only available since May 2013. The strikes have only be collected in 25 increments. These 25 modulo 0 strikes (1600, 1625, 1650 ….) have for OTM Puts a (much) higher volume than the strikes in between. As the download capacities are limited I concentrated on the 25 modulo 0 strikes. The effect of this selection is that the actual delta is usually below the thresholds. If one has the full range of strikes available the delta is in contrast quite close to the target value.
As there are HF data available the exit triggers are tested intraday every 15 minutes. It is also an out of sample test. The parameters of the strategy were first determined with the daily data and then applied to this sample. The whole Affenpinscher can be partly considered as an out of sample test because the basic parameter setting is from the previous Put-Write study of [1]. But the main performance factor is the short Put position which is in both cases the same.
The performance of the HF Affenpinscher is from 2013-05-01 till 2014-05-27 9.6% (7.7% for the Austrian). The Sharpe Ratio is 1.03 (1.15) and the max. relative Drawdown is on 2014-02-03 4.6% (3.2%). All Pinschers outperform the S&P-500 in the first time-range by a wide margin. In the last year it is the other way round. The S&P-500 gains in the same time period 20.8%. But it should be noted that the Sharpe-Ratios are similar. The Austrian is a little bit above the index, the Affenpinscher a little bit below.



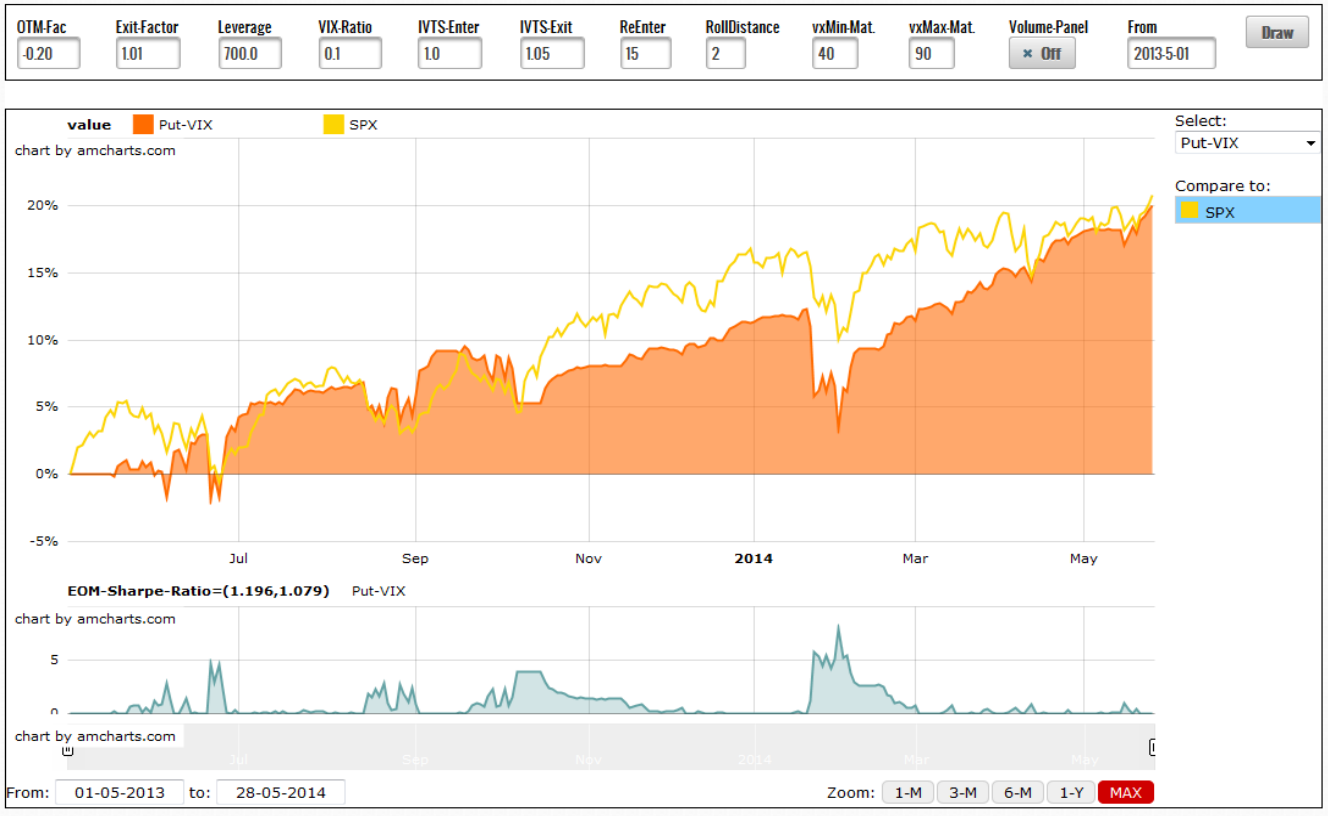
Graphic-3: HF-Affenpinscher (orange) and SPX Index (yellow) from 2013-05-01 till 2014-05-27



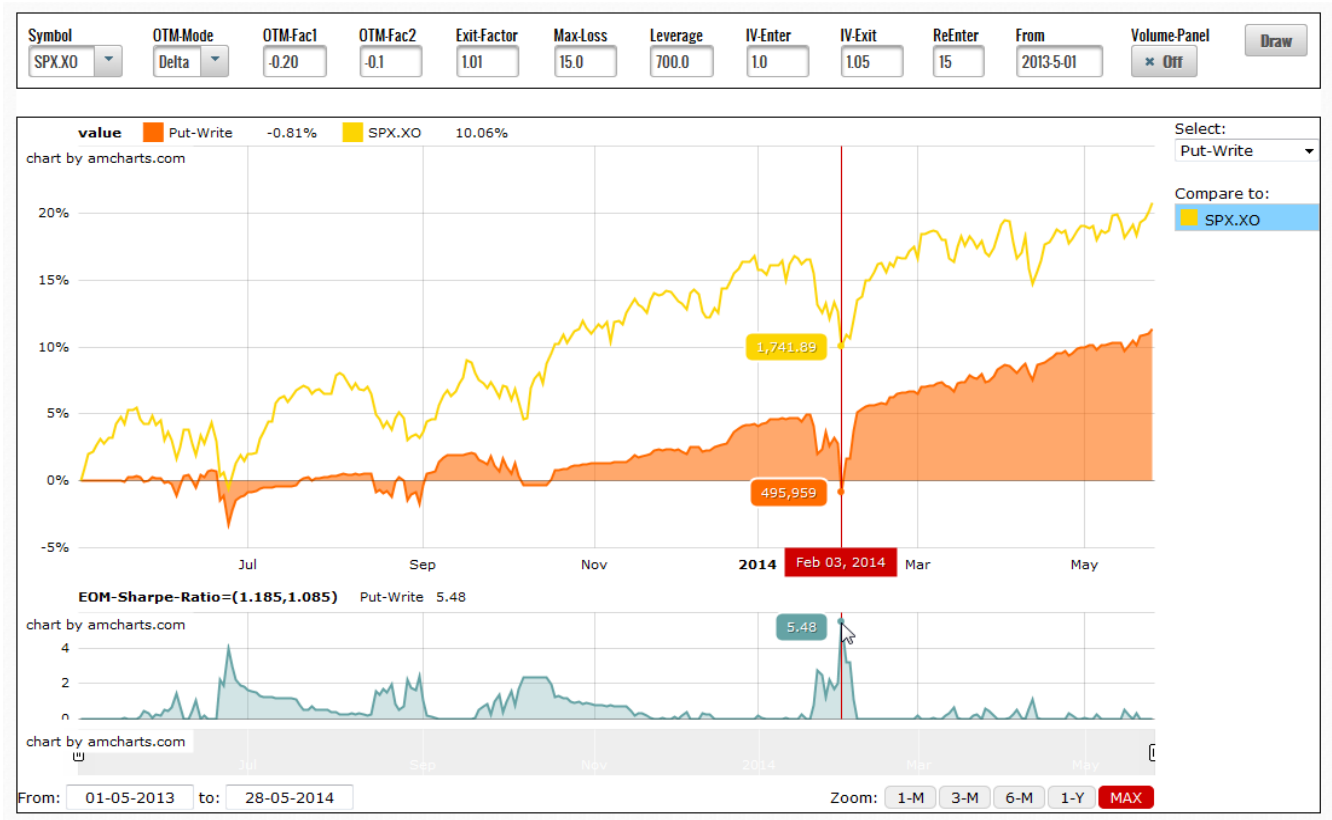
Graphic-4: HF-Austrian Pinscher (orange) and SPX Index (yellow) from 2013-05-01 till 2014-05-27

One has to increase the leverage to K==7.0 to catch up with the S&P-500. Graphic-5 shows the performance of the Affenpinscher. Delta is additionally set to -0.2. The Austrian performs with this delta also somewhat better (Graphic-6).
Note: This was already known in [1], but the goal was to find a value which performs for all scenarios including the Nasdaq stocks well.

The performance of the highly leveraged Affenpinscher is 19.9% (11.4%), the Sharpe-Ratio is 1.2 (1.19) and the max. relative Drawdown is on 2014-02-03 7.9% (5.5%). The Sharpe-Ratio is with a Delta of -0.2 now better than for the S&P-500. But it should be noted that the max. relative Drawdown of the index is with 5.8% lower than for the Affenpinscher. The Futures were not going up fast enough. The Austrian Pinscher does not so readily scale up with the leverage. The long Puts hedge the position fine but they also limit the overall win potential considerable.



Graphic-5: HF-Affenpinscher K==7 (orange) and SPX Index (yellow) from 2013-05-01 till 2014-05-27

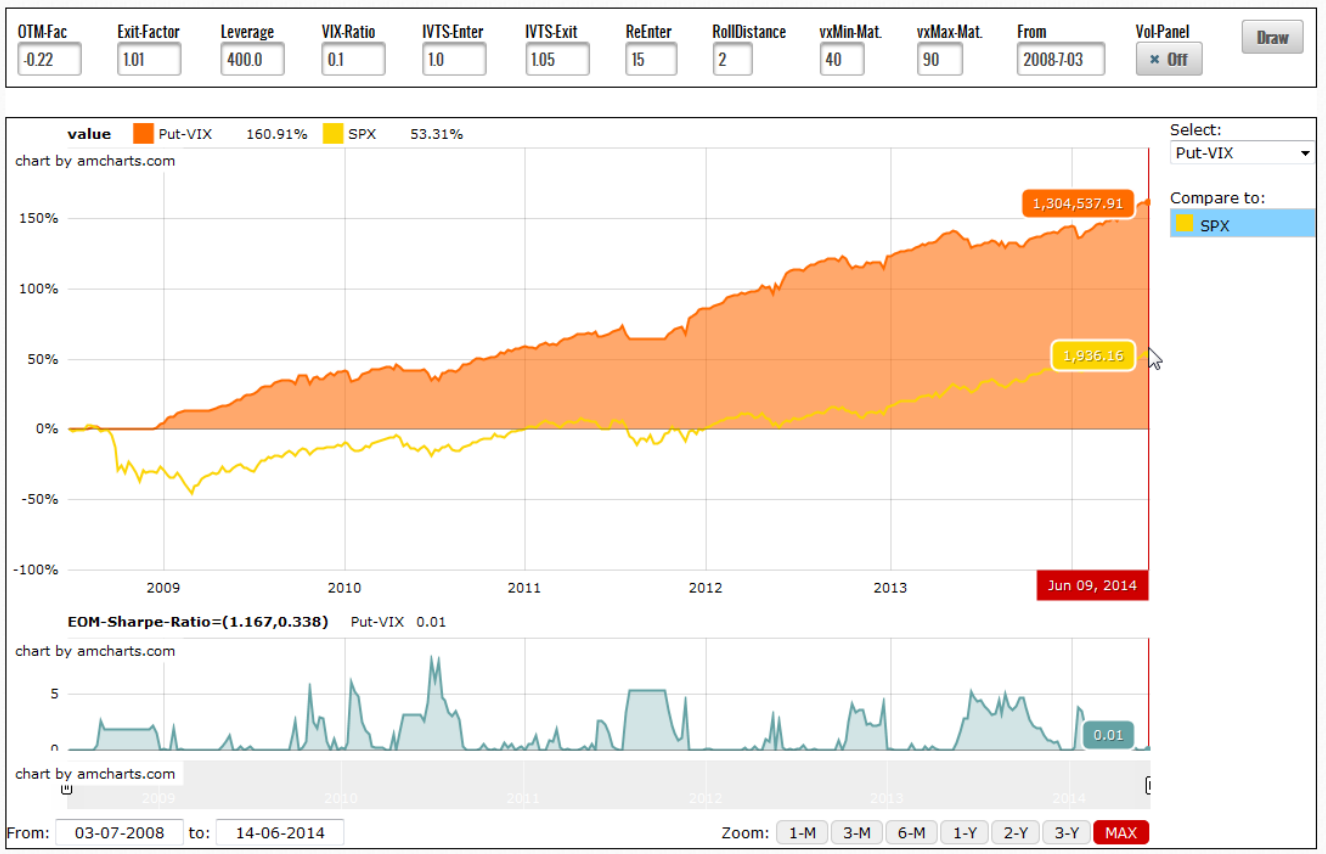


Graphic-6: HF-Austrian Pinscher K==7 (orange) and SPX Index (yellow) from 2013-05-01 till 2014-05-27

Extending the historic simulation (Revision 1):

In the original version the historic simulation ended at 2012-12-11. The Sibyl-fund has bought in the meantime new SPX Options data from Deltaneutral. Revision 1 extends the original historic simulation till 2014-06-13. The calculation of Graphic-1 is hence repeated for this new time range. The used methods are exactly the same. The previous data set was bought from another vendor. There are some discrepancies. So the results differ also slightly in the common time range.

Graphic-7 shows the results. The overall win of the Affenpinscher is 160.9% to 53.3% of the SPX. The Sharpe-Ratio is 1.17 and the max. relative Drawdown is 8.1% at 2010-06-28. The Austrian Pinscher has in Revision-1 a Sharpe-Ratio of 1.05, the Doberman of 1.13 (see [1]). The Affenpinscher has in this respect a slight edge over the other strategies.



Graphic-7: Affenpinscher (orange) and SPX Index (yellow) from 2008-07-03 till 2014-06-13

Conclusion:

The Affenpinscher is an interesting compromise between the solid Austrian- and the more aggressive Doberman Pinscher. The hedge of the long VIX Futures does not work as good as the long Puts. But the drag is also considerable lower.

If one wants to play save the Austrian Pinscher is the better choice. The Doberman is more risk and fun. If one can not decide between the 2 alternatives the Affenpinscher is the logical choice. The out of sample test of Revision-1 confirmed the original results.

References:

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