



# Exploring Systematic

**VSTOXX<sup>®</sup>**

**Futures Trading**

# Introduction

One of the most common strategies using VSTOXX<sup>®</sup> futures is to take a short position in reaction to a quick move higher in expected volatility. Another involves taking a short position based on the spread between a VSTOXX<sup>®</sup> future and the index. This second type of trade is perfect for a rules-based approach and many traders have been doing so since the launch of VSTOXX<sup>®</sup> futures. **This paper explores different systematic approaches to shorting VSTOXX<sup>®</sup> futures based on the convergences of the future and spot index as expiration.**

## VSTOXX<sup>®</sup>

The VSTOXX<sup>®</sup> Index is a consistent measure of expected 30-day volatility for the EURO STOXX 50<sup>®</sup> Index. The forward-looking volatility

measure is calculated using two different EURO STOXX 50<sup>®</sup> series expiring before and after a 30-day time frame.

## VSTOXX<sup>®</sup> Futures

A unique feature of VSTOXX<sup>®</sup> futures contracts is the lack of a fair value relationship that exists in other markets. For example, if a EURO STOXX 50<sup>®</sup> future is at enough of a premium to the index, a trader may sell short the future and purchase a basket of stocks. This trading activity keeps

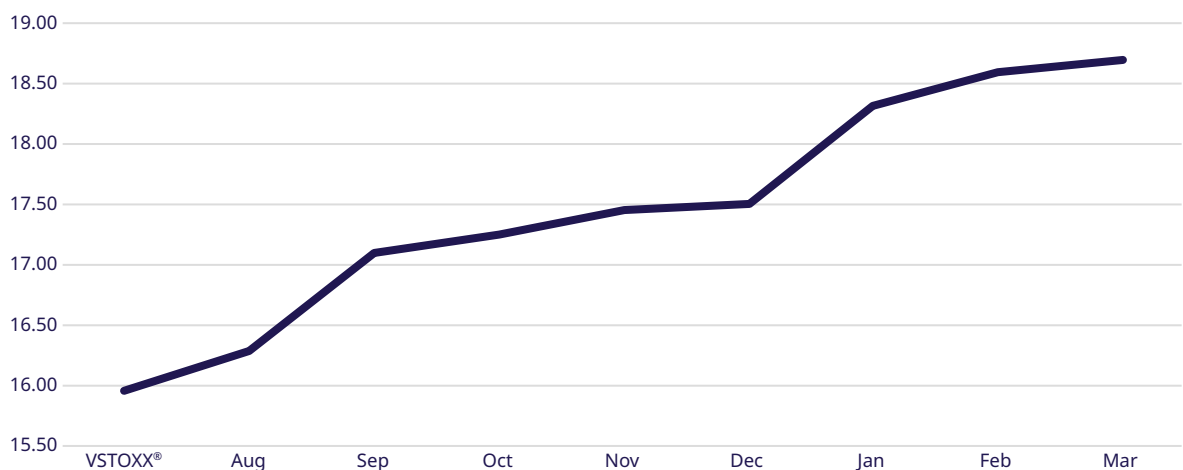
the EURO STOXX 50<sup>®</sup> future and index in a range due to arbitrage activity arising if the two are out of line. This sort of trade is not possible with VSTOXX<sup>®</sup> futures and the index because traders cannot easily replicate the VSTOXX<sup>®</sup> index performance in a portfolio.

## Contango / Backwardation

Because of the lack of a fair value relationship between VSTOXX<sup>®</sup> and VSTOXX<sup>®</sup> futures, the term structure created by plotting the spot index and futures prices may be in contango, backwardation,

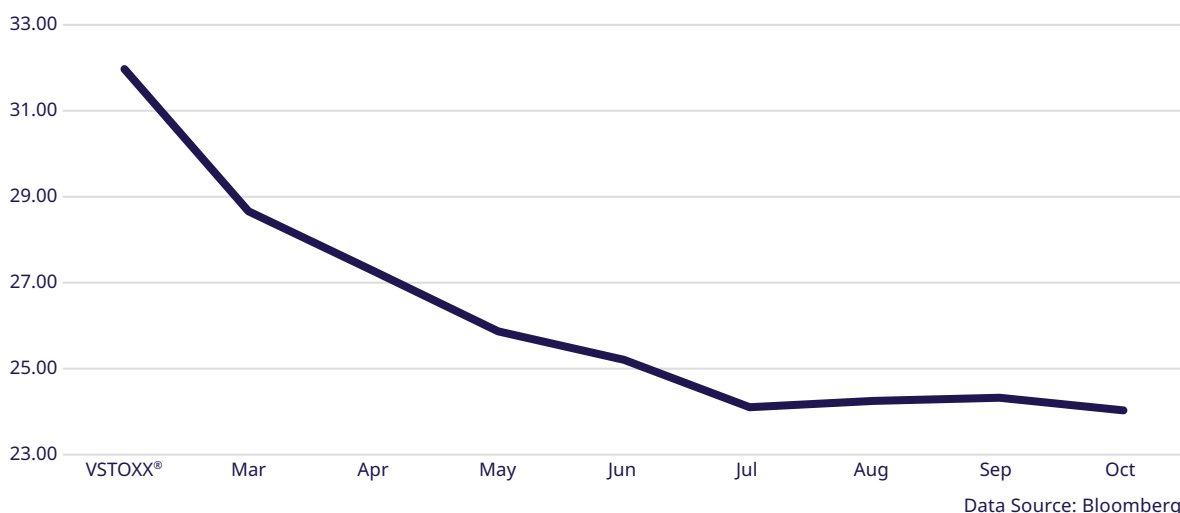
or even a mix of both. Contango refers to the futures pricing moving higher over time. Figure 1 below is the VSTOXX<sup>®</sup> term structure from 1 September 2023.

**Figure 1: VSTOXX<sup>®</sup> Term Structure in Contango**



Data Source: Bloomberg

**Figure 2: VSTOXX® Term Structure in Backwardation**



The farther out in time, the higher the level of each future. Backwardation usually occurs with spot VSTOXX® moving higher and the futures lag the upside move. Figure 2 shows the VSTOXX® term structure in backwardation using pricing from 15 March 2023.

VSTOXX® reacted to the failure of Silicon Valley Bank in the US by rallying to 32.00. The futures also moved higher, but not to the extent as the spot index. This is very typical during periods of fear in the equity markets.

## Methods

For this study, we gathered VSTOXX® Index closing prices from January 2018 through July 2023 and also front-month and second-month futures closing prices for expirations between January 2018 and July 2023. This spans sixty-seven contracts throughout bullish and bearish market environments. All pricing was obtained from Bloomberg.

We explored three different systematic approaches using VSTOXX® data. Test 1 looked at shorting the front-month future. Test 2 explored a calendar spread, shorting the front month and buying the second month. The final backtest, Test 3, also shorted the second-month VSTOXX® future but used the front month day count for trades.

Each analysis incorporates two approaches. The first run explores systematically executing a trade based solely on the number of days remaining until expiration. The second run incorporates a filter, specifically executing trades only when the future contracts are at a premium to the spot VSTOXX® Index. The goal of the filter

is to eliminate situations where the VSTOXX® term structure is in backwardation. Note that when the term structure is in backwardation, the future will drift higher as expiration approaches.

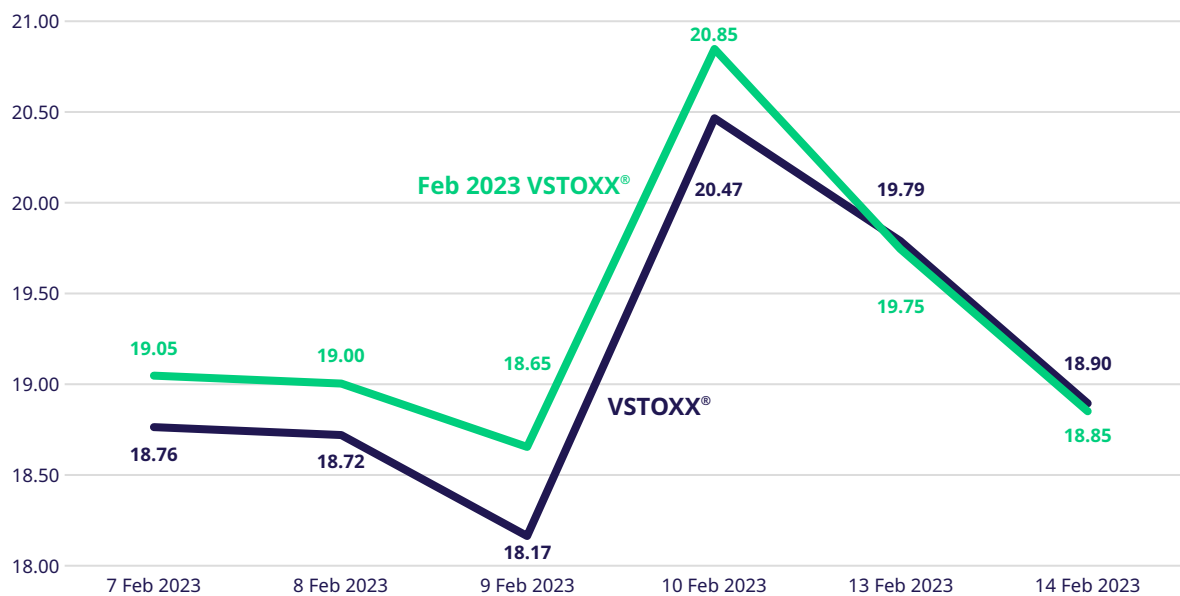


# Test 1 – Short Front Month Future into Expiration

**This first test of a rules-based systematic approach to selling short volatility utilizes the front month VSTOXX® future.** The initial criterion for a trade is based on the number of trading days to expiration and covering the short the day before expiration. As noted, this initial run has no filter. A contract is sold short and then covered on the close on the day before expiration. Table 1 shows the win rate, longest winning streak, and longest losing streak for selling the front month future with no filter.

Although this is a straightforward trade, an example is in order. On 7 February 2023, seven days remained until the February VSTOXX® settlement. The future was at 19.05 and spot VSTOXX® was at 18.76. Following the previous instructions, the trade is to sell the VSTOXX® future at 19.05. Settlement is 15 February 15, so the trade would be closed out on the close on the 14th for a six-day hold. The chart in Figure 3 shows the price action for both the future and spot index.

**Figure 3 – Short Front Month VSTOXX® Future Example Pricing**



Data Source: Bloomberg

This trade is a small winner, shorting at 19.05 and covering the short at 18.85, although the path is not a pleasant one as the future moved into the 20s before coming back down to close just under 19.00. Another interesting aspect of this trade is that the VSTOXX® index is higher on 14 February than on the 7 February close.

This is a major factor in shorting a VSTOXX® future as it approaches expiration, the convergence of the future and index pricing. Table 1 shows the win rate, longest winning streak, and longest losing streak for selling the front month future with no filter in the same manner as the previous example.

**Shorting the front month future both with and without considering the price level of the future versus spot VSTOXX® are profitable trading approaches.**

**Table 1 – Short Front Month Future – Win Rate / Winning Streak / Losing Streak**

No Filter Short Front Month Future X-Days Cover 1 Day before Settlement					
Days to Expiration	Number of Trades	Profitable Trades	Win %	Win Streak	Losing Streak
10	67	45	67%	13	4
9	67	43	64%	8	4
8	67	45	67%	7	4
7	67	45	67%	8	2
6	67	44	66%	5	3
5	67	43	64%	6	3
4	67	40	60%	5	4
3	67	40	60%	6	6
2	67	42	63%	7	4

Data Sources: Bloomberg and Author Calculations

Note that the win rate for selling short the front month future anytime between two and ten days to expiration ranges from 60% to 67%. This is a function of VSTOXX® futures not always trading at a premium to the spot index. As noted, when in backwardation, if spot VSTOXX® is unchanged, the future price will drift higher, resulting in a loss for a short seller.

Note that the winning streaks are longer than the losing ones for all but the 3-day observation. The best Win Streak figure is very impressive

at 13, using trades executed with ten days left to expiration. Another observation is the lack of success, with only three days remaining until expiration. The Win Streak and Losing Streak figures are both 6. Also, the Win percentage rate is only 60%. Despite the low Win % and longest Losing Streak, shorting with three days remaining to expiration and covering the day before is a viable strategy, based on the profit and loss statistics that appear in Table 2.

**Table 2 – Short Front Month Future – Profit and Loss Statistics**

No Filter Short Front Month Future X-Days before Expiration Cover 1 Day before Expiration				
Days to Expiration	Maximum Gain	Maximum Loss	Total Profit/Loss	Average Trade
10	+7.35	-51.95	+3.10	+0.05
9	+6.60	-50.10	-3.85	-0.06
8	+8.55	-41.55	+2.10	+0.03
7	+8.80	-34.20	+7.85	+0.12
6	+8.20	-33.15	+8.55	+0.13
5	+5.20	-31.50	+1.80	+0.03
4	+6.40	-17.00	+12.05	+0.18
3	+5.10	-9.10	+28.60	+0.43
2	+3.85	-3.60	+29.10	+0.43

Data Sources: Bloomberg and Author Calculations

The most startling figures on the profit and loss table are the maximum losses relative to the total profit and loss. This holds up for any test between five and ten days to expiration. Remember, this is a trading test without any market analysis other than how many days remain to expiry. The next run only records a trade if the front month future is at a premium to spot VSTOXX®.

The second look at shorting the front month future has two rules. The first is the same as the first look: the number of days to expiration. The second rule is the future must be at a premium to the spot index. The trading example at the beginning of this section, Table 3, shows initial win-loss statistics associated with applying the future versus spot price filter.

**Table 3 – Short Front Month Future with Filter – Win Rate / Winning Streak / Losing Streak**

Only Trade when Front Month > Spot Index Short Front Month Future X-Days before Expiration Cover 1 Day before Expiration					
Days to Expiration	Number of Trades	Profitable Trades	Win %	Win Streak	Losing Streak
10	42	27	64%	7	4
9	42	28	67%	8	2
8	43	32	74%	13	2
7	33	24	73%	9	2
6	37	25	68%	6	2
5	34	22	65%	6	3
4	42	24	57%	7	5
3	51	28	55%	8	6
2	30	16	53%	6	9

Data Sources: Bloomberg and Author Calculations

First, note the number of trades reduces from 67 to figures between 30 and 51. The 2-day and 3-day results concerning win percentage are discouraging, but the next table may help justify this. There are several pieces of data worth addressing for the second look at shorting the front month future. The win percentage

increases for longer time frames, especially for seven and eight days.

Table 4 shows a dramatic improvement from the non-filtered results. Note that the worst Max Loss is -5.70, which is much more palatable than the 40-to-50-point losses in the first run with no filter.

**Table 4 – Short Front Month Future with Filter – Profit And Loss Statistics**

Only Trade when Front Month > Spot Index Short Front Month Future X-Days before Expiration Cover 1 Day before Expiration				
Days to Expiration	Maximum Gain	Maximum Loss	Total Profit/Loss	Average Trade
10	+6.25	-9.75	+10.10	+0.24
9	+4.95	-7.50	+30.90	+0.74
8	+5.15	-7.00	+31.15	+0.72
7	+4.95	-8.15	+24.40	+0.74
6	+4.55	-7.80	+20.25	+0.55
5	+3.95	-8.45	+5.40	+0.16
4	+5.20	-7.60	-0.80	-0.02
3	+3.65	-4.90	+14.10	+0.28
2	+2.40	-3.60	+0.85	+0.03

Data Sources: Bloomberg and Author Calculations

Despite the low win rate, the shorter (2-day and 3-day) trades do show a profit and a small average profit. With all factors considered, the best-case scenario is the 8-days-to-expiration time frame. The 8-day trade nets over 31 points in profit and an average of +0.72 per trade. Also, with a filter in place, the longest winning streak is 13 trades, and the worst losing streak is only two trades.

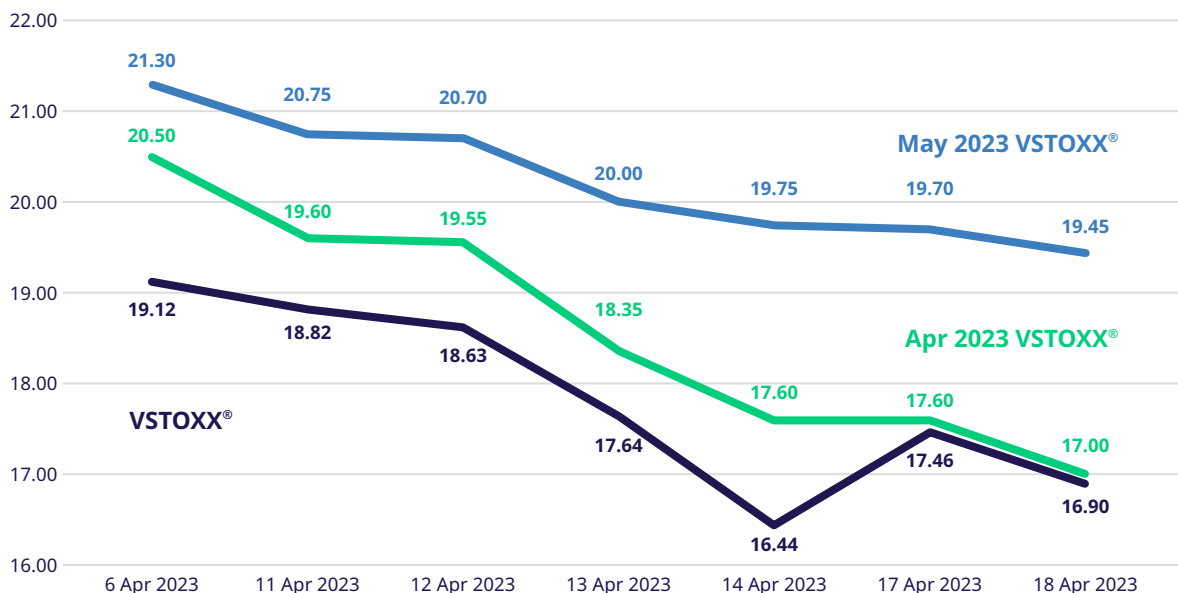
## Test 2 – Short Front Month / Long Second Month Future

**The second approach to having short exposure to VSTOXX® uses a calendar spread.** Specifically, the spread shorts the front month and longs the second month future. The idea behind using a calendar spread is to guard against huge losses. An example of this calendar spread uses the April and May 2023 VSTOXX® futures contracts. On 6 April 2023, with seven days left to expiration for the April VSTOXX® future, the April contract was sold short at 20.50, and the May contract was purchased for 21.30. The spot index was at a discount to the April future at 19.12. On 18 April, the day before April expiration, the April VSTOXX® short is covered at 17.00, while the long May

VSTOXX® future is sold at 19.45. The short April leg of the spread nets a profit of 3.50, while the May leg of the spread is a loss of 1.85, for a net trade profit of 1.65. The price activity for both futures and VSTOXX over this time frame appears in Figure 4.

This trade worked out well, but note the spread between the futures and spot index on the price chart, which is the criteria for filtered calendar spread trades. First, Table 5 shows the unfiltered returns putting on a consistent VSTOXX® futures calendar spread based on the number of days until the front month future expires.

Figure 4 – Short Front Month Buy Second Month VSTOXX® Future Example Pricing



Data Source: Bloomberg

**Table 5 – Short Front Month / Long Second Month – Win Rate / Win Streak / Losing Streak**

No Filter Short Front Month Future / Buy Second Month Future X-Days to Expiration Cover 1 Day before Settlement					
Days to Expiration	Number of Trades	Profitable Trades	Win %	Win Streak	Losing Streak
10	67	38	57%	5	4
9	67	39	58%	5	3
8	67	40	60%	5	3
7	67	43	64%	5	3
6	67	39	58%	4	3
5	67	38	57%	6	6
4	67	39	58%	5	6
3	67	43	64%	7	5
2	67	42	63%	7	4

Data Sources: Bloomberg and Author Calculations

Based on the win percentage and streaks in Table 5, the unfiltered approach of selling the front month and purchasing the second month is not very promising. This is surprising since calendar spreads are very popular trades

as they offer some protection against a quick move higher in VSTOXX® and associated futures. The profit and loss results in Table 6 for calendar spreads are also discouraging.

**Table 6 – Short Front Month / Long Second Month Future – Profit / Loss Statistics**

No Filter Short Front Month Future / Buy Second Month Future X-Days to Expiration Cover 1 Day before Settlement				
Days to Expiration	Maximum Gain	Maximum Loss	Total Profit/Loss	Average Trade
10	+4.30	-18.35	-7.70	-0.11
9	+2.40	-17.95	-9.40	-0.14
8	+2.30	-15.15	-8.80	-0.13
7	+2.70	-11.45	-4.65	-0.07
6	+2.60	-11.20	-3.85	-0.06
5	+2.35	-10.50	-10.65	-0.16
4	+2.20	-5.10	-1.85	-0.03
3	+2.30	-2.50	+11.45	+0.17
2	+5.30	-1.80	+16.15	+0.24

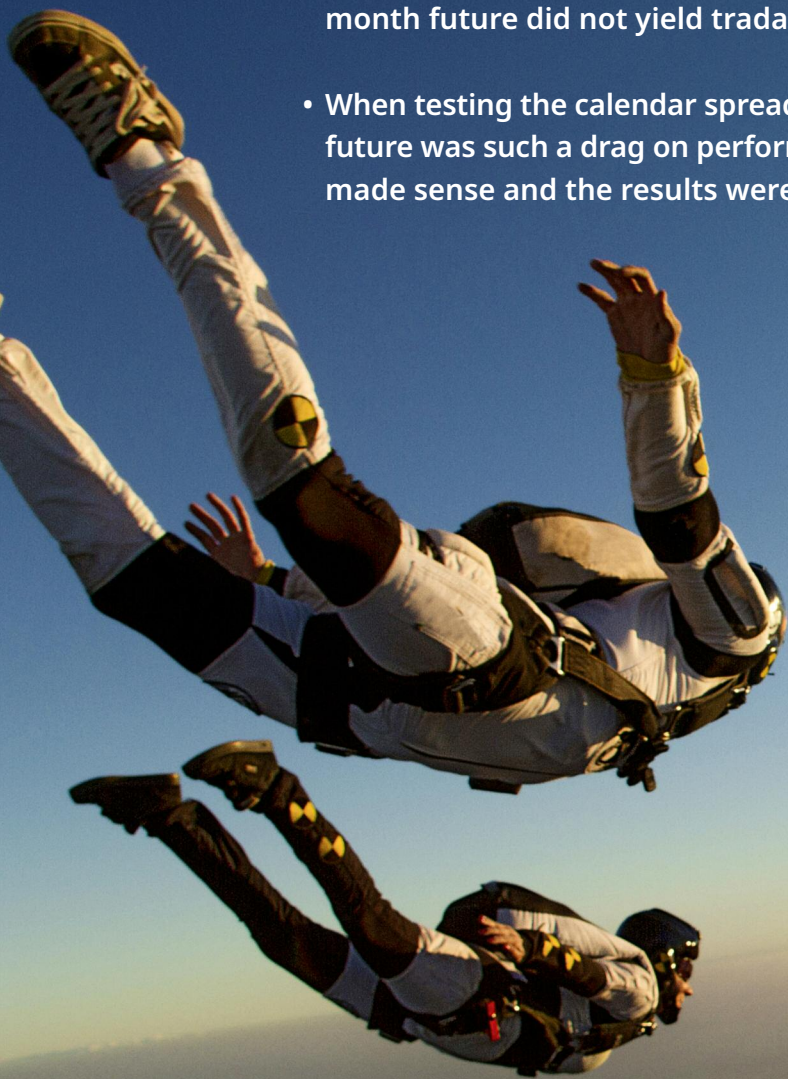
Data Sources: Bloomberg and Author Calculations

Note the 2-day and 3-day approaches perform well, with small drawdowns and solid profits. Beyond the two shortest time frames, there is nothing encouraging from this first test of the calendar spread. However, the filtered approaches are slightly better but not enough to consider trading.

Table 7 shows the initial figures for a filtered calendar spread approach. This filter requires the front month to be higher than the spot index and the second month to be higher than the first month.

# Key Takeaways

- Shorting the front month future both with and without considering the price level of the future versus spot VSTOXX<sup>®</sup> are profitable trading approaches.
- Only shorting the front month future when the price is above spot VSTOXX<sup>®</sup> improves results and avoids some of the recent rapid rises in VSTOXX<sup>®</sup>.
- A calendar spread, shorting the front month, and buying the second month future did not yield tradable results.
- When testing the calendar spread approach, the long second-month future was such a drag on performance that testing as a short system made sense and the results were very encouraging.



**Table 7 – Short Front Month / Long Second Month with Filter – Win Rate / Win Streak / Losing Streak**

Only Trade when Front Month > Spot Index And Second Month > Front Month Short Front Month Future Buy Second Month Future X-Days before Front Month Expiration Cover 1 Day before Expiration					
Days to Expiration	Number of Trades	Profitable Trades	Win %	Win Streak	Losing Streak
10	38	21	55%	5	3
9	39	22	56%	5	3
8	41	25	61%	10	2
7	32	22	69%	8	2
6	35	21	60%	5	3
5	32	18	56%	4	4
4	39	21	54%	7	5
3	44	28	64%	9	5
2	29	18	62%	6	4

Data Sources: Bloomberg and Author Calculations

The winning percentages are still unimpressive, ranging from 54% to 64%. Also, note that the number of trades is dramatically lower than the 67 observations used in this study. A systematic approach with so few signals may be difficult

to maintain, especially if there is no signal for a few months. That is an unquantifiable danger associated with this approach. Table 8 shows improvement for several time frames.

**Table 8 – Short Front Month / Long Second Month Future with Filter – Profit / Loss Statistics**

Only Trade when Front Month > Spot Index And Second Month > Front Month Short Front Month Future Buy Second Month Future X-Days before Front Month Expiration Cover 1 Day before Expiration				
Days to Expiration	Maximum Gain	Maximum Loss	Total Profit/Loss	Average Trade
10	+1.55	-3.55	-2.85	-0.07
9	+2.35	-2.50	+6.55	+0.17
8	+2.25	-3.25	+5.45	+0.13
7	+2.20	-2.55	+4.75	+0.15
6	+2.60	-2.45	+5.50	+0.16
5	+2.35	-3.75	-3.30	-0.10
4	+1.35	-2.95	-5.65	-0.14
3	+1.45	-2.50	+3.30	+0.08
2	+1.15	-1.80	+2.70	+0.09

Data Sources: Bloomberg and Author Calculations

A few more time frames are profitable, but not to the extent that a trader would use this systematic approach. Based on the calendar spread not working and the calendar spread buying the second-month future as part of the spread,

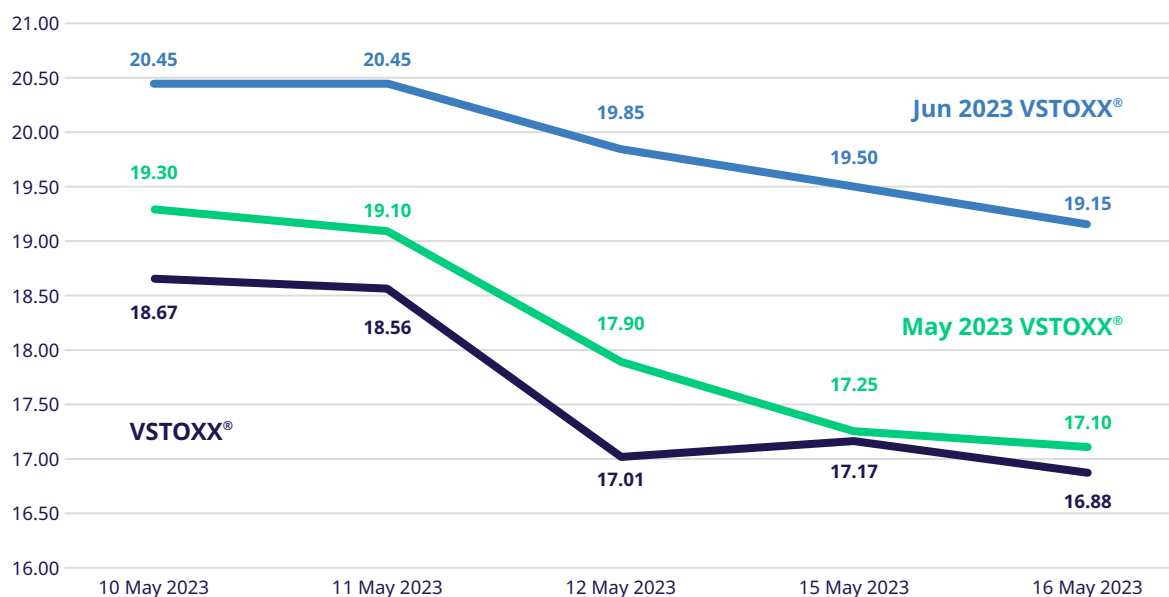
it makes sense to test the second month based on the front month day count. If a long position in the second month was detrimental to performance, exploring shorting the second month is a logical result.

# Test 3 – Short Second Month Future into Front Month Expiration

As noted, the final backtest with VSTOXX<sup>®</sup> futures systematically sells the second-month future but does so using the number of days until the front month expires. Pricing from May 2023 is used to demonstrate this method of trading VSTOXX<sup>®</sup> futures. On 10 May 2023,

the May VSTOXX<sup>®</sup> contract had five days remaining to expiration and was priced at 19.30 while the index was at 18.67. The second month June VSTOXX<sup>®</sup> future is sold short at 20.45. Four days later, on 16 May, the short sale is covered at 19.15 for a profit of 1.30.

Figure 5 – Short Front Month Buy Second Month VSTOXX<sup>®</sup> Future Example Pricing



Data Source: Bloomberg

The second-month VSTOXX<sup>®</sup> future usually does not increase as much as the spot index when VSTOXX<sup>®</sup> rallies, making this a viable approach

to shorting VSTOXX<sup>®</sup>. Table 9 shows the unfiltered results for systematically shorting the second-month future.

Table 9 – Short Second Month Future – Win Rate / Winning Streak / Losing

No Filter Short Second Month Future X-Days before Front Month Expiration Cover 1 Day before Front Month Expiration					
Days to Expiration	Number of Trades	Profitable Trades	Win %	Win Streak	Losing Streak
10	67	46	69%	14	5
9	67	44	66%	7	4
8	67	44	66%	13	4
7	67	48	72%	15	3
6	67	44	66%	11	3
5	67	44	66%	11	4
4	67	41	61%	4	4
3	67	42	63%	6	6
2	67	37	55%	5	5

Data Sources: Bloomberg and Author Calculations

The unfiltered win percentages and win streaks are an improvement relative to the first two tests in this paper. In one case, the win percentage is over 70%, a range only matched in the filtered

version by a couple of observations. Strong profit and loss results for shorting the second-month future show up in Table 10.

**Table 10 – Short Second Month Future – Profit and Loss Statistics**

<b>No Filter Short Second Month Future X-Days before Front Month Expiration Cover 1 Day before Front Month Expiration</b>				
<b>Days to Expiration</b>	<b>Maximum Gain</b>	<b>Maximum Loss</b>	<b>Total Profit/Loss</b>	<b>Average Trade</b>
10	+4.50	-33.60	+10.80	+0.16
9	+5.25	-32.15	+5.55	+0.08
8	+6.90	-26.40	+10.90	+0.16
7	+6.10	-22.75	+12.50	+0.19
6	+5.80	-21.95	+12.40	+0.19
5	+4.05	-21.00	+12.45	+0.19
4	+5.65	-11.90	+13.90	+0.21
3	+4.65	-10.50	+17.15	+0.26
2	+2.55	-1.80	+12.95	+0.19

Data Sources: Bloomberg and Author Calculations

The max losses for all but the 2-day time frame are worrisome despite each time frame showing a profit. Also, the average trade profits are low, with the 4-day trade only profiting by 0.21 a trade.

Table 11 shows the initial figures for an approach that only trades when the second month is at a premium to the index.

**Table 11 – Short Second Month Future with Filter – Win Rate / Winning Streak / Losing**

<b>Only Trade when Second Month &gt; Spot Index Short Second Month Future X-Days before Front Month Expiration Cover 1 Day before Front Month Expiration</b>					
<b>Days to Expiration</b>	<b>Number of Trades</b>	<b>Profitable Trades</b>	<b>Win %</b>	<b>Win Streak</b>	<b>Losing Streak</b>
10	46	33	72%	13	4
9	48	33	69%	9	4
8	52	37	71%	16	3
7	50	37	74%	17	2
6	50	33	66%	8	3
5	47	30	64%	7	3
4	51	30	59%	4	3
3	53	31	58%	6	6
2	49	27	55%	4	3

Data Sources: Bloomberg and Author Calculations

The figures in Table 11 are encouraging, with a few substantial win and short losing streaks. Also, the number of signals is higher than the other filtered approaches, ranging from 47 to 53.

Finally, there are three winning percentages over 70%, more than the other two filtered approaches. The profit and loss in Table 12 is also positive.

**Table 12 – Short Second Month Future with Filter – Profit and Loss Statistics**

Only Trade when Second Month > Spot Index Short Second Month Future X-Days before Front Month Expiration Cover 1 Day before Front Month Expiration				
Days to Expiration	Maximum Gain	Maximum Loss	Total Profit/Loss	Average Trade
10	+4.05	-4.05	+26.55	+0.58
9	+5.25	-5.30	+26.80	+0.56
8	+6.90	-4.90	+36.80	+0.71
7	+4.05	-5.70	+23.55	+0.47
6	+4.20	-5.35	+19.90	+0.40
5	+4.05	-5.70	+12.55	+0.27
4	+4.80	-5.20	+8.10	+0.16
3	+2.35	-2.60	+9.95	+0.19
2	+2.55	-1.80	+6.65	+0.14

Data Sources: Bloomberg and Author Calculations

Of all the systematic approaches tested in this paper, the 8-day filtered approach appears to be the most viable system. The maximum

loss of 4.90 is reasonable, considering the approach's total profit of 36.80.

# Conclusion

Direct exposure to volatility expectations is a feature of VSTOXX<sup>®</sup> futures that attract traders and investors looking for both long and short exposure. Many professional managers use option selling strategies that are a version of short exposure to volatility, but not as pure as shorting VSTOXX<sup>®</sup> futures, specifically the front money VSTOXX<sup>®</sup> contract which will mirror VSTOXX<sup>®</sup> price behavior. Although the front month future is usually the contract of choice based on a VSTOXX<sup>®</sup> outlook, a finding in this paper is that the second month future offers profitable selling opportunities.

There are many uses for VSTOXX<sup>®</sup> futures beyond shorting volatility. However, risk-controlled approaches to shorting VSTOXX<sup>®</sup> futures are a popular approach to this market. In this paper, the only risk control used is a filter based on the relative futures and index pricing. Other methods that incorporate stop losses or even using options instead of futures and building 136 on the three systems presented here will likely improve the various performance statistics.

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