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GLOBAL ENGINEERING & STRATEGY

U.S. Equity Derivatives Flow Commentary

Effect of VIX Listed ETNs on Market Microstructure of VIX Futures and TAS

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Overview and Conclusions

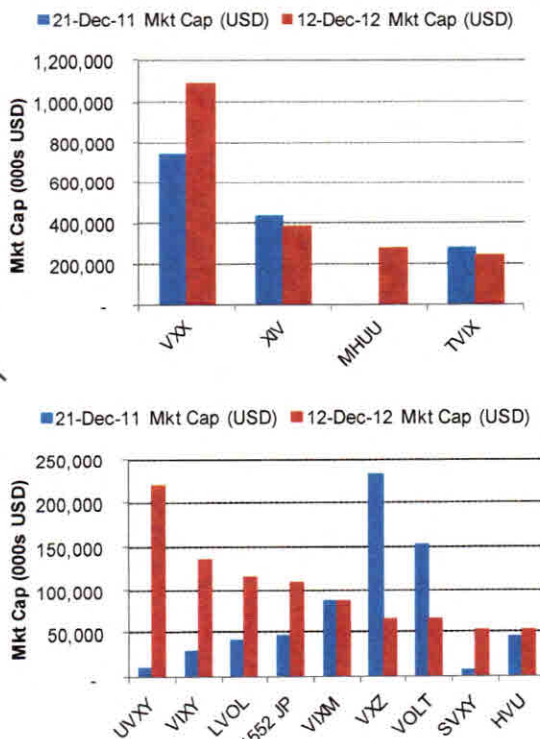
Here, we show that the market cap of these popular listed VIX Equity Traded Notes (ETN) and Equity Traded Funds (ETF) has increased. This has led to large daily futures rolls and hedging activity from the **creation and redemption (C/R)** of these ETNs/ETFs. **On days with large moves in the VIX, we net the daily roll with the C/R flow for each of ETNs or ETFs on the VIX and conclude that the VIX futures going into the close (last 1 hour of trading) are affected by these flows.**

In addition, we show how the VIX trade-at-settlement (TAS) has been increasing as the daily roll and C/R volumes have increased, which are associated with the increased market cap of listed VIX ETNs and ETFs. In addition for some futures, the TAS volume is now close to the daily roll and C/R volumes. **Clearly, some of daily roll and C/R volume for these products is appearing from 3:15 to 4:15 PM, which includes the VIX TAS.**

Market Cap in VIX Related ETNs and ETFs is Higher

Figure 1 and Appendix 1 show that the market cap in USD of most VIX related ETNs moved higher this year and on average has been increasing.

Fig. 1: Increase in Market Cap in Larger Listed VIX related ETN Products (21-Dec-11 to 12-Dec-12)



Source: SG Global Engineering & Strategy, Bloomberg

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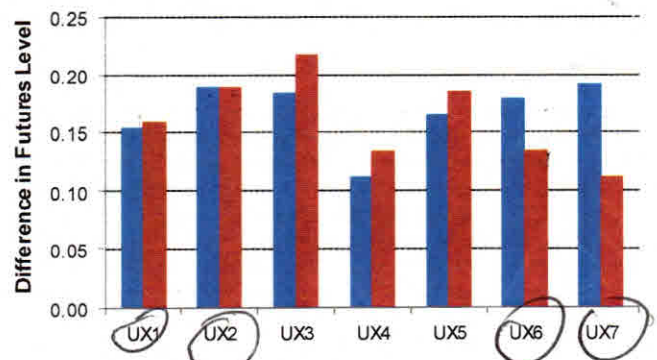
VIX Market Microstructure into the Daily Close:

With the increase in the popularity in these VIX related products, we have seen an increase in the end-of-day trading volumes on the VIX futures. Some of these products are actually designed to trade on the close, making the 3:15 to 4:15 PM trading window and the TAS both attractive times to examine the trading flow. To assess the effect due to the roll and C/R flows, we look at the minute bar data of the liquid VIX futures (UX1 to UX7) on days where the VIX has a large move (greater than 4% higher or -4% lower) and the futures moved in a similar direction (see Appendix 2 for more details). For example if the VIX was at 20, the 4% (-4%) higher (lower) change is equivalent to about 0.8 (-0.8) volatility points.

As shown in figure 2 if the VIX moves higher by 4% and figure 3 if the VIX moves lower by -4%, we can generally forecast the VIX futures direction from 3:15 to 4:15 PM for futures UX1, UX2, UX3, UX4, UX5 and UX6. For UX7, we do better forecasting a move higher for the VIX. Figures 2 and 3 shows the median and mean moves in our sample set over the same VVAP and 3:15 PM window for large up or down moves in the VIX, using data from Appendix 2.

Fig. 2: Avg. Diff between VIX Future VWAP (3:15 to 4:15 PM) minus VIX Future Price at 3:15 PM (VIX higher by 4%)

■ Avg Chg in Future VWAP (3:15 to 4:15 PM) minus Future at 3:15 PM
■ Median Chg in Future VWAP (3:15 to 4:15 PM) minus Future at 3:15 PM

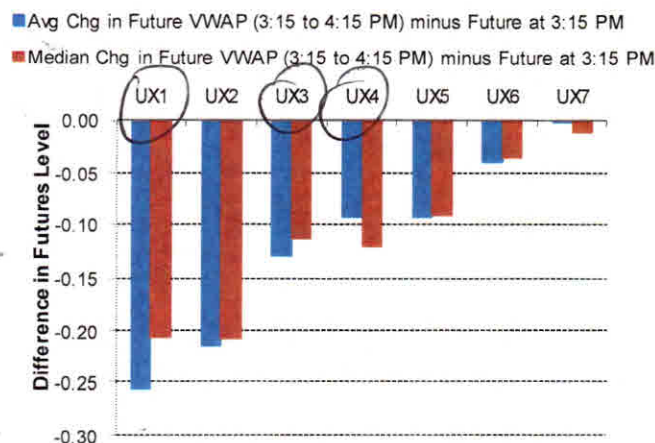


Source: SG Global Engineering & Strategy, Bloomberg

Note: UX1 is using minute bar date from 2-Jan-12 to 6-Dec-12 while UX2 through UX7 is using minute bar date from 1-Jun-12 to 6-Dec-12. All analysis is mid to mid price.

Creation Redemption
Trading Activity
TAS
Intervals
to trades 25

Fig. 3: Avg. Diff. between VIX Future VWAP (3:15 to 4:15 PM) minus VIX Future Price at 3:15 PM (VIX lower by -4%)



Source: SG Global Engineering & Strategy, Bloomberg

Note: UX1 is using minute bar date from 2-Jan-12 to 6-Dec-12 while UX2 through UX7 is using minute bar data from 1-Jun-12 to 6-Dec-12. All analysis is mid to mid price.

As shown in Table 1 and Appendix 2, we can generally predict the VIX futures direction from 3:15 to 4:15 PM for futures UX1, UX2, UX3, UX4, UX5 and UX6. For UX7, we do better predicting the move higher for the VIX. In Table 1, our sample set for some of the futures over the last 6 months is small but still generally conclusive. Moreover, the mean and median values for the difference between VWAP from 3:15 to 4:15 PM versus the 3:15 futures price are very close for the shorter to medium dated futures but slightly lower on a median basis for the longer-dated futures. **In general, on days with a move of up 4% or higher on the VIX and a similar move in the VIX future, the futures for UX1, UX2, UX3, UX4, UX5, UX6 and UX7 will move higher from 3:15 to 4:15 PM on average by 0.15, 0.19, 0.18, 0.11, 0.16, 0.18 and 0.19, respectively, using the VWAP minus the 3:15 price of the futures. In general, on days with a move of down -4% or lower on the VIX and a similar move on the VIX future, the futures for UX1, UX2, UX3, UX4, UX5 and UX6 and will move lower from 3:15 to 4:15 PM on average by -0.26, -0.21, -0.13, -0.09, -0.09, and -0.04, respectively, using the VWAP minus the 3:15 price of the futures.**

In Appendix 2, we go further and on these days of large VIX moves from 3:15 to 4:15 PM, we shows that the average volume ranges from 27.3% for the shorter-dated futures and more liquid futures to as high as 49.2% of the daily volume for the longer-dated but semi-liquid futures. However, large moves in the VIX combined with the daily roll of these ETN products as well as creation and redemption flows influences the closing level.

Table. 1 Impact of Net Flows from Listed VIX ETN Related Products on the Close on Days with Large Moves in the VIX.

Summary Statistics for VIX Futures					
Item	VIX Change over the Day	VIX Future Change over the Day	Change in VIX Future from 3:15 PM to 4:15 PM	VWAP of 3:15 to 4:15 PM minus 3:15 Future Price	Num of Days in Sample
UX1					
VIX Moves Lower by -4% or More	Mean: -8.2% Median: -7.4%	Mean: -7.1% Median: -6.3%	Mean: -0.37 Median: -0.30	Mean: -0.26 Median: -0.21	45
VIX Moves Higher by 4% or More	Mean: 9.6% Median: 9.4%	Mean: 8.3% Median: 6.7%	Mean: 0.25 Median: 0.26	Mean: 0.15 Median: 0.16	31
UX2					
VIX Moves Lower by -4% or More	Mean: -8.7% Median: -8.6%	Mean: -5.4% Median: -5.3%	Mean: -0.28 Median: -0.30	Mean: -0.21 Median: -0.21	26
VIX Moves Higher by 4% or More	Mean: 9.2% Median: 9.0%	Mean: 5.4% Median: 4.5%	Mean: 0.26 Median: 0.28	Mean: 0.19 Median: 0.19	18
UX3					
VIX Moves Lower by -4% or More	Mean: -9.7% Median: -10.3%	Mean: -4.8% Median: -4.9%	Mean: -0.17 Median: -0.12	Mean: -0.13 Median: -0.11	18
VIX Moves Higher by 4% or More	Mean: 10.2% Median: 10.3%	Mean: 5.0% Median: 4.7%	Mean: 0.24 Median: 0.23	Mean: 0.18 Median: 0.22	12
UX4					
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -9.8%	Mean: -3.3% Median: -3.8%	Mean: -0.10 Median: -0.15	Mean: -0.09 Median: -0.12	21
VIX Moves Higher by 4% or More	Mean: 9.4% Median: 9.4%	Mean: 3.7% Median: 3.4%	Mean: 0.15 Median: 0.10	Mean: 0.11 Median: 0.13	16
UX5					
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -10.3%	Mean: -3.3% Median: -3.4%	Mean: -0.10 Median: -0.13	Mean: -0.09 Median: -0.09	18
VIX Moves Higher by 4% or More	Mean: 10.0% Median: 10.3%	Mean: 3.5% Median: 2.9%	Mean: 0.18 Median: 0.05	Mean: 0.16 Median: 0.18	11
UX6					
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -10.8%	Mean: -3.1% Median: -3.1%	Mean: -0.03 Median: -0.02	Mean: -0.04 Median: -0.04	15
VIX Moves Higher by 4% or More	Mean: 10.3% Median: 9.9%	Mean: 3.4% Median: 2.9%	Mean: 0.23 Median: 0.11	Mean: 0.18 Median: 0.13	8
UX7					
VIX Moves Lower by -4% or More	Mean: -9.5% Median: -10.3%	Mean: -2.7% Median: -2.6%	Mean: 0.02 Median: 0.00	Mean: 0.00 Median: -0.01	16
VIX Moves Higher by 4% or More	Mean: 9.9% Median: 9.9%	Mean: 3.3% Median: 3.0%	Mean: 0.27 Median: 0.16	Mean: 0.19 Median: 0.11	8

Source: Bloomberg, SG Global Engineering & Strategy

Note: UX1 is using minute bar date from 2-Jan-12 to 6-Dec-12 while UX2 through UX7 is using minute bar data from 1-Jun-12 to 6-Dec-12. All analysis is mid to mid price.

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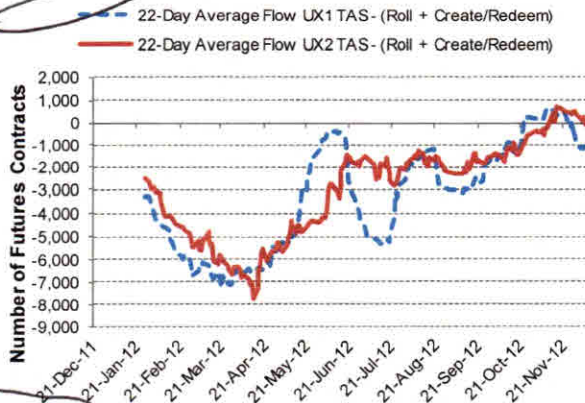
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Effect on VIX Trade-at-Settlement (TAS) Volumes

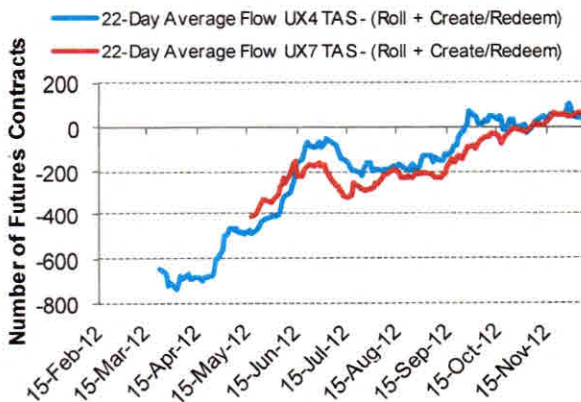
Figures 4 through 6 show the 22-day average TAS volume minus the 22-day average net roll and creation/redemption volume. In figure 4 and 5, as one can see for UX1, UX2, UX4 and UX7, the gap between the two has been moving towards zero. Although we cannot say definitely that the majority of all the creation/redemption and roll volume appears on the close, clearly, some of it does and we believe some of it is the reason the TAS volumes have increased since April of 2012. In figure 6, for the less liquid UX3 and UX6 TAS volumes, the effect is less pronounced; however, it is slightly more prevalent in the UX5 TAS flow.

Fig. 4: Effect of VIX Related ETN Products on TAS Volume for UX1 and UX2 (15-Feb-12 to 6-Dec-12)



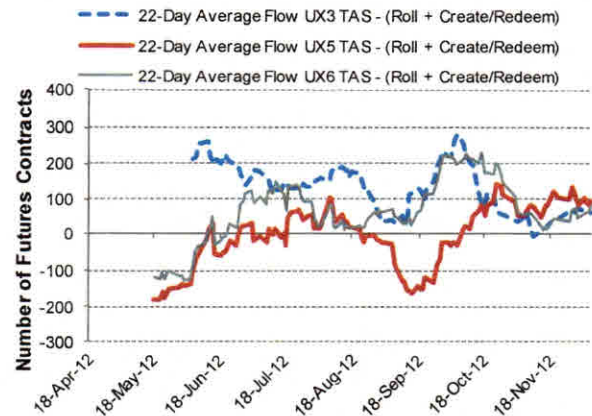
Source: Bloomberg, SG Global Engineering & Strategy

Fig. 5: Effect of VIX Related ETN Products on TAS Volume for UX4 and UX7 (21-Dec-11 to 6-Dec-12)



Source: Bloomberg, SG Global Engineering & Strategy

Fig. 6: Effect of VIX Related ETN Products on TAS Volume for UX3 UX5 and UX6 (18-April-12 to 6-Dec-12)



Source: Bloomberg, SG Global Engineering & Strategy

For more information on the TAS, see our prior report in the footnote below.¹ In short, market participants are able to enter VIX futures orders in a TAS order book during the trading day at a price equal to that day's VIX futures settlement price, or at a specified differential above or below the daily settlement price. Completed TAS transactions are confirmed during the trading session, and the final price of the transaction is confirmed when the daily settlement price is established (see link [CBOE VIX TAS](#)).

Cost
Market Cap
Size

Normalized by
Vol level

Daily Avg Vol on ETFs

evolution of
spread
Avg. Daily
Volume

¹ "SG US Equity Derivatives Flow Commentary: New Market Develops in VIX Futures as TAS Volumes Increase", 20-Nov-12.

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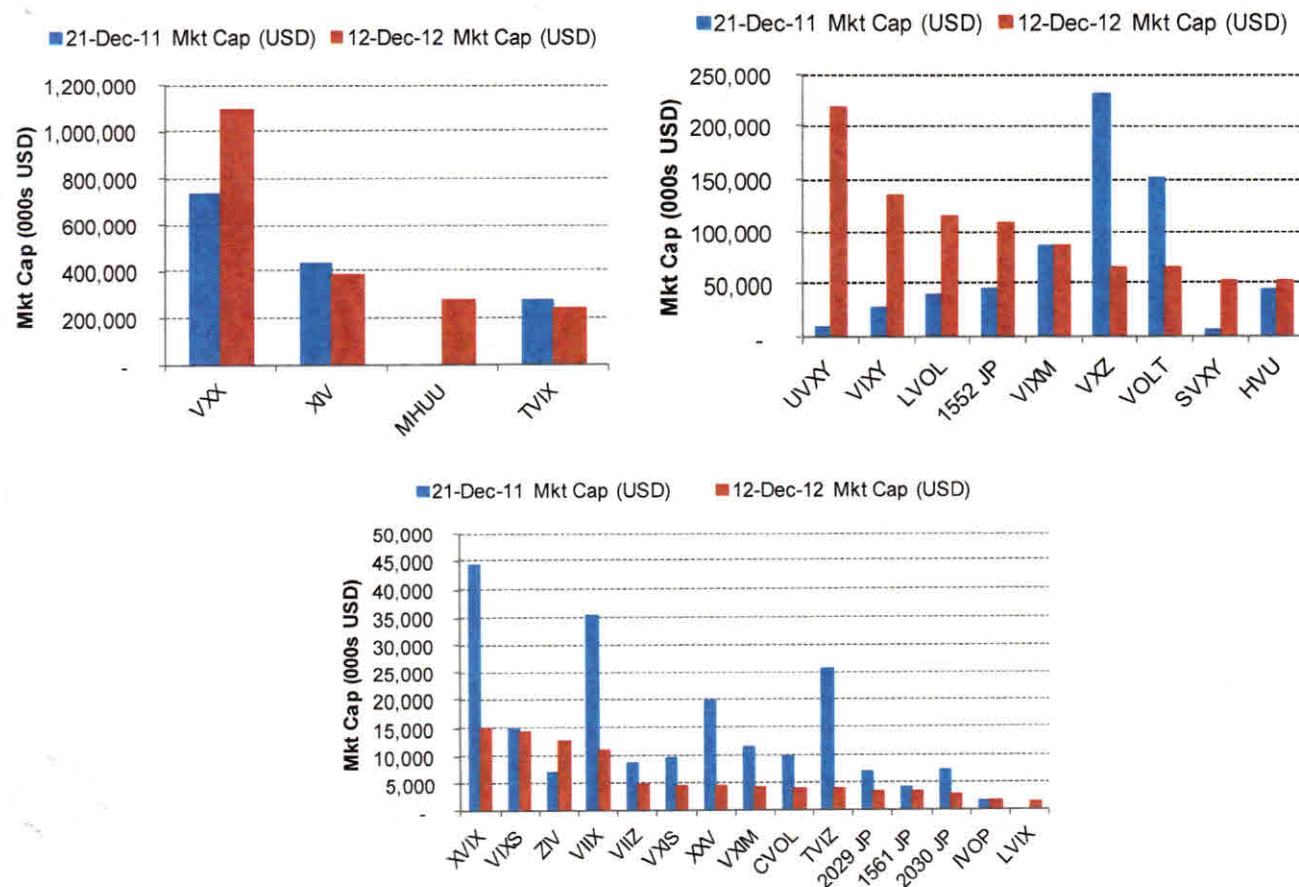
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APPENDIX I

The graphs in **figures 1** in this appendix show that the market cap in USD of most VIX related ETNs moved higher this year and on average has been increasing from 21-Dec-11 to 12-Dec-12. Some of the smaller ETFs in market cap have dropped but the market cap. On average since 21-Dec-11 to 12-Dec-12, the market cap has that uses ETNs or ETFs related to VIX futures has increase by approximately 28% (roughly \$651 Million USD) largely due to increase amounts in VXX, MHUU and LVOL as well as others. MHUU was a new issuance by JPM in February of 2012 and has a market cap of over \$262 million USD. All ETFs have been normalized to USD. **Table 1** provides a list of VIX related ETNs and ETFs used in this analysis.

Fig. 1: Increase in Market Cap (USD) in Listed VIX related ETN Products (12-Dec-11 to 12-Dec-12)



Source: SG Global Engineering & Strategy, Bloomberg
 Note: Market cap includes leverage associated with the product.

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Table 1: VIX Related ETNs and ETFs and Some Additional Information

BB Ticker	Fund Name	Country	Currency	Leverage	Shares Out
TVIX	VELOCITYSHARES 2X VIX SH-TRM	US	USD	2	139,905,400
VXX	IPATH S&P 500 VIX S/T FU ETN	US	USD	1	37,301,670
XIV	VELOCITYSHARES INV VIX SH-TM	US	USD	-1	18,963,880
VIXY	PROSHARES VIX SHORT-TERM FUT	US	USD	1	9,050,000
UVXY	PROSHARES ULTRA VIX ST FUTUR	US	USD	2	7,108,080
HVU	HORIZONS BETAPRO S&P 500 VIX	CN	CAD	2	4,847,500
1552	KOKUSAI S&P500 VIX SHORT ETF	JP	JPY	1	3,690,940
VIXM	PROSHARES VIX MID-TERM FUT	US	USD	1	2,600,000
VXZ	IPATH S&P 500 VIX MT FU ETN	US	USD	1	2,383,890
LVOL	LYXOR ETF S&P 500 VIX FUTURE	FP	EUR	1	1,619,500
CVOL	C-TRACKS ETN VOLATILITY INDX	US	USD	1	1,500,000
VOLT	NOMURA VOLTAGE MID-TERM	LN	USD	1	989,620
VXIS	IPATH S&P 500 VIX S/T FU ETN	GR	EUR	1	982,690
XVIX	ETRACS DAILY LONG/SHORT VIX	US	USD	1	750,000
SVXY	PROSHARES SHORT VIX ST FUTUR	US	USD	-1	700,020
VIX	VELOCITYSHARES VIX SHORT-TRM	US	USD	1	700,000
2030	IPATH S&P 500 VIX S/T FU JDR	JP	JPY	1	625,000
ZIV	VELOCITYSHARES INV VIX MEDIU	US	USD	-1	495,000
VXS	S&P 500 VIX SHORT-TERM FUTUR	LN	USD	1	476,760
TVIZ	VELOCITYSHARES 2X VIX MED-TM	US	USD	2	175,000
VXIM	IPATH S&P 500 VIX MT FU ETN	GR	EUR	1	126,290
VIIZ	VELOCITYSHARES VIX MED-TERM	US	USD	1	125,000
XXV	IPATH INVERSE S&P 500 VIX SH	US	USD	-1	121,300
2029	IPATH S&P 500 VIX MT FU JDR	JP	JPY	1	100,000
IVOP	IPATH INVERSE S&P 500 VIX II	US	USD	-1	50,500
MHUU	JP MORGAN MACRO HEDGE US ETF	LN	USD	1	25,360
LVIX	LYXOR S&P 500 VIX ENH ROLL	FP	USD	1	19,000
1561	KOKUSAI S&P500 VIX MID ETF	JP	JPY	1	4,900

Source: SG Global Engineering & Strategy, Bloomberg

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APPENDIX 2

Table 1 of this appendix shows a complete set of data. In Table 1, our sample set for some of the futures over the last 6 months is small but still generally conclusive. Moreover, the mean and median values for the difference between VWAP from 3:15 to 4:15 PM versus the 3:15 futures price are very close for the shorter to medium dated futures but slightly lower on a median basis for the longer-dated futures. In general, on days with a move of up 4% or higher on the VIX and a similar move in the VIX future, the futures for UX1, UX2, UX3, UX4, UX5, UX6 and UX7 will move higher from 3:15 to 4:15 PM on average by 0.15, 0.19, 0.18, 0.11, 0.16, 0.18 and 0.19, respectively, using the VWAP minus the 3:15 price of the futures. In general, on days with a move of down -4% or lower on the VIX and a similar move on the VIX future, the futures for UX1, UX2, UX3, UX4, UX5 and UX6 and will move lower from 3:15 to 4:15 PM on average by -0.26, -0.21, -0.13, -0.09, -0.09, and -0.04, respectively, using the VWAP minus the 3:15 price of the futures. For example if the VIX was at 20, the 4% (-4%) higher (lower) change is equivalent to about 0.8 (-0.8) volatility points. The level for the move in the VIX futures prices is provided on the purple highlighted line. In addition, the table shows that the average volume ranges from 27.3% for the shorter-dated futures more liquid futures to as high as 49.2% of the daily volume for the longer-dated semi-liquid futures. Finally, we provide the number of days in the sample set.

Table 1: Impact of Net Flows from Listed VIX ETN Related Products on the Close on Days with Large Moves in the VIX and a Similar move in the VIX futures (6/1/12 to 12/6/12)

Summary Statistics for VIX Futures									
Item	VIX Change over the Day	VIX Future Change over the Day	Change in VIX Future from 3:15 PM to 4:15 PM	VWAP of 3:15 to 4:15 PM minus 3:15 Future Price	Net Daily Roll + Creation/Redemption Flow	% of Net Daily Roll + Creation or Redemption Flow over Total Volume	% Contract Volume 3:15 PM to 4:15 PM over Total Volume	% of Total Trades in Future from 3:15 PM to 4:15 PM	Num of Days in Sample
UX1 from 2-Jan-12 to 6-Dec-12 where VIX and UX1 both moved by at least 4%									
VIX Moves Lower by -4% or More	Mean: -8.2% Median: -7.4%	Mean: -7.1% Median: -6.3%	Mean: -0.37 Median: -0.30	Mean: -0.26 Median: -0.21	Mean: -7,823 Median: -7,786	Mean: 24.1% Median: 24.8%	Mean: 31.1% Median: 30.3%	Mean: 22.5% Median: 21.3%	45
VIX Moves Higher by 4% or More	Mean: 9.6% Median: 9.4%	Mean: 8.3% Median: 6.7%	Mean: 0.25 Median: 0.26	Mean: 0.15 Median: 0.16	Mean: -2,069 Median: -2,052	Mean: 9.6% Median: 30.3%	Mean: 27.3% Median: 26.7%	Mean: 21.3% Median: 20.1%	31
UX2 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 3%									
VIX Moves Lower by -4% or More	Mean: -8.7% Median: -8.6%	Mean: -5.4% Median: -5.3%	Mean: -0.28 Median: -0.30	Mean: -0.21 Median: -0.21	Mean: 2,300 Median: 2,689	Mean: 14.7% Median: 11.8%	Mean: 32.8% Median: 30.0%	Mean: 24.0% Median: 23.1%	26
VIX Moves Higher by 4% or More	Mean: 9.2% Median: 9.0%	Mean: 5.4% Median: 4.5%	Mean: 0.26 Median: 0.28	Mean: 0.19 Median: 0.19	Mean: 9,134 Median: 8,866	Mean: 30.8% Median: 30.0%	Mean: 32.4% Median: 31.2%	Mean: 25.0% Median: 23.4%	18
UX3 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 3%									
VIX Moves Lower by -4% or More	Mean: -9.7% Median: -10.3%	Mean: -4.8% Median: -4.9%	Mean: -0.17 Median: -0.12	Mean: -0.13 Median: -0.11	Mean: -145 Median: -154	Mean: 1.3% Median: 1.0%	Mean: 33.2% Median: 33.6%	Mean: 26.5% Median: 25.6%	18
VIX Moves Higher by 4% or More	Mean: 10.2% Median: 10.3%	Mean: 5.0% Median: 4.7%	Mean: 0.24 Median: 0.23	Mean: 0.18 Median: 0.22	Mean: -164 Median: -158	Mean: 1.4% Median: 33.6%	Mean: 28.9% Median: 27.7%	Mean: 26.3% Median: 23.9%	12
UX4 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 2%									
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -9.8%	Mean: -3.3% Median: -3.8%	Mean: -0.10 Median: -0.15	Mean: -0.09 Median: -0.12	Mean: 251 Median: -315	Mean: 6.0% Median: 4.2%	Mean: 34.8% Median: 31.7%	Mean: 30.5% Median: 28.0%	21
VIX Moves Higher by 4% or More	Mean: 9.4% Median: 9.4%	Mean: 3.7% Median: 3.4%	Mean: 0.15 Median: 0.10	Mean: 0.11 Median: 0.13	Mean: -563 Median: -501	Mean: 8.0% Median: 31.7%	Mean: 33.6% Median: 33.7%	Mean: 28.7% Median: 28.7%	16
UX5 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 2%									
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -10.3%	Mean: -3.3% Median: -3.4%	Mean: -0.10 Median: -0.13	Mean: -0.09 Median: -0.09	Mean: 251 Median: 204	Mean: 6.0% Median: 4.8%	Mean: 34.8% Median: 34.4%	Mean: 30.5% Median: 28.8%	18
VIX Moves Higher by 4% or More	Mean: 10.0% Median: 10.3%	Mean: 3.5% Median: 2.9%	Mean: 0.18 Median: 0.05	Mean: 0.16 Median: 0.18	Mean: -193 Median: -064	Mean: 3.7% Median: 34.4%	Mean: 35.4% Median: 33.6%	Mean: 29.4% Median: 28.8%	11
UX6 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 2%									
VIX Moves Lower by -4% or More	Mean: -9.8% Median: -10.8%	Mean: -3.1% Median: -3.1%	Mean: -0.03 Median: -0.02	Mean: -0.04 Median: -0.04	Mean: 072 Median: 121	Mean: 5.7% Median: 4.7%	Mean: 40.9% Median: 40.3%	Mean: 33.1% Median: 32.1%	15
VIX Moves Higher by 4% or More	Mean: 10.3% Median: 9.9%	Mean: 3.4% Median: 2.9%	Mean: 0.23 Median: 0.11	Mean: 0.18 Median: 0.13	Mean: -219 Median: -162	Mean: 5.1% Median: 40.3%	Mean: 40.1% Median: 38.1%	Mean: 31.2% Median: 31.2%	8
UX7 from 1-Jun-12 to 6-Dec-12 where the VIX move by at least 4% and UX2 moved by at least 2%									
VIX Moves Lower by -4% or More	Mean: -9.5% Median: -10.3%	Mean: -2.7% Median: -2.6%	Mean: 0.02 Median: 0.00	Mean: 0.00 Median: -0.01	Mean: 494 Median: 490	Mean: 20.5% Median: 18.1%	Mean: 49.2% Median: 44.7%	Mean: 32.8% Median: 31.1%	16
VIX Moves Higher by 4% or More	Mean: 9.9% Median: 9.9%	Mean: 3.3% Median: 3.0%	Mean: 0.27 Median: 0.16	Mean: 0.19 Median: 0.11	Mean: 321 Median: 346	Mean: 13.5% Median: 44.7%	Mean: 47.5% Median: 47.3%	Mean: 33.5% Median: 38.5%	8

Source: SG Global Engineering & Strategy, Bloomberg

Note: UX1 is using minute bar data from 2-Jan-12 to 6-Dec-12 while UX2 through UX7 is using minute bar data from 1-Jun-12 to 6-Dec-12. All analysis is mid to mid price.

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