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GLOBAL ENGINEERING & STRATEGY

U.S. Equity Derivatives Flow Commentary

New Market Develops in VIX Futures as TAS Volumes Increase

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Overview:

We show how the VIX trade-at-settlement (TAS) has been affected by the increased popularity of VIX indexation, including Equity Traded Notes (ETN) and Equity Traded Funds (ETFs) tracking VIX indices.

What is TAS for the VIX Futures?

- 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**, e.g., price increments can be higher or lower than 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](#)).
- TAS transactions help traders during the day to manage their exposure in VIX futures related to traded notes (ETNs) and exchange traded funds (ETFs) by receiving more price certainty relative to the daily settlement price.
- For the purposes of this piece, we define that the "TAS differential" is the specified difference above or below the settlement price.** This means that settlement plus the TAS differential results in the trade-at-settlement VIX futures price. For an example of how we use TAS, see Appendix I.

Why has TAS volume been increasing for the VIX Futures?

We have seen an increase in TAS volume related to the increased popularity and trading activity of VIX indexation (ETNs and ETFs). Increased volumes in the TAS mechanism generally occur as trades below settlement. Since mid-April, we have seen that the volume weighted TAS differential is generally negative for the on-the-run 2 to 7 month VIX futures. Due to the lack of liquidity for the 8 and 9 month VIX futures, we do not see any TAS volume.

Conclusions:

- Although TAS volumes for on-the-run UX1 and UX2 VIX futures contracts have been increasing, figure 1 shows the even TAS volumes on less liquid 3 to 7 month on-the-run VIX futures have been increasing since mid-April.
- Our experience is that a negative TAS differential is the result of VIX indexers managing their risk against indexes calculated using settlement prices. The settlement price is determined by rounding up from the midpoint of the bid-ask to the nearest tick (\$0.05 increment) and thereby, it is generally disadvantageous to sellers relative to buyers of the VIX futures. VIX future buyers can buy at or near settlement (offer) but sellers of the VIX future will have generally trade below settlement (bid) with a negative TAS spread.

Fig. 1 Increase VIX Futures TAS Volume for 3-Mth through 7-Mth maturities (4/16/12 to 11/9/12)

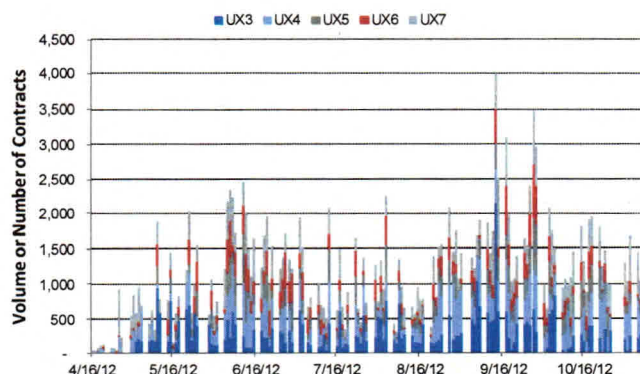


Table 1 shows the mean and median of the daily volume weighted TAS differential over time on an actual and absolute value basis as well as last 22-day average of volume weighted TAS differential on an actual and absolute basis. We can see that the effect is most prominent on the 2 to 7 month VIX futures (UX2 through UX7).

Table 1. Statistics for Volume Weighted TAS Differential from 4/16/12 to 11/9/12

VIX Future	VIX On-The-Run Maturity (Months)	Volume Weighted TAS Differential as of 11/9/12	Mean of Daily Volume Weighted TAS Differential (4/16/12 to 11/9/12)	Median of Daily Volume Weighted TAS Differential (4/16/12 to 11/9/12)	22-Day Avg. of Volume Weighted TAS Differential (10/9/12 to 11/9/12)	Median Absolute Value of Daily Volume Weighted TAS Differential (4/16/12 to 11/9/12)	22-Day Avg. of Absolute Value of Volume Weighted TAS Differential (10/9/12 to 11/9/12)
UX1	1	-0.006	-0.002	-0.002	0.000	0.002	0.002
UX2	2	-0.026	-0.024	-0.027	-0.030	0.027	0.030
UX3	3	-0.015	-0.020	-0.020	-0.019	0.020	0.019
UX4	4	-0.022	-0.016	-0.019	-0.022	0.019	0.022
UX5	5	-0.020	-0.015	-0.013	-0.021	0.014	0.021
UX6	6	-0.021	-0.014	-0.014	-0.019	0.014	0.019
UX7	7	-0.027	-0.018	-0.018	-0.026	0.018	0.026

Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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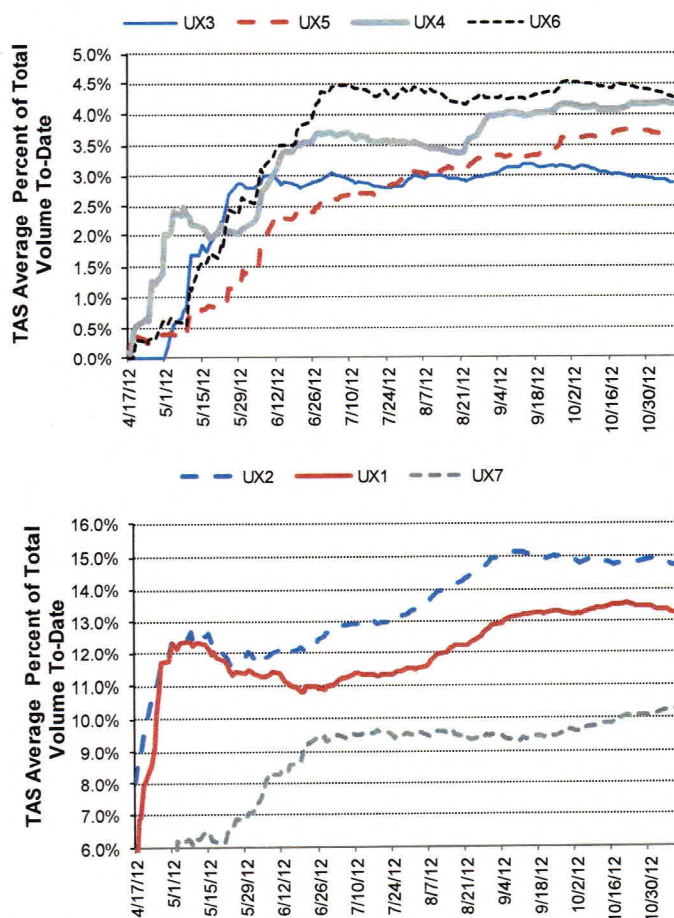
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Since mid-April, **Table 1** also shows that for most of the on-the-run VIX futures, the median and mean of the daily volume weighted TAS differentials are close to one another. However, there are differences between the actual median and mean of the daily volume weighted TAS differentials for UX1 and UX2. This implies that there can be negative and positive TAS values from the settlement. Alternatively, there is little difference between actual and absolute medians for the 3 month to 7 month VIX futures. For the front UX1 (1-mth) VIX futures contract, we have a mean and median as well as 22-day averages close to zero due to the very liquid trading of this front month future.

Since April 2012, **figure 2** shows that TAS volume as a percent of the total VIX futures volume has been increasing across most VIX futures maturities (UX1 through UX7).

Fig. 2 TAS Volume (To-Date) is Increasing Across most all VIX Futures Maturities as Percent of Total Daily VIX Futures Volume (4/16/12 to 11/9/12)



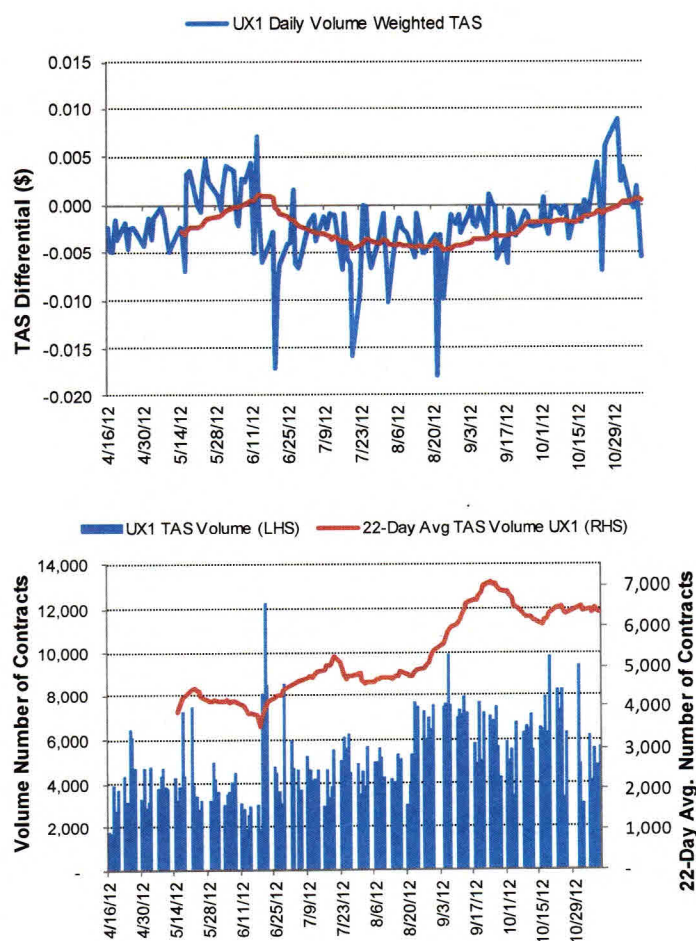
Source: Bloomberg, SG Global Engineering & Strategy

Figures 3, 4, 5, 6, 7, 8 and 9 show that the daily volume weighted TAS differentials for the on-the-run 1, 2, 3, 4, 5, 6 and 7 month VIX futures, respectively, has been widening and becoming more negative over the last few months. In addition, the 22-day

average spread on the daily volume weighted TAS has widened becoming more negative. In addition, the figures show that TAS volume and the 22-day average TAS volume have been generally increasing for all VIX futures maturities over the last few months. However, the TAS volume and 22-day average TAS volume for the 3 and 6-month VIX on-the-run (UX3) has decrease over the last month. Using over 30 listed ETN products on VIX futures as a proxy for the OTC market, we find that most are using the front month contracts UX1 and UX2 and others are using UX4, UX5 and UX7. However, there are very few using the UX3 and UX6 contracts, which can contribute to lower volumes.

With the exception of the front-month VIX futures (UX1) where the volume weighted TAS differential is generally close to zero, for most other maturities, the TAS differential has been negative. Therefore, VIX futures settlement generally becomes the offer due to the mid-market rounding up to the nearest tick while the bid is generally below the settlement price with a negative TAS differential, except for the 1-mth VIX futures contract.

Fig. 3 1-mth VIX (UX1) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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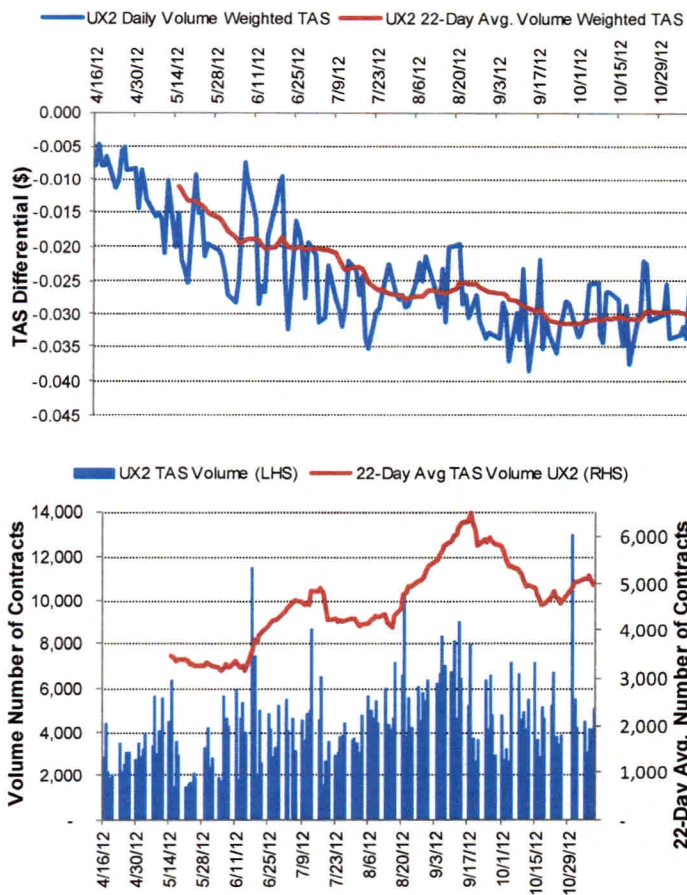
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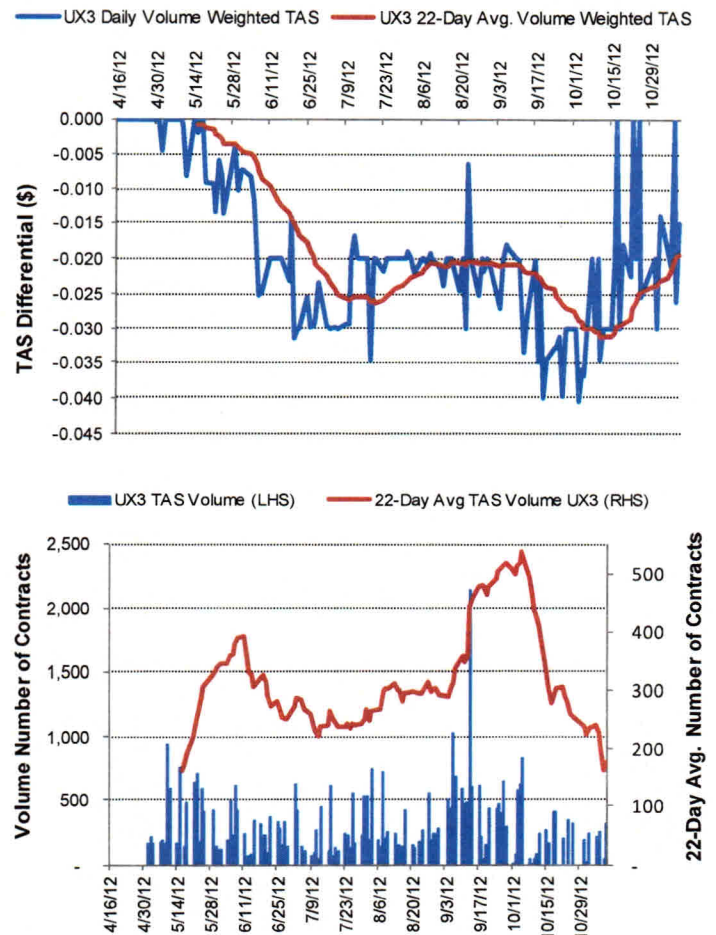
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Fig. 4 2-mth VIX (UX2) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

Fig. 5 3-mth VIX (UX3) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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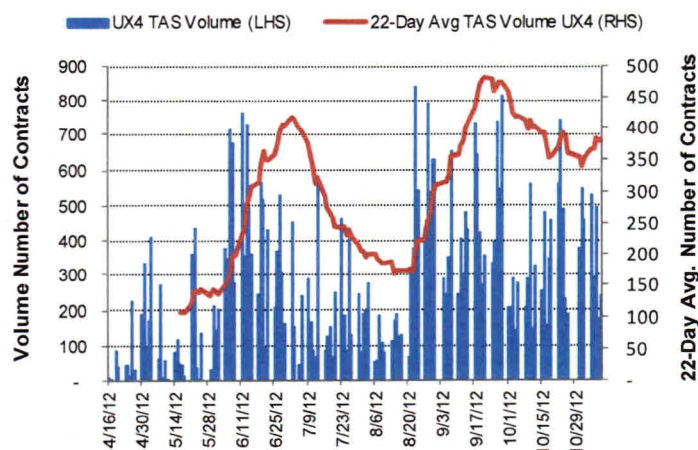
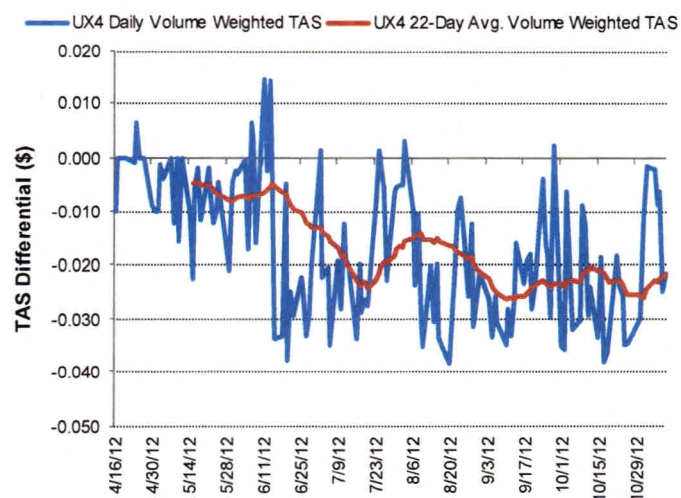
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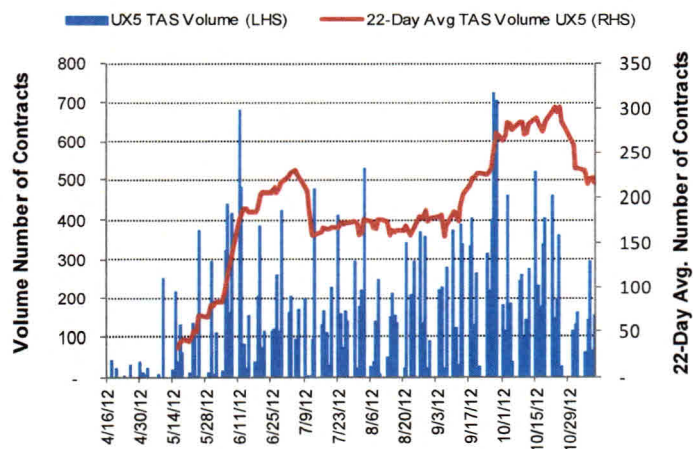
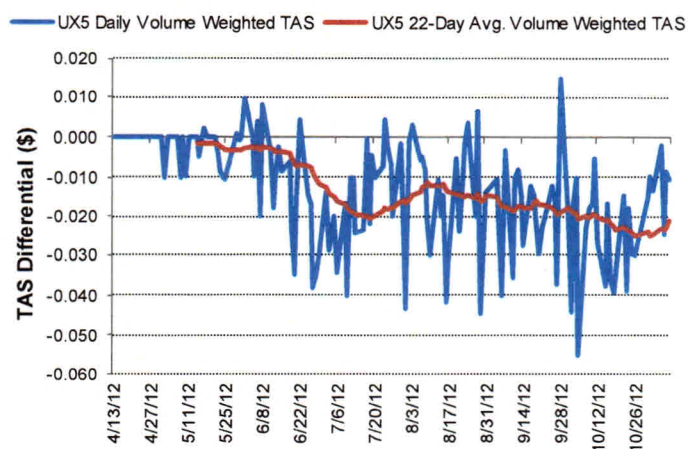
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Fig. 6 4-mth VIX (UX4) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

Fig. 7 5-mth VIX (UX5) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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Fig. 8 6-mth VIX (UX6) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)

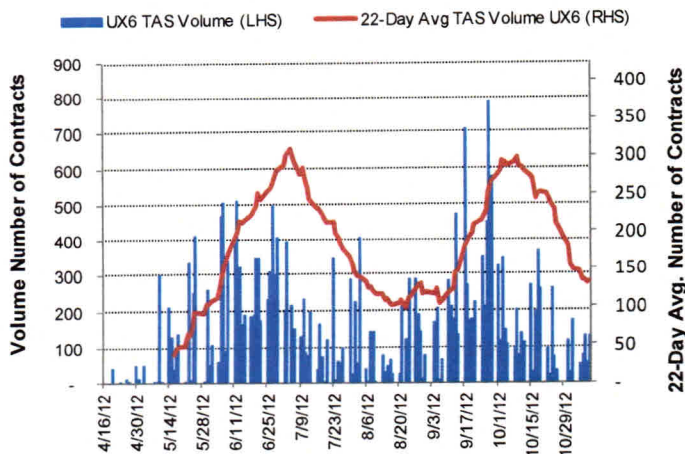
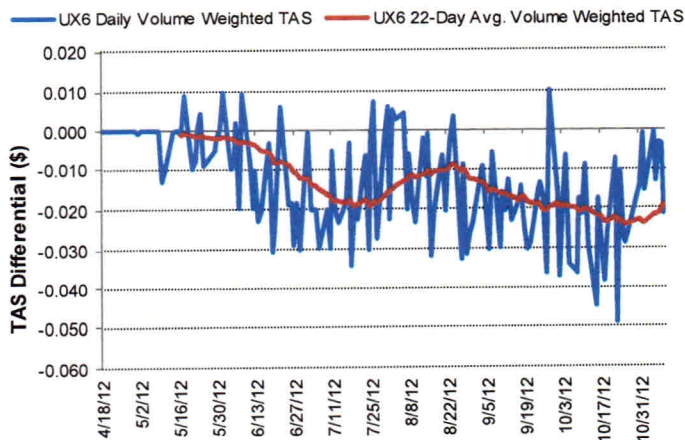
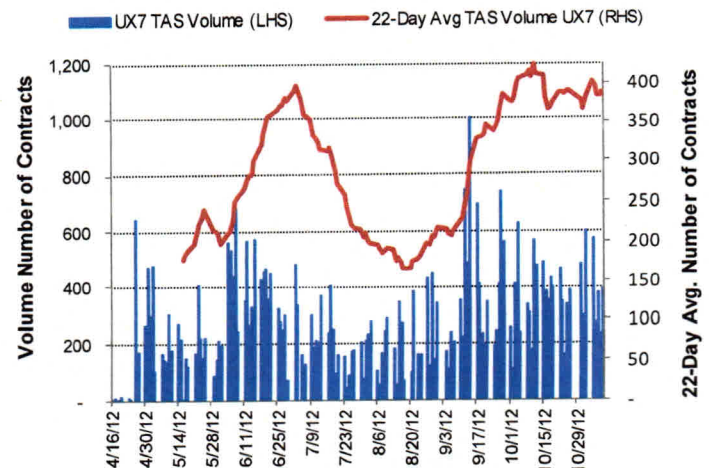
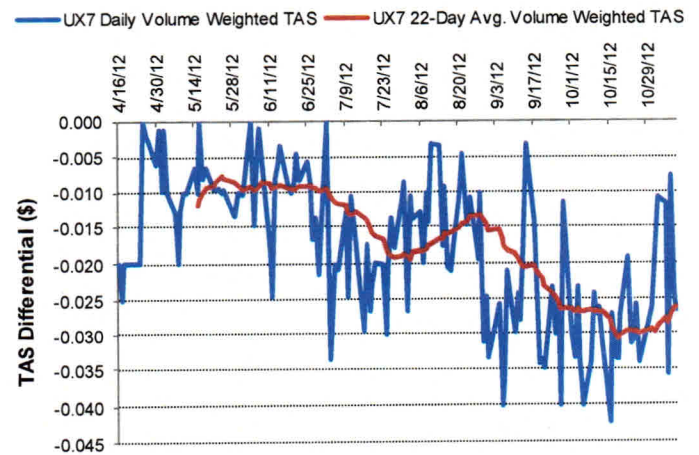


Fig. 9 7-mth VIX (UX7) Volume Weight TAS Differential, Last 22-Day Avg. TAS Differential, Daily TAS Volume, & 22-Day Avg. TAS Volume (4/16/12 to 11/9/12)



Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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APPENDIX I

Table 2 shows the TAS differential at settlement for November 8, 2012 for the March 2012 VIX Futures contract (UXH3). We can use the information to calculate the volume weighted price using the TAS execution prices.

Table 2. UXH3 (March 2013) VIX Futures Trade Recap at Settlement for 11/8/2012 , In Bloomberg <UXH3 Index>

Time	Size	Price	Trade Type
16:35:44	20	21.85	TAS
16:35:44	10	21.83	TAS
16:35:44	3	21.85	TAS
16:35:44	12	21.84	TAS
16:35:44	3	21.83	TAS
16:35:44	10	21.84	TAS
16:35:44	6	21.82	TAS
16:32:54		21.85	Settlement
Volume Weighted Price using TAS on 11/8/12		21.84	

Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

Table 3 shows the TAS differential, order size and entry time for November 8, 2012 for the March 2012 VIX Futures contract (UXH3). We can use the information to calculate the volume weighted TAS differentials on the day. We calculate this each day and use it for our analysis in this report.

Table 3. UXH3 (March 2013) VIX Futures TAS Differential Recap for 11/8/2012 , In Bloomberg <VXTH3 Index>

TAS Order Entry Time	Size	Price	Trade Type
16:32:54		0.00	Settlement
16:08:49	3	0.00	TAS
15:24:23	20	0.00	TAS
14:19:21	12	-0.01	TAS
13:15:21	3	-0.02	TAS
12:13:49	10	-0.01	TAS
12:13:38	10	-0.02	TAS
12:10:58	6	-0.03	TAS
Volume Weighted TAS Differential on 11/8/12		-0.0103	

Source: Bloomberg, SG Global Engineering & Strategy, SG Trading

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