



Tradable Volatility Estimates

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Conference in Honor of Steve Shreve
Carnegie Mellon, June 3, 2015

Outline



- I. Trading Volatility Estimates
- II. Tradable Estimates
- III. A New Hi-Lo Based Tradable Estimate



I. Trading Volatility Estimates

SPX 2006 to 2011 Data

Historical volatility tends to depend on the sampling frequency



SPX 2006 Data

Historical volatility tends to depend on the sampling frequency



SPX 2007 Data

Historical volatility tends to depend on the sampling frequency



SPX 2008 Data

Historical volatility tends to depend on the sampling frequency



SPX 2009 Data

Historical volatility tends to depend on the sampling frequency



SPX 2010 Data

Historical volatility tends to depend on the sampling frequency



SPX 2011 Data

Historical volatility tends to depend on the sampling frequency



Historical Vol / Historical Vol Arbitrage



If weekly historical vol $<$ daily historical vol :

buy strip of T options, Δ -hedge daily

sell strip of T options, Δ -hedge weekly

Adding up :

do not buy or sell any option;

play intra-week mean reversion until T;

final P&L :

Daily / Weekly Vol Arbitrage



Intra week mean reversion strategy



1 day/1 week volatility trade

More profitable when vol is high



500 stocks cross section

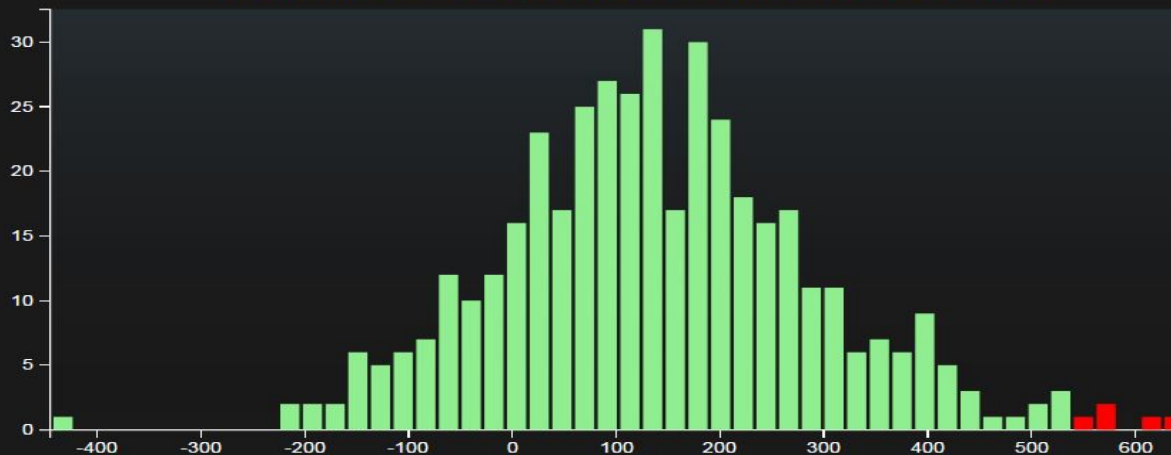
Price Series of SPX Index



Time Series Statistics

● Historical Vol	20.9%
● Skewness	-0.39
● Excess Kurtosis	2.96
● Sharpe Ratio	0.30
● Trend Score	20.7%
● Mean Rev. Score	11.2%
● One Lag Corr	-8.9%
○ Vol Spread in bps	128

Histogram of the 'Vol Spread in bps' for all the stocks in the SPX Index



Vol Spread in bps

MS UN Equity	647
FITB UW Equity	608
PFG UN Equity	566
TROW UW Equity	580
IVZ UN Equity	540

Daily – Weekly Vol Spread for S&P 500 constituents

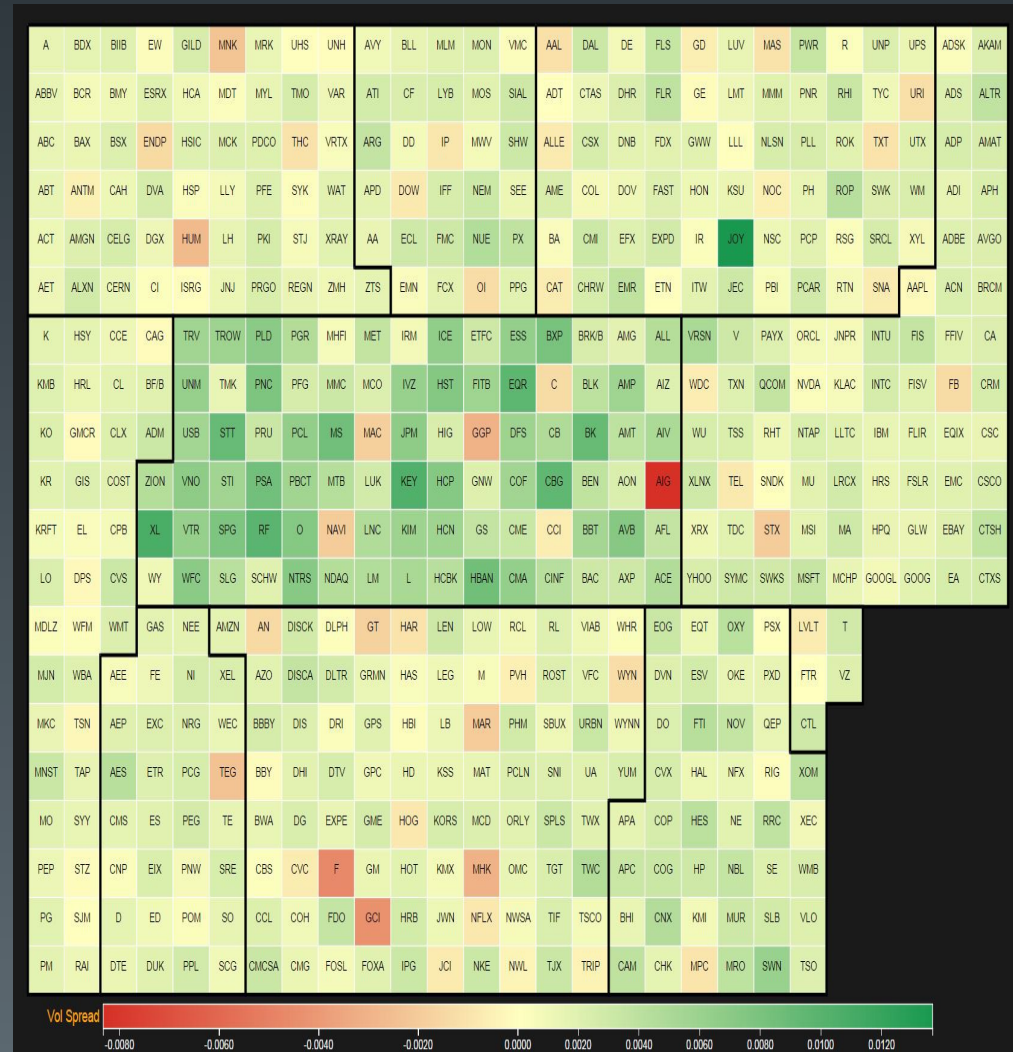
Jan 2008 to Apr 2015



A	BDX	BIB	EW	GILD	MNK	MRK	UHS	UNH	AVY	BLL	MLM	MON	VMC	AAL	DAL	DE	FLS	GD	LUV	MAS	PWR	R	UNP	UPS	AOSK	AKAM	
ABBV	BCR	BMJ	ESRX	HCA	MOT	MYL	TMO	VAR	ATI	CF	LYB	MOS	SIAL	ADT	CTAS	DHR	FLR	GE	LMT	MMM	PNR	RHI	TYC	URI	AOS	ALTR	
ABC	BAX	BSX	ENDP	HSC	MCK	PCO	THC	VRTX	ARG	DO	IP	MW	SHW	ALLE	CSX	DNB	FDX	GMW	LLL	NLSN	PLL	ROK	TXT	UTX	AOP	AWAT	
ABT	ANTM	CAH	DVA	HSP	LLY	PFE	SYK	WAT	APD	DOW	IFF	NEM	SEE	AME	COL	DOV	FAST	HON	KSU	NOC	PH	ROP	SWK	WM	ADI	APH	
ACT	AMGN	CELG	DGX	HUM	LH	PKI	STJ	XRAY	AA	ECL	FMC	NUE	PX	BA	CMH	EFX	EXPD	IR	JOY	NSC	PCP	RSG	SRCL	XYL	ACBE	AVGO	
AET	ALXN	CERN	CI	ISRG	JNJ	PRGO	REGN	ZIHL	ZTS	EMN	FCX	QI	PPG	CAT	CHRW	EMR	ETN	ITW	JEC	PBI	PCAR	RTN	SNA	AAPL	ACN	BRCM	
K	HSY	CCE	CAG	TRV	TROW	PLD	PGR	MHI	MET	IRM	ICE	ETFC	ESS	BXP	BRKB	AMG	ALL	VRSN	V	PAYX	ORCL	JNPR	INTU	FIS	FFIV	CA	
KMB	HRL	CL	BFBS	UNM	TMK	PNC	PFG	MHC	MCO	IVZ	HST	FTB	EQR	C	BLK	AMP	AIZ	WDC	TAN	QCOM	NVDA	KLAC	INTC	FISV	FB	CRM	
KO	GMCR	CLX	ADM	USB	STT	PRU	POL	MS	MAC	JPM	HIG	GGP	DFS	CB	BK	AMT	AV	WU	TSS	Information Technology					EDIX	CSC	
KR	GIS	COST	SON	VNO	STI	PSA	PBCT	MTB	LUX	KEY	HCP	GNW	COF	CBG	BEN	ACN	AVG	XLNX	TEL	SNOK	MJ	LRCX	HRS	FSLR	EMC	CSCO	
Consumer Staples	FB	XL	VTR	SPG	RF	O	NAVI	LNC	KIM	HON	GS	CME	COI	BBT	AVB	APL	IRX	TDC	STX	MSI	MA	HPQ	GLW	EBAY	CTSH		
	CVS	WY	WFC	SLG	SCHW	NTRS	NOAQ	LMI	L	HCBK	HSBK	CMA	CINF	BAC	AXP	ACE	PHOD	SYMC	SWKS	MSFT	MCHP	GOOGL	GOOG	EA	CTXS		
MDLZ	WFM	WMT	GAS	NEE	AMZN	AN	DISCK	DLPH	GT	HAR	LEN	LOW	RCL	RL	VIA	WHR	EOG	EQT	OXY	PSX	Telecommunication Services						
MUN	WEA	AEE	FE	NI	XEL	AZO	DISCA	DLTR	GRMN	HAS	LEG	M	PVH	ROST	VFC	WYNN	DVN	ESV	OKE	PXD							
MKC	TSN	AEP	EXC	NRG	WEC	BBBY	DIS	DRI	GPS	HBI	LS	MAR	PHM	SBUX	URBN	WYNN	DO	FTI	NOV	GEP	CTL						
MINST	TAP	AES	ETR	PGG	TEG	BBY	DHI	DTV	GPC	HD	KSS	NAT	PCN	SNI	UA	YUM	CLX	HAL	NFX	RIG	XOM						
MO	SYI	CMS	ES	PES	TE	BWA	DG	EADE	GME	HUG	KORS	MCU	ORLY	SPLS	TWIX	APA	COP	RES	NE	RRC	XEC						
PEP	STZ	CNP	EXX	PWV	SRE	CBS	CVC	F	GM	HOT	KMX	MHK	OMC	TGT	TWC	APC	COG	HP	NBL	SE	WMB						
PG	SJM	O	ED	POM	SO	CCL	COH	FDX	GCI	HRB	JWN	NFLX	NVSA	TIF	TSCO	BHI	CNX	KMI	MUR	SLB	VLD						
PM	RAI	DTE	DUK	PPL	SCG	QMSA	OMG	FOSL	FOXA	IPG	JCI	NKE	NWL	TJX	TRIP	CAM	CHK	MPC	MRO	SWN	TSC						

Daily – Weekly Vol Spread for S&P 500 constituents

Jan 2008 to Apr 2015



Covariation Trading



Historical Cov / Historical Cov Arbitrage





II. Tradable Estimates

Some Definitions

(Normal as opposed to Lognormal convention)

Tradable
Unbiased



Discretized Quadratic Variation



Δ hedge of a parabola

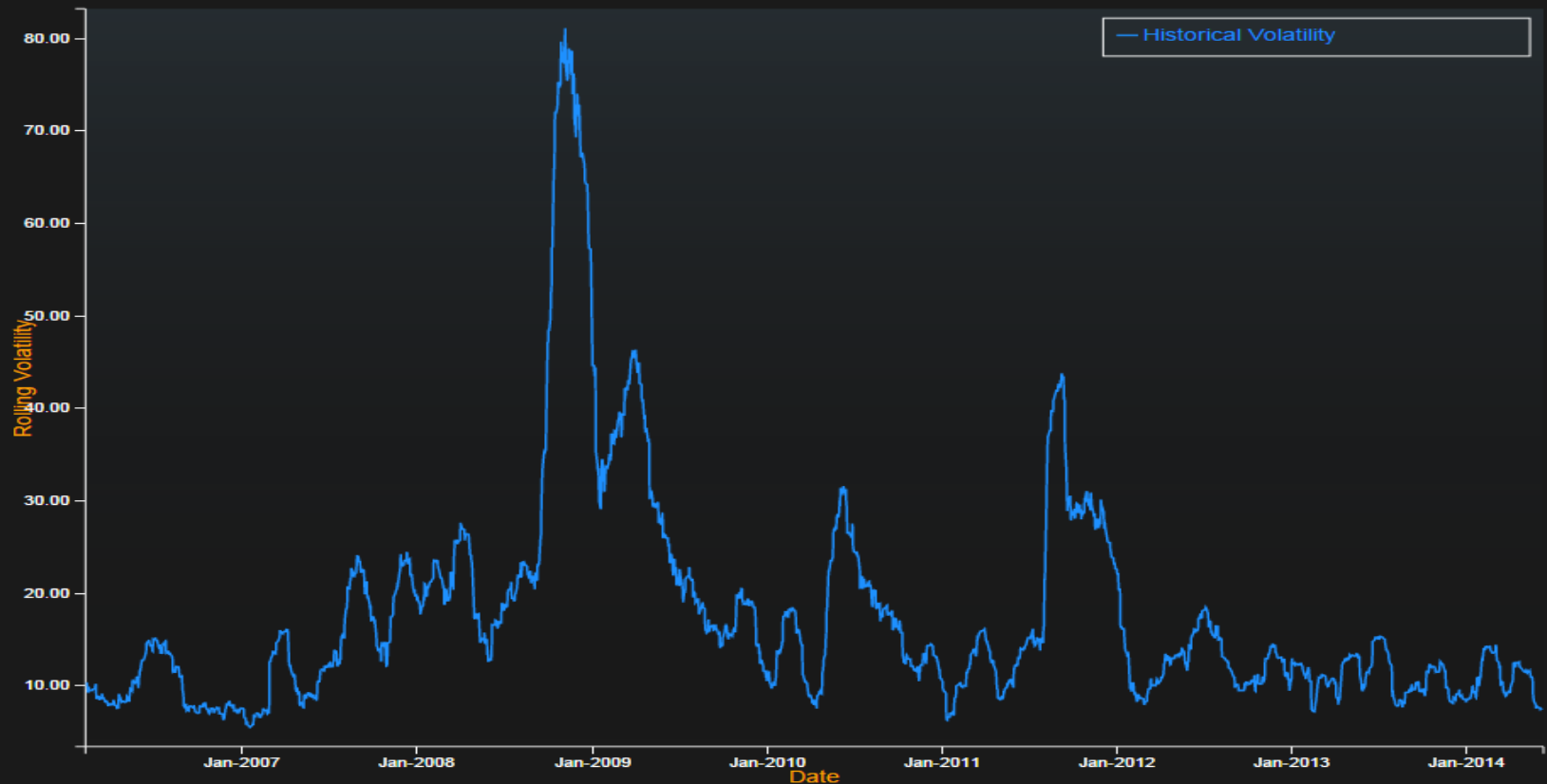
Tradable unbiased estimate

Costless stock trading

Classical Estimator



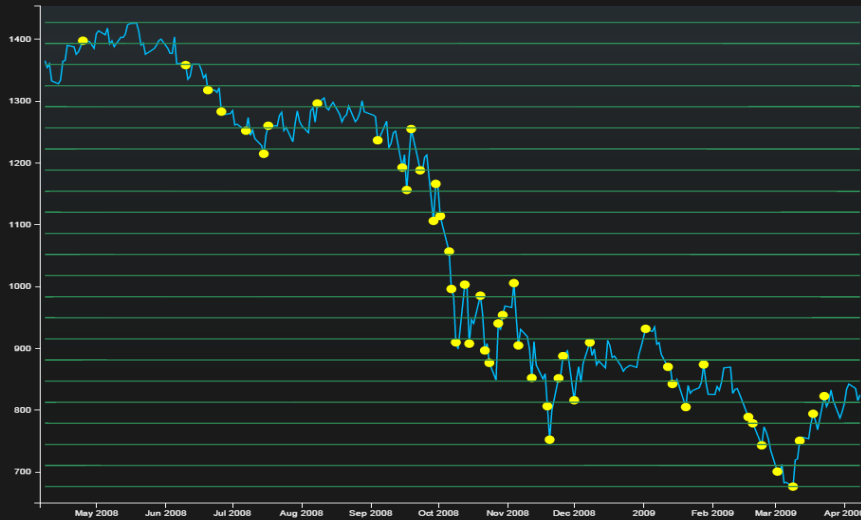
SPX Index 30 Day Rolling Window Historical Volatility Estimate



Move-Based Estimator

For option pricing, a volatility estimate should reflect the cost of hedging

Hedge according to spot moves (move based) better than hedge at fixed times (time based)



SPX Index daily Close Prices

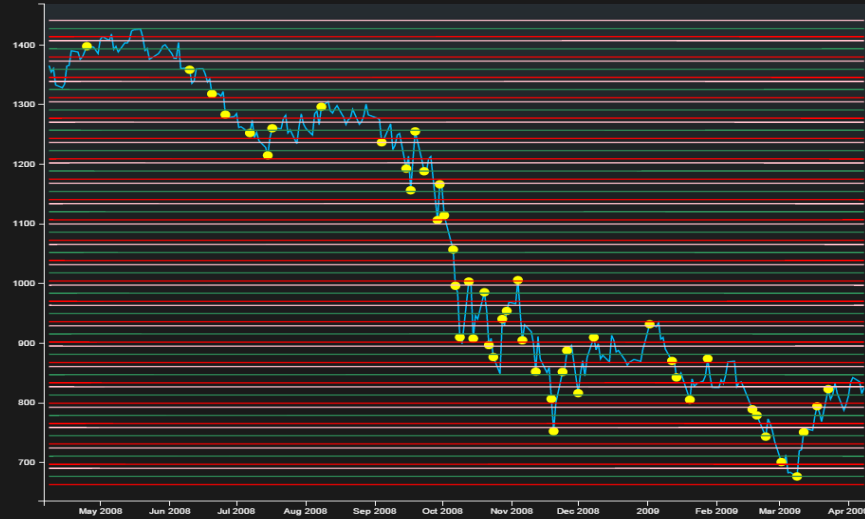


SPX Index daily Move-Based Annualized Volatility

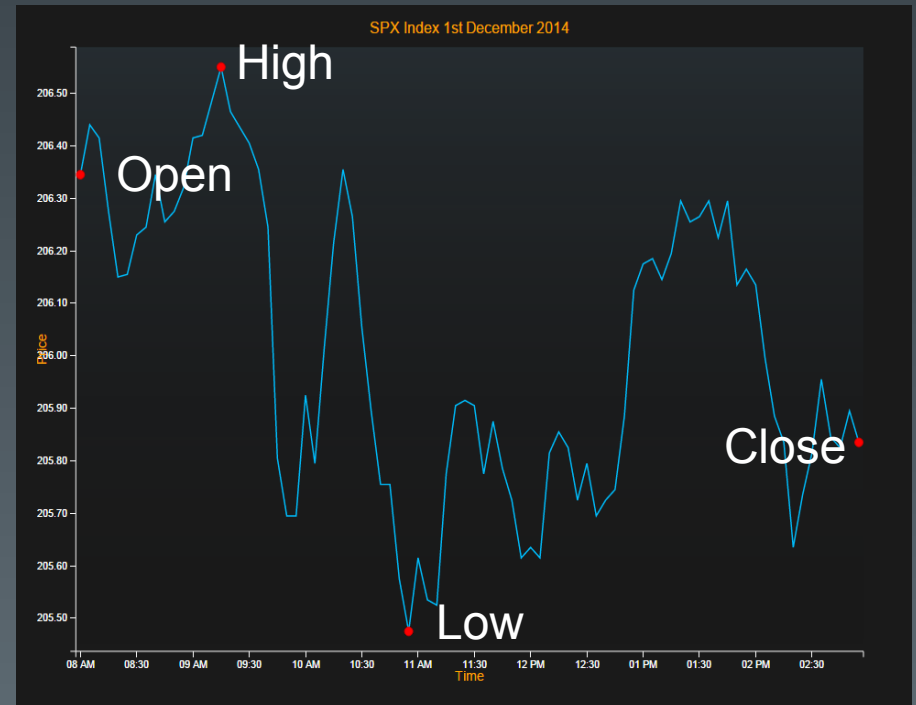
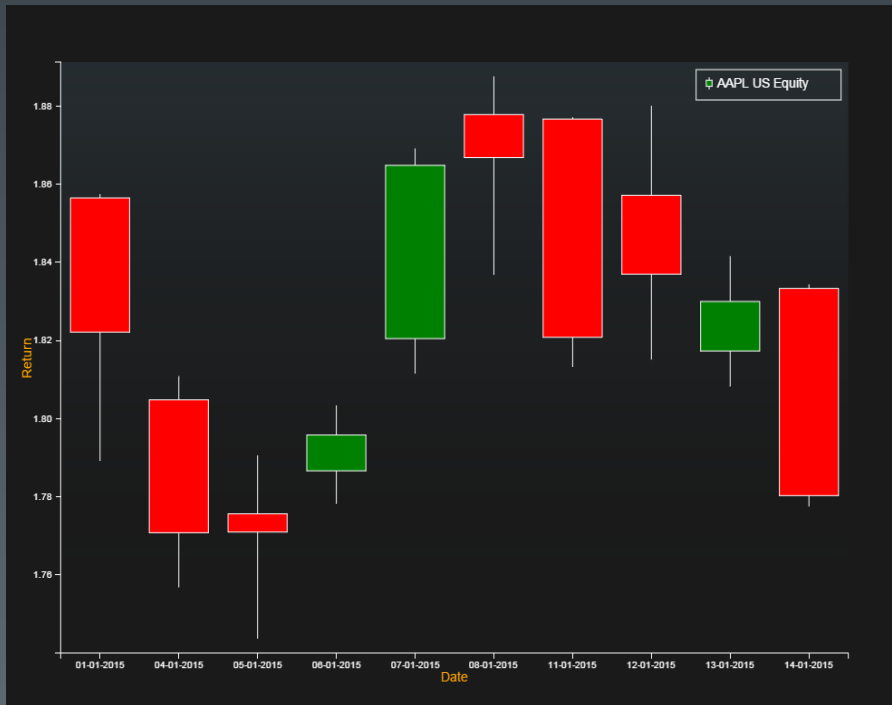


Move-Based Estimator

noise is smoothed out by phase averaging



OHLC



Hi-Lo Estimates

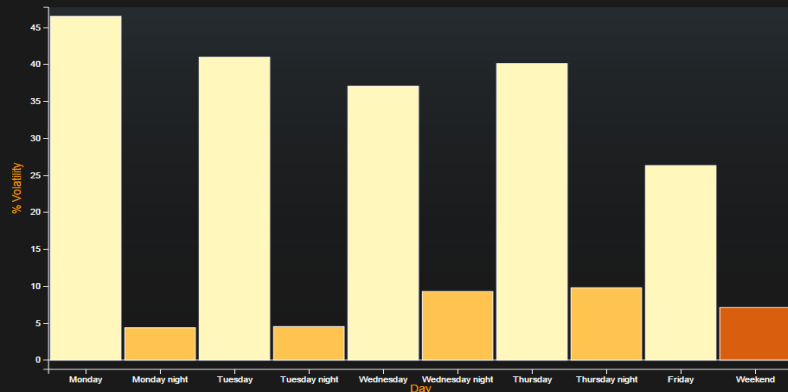


The Uncertainty of the Night

SPX Index



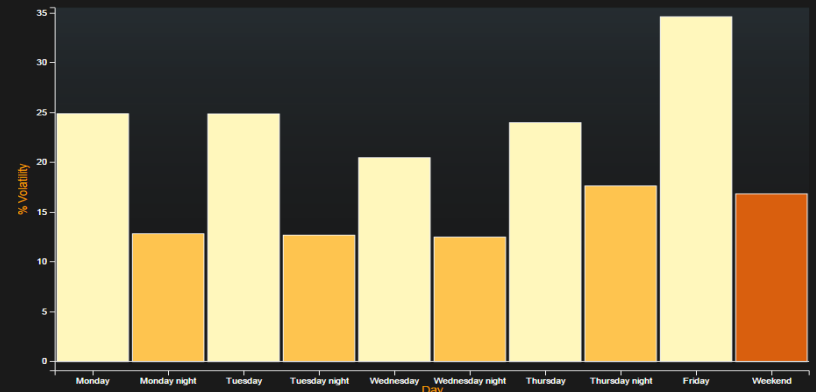
Percentage volatility from 2008-07-26 to 2009-10-22



GS US Equity



Percentage volatility from 2009-10-24 to 2011-03-25



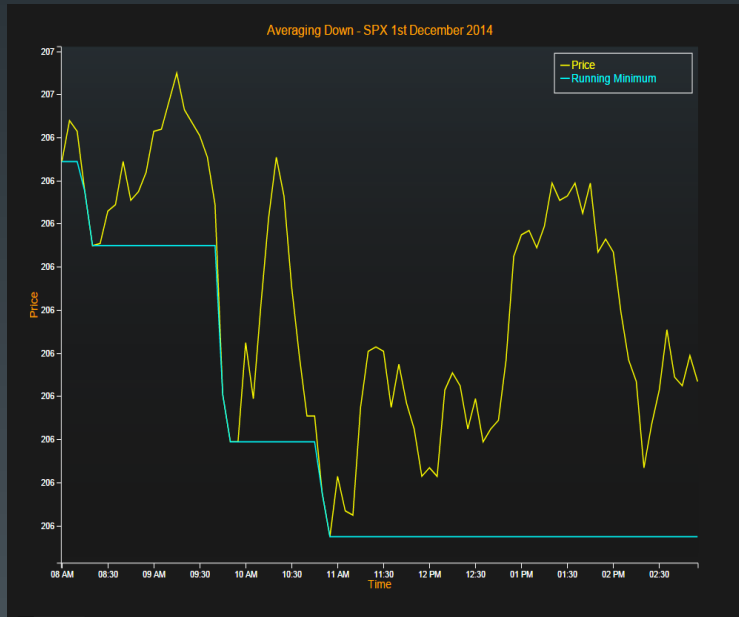
But...

- Hi-Lo Estimators are less useful than the classical one because they cannot be traded
- Highs and Lows are always observed after the fact
- However... we introduce a tradable Hi-Lo based estimator



III. A New Hi-Lo Based Tradable Estimate

Averaging Down



A Side Note



A New Estimator

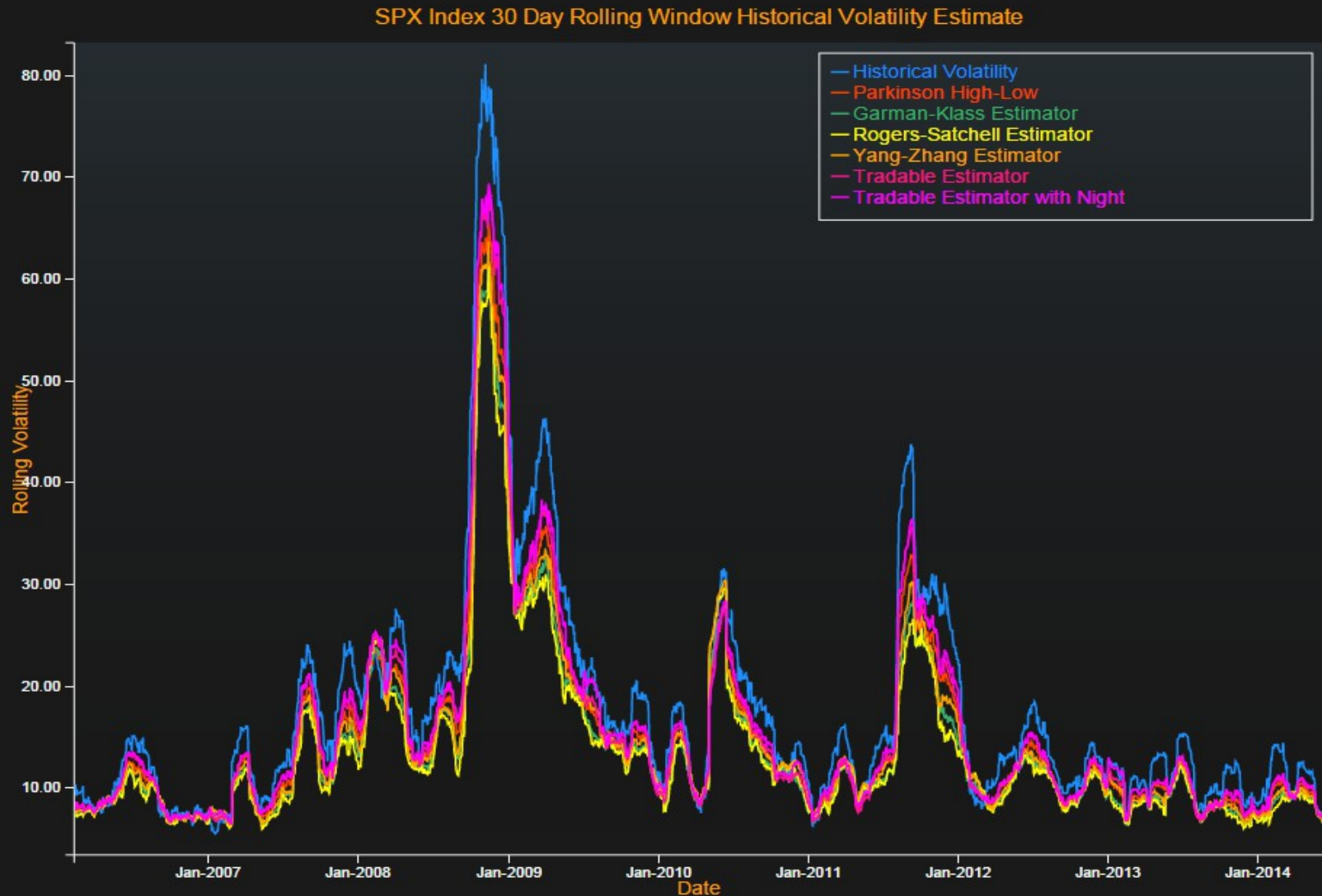


Trading Strategy



(Mid – Close)/Range

Comparison of Estimators



Conclusion

- Most common volatility trade is historical vs implied
- With tradable estimates: can trade historical vs historical, without any option market
- Hi-Lo estimates are usually not tradable...



Thank You