Sharpe Parity -

Tweaking the Edges

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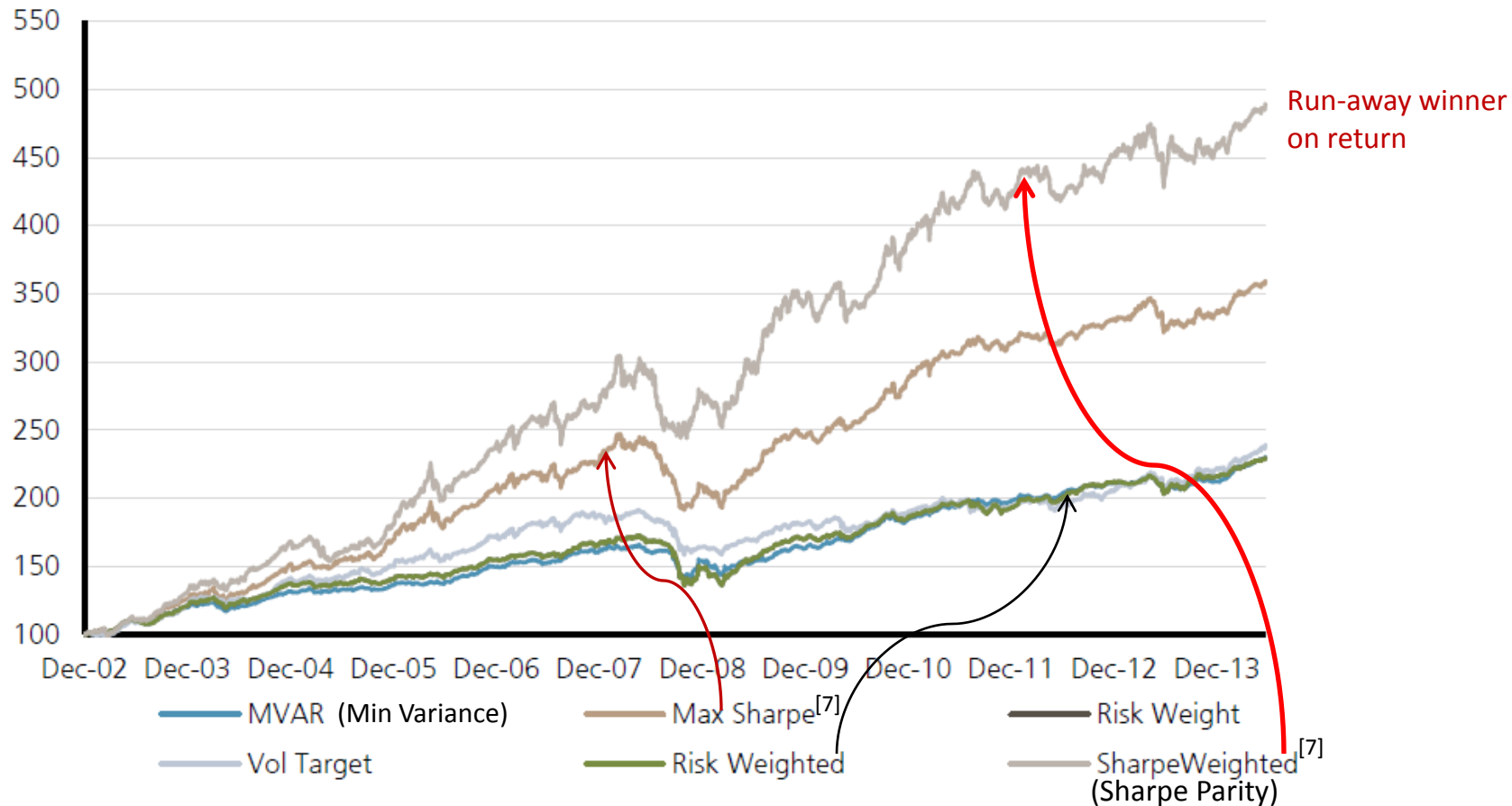
Investment Performance

- Higher return is the objective, yet risk matters.

- Momentum works, at least in the short term.

- Cheap valuation works.

- Diversification is the only free lunch in financial markets. It works best when components of the portfolio are negatively correlated, un-correlated or lowly correlated. Diversification reduces the risk, but does not guarantee high return.

- Goal of asset allocation algorithm: allocate more to assets that will perform well in the future and allocate less or nothing to assets that will perform poorly in the future. As the future is unknown currently and is continuously changing, it cannot be optimized. All we can do is to test and validate the algorithm retroactively and on a "go forward" basis.

Sharpe Parity Historical Performance[1]

Figure 6: Comparison of strategy returns. Sharpe weighted is best in absolute return terms followed by maximum Sharpe. The remaining strategies lag far behind.

Run-away winner on return

Legend:
- MVAR (Min Variance)
- Vol Target
- Max Sharpe[7]
- Risk Weighted
- Risk Weight
- SharpeWeighted[7] (Sharpe Parity)

Source: UBS

S&P 500 total return from Dec/31/2002 to Dec/31/2013: +160%. Or, end point was 260% of starting point.

Sharpe Parity in CIMI Folio Tracking[1]

- **Basic Algorithm**
  - Buy Rules: Weight assets to achieve Sharpe ratio parity
    - Calculate Sharpe parity weightings over the trailing 63 days. See presentation and tracking spreadsheet for details
    - Assets that have a negative Sharpe receive 0 weight
  - Volatility control rules (no sell rule per se)
    - If portfolio volatility is > 1% SD on a trailing 63 day basis, add "cash" to reduce volatility to a 1%
    - "Cash" is 1) IEF, 2) SHY or 3) Money market depending on gains of bonds
  - ETFs used: SPY, QQQ, EEM, IWM, EFA, TLT, IYR, GLD
    - IEF, SHY are used as "cash" to reduce portfolio volatility
- Timing: None (only volatility control)
- Trades: Monthly
- Implementation comments:
  - Started (Oct/2014)
- Valuation: NOT part of the algorithm consideration.

Monthly Re-Alloc	4Q/2014	Jan/2015	Feb/2015	Mar/2015
Sharpe Parity	5.7%	3.1%	-3.5%	-0.2%
SPY	4.2%	-3.0%	5.6%	-1.6%

Sharpe Parity at Turning Points

(Using Weekly Data)

Ticker	Description	Weight (Feb/27/2015)	Weight (Feb/6/2015)	Weight (Jan/30/2015)	Weight (Jan/23/2015)	Weight (Jan/2/2015)
SPY	S&P 500 ETF	9%	6%	0	9%	9%
QQQ	NASDAQ 100	10%	7%	1%	10%	9%
EEM	Emerging Market ETF	0	0	0	1%	0
IWM	Russell 2000 U.S. Small Cap	21%	11%	0	11%	14%
EFA	Developed Markets	10%	2%	0	0	0
TLT	20+ Year U.S. Treasury	18%	26%	44% $S_W = 0.75$	25%	22%
IYR	Real Estate Invest. Trusts	21%	35%	34%	36%	46% $S_W = 0.89$
GLD	Physical Gold Bullion	12%	14%	21%	7%	0
	Total Allocations	100%	100%	100%	100%	100%

- Due to sharp rise in interest rate following the rosy Jan/2015 employment report, Treasury showed sharp decline in allocation, triggered by negative return for Feb/2-19 and increase in 13-week standard deviation. U.S. equities came back after one week of absence.

Historically, the rotation strategies, even when combined, have failed in around one year in three. In the case of momentum, the failures can be especially painful at market turning points. But for the patient, long-run investor who can weather such episodes, the past success of these strategies may provide food for thought. - - - - - - *Credit Suisse Global Investment Returns Yearbook 2015[6].*

Ex Post Sharpe Ratio
Translating Weekly Data into Annualized Equivalence

S = (Avg Annual Return – R$_f$) / σ(Annual Return)

> English: Sharpe ratio is the average annual excess return of the portfolio over and above risk-free return divided by the standard deviation of the annual return.

R$_f$: risk free return ~ 0 in an era of zero interest rate policy.

Avg Annual Return ~ Avg Weekly Return * 52

σ(Annual Return) ~ σ(Weekly Return) * SQRT(52)

S ~ Avg Weekly Return / σ(Weekly Return) * SQRT(52)

= 7.2 * Avg Weekly Return / σ(Weekly Return)

= 7.2 * S$_W$

Refuting Deo & Nakisa's Findings

Wesley Gray's Retro Analysis[2]

Alloc Algo	Ivy 5 EW	Ivy 5 12M-MA	Risk Parity 36M*	Sharpe Parity 36M*	Sharpe Parity 3M*
CAGR	10.5%	10.8%	10.7%	10.9%	11.9%
St. Dev.	10.3%	7.2%	8.2%	10.0%	12.3%
Max DD	- 46.3%	- 12.5%	- 30.1%	- 24.5%	- 36.7%
Sharpe	0.58	0.83	0.72	0.62	0.55
Sortino	0.63	1.00	0.84	0.81	0.61

Comparisons	Deo & Nakisa	Wesley Gray
Asset Classes	SPY, QQQ, IWM, EFA, IYR, EEM, TLT and GLD.	Ivy 5 (SPY, EFA, IYR, GSCI and LTR)
Retro Analysis Period	Dec/2002 – Dec/2013	Jan/1980 – July/2014

Takeaway:

- To make Sharpe parity a truly high performance allocation strategy of all seasons, it needs to increase return while reducing standard deviation and drawdown at the same time.

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* Risk Parity: 36 month look-back period. Sharpe Parity: 36 month and 3 month look-back period for Sharpe ratio calculations.

Tweaking the Edges

- Use currency-hedged equity ETF's to protect the gain from developed market equities when currency weakness is the primary driver for their economic revival.
  - Buy DBEF (Deutsche MSCI EAFE Hedged Equity ETF) instead of EAF (iShares MSCI EAFE).
  - Buy DXJ (Wisdom Tree Japan Hedged Equity ETF) instead of EWJ (iShares MSCI Japan).
  - Buy HEDJ (Wisdom Tree Europe Hedged Equity ETF) instead of VGK (Vanguard FTSE Europe ETF).
- Use higher Sharpe sub-classes for asset classes with large allocations.
  - For example, we may allocate to healthcare (XLV) and consumer discretionary (XLY) if they had higher Sharpe ratios than other sectors when the scheme calls for large allocation to S&P 500.
  - If emerging markets garner large allocation, we may want to allocate to China and India, but not Brazil and Russia, if China and India were the better performing geographical areas.
  - If U.S. small-cap sector garners large allocation, we may want to allocate to either small-cap growth (IWO/IJT) or small-cap value (IWN), depending on whom has higher Sharpe ratio.
- Guard against bubble top for asset class with very high Sharpe ratio by
  - imposing maximum exposure cap once Sharpe ratio exceeds some ceiling (e.g. cap the asset class exposure to no more than 20% once $S_W > 0.5$), or
  - getting out of high-flyers faster once momentum wanes (e.g. exit once the price falls below 50 days moving average, instead of negative return in 13 weeks), or
  - using fundamental factors (e.g. Fed's valuation metrics[3]) or
  - Using technical indicators (e.g. Financial Crisis Observatory's LPPL models[4]).
- Challenge: how to incorporate valuation into the framework to make it work even better? One way is to favor asset classes with lower valuation and/or low correlation but same or similar short-term Sharpe ratios.

Currency-Hedged vs. Un-Hedged ETF's

Ticker	Index	Hedge	Sponsor	Mgmt Fee	Assets	6/30/2014 – 3/31/2015
DXJ	WT Japan	Yes	WisdomTree	0.48%	$15.8 Bil.	+ 22.0%
EWJ	MSCI Japan	No	iShares	0.48%	$16.8 Bil.	+ 2.8%
HEDJ	WT Europe	Yes	WisdomTree	0.58%	$17.3 Bil.	+ 18.3%
VGK	FTSE Europe	No	Vanguard	0.12%	$18.7 Bil.	- 8.1%
DBEF	MSCI EAFE	Yes	Deutsche	0.35%	$7.2 Bil.	+ 11.4%
EFA	MSCI EAFE	No	iShares	0.33%	$57.6 Bil.	- 5.2%
HEWG	MSCI Germany	Yes	iShares	0.53%	$1.3 Bil.	+ 20.2%
EWG	MSCI Germany	No	iShares	0.48%	$6.7 Bil.	- 4.6%

Yet another reason to have hedged foreign exposures is that most of your liabilities (living expenses and taxes etc.) are in US$.

Impact of Asset Class Substitution

- Use DBEF to replace EFA in Deo & Nakisa's eight asset class allocation scheme.
- Sharpe ratio calculations: using weekly data for the last 13 weeks.
- Re-balance: once every 4 weeks. Return measured in 40 weeks.

Starting Allocation	Outcome Ended	Asset Classes	40W Return	Difference
June/13/2014 (Friday Close)	Mar/20/2015	DBEF + 7 Others	+ 10.8%	+ 1.0%
June/13/2014 (base case)	Mar/20/2015	EFA + 7 Others	+ 9.9%	
June/20/2014 (Friday Close)	Mar/27/2015	DBEF + 7 Others	+ 0.7%	+ 0.8%
June/20/2014 (base case)	Mar/27/2015	EFA + 7 Others	- 0.1%	
June/27/2014 (Friday Close)	Apr/3/2015	DBEF + 7 Others	+ 1.2%	+ 1.0%
June/27/2014 (base case)	Apr/3/2015	EFA + 7 Others	+ 0.2%	
July/4/2014 (Friday Close)	Apr/10/2015	DBEF + 7 Others	+ 10.6%	+ 0.9%
July/4/2014 (base case)	Apr/10/2015	EFA + 7 Others	+ 9.7%	
Average of 4 Starts		DBEF + 7 Others	+ 5.9%	+ 0.9%
Average of 4 Starts (base case)		EFA + 7 Others	+ 5.0%	

Sharpe parity did not perform well in Sept/2014 and in Feb/2015.

S&P Healthcare Sector

Ticker	Description	Performance Period	Return
XLV	S&P Healthcare	1Q/2015	+ 6.3%
SPY	S&P 500	1Q/2015	+ 0.9%
DBEF	Hedged Developed Markets	1Q/2015	+ 11.0%
EFA	Developed Markets (EAFE)	1Q/2015	+ 4.9%
XLV	S&P Healthcare	2H/2014	+ 13.2%
SPY	S&P 500	2H/2014	+ 6.1%
DBEF	Hedged Developed Markets	2H/2014	+ 1.4%
EFA	Developed Markets (EAFE)	2H/2014	- 10.1%
XLV	S&P Healthcare	1H/2014	+ 10.5%
SPY	S&P 500	1H/2014	+ 7.0%
DBEF	Hedged Developed Markets	1H/2014	+ 3.8%
EFA	Developed Markets (EAFE)	1H/2014	+ 4.4%

Impact of Sub-Class Substitution

- Use XLV to replace SPY in Deo & Nakisa's eight asset class allocation scheme.
- Sharpe ratio calculations: using weekly data for the last 13 weeks.
- Re-balance: once every 4 weeks. Return measured in 40 weeks.

Starting Allocation	Outcome Ended	Asset Classes	40W Return	Difference
June/13/2014 (Friday Close)	Mar/20/2015	XLV + 7 Others	+ 12.9%	+ 3.0%
June/13/2014 (base case)	Mar/20/2015	SPY + 7 Others	+ 9.9%	
June/20/2014 (Friday Close)	Mar/27/2015	XLV + 7 Others	+ 5.6%	+ 5.7 %
June/20/2014 (base case)	Mar/27/2015	SPY + 7 Others	- 0.1%	
June/27/2014 (Friday Close)	Apr/3/2015	XLV + 7 Others	+ 2.2%	+ 2.0%
June/27/2014 (base case)	Apr/3/2015	SPY + 7 Others	+ 0.2%	
July/4/2014 (Friday Close)	Apr/10/2015	XLV + 7 Others	+ 12.9%	+3.2%
July/4/2014 (base case)	Apr/10/2015	SPY + 7 Others	+ 9.7%	
Average of 4 Starts		XLV + 7 Others	+ 8.4%	+ 3.4%
Average of 4 Starts (base case)		SPY + 7 Others	+ 5.0%	

Impact of Two-Class Substitution

- Use XLV to replace SPY AND DBEF to replace EFA in Deo & Nakisa's eight asset class allocation scheme.

- Sharpe ratio calculations: using weekly data for the last 13 weeks.

- Re-balance: once every 4 weeks. Return measured in 40 weeks.

Starting Allocation	Outcome Ended	Asset Classes	40W Return	Difference
June/13/2014 (Friday Close)	Mar/20/2015	XLV + DBEF + 6 Others	+ 13.7%	+ 3.8%
June/13/2014 (base case)	Mar/20/2015	SPY + EFA + 6 Others	+ 9.9%	
June/20/2014 (Friday Close)	Mar/27/2015	XLV + DBEF + 6 Others	+ 6.0%	+ 6.1%
June/20/2014 (base case)	Mar/27/2015	SPY + EFA + 6 Others	- 0.1%	
June/27/2014 (Friday Close)	Apr/3/2015	XLV + DBEF + 6 Others	+ 3.1%	+ 2.9%
June/27/2014 (base case)	Apr/3/2015	SPY + EFA + 6 Others	+ 0.2%	
July/4/2014 (Friday Close)	Apr/10/2015	XLV + DBEF + 6 Others	+ 13.8%	+ 3.1%
July/4/2014 (base case)	Apr/10/2015	SPY + EFA + 6 Others	+ 9.7%	
Average of 4 Starts		XLV + DBEF + 6 Others	+9.2%	+ 4.2%
Avg of 4 Starts (base case)		SPY + EFA + 6 Others	+ 5.0%	

Is there a broader lesson to improve the return of Sharpe parity framework?

Impact of 2-for-1 Class Substitution

- Use IBB (biotech) and XSD (equal weight semiconductor) to replace QQQ in Deo & Nakisa's eight asset class allocation scheme.
- Sharpe ratio calculations: using weekly data for the last 13 weeks.
- Re-balance: once every 4 weeks. Return measured in 40 weeks.

Starting Allocation	Outcome Ended	Asset Classes	40W Return	Difference
June/13/2014 (Friday Close)	Mar/20/2015	IBB + XSD + 7 Others	+ 15.7%	+ 5.8%
June/13/2014 (base case)	Mar/20/2015	QQQ + 7 Others	+ 9.9%	
June/20/2014 (Friday Close)	Mar/27/2015	IBB + XSD + 7 Others	+ 7.8%	+7.9%
June/20/2014 (base case)	Mar/27/2015	QQQ + 7 Others	- 0.1%	
June/27/2014 (Friday Close)	Apr/3/2015	IBB + XSD + 7 Others	+ 10.1%	+ 9.9%
June/27/2014 (base case)	Apr/3/2015	QQQ + 7 Others	+ 0.2%	
July/4/2014 (Friday Close)	Apr/10/2015	IBB + XSD + 7 Others	+ 16.9%	+ 7.2%
July/4/2014 (base case)	Apr/10/2015	QQQ + 7 Others	+ 9.7%	
Average of 4 Starts		IBB + XSD + 7 Others	+ 12.7%	+ 7.7%
Average of 4 Starts (base case)		QQQ + 7 Others	+ 5.0%	
Average of 4 Starts		SPY	+7.9%	

There could be many other iterations with the basic Deo & Nakisa Sharpe parity framework.

Financial Crisis Observatory Surveillance[4]

As of April/1/2015

Asset Class Description	Bubble Type	LPPL Trust	LPPL Confidence
iBoxx EUR Belgium/France/Lux/Italy Bond Index	Positive	45%+	45%+
iBoxx EUR Spain/Ireland Bond Index	Positive	35 – 40%	65%+
iBoxx EUR Financial / Subordinated Index	Positive	35%+	40%+
S&P 500 Healthcare Providers + Services (USA)	Positive	33%	62%
S&P 500 Healthcare Technology (USA)	Positive	20%	36%
ISEQ Overall (Ireland)	Positive	26%	41%
STOXX Europe 600 Media	Positive	25%	26%
STOXX Europe 600 Travel + Leisure	Positive	23%	34%
STOXX Europe 600 Insurance	Positive	22%	33%
STOXX Europe 600 Health Care	Positive	18%	32%
Deutsche Boerse DAX Index (Germany)	Positive	18%	28%
TOPIX Stock Price Index (Japan)	Positive	9%	39%
Columbia SE General Index	**Negative**	21%	12%
Lima SE Selective Index (Peru)	**Negative**	21%	39%

- **LPPL Trust** indicator measures how closely the pattern matches the theoretical LPPL model, zero being a bad and one being a perfect match.
- **LPPL Confidence** indicator measures the sensitivity of the observed bubble pattern to the chosen starting time. Value ranges from 0 to 1. A very low value of this indicator means that the signal is not robust and only pops up in one or two specific data windows.

Exiting Faster to Reduce Drawdown

- After the final blow-off phase, NASDAQ Composite reached the bubble top in early March/2000. The week before the top, ^IXIC 13 week average return was 2.7% with 13W standard deviation of 4.6%, yielding S_W of 0.58 or annualized Sharpe ratio of 4.18.
- If 50 day moving average were used as the exit criteria, exit occurred slightly below 4,500. 13 week negative return were not reached until ^IXIC fell to 3,321.
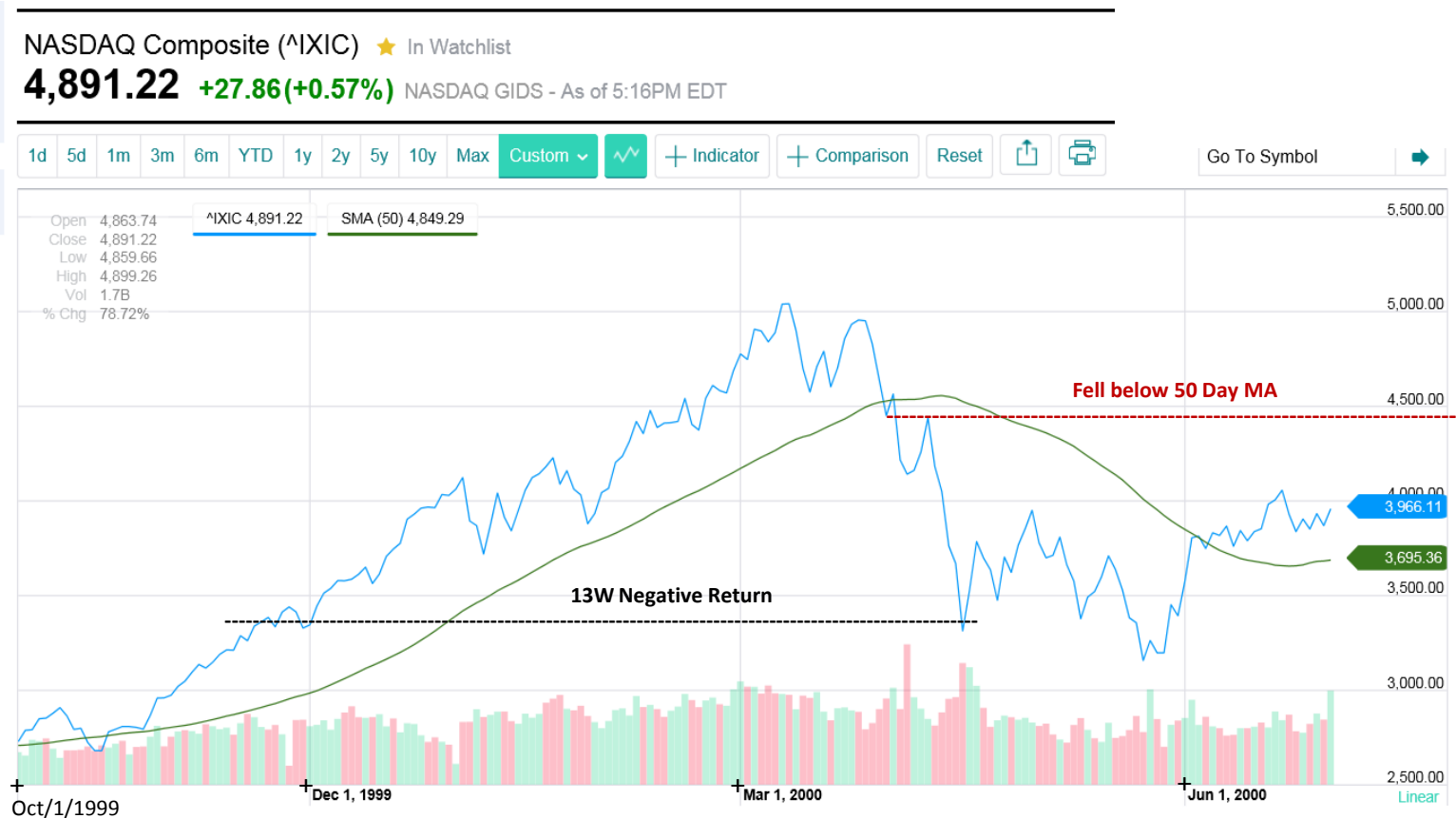
Exiting Even Faster?

- With weekly standard deviation of about 1.2%, VNQ had very high Sharpe ratios in Dec/2014 – Jan/2015. Annualized return of more than 60% was not sustainable. Need to get out super quick once the run is over.
- One potential rule: exit at weekly check point against 25 day moving average once S_W exceeds 0.75 or annualized Sharpe ratio exceeds 5.41.
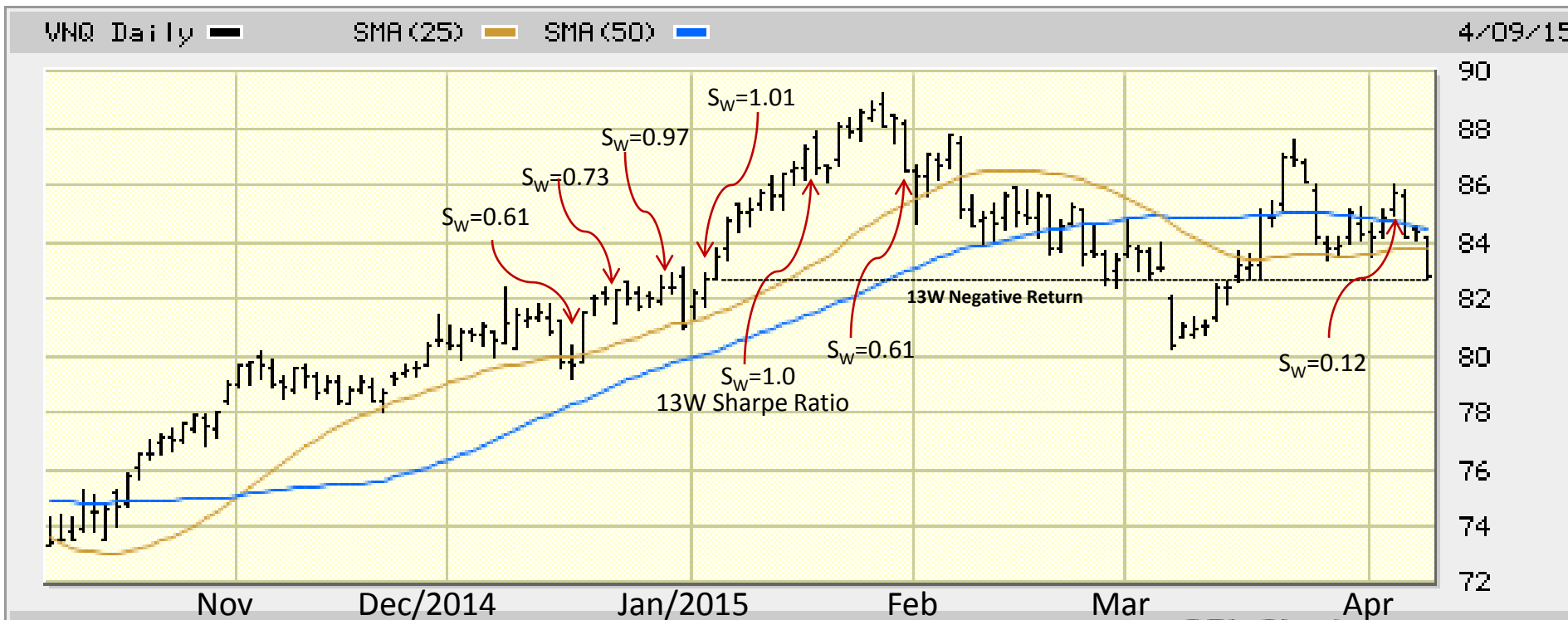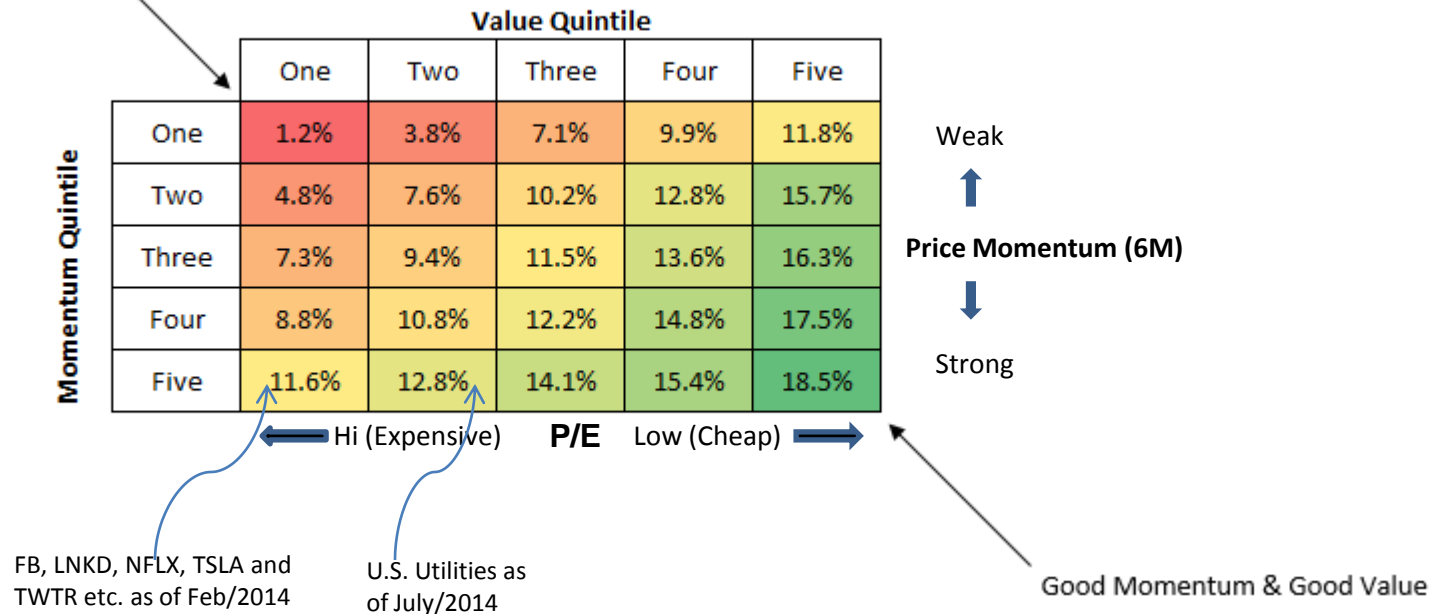
Return by 5 Mo X 5 Value Quintiles[5]
(U.S. Stocks)

Annual Performance (1963 – 2013)[5]

Bad Momentum & Bad Value

	Value Quintile				
	One	Two	Three	Four	Five
One	1.2%	3.8%	7.1%	9.9%	11.8%
Two	4.8%	7.6%	10.2%	12.8%	15.7%
Three	7.3%	9.4%	11.5%	13.6%	16.3%
Four	8.8%	10.8%	12.2%	14.8%	17.5%
Five	11.6%	12.8%	14.1%	15.4%	18.5%

Momentum Quintile

Weak

Price Momentum (6M)

Strong

← Hi (Expensive)   **P/E**   Low (Cheap) →

FB, LNKD, NFLX, TSLA and TWTR etc. as of Feb/2014

U.S. Utilities as of July/2014

Good Momentum & Good Value

Annual Return = -1.09 + 2.286 * Valuation Quintile + 1.804 * Momentum Quintile

Buy the Cheaper One with Same Sharpe Ratio

Ticker/Description	13W S_W Feb/27/2015	13W S_W Feb/20/2015	IBD Rel-Str / Acc/Dist	Yahoo Finance P/E
XSD Semiconductors (thin volume)	0.45	0.45	87/B+	24
PEJ Leisure (thin volume)	0.44	0.57	77/B-	24
HEDJ Hedged Europe	0.32	0.33	74/A-	15
IJT U.S. Small Cap Growth	0.30	0.30	71/B-	21
XLY Consumer Discretionary	0.25	0.29	75/B+	18
FXI China Shares in Hong Kong	0.23	0.25	79/B-	10
IWM Russell 2000 Small Cap	0.22	0.22	64/C+	19
SPY S&P 500	0.09	0.11	66/C-	17
IAI Brokerage/Investment Mgmt	0.10	0.12	71/C	18

- Indifferent between XSD and PEJ. Indifferent between SPY and IAI.
- Select HEDJ instead of IJT due to lower valuation.
- Select FXI instead of XLY or IWM due to lower valuation. A sister of FXI, ASHR (Shanghai A-shares), has very high standard deviation, but higher Sharpe ratio and very low correlation to SPY (ρ=0.01).
- Historical simulations and "go-forward" tracking are needed to demonstrate that the approach works. One recent anecdotal evidence: HEDJ/FXI/ASHR suffered less drawdown than XSD/PEJ/IJT/IWM during the late March/2015 U.S. market sell-off.

Source Documents

1. Stephane Neo and Ramin Nakisa, "Much Better Than Risk Parity: Sharpe Parity", UBS Global Research Weight Watcher July 7, 2014. Download from http://dailyalts.com/wp-content/uploads/2014/07/UBS-Weight-Watcher-Sharpe-Parity-Article-2014-07.pdf.

2. Wesley Gray, "Does Sharpe Parity work better than Risk Parity?", Alpha Architect, January 27, 2015. The article can be downloaded from http://www.alphaarchitect.com/blog/2015/01/27/does-sharpe-parity-work-better-than-risk-parity/#.VRdj4U10yos.

3. Board of Governors of Federal Reserve System, Monetary Policy Reports. Valuation comments can be found on page 24 of Feb/24/2015 report and on page 22 of July/2014 report. Access from the link below http://www.federalreserve.gov/monetarypolicy/mpr_default.htm.

4. Financial Crisis Observatory Cockpit Synthesis Report. Download from http://www.er.ethz.ch/fco.

5. Patrick O'Shaughnessy, "Two Ways to Improve the Momentum Strategy", Millennial Invest, May 12, 2014. The article can be downloaded from http://www.millennialinvest.com/blog/2014/5/12/two-ways-to-improve-the-momentum-strategy.

6. Credit Suisse Global Investment Returns Yearbook 2015.   The comment on turning points appears on page 15. Download from https://publications.credit-suisse.com/tasks/render/file/?fileID=AE924F44-E396-A4E5-11E63B09CFE37CCB.

7. You can view YouTube video for explanation of max Sharpe (tangency portfolio) and Sharpe parity (Sharpe weighted) posted by Joe Gruender, Jr..   The presenter was Al Zmyslowski. There are two parts. See link below. https://www.youtube.com/watch?v=6-Yf0lTmLKQ and https://www.youtube.com/watch?v=FnVPKKXGjhI.