

Some Observations on Dual Momentum

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Agenda

- Introduction (to ~~Due~~ Dual Momentum)
- Calculation (of DM à la Portfolio Visualizer)
 - Tuomo Lampinen of Silicon Cloud Technologies, LLC
- Motivation (of this Research: 'Timing')
- Reproduction (of Portfolio Visualizer DM in Pandas)
- Revelation (Results)
 - Reproduction
 - Crossover
- Conclusion

Introduction: Warren Buffet

- Buffet's Protégé Partner Bet
 - Passive Vanguard S&P 500 * beats Active Management
 - Spoiler: (Buffet is winning)
- Correlation: AAI-CIMI in 2014
 - Every scheme AI presented did worse than SPY
- **Can we improve holding S&P 500?**

* In fact, S&P 500 -is- actively managed, it just has no fees.

Introduction: Gary Antonacci

- “Dual Momentum Investing: An Innovative Strategy for Higher Returns with Lower Risk”
- Conceptually, the strategy is simple. Hold S&P until it starts to trend down. Then go to Cash. Once S&P starts to trend up, buy back in.
- The trick then, is “What is the Trend Function”

Calculation: Portfolio Visualizer *

	A	B	C	D	E	F	G	H	I	J	
1	Time Period	Total Return	12-month time series momentum				Relative Momentum	Dual Momentum			
2	Year	Mo	VFINX	NAESX	TBILL	VFINX 12M	NAESX 12M	TBILL 12M			
14	1986	12	-2.641%	-1.763%	0.490%	{=PRODUCT(1+C3:C14)-1}	{=PRODUCT(1+D3:D14)-1}	{=PRODUCT(1+E3:E14)-1}			
15	1987	1	13.267%	12.650%	0.420%	{=PRODUCT(1+C4:C15)-1}	{=PRODUCT(1+D4:D15)-1}	{=PRODUCT(1+E4:E15)-1}	=IF(F14>=G14,"VFINX","NAESX")	=IF(MAX(F14:G14)>=H14,I15,"Out-of-market")	
16	1987	2	3.965%	8.042%	0.430%	{=PRODUCT(1+C5:C16)-1}	{=PRODUCT(1+D5:D16)-1}	{=PRODUCT(1+E5:E16)-1}	=IF(F15>=G15,"VFINX","NAESX")	=IF(MAX(F15:G15)>=H15,I16,"Out-of-market")	
17	1987	3	2.860%	0.351%	0.470%	{=PRODUCT(1+C6:C17)-1}	{=PRODUCT(1+D6:D17)-1}	{=PRODUCT(1+E6:E17)-1}	=IF(F16>=G16,"VFINX","NAESX")	=IF(MAX(F16:G16)>=H16,I17,"Out-of-market")	
18	1987	4	-0.992%	-1.679%	0.440%	{=PRODUCT(1+C7:C18)-1}	{=PRODUCT(1+D7:D18)-1}	{=PRODUCT(1+E7:E18)-1}	=IF(F17>=G17,"VFINX","NAESX")	=IF(MAX(F17:G17)>=H17,I18,"Out-of-market")	

	A	B	C	D	E	F	G	H		
1	Time Period	Total Return	12-month time series momentum				Relative Momentum			
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14	1986	12	-2.641%	-1.763%	0.490%	{=PRODUCT(1+C3:C14)-1}	{=PRODUCT(1+D3:D14)-1}	{=PRODUCT(1+E3:E14)-1}		
15	1987	1	13.267%	12.650%	0.420%	{=PRODUCT(1+C4:C15)-1}	{=PRODUCT(1+D4:D15)-1}	{=PRODUCT(1+E4:E15)-1}	=IF(F14>	
16	1987	2	3.965%	8.042%	0.430%	{=PRODUCT(1+C5:C16)-1}	{=PRODUCT(1+D5:D16)-1}	{=PRODUCT(1+E5:E16)-1}	=IF(F15>	
17	1987	3	2.860%	0.351%	0.470%	{=PRODUCT(1+C6:C17)-1}	{=PRODUCT(1+D6:D17)-1}	{=PRODUCT(1+E6:E17)-1}	=IF(F16>	
18	1987	4	-0.992%	-1.679%	0.440%	{=PRODUCT(1+C7:C18)-1}	{=PRODUCT(1+D7:D18)-1}	{=PRODUCT(1+E7:E18)-1}	=IF(F17>	

	H	I	J
TBILL 12M	Relative Momentum	Dual Momentum	
{=PRODUCT(1+E3:E14)-1}			
{=PRODUCT(1+E4:E15)-1}	=IF(F14>=G14,"VFINX","NAESX")	=IF(MAX(F14:G14)>=H14,I15,"Out-of-market")	
{=PRODUCT(1+E5:E16)-1}	=IF(F15>=G15,"VFINX","NAESX")	=IF(MAX(F15:G15)>=H15,I16,"Out-of-market")	
{=PRODUCT(1+E6:E17)-1}	=IF(F16>=G16,"VFINX","NAESX")	=IF(MAX(F16:G16)>=H16,I17,"Out-of-market")	
{=PRODUCT(1+E7:E18)-1}	=IF(F17>=G17,"VFINX","NAESX")	=IF(MAX(F17:G17)>=H17,I18,"Out-of-market")	

* Courtesy Tuomo Lampinen of Silicon Cloud Technologies, LLC

<http://www.portfoliovisualizer.com>

Motivation: $=\text{Product}(1+C3:C14)-1$

- **Why 12 months?**

- Is there something better?
- Can we use Return as an “Objective function” to gain insight into the time structure of the market?

- Let's modify “C3:C14” (the 'lookback' or 'lag')

- We will start with one lag and later switch to another lag

- Notation: lag011_(070)_021_(314)
- An 11 month lookback for 70 months then switch to a 21 month lookback for 314 months.

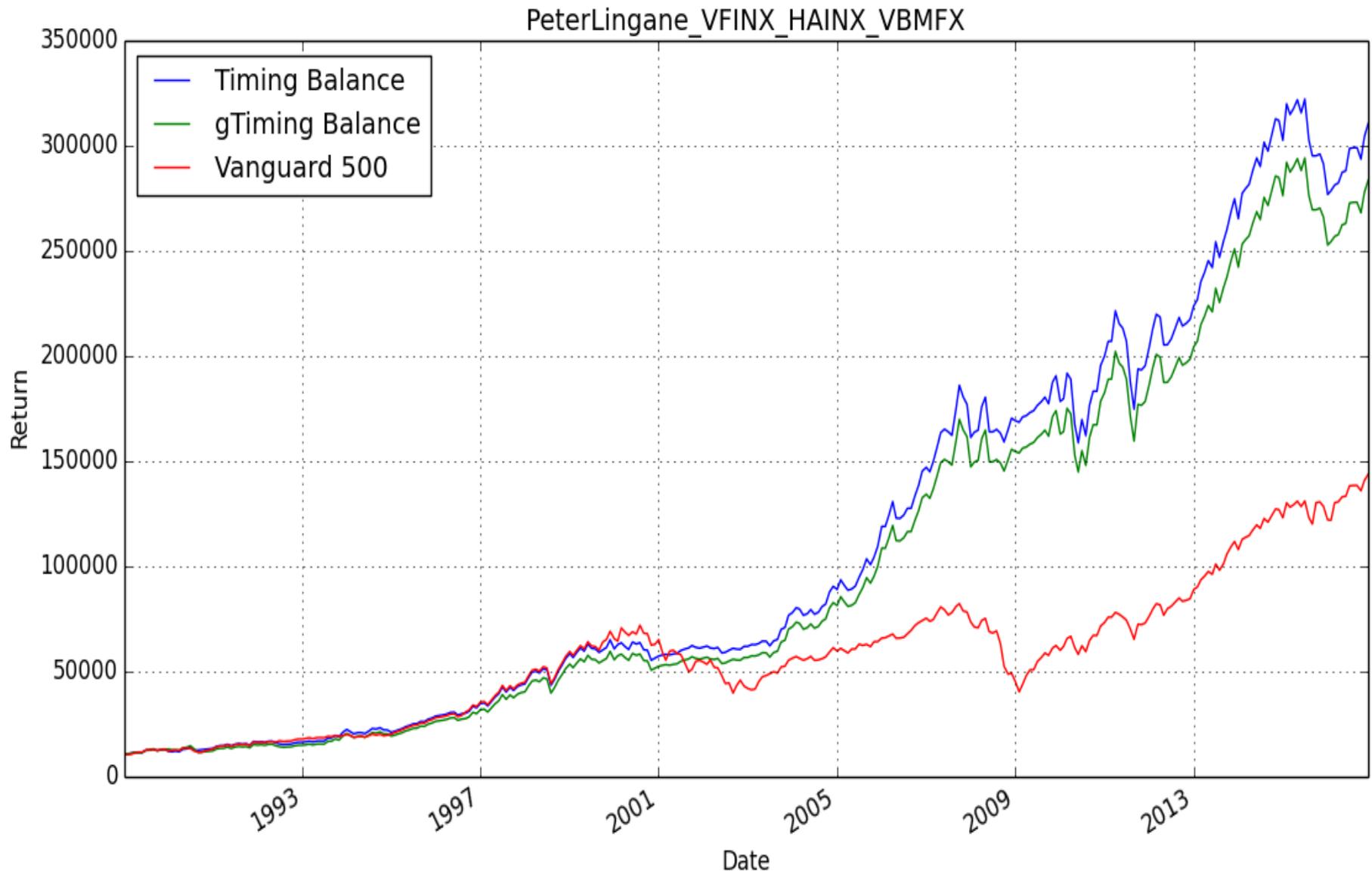
Reproduction

- Plan 1: Run Portfolio Visualizer 1,228,800 times
 - Use 20 PV lags: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 21, 24, 27, 30, 33, 36 months
 - 20 start lags x
 - 20 end lags x
 - 384 switch points (384 months = 32 years) x
 - 2 portfolios (AI – VFINX_NAESX_FGOVX, James - VFINX_HAINX_VBMFX) x
 - 4 TBill Rates (FRB 1 mo, FRB 3 mo, Farma French 1 mo, 'shifted' FF)
- Wait, scratch that.
 - Portfolio Visualizer runs a constant rate over the whole period
- Plan 2: Reproduce Portfolio Visualizer Spreadsheet in pandas and use python to run it 1,228,800 times.
- Validate: Compare Portfolio Visualizer & Pandas Results
 - AI's & James' 201702 Portfolios
 - <http://paseman.com/Analyst/AAll-SV-CIMI/> 20170324ReproducePortfolioVisualizer/

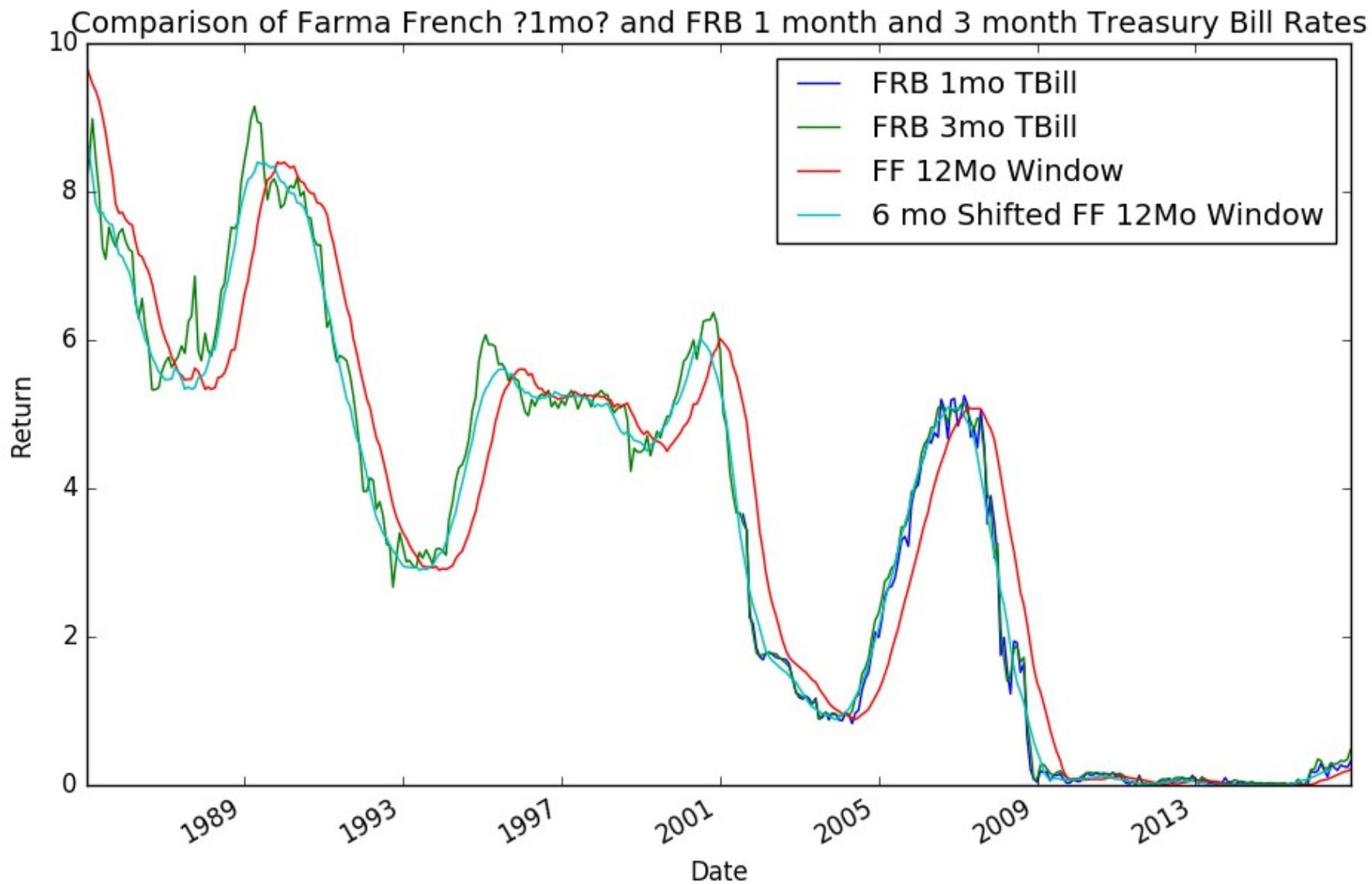
Revelation: Reproduction

- Price Quotes
 - Yahoo (now defunct) <> Portfolio Visualizer's Source
 - 3/384 quotes differ => different return calculation
- Tbill Rates
 - <http://paseman.com/Analyst/AAll-SV-CIMI/20170318createHistoryFiles/>
 - Sources: Federal Reserve and Farma French, -not- BIL
 - <http://paseman.com/Analyst/AAll-SV-CIMI/20170318createHistoryFiles/documentation.html>
 - Column 'E' => 12 month compounding and 2 digit significance
- Return Calculation
 - monthly vs 12 month ratio
- Precision (= Mathematics – Computation)
 - 3/384 calculation differ => different return calculation
 - # 0.097838024 0.0978231319 in VFINXlag NAESXlag
 - `df.loc['1992-11-02','DM'] = 'NAESXlag' ##### I have VFINXlag`
 - # 0.0552612318 0.0565098256 in NAESXlag FGOVXlag
 - `df.loc['2001-06-01','DM'] = 'NAESXlag' ##### I have FGOVXlag`
 - # 0.1564317439 0.1563179165 in VFINXlag NAESXlag
 - `df.loc['2007-01-03','DM'] = 'NAESXlag' ##### I have VFINXlag`

Revelation: Reproduction Effect of Quote Source and Precision errors



Revelation: Reproduction Tbill Rates



Revelation: Top 20 sorted by MaxReturn over 32 years

1	portfolioName	lagName	lag	fileName	TBillName	MaxReturn		Crossover
2	VFINX_HAINX_VBMFX	280lag021_(280)_005_(104)	280	stage1/021_005.csv	DMFF12MoWindowCum	745912	104	04/04/08
3	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DMFRB3moTBillCum	721776	111	09/04/07
4	VFINX_HAINX_VBMFX	274lag012_(274)_002_(110)	274	stage1/012_002.csv	DMFRB3moTBillCum	711507	110	10/04/07
5	VFINX_HAINX_VBMFX	299lag012_(299)_021_(085)	299	stage1/012_021.csv	DMFRB3moTBillCum	697895	85	11/04/09
6	VFINX_HAINX_VBMFX	299lag012_(299)_024_(085)	299	stage1/012_024.csv	DMFRB3moTBillCum	683088	85	11/04/09
7	VFINX_HAINX_VBMFX	280lag021_(280)_005_(104)	280	stage1/021_005.csv	DMFRB3moTBillCum	682844	104	04/04/08
8	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DMFF12MoWindowCum	673212	111	09/04/07
9	VFINX_HAINX_VBMFX	288lag012_(288)_005_(096)	288	stage1/012_005.csv	DMFRB3moTBillCum	673129	96	12/04/08
10	VFINX_HAINX_VBMFX	125lag011_(125)_021_(259)	125	stage1/011_021.csv	DMFRB3moTBillCum	670325	259	05/04/95
11	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DM6moShiftedFF12MoWindowCum	665133	111	09/04/07
12	VFINX_HAINX_VBMFX	280lag018_(280)_005_(104)	280	stage1/018_005.csv	DMFF12MoWindowCum	656871	104	04/04/08
13	VFINX_HAINX_VBMFX	274lag011_(274)_002_(110)	274	stage1/011_002.csv	DMFRB3moTBillCum	653589	110	10/04/07
14	VFINX_HAINX_VBMFX	070lag011_(070)_021_(314)	70	stage1/011_021.csv	DMFF12MoWindowCum	648689	314	10/04/90
15	VFINX_HAINX_VBMFX	185lag011_(185)_005_(199)	185	stage1/011_005.csv	DMFF12MoWindowCum	633712	199	05/04/00
16	VFINX_HAINX_VBMFX	272lag018_(272)_002_(112)	272	stage1/018_002.csv	DMFRB3moTBillCum	631643	112	08/04/07
17	VFINX_HAINX_VBMFX	299lag011_(299)_024_(085)	299	stage1/011_024.csv	DMFRB3moTBillCum	627483	85	11/04/09
18	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DM6moShiftedFF12MoWindowCum	626529	112	08/04/07
19	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DMFRB3moTBillCum	624756	112	08/04/07
20	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DMFF12MoWindowCum	624756	112	08/04/07
21	VFINX_HAINX_VBMFX	280lag012_(280)_005_(104)	280	stage1/012_005.csv	DMFF12MoWindowCum	622770	104	04/04/08

21,12 month followed by 2,5,21 month

Revelation: Top 20 sorted by MaxReturn are then sorted by Crossover

1	portfolioName	lagName	lag	fileName	TBillName	MaxReturn		Crossover
2	VFINX_HAINX_VBMFX	070lag011_(070)_021_(314)	70	stage1/011_021.csv	DMFF12MoWindowCum	648689	314	10/04/90
3	VFINX_HAINX_VBMFX	125lag011_(125)_021_(259)	125	stage1/011_021.csv	DMFRB3moTBillCum	670325	259	05/04/95
4	VFINX_HAINX_VBMFX	185lag011_(185)_005_(199)	185	stage1/011_005.csv	DMFF12MoWindowCum	633712	199	05/04/00
5	VFINX_HAINX_VBMFX	272lag018_(272)_002_(112)	272	stage1/018_002.csv	DMFRB3moTBillCum	631643	112	08/04/07
6	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DM6moShiftedFF12MoWindowCum	626529	112	08/04/07
7	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DMFRB3moTBillCum	624756	112	08/04/07
8	VFINX_HAINX_VBMFX	272lag021_(272)_003_(112)	272	stage1/021_003.csv	DMFF12MoWindowCum	624756	112	08/04/07
9	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DMFRB3moTBillCum	721776	111	09/04/07
10	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DMFF12MoWindowCum	673212	111	09/04/07
11	VFINX_HAINX_VBMFX	273lag021_(273)_002_(111)	273	stage1/021_002.csv	DM6moShiftedFF12MoWindowCum	665133	111	09/04/07
12	VFINX_HAINX_VBMFX	274lag012_(274)_002_(110)	274	stage1/012_002.csv	DMFRB3moTBillCum	711507	110	10/04/07
13	VFINX_HAINX_VBMFX	274lag011_(274)_002_(110)	274	stage1/011_002.csv	DMFRB3moTBillCum	653589	110	10/04/07
14	VFINX_HAINX_VBMFX	280lag021_(280)_005_(104)	280	stage1/021_005.csv	DMFF12MoWindowCum	745912	104	04/04/08
15	VFINX_HAINX_VBMFX	280lag021_(280)_005_(104)	280	stage1/021_005.csv	DMFRB3moTBillCum	682844	104	04/04/08
16	VFINX_HAINX_VBMFX	280lag018_(280)_005_(104)	280	stage1/018_005.csv	DMFF12MoWindowCum	656871	104	04/04/08
17	VFINX_HAINX_VBMFX	280lag012_(280)_005_(104)	280	stage1/012_005.csv	DMFF12MoWindowCum	622770	104	04/04/08
18	VFINX_HAINX_VBMFX	288lag012_(288)_005_(096)	288	stage1/012_005.csv	DMFRB3moTBillCum	673129	96	12/04/08
19	VFINX_HAINX_VBMFX	299lag012_(299)_021_(085)	299	stage1/012_021.csv	DMFRB3moTBillCum	697895	85	11/04/09
20	VFINX_HAINX_VBMFX	299lag012_(299)_024_(085)	299	stage1/012_024.csv	DMFRB3moTBillCum	683088	85	11/04/09
21	VFINX_HAINX_VBMFX	299lag011_(299)_024_(085)	299	stage1/011_024.csv	DMFRB3moTBillCum	627483	85	11/04/09

Relatively few crossover points

Revelation: The crossover points are at bottoms/tops



The system is “overfitting”

Revelation: Since January 2008

1	portfolioName	lagName	lag	fileName	TBillName	MaxReturn		Crossover
2	VFINX_NAESX_FGOVX	044lag001_(044)_036_(064)	44	stage1/001_036.csv	DMFRB3moTBillCum	25860	64	08/04/11
3	VFINX_NAESX_FGOVX	044lag001_(044)_036_(064)	44	stage1/001_036.csv	DMFF12MoWindowCum	25860		
4	VFINX_NAESX_FGOVX	044lag003_(044)_036_(064)	44	stage1/003_036.csv	DMFF12MoWindowCum	25662		
5	VFINX_NAESX_FGOVX	044lag002_(044)_036_(064)	44	stage1/002_036.csv	DMFRB3moTBillCum	25283		
6	VFINX_NAESX_FGOVX	044lag002_(044)_036_(064)	44	stage1/002_036.csv	DMFF12MoWindowCum	25283		
7	VFINX_NAESX_FGOVX	044lag003_(044)_036_(064)	44	stage1/003_036.csv	DMFRB3moTBillCum	24788		
8	VFINX_NAESX_FGOVX	044lag001_(044)_033_(064)	44	stage1/001_033.csv	DMFRB3moTBillCum	24783		
9	VFINX_NAESX_FGOVX	044lag001_(044)_033_(064)	44	stage1/001_033.csv	DMFF12MoWindowCum	24783		
10	VFINX_NAESX_FGOVX	044lag003_(044)_033_(064)	44	stage1/003_033.csv	DMFF12MoWindowCum	24593		
11	VFINX_NAESX_FGOVX	052lag001_(052)_005_(056)	52	stage1/001_005.csv	DMFRB3moTBillCum	24576		
12	VFINX_NAESX_FGOVX	052lag001_(052)_005_(056)	52	stage1/001_005.csv	DMFF12MoWindowCum	24576		
13	VFINX_NAESX_FGOVX	044lag004_(044)_036_(064)	44	stage1/004_036.csv	DMFRB3moTBillCum	24365		
14	VFINX_NAESX_FGOVX	044lag004_(044)_036_(064)	44	stage1/004_036.csv	DMFF12MoWindowCum	24365		
15	VFINX_NAESX_FGOVX	044lag005_(044)_036_(064)	44	stage1/005_036.csv	DMFRB3moTBillCum	24365		
16	VFINX_NAESX_FGOVX	044lag005_(044)_036_(064)	44	stage1/005_036.csv	DMFF12MoWindowCum	24365		
17	VFINX_NAESX_FGOVX	044lag002_(044)_033_(064)	44	stage1/002_033.csv	DMFRB3moTBillCum	24230		
18	VFINX_NAESX_FGOVX	044lag002_(044)_033_(064)	44	stage1/002_033.csv	DMFF12MoWindowCum	24230		
19	VFINX_NAESX_FGOVX	052lag001_(052)_006_(056)	52	stage1/001_006.csv	DMFRB3moTBillCum	24077		
20	VFINX_HAINX_VBMFX	044lag002_(044)_030_(064)	44	stage1/002_030.csv	DMFRB3moTBillCum	24053		
21	VFINX_HAINX_VBMFX	044lag002_(044)_030_(064)	44	stage1/002_030.csv	DMFF12MoWindowCum	24053		

1,2,3 month for 44/52 mo followed by 33,36 month - “Buy and Hold”

Revelation: No crossover

	DM6moShiftedFF12MoWindowCum	DMFF12MoWindowCum	DMFRB1moTBillCum	DMFRB3moTBillCum	lag	lagName	portfolioName
0	416216	425041	178065	448491	383	383lag012_(383)_012_(001)	VFINX_NAESX_FGOVX
1	494829	532641	200065	532641	383	383lag021_(383)_021_(001)	VFINX_HAINX_VBMFX
2	224559	202227	NaN	218937	347	347lag002_(347)_002_(001)	VFINX_NAESX_FGOVX
3	326081	350999	NaN	350999	347	347lag021_(347)_021_(001)	VFINX_HAINX_VBMFX
4	18677	20105	NaN	20105	107	107lag024_(107)_024_(001)	VFINX_HAINX_VBMFX
5	19422	20619	NaN	20619	107	107lag005_(107)_005_(001)	VFINX_NAESX_FGOVX

Al and James are 1,2 for all time periods: 12, 21, 2, 21, 5, 24

Final Word from Tuomo Lampinen

- One thing that makes a big difference in the dual momentum returns is the use of S&P 500 TR as the leading indicator for foreign stocks. Using single momentum means that the absolute momentum test for all assets is based on a single asset. In Gary Antonacci's Dual Momentum book the proposed model is based on US stocks, international stocks and total bond market. In the proposed model instead of testing both US stocks and international stocks against the absolute momentum filter separately, only US stocks are tested against the absolute momentum filter, and if they pass the filter, then the selection between US and international stocks is based on relative strength. This is based David Rapach, Jack K. Strauss, and Guofu Zhou 2013 paper (International Stock Market Return Predictability), in which they find that the US stock market leads the world markets even at the monthly frequency. You can find more information in the methodology section of the FAQ (<https://www.portfoliovisualizer.com/faq#methodology>), and the relevant section in the Dual Momentum book is the paragraph or two immediately before Table 8-3 and Figure 8-2 (note that this is different from the Figure 8.4 in Chapter 8) in case you have the book. If you open the Dual Momentum example from the Examples section (<https://www.portfoliovisualizer.com/examples>), you will notice that the backtested results are better when VFINX is used as the single absolute momentum asset as proposed in the book.

Conclusion

- DM can implement “Buy and Hold”.
- Even with just one crossover,
 - the System overfits
- TBD: See if Phase matters
- Lags of 2, 5, 21, 24 come up a lot.
- 12 comes up also.
- So. One extra Question: Do you feel lucky?
 - If times are volatile, use 5,2 months
 - If times are steady, use 21,24 months

Spares

Exploratory Approach

- Create Parametrized Model
 - Code in pandas, validate with portfoliovisualizer
 - Use “Total Return” as an objective function to explore effect of lag
- Stage 1
 - evalCrossProduct
 - Portfolio Dictionary {Name:Ticker List} 2 portfolios: AI and James
 - Tbill Return Tickers [Names List] 4 rates: 1mo 3mo FarmaFrench, FFshifted
 - Lag Dictionary {Name:vector}
 - Search
 - Sets Timeframe, creates lag dictionary, calls evalCrossProduct
- Stage 2
 - Find Best Single Lag
 - Find Best Beginning/Ending Lag

Correlation and Causation

