

Bloomberg Lab

Team Project

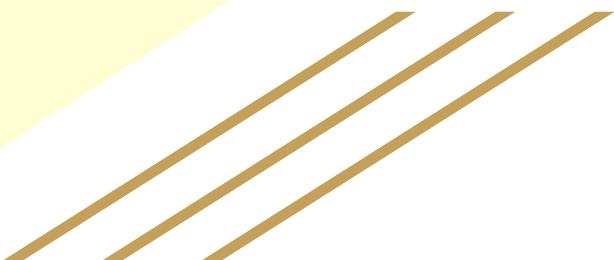
Team Members:

Diyang Yu, dy994

Hao Zhan, hz1629

Peng Lei, pl1736

Ruojing He, rh2692



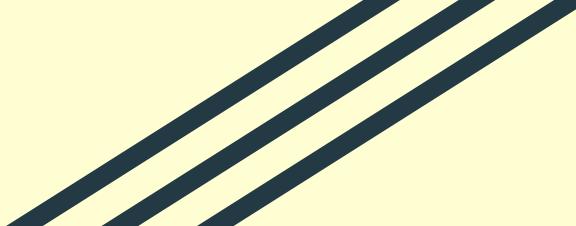
Agenda

Part 1 – Optimization as of the end of 2017

- Factor model built using MarkIt's Research Signals database
- Portfolio optimized in Bloomberg PORT
- Portfolio backtest performance

Part 2 – Optimization as of the end of 2007

- Factor model built using MarkIt's Research Signals database
- Portfolio optimized in Bloomberg PORT
- Portfolio backtest performance



Part 1 – Optimization as of the end of 2017

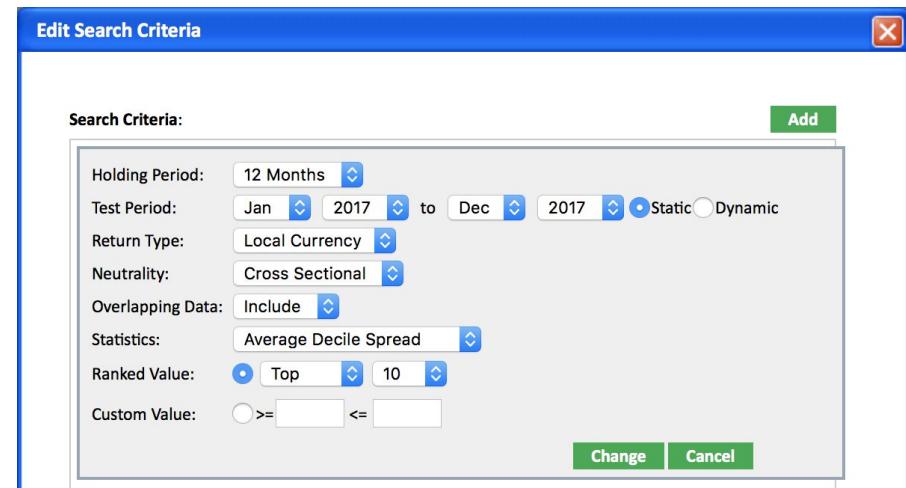


2017->

Factor Model

□ Factor Selection

- **Two goals for searching and selecting the factors:**
 - (1) Cover various groups, including value, momentum, growth, profitability, size, leverage, etc.
 - (2) Commit to generating positive returns in our holding periods.
- **Set search criteria as follows:**
 - find top 10 factors that generate the highest average decile spread (alpha)



2017->

Factor Model

□ Factor Selection

- Repeat searching for each selected group:

relative value and deep value, earnings momentum and price momentum, earnings quality, historical growth, and liquidity, risk & size

- Pick top 1 or 2 factors in each group
- Also look at the definitions of factors carefully to avoid picking similar factors.

The screenshot shows a user interface for selecting factors. At the top, there are dropdown menus for 'Universe' (set to 'US Large Cap') and 'Sector' (set to 'Select Sector'). Below these are two radio buttons: 'Select All' (unchecked) and 'Deselect All' (checked). A large grid of checkboxes follows, divided into several columns. The first column contains: 'Relative Value' (checked), 'Deep Value' (checked), 'Banks and Thrifts' (unchecked), and 'Dividend Forecast' (unchecked). The second column contains: 'Earnings Momentum' (checked), 'ESG' (unchecked), and 'Cybersecurity' (unchecked). The third column contains: 'Earnings Quality' (checked), 'Macro' (unchecked), and 'Short Sentiment Raw' (unchecked). The fourth column contains: 'Historical Growth' (checked), 'Airlines' (unchecked), and 'Custom Factors' (unchecked). The fifth column contains: 'Liquidity, Risk & Size' (checked), 'Oil and Gas' (unchecked), and 'My Licensed Models' (unchecked). The sixth column contains: 'Management Quality' (unchecked), 'Insurance Factors' (unchecked), and 'My User Defined Models' (unchecked). The seventh column contains: 'Price Momentum' (checked), 'Short Sentiment' (unchecked), and 'My Watchlist' (unchecked). The eighth column contains: 'Semiconductor Factors' (unchecked), and 'My Factor Bundle' (unchecked). At the bottom left, there is a 'Search Criteria:' label and an 'Edit' button. To the right of the edit button is a text box containing the search criteria: 'Average Decile Spread: Top 10, Jan 2017 to Dec 2017, Local Currency, 12 months holding period, Cross Sectional, with overlapping data'.

2017->

Factor Model

□ Factor Selection

- Check multicollinearity:

Generate the correlation matrix of all the factors;

Deselect implied volatility and cash-to-price, as both are highly correlated with some other factors: correlation coefficients higher than 0.8;

The rest 7 factors are our final selection.

	<input type="checkbox"/> Factor	1	2	3	4	5	6	7	8	9
1	<input type="checkbox"/> 3-yr MAD of TTM Net Income	--	0.48	0.42	-0.29	0.58	-0.33	0.33	-0.28	0.64
2	<input type="checkbox"/> 5-Year Dividend Growth Rate	0.48	--	-0.10	0.54	0.63	0.27	0.49	0.38	0.70
3	<input type="checkbox"/> 60-Month Trading Volume Trend	0.42	-0.10	--	-0.43	0.61	-0.92	0.41	-0.57	0.24
4	<input type="checkbox"/> Cash-to-Price	-0.29	0.54	-0.43	--	0.15	0.62	0.47	0.86	0.31
5	<input type="checkbox"/> Dividend Coverage Ratio	0.58	0.63	0.61	0.15	--	-0.47	0.74	-0.10	0.75
6	<input type="checkbox"/> Implied Volatility	-0.33	0.27	-0.92	0.62	-0.47	--	-0.20	0.78	-0.00
7	<input type="checkbox"/> Net Fixed Assets to Long-term Debt	0.33	0.49	0.41	0.47	0.74	-0.20	--	0.28	0.68
8	<input type="checkbox"/> Reciprocal of Dividend Yield-adjusted PEG	-0.28	0.38	-0.57	0.86	-0.10	0.78	0.28	--	0.31
9	<input type="checkbox"/> TTM Growth Flow-to-Price	0.64	0.70	0.24	0.31	0.75	-0.00	0.68	0.31	--

Actual data range used in calculation: 1/1/2017 - 1/2/2018

x.xx: Correlations greater than or equal to absolute 0.70.

2017->

Factor Model

□ Factor Selection

Universe:
US large cap

Factor weights:
Optimal

Factor	Group	Definition	Weight
3-yr MAD of TTM Net Income	Profitability	Mean absolute deviation of last 12-quarter's trailing 12-month net income deflated by the average of total assets.	10.5%
5-Year Dividend Growth Rate	Historical growth	5-year growth in dividends.	14.33%
60-Month Trading Volume Trend	Liquidity	Slope of the least squares regression line of the last 60 months of monthly trading volume against time.	13.95%
Dividend Coverage Ratio	Liquidity	A company's trailing 12-month earnings from operations divided by the amount of its indicated annual dividends.	8.28%
Net Fixed Assets to Long-term Debt	Leverage	The most recent quarterly reported net fixed assets divided by the total long-term debt.	12.96%
Reciprocal of Dividend Yield-adjusted PEG	Momentum	Reciprocal of a stock's forward 12-month P/E ratio divided by the total growth rate.	21.48%
TTM Growth Flow-to-Price	Deep value	The sum of trailing 12-month growth flow value per share for a stock divided by its trading price.	18.5%

2017->

Factor Model

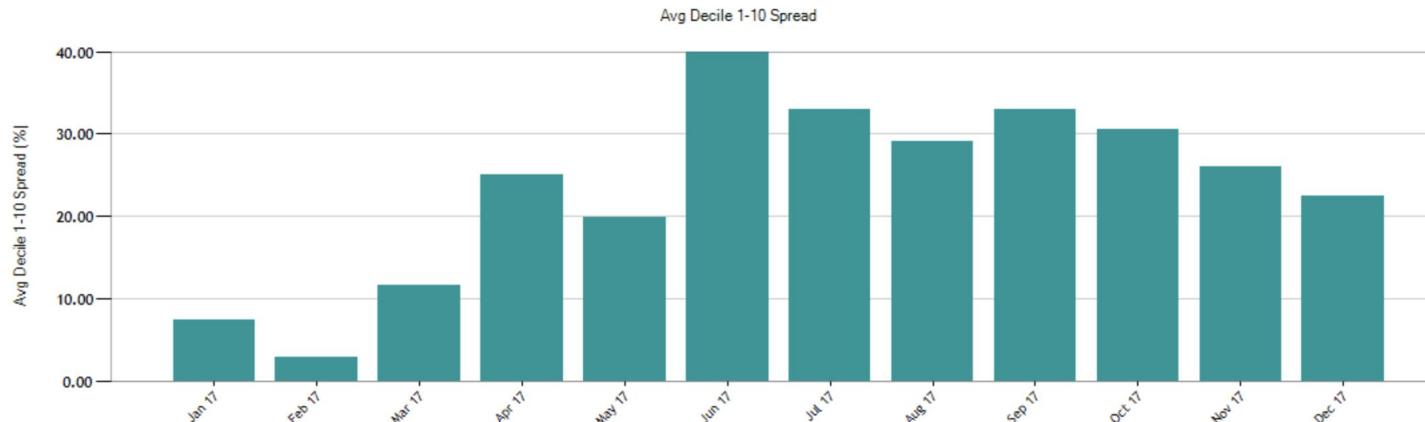
❑ Backtesting Results

- **Alpha of the factor model in 2017: 23.406%**

Build the above factor model at the end of December 2017 and conduct backtesting.

Use the spread between the returns of the top and bottom deciles of the model to determine the alpha.

Test period: Jan. 2017 - Dec. 2017; Holding period: 12 months.



Return Spread Mean: 23.406

Std Dev: 11.202

Hit Rate: 100.00%

IR: 2.090

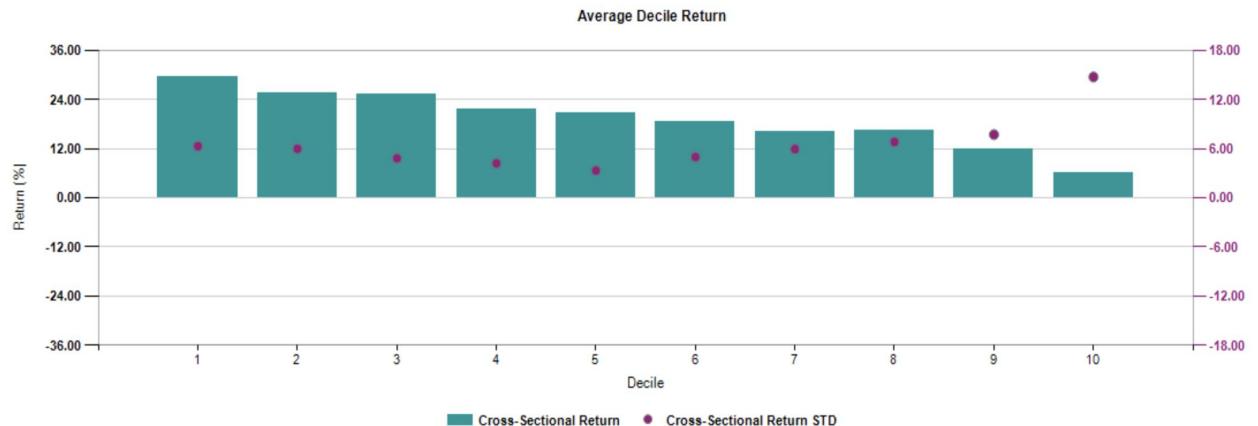
2017->

Factor Model

❑ Backtesting Results

- **Expected return: input to Bloomberg PORT**

- Obtain average return in 2017 for each decile:
decile return -> security return
- Obtain percentile ranks + decile return:
do an interpolation and assign different returns to stocks in the same decile



2017->

Portfolio Optimization

Setup

ORACLE AMERICA I Equity ▾ PORT ▾ Related Functions Menu ▾ Hao Zhan

99<GO> to Analyze in PORT, <Back> to Return

1) Run 2) Tasks 3) Settings 99) Analyze in PORT Portfolio Optimization
 Port MY_CASH Bmrk SPDR S&P500 ETF TRUST Risk Model Bloomberg Risk Mod 01/01/18 Backtest
 51) Setup 52) Frontier 53) Backtest 54) Trades

Task Name Reduce Risk: Minimize Risk with 20% turnover

1. Goals Add
 Action Field Unit
 ✓ Maximize Information Ratio

2. Trade Universes Add
 Source Security List Rule
 ✓ Index/Fund Constituencies SPX Index Trade List

3. Constraints Add Add Frontier Long Only
 Constraint Field Constraint Group Relative Unit Min Max Trade-Off
 ✓ Beta to Benchmark Portfolio None 1 1
 ✓ Active Total Risk Portfolio Benchmark % 3

4. Security Properties Add
 Security Relative Unit Min Max MinHld MinTrd MaxTrd Lot ExpRtn
 ✓ USD Infuse None ▾ Wgt% 0 100
 ✓ S Default for all None ▾ Wgt% 0 100 0 0
 ✓ S COP US Equity None ▾ Wgt% 0 100 0 3.559025
 ✓ S DVN US Equity None ▾ Wgt% 0 100 0 3.559025
 ✓ S EGO US Equity None ▾ Wgt% 0 100 0 3.559025
 ✓ S EQT US Equity None ▾ Wgt% 0 100 0 3.559025

(!) 3 Notices ▾ Stored Results

Goal:
Max Information Ratio

Trade universe:
S&P 500 constituents

Constraints:
 - beta = 1
 - tracking error
 (active total risk) ≤ 3%
 - long only

2017->

Portfolio Optimization

□ Optimization Results:

ORACLE AMERICA I Equity ▶ PORT ▶ Related Functions Menu ▶ Hao Zhan

99<GO> to Analyze in PORT, <Back> to Return

1) Run	2) Tasks	3) Settings	99) Analyze in PORT	Portfolio Optimization	
Port MY_CASH	Bmrk SPDR S&P500 ETF TRUST	Risk Model	Bloomberg Risk Model	01/01/18 Backtest	
51) Setup	52) Frontier	53) Backtest	54) Trades		
Optimization Summary		Status Success	Goal Summary		
Turnover(%)	99.43	Trade Value	Goal	Initial Value	Final Value
# of Buys	501	Value of Buys	Information Ratio	-2.76	2.11
# of Sells	0	Value of Sells			
Proposed Trades					
Security	Name	Trade	Quantity	Init. Weight (%)	Opt. Weight (%)
AAPL US	APPLE INC	Buy	0.02	0	3.81
MSFT US	MICROSOFT CORP	Buy	0.03	0	2.89
AMZN US	AMAZON.COM INC	Buy	0	0	2.11
FB US	FACEBOOK INC-A	Buy	0.01	0	1.85
Portfolio and Group Constraint Results					
Group	Field	Relative	Min	Max	Init Val Final Value Warning
PORTFOLIO	Beta to Benchmark	NONE	1	1	0 1.01
PORTFOLIO	Active Total Risk	BENCHMARK	3	7.84	0.02

Goal:

Final IR = 2.11

Constraints met:

- beta relative to bmk ≈ 1
- tracking error (active total risk) = 0.02% $< 3\%$
- long only

2018->

Portfolio Performance (2018.01-2018.10)

□ Total Return



The maximum difference of the total return between the portfolio and benchmark is below 0.15%

2018->

Portfolio Performance (2018.01-2018.10)

□ Statistical Summary

ORACLE AMERICA I Equity ▾ PORT ▾ Related Functions Menu ▾

Msg: +2 ★ ⓘ ?

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics

TRADE SIMULATION ENABLED Rebalanced 1/1/2018 Optimizer Trades Add Holdings Save/Trade Settings

Intraday Holdings Characteristics VaR Scenarios Tracking Error/Volatility Performance Attribution

Main View Total Return Period Analysis Seasonal Analysis Statistical Summary

Unit Percentage As of 10/31/18

MY_CASH vs SPDR S&P500 by GICS Sectors in USD

Portfolio Statistics

	3 Months		6 Months		Year To Date		1 Year	
	Port	Bench	Port	Bench	Port	Bench	Port	Bench
2. Return								
Total Return	-3.14	-3.23	3.50	3.39	3.20	2.98	3.20	7.31
Maximum Return	2.15	2.14	2.15	2.14	2.73	2.71	2.73	2.71
Minimum Return	-3.25	-3.27	-3.25	-3.27	-4.09	-4.09	-4.09	-4.09
Mean Return (Annualized)	-14.97	-15.41	11.12	10.79	7.14	6.75	5.93	11.92
Mean Excess Return (Annualized)	0.51		0.30		0.36		-5.35	
3. Risk								
Standard Deviation (Annualized)	14.42	14.48	12.15	12.17	15.17	15.17	13.86	14.07
Downside Risk (Annualized)	11.27	11.32	9.30	9.33	11.84	11.84	10.79	10.97
Skewness	-1.02	-1.03	-0.99	-1.00	-1.04	-1.04	-1.13	-1.12
VaR 95% (ex-post)	-1.62	-1.65	-0.99	-0.99	-1.69	-1.72	-1.40	-1.41
Tracking Error (Annualized)	0.23		0.24		0.24		2.46	
4. Risk/Return								
Sharpe Ratio	-0.91	-0.93	0.48	0.46	0.21	0.19	0.18	0.47
Jensen Alpha	0.27		0.24		0.27		-3.98	
Information Ratio	1.57		0.90		1.07		-1.57	
Treynor Measure	-0.13		0.06		0.03		0.03	
Beta (ex-post)	1.00		1.00		1.00		0.97	
Correlation	0.9999		0.9998		0.9999		0.9845	

- return: 3.20%
- vol: 15.17%
- downside risk:11.84%
- VAR: -1.69%
- SR: 0.21
- Jensen Alpha:0.27%
- IR:1.07

As shown in the chart, the year to date realized tracking error (annualized) is 0.24%, which is below our constraint of 3%.

The initial prediction of risk is too low, since our prediction is 0.02%

2018->

Portfolio Performance (2018.01-2018.10)

❑ Tracking Error



The difference in the
risk of our portfolio
v.s. benchmark

2018->

Portfolio Performance (2018.01-2018.10)

Transfer Coefficient

Run another optimizer:

Goal: maximize expected return

Constraints:

- allow long/short
- remove all other constraints
- setting portfolio risk $\leq 7.83\%$
(equal to the risk of the constrained portfolio)

Expected return without constraints: 71.13%

Expected return with constraints: 21.73%

Transfer coefficient = 21.73% / 71.13% = 30.55%

99<GO> to Analyze in PORT, <Back> to Return					
1) Run		2) Tasks		3) Settings	
Port MY_CASH		Bmrk SPDR S&P500 ETF TRUST		Risk Model	Bloomberg Risk Mod
51) Setup	52) Frontier	53) Backtest	54) Trades		01/01/18
Optimization Summary		Status	Success	Goal Summary	
Turnover(%)	949.31	Trade Value	949.31	Goal	Initial Value Final Value
# of Buys	283	Value of Buys	501.8	Expected Return (%) (User-defined)	0 71.13
# of Sells	220	Value of Sells	447.51		
Proposed Trades					
Security	Name	Trade	Quantity	Init. Weight (%) Opt. Weight (%)	Wgt Diff ↓
DISCK US	DISCOVERY INC-C	Buy	0.89	0 18.82	18.82
CMS US	CMS ENERGY CORP	Buy	0.15	0 7.19	7.19
ALL US	ALLSTATE CORP	Buy	0.07	0 6.83	6.83
AON US	AON PLC	Buy	0.05	0 6.55	6.55
Portfolio and Group Constraint Results					
Group	Field	Relative	Min Max	Init Val Final Value	Warning
PORTFOLIO	Portfolio Total Risk	NONE	7.83 0	7.82	

2018->

Portfolio Performance (2018.02-2018.10)

Period Analysis



Underperform in

- March
- May
- August

Outperform in other months

2018->

Portfolio Performance

Attribution

11) View · 12) Actions · 13) Settings · 14) Trade Simulation ·			Portfolio & Risk Analytics						
TRADE SIMULATION ENABLED			Rebalanced 1/1/2018		Optimizer	Trades	Add Holdings	Save/Trade	Settings
Intraday	Holdings	Characteristics	VaR	Scenarios	Tracking Error/Volatility		Performance	Attribution	
Main View	Summary								
MY_CASH	vs SPDR S&P500	by GICS Sectors	in USD	Time	Custo	01/01/18	-	10/31/18	
Model Total Return	Unit Percenta...								
Return Summary	Active Return Attribution Summary								
Portfolio Return	3.20		Active Return	0.22	Currency		0.00		
Benchmark Return	2.98		Allocation	0.03	Interaction		0.01		
Active Return	0.22		Selection	0.18					
Excess Return Summary Graph									
Legacy/Default GICS Sectors									
Port Wgt	Bench Wgt	Wgt Diff		Total Attr	Allocation	Selection	Interaction	Currency	
14.67	14.27	0.40	Financials	-0.06	-0.03	-0.03	0.00	0.00	
14.57	14.26	0.30	Health Care	0.15	0.02	0.12	0.00	0.00	
10.27	10.14	0.12	Communication Services	0.02	0.00	0.01	0.00	0.00	
7.11	7.02	0.09	Consumer Staples	-0.01	0.02	-0.03	0.00	0.00	
6.01	5.97	0.05	Energy	0.03	0.01	0.01	0.00	0.00	
2.76	2.80	-0.04	Utilities	-0.02	-0.01	-0.01	0.00	0.00	
2.59	2.70	-0.11	Real Estate	-0.01	0.00	-0.02	0.00	0.00	
9.71	9.83	-0.12	Consumer Discretionary	-0.01	-0.01	0.00	0.00	0.00	
19.92	20.05	-0.13	Information Technology	0.20	-0.03	0.23	0.00	0.00	
0.23	0.37	-0.14	Not Classified	0.00	0.00	0.00	0.00	0.00	
2.56	2.70	-0.15	Materials	-0.04	0.02	-0.07	0.00	0.00	
9.60	9.88	-0.28	Industrials	-0.03	0.02	-0.05	0.00	0.00	

Benchmark: SPY

Active return = 3.2% - 2.98% = 0.22%

Excess return: 0.22%

Active return due to allocation: 0.03%

- similar weights allocated to each sector as the benchmark
- the good:

less in industrials and materials;

- the bad:
- financials: should have put in less
IT: should have put in more

Active return due to selection: 0.18%

- slightly better equity selection in healthcare and IT section

Active return due to interaction: 0.01%

2018->

Portfolio Performance (2018.01-2018.10)

- Which risk factors were the primary drivers of its performance relative to benchmark?

ORACLE AMERICA I Equity - PORT - Related Functions Menu ▾

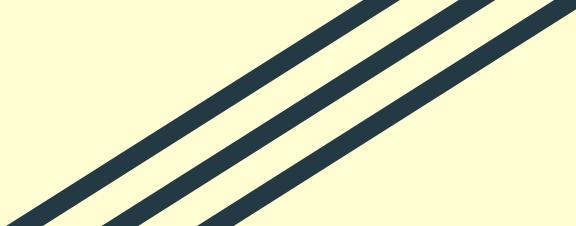
Msg: +2 ★ ⓘ ?

11) View · 12) Actions · 13) Settings · 14) Trade Simulation · Portfolio & Risk Analytics

TRADE SIMULATION ENABLED · Rebalanced 1/1/2018 · Optimizer · Trades · Add Holdings · Save/Trade · Settings

Main View	Holdings	Characteristics	VaR	Scenarios	Tracking Error/Volatility	Performance	Attribution
MY_CASH	vs SPDR S&P500	by GICS Sectors	in USD		As of 01/01/18		
Model Bloomberg Ris	Unit Returns (%)				Horizon 1 Year		
Asset Class All Asset	Group by All Factor	<input checked="" type="checkbox"/> Hide zero exposures					
Factor	Exposure	Risk					
	Portfolio	Benchmark	Active L	Factor Vol (Std %)	Tot. Active (Std)	Marginal (X100)	Contribution %
1. Profit:US Profit	0.12	0.11	0.01	1.827	0.02	0.37	3.63
2. Value:US Value	0.05	0.04	0.01	2.844	0.02	0.15	1.09
3. Leverage:US Leverage	0.01	0.00	0.01	1.528	0.01	-0.14	-0.66
4. DivYld:US DivYld	0.08	0.08	0.00	1.539	0.01	0.08	0.23
5. Momentum:US Mome	0.00	-0.01	0.00	2.821	0.01	0.34	0.89
6. US:US Market	1.00	1.00	0.00	8.071	0.02	-0.85	-1.52
7. Technology:US Hardv	0.06	0.05	0.00	7.431	0.01	0.24	0.34
8. Financials:US P&CIn	0.04	0.03	0.00	6.785	0.01	0.90	0.84
9. Financials:US ConsFi	0.03	0.03	0.00	5.793	0.01	-0.10	-0.09
10. Materials:US Chemic	0.03	0.03	0.00	7.053	0.01	0.33	0.26
11. Size:US Size	0.40	0.40	0.00	2.281	0.00	0.24	0.17
12. ConsumerStap:US Co	0.06	0.06	0.00	7.767	0.01	1.00	0.64
13. Financials:US LifeIns	0.01	0.01	0.00	8.498	0.01	-0.18	-0.10
14. HealthCare:US Health	0.01	0.01	0.00	10.927	0.01	0.63	0.32
15. Communications:US	0.08	0.08	0.00	6.930	0.00	0.09	0.04
16. Energy:US OilSvcs	0.01	0.01	0.00	21.918	0.01	-0.81	-0.35
17. HealthCare:US Manag	0.02	0.02	0.00	11.585	0.01	0.48	0.19
18. Financials:US FinSvc	0.03	0.03	0.00	8.655	0.00	-0.59	-0.22
19. Industrials:US Defen	0.03	0.03	0.00	7.407	0.00	0.22	0.07

As shown in the chart,
we have active exposure
in: profit factor, value
factor, and leverage
factor.



Part 2 – Optimization as of the end of 2007

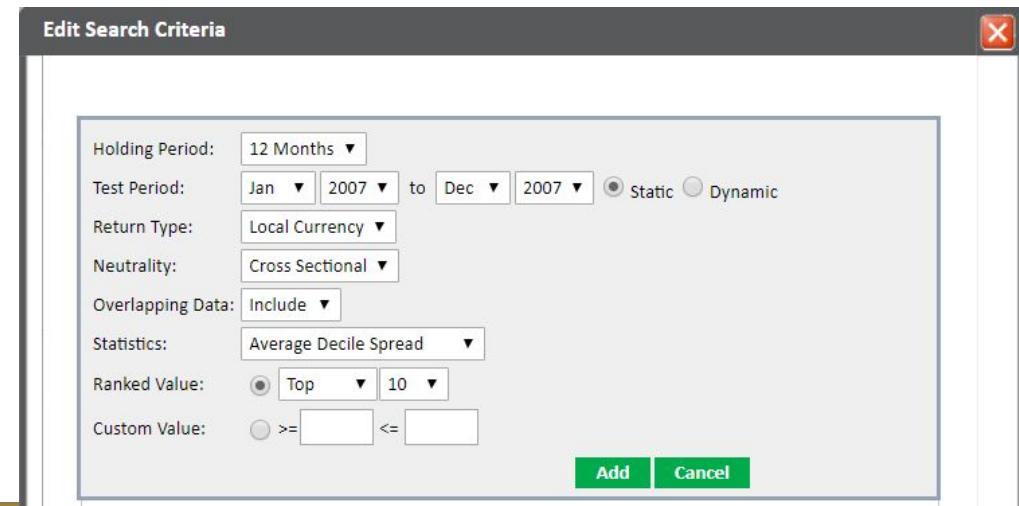


2007 ->

Factor Model

❑ Criteria:

- Diversified groups
relative and deep value, earnings and price momentum, historical growth, liquidity, risk and size
- Rank based on average decile spread (alpha)





2007 ->

❑ Factors Selected

- Tend to choose more factors in the liquidity and risk scope compared to the factors of 2017
- Equal weighted

Factor	Group	Definition	IC Mean
24-month active return with 1-month lag	Price momentum	The percent change in price for a stock from month t-25 to month t-1.	0.086
3-year growth in TTM earnings per share	Historical growth	The percent change in a stock's most recent trailing 12-month earnings per share (EPS) as compared to its EPS 12 quarters ago.	0.048
EBITDA-to-Debt	Liquidity	Trailing-twelve-month earnings before interest, taxes, depreciation and amortization divided by current total debt.	0.042
Implied volatility	Risk	The average implied volatility of the nearest-to-expiration at-the-money option contracts.	0.007
Ohlson Bankruptcy Score	Risk	A model assessing a company's probability of bankruptcy by considering firm size, capital structure, financial performance, and liquidity. It is derived from Ohlson (1980).	0.112

2007 ->

Factor Model

❑ Factors Selected (Cont.)

Factor	Group	Definition	IC Mean
Stock illiquidity	Liquidity	The monthly average of the daily absolute return to the daily dollar trading volume ratio.	0.062
Time weighted EBITDA / EV	Deep value	The time weighted EBITDA/Enterprise Value for FY1 and FY2.	0.135
TTM growth flow-to-price	Deep value	The sum of trailing 12-month growth flow value per share for a stock divided by its trading price. Growth flow is the sum of Research & Development expenses and reported net income.	0.15

2007 ->

Factor Model

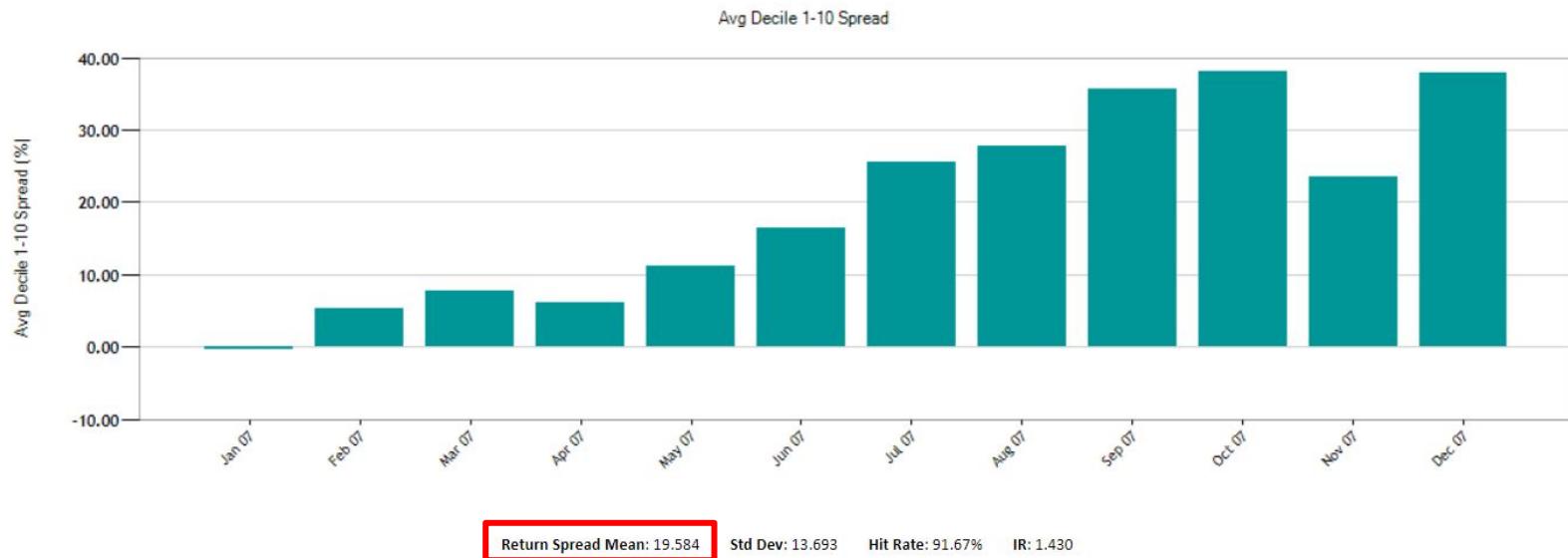
- **Check multicollinearity:**

Generate the correlation matrix of all the factors

	Factor	1	2	3	4	5	6	7	8
1	TTM Growth Flow-to-Price	--	0.74	-0.35	0.15	0.36	0.37	-0.20	0.27
2	Time Weighted EBITDA/ EV	0.74	--	-0.17	0.15	0.32	0.40	0.35	0.56
3	24-Month Active Return with 1-Month Lag	-0.35	-0.17	--	0.75	0.46	0.02	-0.05	-0.29
4	3-yr Growth in TTM Earnings per Share	0.15	0.15	0.75	--	0.69	-0.10	-0.13	-0.37
5	EBITDA-to-Debt	0.36	0.32	0.46	0.69	--	-0.17	-0.37	-0.20
6	Implied Volatility	0.37	0.40	0.02	-0.10	-0.17	--	0.05	0.76
7	Ohlson Bankruptcy Score	-0.20	0.35	-0.05	-0.13	-0.37	0.05	--	0.26
8	Stock Illiquidity	0.27	0.56	-0.29	-0.37	-0.20	0.76	0.26	--

2007 ->

Factor Model Backtesting Results

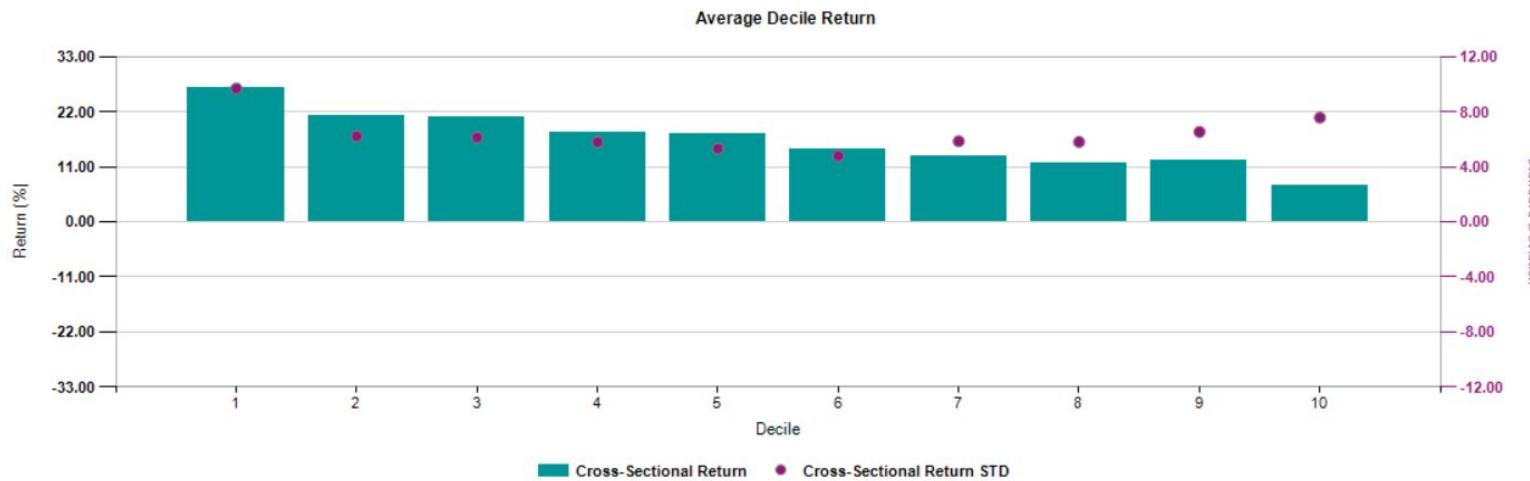


The alpha of our factor model in 2007 is 19.58%.

2007 ->

Factor Model Backtesting Results

Obtain percentile ranks + average decile return: do an interpolation and assign different returns to stocks in the same decile



2007->

Portfolio Optimization

Setup

99<GO> to Analyze in PORT, <Back> to Return

1) Run 2) Tasks 3) Settings 99) Analyze in PORT Portfolio Optimization

Port SPX_2008 Bmrk VANGUARD TOTAL STOC... Risk Model Bloomberg Risk Mo... 01/03/08 Backtest

51) Setup 52) Frontier 53) Backtest 54) Trades

Task Name Reduce Risk: Minimize Risk with 20% turnover

✓ Favorites Current Portfolio Trade List

3. Constraints Add Add Frontier Long Only

Constraint Field	Constraint Group	Relative	Unit	Min	Max	Trade-Off
Beta	Portfolio	None		1	1	
Active Total Risk	Portfolio	Benchmark	%		3	

4. Security Properties Add

Security	Relative	Unit	Min	Max	MinHld	MinTrd	MaxTrd	Lot	ExpRtn
USD	Infuse	None	Wgt%	0	100				
S Default for all		None	Wgt%	0	100			0	16.4
S BAC US Equity		None	Wgt%	0	100			0	4.90535
S BSC US Equity		None	Wgt%	0	100			0	4.90535
S C US Equity		None	Wgt%	0	100			0	4.90535
S COO US Equity		None	Wgt%	0	100			0	4.90535

Goal:
Max Information Ratio

Trade universe:
S&P 500 at 2008

Benchmark: VTI

Constraints:

- beta = 1
- tracking error
- (active total risk) ≤ 3%
- long only

2007->

Portfolio Optimization

□ Optimization Results:

99<GO> to Analyze in PORT, <Back> to Return						
1) Run	2) Tasks	3) Settings	99) Analyze in PORT	Portfolio Optimization		
Port SPX_2008			Bmrk VANGUARD TOTAL STOC...	Risk Model	Bloomberg Risk Mo	01/03/08
51) Setup	52) Frontier	53) Backtest	54) Trades			Backtest
Optimization Summary	Status	Success	Goal Summary			
Turnover(%)	97.13	Trade Value	971,345,000	Goal	Initial Value	Final Value
# of Buys	493	Value of Buys	971,345,000	Information Ratio	0.4	3.89
# of Sells	0	Value of Sells	0			
Proposed Trades						
Security	Name	Trade	Quantity	Init. Weight (%)	Opt. Weight (%)	Wgt Diff ↓
XOM US	EXXON MOBIL CORP	Buy	429,835.38	0	4.03	4.03
1255173D US	WACHOVIA CORP	Buy	674,772.23	0	2.47	2.47
MSI US	MOTOROLA SOLUTIONS INC	Buy	1,349,012.7	0	2.17	2.17
IBM US	INTL BUSINESS MACHINES CORP	Buy	199,209.16	0	2.09	2.09
Portfolio and Group Constraint Results						
Group	Field	Relative	Min	Max	Init Val	Final Value Warning
PORTFOLIO	Beta	NONE	1	1	0	1
PORTFOLIO	Active Total Risk	BENCHMARK		3	15.15	2.17

Goal:

Final IR = 3.89

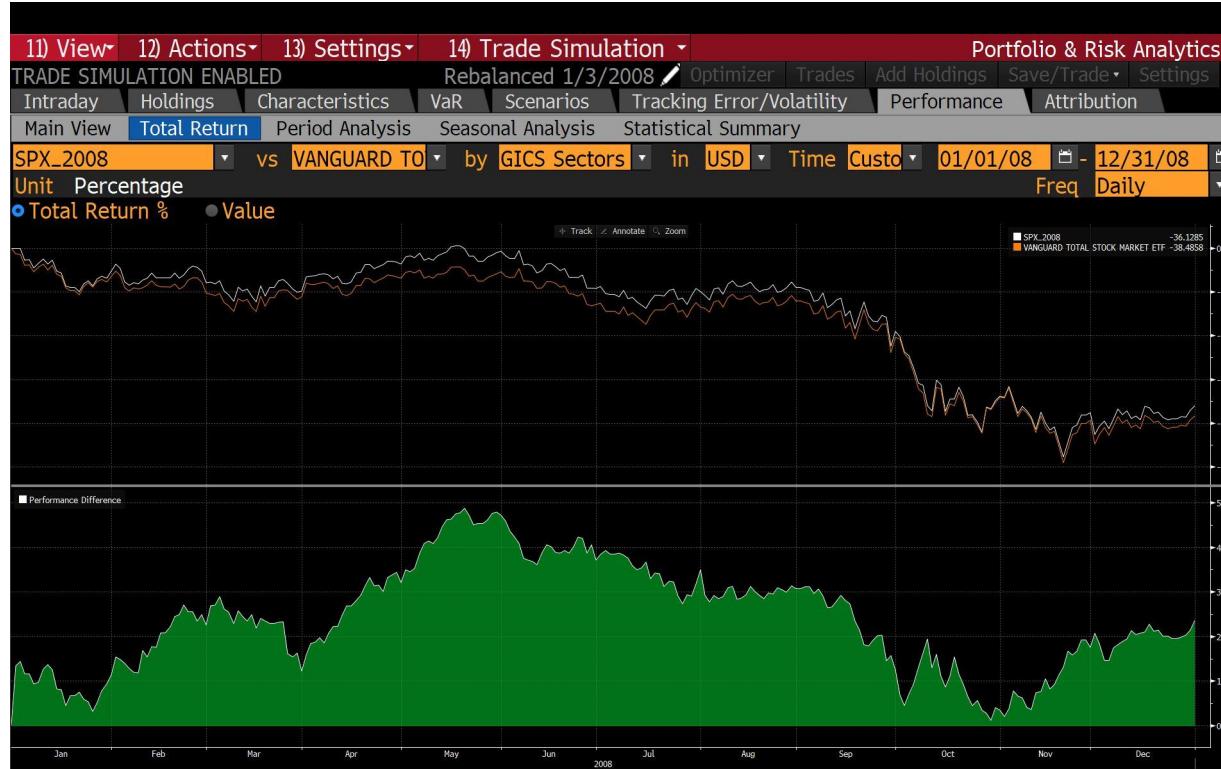
Constraints met:

- beta = 1
- tracking error (active total risk) = 2.17% < 3%
- long only

2008->

Portfolio Performance (2008.01-2008.12)

□ Total Return



The maximum difference of the cumulative return is below 5%

2008->

Portfolio Performance (2008.01-2008.12)

Statistical Summary

Portfolio & Risk Analytics								
TRADE SIMULATION ENABLED		Rebalanced 1/3/2008						
Intraday	Holdings	Characteristics	VaR	Scenarios	Tracking Error/Volatility	Performance	Add Holdings	Save/Trade
Main View	Total Return	Period Analysis	Seasonal Analysis	Statistical Summary				
SPX_2008	vs VANGUARD TO	by GICS Sectors	in USD		As of 01/01/09			
Unit Percentage	SPX_2008							
		3 Months		6 Months		Year To Date	1 Year	
Portfolio Statistics		Port	Bench	Port	Bench	Port	Bench	
Total Return	-19.95	-22.23	-30.00	-29.62	0.00	0.00	-36.13	-38.49
Maximum Return	11.39	11.14	11.39	11.14	0.00	0.00	11.39	11.14
Minimum Return	-8.96	-8.93	-8.96	-8.93	0.00	0.00	-8.96	-8.93
Mean Return (Annualized)	-60.99	-66.36	-55.22	-54.19	0.00	0.00	-40.34	-43.24
Mean Excess Return (Annualized)	15.94		-2.24		0.00		5.10	
3. Risk								
Standard Deviation (Annualized)	64.90	66.06	51.31	52.33		11.96	39.37	39.80
Downside Risk (Annualized)	43.59	45.02	35.64	36.82			27.71	28.20
Skewness	0.38	0.29	0.26	0.15		-0.38	0.22	0.13
VaR 95% (ex-post)	-6.26	-6.51	-5.29	-5.70		-1.21	-4.46	-4.35
Tracking Error (Annualized)	6.04		5.05				4.45	
4. Risk/Return								
Sharpe Ratio	-0.76	-0.82	-0.87	-0.83			-0.82	-0.87
Jensen Alpha	3.96		-1.97				1.83	
Information Ratio	1.85		-0.32				0.81	
Treynor Measure	-0.50		-0.46				-0.33	
Beta (ex-post)	0.98		0.98				0.98	
Correlation	0.9959		0.9954				0.9937	

- return: -36.13%
- vol: 39.37%
- downside risk: 27.71%
- VAR: -4.46%
- SR: -0.82
- Jensen Alpha: 1.83%
- IR: 0.81

As shown in the chart, the 1Y realized tracking error (annualized) is 4.45%, which is above our prediction as 2.17%.

The initial prediction of risk is too low.

2008->

Portfolio Performance (2008.01-2008.12)

❑ Tracking Error



The difference in the risk of our portfolio v.s. benchmark

2008->

Portfolio Performance (2008.01-2008.10)

Transfer Coefficient

Run another optimizer:

Goal: maximize expected return

Constraints:

- allow long/short
- remove all other constraints
- only setting portfolio risk $\leq 14.95\%$
(the portfolio risk when there's constraints)

Expected return without constraints: 84.37%

Expected return with constraints: 25.76%

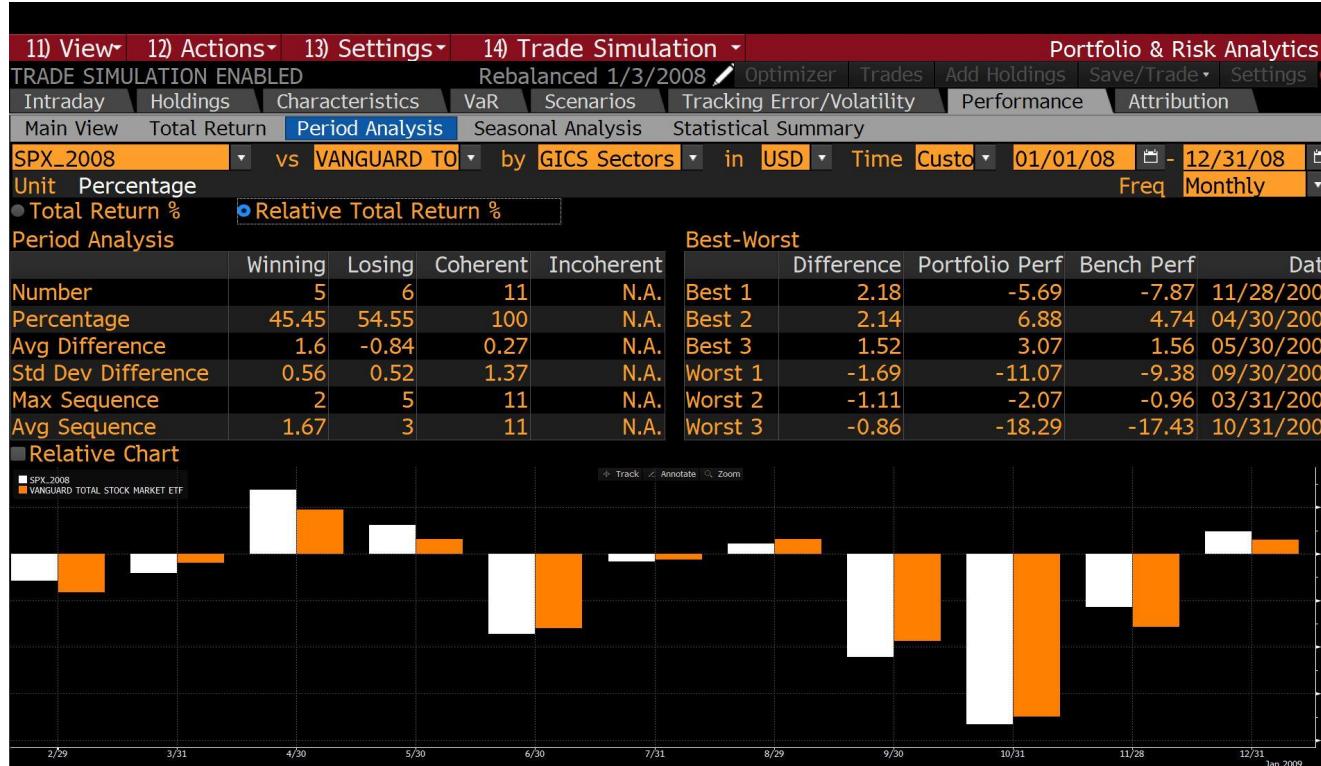
Transfer coefficient = $25.76\% / 84.37\% = 30.53\%$

Port SPX_2008		Bmrk VANGUARD TOTAL STOC...	Risk Model	Bloomberg Risk Mo	01/01/08	Backtest	
5) Setup		5) Frontier	5) Backtest	5) Trades			
Task Name		07-c	Expected Return (%) (User-defined)				
✓ Maximize							
▼ 2. Trade Universes		Add					
Source		Security List	Rule				
✓ Favorites		Current Portfolio	Trade List				
▼ 3. Constraints		Add	Add Frontier	Long/Short			
Constraint Field		Constraint Group	Relative	Unit	Min	Max Trade-Off	
✓ Portfolio Total Risk		Portfolio	None	%	14.95		
▼ 4. Security Properties		Add					
Security		Relative	Unit	Min	MinHld	MinTrd	
USD	Infuse	None	Wgt%			Lot	
S Default for all		None	Wgt%			16.4	
S BAC US Equity		None	Wgt%			0.490535	
S BSC US Fauity		None	Wgt%			0.490535	
1) Run		2) Tasks	3) Settings	99) Analyze in PORT	Portfolio Optimization		
Port SPX_2008		Bmrk VANGUARD TOTAL STOC...	Risk Model	Bloomberg Risk Mo	01/01/08	Backtest	
5) Setup		5) Frontier	5) Backtest	5) Trades			
Optimization Summary		Status	Success	Goal Summary			
Turnover(%)	1,487.82	Trade Value	14,878,600,000	Goal	Initial Value	Final Value	
# of Buys	235	Value of Buys	7,323,290,000	Expected Return (%) (User-defined)	16.4	84.37	
# of Sells	258	Value of Sells	7,555,330,000				
Proposed Trades				Export Trades			
Security	Name	Trade	Quantity	Init. Weight (%)	Opt. Weight (%)	Wgt Diff	
1255173D US	WACHOVIA CORP	Buy	6,925,508.83	0	26.34	26.34	
USD	US DOLLAR	Buy	232,039,790.83	100	123.2	23.2	
SCHW US	SCHWAB (CHARLES) CORP	Buy	5,246,717.95	0	13.41	13.41	
LMT US	LOCKHEED MARTIN CORP	Buy	1,183,397.77	0	12.46	12.46	
Portfolio and Group Constraint Results							
Group	Field	Relative	Min	Max	Init Val	Final Value	
PORTFOLIO	Portfolio Total Risk	NONE	14.95	0	14.95		

2008->

Portfolio Performance (2008.01-2008.12)

Period Analysis



Underperform in

- March
- June
- July
- August
- September
- October

Outperform in other months

2008->

Portfolio Performance

Attribution



Benchmark: VTI

Portfolio return = -36.13%

Active return = -36.13% - (-38.49%) = 2.36%

Excess return: 2.36%

Active return due to allocation: -0.41%

- the good:

less weight in financials;

- the bad:

less weight in consumer staples

Active return due to selection: 1.13%

- better equity selection in healthcare and materials

Active return due to Interaction: 1.64%

-healthcare

2008->

Portfolio Performance (2008.01-2008.12)

- Which risk factors were the primary drivers of its performance relative to benchmark?

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics

TRADE SIMULATION ENABLED Rebalanced 1/3/2008 Optimizer Trades Add Holdings Save/Trade ▾ Settings

Intraday	Holdings	Characteristics	VaR	Scenarios	Tracking Error/Volatility	Performance	Attribution
Main View	Summary	Factors	Risk Bets	Trends	Exposures		
SPX_2008	vs VANGUARD TO	by GICS Sectors	in USD			As of 01/03/08	
Model Bloomberg Ri	Unit Returns (%)					Horizon 1 Year	
Asset Class All Asset	All Asset	Group by All Factor	<input checked="" type="checkbox"/> Hide zero exposures				

Exposure Risk

Factor	Portfolio	Benchmark	Active ↓	Factor Vol (Std %)	Tot. Active (Std)	Marginal (X100)	Contribution %
1. Trade Activity:US Trd	0.10	-0.04	0.15	1.997	0.29	0.04	0.24
2. Value:US Value	0.03	-0.10	0.13	4.269	0.55	0.55	3.27
3. Profit:US Profit	-0.01	-0.10	0.09	1.765	0.16	0.09	0.37
4. Growth:US Growth	-0.01	-0.10	0.09	2.013	0.17	-0.12	-0.47
5. Industrials:US Defens	0.05	0.02	0.03	8.278	0.22	0.71	0.86
6. Utilities:US Utilities	0.05	0.04	0.02	11.538	0.18	0.10	0.07
7. Financials:US FinSvcs	0.04	0.03	0.01	12.102	0.16	0.15	0.09
8. Industrials:US IndSvcs	0.02	0.01	0.01	6.872	0.07	0.35	0.17
9. Technology:US Hardw	0.07	0.07	0.01	7.880	0.05	-0.15	-0.05
10. Technology:US Softw	0.07	0.06	0.01	5.951	0.03	-0.20	-0.05
11. ConsumerDisc:US Hous	0.01	0.01	0.01	12.132	0.07	0.49	0.12
12. ConsumerStap:US Distr	0.03	0.02	0.01	8.357	0.05	0.19	0.05
13. Energy:US OilExpl	0.09	0.09	0.00	18.328	0.08	0.61	0.13
14. HealthCare:US Health	0.02	0.01	0.00	7.445	0.03	0.12	0.02
15. Financials:US MrtgFins	0.01	0.01	0.00	27.039	0.11	-1.26	-0.24
16. Energy:US MidOil	0.01	0.00	0.00	13.885	0.06	0.66	0.12
17. ConsumerDisc:US Auto	0.01	0.01	0.00	13.258	0.05	0.29	0.05
18. Materials:US Metals	0.01	0.01	0.00	15.436	0.06	0.50	0.08
19. ConsumerDisc:US Auto	0.00	0.00	0.00	24.383	0.08	-0.16	-0.03

As shown in the chart, we have high active exposure in: trade activity; value; profit; growth and some industry factors.