SMART PORTFOLIOS

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R-Squared Risk Management

The Problem with Active Management

- Very large funds typically hire a number of active managers, but this practice can quickly become self-defeating, as the effects of the managers pure stock selection skills will diversify away very rapidly, and the fund will effectively be left with a very expensive index fund overlaid with a small number of Style tilts
- A 2009 performance evaluation study done for the Norwegian sovereign wealth fund came to the conclusion that the fund would be better off simply building a set of Style Factor portfolios themselves
- In recent years, this conclusion has resulted in the enormous growth of ‘Smart Beta’ funds and ETFs.

Smart Beta funds . . .

- Finance academics and practitioners have long since identified a number of Style Factors that out-perform the broad equity market, on average, over time
- Examples include Value, Growth, Momentum, Quality
- The underlying idea is that each of these Style Factors has a corresponding factor risk premium, or return, that can be harvested for investors
- Smart Beta funds purport to deliver these returns to investors: they can be thought of as index funds with Style tilts; to a quant, they are Factor portfolios
- A recent internet search in the US market found over 40 Value indices, and 28 Value ETFs

. . . or Not-so-Smart Beta funds?

- The problem with most of them is that the way in which they are constructed means that they do a very poor job of capturing the Style Factor premia
- ‘Smart’ Beta funds are often capitalisation-weighted or equal-weighted
- The S&P (so-called) ‘Pure Style’ ETFs have portfolio weights in proportion to the appropriate style metric; for Value, this is a combination of BV/P, E/P and S/P
- All that is happening here is that some simplistic, arbitrary weighting scheme is being applied to a set of stocks with high exposures to a particular Style

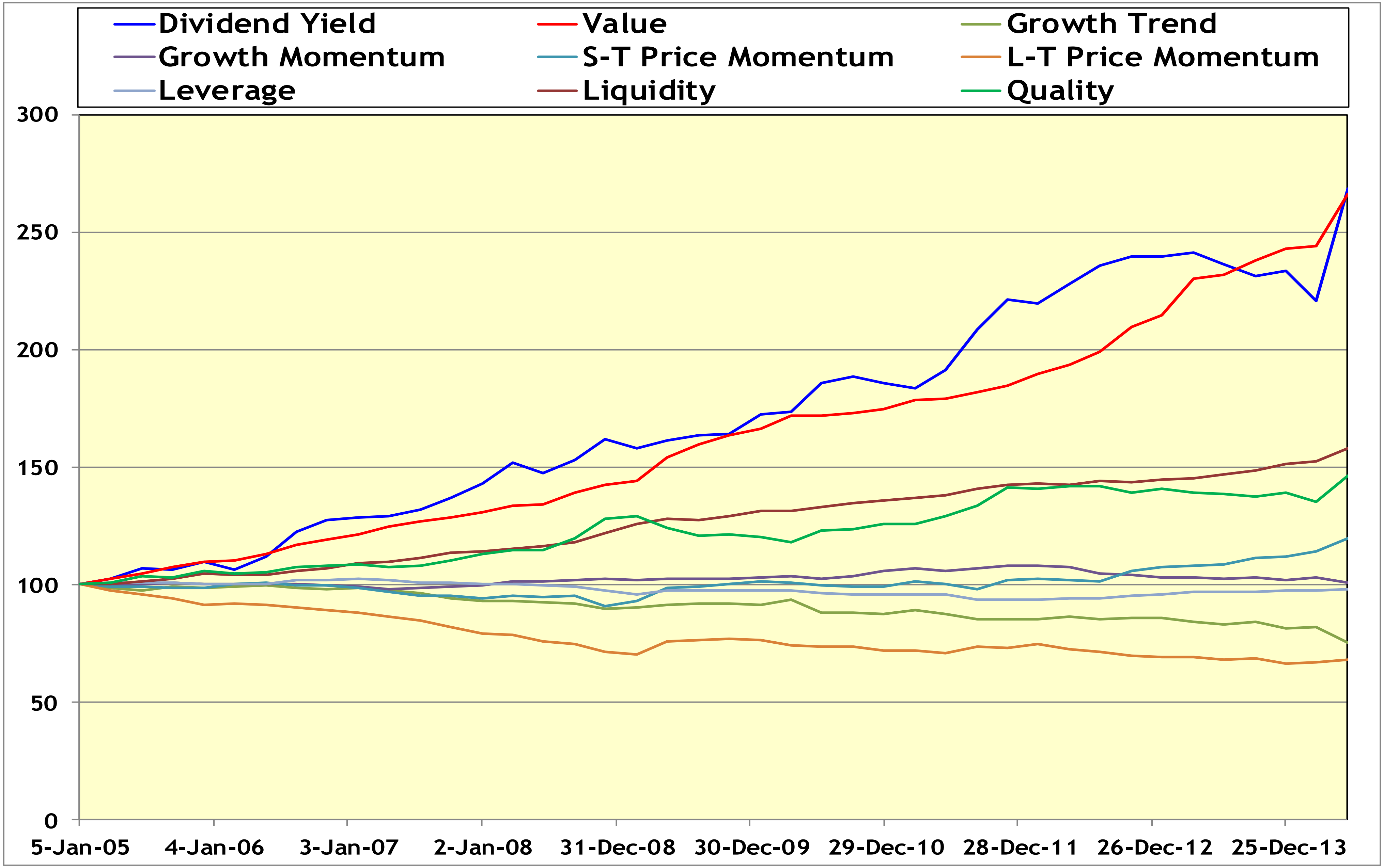
The KISS Principle at Work

- At best, these various weighting schemes will simply give a Style tilt to the portfolios
- What they should be doing is trading off each stock's (Style-related) expected return against its risk
- Without any serious attempt to optimise these Factor portfolios, their performance will be driven mainly by their exposure to market, industry and other factors
- It seems the marketing imperative to have a simple story is more important than an efficient Style tilt
- The consequence is that these funds capture only a small fraction of the Style premia, and often have a higher risk than the market itself

Digression on Style Factor Returns

- It is not possible to measure Style Factor returns directly. In practice, they are estimated, either by creating Factor-Mimicking Portfolios (FMPs), or by running cross-sectional regressions on stock returns
- The difficulty with using FMPs lies in trying to make the portfolios independent of other factor effects
- On the other hand, using cross-sectional regressions means the Style Factor returns will be conditioned on all the other factors included in the regression
- Style Factor returns are usually conditioned on each other; however, they are often conditioned on market, industry or currency factors as well

US Style Factor Returns - 1



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US Style Factor Returns - 2

- The chart shows Style Factor returns since Jan-2005
- Dividend Yield and Value have done best over this period, with total returns of around 170%
- Liquidity and Quality have total gains of around 50%
- Short-Term Price Momentum, Growth Momentum, and Leverage have all been fairly flat, with factor premia close to zero
- Long-Term Price Momentum and Growth Trend have both had negative total returns of around -25%
- All these Style Factors are defined using historic data only, in very standard ways; there is nothing special or unique about the way they are defined

Not-so-Smart Portfolio construction

- Harry Markowitz won his Nobel prize for proposing that the most efficient way to manage portfolios was to have holdings whose contribution to portfolio expected return matched their contribution to risk
- Note that this idea was first published in 1952, and no-one has yet come up with a better idea
- However, most Smart Beta funds don't do this
- In fact, their construction method often disregards risk completely, except for having lots of holdings, which is presumed to give greater diversification
- This makes them inefficient, and it should therefore be easy to improve their performance

Smart Portfolio construction

- We first design an optimal portfolio construction process to create an efficient Style Factor portfolio
- We use Dividend Yield as our test case
- This portfolio significantly outperforms the usual market benchmarks and similar Smart Beta funds
- We then apply exactly the same portfolio construction methodology to other Style Factors
- The results show that building Smart Portfolios can generate significant improvements in performance
- We will also show that Smart Portfolios do a much better job of capturing the Style Factor premia

The RSQRM US YIELD Strategy - 1

- A long-only Dividend Yield factor portfolio
- Target Portfolio Yield = Universe average yield + 3%
- Maximum Stock holding = 3%
- Maximum Cash holding = 2%
  - Standard practice to cover expenses, fees, etc.
- Only uses top 1,000 stocks by market capitalisation
- US Domicile stocks only (no ADRs, GDRs etc)
- Minimum price per share = $5 : this avoids penny stocks, and is a common restriction for mutual funds

The RSQRM US YIELD Strategy - 2

- Expected return = Trailing Annual Dividend Yield
  = Last 12 months dividends / Current price
- Risk = RSQRM US multi-factor risk model
  - 6 Currency factors (only relevant for foreign stocks)
  - 9 Style factors : (the usual suspects)
    - **Div Yield** **Value** **Quality** **Leverage** **Liquidity**
    - **Growth Trend** **Growth Momentum** **S-T price momentum** **L-T Price momentum**
  - 2 US Market factors (US Large – like S&P 500 and US Small – like Russell 2000)
  - 20 US Industry factors (based on GICS classifications)
  - 4 Statistical factors
  - For the Style factors, we estimate the factor returns from cross-sectional regressions
  - For all other factors, we estimate stock betas from time series regressions of stock returns against factor returns

The RSQRM US YIELD Strategy - 3

- Optimisers are notoriously prone to error maximisation
- In order to be useful, we need to have as much confidence in our return and risk estimates as we can
- In the case of Style Factor portfolios, the expected return proxy is actually a sensitivity to the Style factor
- We hope that the Style Factor premium is positive, but at least we are sure about the stock beta to the factor
- In this case, all we are really forecasting is that the next 12 months dividends will be like the last 12
- Using Style betas as the expected return proxy ensures that the portfolios have a significant Style Factor tilt

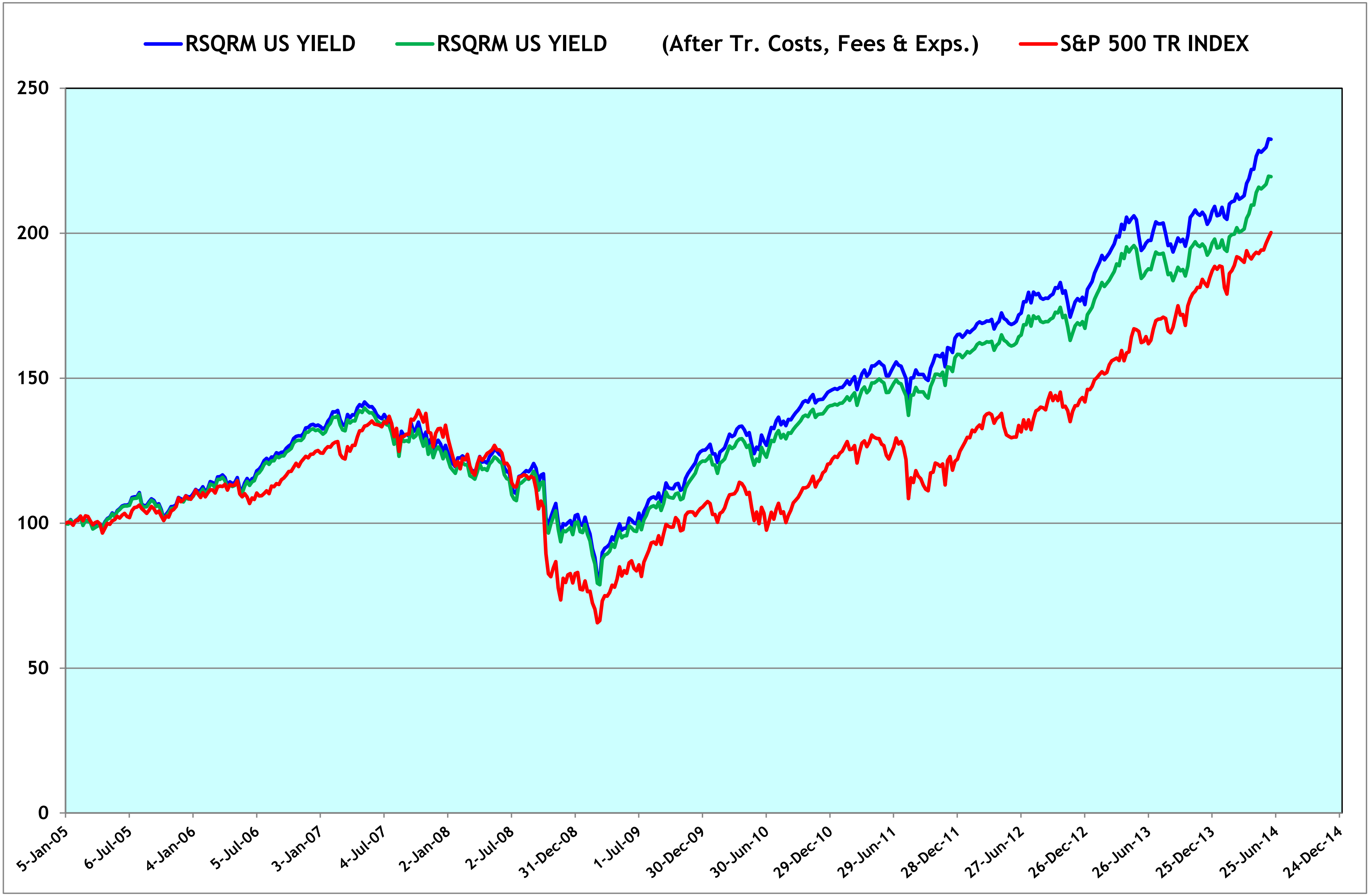
The RSQRM US YIELD Strategy - 4

- We also need to be confident about the risk numbers
- In practice, this means that we need to be sure that the risk model has done a good job of identifying the sensitivities of each stock to the various factors, and of capturing its systematic common factor risks
- To achieve this, we filter the candidate universe to screen out stocks with low R-Squareds
- The risk characteristics of very high risk stocks are more likely to be biased estimates of their true risk, and may also appear to offer (spurious) diversification
- We therefore also filter out these stocks, to avoid them having a disproportionate effect on portfolio risk

The RSQRM US YIELD Strategy - 5

- Liquidity control : the maximum we buy of any stock must be less than 7 times 20% of the average daily volume over the past 60 trading days
- The portfolio is rebalanced every 12 weeks
- For the purposes of illustration, we assume :
  - Estimated transaction costs : Buy 0.15%, Sell 0.15%
  - Estimated management fees : 0.5% + 0.1% expenses
- However, these assumptions are not material to the relative performance of these Style Factor portfolios

US Yield Smart Portfolio



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US Yield Smart Portfolio from 5-Jan-05 to11-Jun-14

Annualised Performance since Inceptio			
	Return	Risk	I. R.
Portfolio	8.7%	13.1%	0.662
Benchmark	7.6%	17.2%	0.444
Relative	1.1%	8.8%	0.119

Beta to S&P 500 TR index = 0.659

Performance Attribution				
	Target Style	Other Styles	Other Factors	Portfolio Alpha
Return	9.3	1.8	2.0	-4.4
Pct	107%	21%	24%	-51%

Average Number of Holdings & Average Turnover			
No. of Holdings	41	Turnover p.a.	18.0%

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US Yield Smart Portfolio – Worst Drawdowns

ABSOLUTE DRAWDOWNS	PEAK	VALUE	VALLEY	VALUE	WEEKS	RETURNS	RELATIVE RETURN
Benchmark	10-May-06	2014.0	14-Jun-06	1876.7	5	-6.8%	5.3%
Portfolio		114.7		113.0		-1.5%	
Benchmark	10-Oct-07	2443.0	4-Mar-09	1153.3	73	-52.8%	12.6%
Portfolio		132.5		79.3		-40.1%	
Benchmark	14-Apr-10	2006.1	30-Jun-10	1715.2	11	-14.5%	9.7%
Portfolio		129.0		122.7		-4.8%	
Benchmark	27-Apr-11	2292.1	10-Aug-11	1906.5	15	-16.8%	9.3%
Portfolio		148.3		137.2		-7.5%	
Benchmark	19-Sep-12	2548.1	14-Nov-12	2372.9	8	-6.9%	2.6%
Portfolio		170.3		163.0		-4.3%	
Benchmark	1-Jan-14	3315.6	5-Feb-14	3146.5	5	-5.1%	3.0%
Portfolio		198.0		193.7		-2.1%	

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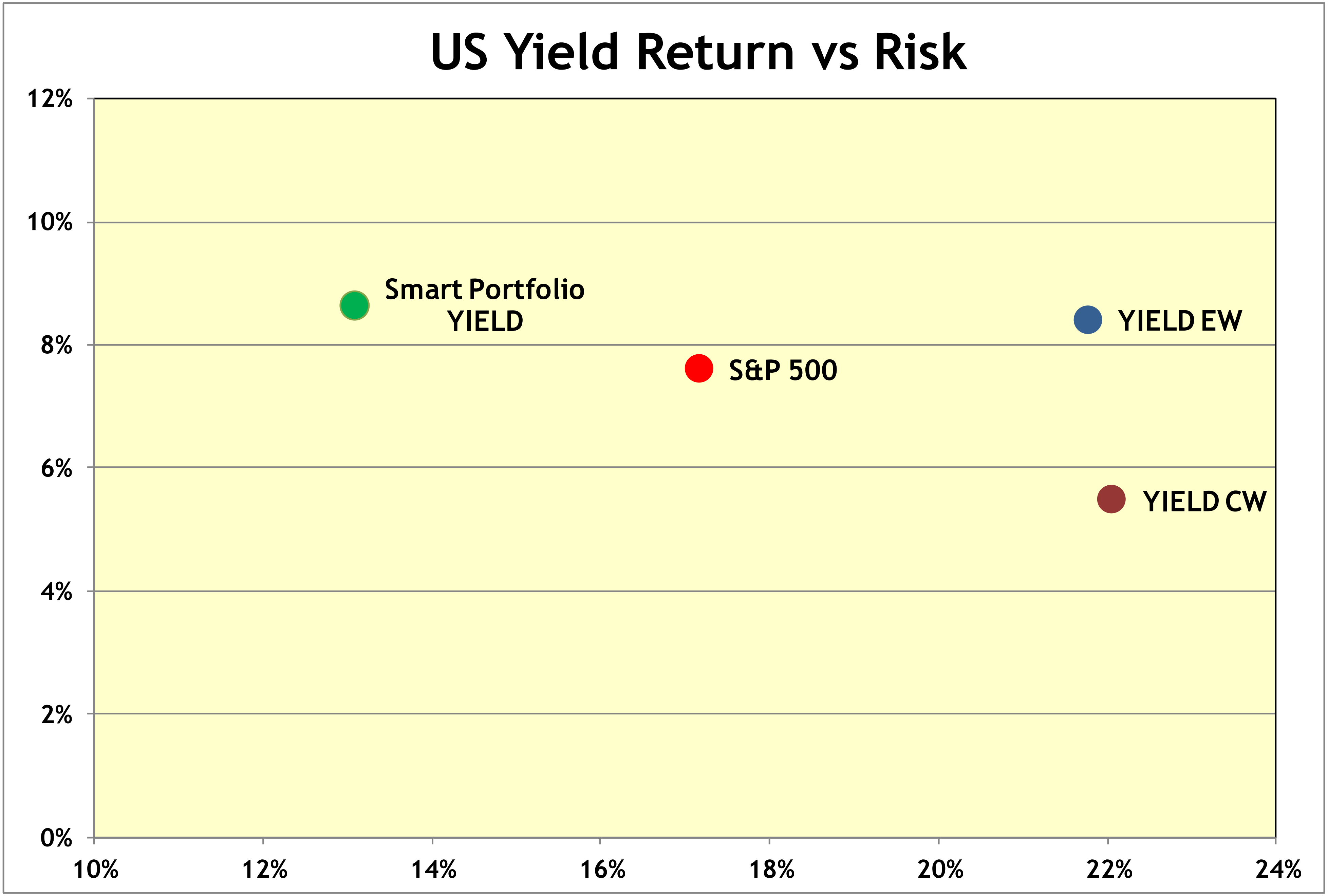
US Yield Return vs Risk
12%
10%
8%
6%
4%
2%
0%
10%
12%
14%
16%
18%
20%
22%
24%
Smart Portfolio
YIELD
YIELD EW
S&P 500
YIELD CW

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Now Repeat for other US Styles

- We now apply EXACTLY the same Smart Portfolio construction process to other Style Factors

- **To emphasise, we use exactly**
  - **The same constraints**
  - **The same risk filters**
  - **The same factor model**
  - **The same optimisation**

- We change ONLY the expected return proxy

Other US Styles for Smart Portfolios

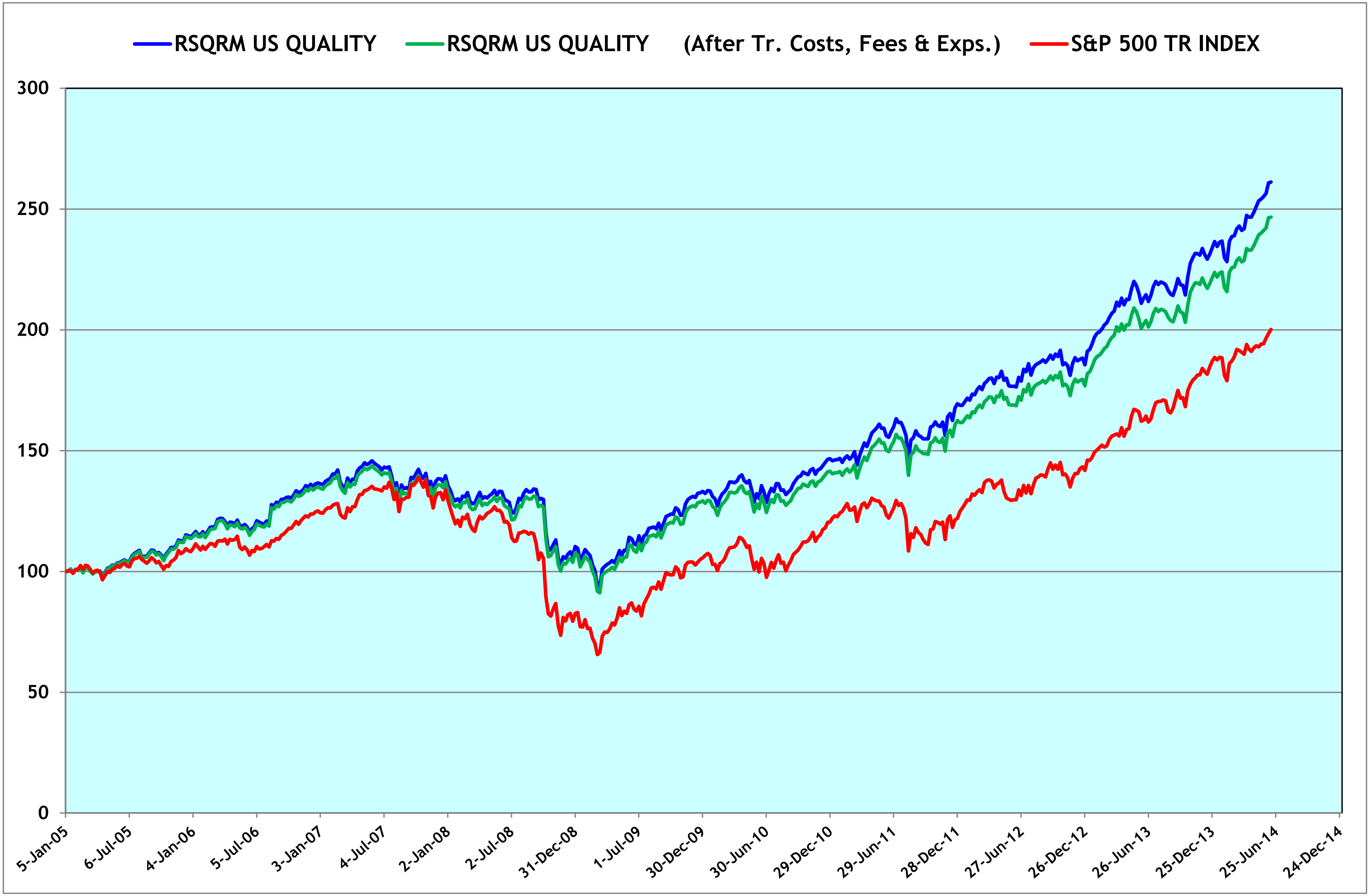
- YIELD = Trailing 12 month Dividend Yield
  Annualised Factor return = 8.57%

- QUALITY = Sustainable Growth, Cash Flow to Sales, Return on Equity and Return on Assets
  Annualised Factor return = 3.26%

- GROWTH TREND = Earnings Growth, Sales Growth, and Book Value Growth
  Annualised Factor return = -2.20%

- VALUE = Book to Price, Cash-flow to Price, and Earnings to Price
  Annualised Factor return = 9.66%

US Quality Smart Portfolio



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US Quality Smart Portfolio from 5-Jan-05 to11-Jun-14

Annualised Performance since Inceptio			
	Return	Risk	I. R.
Portfolio	10.0%	12.7%	0.791
Benchmark	7.6%	17.2%	0.444
Relative	2.4%	7.7%	0.311

Beta to S&P 500 TR index = 0.672

Performance Attribution				
	Target Style	Other Styles	Other Factors	Portfolio Alpha
Return	4.1	7.2	3.2	-4.6
Pct	41%	72%	32%	-46%

Average Number of Holdings & Average Turnover			
No. of Holdings	40	Turnover p.a.	44.4%

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US Quality Smart Portfolio – Worst Drawdowns

ABSOLUTE DRAWDOWNS	PEAK	VALUE	VALLEY	VALUE	WEEKS	RETURNS	RELATIVE RETURN
Benchmark	10-May-06	2014.0	14-Jun-06	1876.7	5	-6.8%	2.4%
Portfolio		120.2		114.9		-4.4%	
Benchmark	10-Oct-07	2443.0	4-Mar-09	1153.3	73	-52.8%	18.5%
Portfolio		139.7		91.8		-34.3%	
Benchmark	14-Apr-10	2006.1	30-Jun-10	1715.2	11	-14.5%	6.9%
Portfolio		134.7		124.4		-7.6%	
Benchmark	27-Apr-11	2292.1	10-Aug-11	1906.5	15	-16.8%	9.2%
Portfolio		151.3		139.8		-7.6%	
Benchmark	19-Sep-12	2548.1	14-Nov-12	2372.9	8	-6.9%	2.3%
Portfolio		180.9		172.7		-4.5%	
Benchmark	1-Jan-14	3315.6	5-Feb-14	3146.5	5	-5.1%	1.5%
Portfolio		223.8		215.9		-3.5%	

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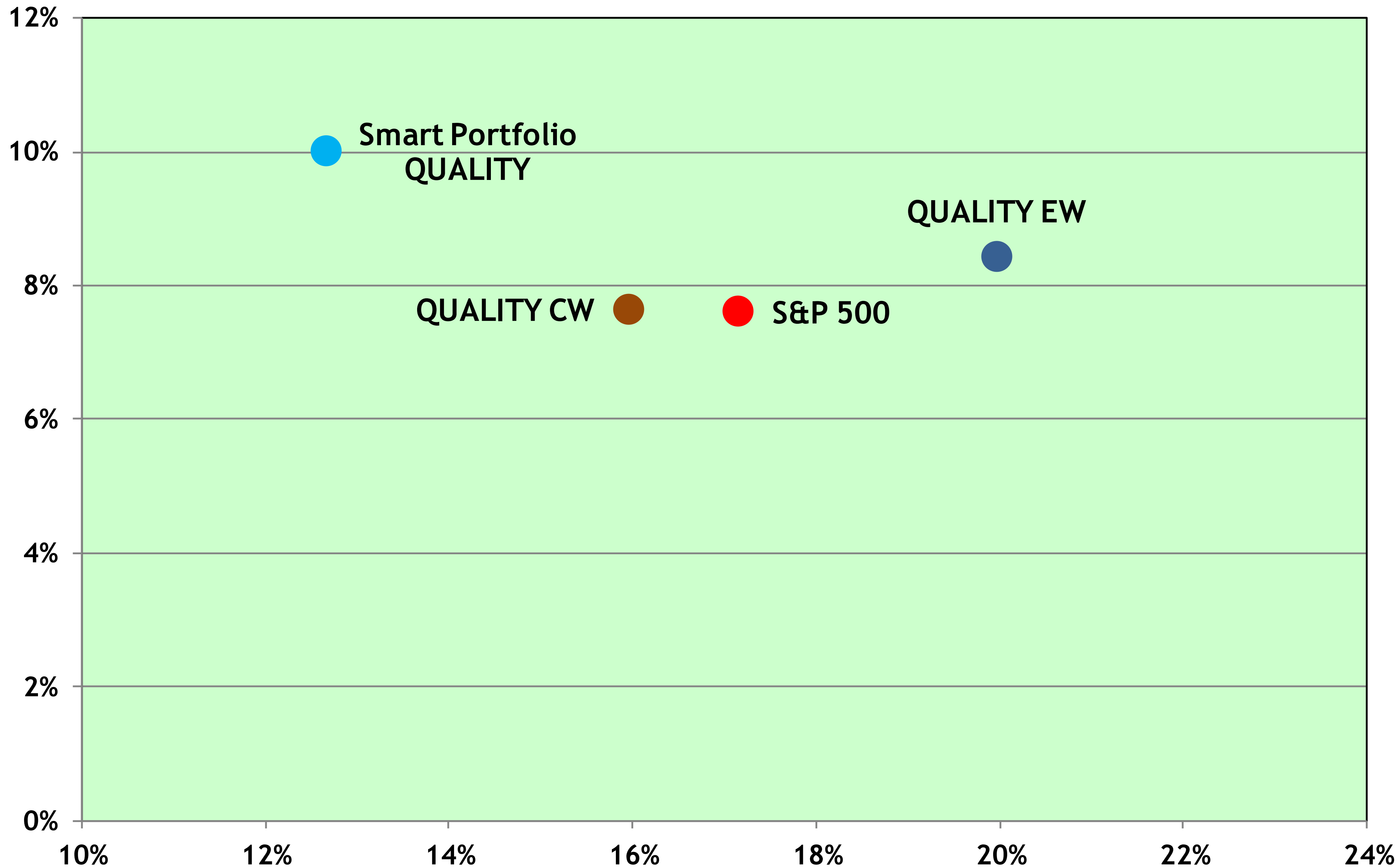
US Quality Return vs Risk



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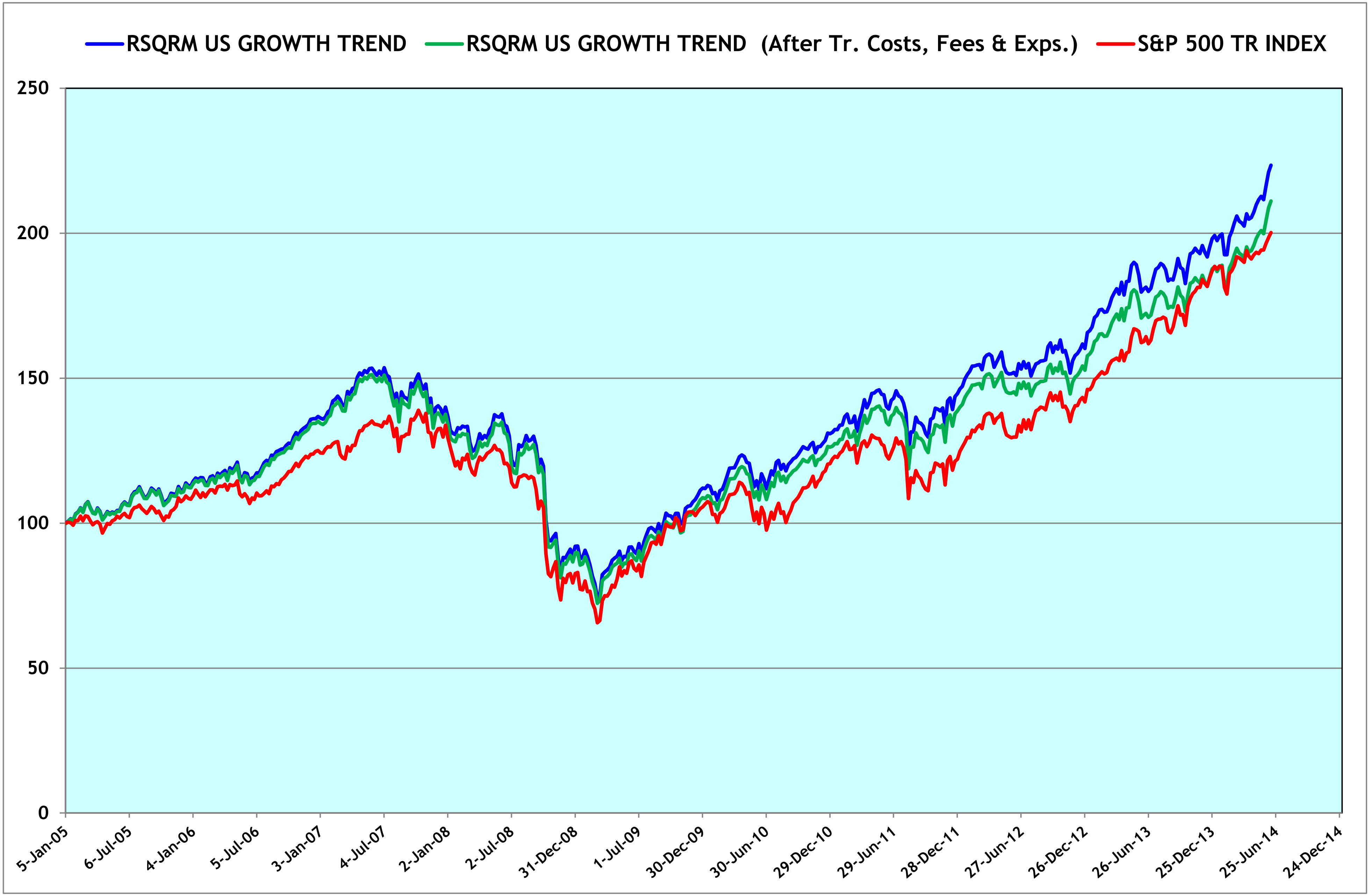
US Growth Trend Smart Portfolio



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US Growth Smart Portfolio from 5-Jan-05 to11-Jun-14

Annualised Performance since Inceptio			
	Return	Risk	I. R.
Portfolio	8.2%	15.7%	0.524
Benchmark	7.6%	17.2%	0.444
Relative	0.6%	6.4%	0.095

Beta to S&P 500 TR index = 0.850

Performance Attribution				
	Target Style	Other Styles	Other Factors	Portfolio Alpha
Return	-2.3	6.9	2.3	1.5
Pct	-28%	84%	27%	18%

Average Number of Holdings & Average Turnover			
No. of Holdings	35	Turnover p.a.	65.5%

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US Growth Smart Portfolio – Worst Drawdowns

ABSOLUTE DRAWDOWNS	PEAK	VALUE	VALLEY	VALUE	WEEKS	RETURNS	RELATIVE RETURN
Benchmark	10-May-06	2014.0	14-Jun-06	1876.7	5	-6.8%	1.2%
Portfolio		120.0		113.3		-5.6%	
Benchmark	10-Oct-07	2443.0	4-Mar-09	1153.3	73	-52.8%	1.4%
Portfolio		148.8		72.4		-51.4%	
Benchmark	14-Apr-10	2006.1	30-Jun-10	1715.2	11	-14.5%	5.5%
Portfolio		118.9		108.2		-9.0%	
Benchmark	27-Apr-11	2292.1	10-Aug-11	1906.5	15	-16.8%	2.1%
Portfolio		139.2		118.8		-14.7%	
Benchmark	19-Sep-12	2548.1	14-Nov-12	2372.9	8	-6.9%	0.3%
Portfolio		154.8		144.6		-6.6%	
Benchmark	1-Jan-14	3315.6	5-Feb-14	3146.5	5	-5.1%	1.8%
Portfolio		188.5		182.2		-3.3%	

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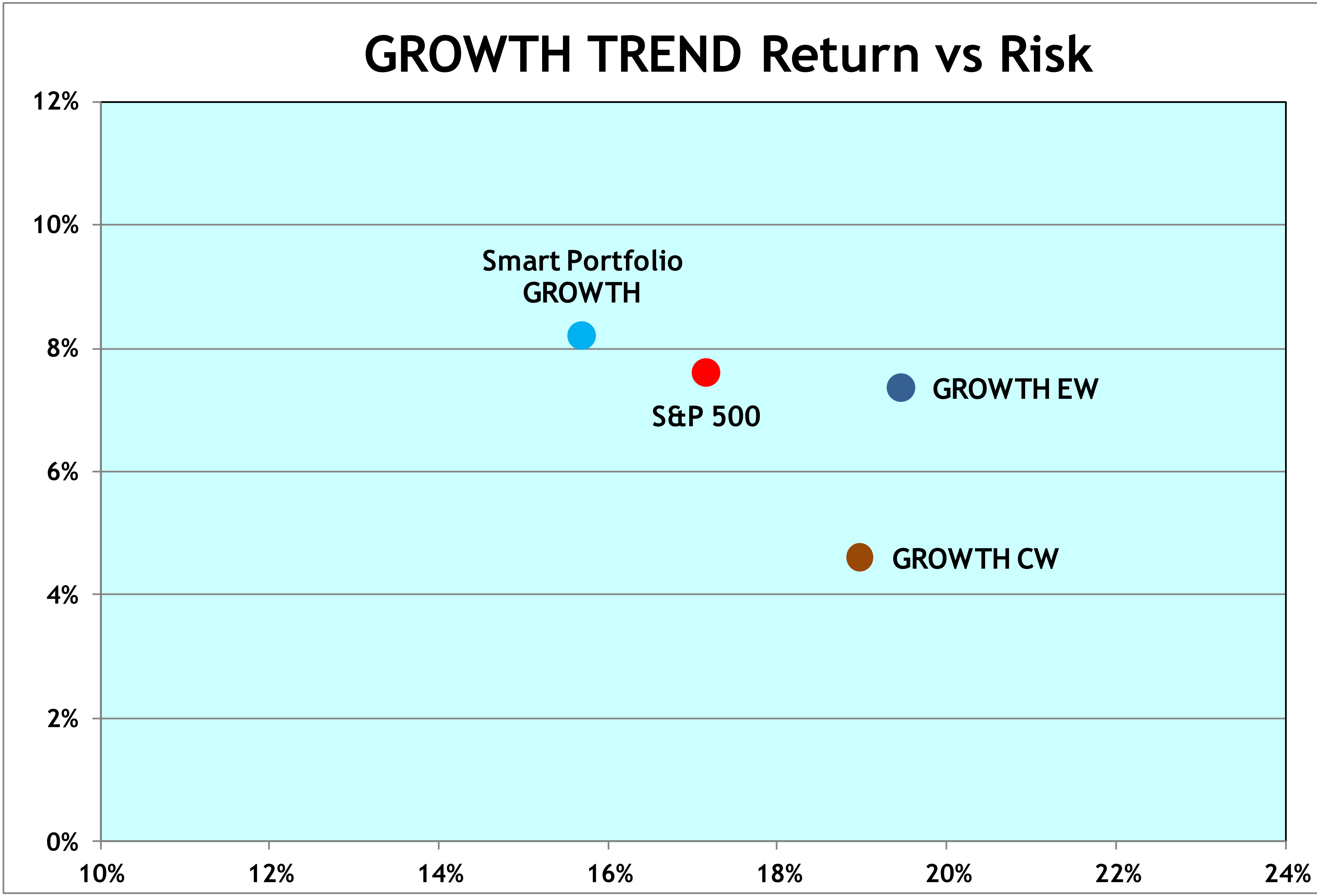
GROWTH TREND Return vs Risk
12%
10%
8%
6%
4%
2%
0%
10%
12%
14%
16%
18%
20%
22%
24%
Smart Portfolio
GROWTH
S&P 500
GROWTH EW
GROWTH CW

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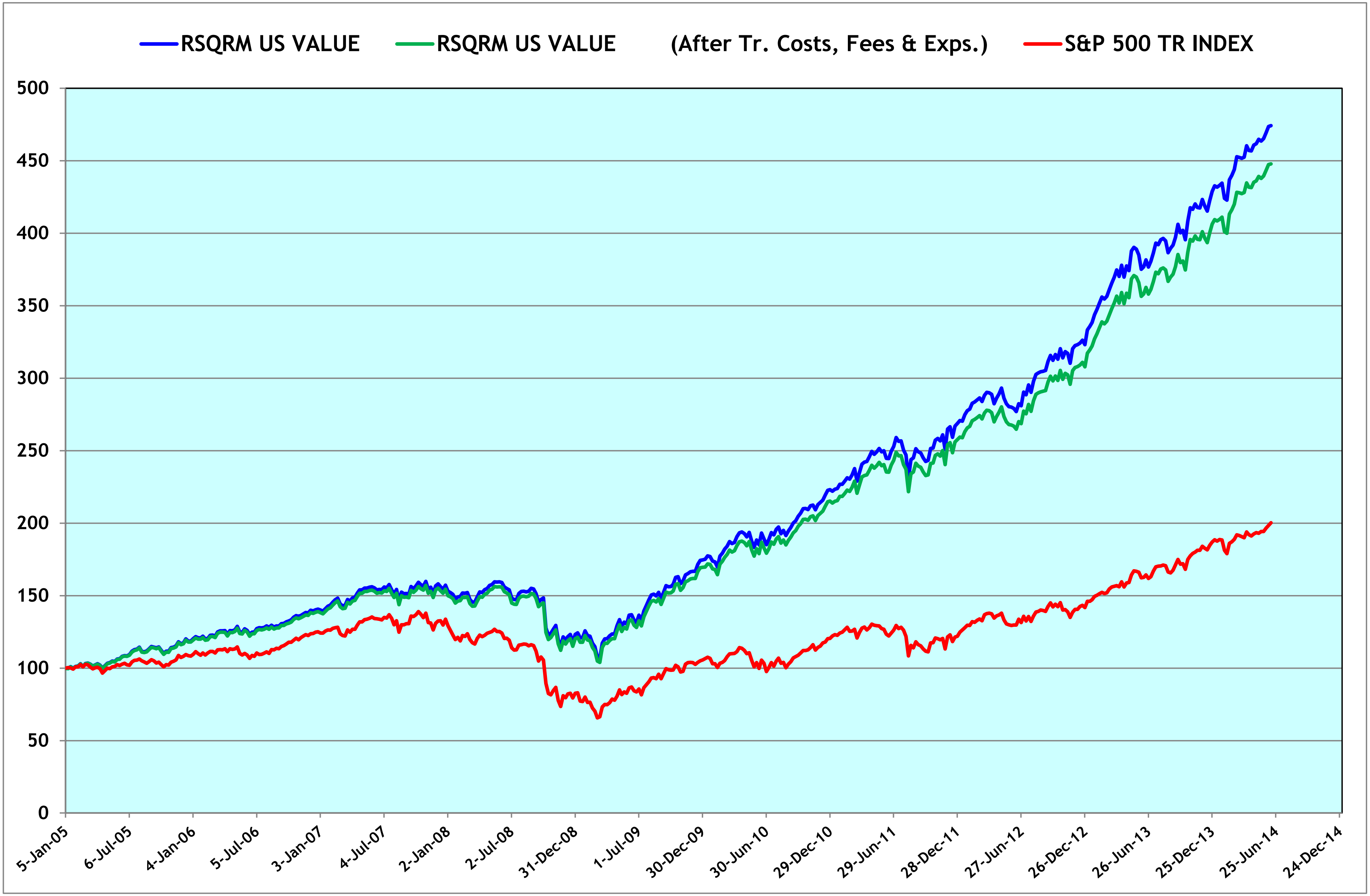
US Value Smart Portfolio



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US Value Smart Portfolio from 5-Jan-05 to11-Jun-14

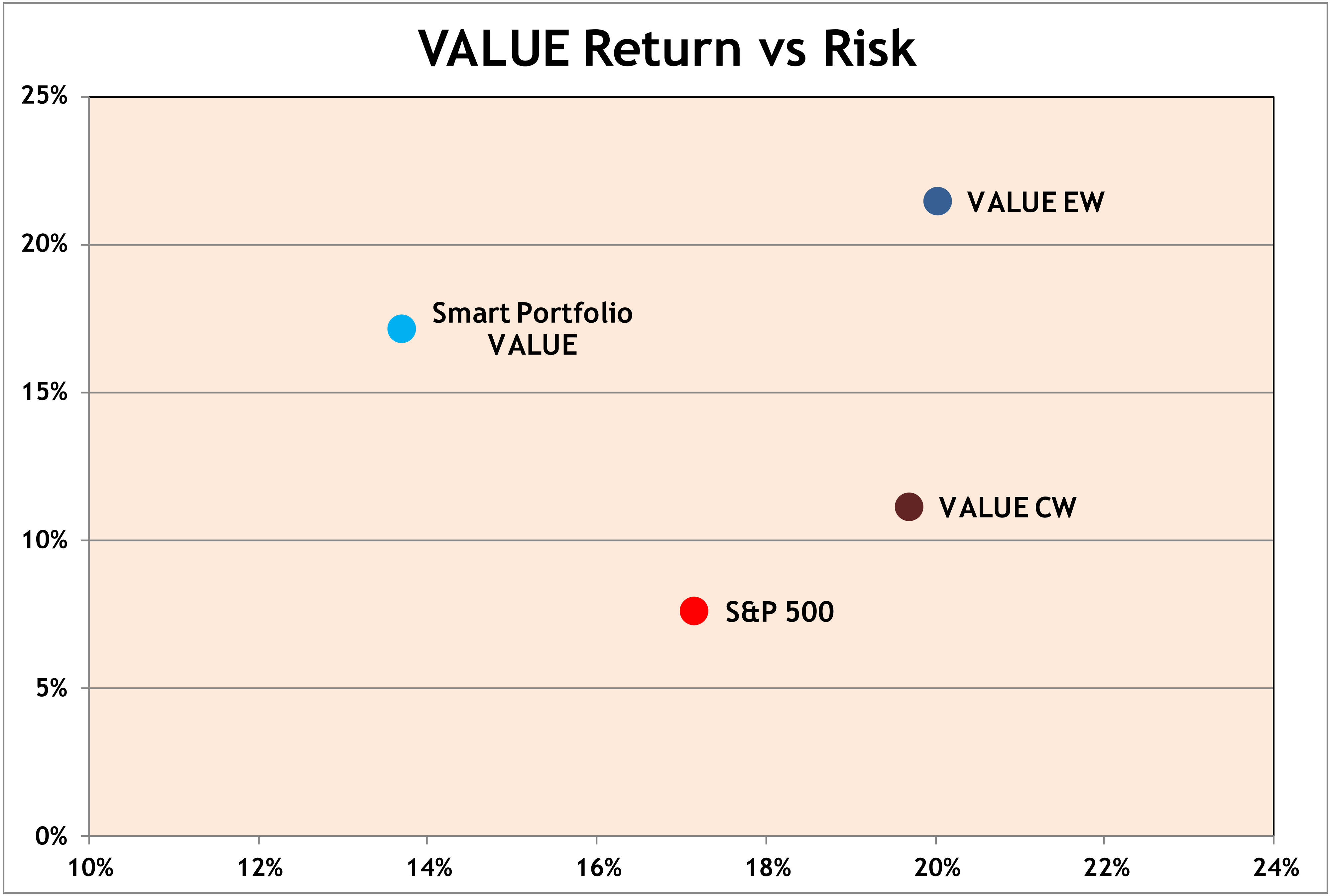
Performance since Inception			
Annualised	Return	Risk	I. R.
Portfolio	17.2%	13.7%	1.253
Benchmark	7.6%	17.2%	0.444
Relative	9.5%	6.5%	1.479

Performance Attribution				
	Target Style	Other Styles	Other Factors	Portfolio Alpha
Return	10.5	8.6	3.2	-5.1
Pct	61%	50%	19%	-30%

Average Number of Holdings & Average Turnover			
No. of Holdings	43	Turnover p.a.	41.5%

US Value Smart Portfolio – Worst Drawdowns

ABSOLUTE DRAWDOWNS	PEAK	VALUE	VALLEY	VALUE	WEEKS	RETURNS	RELATIVE RETURN
Benchmark	10-May-06	2014.0	14-Jun-06	1876.7	5	-6.8%	2.5%
Portfolio		127.6		122.1		-4.3%	
Benchmark	10-Oct-07	2443.0	4-Mar-09	1153.3	73	-52.8%	19.8%
Portfolio		156.3		104.8		-33.0%	
Benchmark	14-Apr-10	2006.1	30-Jun-10	1715.2	11	-14.5%	10.3%
Portfolio		187.1		179.2		-4.2%	
Benchmark	27-Apr-11	2292.1	10-Aug-11	1906.5	15	-16.8%	9.2%
Portfolio		239.9		221.7		-7.6%	
Benchmark	19-Sep-12	2548.1	14-Nov-12	2372.9	8	-6.9%	5.0%
Portfolio		301.4		295.8		-1.9%	
Benchmark	1-Jan-14	3315.6	5-Feb-14	3146.5	5	-5.1%	2.8%
Portfolio		409.4		400.0		-2.3%	


VALUE Return vs Risk
25%
20%
15%
10%
5%
0%
10%
12%
14%
16%
18%
20%
22%
24%
VALUE EW
Smart Portfolio
VALUE
VALUE CW
S&P 500

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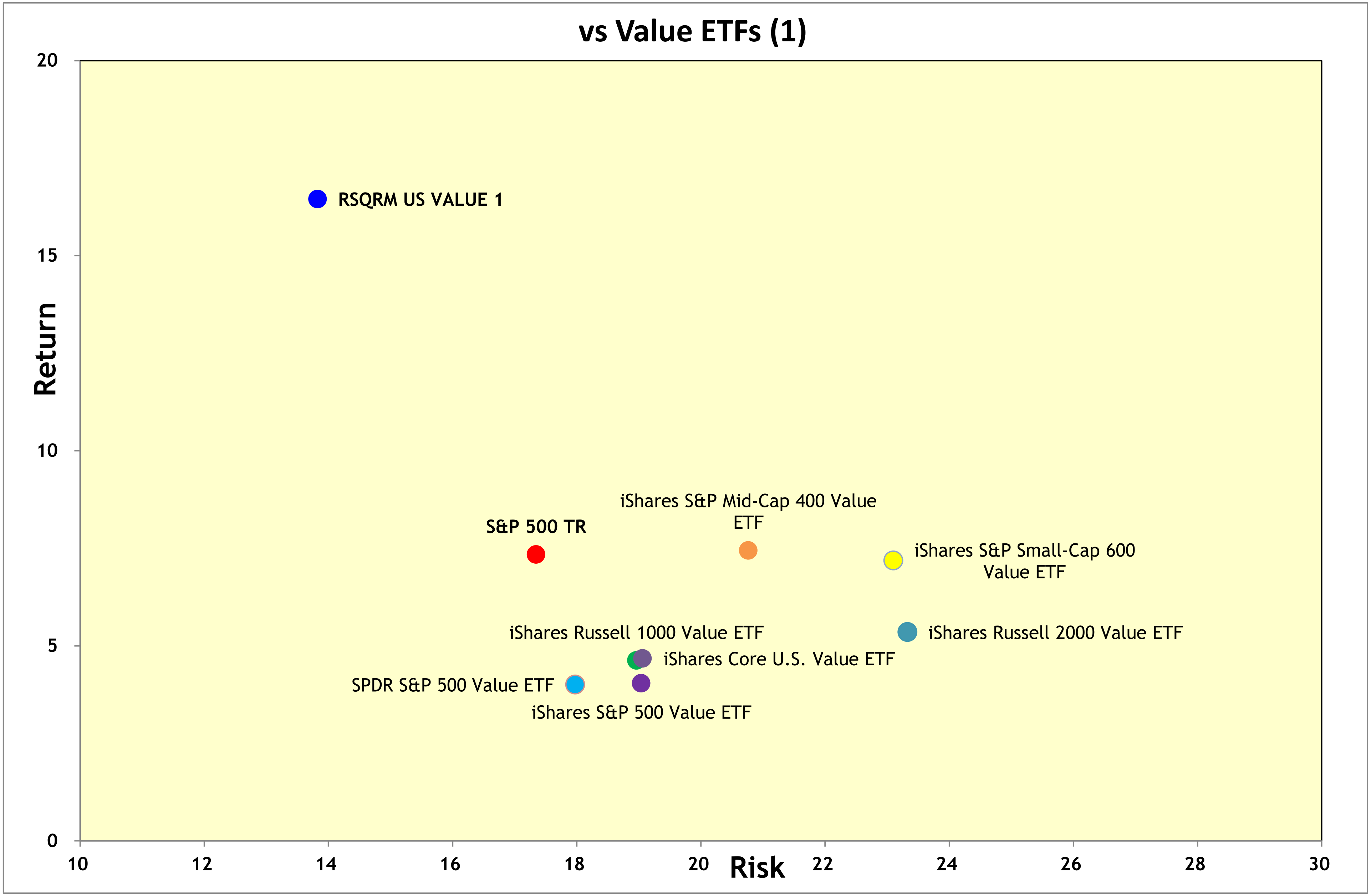
Smart Portfolios - Summary

- These Smart Portfolios have higher return and/or lower risk that the market benchmarks
- They have higher I.R.s than both capitalisation-weighted and equal-weighted Style Factor portfolios
- The Performance Attribution analyses show that each of these Smart Portfolios did a good job of delivering the corresponding Style Factor return, albeit with contributions from other factors and alpha
- We would need to create Long-Short Smart Portfolios to minimise the other return contributions
- Finally, we can compare the US Value Smart Portfolio to 28 US Value ETFs actually being traded . . .

US Value Smart Portfolio vs iShares Value ETFs



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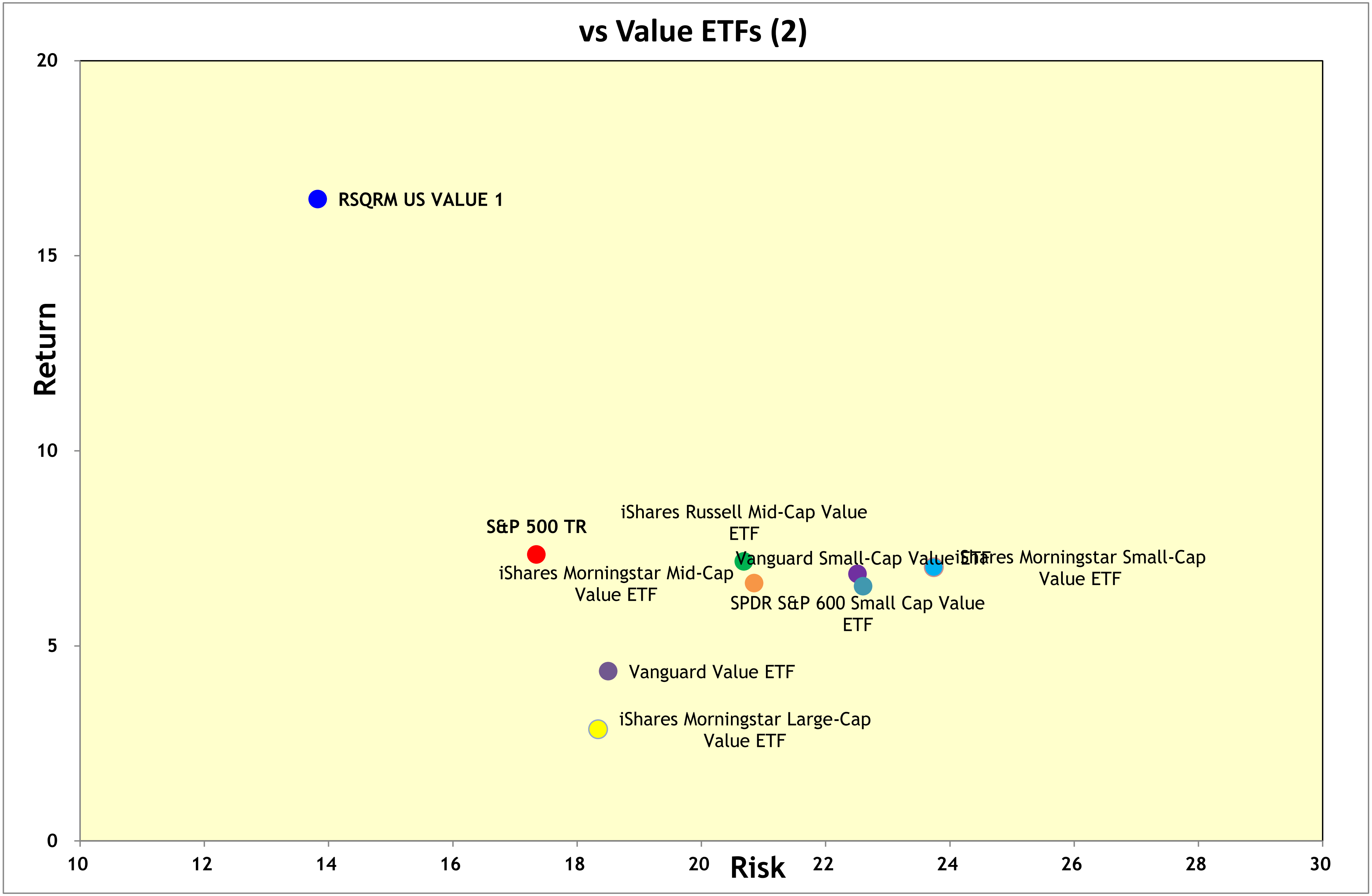
US Value Smart Portfolio vs Various Value ETFs



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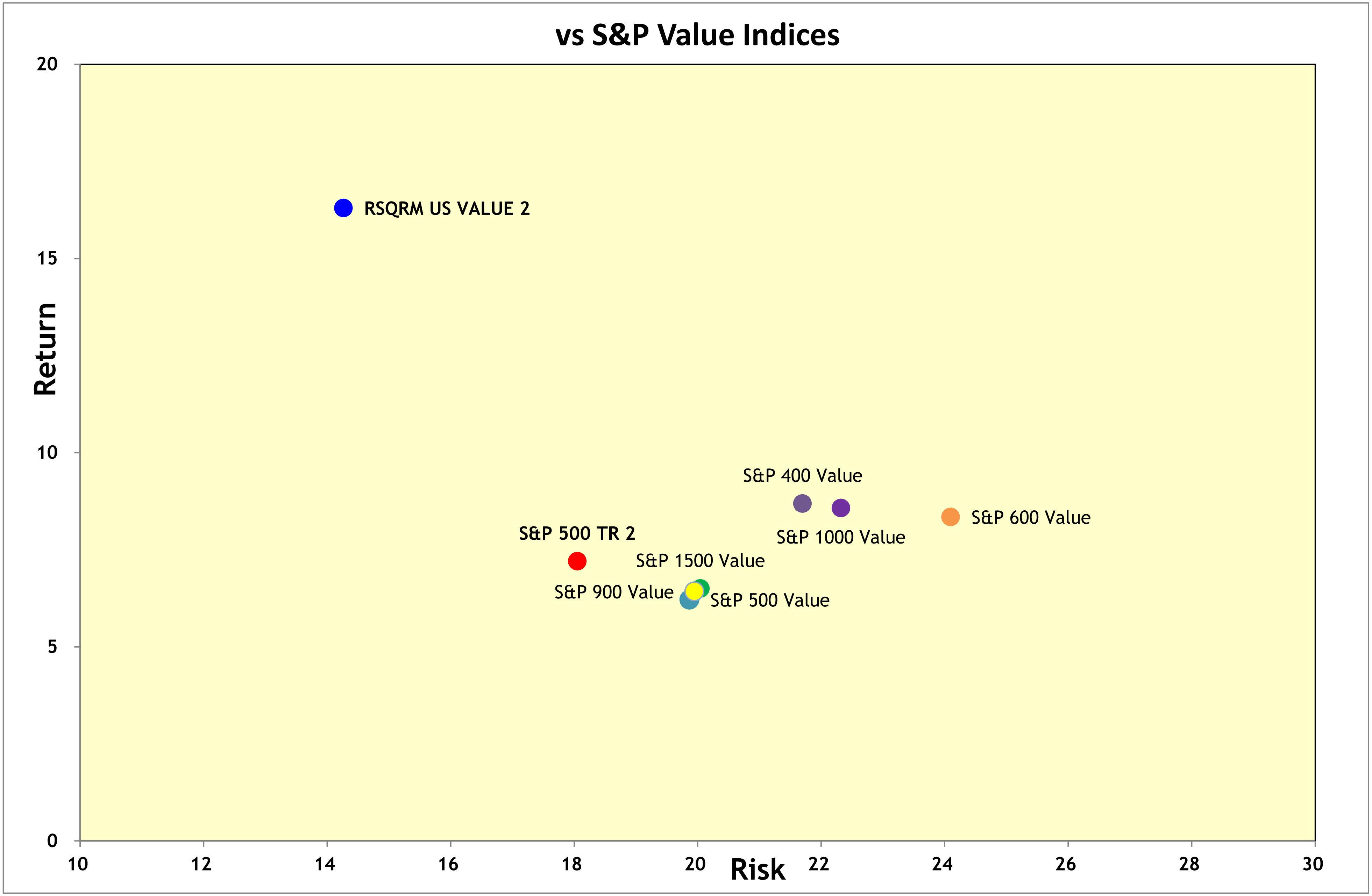
US Value Smart Portfolio vs S&P Value ETFs



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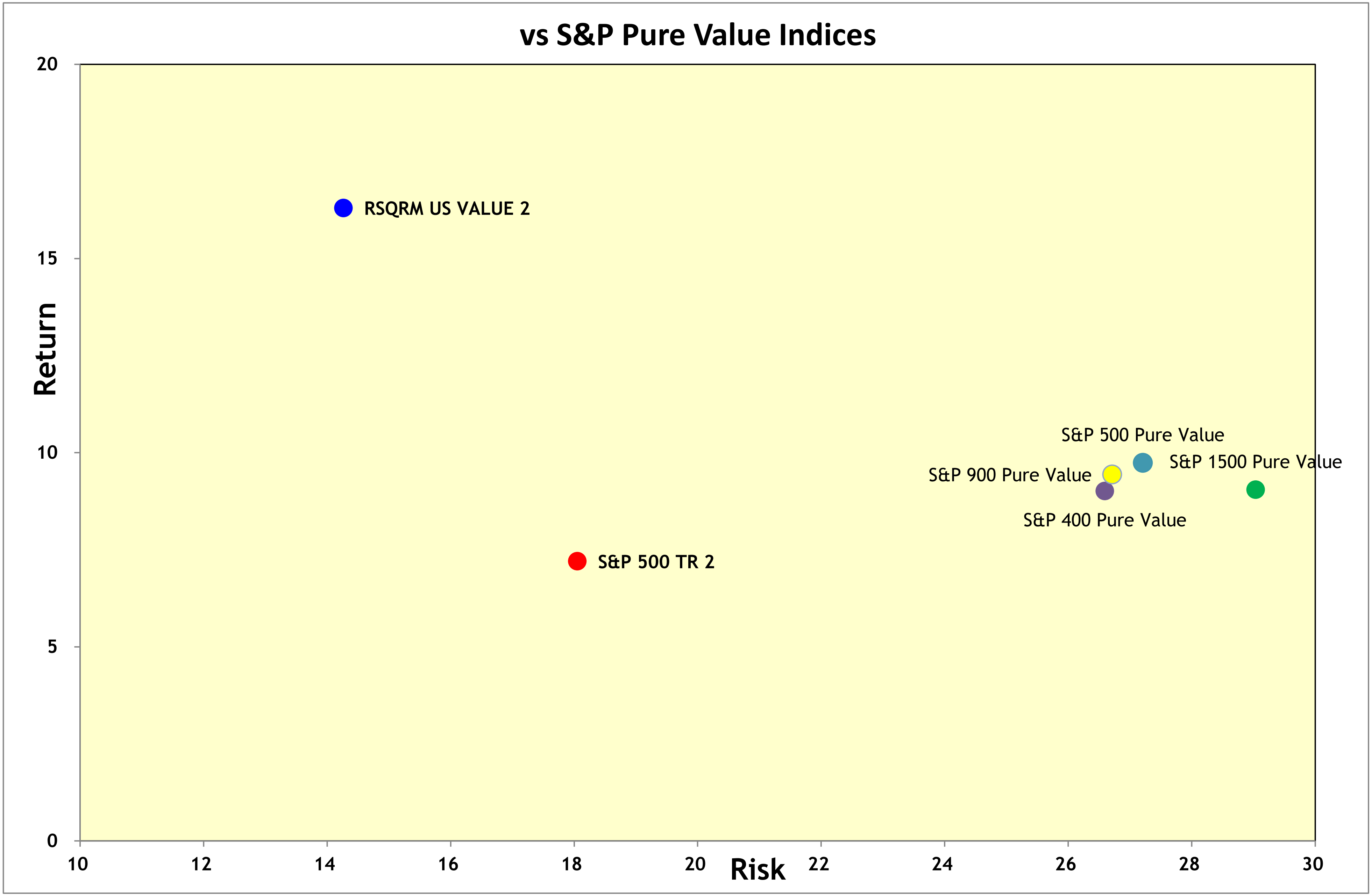
US Value Smart Portfolio vs S&P Pure Value ETFs



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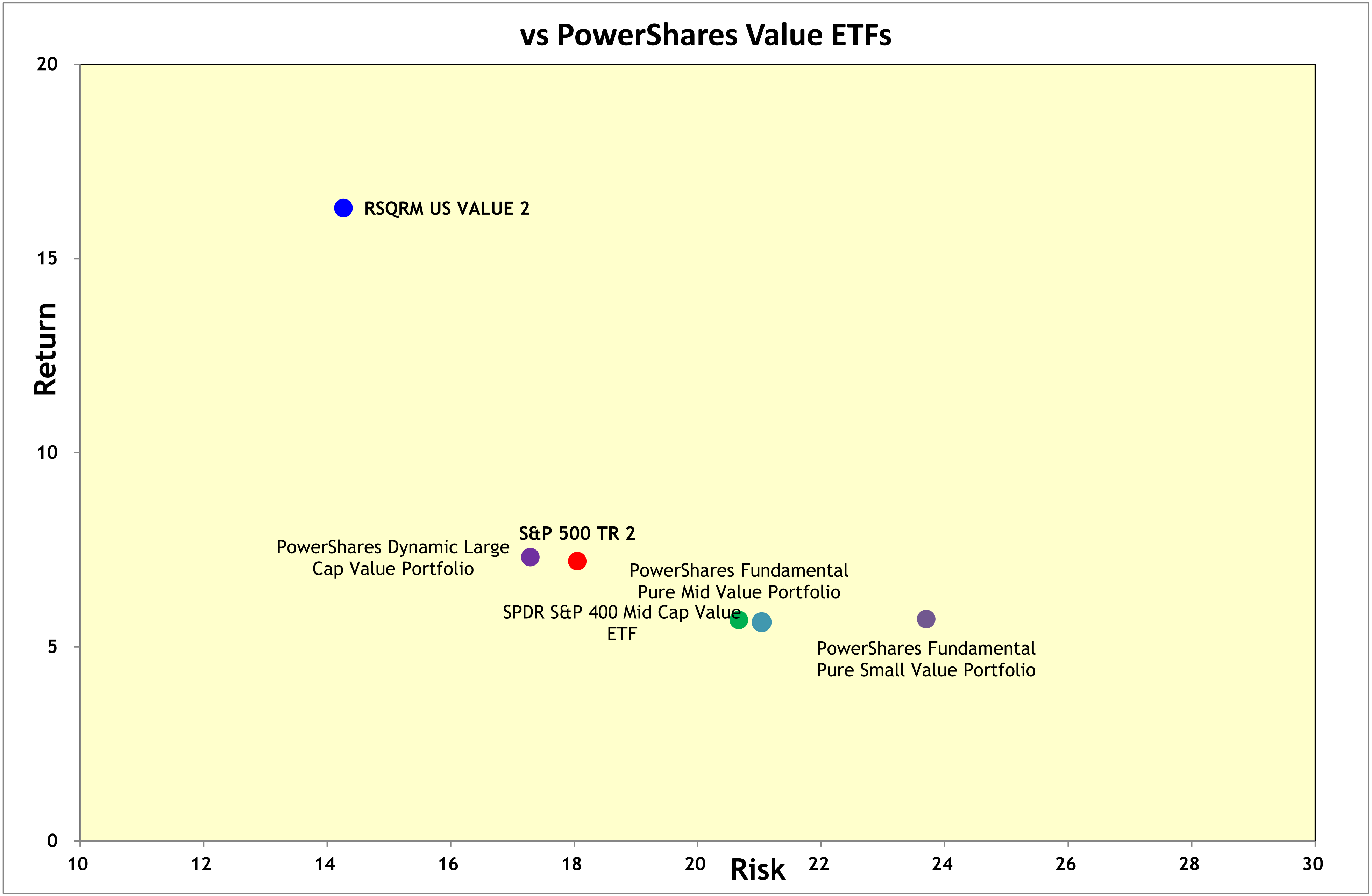
US Value Smart Portfolio vs Powershares Value ETFs



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Smart Portfolios - Conclusions

- The idea of Smart Beta funds makes a lot of sense
- Their basic purpose is to deliver Style Factor returns to investors as cheaply and easily as possible
- Unfortunately, the way in which most Smart Beta funds are created is . . . well, just plain dumb!
- They have a Style tilt, but don’t give the Style return
- They usually have much higher risk than necessary, as well as significant exposures to other factors
- Smart Portfolios can do a much better job of delivering the Style Factor return, with lower overall risk, and much less exposure to other factors

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