

A Practitioner's Defense of Return Predictability

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Equity Premium

- Excess return that investing in the stock market provides over a risk-free rate [*Investopedia*]

Why is it important?

- Offers insight to understanding a key risk-reward trade-off in the marketplace and investor preferences
- Used in asset allocation
 - Individual and institutional investors
- Input for cost of capital calculations, affect corporate decisions

Can We Forecast the Equity Premium?

NO...

- Merton, Samuelson, Malkiel

YES...

- Fama, Shiller, Campbell

We Can't Produce a Good *Ex Post* Estimate

Robert Merton, 1997 Nobel laureate:

Merton (1980) calls attempts to precisely estimate the equity premium “a fool’s errand”

We Can't Predict Where the Market is Going

Paul Samuelson, 1970 Nobel laureate:

“Participation in market timing implies a degree of self-confidence bordering on hubris and self-deception”

Burton Malkiel, author of *A Random Walk Down Wall Street*:

Warned the audience “Don't try to time the market. No one can do it. It's dangerous.” at a conference in 2013

Finance theory tells us the equity premium varies through time

- Changing investment opportunity set, Merton (1973)
- Linked to fluctuations in the macroeconomy
- Influenced by investor disposition

We should be able to forecast this quantity using the appropriate information set

- Variables that capture the state of the economy
- Variables that reveal investor expectations
- Variables that show mispricing

Evidence that Favors Predictability

- Many predictors proposed in literature: Price ratios, bond spreads, technicals, etc
- Fama and French (1988)
- Campbell and Shiller (1988a, 1988b)
- Cochrane (2008)

Participate in the return predictability debate:

Can we predict the equity premium well enough to form a trading strategy?

- Resolve the predictability debate from the investor's perspective
- Traditionally the question has been “Can we predict the equity premium statistically”
- Focus on economic magnitudes, not big t-stats

- Evaluate and combine 20 predictors from literature
 - Capture diverse information sets
- Correlation screening to remove the least informative variables
- Form rolling window forecasts of the equity premium
- Construct market-timing strategy based on forecasts, invest in SPY
 - Backtest shows 12% annual returns in 2001-2015, twice as high as buy-and-hold
 - Sharpe ratio of 0.85, four times that of buy-and-hold
 - Smaller drawdowns
- Eliminate look-ahead bias by including variables as they are discovered in the literature, get same results

- Bulk of data from Bloomberg, Federal Reserve Bank of St. Louis, U.S. Census Bureau
- Short interest of Rapach, Ringgenberg, and Zhou (2015) from Matt Ringgenberg

Construct 20 variables from the predictability literature

- Price ratios: dividend yield, price to earnings, CAPE, etc
- Rates: bond yield, default spread, term spread, etc
- Real economy: Baltic Dry Index, new orders/sales, cay
- Technical: moving average, PCA-tech
- Sell in May, variance risk premium, CPI, short interest

Information in Return Predictors

	DP	PE	BM	CAPE	PCA-price	BY	DEF	TERM	CAY	SIM	VRP	IC	BDI	NOS	CPI	PCR	MA	PCA-tech	OIL	
DP																				
PE	-0.38																			
BM	0.48	-0.76																		
CAPE	-0.59	0.75	-0.96																	
PCA-price	-0.63	0.92	-0.93	0.97																
BY	-0.03	0.08	-0.12	0.13	0.10															
DEF	0.15	-0.39	0.53	-0.48	-0.41	-0.16														
TERM	0.22	-0.12	0.49	-0.52	-0.44	0.17	0.25													
CAY	0.42	0.15	-0.02	-0.07	0.03	0.07	-0.08	0.12												
SIM	-0.15	0.04	-0.07	0.05	0.07	0.21	-0.03	0.06	0.07											
VRP	0.05	-0.08	0.22	-0.17	-0.07	-0.19	0.54	0.04	0.16	-0.13										
IC	0.12	-0.16	0.07	-0.14	-0.15	-0.23	0.36	-0.06	0.12	0.01	0.38									
BDI	-0.09	0.06	-0.07	0.06	0.08	0.11	-0.12	-0.03	0.05	-0.03	0.11	-0.09								
NOS	-0.14	-0.19	-0.15	0.15	0.00	-0.01	-0.32	-0.32	-0.05	-0.39	-0.04	-0.12								
CPI	0.08	0.06	-0.20	0.16	0.04	-0.09	-0.21	-0.18	-0.13	-0.02	-0.39	-0.04	-0.15	0.35						
PCR	-0.65	0.60	-0.84	0.86	0.87	0.05	-0.21	-0.36	-0.16	0.03	0.02	0.03	0.02	0.02	-0.05					
MA	0.00	0.11	-0.21	0.25	0.12	0.17	-0.54	-0.16	-0.09	0.00	-0.41	-0.41	0.03	0.23	0.11	0.05				
PCA-tech	0.02	-0.05	-0.07	0.13	0.02	0.25	-0.48	-0.15	-0.06	0.05	-0.38	-0.38	0.00	0.22	-0.05	-0.06	0.80			
OIL	-0.19	0.08	-0.09	0.11	0.14	0.35	-0.21	0.00	-0.01	0.14	-0.09	-0.11	0.29	0.00	-0.06	-0.09	0.04	0.06		
SI	0.14	-0.15	0.18	-0.22	-0.17	-0.10	0.34	-0.05	0.03	-0.03	0.13	0.21	-0.01	0.05	0.23	-0.34	-0.31	-0.25	0.05	

Correlation matrix of predictor variables. Positive correlations are in green and negative correlations are in red.

Relationship with Market Returns

	R_1M	R_3M	R_6M	R_12M
DP	0.07	0.14	0.21	0.32
PE	-0.08	-0.15	-0.21	-0.25
BM	0.07	0.11	0.19	0.26
CAPE	-0.06	-0.09	-0.16	-0.24
PCA-price	-0.08	-0.13	-0.19	-0.28
BY	-0.05	-0.05	-0.04	0.06
DEF	-0.06	-0.09	-0.04	0.02
TERM	-0.03	-0.06	-0.04	0.08
CAY	0.11	0.19	0.30	0.45
SIM	-0.04	-0.13	-0.15	-0.02
VRP	0.17	0.32	0.29	0.24
IC	0.09	0.12	0.08	-0.03
BDI	0.10	0.22	0.14	0.03
NOS	-0.08	-0.17	-0.20	-0.25
CPI	-0.15	-0.27	-0.32	-0.29
PCR	-0.02	-0.03	-0.08	-0.16
MA	0.11	0.20	0.21	0.21
PCA-tech	0.11	0.18	0.24	0.27
OIL	0.03	0.04	-0.04	-0.13
SI	-0.14	-0.24	-0.28	-0.30

Correlation between predictors and one-, three-, six-, and 12-month future market returns. Positive correlations are in green; negatives are in red.

Econometric Model: Kitchen Sink

Kitchen Sink (KS): Include all predictors except price ratios, which are replaced by PCA-price for a total of 16 variables

$$R_{m,t \rightarrow t+130}^e = \alpha_{KS} + \beta'_{KS} \mathbf{x}_t + \epsilon_{KS,t \rightarrow t+130}$$

$$\mathbf{x}_t = \begin{bmatrix} x_{1,t} \\ x_{2,t} \\ \dots \\ x_{16,t} \end{bmatrix} = \begin{bmatrix} PCA - price_t \\ BY_t \\ \dots \\ SI_t \end{bmatrix}$$

Simulated Strategy:

- Fit model every 20 days to get $\hat{\beta}_{KS}$
- Use $\hat{\beta}_{KS}$ along with updated predictors to construct daily forecast
- Take position in SPY proportional to forecast, adjust daily
- Process repeats every 20 days

Econometric Model: Correlation Screening

Correlation Screening (CS): Include a predictor only if its correlation with 130-day future market returns exceed 10%

$$R_{m,t \rightarrow t+130}^e = \alpha_{CS} + \beta'_{CS} \tilde{\mathbf{x}}_t + \epsilon_{CS,t \rightarrow t+130}$$

$$\tilde{\mathbf{x}}_t = \begin{bmatrix} x_{1,t} I_{|\rho_{1,m}| > 0.1} \\ x_{2,t} I_{|\rho_{2,m}| > 0.1} \\ \dots \\ x_{16,t} I_{|\rho_{16,m}| > 0.1} \end{bmatrix}$$

$$\rho_{i,m} = \text{Corr}(x_{i,t}, R_{m,t \rightarrow t+130}^e)$$

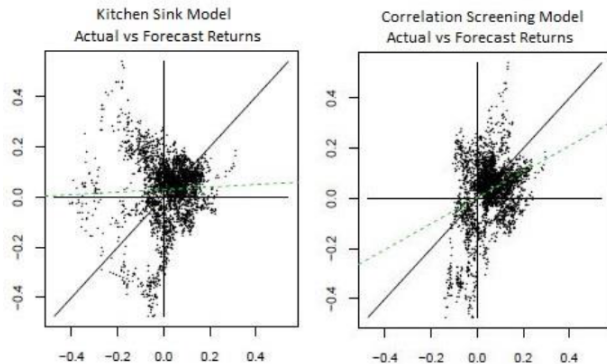
Real-Time Correlation Screening (RTCS): CS, only include variables that have been discovered

$$R_{m,t \rightarrow t+130}^e = \alpha_{RTCS} + \beta'_{RTCS} \check{\mathbf{x}}_t + \epsilon_{RTCS,t \rightarrow t+130}$$

$$\check{\mathbf{x}}_t = \tilde{\mathbf{x}}_t | x_{i,t} \text{ has been discovered}$$

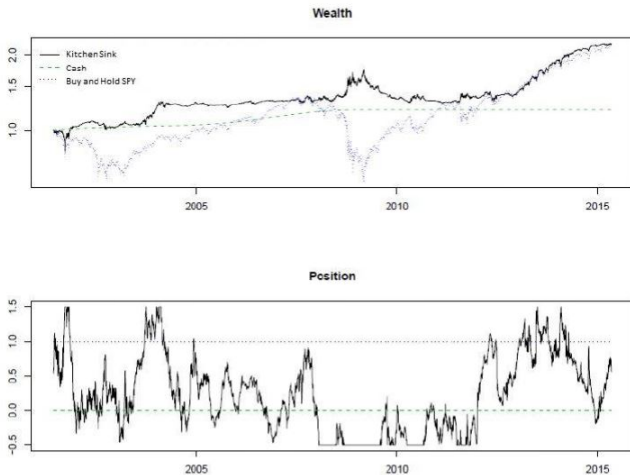
Backtest strategies the same way as KS

Realized Returns vs. Forecasts

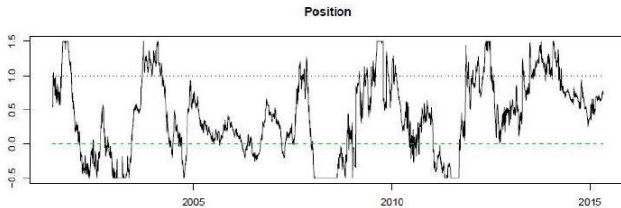
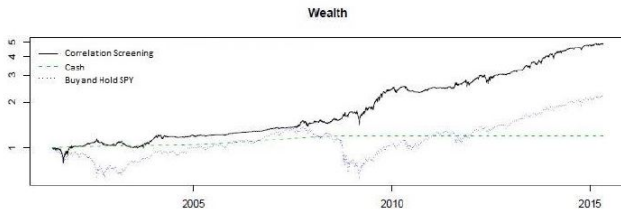


Vertical axis: actual returns; horizontal axis: forecast returns. The black solid line is drawn at 45 degrees. The green dashed line is the best linear fit.

Kitchen Sink Performance



Correlation Screening Performance



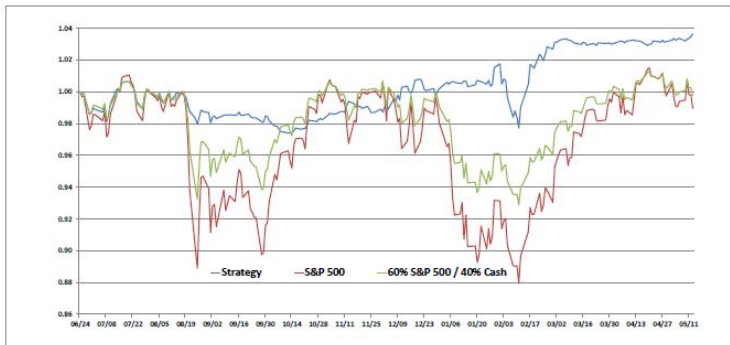
Performance Comparison

- KS returns the same as buying SPY, with half of the volatility
- CS and RTCS double the return on SPY, with half of the risk
- Market-timing strategies all have smoother return profiles than SPY, smaller drawdown

	KS	CS	RTCS	SPY
Return	5.89%	12.11%	11.66%	5.79%
Sharpe Ratio	0.41	0.85	0.88	0.21
Max Drawdown	26.44%	21.12%	21.83%	55.20%

Strategy Performance

Hull Tactical Strategy
06/25/2015 through 05/13/2016



	Strategy	S&P 500	60/40
Return	3.64%	-1.03%	-0.25%
Std Deviation	5.57%	17.33%	10.40%
Information Ratio	0.65	Negative	Negative

- Replicate our work
- Managed account at Hull Investments
- Exchange traded fund: HTUS

Variables Selected with Correlation Screening

