Discussion of:

The Mystery of Currency Betas

by:
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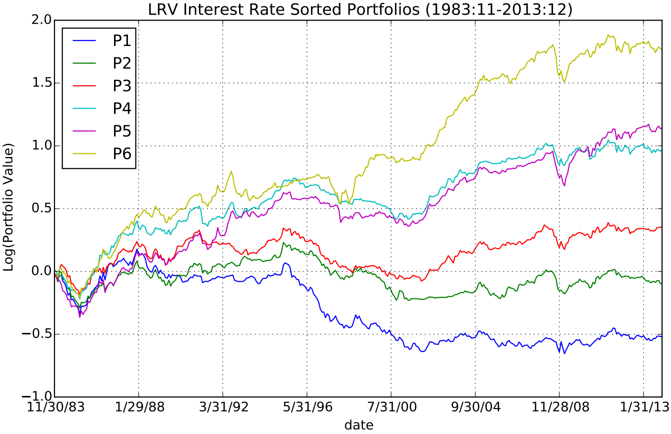
The Carry Trade

- The carry trade has long been a puzzle in asset pricing.
- Let's look at the data from Lustig, Roussanov, and Verdelhan (2011), who sort 35 currencies into six portfolios (P1-P6) based on currency interest rates relative to the dollar interest rate.

LRV Portfolios – Cumulative Returns



- P1 final value is \$0.60; P6 final value is \$5.84
- $t(\bar{R}_{HML_{FX}}=0) = 4.77$; $SR_{HML_{FX}} = 0.87$ (annualized)

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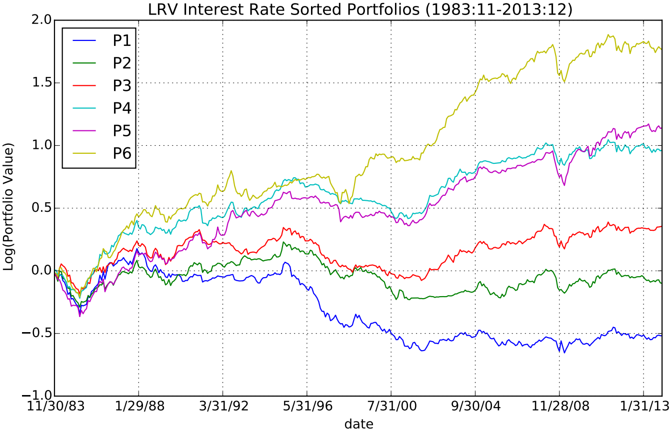

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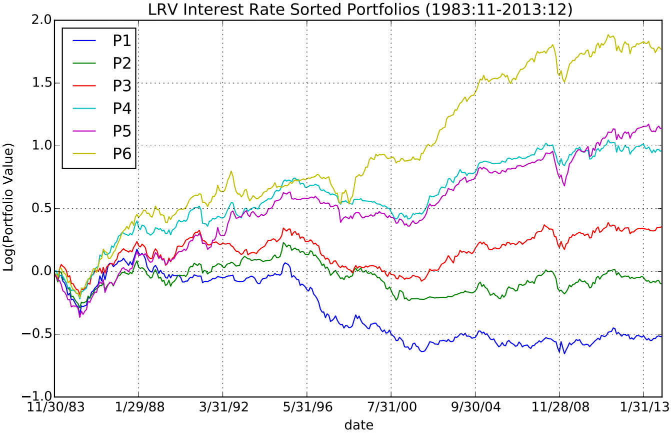

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LRV Factors

- Lustig, Roussanov, and Verdelhan (2011) also find that two return-based risk factors “explain” the cross-section of currency returns:
  - R_{RX}: the cross-sectional average return on all six currency portfolios.
  - $R_{HML_{FX}}$: the difference in the returns on portfolio 6 and portfolio 1.

Asset Return Space

Panel II: Factor Betas

	All Countries						Developed Countries					
Portfolio	α_0^j	$\beta_{HML_{FX}}^j$	β_{RX}^j	R^2	$\chi^2(\alpha)$	p–*value*	α_0^j	$\beta_{HML_{FX}}^j$	β_{RX}^j	R^2	$\chi^2(\alpha)$	p–*value*
1	−0.10	−0.39	1.05	91.64			0.36	−0.51	0.99	94.31		
	[0.50]	[0.02]	[0.03]				[0.53]	[0.03]	[0.02]			
2	−1.55	−0.11	0.94	77.74			−1.17	−0.09	1.01	80.69		
	[0.73]	[0.03]	[0.04]				[0.85]	[0.04]	[0.04]			
3	−0.54	−0.14	0.96	76.72			0.62	−0.00	1.04	86.50		
	[0.74]	[0.03]	[0.04]				[0.79]	[0.03]	[0.03]			
4	1.51	−0.01	0.95	75.36			−0.17	0.12	0.97	82.84		
	[0.77]	[0.03]	[0.05]				[0.85]	[0.03]	[0.04]			
5	0.78	0.04	1.06	76.41			0.36	0.49	0.99	94.32		
	[0.82]	[0.03]	[0.05]				[0.53]	[0.03]	[0.02]			
6	−0.10	0.61	1.05	93.84								
	[0.50]	[0.02]	[0.03]									
All					6.79	34.05%					2.63	75.64%

Note that:

- the R^2s for these time-series regressions are 75%-94% (81%-94% for developed currencies).
- There is considerable variation in $\beta^j_{HML_{FX}}$
- $\beta^j_{RX} \approx 1$ for all portfolios.

Economic Factor Models

- In the absence of arbitrage, all excess returns R_{t+1} are priced by a stochastic discount factor (pricing kernel) $\tilde{m}$ such that:

$$E_t[\tilde{m}_{t+1}\tilde{R}_{t+1}] = 0$$

or, equivalently,

$$E_t[\tilde{R}_{t+1}] = -cov(\tilde{m}_{t+1}, \tilde{R}_{t+1}).$$

where $E_t[\tilde{m}_{t+1}] = 1$.

- For rational investors, and in the absence of frictions, $\tilde{m}_{t+1}$ is the ratio of marginal utilities at time $t+1$ and time t.
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Economic Factor Models

- Thus, it should be possible to link $\tilde{m}$ to a set of factors which proxy for innovations in marginal utility:

$$\tilde{m}_{t+1} = a_t + \mathbf{b}_t' \tilde{\mathbf{f}}_{t+1}$$

- For this reason, a number of macro-finance researchers have proposed macro-based models which deliver a pricing kernel which can “explain” the premia interest-rate sorted portfolios.

Theoretically Motivated Factors

1. Rare Disasters
   - Farhi and Gabaix (2008):
2. Habit-Based Explanation – Consumption/Surplus Ratio
   - Verdelhan (2010)
3. Share of World Consumption (SWC)
   - Colciato and Croce (2013)

In addition, Riddiough examines a set 6 financial risk factors and 6 separate macroeconomic risk factors

- Each of the 6 financial risk factors are found to be priced, with the t-statistic over 3.0 for the composite financial risk.
- Each of the 6 macro risk factors have $t > 2.0$; for four factors, $t > 3.0$.

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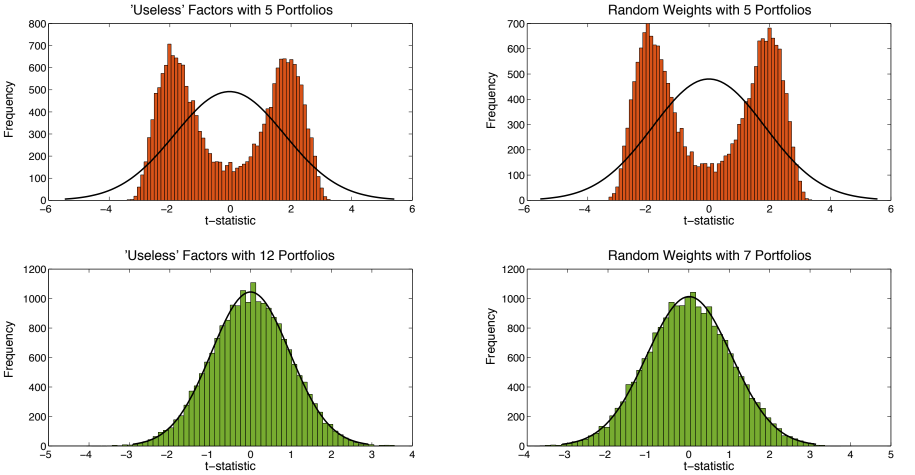
This Paper's Approach



Economically Motivated Explanations

- The finding that there are a number of weakly correlated factors, all of which seem to "explain" the carry trade, is reminiscent of the literature on economic explanations of the value premium (for equities).
- I'm going to present some results from Daniel and Titman (2012) that dealt with this topic, with the goal of explaining this puzzling result from a slightly different point of view.

Economically Motivated Explanations

Paper	Factor(s)	Cond. Vars.
Conditional (C)CAPM Models		
Ferson and Harvey (1999)	VW	S&P 500 Dividend Yield
Lettau and Ludvigson (2001)	VW or Cons Growth	*cay*
Santos and Veronesi (2005)	VW + Labor Income Growth	Labor Income to Cons Ratio (s)
Alternative-Factor Models		
Fama and French (1993)	VW, HML, SMB	
Jagannathan and Wang (1996)	Labor Income Growth	DEF
Heaton and Lucas (2000)	Proprietary Income Growth	
Piazzesi, Schneider, and Tuzel (2007)	Cons Growth $+\Delta$NH Expenditure Ratio ($\Delta log(\alpha)$)	Non-Housing Expenditure Ratio (α)
Lustig and Nieuwerburgh (2002)	Scaled Rental Price Change ($A \Delta log \rho$)	Housing Collateral Ratio
Aït-Sahalia, Parker, and Yogo (2004)	Luxury Good Consumption	
Li, Vassalou, and Xing (2006)	Sector Inv. Growth Rates	
Parker and Juillard (2003)	Innovations in Future Long Horizon Consumption Growth	
Campbell and Vuolteenaho (2004)	CF and DR news	

Too Many Explanations?

- Given this equivalence, and based on the results of these studies, there are more than a dozen factors that appear to "explain" the value effect.
- Interestingly, it turns out that the proposed factors and scaled factors are not highly correlated.

Candidate Factor Sample Correlations

- Sample Correlation Matrix for Candidate Factors
  - Quarterly Data; 1963Q4:1998Q3

	HML	$\mathrm{DP}\cdot r_m$	$\widehat{\mathrm{cay}}\cdot r_m$	$s\cdot r_m$	$\widehat{\mathrm{cay}}\cdot\Delta c$	Δy	$\Delta(\mathrm{prop})$	$\Delta\log(\alpha)$	N_{CF}
HML	1	-0.10	0.07	-0.05	0.06	0.01	0.07	0.11	0.27
$\mathrm{DP}\cdot r_m$	-0.10	1	0.61	0.37	0.14	-0.01	0.04	0.00	-0.09
$\widehat{\mathrm{cay}}\cdot r_m$	0.07	0.61	1	0.03	0.12	-0.03	-0.16	-0.00	-0.12
$s\cdot r_m$	-0.05	0.37	0.03	1	0.07	0.03	0.14	-0.07	0.07
$\widehat{\mathrm{cay}}\cdot\Delta c$	0.06	0.14	0.12	0.07	1	0.13	0.10	-0.07	0.06
Δy	0.01	-0.01	-0.03	0.03	0.13	1	0.25	0.15	-0.10
$\Delta(\mathrm{prop})$	0.07	0.04	-0.16	0.14	0.10	0.25	1	0.28	0.11
$\Delta\log(\alpha)$	0.11	0.00	-0.00	-0.07	-0.07	0.15	0.28	1	0.09
N_{CF}	0.27	-0.09	-0.12	0.07	0.06	-0.10	0.11	0.09	1

- Why do each of these factor explanations seems to "work?"
  - That is, they fail to reject the proposed factor model.
- The surprising answer is that this is because they are all correct.

Return Space Geometry

- Fama and French (1993) (Table 6) run time-series regressions for each of the 25 SZ/BM sorted portfolios:

$$\tilde{R}_{i,t} - RF_t = a + b \cdot (\tilde{R}_{m,t} - RF_t) + h \cdot \tilde{\mathrm{HML}}_t + s \cdot \tilde{\mathrm{SMB}}_t + \tilde{\epsilon}_t$$

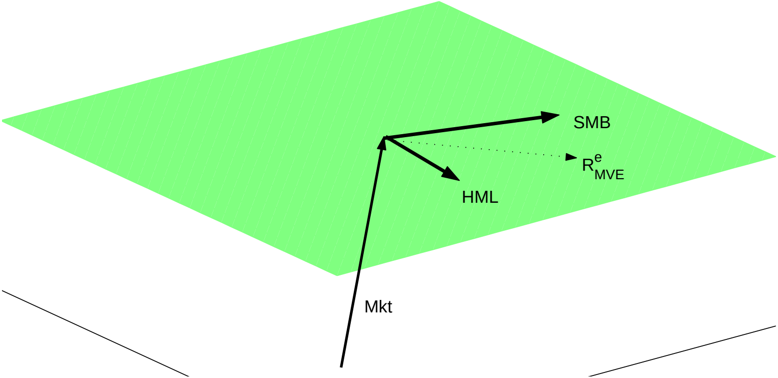
- The R^2s are:

	Low	2	3	4	High
Small	0.94	0.96	0.97	0.97	0.96
2	0.95	0.96	0.95	0.95	0.96
3	0.95	0.94	0.93	0.93	0.93
4	0.94	0.93	0.91	0.89	0.89
Big	0.94	0.92	0.88	0.90	0.83

- In addition, the estimates of b range from 0.91 to 1.18 (std-dev $=$ 0.06).

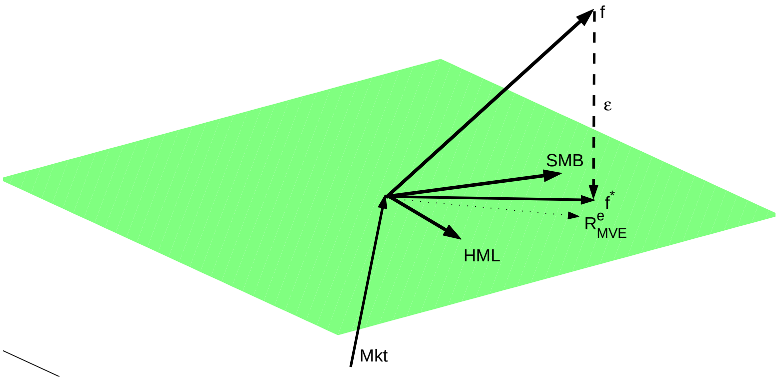
Return Space Geometry

- This means that the returns of these 25 portfolios, net of the market return, lie *approximately* in a 2-dimensional excess return space $\underline{\mathbf{R}}^{e*}$ spanned by HML and SMB:



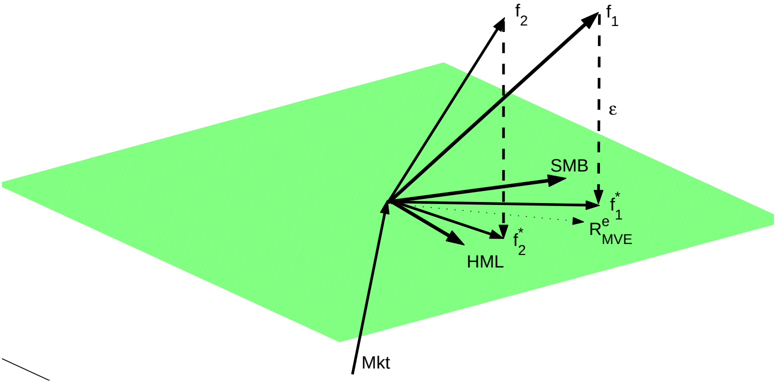
Test Geometry

- In any test where the λs are free parameters, a test of a single-factor model with the 25 FF portfolios is a test of whether $corr(f^*, R^e_{MVE}) = 1$



Multiple Factors

- Moreover, with two factors, assuming $f_1^* \neq k \cdot f_2^*$, some linear combination of the $\tilde{f}$s will always price the assets.
  - Any f_1^* and f_2^* form a basis for the subspace.



A More Powerful Test

- The problem is that *any* $\mathbf{b}'\tilde{\mathbf{f}}$ such that

$$\mathbf{b}'\tilde{\mathbf{f}} = \tilde{R}^e_{MVE} + \tilde{\epsilon}, \text{ for } \ \epsilon \perp \mathrm{HML}, \mathrm{SMB}$$

  will price the 25 portfolios.
  - However, some caveats are:
    - Again, the space is only *approximately* 2-dimensional.
    - Ridiculous factor risk premia (λs) may be required.
- Thus, to increase the power of the test, the test asset space must be augmented in the direction of ϵ.

Test Power

- Any test of an asset pricing model is a test of whether the vector of pricing errors of a set of portfolios (α) is zero.
- The usual way to test this set of moment restrictions is to form the test statistic:

$$\hat{\boldsymbol{\alpha}}'\boldsymbol{\Omega}\hat{\boldsymbol{\alpha}}.$$

  which is asymptotically central χ^2 distributed under the null hypothesis
  - Under the alternative hypothesis, it is non-central χ^2 with NCP $\boldsymbol{\alpha}_{\mathrm{A}}'\boldsymbol{\Omega}\boldsymbol{\alpha}_{\mathrm{A}}$.

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