q^5

Kewei Hou[1] Haitao Mo[2] Chen Xue[3] Lu Zhang[4]

[1]Ohio State and CAFR

[2]LSU

[3]U. of Cincinnati

[4]Ohio State and NBER

2nd World Symposium on Investment Research
May 6, 2019

Augmenting the q-factor model with an expected growth factor to form the q^5 model:

$$
\begin{aligned}
E[R_i - R_f] \quad = \quad & \beta^i_{\text{MKT}} \, E[\text{MKT}] + \beta^i_{\text{Me}} \, E[R_{\text{Me}}] \\
& + \beta^i_{\text{I/A}} \, E[R_{\text{I/A}}] + \beta^i_{\text{Roe}} \, E[R_{\text{Roe}}] + \beta^i_{\text{Eg}} \, E[R_{\text{Eg}}]
\end{aligned}
$$

The q^5 model outperforms the Fama-French 6-factor model in explaining a large set of 150 significant anomalies

Outline

Outline

In the multiperiod investment framework:

$$r_{t+1} \approx \frac{X_{t+1} + (1-\delta)\left[1 + a\left(I_{t+1}/A_{t+1}\right)\right]}{1 + a\left(I_t/A_t\right)}$$

The "dividend yield" component, $X_{t+1}/[1 + a\left(I_t/A_t\right)]$, motivates the q-factor model

The "capital gain" component roughly proportional to investment-to-assets growth, $\left(I_{t+1}/A_{t+1}\right)/\left(I_t/A_t\right)$

Forecast τ-year-ahead investment-to-assets changes, with 3 predictors

Tobin's q: Erickson and Whited (2000)

Cash flows: Internal funds available for investments, Fazzari, Hubbard, and Petersen (1988); better than earnings in capturing the expected growth, likely due to intangibles, Ball et al. (2016)

dRoe: Capturing short-term dynamics of investment growth, Liu, Whited, and Zhang (2009)

τ	$\log(q)$	Cop	dRoe	R^2	Pearson	Rank
1	−0.03	0.52	0.77	6.42	0.14	0.21
	(−5.63)	(12.75)	(7.62)		[0.00]	[0.00]

$E_t[\mathrm{d}^1\mathrm{I/A}]$ and $\mathrm{d}^1\mathrm{I/A}$ aligned at the portfolio level (Corr = 0.64):

	Low	2	3	4	5	6	7	8	9	High	H−L
$E_t[\mathrm{d}^1\mathrm{I/A}]$	−15.2	−7.7	−5.6	−4.2	−3.0	−2.0	−0.9	0.5	2.5	7.7	22.9
$\mathrm{d}^1\mathrm{I/A}$	−16.7	−12.3	−4.1	−3.6	−1.1	−0.4	−0.3	0.6	1.6	6.0	22.7

R_{Eg}, independent 2×3 monthly sorts on size and $E_t[\mathrm{d}^1\mathrm{I/A}]$:

$\overline{R}_{\mathrm{Eg}}$	α	β_{Mkt}	β_{Me}	$\beta_{\mathrm{I/A}}$	β_{Roe}	R^2
0.84	0.67	−0.11	−0.09	0.21	0.30	0.44
(10.27)	(9.75)	(−6.38)	(−3.56)	(4.86)	(9.13)	

- The q-factor model, the q^5 model
- The Fama-French 5-factor model, the 6-factor model, the alternative 6-factor model with RMWc
- The replicated Stambaugh-Yuan 4-factor model
- The Barillas-Shanken 6-factor model, including MKT, SMB, $R_{\mathrm{I/A}}$, R_{Roe}, the Asness-Frazzini monthly formed HML, UMD
- The replicated Daniel-Hirshleifer-Sun 3-factor model

Monthly sharpe ratios of factor models, 1/1967–12/2018

q	q^5	FF5	FF6	FF6c	BS6	SY4	DHS
0.42	0.63	0.32	0.37	0.43	0.48	0.41	0.42

150 anomalies with NYSE breakpoints and value-weighted returns significant at the 5% level (Hou, Xue, and Zhang 2019)

- Momentum: 39
- Value-versus-growth: 15
- Investment: 26
- Profitability: 40
- Intangibles: 27
- Trading frictions: 3

	$\overline{\lvert\alpha_{\text{H−L}}\rvert}$	$\#_{\lvert t\rvert \geq 1.96}$	$\#_{\lvert t\rvert \geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#^{\text{GRS}}_{p<5\%}$
			All (150)		
q	0.28	52	25	0.11	101
q^5	0.19	23	6	0.10	57
FF5	0.43	100	69	0.13	112
FF6	0.30	74	37	0.11	91
FF6c	0.27	59	25	0.11	71
BS6	0.29	63	37	0.13	132
SY4	0.29	64	25	0.11	87
DHS	0.37	70	33	0.14	97

	$\overline{\lvert\alpha_{\mathrm{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq1.96}$	$\#_{\lvert t\rvert\geq3}$	$\overline{\lvert\alpha\rvert}$	$\#^{\mathrm{GRS}}_{p<5\%}$
	Momentum (39)				
q	0.25	11	3	0.10	24
q^5	0.17	4	1	0.09	15
FF5	0.62	37	29	0.15	36
FF6	0.27	19	6	0.10	21
FF6c	0.24	14	5	0.09	18
BS6	0.23	12	4	0.12	33
SY4	0.32	19	6	0.10	23
DHS	0.25	10	3	0.14	26

	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert \geq 1.96}$	$\#_{\lvert t\rvert \geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#^{\text{GRS}}_{p<5\%}$
	Value-versus-growth (15)				
q	0.21	1	0	0.11	8
q^5	0.22	3	0	0.13	7
FF5	0.15	2	0	0.10	7
FF6	0.19	4	0	0.10	9
FF6c	0.17	3	0	0.10	6
BS6	0.23	6	2	0.13	14
SY4	0.24	4	1	0.12	9
DHS	0.78	15	13	0.23	15

	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#^{\text{GRS}}_{p<5\%}$
	Investment (26)				
q	0.22	9	4	0.10	19
q^5	0.10	1	0	0.08	6
FF5	0.24	10	7	0.09	17
FF6	0.22	10	6	0.09	16
FF6c	0.18	8	2	0.08	7
BS6	0.22	8	6	0.11	24
SY4	0.19	8	3	0.09	17
DHS	0.34	20	4	0.10	22

	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#^{\text{GRS}}_{p<5\%}$
	Profitability (40)				
q	0.25	16	6	0.10	28
q^5	0.14	5	1	0.09	14
FF5	0.43	32	23	0.12	32
FF6	0.31	26	13	0.10	25
FF6c	0.26	18	7	0.10	21
BS6	0.31	20	12	0.12	37
SY4	0.29	20	9	0.10	24
DHS	0.18	6	1	0.09	13

	$\alpha_{\text{H-L}}$	$t_{\text{H-L}}$	$\overline{\lvert\alpha\rvert}$	p_{GRS}
	All (150): $\overline{R} = 1.69$ ($t = 9.62$)			
q	0.86	5.64	0.16	0.00
q^5	0.37	2.62	0.10	0.01
FF5	1.33	7.94	0.25	0.00
FF6	0.94	7.46	0.16	0.00
FF6c	0.82	6.77	0.14	0.00
BS6	0.68	4.85	0.13	0.00
SY4	0.90	7.61	0.16	0.00
DHS	0.74	4.98	0.14	0.00

Outline

	Sue1	$R^6 6$	Bm	Oa	dFin	Dac	Rdm
$\overline{R}$	0.45	0.83	0.43	−0.29	0.27	−0.45	0.73
$t_{\overline{R}}$	3.50	3.66	2.14	−2.36	2.43	−3.47	2.96
α_q	0.05	0.30	0.11	−0.57	0.41	−0.74	0.81
α_{q^5}	−0.07	−0.16	0.05	−0.20	0.14	−0.31	0.27
t_q	0.39	1.04	0.71	−4.25	2.97	−5.33	3.64
t_{q^5}	−0.52	−0.64	0.32	−1.30	0.97	−2.16	1.24
α_{FF6}	0.26	0.19	−0.09	−0.48	0.46	−0.69	0.68
α_{FF6c}	0.22	0.16	−0.09	−0.32	0.34	−0.59	0.79
t_{FF6}	2.23	1.92	−0.82	−3.49	3.81	−5.08	3.24
t_{FF6c}	1.84	1.57	−0.74	−2.13	2.63	−4.12	3.64

The q^5 model outperforms the Fama-French 6-factor model in a large-scale empirical horse race