

Lecture Notes

Hou, Xue, and Zhang, 2014, Review of Financial Studies,
Digesting Anomalies: An Investment Approach

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Introduction

Contribution

A q -factor model consisting of the market factor, a size factor, an investment factor, and a profitability factor largely summarizes the cross section of average stock returns

Introduction

The q -factor Model

$$r_t^i - r_t^f = \alpha_q^i + \beta_{\text{MKT}}^i \text{MKT}_t + \beta_{\text{ME}}^i r_{\text{ME},t} + \beta_{\text{I/A}}^i r_{\text{I/A},t} + \beta_{\text{ROE}}^i r_{\text{ROE},t} + \epsilon^i$$

- MKT_t , $r_{\text{ME},t}$, $r_{\text{I/A},t}$, and $r_{\text{ROE},t}$ are the market, size, investment, and *ROE* factors, respectively
- β_{MKT}^i , β_{ME}^i , $\beta_{\text{I/A}}^i$, and β_{ROE}^i are factor loadings

Introduction

Properties of the q -factors, 1/1972–12/2012

	mean	α	β_{MKT}	β_{SMB}	β_{HML}	β_{UMD}
r_{ME}	0.31 (2.12)	0.23 0.04 0.01	0.17 0.02 0.02	0.99 0.99	0.17 0.19	0.03
$r_{1/A}$	0.45 (4.95)	0.52 0.33 0.28	-0.15 -0.06 -0.05	-0.02 -0.02	0.39 0.41	0.05
r_{ROE}	0.58 (4.81)	0.63 0.77 0.50	-0.11 -0.09 -0.03	-0.33 -0.33	-0.20 -0.10	0.28
	$r_{1/A}$	r_{ROE}	MKT	SMB	HML	UMD
r_{ME}	-0.11	-0.31	0.25	0.95	-0.07	0.01
$r_{1/A}$		0.06	-0.36	-0.22	0.69	0.05
r_{ROE}			-0.19	-0.38	-0.09	0.50

Introduction

Preview

About one half of nearly 80 anomalies are insignificant with NYSE breakpoints and value-weighted decile returns

In “explaining” 35 significant anomalies, the q -factor model performs well relative to the Fama-French and Carhart models:

- The average magnitude of high-minus-low alphas: .20% in q , .33% in Carhart, and .55% in Fama-French
- The number of significant high-minus-low alphas: 5 in q , 19 in Carhart, and 27 in Fama-French
- The number of rejections by the GRS test: 20 in q , 24 in Carhart, and 28 in Fama-French

Outline

- 1 Intuition
- 2 Factors/Testing Portfolios
- 3 Factor Regressions: Alphas
- 4 Factor Regressions: Betas
- 5 Sharpe Ratios

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Intuition

An economic model of investment-based asset pricing

Two periods, 0 and 1

Heterogenous firms, indexed by $i = 1, \dots, N$

Firm i 's operating profits in dates 0 and 1, $\Pi_{i0}A_{i0}$ and $\Pi_{i1}A_{i1}$:

- A_{i0} and A_{i1} : Productive assets

$$A_{i1} = I_{i0}$$

in which I_{i0} is investment (the depreciation rate is 100%)

- Π_{i0} and Π_{i1} : Profitability (ROE)

M_1 : Stochastic discount factor

Intuition

An economic model

Firm i 's value-maximization problem:

$$P_{i0} + D_{i0} \equiv \max_{\{I_{i0}\}} \Pi_{i0} A_{i0} - I_{i0} - \frac{a}{2} \left(\frac{I_{i0}}{A_{i0}} \right)^2 A_{i0} + E_0[M_1 \Pi_{i1} A_{i1}]$$

The first principle for investment:

$$1 + a \frac{I_{i0}}{A_{i0}} = E_0[M_1 \Pi_{i1}]$$

A more familiar form from the corporate finance perspective:

$$r_{i1}^S = \frac{P_{i1} + D_{i1}}{P_{i0}} = \frac{\Pi_{i1} A_{i1}}{E_0[M_1 \Pi_{i1} A_{i1}]} = \frac{\Pi_{i1}}{E_0[M_1 \Pi_{i1}]} = \frac{\Pi_{i1}}{1 + a(I_{i0}/A_{i0})}$$

Intuition

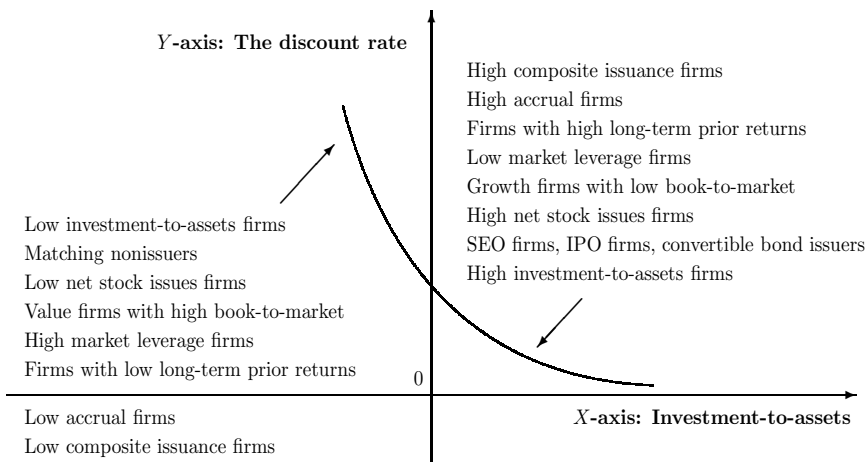
A two-period investment-based asset pricing model

$$E_0[r_{i1}^S] = \frac{E_0[\Pi_{i1}]}{1 + a(I_{i0}/A_{i0})}$$

- All else equal, high investment stocks should earn lower expected returns than low investment stocks
- All else equal, high expected profitability stocks should earn higher expected returns than low expected profitability stocks

Intuition

The investment channel



Intuition

The ROE channel

High ROE relative to low investment means high discount rates:

- Suppose the discount rates were low
- Combined with high ROE, low discount rates would imply high net present values of new projects (and high investment)
- So discount rates must be high to counteract high ROE to induce low investment

Price and earnings momentum winners and low distress firms tend to have higher ROE and earn higher expected returns

The investment-based model is a characteristics-based model

We implement a linear factor model:

- Returns are better measured than accounting variables, also with higher frequency
- Estimating the economic model directly involves specification errors in the production and investment technologies, aggregation, etc., absent from the factor model

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- 1 Intuition
- 2 Factors/Testing Portfolios**
- 3 Factor Regressions: Alphas
- 4 Factor Regressions: Betas
- 5 Sharpe Ratios

Factors/Testing Portfolios

Factor construction

Construct $r_{ME,t}$, $r_{I/A,t}$, and $r_{ROE,t}$ with a triple two-by-three-by-three sort on size, investment, and ROE

Variable definitions:

- Size: Stock price times shares outstanding from CRSP
- Investment, I/A: Annual changes in total assets (item AT) divided by lagged total assets
- ROE: Income before extraordinary items (item IBQ) divided by one-quarter-lagged book equity

Factors/Testing Portfolios

Factor construction

NYSE breakpoints: 50-50 for size, 30-40-30 for investment, and 30-40-30 for ROE

Timing:

- Annual sort in June on the market equity at the June end
- Annual sort in June of year t on I/A for the fiscal year ending in calendar year $t - 1$
- Monthly sort at the beginning of each month on ROE with the most recently announced quarterly earnings

Timing is consistent with the economic model

Factors/Testing Portfolios

Testing portfolios

Use an extensive array of anomaly portfolios (nearly 80), scope comparable with the largest in the literature

- Green, Hand, and Zhang (2013)
- Harvey, Liu, and Zhu (2013)
- McLean and Pontiff (2013)

NYSE breakpoints and value-weighted decile returns to alleviate the impact of microcaps

- Fama and French (2008)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel A: Momentum (plus six momentum-reversal variables)

SUE-1, earnings surprise (1-month holding period), Foster, Olsen, and Shevlin (1984)
Abr-1, cumulative abnormal stock returns around earnings announcements (1-month holding period), Chan, Jegadeesh, and Lakonishok (1996)
RE-1, revisions in analysts' earnings forecasts (1-month holding period), Chan, Jegadeesh, and Lakonishok (1996)
R6-1, price momentum (6-month prior returns, 1-month holding period), Jegadeesh and Titman (1993)
R11-1, price momentum, (11-month prior returns, 1-month holding period), Fama and French (1996)

SUE-6, earnings surprise (6-month holding period), Foster, Olsen, and Shevlin (1984)
Abr-6, cumulative abnormal stock returns around earnings announcements (6-month holding period), Chan, Jegadeesh, and Lakonishok (1996)
RE-6, revisions in analysts' earnings forecasts (6-month holding period), Chan, Jegadeesh, and Lakonishok (1996)
R6-6, price momentum (6-month prior returns, 6-month holding period), Jegadeesh and Titman (1993)
I-Mom, industry momentum, Moskowitz and Grinblatt (1999)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel B: Value versus growth

B/M, book-to-market equity,
Rosenberg, Reid, and Lanstein (1985)

Rev, reversal, De Bondt and Thaler (1985)

EF/P, analysts' earnings forecasts-to-price,
Elgers, Lo, and Pfeiffer (2001)

D/P, dividend yield,
Litzenberger and Ramaswamy (1979)

NO/P, net payout yield, Boudoukh,
Michaely, Richardson, and Roberts (2007)

LTG, long-term growth forecasts
of analysts, La Porta (1996)

A/ME, market leverage,
Bhandari (1988)

E/P, earnings-to-price, Basu (1983)

CF/P, cash flow-to-price,
Lakonishok, Shleifer, and Vishny (1994)

O/P, payout yield, Boudoukh, Michaely,
Richardson, and Roberts (2007)

SG, sales growth,
Lakonishok, Shleifer, and Vishny (1994)

Dur, equity duration,
Dechow, Sloan, and Soliman (2004)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel C: Investment

ACI, abnormal corporate investment,
Titman, Wei, and Xie (2004)

NOA, net operating assets, Hirshleifer,
Hou, Teoh, and Zhang (2004)

IG, investment growth,
Xing (2008)

CEI, composite issuance,
Daniel and Titman (2006)

IvG, inventory growth,
Belo and Lin (2011)

OA, operating accruals, Sloan (1996)

POA, percent operating accruals, Hafzalla,
Lundholm, and Van Winkle (2011)

I/A, investment-to-assets,
Cooper, Gulen, and Schill (2008)

Δ PI/A, changes in PPE
plus changes in inventory scaled by assets,
Lyandres, Sun, and Zhang (2008)

NSI, net stock issues,
Pontiff and Woodgate (2008)

NXF, net external financing,
Bradshaw, Richardson, and Sloan (2006)

IvC, inventory changes,
Thomas and Zhang (2002)

TA, total accruals, Richardson, Sloan,
Soliman, and Tuna (2005)

PTA, percent total accruals, Hafzalla,
Lundholm, and Van Winkle (2011)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel D: Profitability

ROE, return on equity,
Haugen and Baker (1996)

RNA, return on net operating assets,
Soliman (2008)

ATO, asset turnover,
Soliman (2008)

GP/A, gross profits-to-assets,
Novy-Marx (2013)

TES, tax expense surprise,
Thomas and Zhang (2011)

RS, revenue surprise,
Jegadeesh and Livnat (2006)

FP, failure probability,
Campbell, Hilscher, and Szilagyi (2008)

ROA, return on assets,
Balakrishnan, Bartov, and Faurel (2010)

PM, profit margin, Soliman (2008)

CTO, capital turnover,
Haugen and Baker (1996)

F, *F*-score,
Piotroski (2000)

TI/BI, taxable income-to-book income,
Green, Hand, and Zhang (2013)

NEI, number of consecutive quarters
with earnings increases,
Barth, Elliott, and Finn (1999)

O, *O*-score, Dichev (1998)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel E: Intangibles and other characteristics

OC/A, organizational capital-to-assets,
Eisfeldt and Papanikolaou (2013)

Ad/M, advertisement expense-to-market,
Chan, Lakonishok, and Sougiannis (2001)

RD/M, R&D-to-market,
Chan, Lakonishok, and Sougiannis (2001)

H/N, hiring rate,
Belo, Lin, and Bazdresch (2014)

G, corporate governance,
Gompers, Ishii, and Metrick (2003)

Ind, industries, Fama and French (1997)

BC/A, brand capital-to-assets,
Belo, Lin, and Vitorino (2014)

RD/S, R&D-to-sales,
Chan, Lakonishok, and Sougiannis (2001)

RC/A, R&D capital-to-assets, Li (2011)

OL, operating leverage,
Novy-Marx (2011)

AccQ, accrual quality, Francis, Lafond,
Olsson, and Schipper (2005)

Factors/Testing Portfolios

Six categories of anomalies, 80 in total

Panel F: Trading frictions

ME, the market equity,

Banz (1981)

Tvol, total volatility,

Ang, Hodrick, Xing, and Zhang (2006)

MDR, maximum daily return,

Bali, Cakici, and Whitelaw (2011)

D- β , Dimson's beta, Dimson (1979)

Disp, dispersion of analysts' earnings forecasts,

Diether, Malloy, and Scherbina (2002)

1/P, 1/share price,

Miller and Scholes (1982)

Illiq, Absolute return-to-volume,

Amihud (2002)

Ivol, idiosyncratic volatility,

Ang, Hodrick, Xing, and Zhang (2006)

Svol, systematic volatility,

Ang, Hodrick, Xing, and Zhang (2006)

β , market beta,

Frazzini and Pedersen (2014)

S-Rev, short-term reversal, Jegadeesh (1990)

Turn, share turnover,

Datar, Naik, and Radcliffe (1998)

Dvol, dollar trading volume,

Brennan, Chordia, and Subrahmanyam (1998)

Factors/Testing Portfolios

Insignificant anomalies in the broad cross section

	R6-1	A/ME	Rev	EF/P	D/P	O/P	SG	LTG	ACI	NXF
m	0.48	0.43	-0.39	0.45	0.27	0.35	-0.27	0.01	-0.27	-0.30
t_m	1.43	1.82	-1.57	1.73	0.94	1.53	-1.34	0.02	-1.70	-1.55
	TA	RNA	PM	ATO	CTO	F	TES	TI/BI	RS	O
m	-0.19	0.13	0.10	0.22	0.20	0.37	0.32	0.13	0.29	-0.08
t_m	-1.31	0.61	0.40	1.11	1.11	1.28	1.92	0.86	1.82	-0.37
	BC/A	RD/S	RC/A	H/N	G	AccQ	ME	Ivol	Tvol	MDR
m	0.18	0.01	0.32	-0.25	0.03	-0.18	-0.24	-0.54	-0.37	-0.31
t_m	0.73	0.06	1.27	-1.47	0.09	-0.79	-0.90	-1.56	-0.95	-0.94
	β	D- β	S-Rev	Disp	Turn	1/P	Dvol	Illiq		
m	-0.13	0.07	-0.31	-0.33	-0.12	-0.00	-0.26	0.27		
t_m	-0.36	0.30	-1.39	-1.24	-0.43	-0.01	-1.30	1.14		

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Factor Regressions

Significant anomalies in the momentum category

	SUE-1	SUE-6	Abr-1	Abr-6	RE-1	RE-6	R6-6	R11-1	I-Mom	ave
m	0.45	0.24	0.73	0.30	0.89	0.60	0.85	1.18	0.51	
α_{FF}	0.55	0.39	0.84	0.38	1.20	0.94	1.12	1.52	0.68	0.85
α_C	0.34	0.18	0.62	0.19	0.56	0.37	0.06	0.09	-0.18	0.29
α_q	0.16	0.02	0.64	0.26	0.12	0.03	0.24	0.24	0.00	0.19
t_m	3.59	2.17	5.50	3.11	3.43	2.58	3.17	3.52	2.33	
t_{FF}	4.50	3.62	5.93	3.89	4.81	4.52	4.47	4.99	3.25	
t_C	2.62	1.69	4.37	2.06	2.56	2.15	0.51	0.67	-1.11	
t_q	1.12	0.18	4.07	2.18	0.43	0.14	0.71	0.54	0.01	
$ \alpha_{FF} $	0.17	0.13	0.16	0.11	0.27	0.23	0.19	0.26	0.15	0.19
$ \alpha_C $	0.11	0.09	0.12	0.08	0.11	0.09	0.10	0.13	0.06	0.10
$ \alpha_q $	0.05	0.07	0.13	0.07	0.10	0.11	0.08	0.13	0.13	0.10
p_{FF}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	
p_C	0.00	0.00	0.00	0.01	0.16	0.12	0.00	0.00	0.45	
p_q	0.42	0.04	0.00	0.02	0.46	0.08	0.00	0.01	0.03	

Factor Regressions

Significant anomalies in the value minus growth category

	B/M	E/P	CF/P	NO/P	Dur	ave
m	0.70	0.59	0.52	0.66	-0.54	
α_{FF}	0.01	0.05	0.01	0.52	-0.06	0.13
α_C	-0.01	0.01	-0.06	0.49	-0.08	0.13
α_q	0.21	0.17	0.22	0.36	-0.27	0.25
t_m	2.88	2.63	2.44	3.23	-2.59	
t_{FF}	0.04	0.34	0.08	3.51	-0.44	
t_C	-0.06	0.03	-0.40	3.33	-0.56	
t_q	1.15	0.76	1.04	2.38	-1.32	
$ \alpha_{FF} $	0.07	0.10	0.08	0.17	0.11	0.11
$ \alpha_C $	0.06	0.09	0.07	0.15	0.08	0.09
$ \alpha_q $	0.08	0.10	0.14	0.12	0.08	0.10
p_{FF}	0.19	0.18	0.43	0.00	0.15	
p_C	0.29	0.38	0.37	0.00	0.41	
p_q	0.35	0.13	0.02	0.00	0.72	

Factor Regressions

Significant anomalies in the investment category

	I/A	NOA	Δ PI/A	IG	NSI	CEI	IvG	IvC	OA	POA	PTA	ave
m	-0.42	-0.38	-0.51	-0.41	-0.68	-0.57	-0.41	-0.45	-0.30	-0.46	-0.40	
α_{FF}	-0.15	-0.52	-0.41	-0.26	-0.64	-0.50	-0.29	-0.38	-0.37	-0.32	-0.29	0.38
α_C	-0.09	-0.41	-0.36	-0.20	-0.54	-0.40	-0.19	-0.30	-0.33	-0.25	-0.27	0.30
α_q	0.14	-0.38	-0.26	0.05	-0.26	-0.22	-0.03	-0.28	-0.56	-0.12	-0.10	0.22
t_m	-2.45	-2.55	-3.43	-2.93	-4.13	-2.96	-2.77	-3.05	-2.32	-3.02	-2.57	
t_{FF}	-1.09	-3.30	-2.93	-1.99	-4.28	-3.72	-2.10	-2.61	-2.84	-2.42	-2.06	
t_C	-0.61	-2.69	-2.48	-1.51	-3.58	-2.93	-1.34	-1.97	-2.32	-1.88	-1.82	
t_q	1.08	-1.90	-1.85	0.39	-1.75	-1.50	-0.20	-1.84	-3.90	-0.87	-0.67	
$ \overline{\alpha_{FF}} $	0.12	0.17	0.13	0.13	0.18	0.15	0.11	0.12	0.13	0.11	0.11	0.13
$ \overline{\alpha_C} $	0.10	0.14	0.12	0.11	0.15	0.15	0.10	0.10	0.12	0.11	0.10	0.12
$ \overline{\alpha_q} $	0.09	0.12	0.14	0.09	0.11	0.12	0.11	0.08	0.15	0.12	0.08	0.11
p_{FF}	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.01	
p_C	0.02	0.00	0.01	0.00	0.00	0.00	0.11	0.04	0.00	0.01	0.02	
p_q	0.01	0.00	0.00	0.01	0.02	0.01	0.08	0.56	0.00	0.00	0.11	

Factor Regressions

Significant anomalies in the profitability category

	ROE	ROA	GP/A	NEI	FP	ave
m	0.80	0.62	0.34	0.39	-0.67	
α_{FF}	1.17	1.00	0.50	0.63	-1.44	0.95
α_C	0.85	0.67	0.45	0.43	-0.67	0.61
α_q	0.05	0.09	0.11	0.18	-0.17	0.12
t_m	3.11	2.70	2.18	3.31	-1.98	
t_{FF}	5.43	5.40	3.25	6.03	-6.44	
t_C	4.03	3.59	2.85	3.73	-3.79	
t_q	0.37	0.72	0.71	1.68	-0.57	
$\overline{ \alpha_{FF} }$	0.24	0.23	0.14	0.23	0.23	0.21
$\overline{ \alpha_C }$	0.15	0.14	0.14	0.15	0.12	0.14
$\overline{ \alpha_q }$	0.09	0.07	0.11	0.09	0.13	0.10
p_{FF}	0.00	0.00	0.01	0.00	0.00	
p_C	0.00	0.04	0.01	0.00	0.00	
p_q	0.05	0.75	0.38	0.05	0.00	

Factor Regressions

Significant anomalies in the intangibles and other characteristics
as well as trading frictions categories

	OC/A	Ad/M	RD/M	OL	Svol	ave
m	0.56	0.79	0.63	0.39	-0.60	
α_{FF}	0.61	0.15	0.22	0.37	-0.66	0.40
α_C	0.40	0.32	0.31	0.33	-0.62	0.40
α_q	0.09	0.11	0.60	-0.05	-0.37	0.24
t_m	4.07	2.96	2.31	2.06	-2.57	
t_{FF}	4.52	0.79	0.93	1.91	-2.88	
t_C	2.97	1.37	1.40	1.76	-2.59	
t_q	0.66	0.39	2.40	-0.27	-1.42	
$ \overline{\alpha_{FF}} $	0.15	0.13	0.17	0.11	0.19	0.15
$ \overline{\alpha_C} $	0.13	0.18	0.21	0.12	0.16	0.16
$ \overline{\alpha_q} $	0.11	0.11	0.27	0.12	0.11	0.14
p_{FF}	0.00	0.18	0.02	0.07	0.01	
p_C	0.00	0.07	0.01	0.06	0.06	
p_q	0.02	0.07	0.00	0.09	0.20	

Factor Regressions

Significant anomalies: A summary

Overall, except for the operating accrual anomaly and the R&D-to-market anomaly, the q -factor model performs as well as, and in most cases outperforms the Fama-French and Carhart models across major categories of anomalies:

- The q -factor model beats the Carhart model and by a bigger margin the Fama-French model in the momentum category
- The q -factor model also outperforms in the investment category and dominates in the profitability category
- The models are comparable in the value versus growth category
- The size factor plays only a limited role in the q -factor model

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Factor Regressions

q-factor loadings and *q*-characteristics,
anomalies in the momentum category

	SUE-1	SUE-6	Abr-1	Abr-6	RE-1	RE-6	R6-6	R11-1	I-Mom
β_{MKT}	-0.08	-0.06	-0.06	-0.03	-0.05	-0.07	-0.09	-0.14	-0.11
β_{ME}	0.10	0.09	0.07	0.09	-0.15	-0.19	0.27	0.40	0.31
$\beta_{\text{I/A}}$	0.02	-0.11	-0.13	-0.16	0.04	-0.12	-0.07	0.04	-0.03
β_{ROE}	0.48	0.45	0.28	0.18	1.33	1.12	1.02	1.48	0.82
$t_{\beta_{\text{MKT}}}$	-1.82	-1.53	-1.31	-1.20	-0.76	-1.24	-1.17	-1.43	-1.72
$t_{\beta_{\text{ME}}}$	1.94	1.27	0.67	1.82	-1.42	-1.98	1.43	1.74	1.86
$t_{\beta_{\text{I/A}}}$	0.18	-0.97	-1.25	-2.24	0.25	-0.82	-0.27	0.12	-0.13
$t_{\beta_{\text{ROE}}}$	5.75	5.95	3.26	2.94	10.09	9.96	5.31	5.67	4.90
ME	0.69	0.75	-0.01	0.03	0.77	0.87	0.40	0.52	0.62
I/A	-1.46	-0.96	-1.37	-1.13	-0.80	0.72	-4.07	-3.83	-1.18
ROE	5.80	3.38	1.59	1.49	6.58	6.47	4.14	5.34	1.61
t_{ME}	4.91	5.38	-0.29	1.31	8.75	9.65	4.92	4.95	3.67
$t_{\text{I/A}}$	-3.30	-2.57	-2.36	-2.58	-1.22	1.13	-5.54	-4.66	-1.79
t_{ROE}	16.46	19.07	13.38	15.47	29.77	27.86	16.00	17.06	10.24

Factor Regressions

q-factor loadings and *q*-characteristics,
anomalies in the value versus growth category

	B/M	E/P	CF/P	NO/P	Dur
β_{MKT}	-0.03	-0.12	-0.15	-0.18	0.11
β_{ME}	0.46	0.25	0.19	-0.32	-0.23
$\beta_{\text{I/A}}$	1.45	0.99	1.01	1.03	-0.85
β_{ROE}	-0.51	-0.09	-0.24	0.02	0.24
$t_{\beta_{\text{MKT}}}$	-0.59	-2.02	-2.41	-3.86	1.67
$t_{\beta_{\text{ME}}}$	5.37	1.90	1.66	-4.40	-1.61
$t_{\beta_{\text{I/A}}}$	12.74	5.76	6.79	10.25	-5.69
$t_{\beta_{\text{ROE}}}$	-5.98	-0.66	-1.78	0.19	1.87
ME	-2.46	-0.73	-0.89	1.23	0.41
I/A	-9.70	-1.11	-5.63	-14.43	3.95
ROE	-5.68	0.21	-0.72	1.18	0.49
t_{ME}	-10.31	-4.09	-4.57	7.74	5.23
$t_{\text{I/A}}$	-17.06	-1.20	-5.47	-13.81	2.73
t_{ROE}	-29.57	1.30	-4.83	7.27	2.22

Factor Regressions

q-factor loadings and *q*-characteristics,
anomalies in the investment category

	I/A	NOA	Δ PI/A	IG	NSI	CEI	IvG	IvC	OA	POA	PTA
β_{MKT}	0.02	-0.02	0.05	-0.02	0.04	0.24	-0.03	0.04	0.03	-0.01	0.06
β_{ME}	-0.11	0.06	-0.05	-0.11	0.17	0.26	0.12	0.00	0.28	0.15	0.21
$\beta_{\text{I/A}}$	-1.37	-0.01	-0.77	-0.82	-0.68	-1.06	-0.96	-0.65	-0.02	-0.90	-0.90
β_{ROE}	0.15	-0.01	0.16	-0.07	-0.32	-0.12	0.05	0.18	0.29	0.05	0.04
$t_{\beta_{\text{MKT}}}$	0.62	-0.55	1.33	-0.71	0.99	6.27	-0.77	1.01	0.80	-0.19	1.50
$t_{\beta_{\text{ME}}}$	-1.81	0.54	-0.94	-1.95	2.24	3.79	2.85	-0.07	4.41	3.20	3.28
$t_{\beta_{\text{I/A}}}$	-15.50	-0.04	-6.98	-10.91	-6.14	-13.11	-11.81	-5.49	-0.21	-9.61	-8.72
$t_{\beta_{\text{ROE}}}$	2.29	-0.12	1.93	-1.06	-4.07	-1.42	0.56	1.95	4.59	1.04	0.55
ME	0.88	0.07	0.63	0.22	-1.37	-1.79	0.26	0.19	-0.24	-0.36	-0.36
I/A	83.89	55.72	61.16	34.03	27.04	14.80	37.85	44.80	10.15	11.12	16.14
ROE	1.63	-1.24	0.84	0.50	-1.71	-1.41	0.42	1.07	0.88	1.02	0.36
t_{ME}	7.75	1.71	7.56	6.16	-6.44	-7.77	4.27	4.86	-5.13	-9.39	-6.76
$t_{\text{I/A}}$	32.74	18.28	30.77	22.38	13.85	14.37	23.42	34.89	5.19	7.90	12.93
t_{ROE}	10.00	-7.89	5.10	3.24	-11.87	-9.07	3.31	8.13	5.06	7.42	2.56

Factor Regressions

q-factor loadings and *q*-characteristics,
anomalies in the profitability category

	ROE	ROA	GP/A	NEI	FP
β_{MKT}	-0.10	-0.14	0.05	0.02	0.44
β_{ME}	-0.41	-0.38	0.03	-0.10	0.43
$\beta_{\text{I/A}}$	0.10	-0.10	-0.24	-0.30	0.17
β_{ROE}	1.50	1.31	0.52	0.63	-1.61
$t_{\beta_{\text{MKT}}}$	-2.57	-4.48	1.20	0.88	6.46
$t_{\beta_{\text{ME}}}$	-6.56	-6.41	0.51	-2.53	2.45
$t_{\beta_{\text{I/A}}}$	1.05	-1.23	-2.35	-3.78	0.63
$t_{\beta_{\text{ROE}}}$	20.71	16.86	7.08	10.83	-8.79
ME	2.81	2.66	0.39	2.34	-3.09
I/A	3.56	5.32	-1.29	5.35	-3.91
ROE	16.95	14.71	3.94	4.32	-8.74
t_{ME}	10.56	10.50	10.84	11.58	-10.76
$t_{\text{I/A}}$	4.16	6.88	-2.05	11.45	-4.18
t_{ROE}	29.02	27.97	23.88	27.36	-25.56

Factor Regressions

q -factor loadings and q -characteristics, anomalies in intangibles, other characteristics, and trading frictions

	OC/A	Ad/M	RD/M	OL	Svol
β_{MKT}	-0.13	0.04	0.16	-0.06	0.04
β_{ME}	0.25	0.50	0.66	0.26	0.31
$\beta_{\text{I/A}}$	0.35	1.42	0.21	0.16	-0.21
β_{ROE}	0.51	-0.27	-0.58	0.54	-0.43
$t_{\beta_{\text{MKT}}}$	-3.74	0.50	2.51	-1.22	0.53
$t_{\beta_{\text{ME}}}$	5.69	2.85	6.75	2.63	2.30
$t_{\beta_{\text{I/A}}}$	3.52	6.03	1.21	1.34	-1.30
$t_{\beta_{\text{ROE}}}$	7.12	-1.37	-4.10	4.85	-3.54
ME	-1.31	-1.34	-4.39	-1.31	-0.19
I/A	-13.77	-10.71	-3.22	-5.71	0.66
ROE	1.52	-3.33	-2.80	1.86	-0.64
t_{ME}	-9.44	-9.83	-9.47	-8.43	-3.95
$t_{\text{I/A}}$	-11.38	-12.17	-2.54	-4.70	1.37
t_{ROE}	7.97	-12.60	-9.21	11.42	-4.03

Factor Regressions

25 size and book-to-market portfolios

	Low	2	3	4	High	H-L	Low	2	3	4	High	H-L
	m						$\alpha_{FF} (\overline{\alpha_{FF}} = 0.10)$					
Small	0.08	0.72	0.84	0.95	1.11	1.02	-0.54	0.02	0.13	0.18	0.16	0.70
2	0.32	0.69	0.86	0.87	0.99	0.67	-0.21	0.00	0.09	0.07	0.04	0.25
3	0.38	0.71	0.77	0.77	1.02	0.65	-0.09	0.04	0.03	0.00	0.13	0.22
4	0.52	0.59	0.73	0.74	0.84	0.32	0.14	-0.02	0.03	0.00	0.02	-0.12
Big	0.40	0.54	0.54	0.61	0.56	0.16	0.16	0.11	0.09	0.00	-0.16	-0.32
	t_m						$t_{FF} (p_{FF} = 0.00)$					
Small	0.20	2.02	2.57	3.07	3.30	4.59	-4.84	0.23	1.58	2.53	1.97	5.66
2	0.90	2.20	3.03	3.29	3.31	2.93	-2.59	0.01	1.36	0.92	0.45	2.19
3	1.15	2.49	3.03	3.05	3.93	2.76	-1.21	0.52	0.35	0.02	1.28	1.70
4	1.73	2.35	2.91	3.08	3.24	1.43	1.74	-0.23	0.27	0.03	0.17	-0.87
Big	1.70	2.53	2.71	3.04	2.43	0.79	2.66	1.29	0.92	-0.02	-1.31	-2.32

Factor Regressions

25 size and book-to-market portfolios

	Low	2	3	4	High	H-L	Low	2	3	4	High	H-L
	α_C ($ \overline{\alpha_C} = 0.11$)						α_q ($ \overline{\alpha_q} = 0.11$)					
Small	-0.48	0.03	0.12	0.18	0.22	0.70	-0.25	0.27	0.31	0.30	0.32	0.57
2	-0.18	0.03	0.09	0.10	0.04	0.22	-0.14	0.02	0.03	0.07	0.10	0.24
3	-0.04	0.04	0.09	0.03	0.16	0.20	-0.01	-0.03	-0.04	-0.01	0.14	0.15
4	0.15	-0.01	0.07	0.03	0.09	-0.06	0.18	-0.14	-0.01	0.02	0.06	-0.12
Big	0.17	0.07	0.07	-0.03	-0.13	-0.31	0.10	-0.04	0.06	-0.01	-0.04	-0.13
	t_C ($p_C = 0.00$)						t_q ($p_q = 0.00$)					
Small	-4.00	0.36	1.58	2.59	2.53	5.72	-1.48	2.24	3.09	3.68	2.72	2.91
2	-2.28	0.37	1.34	1.40	0.44	1.88	-1.21	0.29	0.37	0.67	0.89	1.25
3	-0.50	0.53	0.93	0.28	1.40	1.43	-0.09	-0.30	-0.37	-0.05	1.16	0.92
4	1.87	-0.16	0.74	0.24	0.75	-0.42	1.50	-1.58	-0.06	0.21	0.44	-0.61
Big	2.89	0.91	0.70	-0.36	-1.02	-2.12	1.32	-0.49	0.65	-0.06	-0.23	-0.70

Outline

- 1 Intuition
- 2 Factors/Testing Portfolios
- 3 Factor Regressions: Alphas
- 4 Factor Regressions: Betas
- 5 Sharpe Ratios**

Sharpe Ratios

Factors

Sharpe ratios							Maximum Sharpe ratios			
MKT	SMB	HML	UMD	r_{ME}	$r_{1/A}$	r_{ROE}	CAPM	FF	Carhart	q
0.10	0.06	0.13	0.16	0.10	0.24	0.22	0.10	0.21	0.30	0.43

Sharpe Ratios

Testing portfolios

	SUE-1	SUE-6	Abr-1	Abr-6	RE-1	RE-6	R6-6	R11-1	I-Mom			
S_{H-L}	0.14	0.09	0.23	0.15	0.16	0.13	0.15	0.16	0.10			
S_m	0.27	0.26	0.28	0.23	0.25	0.21	0.31	0.28	0.20			
	B/M	E/P	CF/P	NO/P	Dur							
S_{H-L}	0.14	0.12	0.11	0.16	0.12							
S_m	0.21	0.24	0.21	0.30	0.24							
	I/A	NOA	Δ PI/A	IG	NSI	CEI	lvG	lvC	OA	POA	PTA	
S_{H-L}	0.11	0.12	0.17	0.14	0.21	0.14	0.13	0.14	0.10	0.15	0.12	
S_m	0.24	0.29	0.25	0.26	0.30	0.32	0.23	0.25	0.25	0.23	0.23	
	ROE	ROA	GP/A	NEI	FP							
S_{H-L}	0.15	0.13	0.10	0.14	0.10							
S_m	0.24	0.21	0.18	0.26	0.28							
	OC/A	Ad/M	RD/M	OL	Svol	all						
S_{H-L}	0.18	0.14	0.12	0.10	0.14	0.48						
S_m	0.26	0.23	0.21	0.17	0.29	1.60						

Conclusion

Summary and interpretation

The q -factor model largely summarizes the cross section of average stock returns, capturing most (but not all) anomalies that bedevil the Fama-French model

A parsimonious empirical model for estimating expected returns, silent about the rational asset pricing versus mispricing debate:

- Rational asset pricing: q -factors constructed on economic fundamentals; comovement indicated in Sharpe ratios; covariation (betas) between anomalies and q -factors
- Mispricing: simultaneous impact on stocks with similar investment (and similar ROE); high Sharpe ratios