Lecture Notes

Zhang (2005, Journal of Finance, "The Value Premium")

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FIN 8250, Autumn 2021
Ohio State

Contribution

Zhang (2005): The first RBC model for the cross section of returns

THE JOURNAL OF FINANCE • VOL. LX, NO. 1 • FEBRUARY 2005

The Value Premium

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ABSTRACT

The value anomaly arises naturally in the neoclassical framework with rational expectations. Costly reversibility and countercyclical price of risk cause assets in place to be harder to reduce, and hence are riskier than growth options especially in bad times when the price of risk is high. By linking risk and expected returns to economic primitives, such as tastes and technology, my model generates many empirical regularities in the cross-section of returns; it also yields an array of new refutable hypotheses providing fresh directions for future empirical research.

WHY DO VALUE STOCKS EARN HIGHER EXPECTED RETURNS than growth stocks? This appears to be a troublesome anomaly for rational expectations, because according to conventional wisdom, growth options hinge upon future economic conditions

Mechanism

The value premium arises from costly reversibility and time-varying price of risk

A causal mechanism of the value premium

“Costly reversibility and countercyclical price of risk cause assets in place to be harder to reduce, and hence are riskier than growth options especially in bad times when the price of risk is high”

- Asymmetry causes countercyclical value-minus-growth risk
- Countercyclical price of risk propagates risk dynamics

Mechanism

Why would asymmetry lead to countercyclical value-minus-growth risk?

With production, adjustment cost leads to risk (Jermann 1998):

- Capital adjustment helps firms smooth dividend stream; so cash flows do not covary much with downturns
- Adjustment cost as the offsetting force of changing capital

Value stocks more sensitive to business cycles than growth stocks

Mechanism

The linkage between value and risk across business cycles

In bad times:

Value Firms $\Rightarrow$ Burdened With More Unproductive Capital
$\Rightarrow$ Want to Cut More Capital $\Rightarrow$ More Adjustment Cost
$\Rightarrow$ Higher Risk

In good times:

Growth Firms $\Rightarrow$ More Productive Capital
$\Rightarrow$ Want to Expand More $\Rightarrow$ More Adjustment Cost
$\Rightarrow$ Higher Risk

Time-varying price of risk implies a positive value premium

Impact

Google Scholar (GS) and Web of Science (WoS) cites as of June 13, 2021 (Y = 2021 − Year of publication)

	GS	GS/Y	WoS	WoS/Y
Berk, Green, and Naik (1999)	1860	84.6	489	22.2
Gomes, Kogan, and Zhang (2003)	904	50.2	254	14.1
Carlson, Fisher, and Giammarino (2004)	871	51.2	251	14.8
Kogan (2004)	203	11.9	55	3.2
Zhang (2005)	1604	100.3	462	28.88
Cooper (2006)	401	26.7	127	8.47
Papanikolaou (2011)	349	34.9	60	6

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TITLE	CITED BY	YEAR
Digesting anomalies: An investment approach K Hou, C Xue, L Zhang The Review of Financial Studies 28 (3), 650-705	2181 *	2015
The value premium L Zhang The Journal of Finance 60 (1), 67-103	1604	2005
Equilibrium cross section of returns J Gomes, L Kogan, L Zhang Journal of Political Economy 111 (4), 693-732	904	2003
Is value riskier than growth? R Petkova, L Zhang Journal of Financial Economics 78 (1), 187-202	775	2005

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The value premium

By: Zhang, L (Zhang, L)

JOURNAL OF FINANCE
Volume: 60 Issue: 1 Pages: 67-103
DOI: 10.1111/j.1540-6261.2005.00725.x
Published: FEB 2005
Document Type: Article
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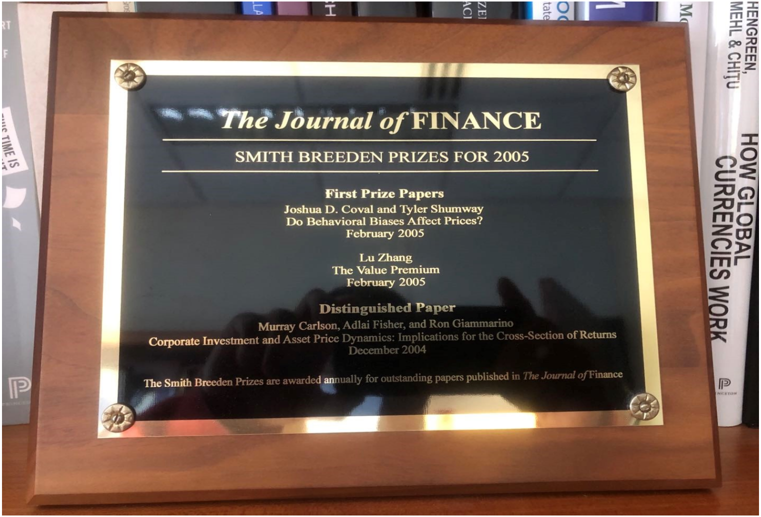
Abstract

The value anomaly arises naturally in the neoclassical framework with rational expectations. Costly reversibility and countercyclical price of risk cause assets in place to be harder to reduce, and hence are riskier than growth options especially in bad times when the price of risk is high. By linking risk and expected returns to economic primitives, such as tastes and technology, my model generates many empirical regularities in the cross-section of returns; it also yields an array

Impact

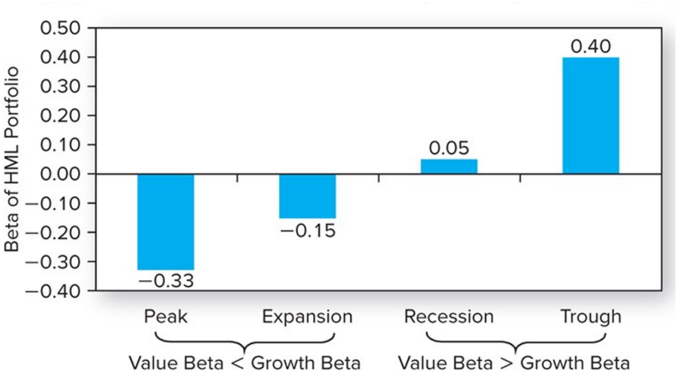
Smith-Breeden Prize for 2005 from Journal of Finance



Impact

Featured in Bodie, Kane, and Marcus's Investments since 2007;
Figure 13.3 in 12th edition published in 2021

HML beta in different economic states: HML is riskier when the market risk premium is high (Petkova and Zhang 2005)



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Bodie, Kane, and Marcus (2021), Investments, 12th edition, p. 408–409

"What might lead to such an association between beta and the market risk premium? Zhang focuses on irreversible investments. He notes that firms classified as value firms (with high book-to-market ratios) on average will have greater amounts of tangible capital. Investment irreversibility puts such firms more at risk for economic downturns because in a severe recession, they will suffer from excess capacity from assets already in place. In contrast, growth firms are better able to deal with a downturn by deferring investment plans. The greater exposure of high book-to-market firms to recessions will result in higher down-market betas. Moreover, some evidence suggests that the market risk premium also is higher in down markets, when investors are feeling more economic pressure and anxiety. The combination of these two factors might impart a positive correlation between the beta of high B/M firms and the market risk premium."

Outline

1. Model
2. Results
3. Causal Mechanism
4. The CAPM Failure
5. Recent Performance
6. Challenges

Outline

1 Model

2 Results

3 Causal Mechanism

4 The CAPM Failure

5 Recent Performance

6 Challenges

The profit function:

$$\pi_{jt} = e^{(x_t + z_{jt} + p_t)} k_{jt}^{\alpha} - f$$

in which

$$\begin{aligned} x_{t+1} &= \bar{x}(1-\rho_x) + \rho_x x_t + \sigma_x \epsilon^x_{t+1} \\ z_{jt+1} &= \rho_z z_{jt} + \sigma_z \epsilon^z_{jt+1} \end{aligned}$$

- x_{t+1}: Source of systematic risk
- z_{jt}: Source of firm heterogeneity (also k_{jt})

Model

Industry equilibrium, SDF

The stochastic discount factor:

$$\begin{aligned} \log M_{t,t+1} &= \log \beta + \gamma_t (x_t - x_{t+1}) \\ \gamma_t &= \gamma_0 + \gamma_1 (x_t - \bar{x}); \qquad \gamma_1 < 0 \end{aligned}$$

The real interest rate and the maximum Sharpe ratio, respectively:

$$R_{ft} = \frac{1}{\beta} e^{-\mu_m - \frac{1}{2}\sigma_m^2}; \quad S_t = \frac{\sqrt{e^{\sigma_m^2}(e^{\sigma_m^2} - 1)}}{e^{\sigma_m^2/2}}$$

in which

$$\begin{aligned} \mu_m &= [\gamma_0 + \gamma_1 (x_t - \bar{x})](1 - \rho_x)(x_t - \bar{x}) \\ \sigma_m &= \sigma_x [\gamma_0 + \gamma_1 (x_t - \bar{x})] \end{aligned}$$

Industry demand function: $P_t = Y_t^{-\eta}$, with $0 < \eta < 1$

The firms' optimal investment problem is:

$$v(k_t, z_t; x_t, p_t) = \max_{i_t} \left\{ \overbrace{e^{x_t + z_t + p_t} k_t^{\alpha} - f - i_t - h(i_t, k_t)}^{\textbf{Current Period Dividend}} + \right.$$

$$\left. \overbrace{\iint M_{t,t+1} v(k_{t+1}, z_{t+1}; x_{t+1}, p_{t+1}) \, Q_z \left(dz_{t+1} | z_t\right) Q_x \left(dx_{t+1} | x_t\right)}^{\textbf{Expected Continuation Value}} \right\}$$

subject to the capital accumulation rule: $k_{t+1} = i_t + (1 - \delta) k_t$

Capital adjustment cost is asymmetric and quadratic:

$$h(i_t, k_t) = \frac{\theta_t}{2} \left(\frac{i_t}{k_t} \right)^2 k_t$$

in which $\theta^- > \theta^+$ and $\theta_t = \theta^+ \chi_{\{i_t \geq 0\}} + \theta^- \chi_{\{i_t < 0\}}$

Model

Costly reversibility, illustration

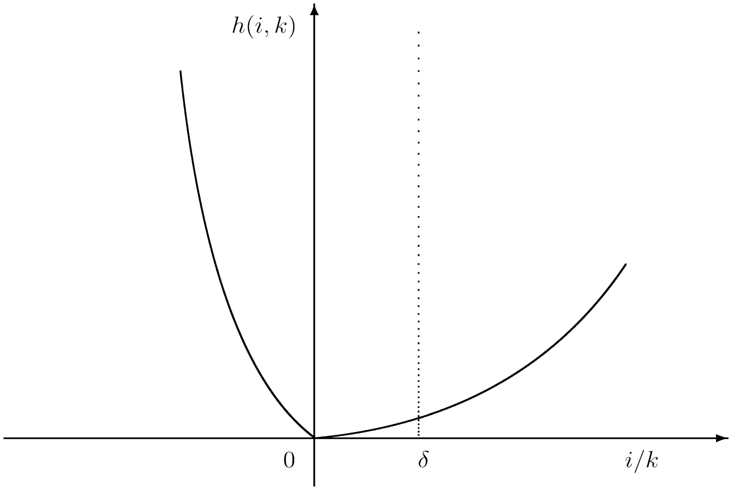


Figure 1. Asymmetric adjustment cost. This figure illustrates the specification of capital ad-

The risk and expected return of firm j satisfy the linear relationship

$$\mathrm{E}_t[R_{jt+1}] = R_{ft} + \beta_{jt}\lambda_{mt},$$

in which R_{ft} is the real interest rate; the stock return is

$$R_{jt+1} \equiv v_{jt+1}/(v_{jt} - d_{jt})$$

- $d_{jt} \equiv \pi_{jt} - i_{jt} - h(i_{jt}, k_{jt})$: Dividend
- $\beta_{jt} \equiv -\mathrm{Cov}_t[R_{jt+1}, M_{t+1}]/\mathrm{Var}_t[M_{t+1}]$: The quantity of risk
- $\lambda_{mt} \equiv \mathrm{Var}_t[M_{t+1}]/\mathrm{E}_t[M_{t+1}]$: The price of risk

The law of motion of the cross-sectional distribution of firms, μ_t, is:

$$\mu_{t+1}(\Theta; x_{t+1}) = T(\Theta, (k_t, z_t); x_t)\mu_t(k_t, z_t; x_t)$$

in which

$$T(\Theta, (k_t, z_t); x_t) \equiv \iint \chi_{\{(k_{t+1}, z_{t+1}) \in \Theta\}} \, Q_z(dz_{t+1}|z_t) Q_x(dx_{t+1}|x_t)$$

Industry output:

$$Y_t \equiv \iint y(k_t, z_t; x_t) \, \mu_t \, (dk, dz; x_t)$$

A recursive competitive equilibrium is characterized by: (i) A log industry output price p_t^*; (ii) an optimal investment rule $i^*(k_t, z_t; x_t, p_t^*)$, as well as a value function $v^*(k_t, z_t; x_t, p_t^*)$ for each firm; and (iii) a law of motion of firm distribution Γ^*:

- Optimality: $i^*(k_t, z_t; x_t, p_t^*)$ and $v^*(k_t, z_t; x_t, p_t^*)$ solve the value-maximization problem for each firm
- Consistency: The aggregate output Y_t consistent with the production of all firms in the industry; the law of motion Γ^* consistent with the optimal decisions of firms
- Product market clearing:

$$e^{p_t^*} = Y_t^{-\eta}$$

Model

Approximate aggregation per Krusell and Smith (1998): p_t depends on the firm distribution via a finite number of moments

1. Guess: $p_{t+1} = a_1 + a_2 p_t + a_3(x_t - \overline{x}) + a_4 \sigma_k$
2. Solve the firms' problem by the value function iteration method
3. Use the optimal investment rule to simulate the industry with 5,000 firms for 12,000 monthly periods
4. Use the stationary distribution to update a_1, a_2, a_3, and a_4
5. Check convergence; if not, go back to step 2
6. Check R^2; if < 0.99, change the p_{t+1} specification

Outline

1 Model

2 Results

3 Causal Mechanism

4 The CAPM Failure

5 Recent Performance

6 Challenges

Group I					Group II			Group III				
α	δ	ρ_x	σ_x	η	β	γ_0	γ_1	θ^-/θ^+	θ^+	ρ_z	σ_z	f
0.3	0.01	$0.95^{1/3}$	0.007/3	0.5	0.994	50	-1000	10	15	0.97	0.1	0.0365

Group I: Capital share, α; depreciation, δ; persistence of aggregate productivity, ρ_x; conditional volatility of aggregate productivity, σ_x; inverse price elasticity of demand, η

Group II: Parameters in the pricing kernel: β, γ_0, and γ_1

Group III: Adjustment cost with $i \geq 0$, θ^+; asymmetry, θ^-/θ^+; persistence of firm-specific productivity, ρ_z; conditional volatility of firm-specific productivity, σ_z

Results

Basic moments averaged across 100 simulations, each with 5,000 firms and 900 months

Moments	Model	Data
Average annual Sharpe ratio	0.41	0.43
Average annual real interest rate	0.022	0.018
Annual volatility of real interest rate	0.029	0.030
Average annual value-weighted industry return	0.13	0.12–0.14
Annual volatility of value-weighted industry return	0.27	0.23–0.28
Average volatility of individual stock return	0.286	0.25–0.32
Average industry book-to-market ratio	0.54	0.67
Volatility of industry book-to-market ratio	0.24	0.23
Annual average rate of investment	0.135	0.15
Annual average rate of disinvestment	0.014	0.02

Results

Properties of portfolios sorted on book-to-market: Model 1 (symmetry and constant price of risk); Model 2 (asymmetry and constant price of risk)

	Data			Benchmark			Model 1			Model 2		
	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ
HML	4.68	0.14	0.12	4.87	0.43	0.12	2.19	0.09	0.04	2.54	0.11	0.04
Low	0.11	1.01	0.20	0.09	0.85	0.23	0.08	0.95	0.30	0.08	0.94	0.30
2	0.12	0.98	0.19	0.10	0.92	0.24	0.09	0.97	0.31	0.09	0.97	0.31
3	0.12	0.95	0.19	0.10	0.95	0.25	0.09	0.99	0.31	0.09	0.98	0.31
4	0.11	1.06	0.21	0.11	0.98	0.26	0.09	1.00	0.32	0.10	0.99	0.31
5	0.13	0.98	0.20	0.11	1.01	0.27	0.10	1.00	0.32	0.10	1.00	0.32
6	0.13	1.07	0.22	0.12	1.04	0.28	0.10	1.01	0.32	0.10	1.01	0.32
7	0.14	1.13	0.24	0.12	1.08	0.28	0.10	1.02	0.32	0.10	1.02	0.32
8	0.15	1.14	0.24	0.12	1.12	0.30	0.10	1.03	0.33	0.11	1.04	0.33
9	0.17	1.31	0.29	0.13	1.18	0.31	0.11	1.04	0.33	0.11	1.05	0.33
High	0.17	1.42	0.33	0.15	1.36	0.36	0.11	1.07	0.34	0.12	1.08	0.34

Results

Model 1 under alternative parameterizations: Low ($\sigma_z = 0.08$) and high ($\sigma_z = 0.12$) volatility as well as fast ($\theta^+ = 5$) and low ($\theta^+ = 25$) adjustment

	Low Volatility			High Volatility			Fast Adjustment			Slow Adjustment		
	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ
HML	1.78	0.07	0.03	2.28	0.10	0.04	1.57	0.07	0.04	2.31	0.08	0.03
Low	0.08	0.95	0.30	0.08	0.94	0.29	0.09	0.96	0.30	0.07	0.95	0.29
2	0.09	0.98	0.31	0.09	0.97	0.30	0.10	0.98	0.31	0.08	0.98	0.30
3	0.09	0.99	0.31	0.10	0.99	0.31	0.10	0.99	0.31	0.09	0.99	0.31
4	0.09	1.00	0.31	0.10	1.00	0.31	0.10	0.99	0.32	0.09	1.00	0.31
5	0.10	1.00	0.31	0.10	1.01	0.31	0.10	1.00	0.32	0.09	1.00	0.31
6	0.10	1.01	0.32	0.10	1.02	0.32	0.10	1.01	0.32	0.10	1.01	0.32
7	0.10	1.02	0.32	0.11	1.02	0.32	0.11	1.02	0.32	0.10	1.02	0.32
8	0.10	1.02	0.32	0.11	1.04	0.32	0.11	1.02	0.33	0.10	1.03	0.32
9	0.10	1.03	0.32	0.11	1.05	0.33	0.11	1.04	0.33	0.11	1.04	0.32
High	0.11	1.05	0.33	0.12	1.08	0.34	0.12	1.07	0.34	0.11	1.06	0.33

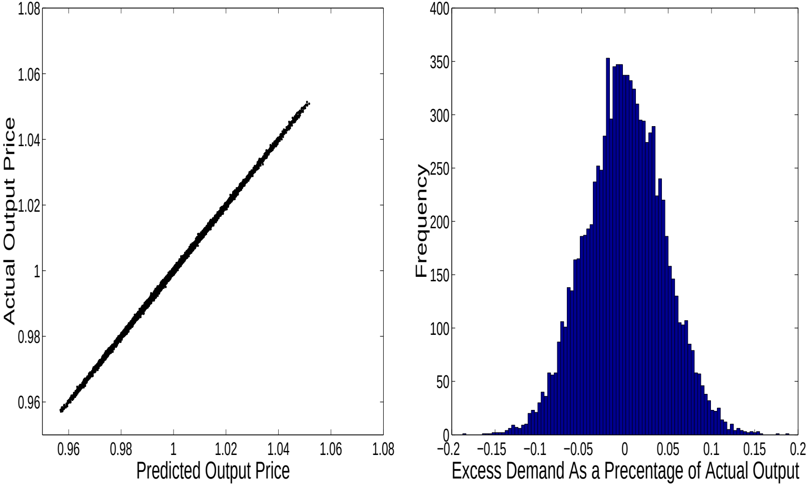
Results

Model 1 under alternative parameterizations: Low ($f = 0.0345$) and high fixed cost ($f = 0.0385$) as well as low ($\rho_z = 0.95$) and high persistence ($\rho_z = 0.98$)

	Low f			High f			Low ρ_z			High ρ_z					
	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ	$\overline{R}$	β	σ
HML	1.89	0.07	0.03	2.34	0.12	0.05	1.88	0.07	0.03	2.63	0.12	0.05	3.13	0.12	0.05
Low	0.08	0.95	0.30	0.09	0.93	0.30	0.09	0.95	0.30	0.07	0.94	0.29	0.05	0.93	0.28
2	0.09	0.98	0.31	0.09	0.97	0.31	0.09	0.98	0.30	0.08	0.97	0.30	0.07	0.97	0.29
3	0.10	0.99	0.31	0.10	0.98	0.31	0.10	0.99	0.31	0.09	0.98	0.31	0.07	0.98	0.30
4	0.10	1.00	0.31	0.10	0.99	0.32	0.10	1.00	0.31	0.09	0.99	0.31	0.08	1.00	0.30
5	0.10	1.00	0.31	0.10	1.00	0.32	0.10	1.00	0.31	0.09	1.00	0.31	0.08	1.01	0.31
6	0.10	1.01	0.32	0.11	1.01	0.32	0.10	1.01	0.31	0.09	1.01	0.32	0.08	1.02	0.31
7	0.10	1.02	0.32	0.11	1.02	0.33	0.10	1.02	0.32	0.10	1.03	0.32	0.09	1.03	0.31
8	0.11	1.02	0.32	0.11	1.04	0.33	0.11	1.02	0.32	0.10	1.04	0.32	0.09	1.04	0.32
9	0.11	1.03	0.32	0.11	1.05	0.33	0.11	1.03	0.32	0.10	1.06	0.33	0.10	1.06	0.32
High	0.12	1.05	0.33	0.12	1.09	0.35	0.11	1.05	0.33	0.11	1.11	0.35	0.11	1.10	0.33

Results

$p_{t+1} = 0.0486 + 0.9821 p_t - 0.1173(x_t - \overline{x}) + 0.0040\sigma_k + e_{t+1}$, with $R^2 = 0.9994$



Outline

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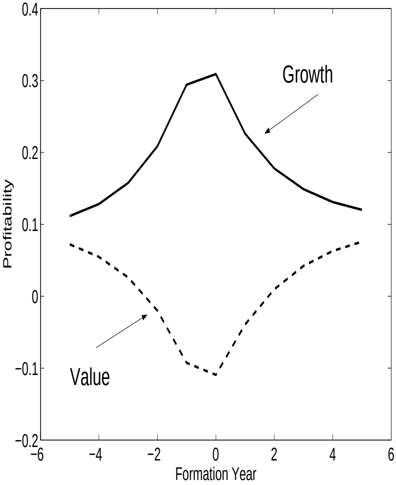
4 The CAPM Failure

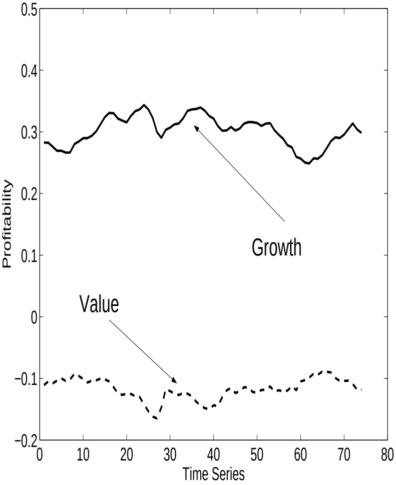
5 Recent Performance

6 Challenges

Mechanism

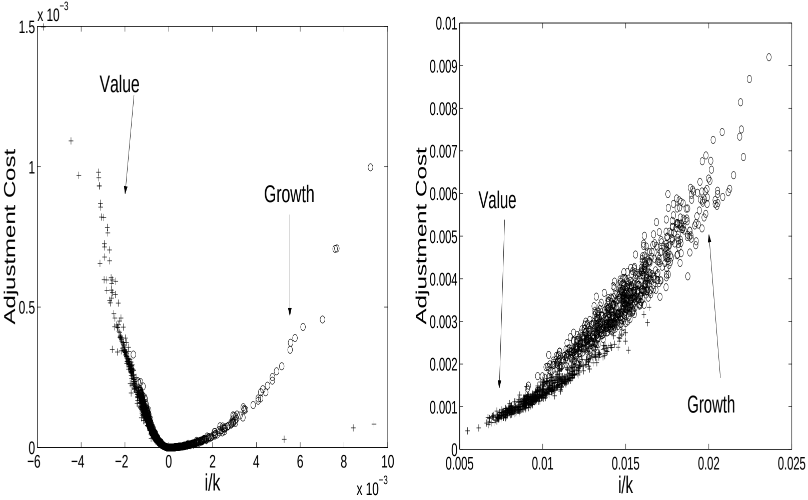
Value firms are less profitable than growth firms, with profitability $= [\triangle k_t + d_t] / k_{t-1}$; 100 artificial samples, each implemented with the Fama-French (1995) procedure





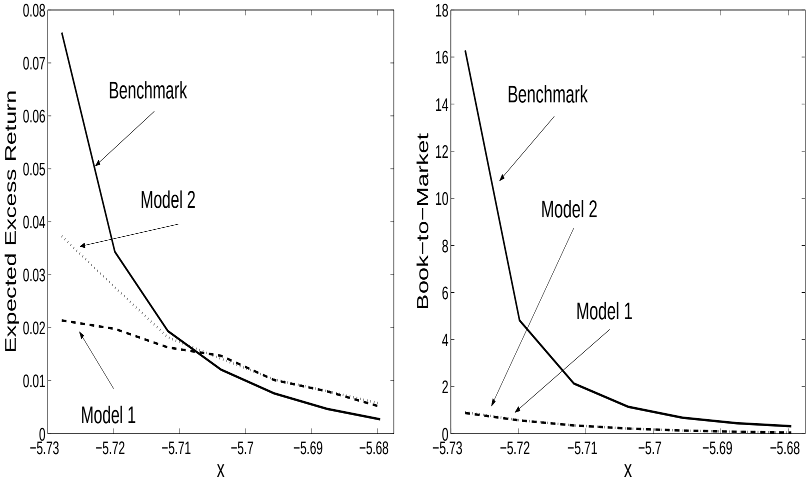
Mechanism

Value firms disinvest more with higher adjustment costs than growth firms, and growth firms invest more with higher adjustment costs in good times



Mechanism

Risk as inflexibility: Value riskier than growth, especially in bad times, due to asymmetry and countercyclical price of risk; the expected value premium vs. the value spread



Mechanism

Initial resistance stemming from Lakonishok, Shleifer, and Vishny (1994, p. 1543)

"To be fundamentally riskier, value stocks must underperform glamour stocks with some frequency, and particularly in the states of the world when the marginal utility of wealth is high."

"We look at the frequency of superior (and inferior) performance of value strategies, as well as at their performance in bad states of the world, such as extreme down markets and economic recessions."

"We find little, if any, support for the view that value strategies are fundamentally riskier."

Risk evidence addressed in Petkova and Zhang (2005)

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The CAPM Failure

Lin and Zhang (2013): The Zhang model fails to explain the CAPM failure

Production: $\Pi_{it} = X_t Z_{it} K_{it}^{\alpha} - f$

- Aggregate productivity, $x_t \equiv \log X_t$, assume:

$$x_{t+1} = \bar{x}(1 - \rho_x) + \rho_x x_t + \sigma_x \mu_{t+1}$$

- Firm-specific productivity, $z_{it} \equiv \log Z_{it}$ for firm i, assume:

$$z_{it+1} = \rho_z z_{it} + \sigma_z \nu_{it+1}$$

The pricing kernel:

$$M_{t+1} = \eta \exp\left[[\gamma_0 + \gamma_1(x_t - \overline{x})](x_t - x_{t+1})\right]$$

Capital accumulation: $K_{it+1} = I_{it} + (1-\delta)K_{it}$

Asymmetric adjustment costs:

$$\Phi(I_{it}, K_{it}) = \begin{cases} a^{+}K_{it} + \frac{c^{+}}{2}\left(\frac{I_{it}}{K_{it}}\right)^2 K_{it} & \text{for} \quad I_{it} > 0 \\ 0 & \text{for} \quad I_{it} = 0 \\ a^{-}K_{it} + \frac{c^{-}}{2}\left(\frac{I_{it}}{K_{it}}\right)^2 K_{it} & \text{for} \quad I_{it} < 0 \end{cases}$$

in which $a^{-} > a^{+} > 0$, and $c^{-} > c^{+} > 0$

The cum-dividend market value of equity, $V(K_{it}, X_t, Z_{it})$:

$$\max_{\{I_{it}\}} \Pi_{it} - I_{it} - \Phi(I_{it}, K_{it}) + E_t\left[M_{t+1}V(K_{it+1}, X_{t+1}, Z_{it+1})\right]$$

$\eta = .9999$, $\gamma_0 = 17$, and $\gamma_1 = -1000$

$\rho_x = .95^{1/3}$ and $\sigma_x = .007/\sqrt{1 + \rho_x^2 + \rho_x^4} = .0041$ (Heer and Maussner 2009)

$a^+ = .01, a^- = .03$, $c^+ = 20$, and $c^- = 200$

$\bar{x} = -3.65, \rho_z = .97$, $\sigma_z = .1$, $\alpha = .7$, $\delta = .01$, and $f = .0032$

	Low	2	3	4	5	6	7	8	9	High	H−L
	January 1965–December 2010, the BM deciles										
Mean	0.33	0.44	0.48	0.48	0.46	0.55	0.60	0.65	0.74	0.88	0.55
Std	5.3	4.9	4.8	4.9	4.6	4.6	4.5	4.7	4.9	6.0	4.8
α	−0.13	0.01	0.06	0.06	0.08	0.16	0.23	0.27	0.35	0.43	0.56
t_α	−1.2	0.1	1.0	0.5	0.7	1.6	2.0	2.1	3.2	2.9	2.4
β	1.07	1.01	0.98	0.99	0.91	0.93	0.87	0.88	0.93	1.06	−0.00
t_β	33.4	35.0	25.7	24.8	24.4	26.5	19.6	15.3	17.4	12.6	−0.03

The CAPM Failure

Sampling variation: The CAPM explains the value premium in the long sample; adding a second shock to fail the CAPM would contradict the long sample evidence

	Low	2	3	4	5	6	7	8	9	High	H−L
	January 1927–December 2010, the BM deciles										
Mean	0.55	0.65	0.64	0.63	0.71	0.74	0.75	0.91	0.97	1.08	0.53
Std	5.8	5.5	5.4	6.1	5.7	6.2	6.7	7.0	7.6	9.5	6.7
α	−0.07	0.05	0.05	−0.03	0.10	0.08	0.05	0.19	0.20	0.18	0.25
t_α	−1.0	0.9	1.1	−0.4	1.3	0.9	0.6	1.8	1.9	1.1	1.2
β	1.00	0.98	0.94	1.06	0.98	1.07	1.12	1.16	1.24	1.45	0.45
t_β	37.5	35.1	29.1	18.9	21.1	15.0	12.3	10.6	14.1	11.9	3.1

The CAPM Failure

The Lin-Zhang model cannot explain the CAPM failure in the 1965–2010 sample

	Low	2	3	4	5	6	7	8	9	High	H−L
Mean	0.62	0.66	0.69	0.70	0.77	0.76	0.81	0.86	0.92	1.12	0.50
Std	5.9	6.3	6.5	6.6	7.1	7.0	7.4	7.8	8.2	9.5	3.9
α	−0.02	−0.01	−0.01	−0.01	0.00	0.00	0.01	0.02	0.04	0.10	0.11
t_α	−0.8	−0.6	−0.5	−0.4	0.0	−0.1	0.5	0.6	1.0	1.5	1.4
α, 2.5	−0.09	−0.08	−0.06	−0.06	−0.03	−0.03	−0.03	−0.03	−0.03	−0.04	−0.05
α, 97.5	0.02	0.02	0.02	0.02	0.04	0.03	0.07	0.12	0.21	0.50	0.59
β	0.86	0.91	0.95	0.96	1.03	1.02	1.07	1.13	1.17	1.36	0.50
t_β	123.2	164.4	219.8	162.5	123.9	227.4	127.3	112.2	76.9	42.0	12.4
β, 2.5	0.83	0.87	0.93	0.93	1.00	1.00	1.05	1.07	1.10	1.18	0.27
β, 97.5	0.91	0.94	0.96	0.99	1.07	1.06	1.12	1.18	1.29	1.52	0.68

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Recent Performance

Is the value premium disappearing? The BM deciles, global-q.org

	Low	2	3	4	5	6	7	8	9	High	H−L
	The book-to-market (BM) deciles, 1/1967–12/2020										
$\overline{R}$	0.55	0.62	0.67	0.60	0.58	0.63	0.66	0.67	0.73	0.85	0.30
t	2.67	3.24	3.59	3.13	3.23	3.50	3.66	3.73	3.88	3.64	1.58
α	−0.07	0.03	0.09	0.02	0.05	0.10	0.14	0.17	0.21	0.25	0.32
t_α	−0.71	0.47	1.52	0.29	0.56	1.40	1.42	1.42	1.79	1.42	1.28
β	1.06	1.01	0.98	0.99	0.92	0.91	0.89	0.87	0.90	1.03	−0.03
t_β	40.66	56.77	37.17	38.62	31.17	36.56	30.69	21.34	19.97	14.78	−0.30

Recent Performance

Is the value premium disappearing? The CopME deciles, global-q.org

	Low	2	3	4	5	6	7	8	9	High	H−L
	The operating cash flow-to-market (CopME) deciles, 1/1967–12/2020										
$\overline{R}$	0.15	0.57	0.64	0.64	0.73	0.72	0.67	0.86	0.86	0.95	0.80
t	0.61	2.77	3.43	3.54	3.94	3.92	3.51	4.39	4.03	3.94	4.18
α	−0.60	−0.04	0.08	0.09	0.17	0.17	0.12	0.29	0.26	0.31	0.91
t_α	−4.91	−0.39	0.99	1.15	2.15	2.23	1.20	2.51	2.11	1.88	3.93
β	1.29	1.05	0.98	0.94	0.95	0.94	0.94	0.98	1.02	1.10	−0.18
t_β	37.36	36.70	39.25	37.76	30.21	34.77	31.25	30.92	28.68	18.85	−2.32

Operating cash flow better than book equity in capturing the impact of intangibles (Penman 2009)

Recent Performance

The BM deciles, monthly percent, global-q.org

	Low	2	3	4	5	6	7	8	9	High	H−L
						1/2020–12/2020					
$\overline{R}$	3.86	2.56	1.90	2.02	0.39	1.19	−0.30	0.23	0.90	0.15	−3.71
t	1.67	1.24	0.94	0.88	0.17	0.49	−0.11	0.08	0.29	0.03	−1.10
						1/2018–12/2020					
$\overline{R}$	2.21	1.61	1.10	1.45	0.54	0.87	−0.08	0.27	0.54	−0.45	−2.66
t	2.15	1.66	1.26	1.53	0.56	0.89	−0.08	0.25	0.47	−0.25	−2.11
						1/2016–12/2020					
$\overline{R}$	1.83	1.49	1.32	1.24	0.89	1.04	0.39	0.68	0.89	0.28	−1.55
t	2.74	2.44	2.39	2.09	1.42	1.66	0.56	1.00	1.26	0.24	−1.84
						1/2011–12/2020					
$\overline{R}$	1.56	1.21	1.23	1.12	0.86	1.04	0.64	0.78	0.83	0.55	−1.00
t	3.85	3.18	3.51	3.01	2.17	2.62	1.48	1.92	2.03	0.87	−2.07

Recent Performance

The operating cash flow-to-market deciles, monthly percent, global-q.org

	Low	2	3	4	5	6	7	8	9	High	H−L
						1/2020–12/2020					
$\overline{R}$	5.34	4.63	2.35	1.06	1.91	0.79	0.72	−0.11	1.27	1.69	−3.65
t	2.03	2.16	0.99	0.45	0.89	0.28	0.34	−0.04	0.36	0.50	−1.87
						1/2018–12/2020					
$\overline{R}$	2.30	2.34	1.44	1.17	1.34	0.86	0.66	0.23	0.78	0.27	−2.03
t	1.77	2.44	1.39	1.20	1.43	0.76	0.69	0.20	0.59	0.20	−2.32
						1/2016–12/2020					
$\overline{R}$	1.57	1.92	1.39	1.23	1.31	1.07	1.08	0.80	0.84	0.59	−0.98
t	1.79	3.12	2.18	2.03	2.18	1.54	1.73	1.10	1.00	0.65	−1.60
						1/2011–12/2020					
$\overline{R}$	1.14	1.61	1.17	1.13	1.11	1.18	0.98	0.86	0.91	0.64	−0.50
t	2.15	4.16	2.91	2.98	2.95	2.83	2.50	1.98	1.86	1.19	−1.28

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The first RBC model of the cross section

Adapting from quantitative macro:

- Industry vs. general equilibrium
- Globally nonlinear solution algorithm

Departing from analytically oriented asset pricing theory

To many empiricists, calibration is like a "black art"

- Transparency with algorithm, intermediate results, comparative statics, replication, codes sharing, etc
- Closer match with data: accounting vs. economic depreciation
- From calibration to SMM

Challenges

Explaining value, momentum, investment, and profitability premiums simultaneously

The business cycle analysis of risks and risk premiums has withstood the test of time (despite rounds of scrutiny)

However, despite positive value and investment premiums, the profitability and momentum premiums are negative in Zhang (2005)

Is the Li (2018) mechanism the answer?