Costly External Equity: Implications for Capital Markets Anomalies

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Do investment frictions affect capital markets anomalies?

Theme

Answer: Yes, to some extent

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
Full Sample	−0.74	−0.78	−0.09	−1.96	−0.06	−0.54
	(−5.2)	(−8.4)	(−5.8)	(−7.2)	(−1.9)	(−5.3)
Small assets	−1.05	−0.93	−0.09	−1.63	−0.05	−0.52
Big assets	−0.34	−0.50	−0.06	−1.54	0.03	−0.42
Small-minus-big	[−2.9]	[−2.8]	[−0.9]	[−0.2]	[−1.5]	[−0.7]
Low payout	−1.02	−0.89	−0.10	−1.60	−0.10	−0.54
High payout	−0.34	−0.54	−0.04	−1.77	−0.02	−0.47
Low-minus-high	[−3.1]	[−2.7]	[−2.0]	[0.4]	[−1.6]	[−0.6]
With bond rating	−0.51	−0.56	−0.05	−1.84	−0.10	−0.52
Without bond rating	−0.93	−0.93	−0.11	−2.03	−0.04	−0.54
Without-minus-with	[−2.7]	[−3.4]	[−2.5]	[−0.6]	[1.6]	[−0.2]

Outline

1. Model

2. Tests

3. Motivation

Outline

Model

Why should investment frictions affect capital markets anomalies?

Two periods, 0 and 1

Firm i's capital: K_{i0} and K_{i1}, $K_{i1} = I_{i0} + (1-\delta)K_{i0}$

Firm i's *ROA*: Π

Firm i's operating profits: ΠK_{i0} and ΠK_{i1}

Firm i's investment costs:

$$C(I_{i0}, K_{i0}) = \frac{\lambda_i}{2}\left(\frac{I_{i0}}{K_{i0}}\right)^2 K_{i0}, \quad \lambda_i > 0$$

Model

The first-order condition

Firm i's discount rate: R_i

Firm i's value-maximization problem:

$$\max_{\{I_{i0}\}} \Pi K_{i0} - I_{i0} - \frac{\lambda_i}{2}\left(\frac{I_{i0}}{K_{i0}}\right)^2 K_{i0} + \frac{1}{R_i}\left[\Pi K_{i1} + (1-\delta)K_{i1}\right]$$

Firm i's first-order condition:

$$R_i = \frac{\Pi + 1 - \delta}{1 + \lambda_i (I_{i0}^*/K_{i0})}$$

Model

The investment-discount rate relation and its interaction with investment frictions

Totally differentiating the first-order condition w.r.t. R_i:

$$\frac{\partial(I_{i0}^*/K_{i0})}{\partial R_i} < 0$$

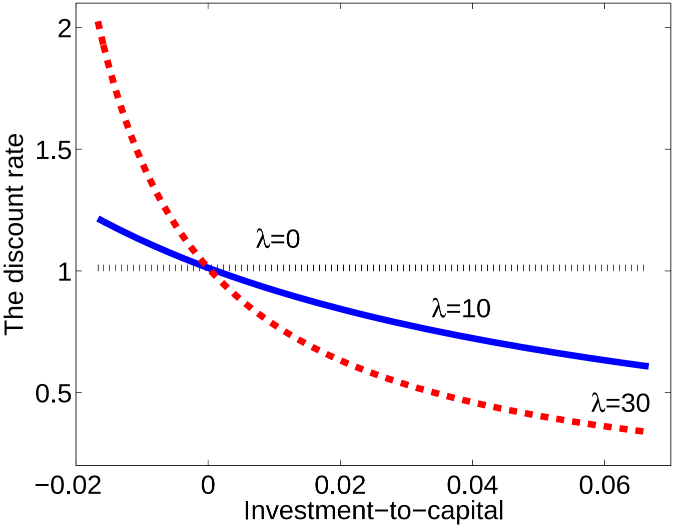
as in Cochrane (1991), Xing (2008), and Chen and Zhang (2009)

The investment-discount rate relation varies with investment frictions:

$$\partial \left| \frac{\partial(I_{i0}^*/K_{i0})}{\partial R_i} \right| / \partial \lambda_i < 0$$

Model

How investment frictions affect the expected return-investment relation? Plot $R_i = \frac{\Pi+1-\delta}{1+\lambda_i(I^*_{i0}/K_{i0})}$ with $\Pi = .15/12$ per month and $\delta = 0$



Model

How investment frictions affect the expected return-investment relation? Intuition

$$R_i = \frac{\Pi + 1 - \delta}{1 + \lambda_i (I_{i0}^* / K_{i0})}$$

- When investment is frictionless, $\lambda_i = 0$, investment is infinitely elastic to the discount rate, or R_i is flat in I_{i0}^*/K_{i0}
- With frictions, $\lambda_i > 0$, investment is no longer infinitely elastic to R_i
- $\lambda_i \uparrow$, the more inelastic investment is, a given change in I_{i0}^*/K_{i0} corresponds to a higher magnitude of change in R_i

Model

The testable hypothesis

Investment is a more powerful predictor of future stock returns in firms with high investment frictions than in firms with low investment frictions

Outline

Tests
Design

Fama-MacBeth cross-sectional regressions of monthly returns on a given investment variable within different subsamples categorized by firm-level measures of investment frictions

The q-theory logic says that the magnitude of the slope is higher in the high-frictions subsample than in the low-frictions subsample

But what is investment and what are investment frictions?

Tests

Measures of investment

Investment-to-assets: I/A = (Change in PPE + Change in inventories)/Lagged total assets, Chen and Zhang (2009)

Asset growth: $\triangle A/A$ = Change in total assets/Lagged total assets, Cooper, Gulen, and Schill (2008)

Investment growth: $\triangle I/I$ = Change in CAPX/Lagged CAPX, Xing (2008)

Tests

Measures of investment

Net stock issues: NSI = log growth rate of the split-adjusted shares outstanding, Fama and French (2008)

Abnormal corporate investment:
$ACI_{t-1} = 3CE_{t-1}/(CE_{t-2} + CE_{t-3} + CE_{t-4}) - 1$ with CE = CAPX/Sales, Titman, Wei, and Xie (2004)

Net operating assets: NOA = (Operating assets − Operating liabilities)/Lagged total assets, Hirshleifer, Hou, Teoh, and Zhang (2004)

Tests

Measures of investment frictions

Identify investment frictions with firm-level measures of financing constraints: if there are costs to investing, financing constraints increase these costs at the margin

- *Asset size*: Total assets, annual sorts, the small-assets tercile = more constrained, the big-assets tercile = less constrained
- *Payout ratio*: (Dividends for preferred stocks + Dividends for common stocks + Share repurchases)/Operating income before depreciation, annual sorts, the low-payout tercile = more constrained, the big-payout tercile = less constrained, special treatment for firms with negative earnings (zero dividends = more constrained, positive dividends = less constrained)
- *Bond ratings*: Unrated = more constrained, rated = less constrained

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Tests

Cross-correlations (Spearman)

	Asset size	Payout ratio	Bond rating
Asset size	1		
Payout ratio	0.51^{**}	1	
Rating dummy	-0.37^{**}	-0.21^{**}	1

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
I/A	1					
$\triangle A/A$	0.74^{**}	1				
$\triangle I/I$	0.59^{**}	0.52^{**}	1			
NSI	0.44^{**}	0.54^{**}	0.36^{**}	1		
ACI	0.32^{**}	0.26^{**}	0.52^{**}	0.17^{**}	1	
NOA	0.60^{**}	0.65^{**}	0.39^{**}	0.43^{**}	0.26^{**}	1

Tests

The key table

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
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Small-minus-big	[−2.9]	[−2.8]	[−0.9]	[−0.2]	[−1.5]	[−0.7]
Low payout	−1.02	−0.89	−0.10	−1.60	−0.10	−0.54
High payout	−0.34	−0.54	−0.04	−1.77	−0.02	−0.47
Low-minus-high	[−3.1]	[−2.7]	[−2.0]	[0.4]	[−1.6]	[−0.6]
With bond rating	−0.51	−0.56	−0.05	−1.84	−0.10	−0.52
Without bond rating	−0.93	−0.93	−0.11	−2.03	−0.04	−0.54
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Tests

Connection with the limits to arbitrage literature

When arbitrage costs (due to trading frictions) outweigh arbitrage benefits, mispricing can persist, Shleifer and Vishny (1997)

Our insight: If a firm whose stock is more costly to arbitrage also faces high investment frictions, q-theory provides an alternative interpretation to evidence that has been attributed exclusively to limits to arbitrage

Tests

The impact of limits to arbitrage

Measures of trading frictions: Idiosyncratic volatility and Dollar trading volume, Ali, Hwang, and Trombley (2003)

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
High-minus-low	−0.74	−0.57	−0.07	0.14	−0.02	−0.27
idio. volatility	[−3.9]	[−4.7]	[−2.5]	[0.4]	[−0.4]	[−2.7]
Low-minus-high	−0.58	−0.34	−0.01	−0.23	−0.08	−0.24
trading volume	[−2.9]	[−2.2]	[−0.5]	[−0.6]	[−1.9]	[−2.0]

Tests

Correlations between trading frictions and investment frictions

	Asset size	Payout ratio	Bond rating
Idio. volatility	$-0.61^{\star\star}$	$-0.54^{\star\star}$	$0.29^{\star\star}$
Trading volume	$0.73^{\star\star}$	$0.32^{\star\star}$	$-0.36^{\star\star}$

Tests

Investment frictions reduce the impact of idiosyncratic volatility

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
Small assets,	−0.58	−0.49	−0.02	1.06	0.03	−0.17
H−L volatility	[−2.4]	[−2.9]	[−0.5]	[2.1]	[0.6]	[−1.3]
Big assets,	−0.48	−0.36	−0.09	0.38	0.00	−0.24
H−L volatility	[−2.0]	[−2.4]	[−2.2]	[0.9]	[0.0]	[−2.0]
Low payout,	−0.40	−0.42	−0.04	0.57	0.07	−0.17
H−L volatility	[−2.0]	[−3.0]	[−1.2]	[1.3]	[1.5]	[−1.5]
High payout,	−0.68	−0.41	−0.06	−0.12	−0.02	−0.24
H−L volatility	[−2.7]	[−2.4]	[−1.6]	[−0.2]	[−0.3]	[−1.8]
With rating,	−0.70	−0.48	−0.07	0.00	−0.08	−0.12
H−L volatility	[−2.9]	[−3.0]	[−1.7]	[0.0]	[−1.3]	[−0.9]
Without rating,	−0.65	−0.60	−0.05	0.27	0.02	−0.35
H−L volatility	[−2.9]	[−3.9]	[−1.8]	[0.6]	[0.4]	[−3.0]

Tests

Investment frictions reduce the impact of dollar trading volume

	I/A	$\triangle A/A$	$\triangle I/I$	NSI	ACI	NOA
Small assets,	−0.47	−0.10	−0.01	−0.16	−0.02	−0.08
L−H volume	[−1.3]	[−0.4]	[−0.2]	[−0.2]	[−0.3]	[−0.4]
Big assets,	0.12	−0.13	−0.01	−0.16	−0.03	0.06
L−H volume	[0.5]	[−0.6]	[−0.3]	[−0.3]	[−0.6]	[0.4]
Low payout,	−0.56	−0.32	0.00	−0.19	−0.04	−0.25
L−H volume	[−2.3]	[−2.0]	[−0.1]	[−0.3]	[−0.7]	[−1.6]
High payout,	−0.47	−0.22	0.01	−0.77	−0.02	−0.21
L−H volume	[−2.0]	[−1.2]	[0.3]	[−1.6]	[−0.5]	[−1.4]
With rating,	−0.29	0.07	−0.03	0.06	−0.06	−0.06
L−H volume	[−1.1]	[0.3]	[−0.7]	[0.1]	[−1.2]	[−0.4]
Without rating,	−0.52	−0.39	0.00	−0.33	−0.11	−0.23
L−H volume	[−2.1]	[−2.2]	[−0.1]	[−0.7]	[−2.1]	[−1.6]

Outline

Motivation

Incremental contribution

The broad-ranging implications of the expected return-investment relation:

- Cochrane (1991, 1996)
- Berk, Green, and Naik (1999), Gomes, Kogan, and Zhang (2003), Carlson, Fisher, and Giammarino (2004, 2006)
- Zhang (2005), Gomes, Yaron, and Zhang (2006), Li, Livdan, and Zhang (2009), Liu, Whited, and Zhang (2009)
- Anderson and Garcia-Feijoo (2006), Li, Vassalou, and Xing (2006), Lyandres, Sun, and Zhang (2008), Xing (2008), Chen and Zhang (2009), Wu, Zhang, and Zhang (2009)

News: the impact of frictions on the expected return-investment relation

Conclusion

Summary and interpretation

The investment, asset growth, and investment growth effects are stronger in firms with high investment frictions, but the net stock issues, abnormal corporate investment, and net operating assets effects are not

Interpretation: The q-theory logic works for the former three effects, but doesn't for the latter three

q-theory provides an alternative interpretation to limits to arbitrage