The Economics of Value Investing

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The investment CAPM provides an economic foundation for Graham and Dodd's (1934) *Security Analysis*, without mispricing

Cross-sectionally varying expected returns, depending on firms' investment, profitability, and expected investment growth

- Perspective: Differing from Ou and Penman 1989, Lev and Thiagarajan 1993, Abarbanell and Bushee 1998, Frankel and Lee 1998, Piotroski 2000, Soliman 2008, Lee and So (2015)
- Cost of capital modeling: An appealing alternative to the Ohlson and Penman-Reggiani-Richardson-Tuna models

Augmenting the q-factor model with an expected growth factor

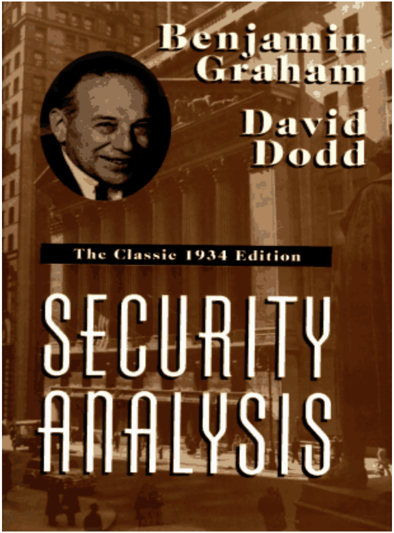
1. Security Analysis: Background
2. The Investment CAPM
3. The Expected Growth Factor
4. Comparison with Accounting Models

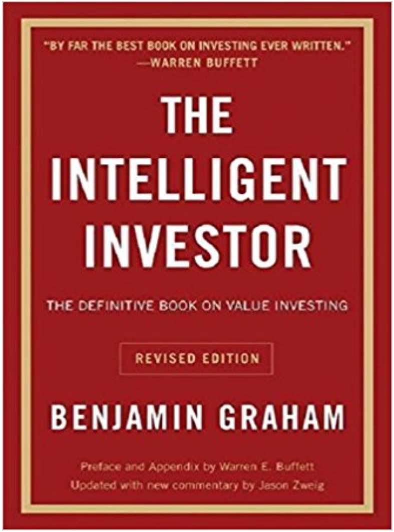
1 Security Analysis: Background

2 The Investment CAPM

3 The Expected Growth Factor

4 Comparison with Accounting Models


Benjamin Graham
David Dodd
The Classic 1934 Edition
SECURITY ANALYSIS


"BY FAR THE BEST BOOK ON INVESTING EVER WRITTEN."
—WARREN BUFFETT
THE INTELLIGENT INVESTOR
THE DEFINITIVE BOOK ON VALUE INVESTING
REVISED EDITION
BENJAMIN GRAHAM
Preface and Appendix by Warren E. Buffett
Updated with new commentary by Jason Zweig

Invest in undervalued securities selling well below the intrinsic value

- The intrinsic value is the value that can be justified by the firm's earnings, assets, and other accounting information
- The intrinsic value is distinct from the market value subject to artificial manipulation and psychological distortion

Maintain margin of safety, the intrinsic-market value distance

Security analysis is "concerned with the intrinsic value of the security and more particularly with the discovery of discrepancies between the intrinsic value and the market price (p. 17)"

The intelligent investor "would be well advised to devote his attention to the field of undervalued securities—issues, whether bonds or stocks, which are selling well below the levels apparently justified by a careful analysis of the relevant facts (p. 13)"

Security Analysis

Security analysis and efficient markets viewed as diametrically opposite

The Superinvestors of Graham-and-Doddsville

By Warren E. Buffett

"Superinvestor" Warren E. Buffett, who got an A+ from Ben Graham at Columbia in 1951, never stopped making the grade. He made his fortune using the principles of Graham & Dodd's Security Analysis. *Here, in celebration of the fiftieth anniversary of that classic text, he tracks the records of investors who stick to the "value approach" and have gotten rich going by the book.*

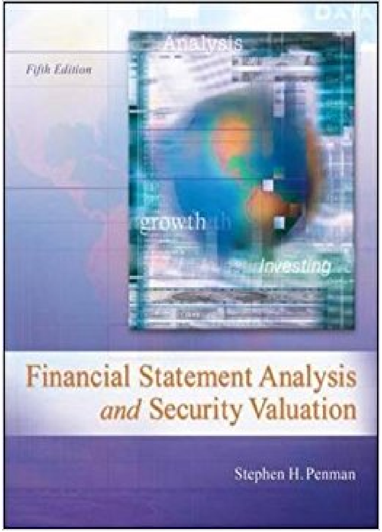
"Our Graham & Dodd investors, needless to say, do not discuss beta, the capital asset pricing model or covariance in returns among securities. These are not subjects of any interest to them. In fact, most of them would have difficulty defining those terms (p. 7)"

"Ships will sail around the world but the Flat Earth Society will flourish (p. 15)."

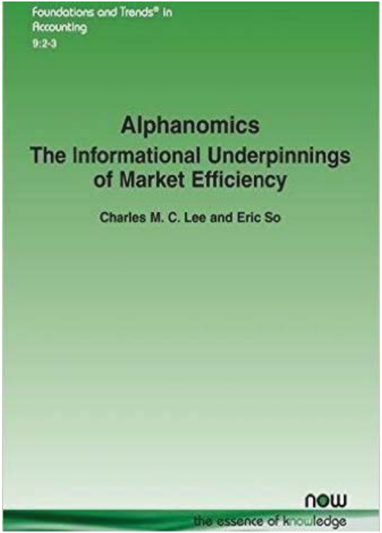
"Rather than taking prices as value benchmarks, 'intrinsic values' discovered from financial statements serve as benchmarks with which prices are compared to identify overpriced and underpriced stocks. Because deviant prices ultimately gravitate to the fundamentals, investment strategies which produce 'abnormal returns' can be discovered by the comparison of prices to these fundamental values (p. 296)."

“During the past 25 years, research in academia has been otherwise directed. Both traditional fundamental analysis and accounting measurement theory have been judged as ad hoc and lacking the theoretical foundations required of rigorous economic analysis.”

“‘Modern finance’ established those foundations but has not brought the theory to the question of fundamental analysis. Rather, it has been preoccupied with relative pricing... but expressions for pricing the fundamental security have not advanced much beyond the dividend discounting formula.”



"Passive investors accept market prices as fair value. Fundamental investors, in contrast, are active investors. They see that price is what you pay, value is what you get. They understand that the primary risk in investing is the risk of paying too much (or selling for too little). The fundamentalist actively challenges the market price: Is it indeed a fair price (p. 210, original emphasis)?"



"[B]e forwarned: none of these studies will provide a clean one-to-one mapping between the investor psychology literature and specific market anomalies. Rather, their goal is to simply set out the experimental evidence from psychology, sociology, and anthropology. The hope is that, thus armed, financial economists would be more attuned to, and more readily recognize, certain market phenomena as manifestations of these enduring human foibles."

1 Security Analysis: Background

2 The Investment CAPM

3 The Expected Growth Factor

4 Comparison with Accounting Models

The first principle of consumption:

$$E_t[M_{t+1} r^S_{it+1}] = 1$$

r^S_{it+1} stock i's return, M_{t+1} the stochastic discount factor

Equivalently,

$$E_t[r^S_{it+1}] - r_{ft} = \beta^M_{it} \lambda_{Mt}$$

r_{ft} real interest rate, β^M_{it} consumption beta, λ_{Mt} price of risk

An individual firm i maximizes the present value of net dividends:

$$P_{it} + D_{it} \quad \equiv \quad \max_{\{I_{it+s}, B_{it+s+1}\}_{s=0}^{\infty}} \; E_t \left[\sum_{s=0}^{\infty} M_{t+s} D_{it+s} \right]$$

in which

$$D_{it} = (1-\tau)[X_{it} A_{it} - \Phi(I_{it}, A_{it})] - I_{it} + B_{it+1} - r_{it}^{B} B_{it} + \tau \delta A_{it} + \tau (r_{it}^{B} - 1) B_{it}$$

- Retaining the Miller-Modigliani 1961 dividend irrelevance

Endogenous investment, differing from Feltham and Ohlson 1995, Ohlson 1995, Ohlson and Juettner-Nauroth 2005

The first principle of investment, $E_t[M_{t+1} r^I_{it+1}] = 1$, in which:

$$r^I_{it+1} = \frac{(1-\tau)\left[X_{it+1} + \frac{a}{2}\left(\frac{I_{it+1}}{A_{it+1}}\right)^2\right] + \tau\delta + (1-\delta)\left[1 + (1-\tau)a\left(\frac{I_{it+1}}{A_{it+1}}\right)\right]}{1 + (1-\tau)a\left(\frac{I_{it}}{A_{it}}\right)}$$

The weighted average cost of capital (Modigliani-Miller 1958 Propositions II and III):

$$r^I_{it+1} = w_{it}\, r^{Ba}_{it+1} + (1 - w_{it})\, r^S_{it+1}$$

w_{it} market leverage, r^{Ba}_{it+1} after-tax cost of debt

Combining the neoclassical investment theory and Modigliani and Miller 1958 yields an asset pricing theory:

$$r^S_{it+1} = r^I_{it+1} + \frac{w_{it}}{1 - w_{it}} \left(r^I_{it+1} - r^{Ba}_{it+1} \right)$$

Complementarity: The consumption CAPM derived from the demand of risky assets, the investment CAPM from supply

- Both hold in equilibrium, delivering identical expected returns
- Immune to the aggregation problem, the investment CAPM is more empirically tractable than the consumption CAPM

Cross-sectionally varying expected stock returns:
Investment-to-assets, expected profitability, and expected investment growth

- Security analysis in corporate bonds:

$$r_{it+1}^{Ba} = r_{it+1}^{I} - \frac{1 - w_{it}}{w_{it}} \left(r_{it+1}^{S} - r_{it+1}^{I} \right)$$

Fundamental analysis is consistent with efficient markets:

- Realized returns = expected returns + abnormal returns

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Prior work examines investment and profitability

- Hou, Xue, and Zhang 2015, see also Fama and French 2015

But the expected growth effect unexplored

Although performing well, the *q*-factor model leaves 46 anomalies significant at the 5% level (Hou, Xue, and Zhang 2017)

Construct cross-sectional forecasts of annual I/A changes

Form a factor based on the cross-sectional forecasts

Augmenting the q-factor model with the expected growth factor

Factor regressions with and without the expected growth factor

Annual Fama-MacBeth cross-sectional regressions of I/A changes

Motivating predictors based on a priori conceptual arguments:

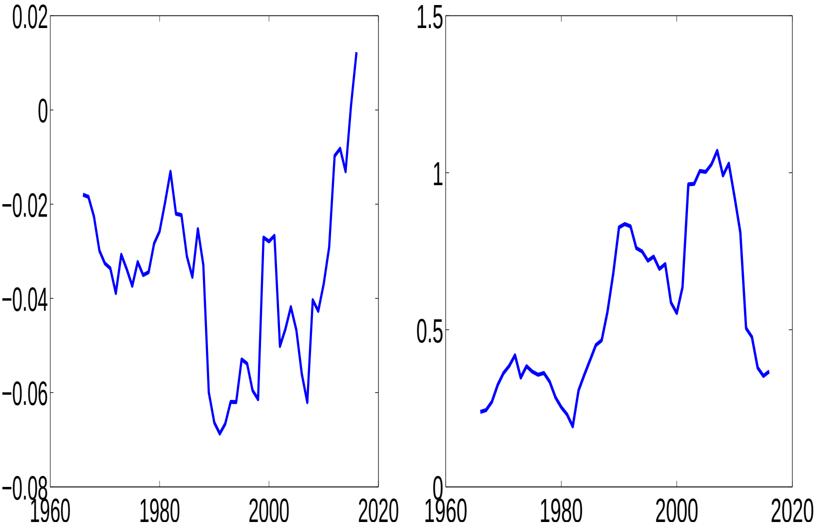
- Tobin's q: Erickson and Whited 2000
- Cash flow: Fazzari, Hubbard, and Petersen 1988

Total revenue minus cost of goods sold, minus selling, general, and administrative expenses, plus research and development expenditures, minus change in accounts receivable, minus change in inventory, minus change in prepaid expenses, plus change in deferred revenue, plus change in trade accounts payable, and plus change in accrued expenses, all scaled by book assets (Ball, Gerakos, Linnainmaa, and Nikolaev 2016)

The Expected Growth Factor

Cross-sectional regressions of τ-year-ahead I/A changes, weighted least squares, 1/1961–12/2016

τ		$\log(q)$	Cop	$R^2(\%)$	OOS Correlation Pearson	OOS Correlation Spearman
1	Slope	-0.03	0.55	4.78	0.15	0.19
	t	-3.38	6.44			
2	Slope	-0.08	0.74	7.77	0.16	0.20
	t	-5.55	6.25			
3	Slope	-0.09	0.76	7.77	0.17	0.21
	t	-6.46	6.09			


0.02
0
−0.02
−0.04
−0.06
−0.08
1960
1980
2000
2020
1.5
1
0.5
0
1960
1980
2000
2020

The Expected Growth Factor

Deciles on expected I/A changes, NYSE breakpoints with value-weights, 1/1967–12/2016

τ		Low	2	3	4	5	6	7	8	9	High	H−L
1	m	0.00	0.37	0.42	0.53	0.50	0.50	0.62	0.61	0.78	0.76	0.76
	t_m	−0.01	1.45	1.85	2.50	2.41	2.70	3.43	3.22	4.06	3.70	4.71
2	m	−0.01	0.33	0.41	0.45	0.50	0.63	0.63	0.71	0.68	0.81	0.82
	t_m	−0.03	1.38	1.97	2.12	2.58	3.50	3.41	3.64	3.59	3.56	5.26
3	m	0.00	0.29	0.39	0.54	0.47	0.60	0.70	0.60	0.69	1.01	1.01
	t_m	−0.01	1.28	1.77	2.71	2.42	3.26	3.46	2.90	3.56	4.50	5.93
1	α_q	−0.35	−0.18	−0.16	−0.06	−0.18	0.00	0.10	0.07	0.29	0.44	0.78
	t_q	−3.43	−1.83	−1.36	−0.72	−2.33	−0.01	1.25	0.98	3.54	4.22	5.40
2	α_q	−0.29	−0.14	−0.20	−0.11	−0.08	0.01	0.01	0.10	0.29	0.52	0.82
	t_q	−2.96	−1.68	−2.69	−0.99	−1.10	0.14	0.18	1.31	3.33	4.03	5.03
3	α_q	−0.29	−0.10	−0.26	−0.14	−0.08	0.03	0.15	0.19	0.31	0.52	0.81
	t_q	−2.91	−1.18	−2.84	−1.72	−1.13	0.38	2.00	2.34	3.13	3.24	4.08

Mean	α	MKT	Me	I/A	Roe		R^2
0.56	0.53	−0.16	−0.08	0.14	0.14		0.37
6.66	7.12	−8.13	−1.86	2.78	3.66		
	α	MKT	SMB	HML	UMD		R^2
	0.58	−0.17	−0.12	0.07	0.10		0.38
	8.75	−8.85	−3.56	2.22	5.88		
	α	MKT	SMB	HML	RMW	CMA	R^2
	0.56	−0.15	−0.09	−0.05	0.17	0.21	0.39
	7.59	−7.36	−2.49	−0.91	2.65	3.68	


AR 106ST

The Expected Growth Factor

The Q5 model: MKT, Me, I/A, Roe, and Eg

The Q5 model improves on the q-factor model substantially

	H−L alpha			m.a.e.	
	Magnitude	$\#_{\|t\|\geq 1.96}$	$\#_{\|t\|\geq 3}$	Mean	$\#_{p_{GRS}<5\%}$
$q4$	0.52	46	17	0.16	39
Q5	0.34	19	4	0.12	18

	Abr1	Abr6	Abr12	dEf1	Sm1	Ilr1	Cm1	Cim1
m	0.70	0.33	0.23	0.94	0.53	0.69	0.78	0.75
t_m	5.45	3.41	2.99	4.33	2.36	3.33	3.85	3.35
α_q	0.62	0.30	0.24	0.55	0.59	0.73	0.70	0.64
t_q	4.25	2.61	2.79	2.49	2.15	2.94	2.84	2.36
α_Q	0.65	0.30	0.24	0.53	0.55	0.68	0.76	0.46
t_Q	4.58	2.60	2.72	2.25	1.88	2.82	2.96	1.63
β_{Eg}	−0.06	−0.01	−0.01	0.05	0.08	0.11	−0.11	0.32
t_{Eg}	−0.40	−0.17	−0.14	0.29	0.40	0.63	−0.63	1.67
d1i	3.36	4.48	4.43	7.68	1.21	0.37	1.84	0.94
d2i	5.67	5.50	4.46	13.44	2.77	3.37	1.62	3.09
d3i	4.83	4.01	2.47	9.55	2.48	2.89	2.03	2.93
t_1	4.66	8.17	11.49	7.15	1.49	0.65	2.21	1.20
t_2	7.27	9.33	11.25	11.49	3.09	5.09	1.82	4.33
t_3	6.26	6.69	6.12	8.72	2.63	4.54	2.00	3.97

	Bm^{q}12	Nop	Em^{q}1	Ocp
m	0.48	0.63	−0.71	0.70
t_m	2.21	3.40	−3.21	3.14
α_q	0.37	0.35	−0.48	0.36
t_q	2.18	2.42	−2.00	1.98
α_Q	0.38	0.08	−0.47	0.20
t_Q	2.25	0.58	−1.92	1.14
β_{Eg}	−0.03	0.49	−0.02	0.30
t_{Eg}	−0.16	3.40	−0.09	1.67
d1i	−7.70	18.44	0.30	−1.32
d2i	−5.16	24.26	−3.37	5.14
d3i	−0.88	26.59	−4.98	7.70
t_1	−6.97	13.59	0.36	−1.27
t_2	−4.00	13.66	−2.99	3.82
t_3	−0.72	15.58	−5.79	6.43

The Expected Growth Factor

Using the Q5 model to explain 46 q-anomalies, investment, 1/1967–12/2016

	Noa	Nsi	Cei	Ivc	Oa	dWc	dFin	Dac	Pda
m	−0.44	−0.64	−0.57	−0.44	−0.27	−0.42	0.28	−0.39	−0.48
t_m	−3.25	−4.46	−3.32	−3.33	−2.19	−3.25	2.39	−2.95	−3.91
α_q	−0.45	−0.29	−0.29	−0.28	−0.56	−0.51	0.43	−0.67	−0.39
t_q	−2.59	−2.32	−2.25	−2.08	−4.10	−3.80	3.00	−4.73	−2.60
α_Q	−0.12	−0.12	0.00	−0.02	−0.26	−0.29	0.17	−0.32	−0.09
t_Q	−0.79	−0.90	0.01	−0.13	−1.85	−2.16	1.22	−2.22	−0.61
β_{Eg}	−0.62	−0.33	−0.54	−0.49	−0.56	−0.41	0.49	−0.65	−0.56
t_{Eg}	−5.58	−3.14	−4.85	−5.47	−5.31	−3.50	5.61	−6.81	−5.57
d1i	−49.21	−34.29	−8.74	−30.09	−2.29	−16.25	36.33	−6.16	−3.21
d2i	−54.36	−39.42	−18.67	−35.02	−6.73	−21.13	36.28	−9.86	−8.07
d3i	−53.26	−40.18	−22.51	−38.45	−8.36	−21.03	37.35	−8.92	−10.02
t_1	−18.41	−14.71	−6.29	−24.94	−1.15	−12.18	19.42	−4.40	−1.77
t_2	−19.29	−16.68	−13.26	−28.37	−3.26	−14.17	18.31	−6.23	−5.53
t_3	−18.99	−16.49	−12.69	−26.66	−3.89	−12.56	18.42	−5.30	−7.15

The Expected Growth Factor

Using the Q5 model to explain 46 q-anomalies, profitability, 1/1967–12/2016

	dRoe1	Ato^{q}1	Ato^{q}6	Ato^{q}12	Opa	Ola^{q}1	Ola^{q}12	Cop	Cla	Cla^{q}1	Cla^{q}6	Cla^{q}12
m	0.75	0.62	0.53	0.42	0.41	0.75	0.46	0.63	0.55	0.52	0.49	0.46
t_m	5.53	3.44	3.07	2.56	2.09	3.53	2.46	3.57	3.23	3.26	3.60	3.63
α_q	0.34	0.35	0.34	0.32	0.46	0.40	0.32	0.69	0.75	0.46	0.41	0.45
t_q	2.37	2.06	2.09	2.03	2.96	2.64	2.49	5.04	5.23	3.02	2.97	3.63
α_Q	0.42	0.07	0.09	0.09	−0.06	0.01	−0.10	0.12	0.19	0.09	0.01	0.07
t_Q	2.85	0.43	0.54	0.58	−0.42	0.06	−0.94	1.11	1.72	0.62	0.11	0.70
β_{Eg}	−0.14	0.52	0.47	0.42	0.97	0.72	0.77	1.09	1.06	0.68	0.72	0.69
t_{Eg}	−1.09	3.79	4.13	3.99	10.19	7.22	9.46	14.53	13.88	6.53	9.90	10.65
d1i	5.02	6.83	7.83	7.31	10.88	11.50	6.47	20.49	7.33	−1.49	0.41	2.92
d2i	14.38	11.37	10.10	7.98	12.22	12.98	5.76	27.01	12.58	6.40	6.93	7.43
d3i	12.65	9.27	8.10	6.04	13.22	9.85	4.05	28.57	13.99	6.64	6.79	7.47
t_1	3.71	5.82	6.74	6.51	5.16	6.78	4.63	10.67	3.65	−1.85	0.59	4.12
t_2	17.09	7.87	7.69	6.81	4.75	6.94	3.93	12.73	7.05	7.77	8.48	8.50
t_3	15.38	6.22	5.94	5.00	4.83	4.94	2.47	11.99	7.18	7.04	7.38	8.12

	Rdm	Rdm^{q}1	Rdm^{q}6	Rdm^{q}12	Rer	Eprd	R_a^1	$R_a^{[2,5]}$	$R_a^{[6,10]}$	$R_a^{[11,15]}$	$R_a^{[16,20]}$
m	0.70	1.11	0.80	0.82	0.34	−0.53	0.67	0.69	0.83	0.62	0.54
t_m	2.75	2.91	2.18	2.43	2.44	−2.96	3.43	4.11	5.06	4.46	3.26
α_q	0.72	1.39	0.95	0.81	0.34	−0.55	0.58	0.81	1.11	0.60	0.62
t_q	3.11	3.06	2.87	3.01	2.05	−3.02	2.75	4.06	5.05	3.48	3.22
α_Q	0.27	1.30	0.72	0.52	0.30	−0.48	0.52	0.79	1.00	0.57	0.57
t_Q	1.22	2.74	2.07	1.85	1.75	−2.97	2.47	3.82	4.78	3.40	2.64
β_{Eg}	0.86	0.17	0.42	0.52	0.08	−0.12	0.11	0.03	0.20	0.05	0.10
t_{Eg}	5.12	0.50	1.35	2.18	0.49	−0.83	0.60	0.21	1.29	0.33	0.85
d1i	−0.15	−6.05	−4.81	−2.54	−2.18	0.96	6.08	−2.58	−0.08	−0.94	0.40
d2i	5.68	−3.05	0.47	4.65	4.30	1.56	4.32	−3.61	−1.12	0.08	0.51
d3i	5.75	3.84	6.63	9.73	4.64	1.41	2.96	−5.15	−1.74	−0.69	0.85
t_1	−0.12	−2.86	−2.66	−1.84	−1.79	1.00	10.54	−4.33	−0.17	−1.81	0.98
t_2	3.11	−1.19	0.20	2.26	4.48	1.70	6.22	−6.51	−1.80	0.16	1.19
t_3	3.36	1.49	2.78	4.75	4.87	1.55	4.22	−8.52	−3.06	−1.21	1.84

	Isff1	Isq1
m	0.28	0.25
t_m	3.11	2.80
α_q	0.27	0.29
t_q	2.56	2.84
α_Q	0.23	0.19
t_Q	2.02	1.74
β_{Eg}	0.09	0.19
t_{Eg}	1.13	2.39
d1i	0.10	0.35
d2i	0.17	0.81
d3i	0.23	0.72
t_1	0.23	0.92
t_2	0.39	1.63
t_3	0.53	1.34

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The investment CAPM has more appealing theoretical properties on the cost of capital than popular accounting models

Preinreich 1938, Miller and Modigliani 1961, Ohlson 1995:

$$\frac{P_{it}}{Be_{it}} = \frac{\sum_{\tau=1}^{\infty} E[Y_{it+\tau} - \triangle Be_{it+\tau}]/(1+r_i)^{\tau}}{Be_{it}}$$

$$\frac{P_{it}}{Be_{it}} = \frac{\sum_{\tau=1}^{\infty} E[Y_{it+\tau} - r_i Be_{it+\tau}]/(1+r_i)^{\tau}}{Be_{it}}$$

A voluminous implied cost of capital literature:

- Claus and Thomas 2001, Gebhardt, Lee, and Swaminathan 2001, Easton 2004
- Botosan 1997, Botosan and Plumlee 2002, Hribar and Jenkins 2004, Hail and Leuz 2006, Pastor, Sinha, and Swaminathan 2008, Lee, Ng, and Swaminathan 2009
- Easton and Monahan 2005, Guay, Kothari, and Shu 2011

Fama and French 2015 derive three predictions, all else equal:

- A lower P_{it}/Be_{it} means a higher r_i
- A higher $E[Y_{it+\tau}]$ means a higher r_i
- A higher $E[\triangle Be_{it+\tau}]/Be_{it}$ means a lower r_i

Gebhardt, Lee, and Swaminathan 2001:

$$P_t = Be_t + \sum_{\tau=1}^{11} \frac{(E_t[\text{Roe}_{t+\tau}] - \text{ICC}) \times Be_{t+\tau-1}}{(1+\text{ICC})^{\tau}} + \frac{(E_t[\text{Roe}_{t+12}] - \text{ICC}) \times Be_{t+11}}{\text{ICC} \times (1+\text{ICC})^{11}}$$

Easton 2004:

$$P_t = \frac{E_t[Y_{t+2}] + \text{ICC} \times E_t[D_{t+1}] - E_t[Y_{t+1}]}{\text{ICC}^2}$$

Claus and Thomas 2001:

$$P_t = Be_t + \sum_{\tau=1}^{5} \frac{(E_t[\text{Roe}_{t+\tau}] - \text{ICC}) \times Be_{t+\tau-1}}{(1+\text{ICC})^{\tau}} + \frac{(E_t[\text{Roe}_{t+5}] - \text{ICC}) \times Be_{t+4} \times (1+g)}{(\text{ICC} - g) \times (1+\text{ICC})^{5}}$$

Ohlson and Juettner-Nauroth 2005:

$$\mathrm{ICC} = A + \sqrt{A^2 + \frac{E_t[Y_{t+1}]}{P_t} \times (g - (\gamma - 1))}$$

in which

$$\begin{aligned} A &\equiv \frac{1}{2}\left((\gamma - 1) + \frac{E_t[D_{t+1}]}{P_t}\right) \\ g &\equiv \frac{1}{2}\left(\frac{E_t[Y_{t+3}] - E_t[Y_{t+2}]}{E_t[Y_{t+2}]} + \frac{E_t[Y_{t+5}] - E_t[Y_{t+4}]}{E_t[Y_{t+4}]}\right) \end{aligned}$$

Comparison with Accounting Models

ICC is not the one-period-ahead expected return, IBES earnings forecasts, 1979–2016

	AR	ICC	Diff	AR	ICC	Diff
		GLS			Easton	
SMB	1.51	0.88	0.64	1.57	2.51	−0.94
[t]	0.76	4.62	0.33	0.82	14.85	−0.50
HML	2.98	3.50	−0.52	2.90	3.26	−0.36
[t]	1.39	18.91	−0.25	1.29	7.45	−0.17
RMW	3.72	−1.19	4.91	4.48	−3.27	7.75
[t]	2.64	−8.27	3.58	2.82	−9.44	4.75
CMA	3.46	0.64	2.82	3.58	2.45	1.13
[t]	2.87	4.69	2.42	3.14	7.91	1.08
		CT			OJ	
SMB	1.55	1.11	0.43	1.70	0.68	1.02
[t]	0.78	6.84	0.22	0.86	4.57	0.53
HML	3.12	0.14	2.98	2.05	0.73	1.32
[t]	1.42	0.42	1.33	0.98	3.77	0.63
RMW	3.66	0.29	3.38	4.07	−0.05	4.12
[t]	2.68	1.94	2.48	3.41	−0.27	3.41
CMA	3.41	0.11	3.30	3.15	0.08	3.07
[t]	2.88	0.79	2.78	2.79	0.48	2.70

Comparison with Accounting Models

ICC is not the expected return, cross-sectional earnings forecasts, 1967–2015

	AR	ICC	Diff	AR	ICC	Diff
		GLS			Easton	
SMB	2.57	1.52	1.04	2.38	5.11	−2.72
[t]	1.25	4.02	0.53	1.18	6.96	−1.44
HML	3.36	5.57	−2.20	3.27	7.23	−3.96
[t]	1.83	27.23	−1.24	1.77	15.32	−2.08
RMW	3.46	−1.43	4.89	4.06	−3.66	7.72
[t]	2.72	−6.54	4.00	2.77	−10.22	5.00
CMA	3.72	1.59	2.13	4.46	4.06	0.40
[t]	3.17	9.09	1.87	4.34	11.56	0.37
		CT			OJ	
SMB	2.65	2.71	−0.06	3.73	3.21	0.52
[t]	1.29	4.23	−0.03	1.91	5.39	0.28
HML	3.14	3.68	−0.54	2.85	4.74	−1.89
[t]	1.71	16.21	−0.29	1.69	17.64	−1.10
RMW	3.18	−0.01	3.19	3.16	−1.57	4.72
[t]	3.01	−0.03	3.04	3.14	−5.50	4.45
CMA	3.32	1.52	1.81	3.89	2.12	1.77
[t]	2.92	11.29	1.54	3.35	11.11	1.54

Reformulating the residual income model with $E_t[r_{it+1}]$:

$$
\begin{aligned}
P_{it} &= \frac{E_t[Y_{it+1} - \triangle Be_{it+1}] + E_t[P_{it+1}]}{1 + E_t[r_{it+1}]}, \\
\frac{P_{it}}{Be_{it}} &= \frac{E_t\left[\frac{Y_{it+1}}{Be_{it}}\right] - E_t\left[\frac{\triangle Be_{it+1}}{Be_{it}}\right] + E_t\left[\frac{P_{it+1}}{Be_{it+1}}\left(1 + \frac{\triangle Be_{it+1}}{Be_{it}}\right)\right]}{1 + E_t[r_{it+1}]}, \\
\frac{P_{it}}{Be_{it}} &= \frac{E_t\left[\frac{Y_{it+1}}{Be_{it}}\right] + E_t\left[\frac{\triangle Be_{it+1}}{Be_{it}}\left(\frac{P_{it+1}}{Be_{it+1}} - 1\right)\right] + E_t\left[\frac{P_{it+1}}{Be_{it+1}}\right]}{1 + E_t[r_{it+1}]}.
\end{aligned}
$$

This prediction consistent with the investment CAPM

Comparison with Accounting Models

Past investment does not forecast future investment, annual cross-sectional regressions of future book equity growth on past asset growth (book equity growth), 1963–2015

		$\frac{\triangle Be_{it+\tau}}{Be_{it+\tau-1}} = \gamma_0 + \gamma_1 \frac{\triangle A_{it}}{A_{it-1}} + \epsilon_{t+\tau}$					$\frac{\triangle Be_{it+\tau}}{Be_{it+\tau-1}} = \gamma_0 + \gamma_1 \frac{\triangle Be_{it}}{Be_{it-1}} + \epsilon_{t+\tau}$				
τ	#firms	γ_0	$t(\gamma_0)$	γ_1	$t(\gamma_1)$	R^2	γ_0	$t(\gamma_0)$	γ_1	$t(\gamma_1)$	R^2
1	3,105	0.09	14.46	0.22	13.94	0.05	0.09	13.10	0.20	8.47	0.06
2	2,843	0.10	14.32	0.10	7.60	0.01	0.10	14.43	0.10	5.21	0.02
3	2,624	0.10	14.71	0.06	6.31	0.01	0.10	14.70	0.06	4.05	0.01
4	2,431	0.10	15.78	0.05	5.53	0.00	0.10	15.88	0.05	3.69	0.00
5	2,259	0.10	14.76	0.04	3.44	0.00	0.10	15.71	0.02	1.92	0.00
6	2,103	0.10	14.99	0.05	4.57	0.00	0.10	14.71	0.03	2.27	0.00
7	1,961	0.09	15.15	0.04	4.43	0.00	0.10	15.26	0.03	2.68	0.00
8	1,828	0.09	15.07	0.03	4.14	0.00	0.10	15.35	0.01	1.71	0.00
9	1,706	0.09	15.09	0.03	3.37	0.00	0.10	15.16	0.01	1.19	0.00
10	1,593	0.09	14.47	0.04	4.32	0.00	0.09	14.61	0.02	2.13	0.00

Consistent with the lumpy investment literature (Dixit and Pindyck 1994, Doms and Dunne 1998, Whited 1998)

Building on Easton, Harris, and Ohlson 1992, PRRT work with:

$$\begin{aligned} E_t[r^S_{it+1}] &= E_t\left[\frac{P_{it+1} + D_{it+1} - P_{it}}{P_{it}}\right] \\ &= \frac{E_t[Y_{it+1}]}{P_{it}} + E_t\left[\frac{(P_{it+1} - Be_{it+1}) - (P_{it} - Be_{it})}{P_{it}}\right] \end{aligned}$$

The expected change in the market-minus-book equity linked to the expected earnings growth (Shroff 1995)

Mark-to-market:

$$P_{it} = Be_{it} \quad \Rightarrow \quad E_t[r^S_{it+1}] = \frac{E_t[Y_{it+1}]}{P_{it}}$$

No earnings growth:

$$P_{it+1} - Be_{it+1} = P_{it} - Be_{it} \quad \Rightarrow \quad E_t[r^S_{it+1}] = \frac{E_t[Y_{it+1}]}{P_{it}}$$

Growth related to risk and return:

- Ohlson and Juettner-Nauroth 2005: The expected return as a weighted average of the forward earnings yield and book-to-market (a proxy for the expected earnings growth)

Penman and Zhang 2012: Accounting conservatism expenses R&D and advertising, inducing high expected earnings growth

Penman and Reggiani 2013: Deferring earnings recognition raises the expected earnings growth, connected to risk (uncertainty)

Penman and Zhu 2014: Many anomaly variables forecast the forward earnings yield and two-year-ahead earnings growth in the cross section, in the same direction of forecasting returns

Penman and Zhang 2016: Under conservative accounting, a lower Roe implies higher risk and a higher expected return

Penman and Zhu 2016: Regress future returns on variables connected to expected earnings growth to estimate costs of capital

Both models study the one-period-ahead expected return, as opposed to the internal rate of return in the residual income model

The one-period-ahead expected earnings and expected growth as the key drivers of the expected return:

- Earnings scaled with the market equity in PRRT, but book assets in the investment CAPM

The PRRT model uses accounting insights to link the expected market-minus-book equity change to the expected earnings growth

- The investment CAPM uses the investment-value linkage to substitute, analytically, capital gain with investment growth

The PRRT model still has the market equity, the investment CAPM is more "fundamental" via the investment-value linkage

Accounting conservatism implies a negative Roe-expected return relation, but the investment CAPM implies a positive relation

The PRRT model picks earnings yield to proxy for the forward earnings yield, and book-to-market to proxy for the expected earnings growth to explain the cross section of expected returns

Investment-to-assets, profitability, and expected investment growth subsume earnings yield and book-to-market empirically

Complementarity: Overlay the economics of the investment CAPM with PRRT's accounting under uncertainty

The investment CAPM reconciles the Graham-Dodd philosophy of value investing with neoclassical economics

- Cross-sectionally varying expected returns, depending on firms' investment, profitability, and expected investment growth
- An appealing alternative to accounting models for characterizing the cost of capital

An upgraded q-factor model augmented with an expected investment growth factor (the Q5 model)