CHULALONGKORN BUSINESS SCHOOL

FLAGSHIP FOR LIFE

Practical Corporate Financial Modeling

Opportunity Cost

Cost of Capital

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Why cost of capital matter?

A man wants to award a contract that gives you THB 10 million every year for 5 years. How much will you bid for the contract?

- **Discount rate of zero**: Present benefits and future benefits are valued equally—there is no preference between receiving a benefit today or in the future.

- **Low discount rate**: Present benefits are only slightly more valuable than future benefits.

- **High discount rate**: Present benefits are much more valuable than future benefits.

What's a FAIR rate of return?

https://www.rff.org/publications/explainers/discounting-101/

To create value, firms should focus on three things: maximize returns, minimize risk and maximize growth, and the order is very important.

Let's take a look at a simple DCF model with perpetual growth.

$$EV = \frac{FCF}{r - g}$$

free cash flow comes from profit & investment & dis investment

With some assumptions (not covered here) and further simplification, we can write:

$$EV = \left[\frac{ROIC - g}{r - g}\right] \times IC = M \times IC$$

We want M > 1. In order to achieve that, we must (1) have **ROIC > r**. Then, if and only if this is achieved, we can proceed to (2) maximize **g**.

Economic value added (EVA) is an alternative measure of value creation.

How much excess profit firm can generate

P/BV > 1   business generates profit to investors

- Economic value added (EVA) measures economic profits.
  abnormal profit

- Invested capital can be thought of as the economic capital employed. Capital is not free! So let's define

$$NOPAT = EBIT \times (1 - T)$$

$$Capital\ charge = IC \times r$$

$$EVA = NOPAT - capital\ charge$$

$$EVA = (ROIC - r) \times IC$$

- EVA is calculated on a period-by-period basis like cash flow, but it measures the addition value created from the capital employed.

Does business generate enough profit to satisfy investors?
↳ deploy capital in productive way

STERN STEWART'S

EVA
ECONOMIC VALUE ADDED

THE REAL KEY TO
CREATING WEALTH

AL EHRBAR
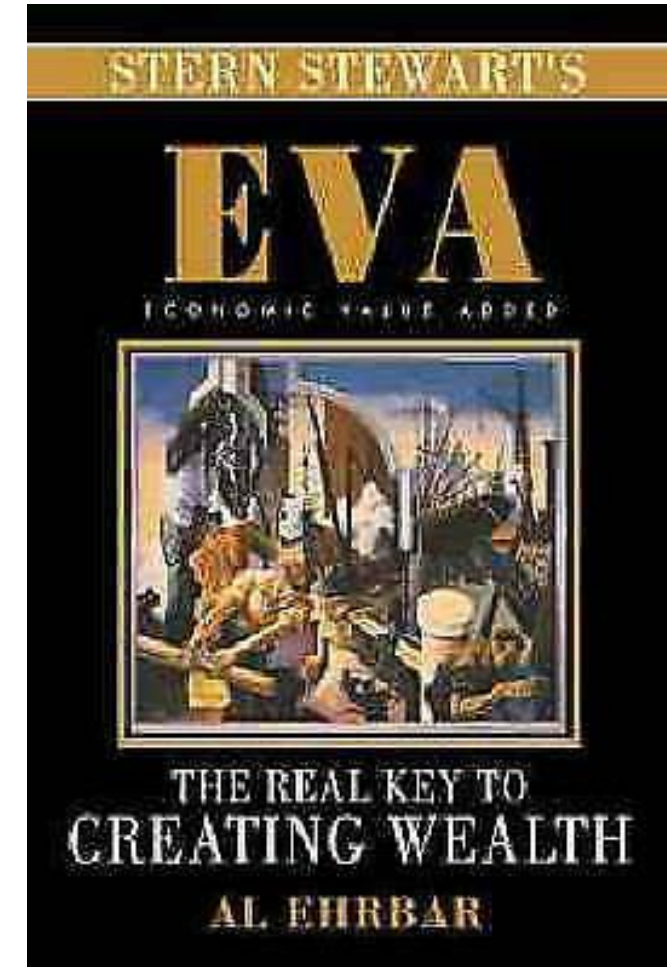
Add the PV of EVA to original IC and we get firm value.

- From before, the enterprise value (EV) is given by:

$$EV = \frac{FCF}{r-g} = \left[\frac{ROIC - g}{r-g}\right] \times IC$$

profitability

same thing

- With EVA formulation, we have:

How much you put in?

$$EV = IC + \frac{EVA}{r-g} = IC + \frac{(ROIC - r) \times IC}{r-g}$$

$$= \left[\frac{ROIC - g}{r-g}\right] \times IC$$

is Firm generate enough (ROIC) return compared to cost of capital

generate enough profit or not?

Often, retained earnings are not immediately invested but instead kept on balance sheet as 'excess cash'.

$$WACC = r_d(1-T)W_d + r_e W_e$$

$$r_e = \frac{WACC - r_d(1-T)W_d}{W_e}$$

$$EV = \frac{FCF}{r-g} \rightarrow EV(r-g) = FCF$$

$$r = \frac{FCF + gEV}{EV}$$

Cash on hand = operating cash + excess cash

- Operating cash is part of NOWC and needs to be estimated.

- Excess cash is part of firm value, but not enterprise value.

Firm value = Excess Cash + EV

Net Debt = Debt – Excess Cash

EV = Net Debt + Equity

Excess Cash	Debt
Enterprise Value	
	Equity

The cost of capital is the required rate of return the firm must generate in order to compensate investors for their capital. If ROIC > r, then the firm is creating value.

Capital < debt, equity

ROIC

| Net Operating Working Capital | Debt (Book Value) 50 |
| Net Long-Term Assets | Equity 100 (Book Value) |

what people put it
↓
not represent what shdr get when selling firm

sell for 200 → D/V = 50/200
→ E/V = 150/200

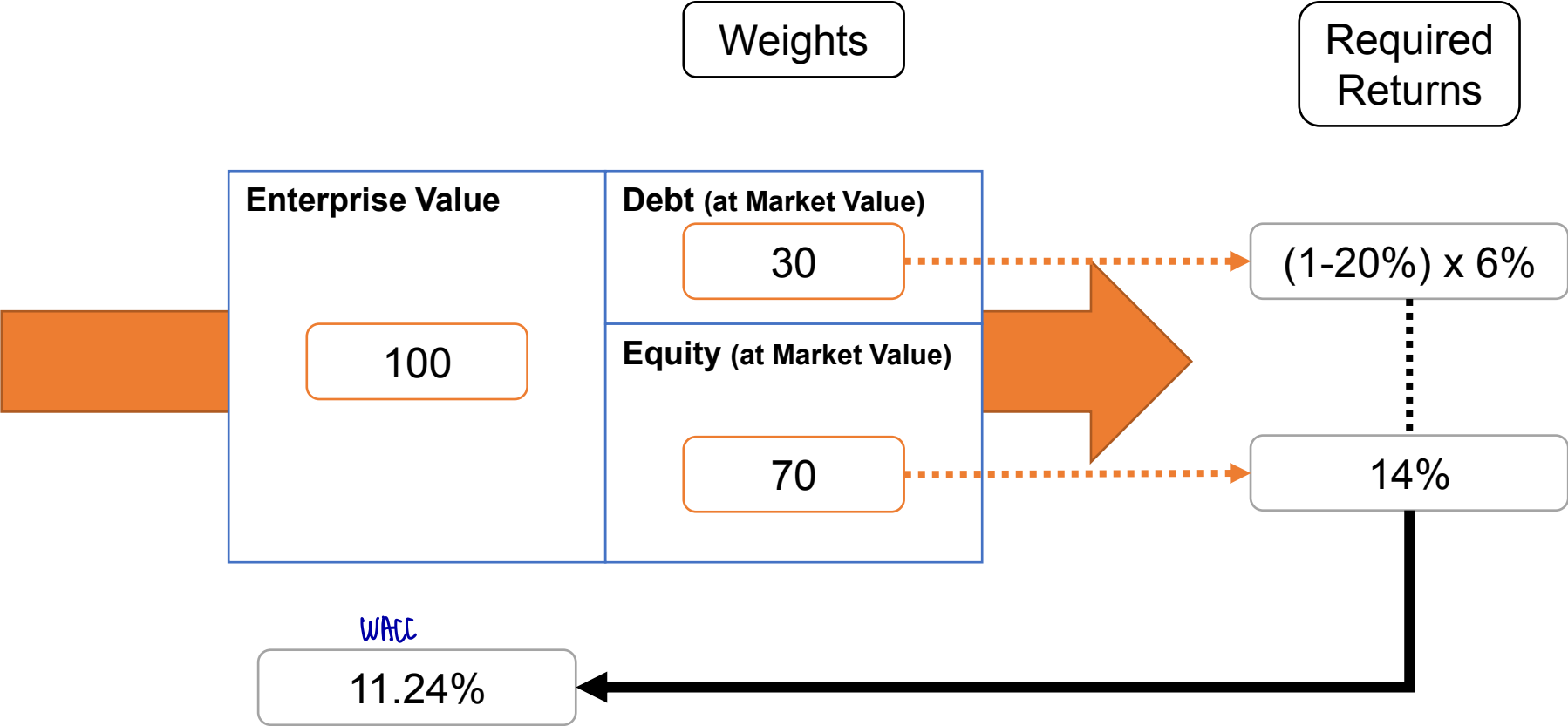| Enterprise Value (EV) | Debt (Market Value) |
| | Equity (Market Value) |

r
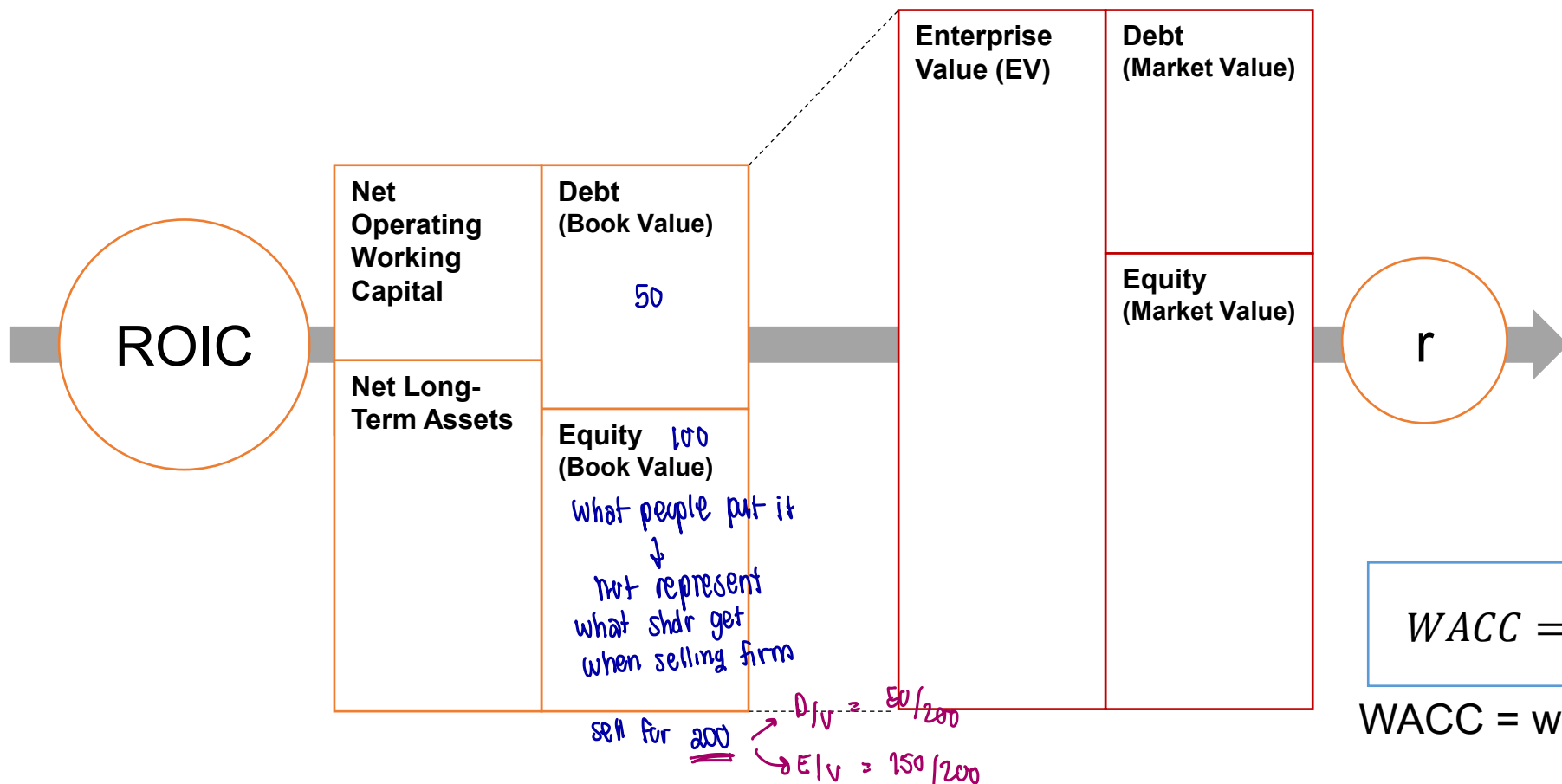
For firm-level [free] cash flow, we use the weighted average rate. With no friction, the balance sheet identity holds. However, because of frictions, this is not the case.

The most prominent one is tax, making relevant cost of debt after-tax instead.

$$WACC = \frac{D}{D+E} r_D (1-T) + \frac{E}{D+E} r_E$$

WACC = weighted average cost of capital

Weights

Required Returns

Enterprise Value

100

Debt (at Market Value)

30

Equity (at Market Value)

70

(1-20%) x 6%

14%

WACC

11.24%

Practical issues with estimating cost of capital

Practical issues with CAPM

The CAPM equation is given by:

$$r_i = r_f + \beta_i \left(r_m - r_f \right)$$

where

r_i = required return on asset i

r_f = risk-free rate of return, but what's "risk-free"?

β_i = beta coefficient, but how to estimate beta?

r_m = market return, but what's "market"?

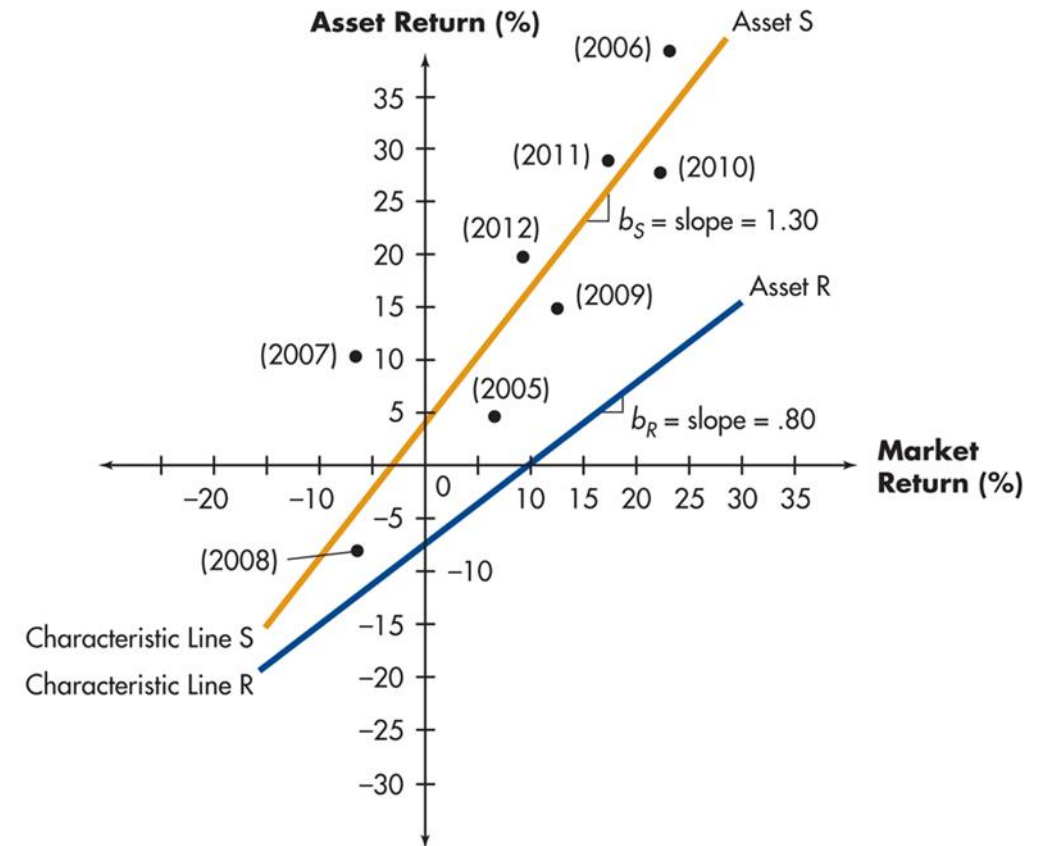# The beta can be estimated using linear regression.

- The CAPM equation looks like a linear regression equation.

$$r_i = r_f + \beta_i(r_m - r_f)$$
$$r_i = a_i + b_i r_m + \varepsilon_i$$

FIGURE 8.8

Beta Derivation^a
Graphical derivation of beta for assets R and S

^{a}All data points shown are associated with asset S. No data points are shown for asset R.

The beta measures how correlated the asset's returns are with market returns.

- Beta can be decomposed into correlation with market (direction) and ratio between the asset's dispersion relative to market dispersion (magnitude).

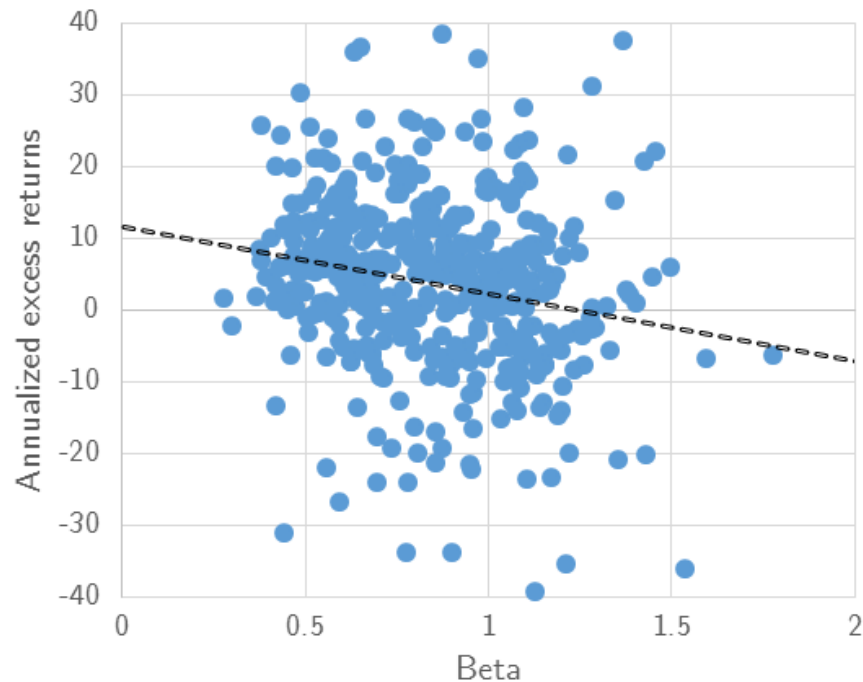$$\beta_i = \frac{cov(r_i, r_m)}{var(r_m)} = \frac{\sigma_{im}}{\sigma_m^2} = \frac{\rho_{im}\sigma_i\sigma_m}{\sigma_m^2} = \boldsymbol{\rho_{im}} \times \frac{\boldsymbol{\sigma_i}}{\boldsymbol{\sigma_m}}$$

- The correlation could have been chosen between any pair of assets. Why do you think the market chosen as the reference asset?
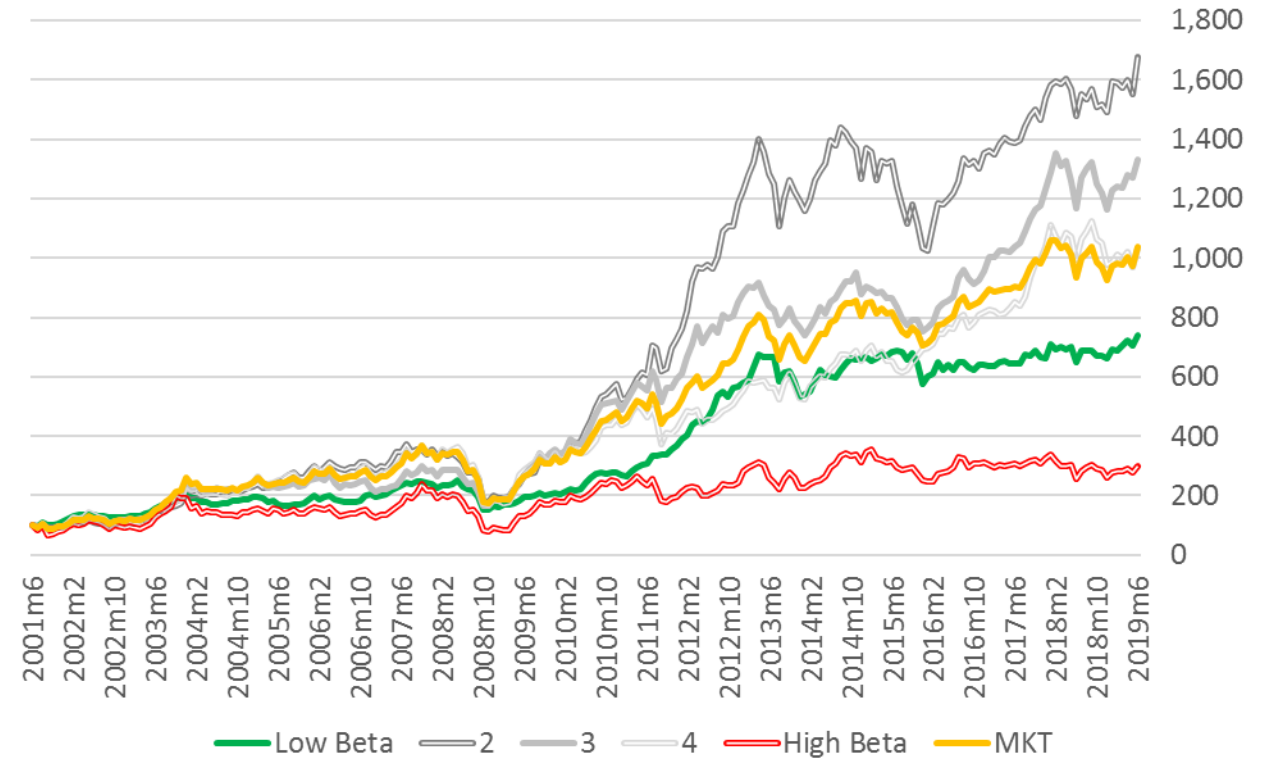
Empirically, the CAPM doesn't always hold.

- See, for example, Black (1972)

Saengchote, K. (2017). THE LOW-RISK ANOMALY: EVIDENCE FROM THE THAI STOCK MARKET. Asian Academy of Management Journal of Accounting & Finance, 13(1).

Stocks in SET100 from June 2001 to June 2019. Betas are estimated with Fama-French produced using 60 months historical returns, requiring at least 24 months, with value-weighted return of SET and MAI stocks as market portfolio and one-month treasury bill as risk-free rate. Portfolios are rebalanced monthly based on the most updated beta.
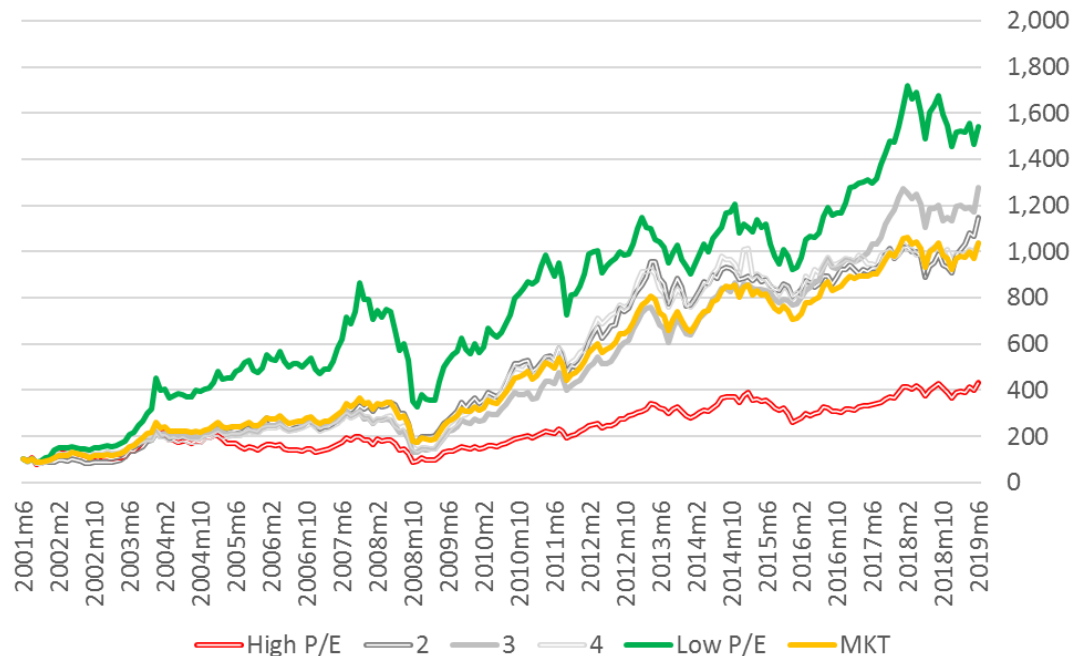
Other practical issues for the beta

- What's the estimation window?

- Is it free from estimation error?
    - Adjustment. See Blume (1975) and Vasicek (1973)

- Is it static over time?
    - Conditional beta. See Jagannathan and Wang (1996)
    - Dynamic conditional beta. See Bali, Engle and Tang (2016)

Also, certain stock characteristics are found to be correlated with returns…

Stocks in SET100 from June 2001 to June 2019. Portfolios are rebalanced annually in June based on EPS from last fiscal year and price per share at end of December.
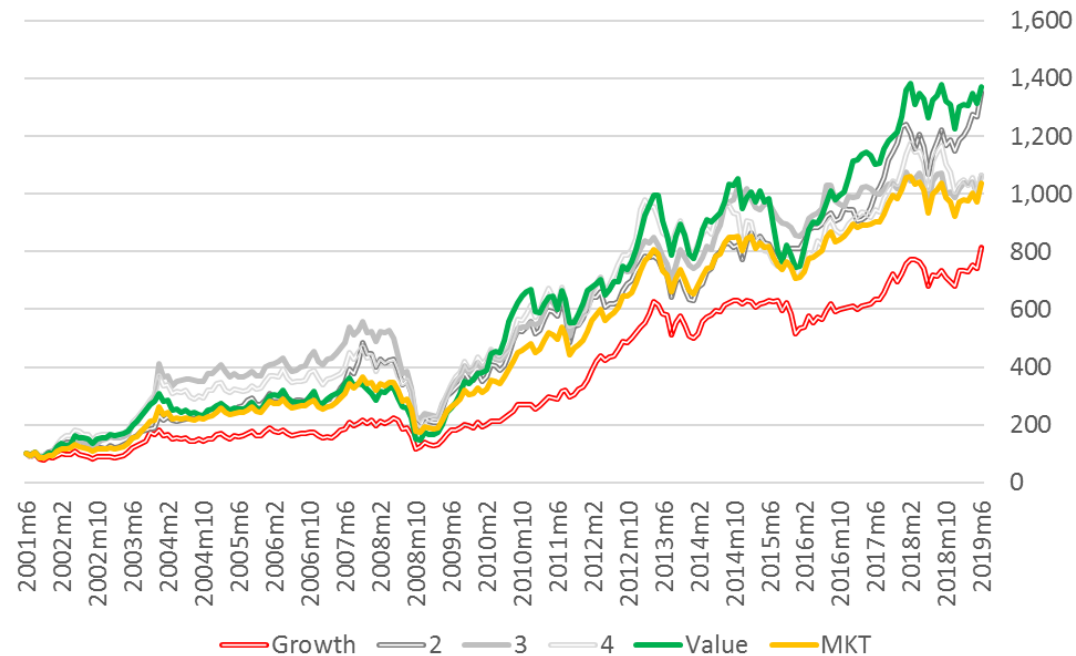
Stocks in SET100 from June 2001 to June 2019. Portfolios are rebalanced annually in June based on book value of equity from last fiscal year and market capitalization at end of December. Growth stocks are stocks with low B/M ratio and vice versa.

…so are these **'anomalies'** [our asset pricing model is right; the market is inefficient], or are our definition of 'systematic' risk wrong [the market is efficient; our asset pricing model is wrong]?
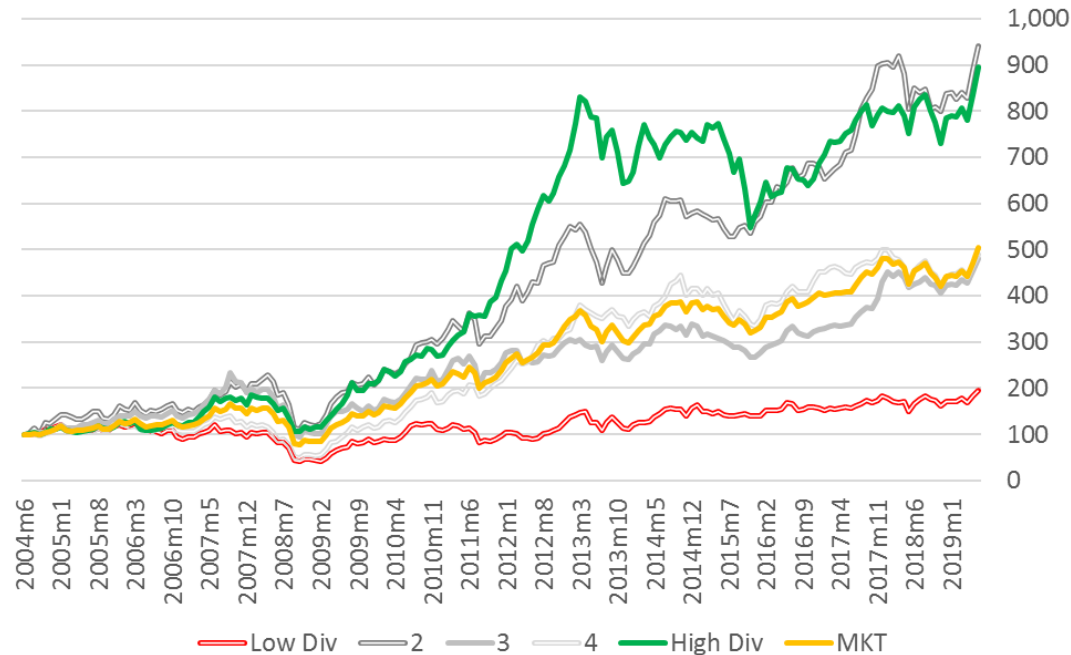
Stocks in SET100 from June 2001 to June 2019. Portfolios are rebalanced annually in June based dividend yield from end-of-December.
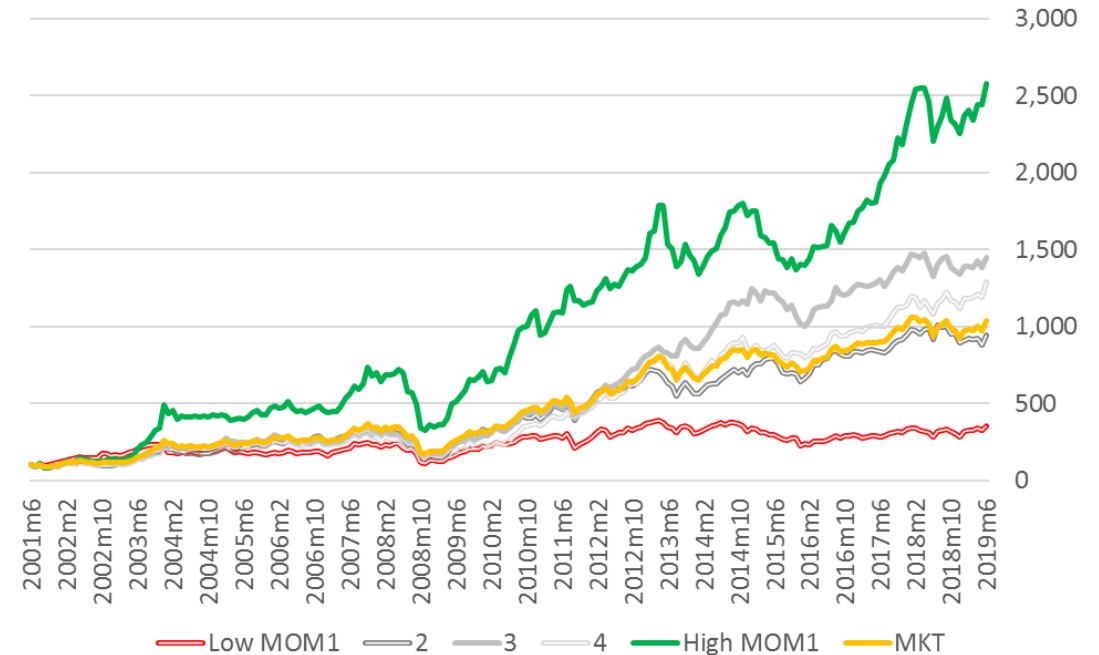
Stocks in SET100 from June 2001 to June 2019. . Portfolios are rebalanced monthly based on the most recent monthly return.

Arbitrage pricing theory by Ross (1976) allows for broader specification of risk 'factors'.

- Absence of arbitrage → two portfolios that have the same payoff must have the same price. If we can construct securities from factors, we can price them, too!

$$m = a + b'f$$
$$E(R^i) = R^f + \beta_i'\lambda$$

- In practice, we are pretty casual about what "factors" and "factor loadings" are. For convenience, we will use the following equation:

$$R_t^{ei} = \alpha_i + \beta_i'f_t + \varepsilon_t^i, \qquad t = 1,2,\dots,T$$

Alternatively, implied cost of equity can be estimated using valuation model.

- The dividend discount (DD) model

price to back out implied cost of capital

$$P_t(x) = \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[d_{t+\tau}]$$

Many variants exist. See:
- Gordon and Gordon (1997)
- Botosan and Plumee (2002)
- Claus and Thomas (2001)
- Gebhardt, Lee and Swaminathan (2001)
- Ohlson and Juettner-Nauroth (2005)
- Easton (2004)

- Two variants:

$$P_t(x) = \frac{E_t[d_{t+1}]}{r-g}$$

Gordon Growth Model

residual income model

$$P_t(x) = b_t + \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[x_{t+\tau} - r b_{t+\tau-1}]$$

Residual Income Model

Debt has lower cost of capital, so why not use more debt than equity to reduce WACC?

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Weights

Required Returns

Enterprise Value	Debt (at Market Value)
100	50
	Equity (at Market Value)
	50

(1-20%) x 6%

14%

9.40%

hold cash → bond → int income
& pay tax!
↓
negative tax shield

Negative debt
Negative tax shield ⇒ $T_c \times$ int expenses

Borrow more money → WACC↓ → make your company attractive

bc we kept coc constant
go back to 0% debt first → HAMADA equation

Cost of Capital - Kanis Saengchote, Ph.D. ©

When we *change capital structure*, the appropriate cost of equity must change, since **equity risk = business risk + financial risk**.

- The business risk is unaffected by changes in capital structure, but with more debt, equity investors face increased risk.

- The **Hamada Equation** to unlever/relever equity beta is a necessary tool for this situation.

Unlever: removing financial risk

Relever: incorporating financial risk

$$\beta_E^U = \frac{\beta_E^L}{\left[1 + \frac{D}{E}(1 - \tau)\right]}$$

$$\beta_E^L = \left[1 + \frac{D}{E}(1 - \tau)\right]\beta_E^U$$

Another name for the unlevered equity beta β_E^U is the "asset" beta, since it reflects the business risk. This is because when a firm has no debt, the risk of the business is borne entirely by its equity investors.

The Hamada equation as we know it requires 3 assumptions.

① Assume $\beta_D = 0$

$$\underset{\text{price yield}}{\frac{P_{t+1} - P_t}{P_t}} + \underset{\text{div yield}}{\frac{D_{t+1}}{P_t}}$$

$$r_d - r_f = \beta_D (r_M - r_f)$$
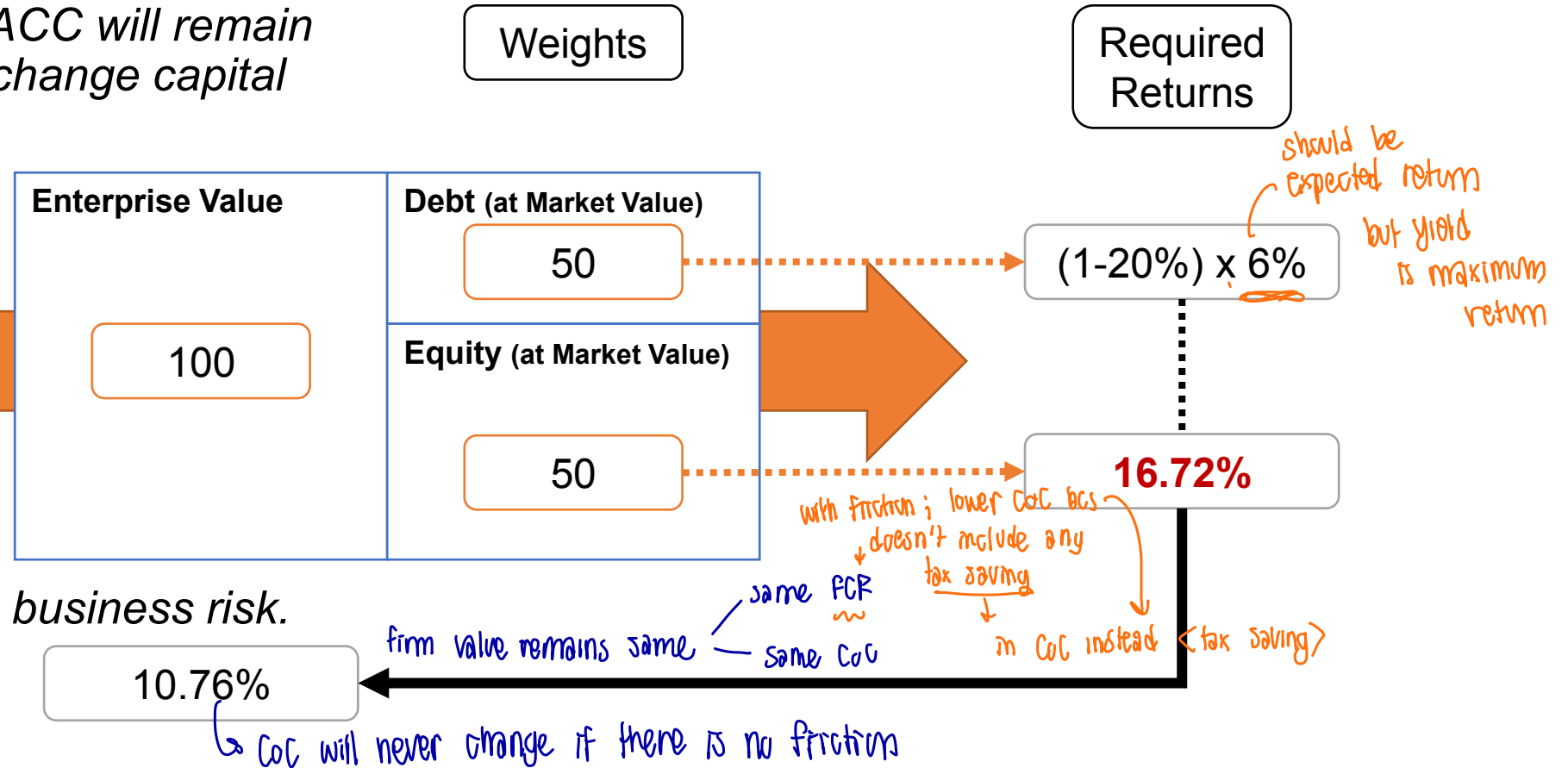
actually positive not zero!!

WACC can be reduced from 11.24%, but the real mechanism is through interest **tax savings**, so the magnitude is smaller. This is one of the most common misunderstandings in practice.

leveraged equity → more sensitive

In absence of tax, WACC will remain constant even if you change capital structure.

Weights

Required Returns

Enterprise Value	Debt (at Market Value)
100	50
	Equity (at Market Value)
	50

(1-20%) x 6%

should be expected return but yield is maximum return

16.72%

with friction; lower CoC bcs doesn't include any tax saving

in CoC instead ⟨tax saving⟩

The best way to meaningfully reduce WACC is to minimize business risk.

same FCF

firm value remains same — *same CoC*

10.76%

↳ CoC will never change if there is no friction

M&M 1

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How to estimate cost of debt?

Bond yield and bond return are NOT the same concept. Do you expect to receive the quoted yield if you invested in this bond?

Financial collapse

Greece

GGGB10YR

2011   2012   2013   2014   2015

30.000

20.000

10.000

03/02   37.101

Source: http://www.bloomberg.com/quote/GGGB10YR:IND

Gout may default
no guarantee

NIM → assume bank can collect all debt
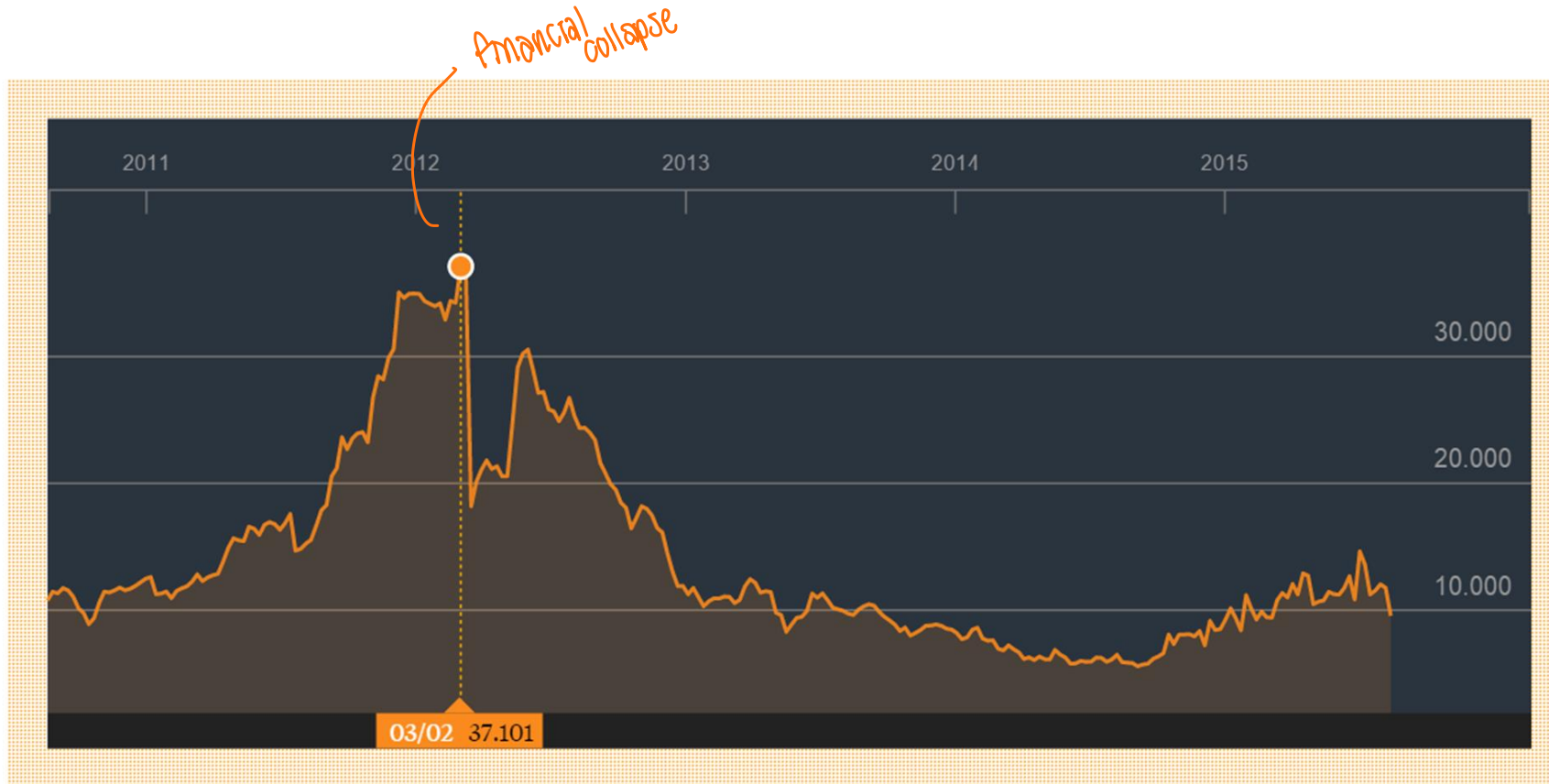
Thus, sometimes the YTM is also called **promised yield**.

Cost of debt: theory versus practice

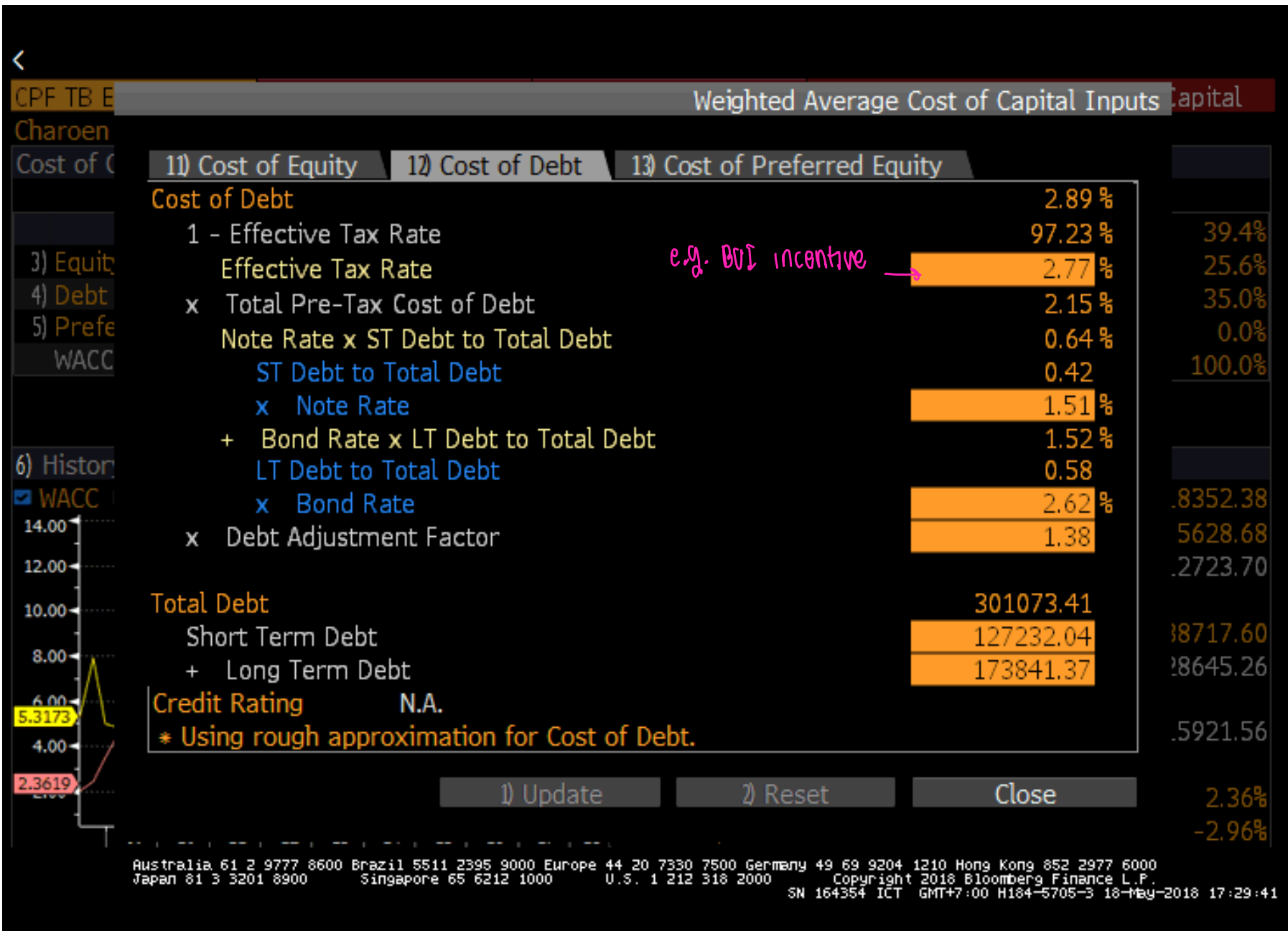- Risks in debt securities: Default + Maturity + Liquidity + Prepayment

- Debt maturity
  - Shape of yield curve determines rate, so do we use

- Bond versus loan
  - Amortization schedules are different.
  - Bonds are more tradeable (hence liquid) than loans.
  - Loans often contain embedded options (prepayment put, default call).

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CPF TB E ... Capital

Charoen

Cost of (

11) Cost of Equity   12) Cost of Debt   13) Cost of Preferred Equity

Cost of Debt	2.89 %	
1 - Effective Tax Rate	97.23 %	39.4%
Effective Tax Rate	2.77 %	25.6%
x Total Pre-Tax Cost of Debt	2.15 %	35.0%
Note Rate x ST Debt to Total Debt	0.64 %	0.0%
ST Debt to Total Debt	0.42	100.0%
x Note Rate	1.51 %	
+ Bond Rate x LT Debt to Total Debt	1.52 %	
LT Debt to Total Debt	0.58	
x Bond Rate	2.62 %	
x Debt Adjustment Factor	1.38	

e.g. BOI incentive (handwritten annotation pointing to Effective Tax Rate 2.77%)

Total Debt	301073.41
Short Term Debt	127232.04
+ Long Term Debt	173841.37
Credit Rating N.A.	

* Using rough approximation for Cost of Debt.

1) Update   2) Reset   Close

3) Equit
4) Debt
5) Prefe
WACC

6) Histor
WACC

14.00
12.00
10.00
8.00
6.00
5.3173
4.00
2.3619

.8352.38
5628.68
.2723.70

8717.60
8645.26

5921.56

2.36%
-2.96%

General practical notes and best practice

- Bloomberg WACC methodology
  - Cost of equity and CAPM
    - 10-year treasury as risk-free rate
    - Forward-looking equity risk premium
    - Blume (1975) adjusted beta: (0.67) x Raw Beta + (0.33) x 1.0
  - Cost of debt
    - Weighted average between short- and long-term debt
    - Debt adjustment factor is used when a company does not have a fair market curve (FMC); if missing, 1.38x

- Alternative methodologies
  - Cost of debt: treasury + spread

To use CAPM means to accept its assumptions (and limitations).

FINANCIAL ANALYSIS

Does the Capital Asset Pricing Model Work?

by David W. Mullins, Jr.

From the January 1982 Issue

An important task of the corporate financial manager is measurement of the company's cost of equity capital. But estimating the cost of equity causes a lot of head scratching; often the result is subjective and therefore open to question as a reliable benchmark. This article describes a method for arriving at that figure, a method spawned in the rarefied atmosphere of financial theory. The capital asset pricing model (CAPM) is an idealized portrayal of how financial markets price securities and thereby determine expected returns on capital investments. The model provides a methodology for quantifying risk and translating that risk into estimates of expected return on equity.

What if you're not well-diversified?

…**because well-diversified investors are exposed only to systematic risk**, with CAPM the relevant risk in the financial market's risk/expected return tradeoff is systematic risk rather than total risk. Thus, an investor is rewarded with higher expected returns for bearing only market-related risk.

General practical notes and best practice

- Unlisted companies?
  - Unlevered comp + "illiquidity premium"
  - How many comps? Trade-off between close competitor and estimation error

- New industries and no comp?
  - Closest competitor / biggest customers

- Startups?
  - Don't use WACC!

- Note: only a handful of companies are listed and actively traded.

Bed Bath & Beyond (due 30 Jan)

roleplay as IB → writing memo < 2 pages + 3 exhibit pages in pdf > ← ans to the point

• real issue that case doesn't address !!!

To be handed in by all groups and discussed in class.

- **BBBY has $867 million cash on its balance sheet and investors are unhappy to see all that cash sitting on BBBY's book. BBBY is considering a leveraged recapitalization. Is this a good idea?**

  borrow money & pay out cash to investor

- In analyzing the case, you may want to think about the following issues:
  - Why did BBBY accumulate so much cash and why are investors unhappy? The plan involves taking on debt. Is BBBY attractive to lenders?
  - The leveraged recapitalization will increase ROE and EPS. Are these changes really good for shareholders? Demonstrate the effect that leveraged recapitalization has on firm value with 40% leverage.
  - BBBY is considering leverage of up to 80%. Are they able to sustain this leverage? Is it better to go for 40% leverage or 80% leverage?

Chestnut Foods (due 6 Feb)

To be handed in by all groups and discussed in class.

- **Brenda Pedersen, CFO of Chestnut Foods, needs to prepare a memo to the board of directors re: Rollo Van Muur's recommendation to sell off Instruments division. What should she propose?**

- In analyzing the case, you should think about the following issues.
  - Why is Van Muur soliciting control of Chestnut?
  - With respect to the dinner conversation between Suchecki and Meyer, do you think Chestnut Food is creating value for shareholders? State any assumptions that you make in arriving at your conclusion.
  - Do you support Pederson's proposal? In light of the recent developments, is her investment and identity proposal more relevant? What recommendations should Pederson make to respond to Van Muur?