Plenary 12: Weighted Average Cost of Capital (WACC)

Wednesday, 14:00 to 15:00

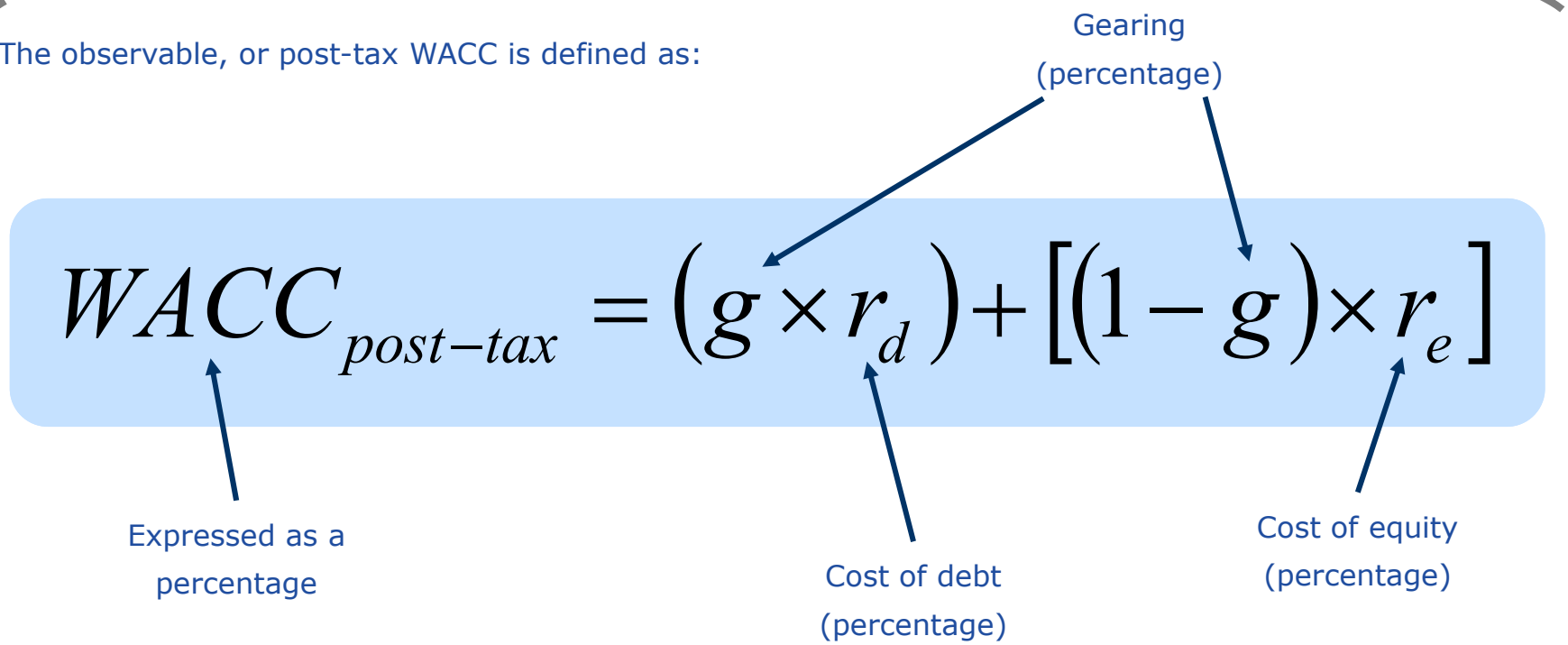
Session agenda

1. The WACC
2. The cost of debt
3. The cost of equity
4. Bringing the WACC together
5. Summary and further reading
6. Annex 1: FESCO example
7. Annex 2: dealing with data problems

What is the WACC?

- The Weighted Average Cost of Capital (WACC) is an approximation of a company's cost of finance.
- It is expressed as a mixture of debt and equity, ignoring the wide range of financing options available for companies in the grey area in between the two.

The observable, or post-tax WACC is defined as:



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The cost of debt

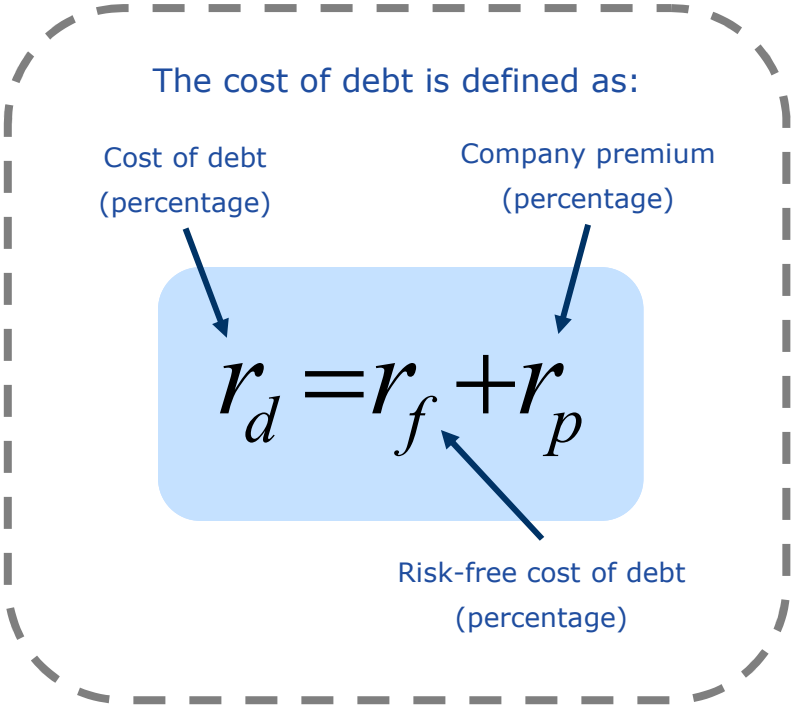
- This is the cost of borrowing funds for the company from the debt markets
- It is traditionally estimated by considering the Eurobond markets
- May not be available to most of the companies, but is the key market for determining the cost of funds
- The cost of debt is defined as a risk-free rate plus a company premium
- Reality check is to consider the actual cost of borrowing and determine financial indicators

Definition: Eurobond

"A bond issued in a currency other than the currency of the country or market in which it is issued."

Investopedia.com

The cost of debt is defined as:



Risk-free rate

- Risk-free rate (r_f) is the cost of government borrowing.
- Two issues need to be considered:
    - the impact of inflation – ideally the risk-free rate should remove inflation risk - can be done in some countries through the use of index-linked bonds (although these can be subject to market distortions); and
    - time horizon – this depends on the availability of information (bonds) and the time horizon of the investment.
- Once these dimensions have been set, the risk-free rate can be calculated as the yield to maturity of an appropriate government bond. This could be calculated as a premium over a US or Euro-bond if no appropriate domestic bonds exist. Spot rates and averages of historic rates are used in different circumstances.

Definition: yield to maturity

- This is the measure of total return to debt over the life of the instrument.
- It captures both the coupon and the difference between redemption value (face value) and market price.

The yield to maturity is the solution of the following equation:

Years to maturity

$$\text{Price} = \left\{ \sum_{n=1}^{n=N} \left[\frac{\text{Coupon}_{\,n}}{(1+\rho)^n} \right] \right\} + \left[\frac{\text{Face Value}}{(1+\rho)^N} \right]$$

Yield to maturity

Company debt premium

- Companies pay a premium over the Government for borrowing because of:
    - credit risk; and
    - business risk.
- This can be captured by comparing the YTM for a company bond with the appropriate Government bond. Appropriate in terms of:
    - maturity and coupon; and
    - can also consider average life or duration of bonds.
- Often no choice over comparators, and only limited company bond information.

Examples of debt premia

Company	Maturity	Amount	YTM	Credit Rating	Premium
Severn Trent	2018	£400m	6.0%	BBB+	246
Centrica	2022	£400m	6.2%	A-	292
ENW Capital	2015	£200m	6.8%	BBB	374
EDF LPN	2016	£300m	4.9%	A	167
Iberdrola	2016	€125m	5.7%	A-	203
Bord Gais	2014	€550m	5.3%	A-	262
Veolia	2017	€250m	5.3%	BBB+	217
ENEL	2020	€100m	4.4%	A-	116

Source: CEPA analysis of Bloomberg data

Examples of the cost of debt

Country	Sector	Date	Case	r_f	Debt premium	r_d
Chile	Water Dist.	1998	Low	6.29	3.00	9.29
			High	6.29	3.50	9.79
Netherlands	Electricity	2006	Low	3.7	0.6	4.30
			High	4.3	0.8	5.1
UK	Airports	2007	Central	2.5	1.1	3.6
Ireland	Airports	2009	Central	2.5	1.6	4.1
UK	Water	2009	Central	2.9	1.6	3.6

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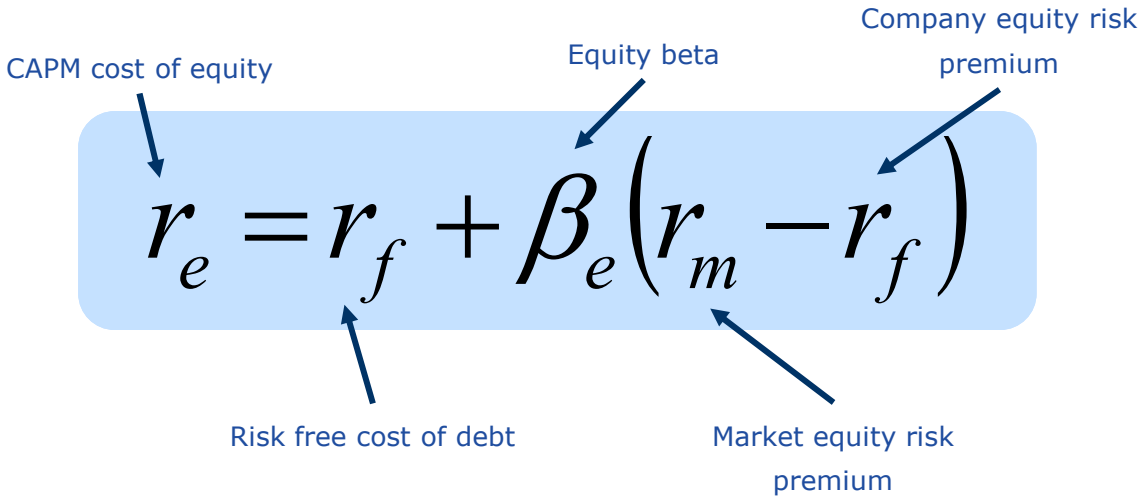
The cost of equity

- Several models exist for determining the cost of equity including:
    - Capital Asset Pricing Model (CAPM);
    - Dividend Growth Model; and
    - Arbitrage Pricing Theory.
- CAPM is used in several countries (Argentina, Australia, Columbia, Hong Kong, India, UK etc).
- This method depends on significant amounts of data, but options exist when information is limited.

The Capital Asset Pricing Model (CAPM)

- Depends on information about:
  - risk (r_f);
  - company risk (but only non-diversifiable or market risk); and
  - the equity risk premium (the additional return required to hold the whole market portfolio rather than r_f)

The CAPM cost of equity is defined as:



Calculating beta

- Beta is a measure of the relative riskiness of the company, with respect to undiversifiable risk.
- So, beta is a scalar applied to the equity risk premium.
- The value used in the calculation is the equity beta. This measures:
    - underlying business risk (referred to as the asset beta); and
    - financial risk (arising from the debt-equity structure).
- So, although two companies have the same business risk, if they have different gearing levels then the equity beta will be different.

Definition: Undiversifiable risk

"Risk which is common to an entire class of assets or liabilities. The value of investments may decline over a given time period simply because of economic changes or other events that impact large portions of the market. Asset allocation and diversification can protect against undiversifiable risk because different portions of the market tend to underperform at different times. also called systematic risk or market risk."

Investopedia.com

Asset betas

- Calculating an asset beta from an equity beta is based on the following relationship:

$$\beta_a = [(1 - g) \times \beta_e] + (g \times \beta_d)$$

- Then, the debt beta is assumed to be zero, simplifying the relationship to:

$$\beta_a = [(1 - g) \times \beta_e] \text{ or}$$

$$\beta_e = \beta_a / (1 - g)$$

The equity risk premium

- The equity risk premium (ERP) is the subject of academic and regulatory debate.
- Historic evidence suggests a rate of 4% to 6% in the USA and Europe.
- Debate surrounds:
    - methodology (*ex post* or *ex ante* estimates);
    - sources (historical outturn returns or survey of investors' expectations); and
    - whether to use the geometric or arithmetic average.
- In the UK, some consensus on Dimson, Marsh & Staunton database as most comprehensive source (100+ years of historical data for 19 countries). Regulatory decisions in the past 10 years have been in the range 3.5% to 5.5%.
- Similar ranges used by regulators in Ireland and the Netherlands.

Examples of the cost of equity

Country	Sector	Date	Case	r_f	ERP	β_e	r_e
Argentina	Gas Dist.	1997	Central	11.12	6.08	0.8	15.9
Netherlands	Electricity	2006	Low	3.7	4.0	0.6	6.0
			High	4.3	6.0	0.8	9.1
UK	Airports	2007	Central	2.5	4.5	1.1	7.2
Ireland	Airports	2009	Central	2.5	5.0	1.2	8.5
UK	Water	2009	Central	2.0	5.4	0.9	7.1

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Gearing

- The cost of debt and the cost of equity need to be weighted together to calculate the WACC
- The weight applied is gearing (leverage) – the relationship between debt and equity
- Gearing is normally calculated as debt as a % of debt and equity
- Debt should be calculated as net debt
- Leverage is calculated differently – has an impact on the WACC calculation
- Should this be actual, marginal or optimal?

The WACC

- Once the three elements of the WACC have been calculated it is possible to undertake the estimation.
- Combining the figures provides an overall WACC .
- Regulators have been interested in both post-tax and pre-tax WACC estimates.

Taxation

- Tax affects debt and equity in different ways:

Debt

- Interest payments on debt are tax deductible, this means that although the company has to earn the same amount to pay the interest, the Government then effectively pays part of the bill.

Equity

- Equity payments - dividends - can be taxed in a variety of ways. Two basic approaches are:
    - classical which assumes that dividends are paid out of post-corporate tax earnings and then subject to individual taxes; or
    - imputation which assumes that dividends are paid out of post-corporate tax earnings but that some of the corporate tax is effectively pre-payment of the personal tax liability.

Approaches to tax

- The tax treatment of WACC to move from observable post-tax to pre-tax depends on:
    - the perception of the basis of the calculation (pre-pre, pre-post, post-post etc); and
    - the overall position of the regulator - worried about optimal or actual taxes.
- Key issue is consistency - financial modeling and WACC should be consistent (was a failure in the 1999 draft water determination in England & Wales).
- Has become an important issue - significant work in Australia on how the tax treatment should be incorporated.

Examples of taxation

Traditional UK:

$$WACC_{post-tax} = (g \times r_d) + [(1-g) \times r_e]$$

$$WACC_{pre-tax} = (g \times r_d) + \left[\left(\frac{1-t_y}{1-t_c}\right)(1-g) \times r_e\right]$$

Corporate tax rate

Tax imputation rate

Latest reviews:

$$WACC_{post-tax} = [(1-t_c) \times (g \times r_d)] + [(1-g) \times r_e]$$

$$WACC_{pre-tax} = (g \times r_d) + \left[\left(\frac{1-t_y}{1-t_c}\right)(1-g) \times r_e\right]$$

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Summary

- Getting the WACC right is important
- Calculations can be data intensive
- However, a lack of data is not sufficient reason to use simple approaches. Comparators and international evidence is available and should be used as a starting point – the FESCO example in Annex 1 clearly shows how this can be done
- Always ensure that the right adjustments are made to international data
- Share information and experiences

Further sources

Online

1. Alexander et al. (1999) "A Few Things Transport Regulators Should Know About Risk and the Cost of Capital" World Bank
   http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/1999/09/14/000094946_99073007343485/Rendered/PDF/multi_page.pdf
2. Alexander et al. (1997) "A back-of-the-envelope approach to assess the cost of capital for network regulators"
   http://www.regulationbodyofknowledge.org/documents/010.pdf

Books

1. Ogier et al. (2004) "The Real Cost of Capital" FT Prentice Hall
2. Pratt et al. (2008) "Cost of Capital: Applications and Examples"
3. Arnold (2008) "Corporate Financial Management" 4th ed. FT Prentice Hall, Chapter 19

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Annex 1: NEPRA 2005-12 determination example

- Best way to illustrate the calculation is to use an actual one
- Not necessarily a right or wrong answer – many of the elements become a matter of judgement
- Using the NEPRA FESCO determination from 2005-12

About FESCO

FESCO Distributes and supplies electricity to about 2.81 million customers within its territory with a population over 26.5 million under a Distribution License granted by National Electric Power Regulatory Authority (NEPRA) pursuant to the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (NEPRA Act). Geographical service area of FESCO comprises Faisalabad, Sargodha, Mianwali, Khushab, Jhang, Bhakker, T.T Singh and Chiniot.

www.fesco.com.pk

FESCO and the Cost of Debt

Company premium 200 basis points (2%)
Proposed by the company and based on generic comparator data

+

Risk-free rate 6.7%
Based on the yield on 10 year Pakistan Investment Bond

=

Gives a cost of debt of
8.7%

FESCO – the revised CAPM

- Slightly revised version used since basic US data is utilised
- CRP is the country risk premium – a measure of the risk of Pakistan compared to the US
- Lambda is the measure of the exposure of the company to the CRP

$$r_e = r_f + \beta_e\left(r_m - r_f\right) + \ell CRP$$

FESCO – the cost of equity data

- **Risk free rate: 4.5%**

  Based on 45 day average of 10 year US Treasury bonds

- **Beta: 1.23**

  Based on comparable asset betas adjusted for the capital structure of a Pakistan electricity distribution company

- **ERP/MRP: 5.5%**

  Based on US data

- **CRP: 6.05%**

  Based on a comparison of US and Pakistan data

- **Lambda: 0.55**

4.5 + (1.23 x 5.5) + (0.55 x 6.05) =

Gives a post-tax cost of equity of

14.59%

Issues with the cost of equity

- Not consistent with cost of debt – why a different risk-free rate?
- Should lambda be used?
- Is the US MRP appropriate? International capital relatively free to move but there are differences in the economies
- What comparators were used?

FESCO – WACC

- Additional ingredients:
  - gearing of 60%;
  - tax for debt 34%; and
  - tax, if paid, to be treated as a cost pass-through item.

Traditional post-tax WACC:

$$WACC_{post-tax} = \left[\left(1-t_c\right)\times\left(g\times r_d\right)\right]+\left[\left(1-g\right)\times r_e\right]$$

$$\left[\left(0.6\times 8.7\%\right)\right]+\left[\left(1-0.6\right)\times 14.59\%\right]=11.27\%$$

New post-tax WACC:

$$WACC_{post-tax} = \left[\left(1-t_c\right)\times\left(g\times r_d\right)\right]+\left[\left(1-g\right)\times r_e\right]$$

$$\left[\left(1-0.34\right)\times\left(0.6\times 8.7\%\right)\right]+\left[\left(1-0.6\right)\times 14.59\%\right]=9.27\%$$

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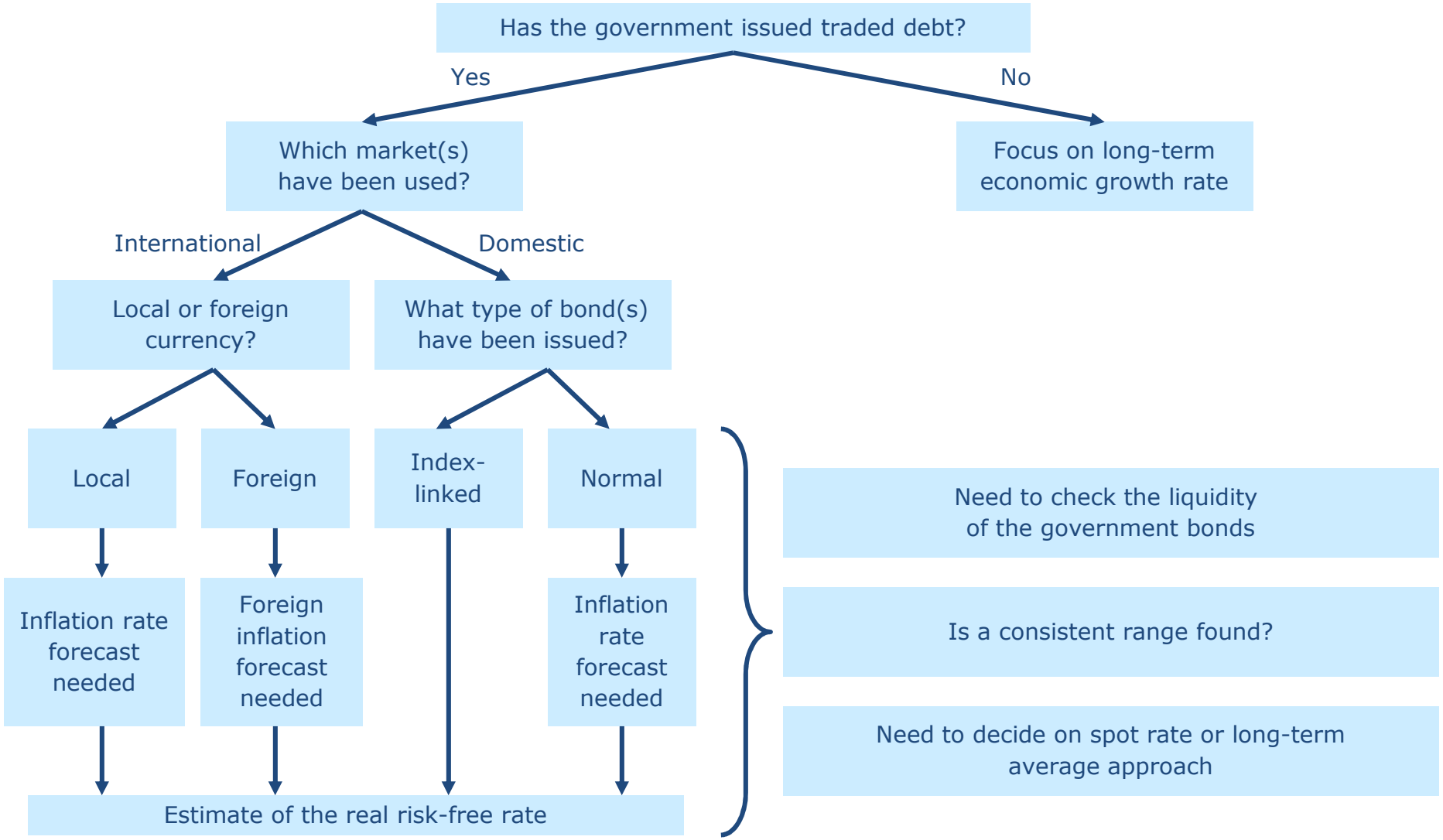
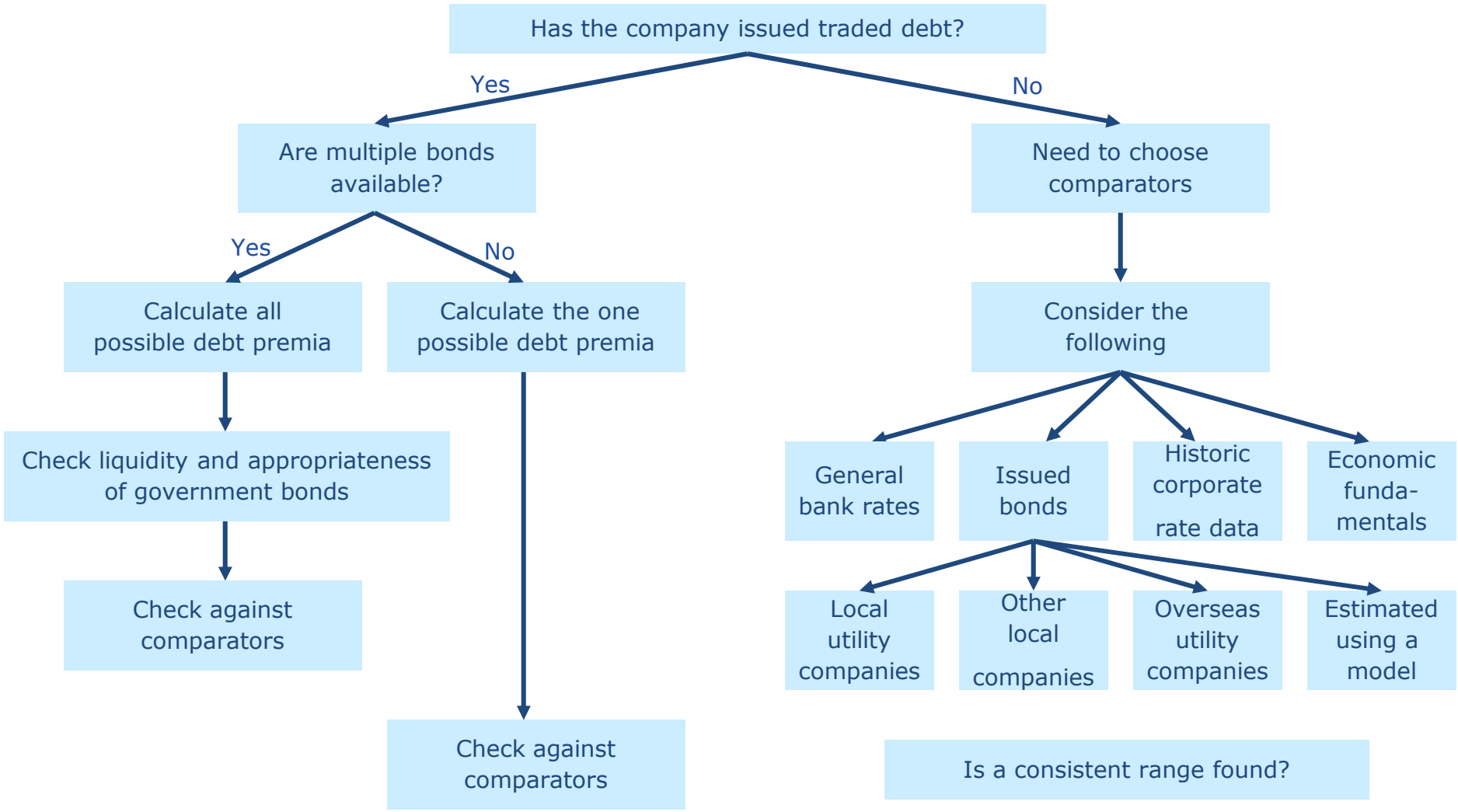
Dealing with data problems

- A concern in many countries is the lack of data, especially for the calculation of the cost of equity.
- Alternative options have been proposed:
    - use comparator information - e.g. beta values for similar companies in other countries, ERP data from world-wide sources etc.;
    - using alternative methods - such as historic borrowing rates or DGM type approaches; and
    - estimating an overall cost of capital for an economy and then considering how utility companies differ from this.
- Key issues are - consistency, adjustment to fit the country specifics and not relying on a point estimate but a range, possibly built-up from different approaches.

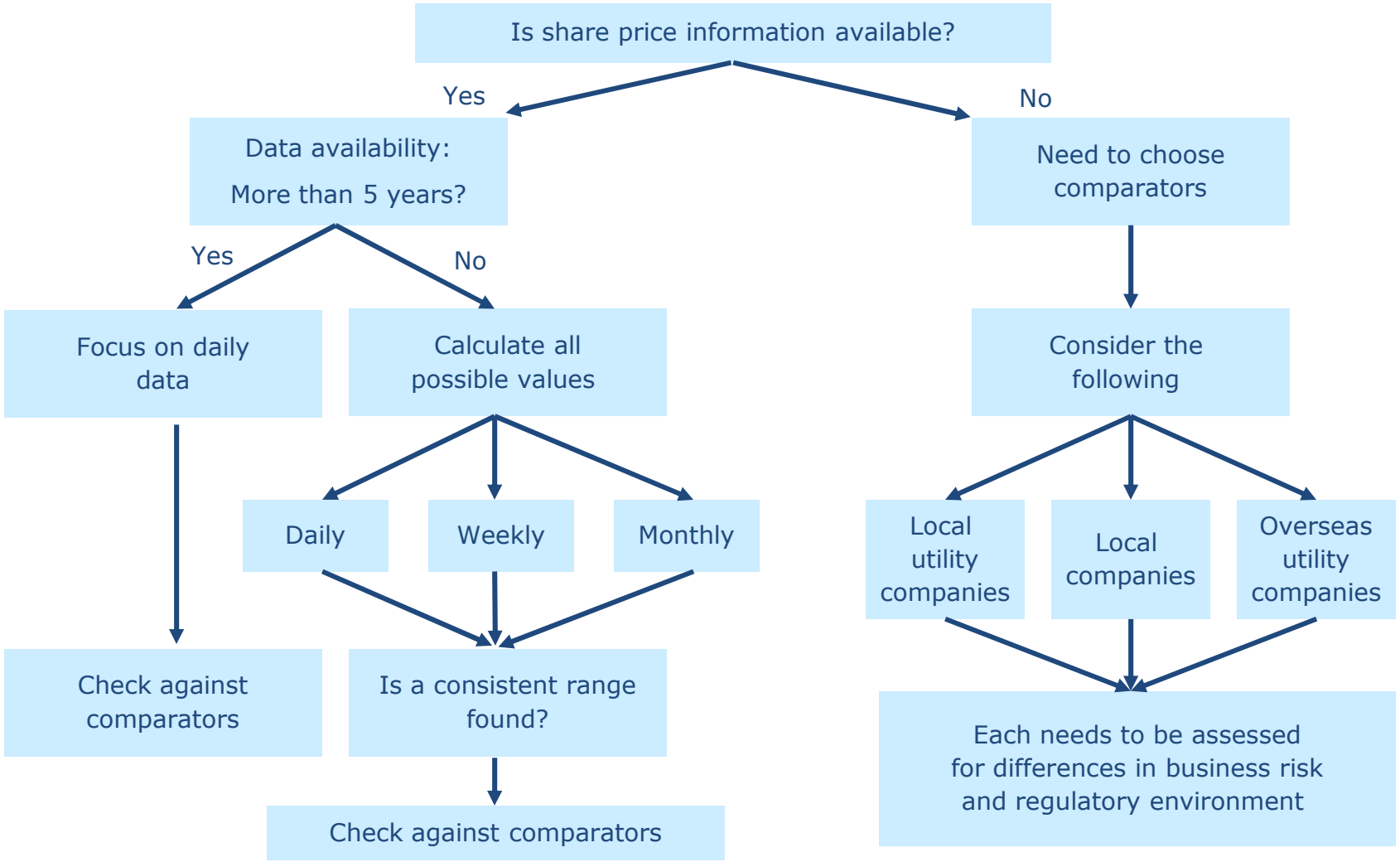
1) Risk-free rate



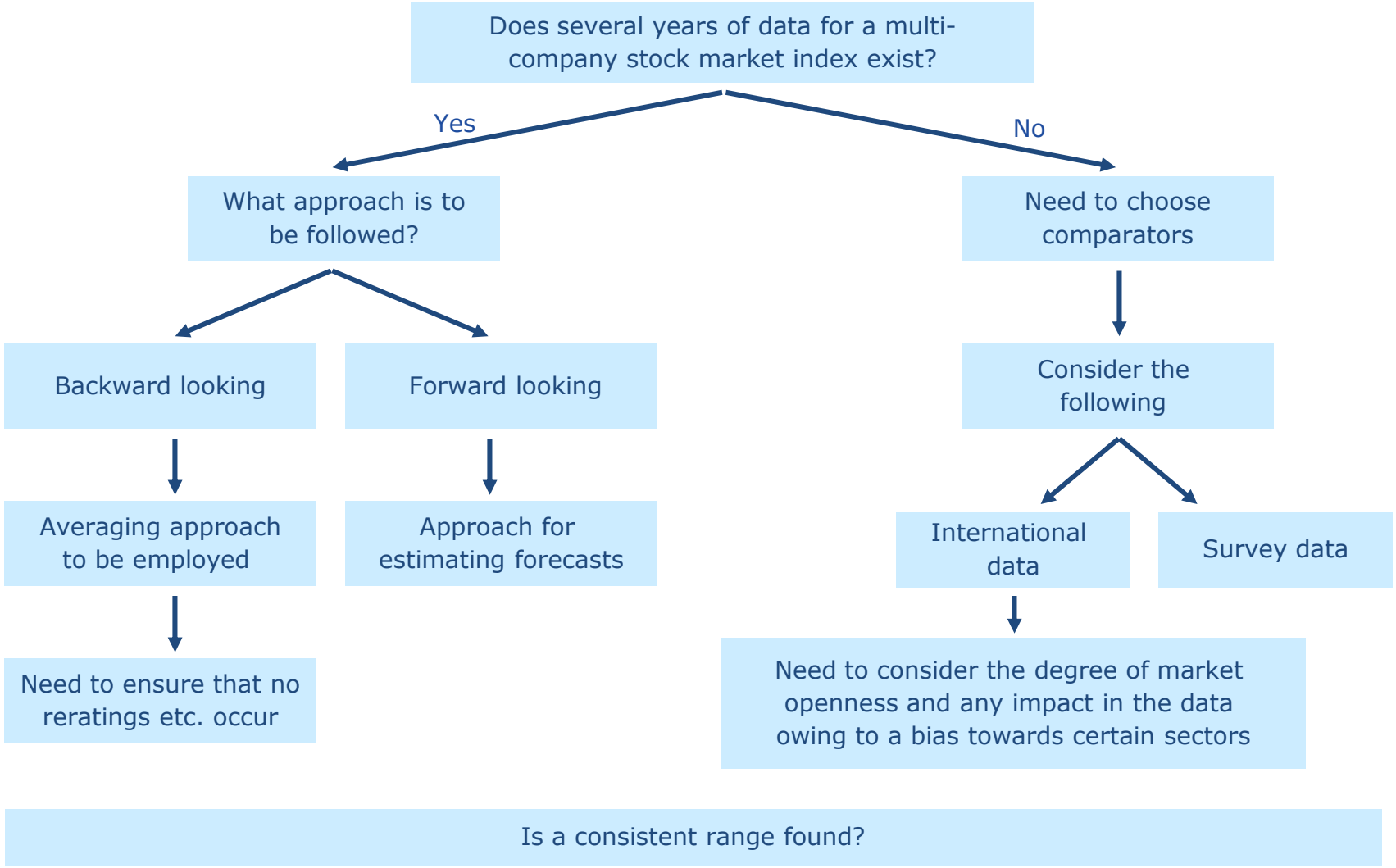
2) Debt premia



3) Beta


Is share price information available?
Yes
No
Data availability:
More than 5 years?
Need to choose comparators
Yes
No
Focus on daily data
Calculate all possible values
Consider the following
Daily
Weekly
Monthly
Local utility companies
Local companies
Overseas utility companies
Check against comparators
Is a consistent range found?
Each needs to be assessed for differences in business risk and regulatory environment
Check against comparators

4) Equity risk premium



Dealing with data problems: summary

- Options are available for handling data problems.
- The Pakistan example shows that something can be done.
- Learn from the mistakes/solutions adopted elsewhere.
- Improve the estimate as time progresses.