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# Determining a WACC estimate for Port of Melbourne

A report prepared in context of the Pricing Order for the 2018-19 Tariff Compliance Statement

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# Snapshot

The table below provides a short summary of the reasons for the difference between the weighted average cost of capital estimate Synergies has calculated for the 2018-19 Tariff Compliance Statement (TCS) compared to the estimate calculated for the 2017-18 TCS.

| Chapter | Element | 2017-18 TCS | 2018-19 TCS |
|---|---|---|---|
| | **WACC estimate** | 11.54% | 11.52% |
| **2** | **WACC formulation** | Pre-tax nominal as required by the Pricing Order | No change |
| **3** | **One or a combination of well-accepted approaches** | PoM presented its views on the meaning of well-accepted in the context of the Pricing Order | Based on engagement with the ESC and the ESC's published SoRA, PoM believes the majority of the 2017-18 TCS is aligned with the view of the ESC.<br>However, this section considers and responds to the guidance provided by the ESC in the SoRA regarding the requirements of the Pricing Order on well-accepted. |
| **4** | **Benchmark efficient entity (BEE)** | 45 entities across (i) Marine and Ports Services (22), (ii) Railroads (10) and (iii) Airports (13) GICS classifications | 6 additional entities as a result of removing the US$100m market capitalisation threshold in response to the ESC's commentary (new total comparison set of 51 entities) |
| **5** | **Capital Structure** | 30%<br>Represented the mid-point (rounded to the nearest 5%) of the gearing ratios for the 17 investment-grade listed benchmark efficient entities of 22% and the gearing ratios for the 3 privatised Australian ports of 42% | 30%<br>No change to approach. Updated median gearing ratio for the 17 investment-grade listed benchmark efficient entities is unchanged at 22% and there have been no new Australian port privatisations |
| **6** | **Cost of equity approaches** | In the absence of any substantive grounds to favour one over the other, an equal weighting of the SL CAPM, Black CAPM and FFM estimation methods | No change to approach |
| **7** | **SL CAPM** | 13.66% | 13.48%<br>No change to approach, but there has been a slight decrease in the risk-free rate and market risk premium |
| **7.1** | **Risk-free rate** | 2.81%<br>20-day average of the 10-year Australian Government bond yield to 31 March 2017 | 2.74%<br>No change to approach. Updated to reflect the 20-day period to 31 March 2018 |
| **7.2** | **Beta** | 0.70<br>Based on the median (0.68) and average (0.69) 5-year asset betas (rounded to the nearest 0.05) for the 45 comparators, corresponding to an equity beta of 1.00 with 30% gearing. Supported by the 10-year asset beta median (0.75) and average (0.74). | 0.70<br>No change to approach. Median (0.69) and average (0.72) 5-year asset betas for the 51 comparators benchmark efficient entities are largely unchanged as a result of the 6 additional entities and updated data, supporting the same asset beta (rounded to the nearest 0.05). Also supported by the 10-year asset beta median and average of 0.75. |
| **7.3** | **Market risk premium** | 7.77%<br>In the absence of any substantive grounds to favour one over the other, a 50:50 weighting of the Ibbotson and Wright MRP methodologies | 7.71%<br>No change to methodology, estimates updated for additional year of data. Wright MRP adjusts in line with changes in risk-free rate. |

| Chapter | Element | 2017-18 TCS | 2018-19 TCS |
|---|---|---|---|
| **8** | **Black CAPM** | 13.66% | 13.48%<br>No change to approach. Estimate is identical to SL CAPM estimate due to equity beta of 1.00. |
| | **Zero beta premium** | 3.34%<br>SFG Consulting (2014). Cost of equity in the Black Capital Asset Pricing Model, 22 May | 3.34%<br>No change |
| **9** | **Fama-French Model** | 15.12% | 15.51%<br>Marginally higher than the 2017-18 estimate. A decrease in the HML beta has been offset by increases in the MRP and SMB betas. We have made a slight adjustment to our methodology to improve the robustness of the estimates for companies from countries without country-specific factors. Further details are provided in Chapter 9. |
| | **Market excess returns** | 0.89 equity beta and 7.77% risk factor premium | 1.06 equity beta and 7.71% risk factor premium<br>Calculation of risk factor premium is unchanged. Updated data |
| | **High-minus-low factor** | 0.29 equity beta and 6.05% risk factor premium | 0.11 equity beta and 6.10% risk factor premium<br>Calculation of risk factor premium is unchanged. Updated data |
| | **Small-minus-big factor** | 0.16 equity beta and 1.77% risk factor premium | 0.23 equity beta and 1.93% risk factor premium<br>Calculation of risk factor premium is unchanged. Updated data |
| **10** | **Return on debt** | 5.45%<br>100% weighting to the 'on-the-day' cost of 5.45% | 5.37%<br>90% weighting to the 2017-18 'on-the-day' cost of 5.45% and 10% weighting to the 2018-19 'on-the-day' cost of 4.58%, as weightings are adjusted 10% each year towards a 10-year trailing average approach |
| **10.4** | **Notional credit rating** | BBB | No change |
| **10.7** | **Debt risk premium** | 2.54%<br>In the absence of any substantive grounds to favour one source over the other, a 50:50 weighting of the 20-day average on the 10-year RBA and Bloomberg BVAL data series to 31 March 2017 | 2.53%<br>Based on the trailing average return on debt of 5.37%, a risk-free rate of 2.74%, and debt raising costs of 0.10% |
| **10.8** | **Debt raising costs** | 0.10%<br>PwC (2013), p.6 | 0.10%<br>No change |
| **11** | **Gamma** | 0.25<br>In the absence of any substantive grounds to favour one approach over another, an equal weighting (rounded to the nearest 0.05) of the gamma value implied by finance theory (zero), the equity ownership approach (0.45) and market valuation studies (0.25) | 0.25<br>No change |

# Executive Summary

The purpose of this report is to provide an estimate of the return on capital for the Port of Melbourne (PoM) for its second regulatory year under the regulatory framework established by the *Port Management Act (Vic) 1995* and Pricing Order.

To determine an estimate of the return on capital that is consistent with the Pricing Order, the key requirement is that the Port Licence Holder (PoM) must use one or a combination of well-accepted approaches that distinguish the cost of equity and debt and so derive a weighted average cost of capital (WACC).

This requirement reflects the unique nature of the Pricing Order, which establishes a set of processes for PoM to follow in setting prices for its Prescribed Services that must provide it with a reasonable opportunity to recover revenue in the range of efficient costs. The Pricing Order therefore places the initial onus on PoM to interpret the meaning of the Pricing Order, including the meaning of the phrase "well-accepted" in the context of deriving a WACC estimate. Since the 2017-18 TCS submission, the ESC has provided guidance on its interpretation through its Interim Commentary and Statement of Regulatory Approach (SoRA), which we respond to throughout the report.

## WACC formulation

The Pricing Order requires that the WACC must be calculated on a pre-tax nominal basis. The pre-tax nominal formulation adjusts for taxation and dividend imputation in the WACC formula rather than the cash flows of the business and is expressed as follows:

$$\frac{R_e}{\left(1-t_c\left[1-\gamma\right]\right)} * \frac{E}{E+D} + R_d \frac{D}{E+D}$$

Where:

Re = post-tax return on equity

Rd = pre-tax return on debt

D = proportion of debt within the assumed capital structure

E = proportion of equity within the assumed capital structure

t = corporate tax rate

γ = gamma (value of imputation credits)

## Benchmark Efficient Entity

In compliance with the Pricing Order, we have identified a benchmark efficient entity (BEE) for POM that is assumed to be in the same industry with the same risk profile as PoM in its provision of Prescribed Services.

The ESC has maintained its view that, for the purposes of defining the BEE, the Prescribed Services are provided by a port in Australia. However, we have found there are insufficient comparable businesses listed in Australia that have similar risks to this assumed BEE. Consequently, it has been necessary for us to follow a well-accepted alternative for such situations that is used by Australian economic regulators and supplement our sample of comparable Australian listed entities with international listed entities with comparable risks. An element of judgement is required in this task.

To this end, we expanded the port and marine services comparator sample to include listed railroads and airports based on a first principles analysis of the typical systematic risks of these businesses and their similarities (in aggregate) to the BEE. We then reviewed the business description for each listed company in our international sample and eliminated companies whose systematic risks did not appear comparable to the BEE.

In the SoRA, the ESC identified differences between the BEE definitions put forward by the ESC and PoM, respectively, which we address in Chapter 4. These positions differ mainly on whether the availability of listed comparators should be reflected in the BEE definition, or whether this should be addressed later in the comparator entity filtering process. The resulting comparator set is likely to be similar under both definitions. In response to commentary from the ESC, we have removed the requirement that the BEE has a market capitalisation of at least $US100 million. As a result, we have included six additional firms in our comparator set, with no material change in the gearing and beta estimates.

## Capital Structure

To inform PoM's benchmark capital structure, we have had regard to the listed comparator set from a first principles analysis perspective, as well as recent Australian port acquisition comparators, including major landlord ports in Australia comparable to PoM.

Our benchmark capital structure range extends from 22% (based on the average and median of investment-grade listed comparators) to 42% (average and median of the acquisition comparators). We have chosen the mid-point of this range which is 30% (rounded down from 32%) consistent with our approach to deriving a point estimate from other estimated ranges.

## Combination of well-accepted cost of equity approaches

The ESC has proposed that for an approach to be considered well-accepted, it must be used by at least one economic regulator (or a review body overseeing decisions by economic regulators) to determine the rate of return for the purpose of calculating the ARR using a building block methodology. However, it is not evident that the Pricing Order restricts the definition of well-accepted in this manner. Moreover, this definition precludes the consideration of important evidence from financial practice and academia.

Based on academic recognition and empirical fit analysis, well-established market practice in the finance industry as well as by Australian and international regulators, we consider there are a range of cost of equity models that are well-accepted within the meaning of the Pricing Order for estimating the cost of equity.

We have determined the cost of equity estimate for the BEE for PoM using a combination of the following models:

- Sharpe-Lintner Capital Asset Pricing Model (SL CAPM)
- Black CAPM
- Fama-French Model (FFM)

As each model has its own strengths and weaknesses, and in the absence of any substantive grounds to favour one model over the other, we have adopted an average of the estimates derived from the application of these approaches to produce a cost of equity estimate.

## Estimation of cost of equity

### SL CAPM

The SL CAPM is expressed as follows:

$$Re = R_f + \beta_e * [E(R_m) - R_f]$$

Where:

Rf = the risk-free rate of return

E(Rm) = the expected return on the market

[E(Rm) – Rf] = the market risk premium

βe = equity beta (measures systematic risk)

Our approach to estimating the above parameters is summarised below.

*Risk-free rate*

The Commonwealth Government bond yield is most commonly used as a proxy for the risk-free rate in Australia by academics, regulators (including by the ESC) and finance practitioners. We have assumed a ten-year term to maturity, balancing the liquidity of available long-term bond instruments in the Australian market, and the long-term nature of the PoM investment.

In general, a commonly used approach to estimate the risk-free rate is to use short averaging periods close to the commencement of each regulatory period. Consistent with this well-accepted approach, our estimates are produced over a twenty-day period to 31 March 2018. As the quoted rates are semi-annual, we have converted them to annual effective rates.[1] The resulting estimate is 2.74%.

*Beta*

An asset beta of 0.70 has been estimated based on:

- the same set of comparable listed companies that underpinned our gearing assessment (noting that a higher asset beta of 0.75 could be justified on the basis of the 10 year estimates)
- rounding the median asset beta of this set of comparable companies.

Given the gearing estimate of 30%, this asset beta translates into an estimated equity beta of 1.0.

*Market risk premium*

The market risk premium (MRP) is a function of the difference between the expected equity market return and the risk-free rate of return. It is an inherently forward-looking parameter, which is therefore not directly observable and is difficult to estimate.

Dividend Discount Models (DDM) attempt to address this challenge by estimating the market risk premium by reference to dividend yields, long-term expected dividend growth and a transitional path between these values. However, there is a lack of agreement around the appropriate value for the long-run growth rate in DDMs. As this is a key input in DDM calculations, different estimates can lead to substantial differences in final estimates of the MRP. Any instability generated by fluctuating dividend forecasts, as well as disagreement about the assumed speed at which dividend growth converges to the long-run rate, further compounds the instability of this value.

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[1] Annual effective rate = (1+ semi-annual rate/2)^2 -1

Accordingly, these difficulties with DDMs led us to rely upon historical data using:

- the Ibbotson approach, which calculates the MRP by taking the difference between the long-term observed average return on market and the risk-free rate. This method assumes that the market risk premium remains stable over time, and the overall return on market will fluctuate largely in-step with the risk-free rate of return; and
- the Wright approach, which calculates the MRP by taking the difference between the long term observed average return on market and the current risk-free rate of return. This method assumes that the overall return on equity remains stable over time, and does not fluctuate in-step with the risk-free rate of return.

We provide evidence that both approaches are used by economic regulators in Australia. As each approach has its own strengths and weaknesses, and in the absence of any substantive grounds to favour one over the other, our estimate of the MRP is 7.71% based on simple averaging of both approaches (allowing for the impact of imputation credits, addressed below).

*SL CAPM cost of equity*

Our estimate of the pre-tax cost of equity for the BEE based on the SL CAPM is 13.48%**.**

### Black CAPM

The Black CAPM augments the SL CAPM by adding what is known as a zero-beta portfolio to the risk-free rate to address the observed tendency of the SL CAPM to understate asset returns for companies with betas less than one.

SFG Consulting has estimated the zero-beta premium to be 3.34%.[2] The zero-beta return is the sum of risk-free rate and the zero-beta premium. Hence, our SL CAPM estimate can be combined with this zero-beta premium to estimate the Black CAPM return on equity.

Our estimate of the pre-tax return on equity for the BEE based on the Black CAPM is also 13.48%, given our estimated equity beta of 1 (the respective slopes of the SL CAPM and Black CAPM cross at this point estimate).

[2] SFG Consulting (2014a). Cost of equity in the Black Capital Asset Pricing Model, 22 May.

### FFM

The FFM is based on the principle that the empirically observed excess returns to the market can be assessed having regard to the following three explanatory factors:

- the returns on the market as a whole;
- HML (High Minus Low) is the average return on two 'value' portfolios minus the average return on two 'growth' portfolios; and
- SMB (Small Minus Big) is the average return on three small listed entity portfolios minus the average return on three big listed entity portfolios.

The risk-free rate and MRP under the FFM match the values used in the SL CAPM. As for the SL CAPM, the FFM restricts the zero-beta rate to be the risk-free rate.

Table 1 presents our equity betas and associated risk premiums.

Table 1 FFM equity betas and risk factor premiums

| Risk factors | Estimated equity betas | Risk factor premiums |
|---|---|---|
| Market risk premium | 1.06 | 7.71% |
| High minus low cap premium | 0.11 | 6.10% |
| Small minus big premium | 0.23 | 1.93% |

**Source:** Synergies

Our estimate of the pre-tax return on equity for the BEE based on the FFM is 15.51%.

### Cost of equity estimates

Table 2 presents the cost of equity estimates from the three approaches.

Table 2 Cost of equity (pre-tax nominal) estimates by approach

| SL CAPM | Black CAPM | FFM |
|---|---|---|
| 13.48% | 13.48% | 15.51% |

**Source:** Synergies

As each approach has its own strengths and weaknesses, and in the absence of any substantive grounds to favour one over the other, using simple averaging of the three estimates in Table 2 results in an estimated nominal pre-tax cost of equity for the BEE of 14.16%.

## Cost of debt

The cost of debt calculation is the sum of the risk-free rate and an estimate of the debt risk premium consistent with the risk profile of the BEE.

This approach is well-accepted in financial markets and by economic regulators in Australia and internationally, underpinned by the concept of credit spreads reflecting different credit and liquidity risks associated with government and corporate bonds respectively.

The return on debt calculation can be expressed as follows:

$$R_d = R_f + DRP + DRC$$

Where:

Rf = risk-free rate

DRP = debt risk premium

DRC = debt raising costs

We have used the same risk-free rate estimate as derived in our cost of equity calculation.

For the debt risk premium, we consider that both the Reserve Bank of Australia (RBA) and Bloomberg data series represent an independent, credible and reliable data source for return on debt estimation purposes. Consistent with our approach to estimating cost of equity parameters, in the absence of any substantive grounds to favour one over the other we have calculated a simple average of these comparable series.

An assumption of ten basis points has been used for debt raising costs based on authoritative evidence gathered by PwC of debt raising costs for Australian corporates, based on surveys and interviews with legal firms, banks and credit rating agencies that are involved in the corporate bond raising process.[3]

Consistent with the approach applied under the Australian national energy framework, we consider that the choice between the on-the-day and trailing average approach to estimating the cost of debt is appropriately made by the regulated entity provided the calculation reflects an efficient benchmark. Both the on-the-day and trailing average approaches are in use by Australian regulators.

In the 2017-18 WACC submission, we applied an on-the-day approach, which was appropriate in the context of the PoM Long Term Lease transaction and the first TCS. This year we have commenced a trailing average approach, which is currently adopted by several Australian regulators. The trailing average calculation places a 90% weighting on the 2017 return on debt estimate, and a 10% weighting on the 2018 return on debt estimate. The present intention is that with each subsequent year, 10% of the 2017 weighting will be refreshed with the prevailing return on debt estimate.

[3] PwC (2013). Energy Networks Association: Debt financing costs, June.

This approach is being adopted on the basis of its lower volatility over time, and because it is more consistent with the debt management practices of a benchmark efficient entity. It is also in line with our approach to other WACC parameters, which, where possible, are based on long-term averages. This methodology is also consistent with the approach currently in use by the AER.

Table 3 shows our 2018 on-the-day cost of debt estimate for the BEE of 4.58%, to which a 10% weighting is applied in the trailing average calculation.

Table 3 2018 on-the-day cost of debt estimate for BEE (assuming BBB credit rating)

| Averaging period | RBA | Bloomberg | Average |
|---|---|---|---|
| BBB DRP based on 20 days to 31 March 2018 | 1.77% | 1.70% | 1.74% |
| Risk-free rate based on 20 days to 31 March 2018 | 2.74% | 2.74% | 2.74% |
| Debt raising costs | 0.10% | 0.10% | 0.10% |
| **On-the day cost of debt** | **4.61%** | **4.54%** | **4.58%** |

**Source:** RBA, Bloomberg, Synergies calculations

This 2018 on-the-day cost of debt estimate is then used as an input in the trailing average calculation, as displayed in Table 4. This results in a cost of debt estimate of 5.37%.

Table 4 Trailing average cost of debt calculation

| Time period | Estimate | Weighting |
|---|---|---|
| 2017 on-the-day cost of debt | 5.45% | 90% |
| 2018 on-the-day cost of debt | 4.58% | 10% |
| **Cost of debt** | **5.37%** | |

**Note:** Assuming a risk-free rate of 2.74% and debt raising costs of 0.10%, this implies a DRP of 2.53%

**Source:** RBA, Bloomberg, Synergies calculations

## Gamma

Gamma is a product of the following two inputs that must be estimated:

- the portion of franking credits distributed to investors (the distribution rate); and
- the utilisation value per dollar of franking credits distributed (also referred to as the utilisation rate or 'theta').

In attempting to identify a well-accepted approach to gamma, we have reviewed academic literature, relevant finance industry evidence (particularly from independent expert reports), as well as Australian regulatory practice.

The first well-accepted approach is adopted from the academic literature and indicates that the gamma for a security where the marginal investor is foreign should be zero.

There is also substantial evidence that imputation credits are not considered by independent experts in a valuation context. Australian economic policy makers have also questioned the value of imputation credits in an economy that is small by international standards and characterised by open capital markets.

In contrast to this reasonably consistent view, there are several approaches that have been applied in Australian regulatory practice.

The distribution rate is relatively non-contentious and has settled around 70%. In contrast, the value of theta continues to be highly contentious and in broad terms can be estimated using the following approaches:

- the equity ownership approach, which is the proportion of Australian equity held by Australian residents (given only domestic investors can utilise franking credits), or alternative taxation approach using statistics drawn from the Australian Taxation Office on the utilisation of franking credits – which forms our second well-accepted approach; and
- market value studies, which seek to ascribe the value that investors place on theta using techniques, including dividend 'drop-off' studies (i.e. analysing pre and post-dividend share prices) - this forms our third well-accepted approach.

Each of these approaches establishes a broad range of theta values and in turn a gamma value.

The second approach has been applied by some regulators, including the ESC. It provides a theta value of around 0.6 to 0.7 resulting in a gamma value of 0.4 to 0.5 (which we have averaged at 0.45).

In contrast, the third approach relies on a market value estimate of imputation credits and the most authoritative study[4] supports a theta value of 0.35. In turn, this results in a gamma value of 0.25 (assuming a 70% distribution rate).

Accordingly, we consider these three broad approaches have been well-accepted in the relevant communities of expertise. Consistent with our approach throughout this report, calculating a simple average of the three values (which are zero if based on finance theory, 0.45 if based on a non-market equity ownership approach and 0.25 if based on market valuation studies) results in a gamma estimate of 0.23, which we have rounded to 0.25. This is the same as IPART's current gamma estimate.

[4] SFG Consulting (2014b). An appropriate regulatory estimate of gamma, 21 May.

## Synergies' WACC estimate

Our pre-tax nominal WACC estimate for the BEE for PoM under the Pricing Order is 11.52%. We consider this value is consistent with the 'well-accepted' guiding principle of the Pricing Order to be applied in determining a WACC estimate and the broader objectives of the Port Management Act. As previously noted, our WACC estimate is based on an average of each of the SL CAPM, Black CAPM and FFM cost of equity estimates in the absence of any substantive grounds to favour one over the other. Table 5 presents all key parameter values for our pre-tax nominal WACC estimate.

Table 5 WACC estimate for PoM

| Parameter | 2017-18 TCS | 2018-19 TCS |
|---|---|---|
| Risk-free rate | 2.81% | 2.74% |
| Capital structure | 30% | 30% |
| Gamma | 0.25 | 0.25 |
| Corporate tax rate | 30% | 30% |
| | | |
| **CAPM Parameters** | | |
| Market risk premium (MRP) | 7.77% | 7.71% |
| Asset beta | 0.70 | 0.70 |
| Equity beta | 1.00 | 1.00 |
| Zero Beta Premium | 3.34% | 3.34% |
| | | |
| **Fama-French Model Parameters** | | |
| Market risk premium (MRP) | 7.77% | 7.71% |
| Value (HML) premium | 6.05% | 6.10% |
| Size (SMB) premium | 1.77% | 1.93% |
| Asset beta (Market) | 0.62 | 0.74 |
| Asset beta (HML) | 0.20 | 0.08 |
| Asset beta (SMB) | 0.11 | 0.16 |
| Equity beta (Market) | 0.89 | 1.06 |
| Equity beta (HML) | 0.29 | 0.11 |
| Equity beta (SMB) | 0.16 | 0.23 |
| | | |
| **Return on equity (pre-tax)** | | |
| SL CAPM | 13.66% | 13.48% |
| Black CAPM | 13.66% | 13.48% |
| FFM | 15.12% | 15.51% |
| Weighted return on equity (pre-tax) | 14.14% | 14.16% |
| | | |
| Debt beta | 0.00 | 0.00 |
| Debt risk premium | 2.54% | 2.53% |

| Parameter | 2017-18 TCS | 2018-19 TCS |
|---|---|---|
| Debt raising costs | 0.10% | 0.10% |
| Return on debt (pre-tax) | 5.45% | 5.37% |
| **Pre-tax nominal WACC** | **11.54%** | **11.52%** |

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# Contents

# Figures and Tables

# 1 Introduction

Synergies has been engaged by Port of Melbourne (PoM) to provide an opinion on PoM's appropriate weighted average cost of capital (WACC) in accordance with the requirements of the Pricing Order.

The WACC has been estimated in the context of PoM submitting its 2018-19 Tariff Compliance Statement (TCS) to the Essential Services Commission (ESC) under the Pricing Order. For ease of reference, each chapter of this report begins with a very brief description of the relevant parameter values and identifies any changes to the 2017-18 TCS.

The Prescribed Services under the Pricing Order are the relevant services for the assessment of the WACC.

This report is structured as follows:

- Chapter 2 – WACC formulation
- Chapter 3 – discusses the requirements of the Pricing Order and the use of well-accepted approaches
- Chapter 4 – defines the benchmark efficient entity (BEE)
- Chapter 5 – assumed capital structure
- Chapter 6 – analyses alternative well-accepted return on equity models
- Chapter 7 – estimates the return on equity using the SL CAPM
- Chapter 8 – estimates the return on equity using the Black CAPM
- Chapter 9 – estimates the return on equity using the Fama-French Model
- Chapter 10 – estimates the return on debt
- Chapter 11 – estimates the value of gamma
- Chapter 12 – proposes a WACC estimate for the BEE
- Attachment A – presents gearing ratios for our comparable companies set
- Attachment B – presents our full list of asset beta estimates and beta diagnostics
- Attachment C – presents supplementary evidence on our well-accepted return on equity approaches

- Attachment D – presents a detailed first principles analysis used to inform our beta assessment
- Attachment E – summarises Australian regulatory precedent on beta determination
- Attachment F – presents supplementary information on market risk premium estimates
- Attachment G – provides additional detail on the methodology for the listed comparator WACC estimates calculated in Section 12.6.

# 2 WACC formulation

| Chapter overview |
| --- |
| This section sets out the pre-tax nominal WACC formulation that we have used as required by the Pricing Order. This formulation is unchanged from the 2017-18 submission. |

## 2.1 Introduction

An infrastructure service provider, such as PoM, requires significant funding to invest in and operate its capital-intensive business. These funds must be raised either from PoM's shareholders or lenders. The sum of the returns required by equity and debt holders – weighted by the proportions of equity and debt used in the capital structure – is often referred to as the weighted average cost of capital (WACC).

Regulatory processes can ascribe an unrealistic degree of precision to the calculation of the rate of return, which has a high degree of subjectivity. This is particularly the case in estimating the return on equity, which is unobservable in the market. The Productivity Commission has previously cautioned the asymmetric consequences of regulatory error as follows:[5]

> …. the Commission does not subscribe to the view that, in a regulated environment, the community faces a choice between incurring the allocative efficiency costs of over-compensation and (more serious) dynamic costs of under-compensation. Both types of error are likely to influence investment outcomes and therefore have dynamic efficiency implications.
>
> Nonetheless, the Commission accepts that there is a potential asymmetry in effects:
>
> Over-compensation may sometimes result in inefficiencies in the timing of new investment in essential infrastructure (with flow-ons to investment in related markets), and occasionally lead to inefficient investment to by-pass parts of a network. However, it will never preclude socially worthwhile investments from proceeding.
>
> On the other hand, if the truncation of balancing upside profits is expected to be substantial, major investments of considerable benefit to the community could be forgone, again with flow-on effects for investment in related markets.
>
> In the Commission's view, the latter is likely to be a worse outcome. Accordingly, it concurs with the argument that access regulators should be circumspect in their

[5] Productivity Commission (2001). Review of the National Access Regime, Report No. 17, AusInfo, Canberra, p.83.

attempts to remove monopoly rents perceived to attach to successful infrastructure projects.

Accordingly, the choice of WACC formula has important implications for the cash flows of the investors in PoM as well as to provide PoM the appropriate incentives to continue making efficient investments which are central to achieving the objectives of the *Port Management Act (Vic) 1995* (the Port Management Act).[6]

## 2.2 Chosen WACC formulation

### 2.2.1 Post tax nominal WACC

The approach most commonly applied to estimate WACC in Australian regulatory regimes is the post-tax nominal 'vanilla' WACC. In other words, the rate of return estimate is expressed as a weighted sum of the returns on equity and debt in inflation-adjusted and after-tax terms. Under the post-tax nominal 'vanilla' WACC formula, tax is modelled as a cost in the cash flows rather than forming part of the WACC calculation. It is expressed as follows:

$$\text{Nominal post-tax WACC} = R_e \frac{E}{E+D} + R_d \frac{D}{E+D}$$

Where:

Re = post-tax return on equity

Rd = pre-tax return on debt

D = proportion of debt (gearing) within the assumed capital structure

E = proportion of equity within the assumed capital structure

### 2.2.2 Pre-tax nominal WACC

In contrast, the Pricing Order requires the WACC formula to be expressed in pre-tax nominal terms. The pre-tax nominal formulation adjusts for taxation and dividend imputation in the WACC formula rather than the cash flows of the business. It is expressed as follows:

$$\text{Nominal pre-tax WACC} = \frac{R_e}{\left(1 - t_c\left[1-\gamma\right]\right)} * \frac{E}{E+D} + R_d \frac{D}{E+D}$$

[6] *Port Management Act 1995* (Vic), Section 48.

Where:

Re = post-tax return on equity

Rd = pre-tax return on debt

D = level of debt within the capital structure

E = level of equity within the capital structure

t = corporate tax rate

$\gamma$ = gamma (value of imputation credits)

An underlying assumption of the pre-tax nominal WACC formulation is that the BEE will pay the Australian statutory corporate income tax rate of 30%. This is a standard approach across the broader finance community, whether it be in academic literature, the corporate finance industry or incentive-based regulatory frameworks, whereby the cost of capital is established having regard to benchmark efficient costs rather than the actual costs of the regulated entity.

The Federal Government proposes to reduce the corporate tax rate to 25% for all corporate entities by 2026-27.[7] However, we note that these changes have not yet been legislated. We will continue to monitor developments with the corporate tax rate in future submissions.

In effect, the return required by equity investors is multiplied by this tax wedge, which converts the post-tax return on equity to a pre-tax cost of equity. This value is assumed to provide sufficient revenues to meet the BEE's tax liabilities.

[7] ATO. (2018). Reducing the corporate tax rate. Available from: https://www.ato.gov.au/General/New-legislation/In-detail/Direct-taxes/Income-tax-for-businesses/Reducing-the-corporate-tax-rate/ [Accessed 16 May 2018].

# 3 Use of one or a combination of well-accepted approaches

| Chapter overview |
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| This section considers and responds to the guidance provided by the ESC in the SoRA regarding the requirements of the Pricing Order on well-accepted. We present our views on the relevant tests for well-accepted in the context of the Pricing Order. |

## 3.1 Requirements under the Pricing Order

The key provisions in the Pricing Order in regards to the estimation of a WACC for the port are Clauses 3.1, 4.1 and 4.3.

*Clause 3.1*

The tariffs adjustment limit (TAL) requires the weighted average tariff increase for Prescribed Services to not exceed the percentage change in the Australian Consumer Price Index (CPI) between the March quarter in the preceding financial year and the March quarter in the financial year two years prior. In short, average prices cannot rise faster than CPI during the period in which the TAL applies.

*Clause 4.1*

Sub-clause 4.1.1 requires that for determining its Annual Revenue Requirement, the Port Licence Holder must apply an accrual building block methodology that, amongst other things, includes an allowance to recover a return on its capital base that is commensurate with a BEE providing services with a similar degree of risk as the Port Licence Holder in regards to the provision of Prescribed Services.

*Clause 4.3*

In determining the return on capital allowance in accordance with sub-clause 4.3.1, the Port Licence Holder must use one or a combination of well-accepted approaches that distinguish the cost of equity and debt to determine the WACC.

The WACC is to be calculated on a pre-tax nominal basis.

## 3.2 Interpretation of Pricing Order provisions

The Pricing Order confers important discretions upon the Port Licence Holder in determining the WACC and return on capital allowance.

The key guidance provided in the Pricing Order relates to:

- the use of a BEE with a similar degree of risk to PoM in providing Prescribed Services under the Pricing Order;
- the use of one or a combination of well-accepted approaches that distinguish the cost of equity and debt to determine the WACC; and
- the WACC is to be calculated on a pre-tax nominal basis.

Under the Pricing Order, it is up to the Port Licence Holder to interpret the requirements of the relevant provision and to demonstrate how it complies with the Pricing Order.

As such, the Pricing Order contrasts with the approach adopted in regulatory determination processes in Australia, whereby the relevant regulator ultimately holds deterministic responsibilities on the interpretation of the relevant requirements of the instrument and the assessment of the appropriate parameter values for that determination.

Considering this guidance and the important discretions given to the Port Licence Holder, PoM, in determining its WACC, this report presents and substantiates the estimation of a WACC having regard to relevant estimation methods, asset pricing models, market data and regulatory precedent in accordance with the Pricing Order.

## 3.3 Overview of ESC commentary

Since PoM completed its 2017-18 TCS submission, the ESC has published a number of commentary documents in relation to WACC. These are as follows:

- Interim Commentary (November 2017)
- Statement of Regulatory Approach (SoRA) (December 2017).

A key theme emerging from these documents is the definition of 'well-accepted' in the context of the Port License Holder using 'one or a combination of well-accepted approaches that distinguish the cost of equity and debt, and so derive a weighted average cost of capital.'[8] Based on expert legal and regulatory advice, PoM submitted that 'well-accepted' encompasses regulatory precedent, financial practitioner evidence and academic literature. The ESC disagreed with this interpretation, rather focussing narrowly on regulatory precedent.

[8] *Port Management Act 1995* (Vic) Pricing Order, Clause 4.3.1.

The ESC also queries aspects of PoM's definition of the BEE to be used in the context of the Port License Holder's calculation of an allowance to recover a risk-weighted return on its capital base.[9]

The ESC's commentary on WACC estimation issues will be examined in the remainder of this chapter.

## 3.4 ESC 3-step process for assessing rate of return clauses

The ESC has indicated that it will adopt a three-step compliance assessment framework to assess whether PoM has complied with the requirements of the Pricing Order and the broader objectives of the Port Management Act. Each step is summarised below.

### 3.4.1 Step 1: Well-accepted test

The first step, "the well-accepted test," relates to clause 4.3.1 and assesses whether the approach or combination of approaches used by PoM to determine the allowed rate of return are "well-accepted."

Step 1 has a narrow focus on approaches applied by regulators, and the ESC intends for this to be a qualitative assessment only, with quantitative evaluation to occur in later steps of the process.

The ESC's preferred criterion for well-accepted is its use by at least one economic regulator to determine the rate of return in calculating the annual revenue requirement under the building block methodology, or by a review body overseeing decisions by economic regulators.

Synergies understands from PoM that the ESC noted it will consider both Australian and international regulatory precedent.[10] However, as we detail in Section 3.5, our view is that 'well-accepted' encompasses regulatory precedent, evidence from financial practitioners, and academic literature.

### 3.4.2 Step 2: Benchmark efficient entity test

The second step, "the benchmark efficient entity test", relates to clause 4.1.1 of the Pricing Order. Accordingly, this step aims to verify whether the return on capital outcome determined by the port is commensurate with the required rate of return for the BEE.

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9 *Port Management Act 1995* (Vic) Pricing Order, Clause 4.1.1.

10 PoM advice provided to Synergies on 18 January 2018.

The assessment will be quantitative with an emphasis on the quantum of the WACC estimate and its reasonableness. This step entails two components.

First, high level cross-checks will be undertaken by the ESC in order to evaluate the reasonableness of the return on equity. Such cross-checks may involve an appraisal of relevant regulatory decisions, surveys, valuation and broker reports, and other reference points. Comparator entities that are adopted must be "efficient" and unlikely to face significant competition, and can include Australian and international regulated and non-regulated entities. At this stage, PoM would be considered in compliance with the Pricing Order if these cross-checks confirm that the submitted rate of return is consistent with that required by the BEE.

Although this is not a requirement of the Pricing Order, we have performed this analysis and provided the results in Section 12.2.2 pursuant to this request by the ESC, demonstrating compliance with this step.

If the cross-checks suggest the return on capital is not commensurate with that required by the BEE, then the ESC would seek to identify which specific components of the WACC are leading to the unreasonable return. This could involve a closer examination of individual parameter estimates, or the way in which individual estimates have been combined to calculate the overall WACC. This is the focus of Step 3.

### 3.4.3 Step 3: Further investigation

If reached, Step 3 would necessitate more detailed, focussed analysis on the part of the ESC to assess whether the WACC is compliant with the objective of the Pricing Order. The ESC has indicated in its SoRA that this could involve:

- A review of the assumptions and data underpinning PoM's chosen estimation models or methodologies.
- Sensitivity testing of empirical analysis relied upon by PoM.
- First principles analysis of PoM's risk profile, comparing these risks to the listed comparator sample to determine whether such risks are higher or lower.
- Empirical implementation of other well-accepted approaches that may lead to different rate of return outcomes.
- Establishment of confidence bands or plausible ranges for the overall WACC, as well as individual parameters.

The ESC has indicated to PoM that it may proceed to Step 3 regardless of the outcomes from Step 2, but the likelihood of a non-compliant finding on the basis of Step 3 alone is very low.

Synergies' approach to the estimation of each WACC parameter for the 2017-18 TCS was, and for the 2018-19 TCS continues to be, in compliance with the guiding principles of this step, as we consider that these naturally form part of a robust WACC estimation process. As such, our interpretation of the Pricing Order is that while the three issues identified by the ESC are relevant to the assessment of PoM's compliance with the 'well-accepted' principle, they need not be applied as a sequential test. This is because the Pricing Order does not establish any such prescription in the WACC estimation process. To this end, throughout our report, we demonstrate how our proposed WACC estimate satisfies ESC's assessment framework. However, we do not agree that the three-step sequential assessment framework is necessarily binding on PoM in the context of the Pricing Order.

## 3.5 Interpreting a well-accepted approach

As noted above, the ESC has proposed that for an approach to be well-accepted within the meaning of clause 4.3.1, it must be used by:

(a) at least one economic regulator to determine the rate of return for the purpose of calculating the ARR using a building block methodology or;

(b) a review body overseeing decisions by economic regulators.

The ESC has also posited that the application of academic and financial market approaches may disregard the regulatory context in which the allowable rate of return is being set.

In contrast, our interpretation of a well-accepted approach is based on the application of the following key principles:

- Consistency with the Port Management Act 1995 objectives.
- The guiding principles espoused by economic regulators to identify acceptable attributes of an approach to assessing the cost of capital.
- That the Pricing Order confers upon PoM an important discretion to the Port Licence Holder to determine the WACC and return on capital allowance, subject to meeting the broader objectives of the Port Management Act.
- Reflecting the design of the Pricing Order, which is drafted in an open way.

Each of these factors is discussed below.

### 3.5.1 Port Management Act 1995 objectives

The Pricing Order is a regulatory instrument made under section 49A of the *Port Management Act 1995* (the PMA).

Part 3 of the PMA establishes the framework for the regulation of port services, including the objectives to guide interpretation of the Pricing Order. The objectives of most relevance to the estimation of PoM's cost of capital are the following:

- to promote efficient use of, and investment in, the provision of prescribed services for the long-term interests of users and Victorian consumers (s48(1)(a));
- to protect the interests of users of prescribed services by ensuring that prescribed prices are fair and reasonable whilst having regard to the level of competition in, and efficiency of, the regulated industry (s48(1)(b)); and
- to allow a provider of Prescribed Services a reasonable opportunity to recover the efficient costs of providing Prescribed Services, including a return commensurate with the risks involved (s48(1)(c)).

These objectives reflect the intention of all economic regulatory regimes to ensure that efficient outcomes consistent with those found in a workably competitive market are achieved. That is, the Pricing Order is intended to operate as "a surrogate for the rewards and disciplines normally provided by a competitive market."[11]

The concept of a well-accepted approach to determining the cost of capital must have regard to these objectives. In broad terms, this means that the cost of capital must be set to promote efficient use of, and investment in, the provision of Prescribed Services in the long-term interests of port users and Victorian consumers.

In our view, these objectives require a broad meaning of "well-accepted" to be adopted that includes not only the approaches accepted by regulators (both Australian and international), but also those approaches adopted by the financial and academic communities.

All these communities ultimately attempt to value businesses in an efficient manner, consistent with the objectives of the regulatory regime. Furthermore, consideration of approaches used in a workably competitive market are clearly relevant to the consideration of how the BEE should be valued given that the efficiencies referred to in

[11] *East Australian Pipeline v Australian Competition and Consumer Commission* (2007) 233 CLR 229, para. 81.

the objectives of the regulatory regime are intended to reflect the out-workings of a workably competitive market. The approaches of regulators remain relevant because they represent the regulator's views of approaches used to achieve the objectives in the market. However, they only form a subset of possible approaches that may be considered "well-accepted". It is therefore inappropriate to limit the meaning of "well-accepted" to only those approaches adopted by regulators or the more limited subset of Australian regulators.

This is not to say that our proposed WACC methodology is inconsistent with regulatory precedent. Table 6 outlines the evidence from economic regulators in support of the approaches that we have used. However, the case for these approaches is strengthened by having proper regard to academic and financial practitioner evidence.

Table 6 Regulatory precedent for WACC proposal

| WACC component | Proposed approach | Use by economic regulators |
|---|---|---|
| Risk-free rate | 20-day average on 10-year Commonwealth Government bonds | Used by numerous Australian and international regulators |
| Capital structure | Gearing based on median and average from sample of comparable listed and unlisted entities. | Gearing based on median or average of relevant comparator sample. |
| Return on equity | Multi-model approach, consisting of: | |
| | SL CAPM | SL CAPM is widely used by regulators |
| | Black CAPM | The AER has endorsed the Black CAPM in its Rate of Return Guideline and uses it indirectly to inform the asset beta component of its cost of equity estimate. Also used in US and Canadian regulatory decisions. |
| | Fama-French Model (FFM) | IPART has announced that it will monitor the FFM over the next 5 years. Endorsement of FFM by NZ Commerce Commission, as well as regulatory use in the UK and US. |
| Beta | Asset beta based on median and average from sample of comparable listed domestic and international transport entities from multiple sectors | Regulatory decisions have used companies from other transport sectors to inform beta estimates or ranges (e.g. ERA's use of port comparators for rail WACC determinations). Regulators also rely on overseas comparators if insufficient domestic comparators are available. |
| Market risk premium | 50:50 weighting of Wright and Ibbotson MRP approaches) | Ibbotson MRP in use by various Australian regulators. Both the ERA and QCA have regard to the Wright MRP. |
| Return on debt | On-the-day approach based on average of RBA and Bloomberg methodologies. Transition to trailing average possible once return on debt history is established. | On-the-day approach in use by the ACCC and QCA; trailing average now in use by AER, IPART and ERA. Trailing average also adopted by Ofgem and NZ Commerce Commission. |
| Gamma | Based on average of gamma values derived from finance theory, equity ownership approach and market valuation studies. | Typically based on equity ownership approach and/or market valuation studies. |

**Source:** Synergies analysis, various regulatory decisions

### 3.5.2 Guiding principles for well-accepted approach

The need for a broader interpretation of the well-accepted provision is reinforced by the adoption of valuation and asset pricing models by each of these communities. Regulators have adopted models developed in academia and have also adopted models used by financial practitioners.

In its WACC methodology review released in February 2018, IPART addressed four principles for the determination of an appropriate rate of return. They are as follows:[12]

- WACC methods should produce estimates of the cost of capital that are as reasonably accurate as possible. This will ensure that customers do not pay more than necessary and that the regulated firms will be financially viable and have the incentive to invest in the efficient level of productive assets.
- WACC methods should be relatively stable over time to give stakeholders certainty.
- WACC methods should be predictable and replicable by stakeholders to provide transparency and reduce resources required in each review.
- Incremental improvements should be made where there is sufficient evidence that they increase the accuracy of the cost of capital faced by a benchmark efficient firm.

Similarly, in its December 2013 *Better Regulation – Rate of Return Guideline*, the AER considered that rate of return decisions should use "estimation methods, financial models, market data and other evidence that are, where applicable, reflective of economic and finance principles and market information."[13] Furthermore, such approaches should be "informed by sound empirical analysis and robust data" and should be "sufficiently flexible as to allow changing market conditions and new information to be reflected in regulatory outcomes as appropriate."

In the context of the Pricing Order, including its lack of prescription and scope for differing interpretations of the well-accepted guiding principle, we consider a relevant WACC assessment approach is that it should adhere closely to the regulatory principles identified above (i.e. accuracy, stability, predictability, replicability, transparency) rather than simply reducing to an assessment of whether an aggregate WACC estimate or component parameter estimate is accepted by one or more regulators.

Table 7 (over page), shows how we have applied these criteria to our proposed WACC submission for PoM.

[12] IPART (2018a). Review of our WACC method. February, p.14.

[13] AER (2013a). Better regulation – rate of return guideline, December, p.6.

Table 7 Application of IPART and AER criteria to PoM WACC submission

| Parameter | Accuracy | Stability and predictability | Transparency and replicability | Reflective of economic/financial principles | Flexibility with changing market conditions | Robust data |
|---|---|---|---|---|---|---|
| **Risk-free rate** | 20-day average avoids one-off anomalies whilst capturing recent market conditions | Risk-free rate will change with market conditions, but 20-day average will be a stable estimator of current underlying conditions | RBA dataset is publicly available | 10-year government bond corresponds to PoM's long-term investment horizon | 20-day average will incorporate changes in market conditions promptly. | RBA is acknowledged as a reliable data source and is frequently used by regulators |
| **Capital structure** | Observed gearing of listed firms best proxy for unobservable BEE, supplemented by privatisation evidence | 5 and 10-year comparator averages less susceptible to short-term fluctuations | Gearing data from Bloomberg is publicly available | Firms with similar risk profiles to PoM will maintain similar capital structures | Changes in gearing will be incorporated into averages over time. | Bloomberg is a globally-recognised data source |
| **SL CAPM** | Empirical shortcomings in SL CAPM imply that it may underestimate the return on equity, particularly for entities with equity betas less than 1 | SL CAPM remains stable provided estimates of risk-free rate and MRP are responsive to changes in market conditions | Formula is easy to apply | SL CAPM empirical performance is poor | Changes in return on equity will be driven by changes in risk-free rate, beta and MRP | SL CAPM is a function of the risk-free rate, beta and MRP, all of which are based on robust data |
| **Black CAPM** | Use of zero beta premium corrects for low-beta bias of SL CAPM | Relationship between SL CAPM and Black CAPM is well-defined | We have adopted the SFG (2014) zero-beta premium estimate of 3.34% | Low-beta bias is empirically observed | Changes in return on equity will be driven by changes in risk-free rate, beta and MRP | Zero beta premium can be derived from market data |
| **Fama-French Model** | FFM accounts for factors not captured by CAPM. Widely recognised | Averaging across all firms in the comparator set reduces the impact of outliers | We have provided an extensive description of our approach | Listed entity size and value premiums have been consistently observed around the world | FFM results in a more rigorous estimate of the return on equity | Professor French's dataset is globally recognised |
| **Beta** | Our use of different sectors establishes a reasonable range for PoM's asset beta | Large number of comparator companies and 5/10-year averages/medians reduces impact of outliers | All beta estimates can be replicated via Bloomberg, and we have detailed our de-levering process | Companies with similar risk profiles will tend to share similar exposure to systematic risk | Long-term averages will gradually incorporate changes in companies' exposure to systematic risk | Data on beta is based on observed security returns from Bloomberg, a globally recognised data source |

| Parameter | Accuracy | Stability and predictability | Transparency and replicability | Reflective of economic/financial principles | Flexibility with changing market conditions | Robust data |
|---|---|---|---|---|---|---|
| **Market risk premium (Ibbotson MRP)** | Historical averages based on observed market returns; forward-looking approaches sensitive to assumptions | Historical averages fluctuate less than forward-looking estimates | We have detailed our approach to calculating the Ibbotson MRP | Ibbotson MRP captures the stability of the MRP under conventional market conditions, but may be misrepresentative if the risk-free rate deviates from its long-term average | Ibbotson MRP does not adjust in response to risk-free rate – hence our 50:50 weighting with the Wright MRP | Bloomberg is a globally recognised data source, and NERA MRP data is well recognised in Australia |
| **Market risk premium (Wright MRP)** | Historical averages based on observed market returns; forward-looking approaches sensitive to assumptions | Historical averages fluctuate less than forward-looking estimates | We have detailed our approach to calculating the Wright MRP | Wright MRP reflects empirical tendency for return on equity to remain relatively stable over time | Wright MRP adjusts in response to risk-free rate | Bloomberg is a globally recognised data source, and NERA MRP data is well recognised in Australia |
| **Return on debt** | Short term averages from RBA and Bloomberg will reliably estimate the current return on debt, although the actual return on debt will vary over time with market conditions | Trailing average may offer more stability over the long run, but this does not invalidate the on-the-day approach | RBA and Bloomberg data is publicly available, and we have detailed the adjustments we have made to the raw estimates | On-the-day approach is more intuitive for PoM given recent privatisation, but trailing average may be more viable once return on debt history is established | Return on debt methodology will reflect changes in the risk premium attributable to a BBB credit rating over time. Trailing average may be more representative of actual debt management practices | Historical evidence suggests that neither RBA nor Bloomberg approach has been systematically higher than the other |
| **Gamma** | Combination of well-accepted approaches avoids reliance on a single method that may promote over or underestimation of the parameter | Consecutive dividend drop-off studies indicate gamma value of 0.25. Foreign status of marginal investor unlikely to change over investment horizon, implying zero gamma value | Evidence on gamma is well-documented in financial practice and academic journals | Marginal investor is likely to be foreign in Australia given size of domestic market, meaning that imputation credits are valued well below face value | The estimate of gamma is less likely to vary than other parameters over time assuming investors' required post-tax return on equity is stable | Dividend drop-off studies are based on observed market data |

**Source:** Criteria are derived from IPART WACC Methodology (2018) and AER Better regulation – rate of return guideline (2013)

Approaches that meet such a higher-level threshold may also be found in financial or academic sectors. Like regulators, financial practitioners have adopted and adapted models developed in academia. This suggests that regulators themselves are borrowing knowledge and learnings from these other communities. A failure to consider these broader models may result in a failure to achieve the efficiencies referred to in the objectives of the Port Management Act.

Accordingly, consistent with the objectives of the Port Management Act, we have interpreted a well-accepted approach as being an approach accepted/adopted by one or more regulators (both Australian and international), the financial community or academia.

### 3.5.3 Inappropriate to unduly limit the discretion of PoM

In the Consultation Paper, the ESC describes the Pricing Order as a price compliance regime, which it distinguishes as being lighter handed than a price determination regime. The ESC describes the Pricing Order as: [14]

> a unique form of regulation best described as a price compliance regime. It represents a more heavy-handed form of regulation than a typical price monitoring regime, but is lighter handed than a price determination regime.

As a "price compliance regime," the Pricing Order establishes a set of processes for PoM to follow in setting prices for its Prescribed Services that must provide it with a reasonable opportunity to recover revenue in the range of efficient costs. This includes placing a CPI-based cap on prescribed service tariff increases for the first 20 years of the lease term. The Pricing Order therefore places the initial onus on PoM to interpret the meaning of the Pricing Order, including the meaning of the phrase "well-accepted", such that it meets the objectives of the PMA. This discretion provided to PoM to interpret the meaning of the Pricing Order is intended and important, recognising that the Port License Holder must also demonstrate compliance with the Pricing Order.

In doing so, the Pricing Order provides that, should PoM's interpretation of it be determined to be wrong, and PoM is properly found to be in significant and sustained non-compliance, the form of regulation can change with a heavier-handed approach implemented in place of the Pricing Order framework.

In our view, these features of the regulatory regime reflect the fact that the Victorian Parliament intended there to be greater discretion afforded to PoM in interpreting the

[14] ESC (2017a). Regulatory approach to the Pricing Order – a consultation paper, May, p.3.

Pricing Order when compared to the more constrained discretion it would have under a conventional price determination regime.

That is, PoM is conferred an important discretion in the first instance when establishing the parameters of the building block model for the purposes of complying with the Pricing Order. As such, it is inappropriate for the ESC to limit PoM's discretion to determine a well-accepted approach to only those approaches accepted in a regulatory setting, provided that the approach meets the objectives of the PMA and otherwise complies with the Pricing Order. For the reasons outlined above, in our view, whilst an approach needs to be suitable for a regulatory setting, the range of options open to PoM under the Pricing Order is not limited to approaches that have been accepted by regulators.

Allowing PoM to determine what a well-accepted approach is using a wide range of models gives the regulatory regime the flexibility necessary to quickly adjust to developments in knowledge and learning by academia and the financial industry in relation to the weighted average cost of capital.

There is no reason to suggest that a breakthrough model developed and accepted in academia, or by the financial community, should not be considered well-accepted for the purposes of the Pricing Order simply because other regulators (who may operate with very different tests and legislative approaches to those contained in the Pricing Order) are yet to adopt it.

Equally, it is respectfully suggested that the adoption of an approach by a regulator to the cost of equity, such as the increments potentially available under the ESC's PREMO approach applied to Victorian water utilities, which have been adopted for wider purposes than simply remunerating past investment, does not legitimise that approach as a well-accepted approach in regulatory circles to the determination of the cost of equity. As such, the Pricing Order does not qualify the meaning of "well-accepted" in the manner inferred by the Commission.

### 3.5.4 The Pricing Order is drafted in an open way

The language of the Pricing Order does not limit or provide any guidance on the meaning of the phrase "well-accepted" other than that it should be interpreted in a manner consistent with the objectives of the Port Management Act as discussed above and the concept of "a combination of well-accepted approaches" is expressly permitted by the Pricing Order. Accordingly, the phrase should be given its natural meaning.

In our view, the natural meaning of the phrase "well-accepted" is not "well-accepted by Australian regulators or regulators elsewhere". Had this been the case, it would have

been a simple matter for the Pricing Order to be constrained in this way. Hence, it is not appropriate that the meaning of the phrase is circumscribed in the manner suggested by the ESC. Instead, the phrase permits an approach that is well-accepted by global regulators, by the financial community or by academia to also be well-accepted for the purposes of the Pricing Order. Such approaches clearly fall within the broad natural meaning of the phrase "well-accepted" and are therefore contemplated as being able to be used by PoM when determining the weighted average cost of capital. In our view, if a narrower meaning was intended, then the Pricing Order would have been drafted to specify that narrower meaning.

The broad language chosen by the ESC Minister in the Pricing Order, including the express reference to "a combination of well-accepted approaches," reflects recognition in other regulatory regimes that a range of approaches can be used to inform an assessment of the parameters for the weighted average cost of capital. For example, the AER and ERA were given greater discretion when determining the return on equity and the return on debt for electricity networks and regulated gas pipelines in 2012 following a rule change made by the AEMC. The Pricing Order has been drafted reflecting this trend. However, the Pricing Order is different from the instruments governing the AER and ERA processes in the sense that it confers the discretion on the Port Licence Holder so long as the Port Licence Holder adopts one or a combination of well-accepted approaches and otherwise demonstrates compliance with the Pricing Order. It is therefore submitted that the ESC's assessment of the Port Licence Holder's compliance with the Pricing Order should be applied in this context.

## 3.6 Determining one or a combination of approaches

In considering the component parts of PoM's weighted average cost of capital, including its cost of equity, cost of debt and WACC parameters, we have canvassed what we believe to be well-accepted approaches. The Pricing Order is silent in terms of how PoM should apply a combination of well-accepted approaches.

We do not identify strong, compelling arguments to give more weight to one well-accepted approach over another, rather where relevant we have applied an equal weighting to each approach in deriving the relevant WACC input. We have done this to provide a transparent, unbiased weighted average cost of capital which avoids the perception of cherry picking one approach over another. We believe that this is consistent with the characteristics of an approach appropriate for a regulatory process as outlined above (i.e. accuracy, stability, predictability, replicability, transparency). Each subsequent period PoM will need to reassess this averaging approach and the fundamental pros and cons of each to substantiate the weights applied based on the evidence available at the time.

It is also important to highlight that the 'well-accepted' stipulation is used in reference to the approaches used by PoM, whether alone or in combination, and not to the chosen combination itself. In other words, PoM is required to adopt a 'combination of well-accepted approaches' but not necessarily a 'well-accepted combination of well-accepted approaches.' In determining a WACC estimate for PoM, where there is a lack of regulatory or other consensus on the appropriate weighting for combinations, we generally opt for an equal weighting of these approaches.

### 3.6.1 All approaches have practical difficulties

There is some merit in the ESC's observation that:[15]

> Some approaches used in academia or by finance practitioners are not well-accepted in Australian regulatory practice and their application can be difficult in practice due to data quality and availability issues or methodological choices.

However, it does not follow that *only* the approaches used by Australian regulators can be applied by PoM when determining the weighted average cost of capital. It is only the application of *some* approaches used in academia and by financial practitioners that are affected by this criticism. Indeed, data quality and availability presents challenges in the application of all cost of equity models, including those favoured in Australian regulatory practice.

Data quality and availability issues and methodological choices do not therefore provide a justification for limiting the meaning of the phrase "well-accepted" approaches to only those approaches accepted by Australian regulators. It requires a case by case assessment.

Furthermore, the cost of equity approaches commonly used in Australian regulatory practice are not without limitation and have often been contentious in application, particularly following the Global Financial Crisis. This confirms that a well-accepted approach to determining the weighted average cost of capital cannot reasonably be constrained to Australian regulatory practice having regard to the range of approaches that could be adopted by PoM and comply with the Pricing Order.

Finally, we do not consider that the practical difficulties in applying some of the approaches used by the financial community and academia to determine the weighted average cost of capital should result in the exclusion of all the approaches used by the financial community and academia. Some of these approaches can be used by PoM and

[15] ESC (2017a), p.41.

many have the same or similar practical difficulties as those used by Australian regulators.

# 4 Benchmark efficient entity (BEE)

| Chapter overview |
| --- |
| In response to the ESC's commentary, we have removed the requirement that the BEE must have a market capitalisation of at least $US100 million. However, we have retained our classification of the BEE as a private sector entity, because public sector entities typically lack the market data required to facilitate WACC analysis. |

## 4.1 Identifying a BEE

Under incentive-based economic regulation, the WACC is set having regard to a BEE with comparable risks to the regulated entity and that is reflective of prevailing conditions in equity and debt markets.

### 4.1.1 Pricing Order requirements

The Pricing Order is consistent with this approach by requiring that the rate of return allowance be calculated using a 'benchmark efficient entity' with a similar risk profile to PoM in its provision of Prescribed Services (which excludes property-related services). In other words, the WACC estimate should be based on an efficient external benchmark rather than PoM's actual cost of capital.

There is no formal definition of the BEE in the Pricing Order. Consequently, there is a need to identify the key characteristics of such an entity. This involves establishing a conceptual definition of the characteristics of the BEE relevant to WACC estimation. Once defined, it is necessary to gather evidence from actual 'comparator' entities which best resemble the conceptual entity, as a means to inform the benchmark parameters for the cost of equity and the cost of debt.

In its Consultation Paper, the ESC provided its view on the risk profile of PoM and the factors that could be used to identify appropriate comparator entities which best resemble the conceptual BEE.[16]

In terms of risk profile, the ESC notes the relevant risk characteristics of the services provided by PoM include that the Prescribed Services:

- relate primarily to the provision of wharfage and channel access services
- are provided by a port that predominantly derives revenue from services to container cargo, with a smaller share of bulk and non-bulk cargoes
- are provided by a port in Australia.

[16] ESC (2017a).

In regards to comparator entities, the ESC recognises there are no publicly-listed ports in Australia. Accordingly, it suggested the following methodology:[17]

> Consequently, the port will have to determine a comparator set by considering other characteristics of the port's prescribed services, and by making trade-offs between elements of comparability. For example, by including other firms (not ports) that provide similarly risky services or to include overseas ports in the comparator set. Whichever approach is adopted, it is important that a systematic approach to comparator selection be used to avoid 'cherry picking' comparators in each regulatory period.

### 4.1.2 Australian regulatory precedent

In terms of the conceptual efficient benchmark definition, the Western Australia Economic Regulation Authority (ERA) has provided guidance on its regulatory interpretation as follows:[18]

> It is desirable that the benchmark not be hypothetical. This means that the benchmark must, as far as possible, reflect achievable financing practices, which reflect the practices of efficient firms exposed to a similar degree of risk as the regulated firm. Importantly, by reflecting achievable efficient financing practices, the benchmark will allow the service provider 'reasonable opportunity' to achieve the efficient parameters determined for the benchmark entity.

Whilst the Pricing Order applies to only one entity (as opposed to a range of regulated businesses as was the case for the ERA), the ERA's approach is consistent with the Pricing Order requirement that the Port Licence Holder be given a reasonable opportunity to recover the efficient cost of providing all Prescribed Services.

The ERA's review also provided useful guidance on the reliance on international comparators in informing the assessment of the risk profile of a BEE, including the degree to which:[19]

- foreign investors seek to invest equity in Australian firms, augmenting domestically-sourced investment (in the case of Port of Melbourne, the Lonsdale Consortium involves a number of foreign investors);

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17 ESC (2017a), p.40.

18 ERA (2015a). Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks, Final decision, 18 September, p.20.

19 ERA (2015a), p.22.

- Australian firms raise capital for their Australian investments on overseas capital markets, to supplement capital raisings in Australia; and
- there is arbitrage between Australia's financial markets and those overseas.

This reflects the broader issue of whether estimation of the BEE's cost of capital should be based solely on domestic parameter values or can also incorporate international parameter values. The ERA has previously commented on this issue as follows:[20]

> Overall, the Authority considers that not strictly adhering to the internal consistency of the estimation method – by basing some estimates on a mix of domestic and international estimates – is reasonable in the circumstances in order to enhance the robustness of the parameter estimates.
>
> In this context, the Authority considers that some parameters are likely to be more independent of jurisdiction than other parameters. For instance, gearing, credit rating and equity beta (notwithstanding differences in, for example, tax treatment) are likely to be more independent of jurisdiction than are the risk-free rate and market risk premium, which will be closely related to country conditions.

Both the ERA and ACCC have used international comparators to ensure the estimation of robust efficient benchmark beta and gearing parameter values for regulated Australian transport entities. Synergies concurs with this approach.

This view has been reflected by the Full Federal Court in its recent judgment in *Australian Energy Regulator v Australian Competition Tribunal (No 2)* where it comments in relation to the BEE:[21]

> …The allowed rate of return objective confers on the benchmark its particular, necessary and defining characteristics: it must be efficient and it must face "a similar degree of risk" as that which applies to the particular service provider in question in relation to the provision of standard control services. But the attribution of the relevant "efficiency" (i.e., in respect of financing costs) is to be gauged by the disciplines of a workably competitive market (i.e., an unregulated market).

That is, the Full Federal Court has found that the BEE must face the risks specific to the business it is intended to replicate and the efficiencies possessed by that BEE are those determined by a workably competitive market. If the relevant workably competitive market is an international one, then international comparators should be used.

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[20] ERA (2015a), p.24.

[21] *Australian Energy Regulator v Australian Competition Tribunal (No 2)* [2017] FCAFC 79, para. 537.

## 4.2 ESC definition of BEE

In its SoRA, the ESC reinforced its view from earlier commentary on the characteristics of the BEE, as discussed in the previous section. However, the ESC acknowledged the challenges in identifying a sufficiently large set of comparators in Australia that closely reflect the risk characteristics of the BEE.

The key differences between our previous report and the ESC on the definition of the BEE are summarised in Table 8.

Table 8 Contrasting positions of Synergies 2017 report and the ESC on the BEE

| Synergies | ESC |
|---|---|
| Supplies services equivalent to PoM's Prescribed Services | Primarily supplies wharfage and channel access services |
| Freight-focused | Predominantly derives revenue from container cargo, smaller share of bulk and non-bulk cargoes |
| Not necessarily domiciled in Australia | Domiciled in Australia |
| Private sector provider | Not necessarily private/public ownership, but efficient |
| Market cap > $US100m | Unlikely to face significant competition in short to medium term. |
| Not vertically integrated in relevant supply chain | |
| Some contestability between ports | |

Several points of difference can be drawn from this comparison:

- the ESC has questioned the need for a $US100m threshold for market capitalisation. We consider entities with less than $US100m market capitalisation could meet the test of the BEE but should still be subject to the statistically significant filtering process for beta estimation based on available data;
- we consider public sector entities could well form part of the sample of the BEE as suggested by the ESC, but they would fail any filtering process for the purposes of estimating the cost of capital because they cannot sensibly inform the determination since they are not traded;
- our earlier report identified a "freight-focused" entity, whereas the ESC's characterisation is arguably narrower in that it refers to an entity that derives revenue from container cargo and a smaller share of bulk and non-bulk cargoes;
- we assume the BEE could face some contestability with other ports, in contrast the ESC considers the BEE is unlikely to face significant competition in the short to medium term; and
- our earlier report assumed the BEE is not necessarily domiciled in Australia, whereas the ESC favours an Australia-domiciled BEE.

Each of these points of difference is discussed in the following sections of this chapter.

*Market capitalisation threshold*

In our 2017 report, we placed a market capitalisation threshold on the size of the BEE, at $US100 million, in recognition that asset intensity is a relevant consideration for assessing comparability with the Port Licence Holder. The ESC responded that "it is not obvious that size should define the risk characteristics of the BEE."[22]

As a matter of principle, the key question is whether the comparator entity reasonably reflects the risk profile of PoM. We acknowledge that it is an open question whether it is possible for an entity that is substantially smaller in scale compared to PoM to meet this threshold (noting that size and asset intensity are relevant, but not determinative, considerations to the classification of PoM's BEE, including, for example, operating leverage).

In practice though, we note that firms with small market capitalisations are generally more prone to missing data or statistically insignificant beta estimates. With this in mind and in addressing the ESC's comments regarding size, we note that the decision to be made is whether these firms are removed from consideration at the BEE definition stage, or through statistical criteria in the subsequent asset beta filtering process.

We therefore acknowledge that the $US100 million threshold was arbitrary and that each firm should be considered individually in terms of risk characteristics as well as statistical significance. Accordingly, we have included companies whose market capitalisation is less than $US100 million in the comparator set where appropriate this year. In the context of beta estimation, the majority of these firms (36 of the 48) have statistically insignificant betas or insufficient data with which to generate a robust estimate. Of the 12 statistically valid firms, only 6 have characteristics that signify comparability to PoM.[23] In the airports sample, the only statistically valid firms with a market capitalisation of less than $US100 million are two aviation service providers in Africa.[24]

*Public or private sector status of the BEE*

Another point of difference between the two BEE definitions relates to the public and private sector delineation.

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[22] ESC (2017b). Feedback on consultation and other matters: Statement of Regulatory Approach version 1.0., December, p.43.

[23] These 6 firms are highlighted in the comparator list in Attachment B. The entities that can be most closely compared with PoM tend to have higher betas than the sample we adopted previously.

[24] There are no statistically significant freight railroads with a market capitalization of less than $US100 million.

The ESC stated that "Synergies did not explain why the BEE should be a private sector provider."[25] Instead, the ESC held that the BEE could be private or public, provided it was 'efficient.'[26] In our view, the key issue is the purpose of the investigation – for example, we agree that for assessments of operating cost, public sector entities may well be relevant comparators.

Accordingly, in principle, Synergies does not object to a definition of the BEE that encompasses both private and public sector owned entities. However, there are significant practical limitations using public-sector entities to inform the cost of capital because of the absence of relevant market data. For example, publicly owned entities, even if they are very similar to the Port Licence Holder, cannot inform the assessment of beta. Even in the case of capital structure, concerns arise regarding the focus on commercial incentives of publicly owned entities.

As such, at least for the purposes of assessing the cost of capital, we maintain that only private sector entities can be considered in the context of the BEE.

*Freight-focussed BEE*

In practice, we do not perceive material issues in the composition of the trade of comparator ports for the purposes of identifying the BEE. We agree that the BEE should broadly reflect PoM's freight exposure.

By this reasoning, coal-related entities are not considered relevant to PoM's BEE. Entities such as Aurizon Network, Dalrymple Bay Coal Terminal and the ARTC Hunter Valley rail network will have different risk profiles due to their narrow exposure to international thermal and coking coal markets, as well as the prevalence of take-or-pay contracts regarding the provision of transport infrastructure services in this sector. Accordingly, whilst freight focused, considerably less weight should be placed on these entities for comparison purposes.

In this regard, the ESC noted the need for trade-offs when sourcing comparators from other sectors (such as rail and airports).

*Extent of competition*

The prospect of competition from a second port for PoM also received attention from the ESC in the SoRA.

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25 ESC (2017b), p.38.

26 ESC (2017b), p.43.

We argued that PoM's BEE should be exposed to some contestability between ports, particularly given the prospect of a second container port being developed in the Melbourne region.[27] In contrast, the ESC said that the BEE would be unlikely to face significant competition in the provision of services similar to those of the Prescribed Services.

The ESC considered that, at the present time, it is "highly uncertain whether a second port will be developed in the Melbourne region."[28] We contend that the likelihood of the development of a second Melbourne port is considerably more certain than has been characterised by the ESC, although the timing of such a development is uncertain.

The ESC then goes on to state that even if the development of a second port were a reasonable likelihood, the specified timeframe for the port is nearly 40 years away, and is therefore unlikely to exert competitive pressures.

In May 2017, Infrastructure Victoria reported to the Victorian government that a new container report would be required in Melbourne by 2055. However, the Victorian government is yet to formerly endorse this timeline, and it has been contended that the construction of the port could be brought forward. Whilst clearly not imminent, the prospect of the development of a new port has material implications for PoM with respect to its return on future investments. PoM must make investment decisions across long-term horizons, and any change in demand for services will affect these investment decisions. Furthermore, PoM is only entitled to compensation for the construction of a second port if it takes place within the next 15 years.[29] From that point onwards, a significant barrier to the second port's construction is removed.

The impact of competition on our beta estimation is covered in further detail in the first principles analysis in Section 7.2.5 and in Attachment C of our report.

*Domicile of BEE*

The ESC has maintained its view that, for the purposes of defining the BEE, the Prescribed Services are provided by a port in Australia. In principle, the assumption of an Australian-domiciled BEE is reasonable given PoM is a Melbourne-based entity with no operations or revenue streams outside of Australia. However, when deriving a WACC estimate for an Australian entity, the practical reality is that there are generally insufficient Australian listed entities to derive robust asset beta and gearing estimates.

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27 Further details on the second Melbourne port are presented in Attachment D.

28 ESC (2017b), p.43.

29 *Delivering Victorian Infrastructure (Port of Melbourne Lease Transaction) Act 2016*, Clause 65(2)(a)(ii).

Our BEE assumption reflects this practical reality. In this regard, the need to use comparator entities outside of Australia is acknowledged by the ESC.

## 4.3 Defining the BEE for PoM

Having regard to the commentary provided by the ESC, we consider that the competing concepts of the BEE are not irreconcilable. The main challenge we (and the ESC) face is that there are relevant practical considerations, such as data limitations and the lack of suitable comparator entities, which need to be recognised, particularly in asset beta estimation.

As such, we propose to substantively retain our position on the BEE definition from the 2017-18 TCS submission. This position is driven in part by what we believe to be the true BEE for PoM, but is primarily based on the practical issue of identifying an appropriate sample of entities to inform WACC estimation.

In response to the ESC's commentary, we have provided additional justification of our asset beta comparator filtering procedure, and the implications that this has for the resulting sample of comparable firms. These are examined in detail in Section 4.4 below and in Chapter 7 of the report.

Given the above considerations, we remain of the view that PoM's BEE that is required to be identified by the Pricing Order, is a freight-focussed private sector provider of services equivalent to the Prescribed Services.

Further, this BEE is not vertically integrated upstream or downstream from the provision of port services consistent with the narrow definition of Prescribed Services. Conceptually, for the purposes of the Pricing Order, the BEE would not earn revenue from sources other than Prescribed Services, which excludes property-related assets and activities.

Ideally, the BEE would have reference to landlord port businesses in Australia and internationally that provide a similar range of services to the Prescribed Services and hence face comparable risks. However, in practice, there are few listed port entities that provide comparable services to construct a sample that reliably estimates a benchmark gearing ratio and equity beta for the BEE. Hence, this has required us to identify transport entities outside of the Australian and international port sector with a comparable risk profile to PoM's Prescribed Services.

The systematic approach we have taken in determining WACC parameter values for the BEE with comparable risks to PoM are discussed in more detail in Chapter 5 (capital structure) and Chapter 6 (return on equity) of our report. The following section provides

an overview of the sectors that we have investigated to source comparable companies for the BEE. These are required in order to generate gearing and beta estimates.

## 4.4 Listed comparable companies

There are no listed port businesses operating in Australia providing Prescribed Services and there is a very limited number of listed companies that have the same risks as a BEE under the Pricing Order. Moreover, PoM is an international gateway port operating in an inherently global market. Consequently, it is necessary to rely on international comparators that face similar systematic risks as PoM.

The first step in a comparable companies' analysis involves identifying an appropriate set of listed companies with similar cash flow risks.

### 4.4.1 Comparable Marine Ports and Services

Port-related businesses are categorised as "Marine Ports and Services" under the Global Industry Classification Standard (GICS) classification. However, many of the entities in the Marine Ports and Services category operate primarily as terminal operators or stevedores and do not provide the core infrastructure service that PoM provides.

Further, whilst terminal operators and PoM may have similar market exposure, terminal operators generally have lower fixed capital costs and higher variable costs within their total cost base than a landlord port such as PoM. As discussed in our first principles analysis, this means that these terminal operators' earnings will be less sensitive to sales volumes than PoM.

Consequently, whilst PoM's risk profile is not identical to several of these businesses, there is a strong overlap in market exposure and demand drivers between the entities comprised within the Marine Ports and Services classification and PoM, which warrants their inclusion in our comparable companies set.

### 4.4.2 Comparable Railroads and Airports

We have also included freight railroad companies in our sample as there are a number of publicly listed firms in this sector with similar infrastructure characteristics and demand drivers to ports. Additionally, major city airports have similar infrastructure characteristics to ports given their (albeit more limited) exposure to domestic cyclical economic conditions, as well as from an operating leverage (high fixed costs in their total cost base) and investment perspective. The strong fixed capital cost and associated cash flow risk exposures represent close comparators from a gearing and beta perspective.

For these reasons, we have included railroads and airports categories in our comparable companies set.

### 4.4.3 Comparable List Application

Having selected the relevant industry sectors for inclusion in our comparable companies set, we reviewed the business description for each listed company in each relevant sector and eliminated companies that were of limited relevance to PoM's business because there are unlikely to face comparable risks. We separately identified companies that were sufficiently like the BEE from a risk perspective that were operating in OECD and non-OECD countries for analytical purposes.

Using Bloomberg, we have extracted gearing and other relevant data from companies in the following GICS categories:

- Marine Ports and Services
- Railroads
- Airports.

Regarding possible adjustments to empirical beta estimates, the ESC's commentary sought explanation about how specific adjustments to our empirical beta estimates (and to a lesser extent gearing) should be made where the nature of the comparators and their risk characteristics are not strictly equivalent to the benchmark efficient entity (BEE) used to establish PoM's WACC.

In our view, the best response is to argue that caution should always be taken in determining asset beta estimates to avoid applying 'false precision,' especially at a firm level. This includes applying purportedly precise quantitative adjustments to beta estimates derived from the comparator set. Instead, the approach that we have taken is to consider the characteristics of the three industry sectors that comprise the comparator set, with this set establishing a reasonable asset beta range from which a point estimate can be selected and substantiated qualitatively based on differential risk factors.

# 5 Capital structure

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| We have retained our assumed capital structure for PoM of 30% from the 2017-18 submission. This remains within the range of transport regulatory decisions, and evidence from listed comparators indicates no material movement in gearing levels. |

## 5.1 Introduction and background

The Pricing Order requires the cost of debt and equity to be distinguished. This in turn requires the weighting of equity and debt in the rate of return calculation to be established. The purpose of this chapter is to identify an appropriate long-term target gearing ratio for the BEE based on domestic and international entities with comparable risks, and having regard to relevant regulatory precedent.

In a perfect capital market, finance theory provides that the valuation of a firm is unaffected by its capital structure. A higher proportion of debt in the capital structure will increase the weight placed on the return on debt (which is typically lower than the return on equity), but this is offset by an increase in the required return on equity resulting from the higher leverage. However, in practice, the assumptions underpinning a perfect capital market do not hold and as such capital structure can have valuation impacts. Clearly, this is relevant to a consideration of the capital structure applying to a BEE.

The assessment of capital structure (or gearing) in the WACC calculation is therefore based on an assessment of an 'optimal' long-term target capital structure for the BEE given its risk profile and the industry within which it operates.

To achieve consistency with the Pricing Order requires the selection of a benchmark gearing ratio that would apply to an efficient benchmark firm in the same industry with the same risk profile as PoM. However, in practice we see numerous and sometimes disparate factors affecting the capital structure adopted by firms within the same industry (for example, different financing strategies, investment needs, owner preferences, tax treatments).

Consequently, it is reasonable to determine a range to assess the efficient financing of a benchmark entity before choosing a point estimate from within the range based on a qualitative assessment of PoM's risk profile. To inform this range for PoM we begin by looking at relevant regulatory precedent followed by evidence from comparable entities.

## 5.2 ESC commentary on proposed capital structure for BEE

In its November 2017 interim commentary, the ESC noted that regulators have tended to use gearing levels higher than that assumed by Synergies for the BEE.

It is not clear whether the ESC's comment is referring just to gearing assumption decisions applying to regulated transport entities, or more broadly (for example, also encompassing energy and water utilities).

Energy and water utilities tend to have higher assumed gearing because of the stability of their cash flows in relation to economic activity. However, we consider that energy and water utilities are not suitable comparators for PoM because their risks are not comparable.

Rather, we consider any comparison of gearing levels should focus on assumptions previously approved by Australian regulators for regulated transport entities, which range from 20% for the Pilbara railways up to 60% for Dalrymple Bay Coal Terminal (DBCT). As such, our proposed gearing ratio of 30% sits comfortably within this regulatory range. Even within this regulatory range though, we observe that there are entities with varying risk profiles, in part due to different contractual and regulatory characteristics. For this reason, we have refrained from drawing direct comparisons to the regulatory entities.

The remainder of this chapter explains the basis of our proposed gearing assumption for the BEE.

## 5.3 Regulatory precedent

Consistent with the other WACC parameters, Australian regulators apply a benchmark capital structure (gearing) that would apply to an efficient benchmark entity in the same industry with the same risk profile. It is based on an 'optimal' long-term target for the regulated entity given its risk profile and the industry within which it operates. This is reflected in relatively stable gearing ratios once established. A similar approach is also used by international regulators.

Under this benchmark approach, the regulated entity's actual gearing level is given limited (and perhaps no) weight. This is consistent with the objective of incentive regulation, which bases costs on efficient benchmark targets. The gearing assumption also influences the notional credit rating assumption used to estimate the return on debt.

Table 9 shows recent regulatory decisions relating to the regulated Australian transport sector. The highest observed gearing assumption is 60% (debt to total value) for Dalrymple Bay Coal Terminal, Australia's most heavily regulated port related asset, and

thus not an ideal comparator for PoM. In contrast, for rail entities, gearing assumptions have generally been lower, including the lowest of 20% for the dedicated iron-ore terminal operated by The Pilbara Infrastructure.

Table 9 Recent Australian regulatory gearing decisions for transport entities

| Company | Regulator | Year | Gearing Ratio |
|---|---|---|---|
| Dalrymple Bay Coal Terminal | QCA (Ports) | 2016 | 60% |
| Dalrymple Bay Coal Terminal | QCA (Ports) | 2010 | 60% |
| Aurizon Network | QCA (Rail) | 2017 | 55% |
| Public Transport Authority - passenger | ERA (Rail) | 2015 | 50% |
| Arc Infrastructure (formerly Brookfield Rail) - freight | ERA (Rail) | 2015 | 25% |
| The Pilbara Infrastructure – iron ore | ERA (Rail) | 2015 | 20% |
| V/Line | ESC (Rail) | 2012 | 50% |
| Pacific National | ESC (Rail) | 2012 | 50% |
| Vic Track | ESC (Rail) | 2012 | 50% |
| Metro Trains Melbourne | ESC (Rail) | 2011 | 55% |
| ARTC (Hunter Valley Coal Network) | ACCC (Rail) | 2011 & 2017 | 52.5% |
| Queensland Rail | QCA (Rail) | 2010 | 55% |
| ARTC Interstate Rail Network | ACCC (Rail) | 2008 | 50% |

**Source:** Synergies, various regulatory decisions.

The basis of Australian regulator's gearing assumption is generally an analysis of internationally comparable companies, an approach we have adopted in our report. Such an approach is also frequently observed in regulatory determinations overseas.

In the context of the PoM and the BEE, we consider the two most relevant regulatory gearing assumptions are for:

- ARTC's interstate freight network, which currently assumes 50 per cent gearing
- Arc Infrastructure's freight network, which currently assumes 25 per cent gearing.

ERA's most recent review of the WACC to apply to Brookfield Rail (now Arc Infrastructure), which was completed in 2015, included an updated review of the gearing levels for a set of comparator firms.[30] Its sample included the US Class I railways, as well as a small number of other firms (including Aurizon Holdings). In the review prior to

[30] ERA (2015a).

this, finalised in 2008, the gearing of its predecessor (WestNet Rail) was set at 35 per cent. The reduction in gearing that occurred in the most recent review was attributed to the reduction in the average gearing levels of the comparator sample.

In its 2008 decision for ARTC's interstate freight network, the ACCC accepted ARTC's proposed gearing ratio of 50 per cent. The gearing levels of ARTC's sample of firms across the rail, trucking and shipping industries examined at the time were generally higher in the pre-GFC environment than currently observed. However, the average capital structure of the 12 rail companies in ARTC's survey was 27 per cent debt, with the most levered firm holding only 47 per cent debt.[31] ARTC has applied for gearing of 52.5% in its 2018 undertaking (currently in progress). However, this does not invalidate a gearing level of 30% for PoM, given that ARTC's undertaking for the Interstate network aligns its gearing with its Hunter Valley network. This is particularly evident in the context of the ERA's findings that resulted in the application of a lower gearing level in the most recent review for Arc Infrastructure (formerly Brookfield Rail).

## 5.4 Metrics

Attachment A contains our comparator set emerging from the above process and categorises the sample by:

- Sector
- OECD/non-OECD status
- Companies that are rated by rating agencies and those that have not been.

Attachment A contains the gearing ratios for each company in the comparator set. We now turn to a consideration of the results of this analysis.

## 5.5 Gearing range

Determining the appropriate target gearing level is inherently imprecise. The starting point for the analysis is the range of gearing levels maintained by comparable entities which, by definition, must be consistent with one or a combination of well-accepted approaches.

[31] ACCC (2008). Australian Rail Track Corporation access undertaking – Interstate Rail Network, Final decision, July, p.158.

### 5.5.1 Empirical Evidence

In determining an appropriate gearing ratio for PoM, it is reasonable to analyse empirical evidence from relevant comparator firms, including the entities that we have also used to estimate beta for the return on equity calculation.

We have examined the average gearing levels maintained by other relevant comparator entities in Australia and internationally (both OECD and non-OECD nations).

Gearing ratios (average and median ratios) for the entities comprising our comparator set and that are rated by ratings agencies as having an investment grade or better (both OECD and non-OECD) are contained in the tables below. We have classified these results by sector in Table 10 below and included the latest available credit ratings where possible.

Table 10 Companies with official investment grade ratings

| Company | Country | OECD | Sector | **Moody's Credit** Rating | S&P Credit Rating | Gearing |
|---|---|---|---|---|---|---|
| China Merchants Port Holding Company | Hong Kong | No | Marine Ports and Services | Baa1 | BBB | 23% |
| ADSEZ | India | No | Marine Ports and Services | Baa3 | BBB- | 22% |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | - | BBB+ | 4% |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | Baa1 | BBB+ | 43% |
| DP World | UAE | No | Marine Ports and Services | Baa2 | NR (not rated | 28% |
| Aurizon Holdings | Australia | Yes | Railroads | Baa1 | BBB+ | 23% |
| Canadian National Railway Company | Canada | Yes | Railroads | A2 | A | 12% |
| Canadian Pacific Railway | Canada | Yes | Railroads | - | BBB+ | 19% |
| CSX Corporation | US | Yes | Railroads | Baa1 | BBB+ | 24% |
| Kansas City Southern | US | Yes | Railroads | Baa3 | BBB- | 16% |
| Norfolk Southern Corporation | US | Yes | Railroads | Baa1 | BBB+ | 23% |
| Union Pacific Corporation | US | Yes | Railroads | A3 | A | 13% |
| Sydney Airport | Australia | Yes | Airports | Baa2 | NR | 38% |
| Vienna International Airport | Austria | Yes | Airports | Not Rated, but 2015 Annual Report claims position reflect investment grade rating | | 22% |
| Paris Airport | France | Yes | Airports | - | A+ | 29% |

| Company | Country | OECD | Sector | **Moody's Credit** Rating | S&P Credit Rating | Gearing |
|---|---|---|---|---|---|---|
| Auckland International Airport Limited | New Zealand | Yes | Airports | - | A- | 19% |
| Zurich Airport | Switzerland | Yes | Airports | - | AA- | 17% |

**Source:** Moody's

Amongst companies in our sample with an investment grade rating, the median and average gearing level is 22%. As demonstrated in Attachment A, the average and median gearing ratios are almost identical when considering the full sample of comparable companies. Average and median gearing by industry sector is summarised in Table 11.

Table 11 Gearing averages and ranges by sector

| | **Overall Average** | **Overall Median** | **Overall Minimum** | **Overall Maximum** |
|---|---|---|---|---|
| Full Sample | 22% | 19% | 0% | 64% |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 24% | 23% | 0% | 64% |
| Railroads | 18% | 18% | 0% | 32% |
| Airports | 20% | 17% | 7% | 40% |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 25% | 19% | 0% | 64% |
| Railroads | 20% | 21% | 12% | 32% |
| Airports | 22% | 19% | 7% | 40% |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 23% | 23% | 0% | 56% |
| Railroads | 8% | 8% | 0% | 15% |
| Airports | 9% | 9% | 7% | 12% |

**Source:** Bloomberg

### 5.5.2 Privatised Australian ports

To evaluate gearing, we have augmented our comparable companies set with private ports from around Australia. The gearing of recently privatised ports also provides a relevant benchmark, while recognising initial gearing levels may not be reflective of longer term gearing levels depending on reported earnings growth.

Further, gearing levels of privatised ports are reflective of the risk profile of the total port business, including lower risk property assets, compared to a gearing level pertaining only to prescribed service assets (as defined for PoM) that, in principle, would be lower.

Table 12 presents the acquisition gearing from four port privatisations (all privatisations other than Flinders Ports). It shows an average initial gearing ratio in excess of 40% for all privatisations.

Table 12 Acquisition Gearing Ratios for Australian Ports

| Port | Acquisition Value ($ million) | Acquisition Debt (drawn) ($ million) | Acquisition Gearing |
|---|---|---|---|
| Port of Brisbane (2010) | 2,100 | 847 | 40% |
| Port Botany / Kembla (2013) | 5,070 | 2,010 | 40% |
| Port of Newcastle (2014) | 1,750 | 800 | 46% |
| **Average** | | | 42% |

PoM's acquisition gearing ratio is in line with these precedents.[32]

## 5.6 Conclusion

Considering relevant market evidence, we maintain our view that a gearing range of between 20% and 40% is appropriate for the efficient benchmark port entity. The considerations that inform this view are as follows:

- The gearing levels for our comparator sample range between 22% and 42%.
- There are two cases where we have seen gearing levels approved below 50% for Australian regulated entities, which are in the ERA's most recent decisions for rail networks, where it applied 25% gearing for Brookfield Rail (the most relevant comparator for PoM) and 20% for The Pilbara Infrastructure, a dedicated iron ore rail and port infrastructure provider.

The very nature of a gearing range is that a reasonable value may fall anywhere within that range. Furthermore, both the range and the point estimate for a BEE may change over time in response to several factors.

For the purpose of this review, a gearing level of 30% has been retained, which represents the mid-point of the gearing ratios for the investment-grade listed companies of 22% and the gearing ratios for the privatised ports of 42% (after rounding to the nearest 5%).

[32] Recognising that these privatised gearing ratios relate to the whole port entity rather than the narrower range of port channel and berthing-related services that are covered by the Prescribed Services definition.

# 6 Assessing alternative return on equity approaches

| Chapter overview |
| --- |
| We have not made any changes to the multi-model approach that we adopted in the 2017-18 submission. We present comprehensive evidence that each of these approaches can be considered well-accepted in accordance with the Pricing Order. |

## 6.1 Cost of equity approaches

Four return on equity approaches are described below that we consider are likely to support an estimate of the return on equity commensurate with the requirements of the BEE and the Pricing Order:

- Sharpe-Lintner Capital Asset Pricing Model (SL CAPM) – the SL CAPM expresses the return on equity as the premium required in regards to the undiversifiable risk of holding a portfolio of assets relative to overall market risk (reflected in a beta estimate). The SL CAPM predicts that the variations in mean returns of this portfolio of assets should be entirely explained by variations in the beta estimate.
- Black CAPM – this model is a more broadly based form of CAPM, which adds the excess returns of a zero-beta portfolio to the return earned on the risk-free rate in the SL CAPM formula. If the excess returns of the zero-beta portfolio are estimated to be zero, the Black CAPM reduces to the same formula as the SL CAPM. As per the SL CAPM, the Black CAPM predicts that variations in mean returns should be entirely explained by variations in the beta estimates.
- Fama-French three factor model (FFM) – this model can be considered an extension of the SL CAPM by including two additional explanatory factors: small capitalisation stocks; and high book-to-market value stocks (in addition to the sensitivity of the returns of the asset compared to the overall market return as captured under the SL CAPM).
- Dividend Discount Model (DDM) – this model estimates a return on equity based on a company's stock price and future expected dividend payments. It states that the required return on an asset is dependent on the expected future growth rate in dividends.

These return on equity models are not intended to be an exhaustive list. Rather, we consider that each one satisfies the well-accepted threshold established by the Pricing Order. The next section of our report summarises the strengths and weaknesses of each of these models. Further detail on our four chosen methodologies is provided in Attachment C.

## 6.2 Sharpe-Lintner and Black CAPM

### 6.2.1 SL CAPM formulation

The SL CAPM is expressed as follows:

$$Re = R_f + \beta_e * [E(R_m) - R_f]$$

Where:

Rf = the risk-free rate of return

E(Rm) = the expected return on the market

[E(Rm) – Rf] = the market risk premium

βe = equity beta (measures systematic risk)

The equity beta measures systematic business risk, as well as the financial risk of a company. This can be contrasted with the asset beta, which reflects only the business risk of a company and can be calculated by de-levering the observed equity beta.

A well-accepted approach of estimating a company's equity beta is taking the asset beta (observed from a comparable set) and then re-levering the asset beta by applying the company's assumed capital structure (in PoM's case, the gearing of a BEE) to finally arrive at an estimated equity beta measurement for the company.

### 6.2.2 Strengths

The SL CAPM was the original prescription of the CAPM and is the model from which other CAPM-oriented models have evolved. One strength of the SL CAPM is its relative simplicity and intuitive appeal, specifically its underlying theoretical basis regarding the relationship between expected returns and risk in asset portfolio context.

Systematic risk is a useful way to think about risks incorporated into market prices.

Its intuitive appeal has resulted in the use of the SL CAPM in both financial market and regulatory contexts. However, its use in financial market contexts has often been with practitioners making adjustments to individual parameter values, specifically the risk-free rate or market risk premium.

### 6.2.3 Weaknesses

The main weakness of the SL CAPM is that it generates values of expected returns that have very limited relevance with actual returns (i.e. the method produces a poor fit to the observed data).

Empirical studies published in academic journals demonstrate that the model presents a downwardly biased estimate of the rate of return for the low-beta entities, which signifies that the relationship between beta estimates and average stock returns is too flat in comparison to what we observe. Similarly, companies with high book-to-market ratios (high stock returns) counter the predictions of this model (refer to discussion of the FFM in Section 6.3 below).

The frequency of use of SL CAPM in a regulatory context in Australia has revealed further limitations of the model when applied in a prescriptive, formulaic way, as has been the practice of most Australian regulators over the past decade. These concerns have become more pronounced since the Global Financial Crisis (GFC), when risk-free rates have fallen to historical lows, resulting in low return on equity outcomes when the low risk-free rate is combined with a 'static' long-run average market risk premium (MRP) of 6%, which, at least until the GFC, was the most commonly applied value for the MRP. These concerns were particularly evident when debt margins increased considerably following the GFC at the same time as regulatory allowances for the return on equity reduced because of falling risk-free rates. To our knowledge no logical reason has ever been advanced as to why this would be the case.

The underlying assumptions for the model are also problematic, including that investors can borrow or lend freely at the risk-free rate and investors share the same beliefs about distribution of returns.

### 6.2.4 Application of SL CAPM

The SL CAPM model is acknowledged by the ESC as meeting the criterion of being well-accepted and we agree with its assessment. However, when applied in practice, the model does encounter significant empirical limitations.

The SL CAPM is used extensively by regulators in Australia and other jurisdictions. Graham and Harvey (2001) surveyed nearly 400 chief financial officers of large US corporations to establish, among other things, what approaches these businesses applied in valuing capital.[33] Brounen, de Jong and Koedijk (2004) broadened this work by extending the survey to businesses in the UK, Netherlands, Germany and France.[34] In all, these researchers confirmed the widespread use of CAPM in companies in the US and several European countries (around 60 per cent).

[33] Graham, J. and Harvey, C. (2001). The theory and practice of corporate finance: Evidence from the field. Journal of Financial Economics, 60, pp.187-243.

[34] Brounen, D., de Jong, A. and Koedijk, C.G. (2004). Corporate finance in Europe: Confronting theory with practice. 2004 Maastricht Meetings Paper No. 2769. Also published in Financial Management.

A number of studies have also provided evidence in support of using the SL CAPM. The results from Moyer, McGuigan and Kretlow (2001)[35] and Campbell, Lo and Mackinlay (1997)[36], for instance, suggest that the SL CAPM is appropriate for examining the pricing of capital assets, evaluation of investment portfolios and event studies of efficient markets. Davis (2011), Handley (2014)[37] as well as McKenzie and Partington (2014)[38] supported the use of the SL CAPM in reports to the Australian Energy Regulator (AER).[39]

Two of the earliest and most significant contributions were Black et al. (1972)[40] and Fama and Macbeth (1973).[41] To investigate the association between beta estimates and average stock returns, Black et al. (1972) used monthly statistics relating to price, dividend, adjusted price and dividend information for all common stocks traded on the New York Stock Exchange for the period between January 1926 and March 1966. Similarly, Fama and Macbeth (1973) used monthly percentage returns for the same data from January 1926 to June 1968. The results from these two studies highlighted that the SL CAPM generated values of expected returns that had a small or zero association with actual returns. Specifically, the findings from these studies suggested that the SL CAPM produced a poor fit to the observed data.

In addition to the study by Black et al. (1972), a 2004 review of the literature concerning CAPM by Fama and French (2004) highlighted that the SL CAPM presented a downwardly biased estimate of the rate of return for the low-beta firms.[42] This provided an indication that the linear relation between average return and beta is flat compared to SL CAPM predictions, i.e., a shortcoming in the SL CAPM identified as the low beta bias. The authors (Fama and French) concluded that:

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35 Moyer, R.C., McGuigan, J.R. and Kretlow, W.J. (2001). Contemporary financial management, 8th ed., South-Western, Cincinnati, Ohio.

36 Campbell, Y.J., Lo, A.W. and Mackinlay, A.C. (1997). The econometrics of financial markets. Princeton University Press, Princeton, New Jersey.

37 Handley, J. (2014). Advice on the return on equity, University of Melbourne, Melbourne.

38 McKenzie, M. and Partington, G. (2014). Report to the AER Part A: Return on equity, SIRCA, Sydney, New South Wales.

39 Davis, K. (2011). Cost of equity issues: A report for the AER, University of Melbourne, Melbourne.

40 Black, F., Jensen, M.C., and Scholes, M. (1972). The capital asset pricing model: Some empirical tests, in Studies in the Theory of Capital Markets. Michael C. Jensen, ed. New York: Praeger, pp.79-121.

41 Fama, E. F. and Macbeth, J. (1973). Risk, return and equilibrium: Empirical tests. Journal of Political Economy, 81(3), pp. 607–636.

42 Fama, E.F. and French, R.K. (2004). The capital asset pricing model: Theory and evidence. Journal of Economic Perspectives, 18(3), pp. 25–46.

> The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model.
>
> In the end, we argue that whether the model's problems reflect weaknesses in the theory or in its empirical implementation, the failure of the CAPM in empirical tests implies that most applications of the model are invalid.

Acknowledging that the true market portfolio is unobservable, Shanken (1987) reported empirical evidence that SL CAPM was invalid by generating a multivariate proxy for the true market portfolio.[43] Burmeister and McElroy (1988) employed the S&P500 Index as a proxy for the market and also rejected the hypothesis of SL CAPM.[44] Findings from a number of recent studies are also found to be in line with the findings of these earlier empirical works. Mehrling (2005), for instance, revealed that:[45]

> One important consequence of the BJS (a 1972 paper of Fischer Black, Michael Jensen, and Myron Scholes titled The Capital Asset Pricing Model: Some Empirical Tests) was to confirm earlier suggestions that low-beta stocks tend to have higher returns and high-beta stocks tend to have lower returns than the theory predicts.

Campbell and Vuolteenaho (2004) revealed that:[46]

> It is well known that the CAPM fails to describe average realized stock returns since the early 1960s, if a value-weighted equity index is used as a proxy for the market portfolio. In particular, small stocks and value stocks have delivered higher average returns than their betas can justify. Adding insult to injury, stocks with high past betas have had average returns no higher than stocks of the same size with low past betas.

Da, Guo and Jagannathan (2012) revealed that:[47]

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43 Shanken, J. (1987). Multivariate proxies and asset pricing relations. Journal of Financial Economics, 18, pp.91-110.

44 Burmeister, E. and McElroy, M.B. (1988). Joint estimation of factor sensitivities and risk premia for the Arbitrage Pricing Theory. Journal of Finance, 43, pp.721-33.

45 Mehrling, P. (2005). Fischer Black and the revolutionary idea of finance, Wiley, pp.104–105.

46 Campbell, Y. J and Vuolteenaho, T. (2004). Bad beta, good beta. The American Economic Review, 94(5), p.1249.

47 Da, Z. Guo, R.J. and Jagannathan, R. (2012). CAPM for estimating the cost of equity capital: Interpreting the empirical evidence. Journal of Financial Economics, 103(1), pp.204–206.

> A variety of managed portfolios constructed using various firm characteristics earn very different returns on average from those predicted by the CAPM. Fama and French make a convincing case that the CAPM fails to describe the cross section of stock returns.

Lewellen and Nagel (2006) respond to suggestions that the unconditional SL CAPM failed due to time-variation in risk and expected returns. This would imply a role for a conditional SL CAPM, which allows for beta to vary over time. However, the authors demonstrated that the conditional SL CAPM performed nearly as poorly as the unconditional SL CAPM, and that time-variation in betas and the equity premium would have to be implausibly large to explain the value premium.[48]

Relevantly for our assessments of acceptance of other approaches besides the SL CAPM, the survey research found that a significant minority of corporations (skewed towards larger companies) modified the SL CAPM by including additional risk factors. In other words, many companies regarded the SL CAPM as insufficient to be used as the sole measure of the cost of equity.

In summary, the SL CAPM's theoretical foundations are attractive but its empirical performance is poor. Accordingly, we consider exclusive reliance upon the SL CAPM is unwarranted given the asymmetric consequences of regulatory error.

### 6.2.5 Black CAPM formulation

The Black CAPM is expressed as follows:

$$Re = Rz + \beta_e * [E(R_m) - Rz]$$

Where:

Rz = the rate of return on the zero-beta portfolio (equal to risk-free rate plus zero beta premium)

E(Rm) = the expected return on the market

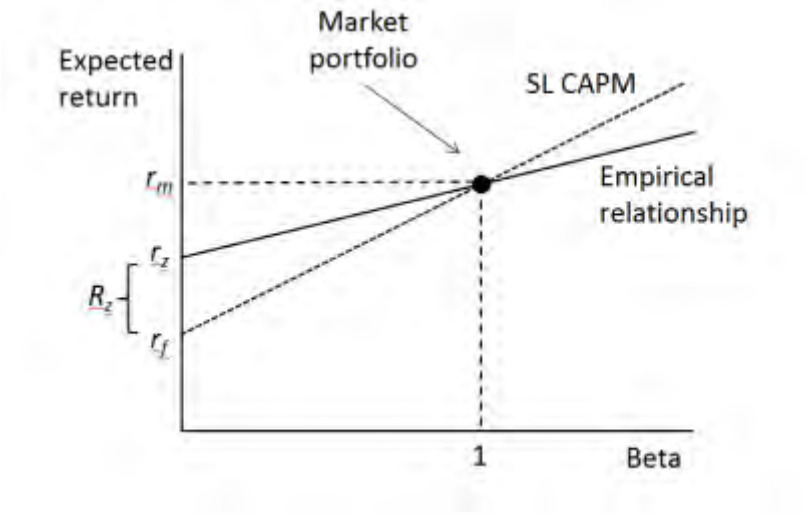
[E(Rm) – Rz] = the zero-beta adjusted market risk premium

βe = equity beta (measures systematic risk)

[48] Lewellen, J. and Nagel, D. (2006). The Conditional CAPM does not explain asset-pricing anomalies. Journal of Financial Economics, 82, pp.289-314.

The relationship between the SL CAPM and Black CAPM is indicated in Figure 1.[49] The SL CAPM uses a theoretical lower bound for the intercept (i.e., the intercept cannot possibly be lower than the risk-free rate). In contrast the Black CAPM provides an empirical estimate of the risk-free rate, the zero-beta portfolio. This is reflected in a higher intercept point on the Y-axis, reflecting the zero-beta premium.

Figure 1 Relationship between SL CAPM and Black CAPM




Source: SFG Consulting (2014)

### 6.2.6 Black CAPM strengths

By construction, the Black CAPM removes the tendency of the SL CAPM to under-estimate the returns to low beta assets and over-estimate the returns to high beta assets. There is substantial evidence in Australia and the US demonstrating large zero-beta premiums.

It has less restrictive assumptions than the SL CAPM, with its central prediction being that market betas suffice to explain expected returns and the risk premium for beta is positive (in contrast the SL CAPM assumes the premium per unit of beta is strictly the expected market return minus the risk-free interest rate).

It has been applied in rate of return regulation cases in other jurisdictions, for example in the United States and Canada, where it is sometimes known as the empirical CAPM (ECAPM).

[49] SFG Consulting (2014c). The required return on equity for regulated gas and electricity network businesses, 27 May, p.22.

### 6.2.7 Black CAPM weaknesses

While the Black CAPM is intended to address the low beta bias inherent in the SL CAPM, many studies have found that it too fails to produce a statistically significant association between beta estimates and stock returns.

### 6.2.8 Evolution of model

The purpose of this section is to explain the evolution of the Black CAPM (1972) and its application.[50] The Black CAPM augments the SL CAPM by adding what is known as a zero-beta portfolio to the risk-free rate to take into account the observed tendency of the SL CAPM to understate asset returns for companies with betas less than one. We have applied the Black CAPM to estimate a return on equity for the benchmark port entity.

A key motivation for modifying SL CAPM is the empirical observation of low beta bias, evidence of which is well documented in academic literature.

### 6.2.9 Academic research findings

Black, Jensen and Scholes (1972), among others, discovered that the slope in CAPM regressions was flatter than would be implied by SL CAPM. Specifically, the SL CAPM tended to understate asset returns for companies with betas less than one, and overstate asset returns for betas greater than one. One implication of this is that the intercept in these regressions was higher than expected. In the SL CAPM, the intercept takes the form of the risk-free rate. Therefore, the Black CAPM proposes adding the zero-beta premium to the risk-free rate.

A key difference between the SL CAPM and the Black CAPM is that the SL CAPM assumes that investors can borrow and lend at the risk-free rate, which presents difficulties in practice. The Black CAPM does not require this assumption, but instead assumes that investors can short sell risky assets such as stocks. This assumption has its limitations too because investors may be able to short sell only to a certain extent. However, it is not considered to be as limiting an assumption. These differing assumptions thus explain the contrasting formulas for the two models. In the Black CAPM, expected return is equal to the return on a zero-beta asset (an asset with no systematic risk) plus a premium for bearing systematic risk (the SL CAPM equity beta).

[50] Black, F. (1972). Capital market equilibrium with restricted borrowing. Journal of Business, 28(1), pp.444-454.

### 6.2.10 Acceptance in other spheres

The Black CAPM has gained greater acceptance within a regulatory setting, with the AER stating in its December 2013 *Better regulation – Rate of return guideline* that:[51]

> 'We account for the Black CAPM because we recognize that there is merit to its theoretical basis, particularly when viewed alongside the standard Sharpe-Lintner CAPM.'

The AER noted that the Black CAPM can be used to inform the equity beta.[52] This was attributable to the SL CAPM understating and overstating the return on equity for low beta stocks and high beta stocks, respectively.

The AER cited the relaxed assumptions of the Black CAPM compared to the SL CAPM as reasons for consideration, but does caution that even these assumptions may not hold in practice.

In its 2010 final decision relating to network regulation, Ofgem (UK Office of Gas and Electricity Markets) highlighted that although the return on equity will be computed using the CAPM approach, evidence from other models will also be considered.[53] Subsequently, Ofgem stated that the CAPM should be "sense-checked by other approaches and evidence."[54] This implies that other potential models (e.g. Black CAPM, FFM, DDM) can be used as cross-checks for the analysis of the return on equity.

The Public Service Commission of Maryland (PSCM 2016) was found to consider the Black CAPM as well as a number of other financial models for its determination of return on equity. It should be noted that US regulators typically refer to the Black CAPM as the empirical CAPM (ECAPM) or the zero-beta CAPM. According to PSCM:[55]

> The ROE witnesses used various analyses to estimate the appropriate return on equity for BGE's electric and gas distribution operations, including the DCF model, the IRR/DCF, the traditional CAPM, the ECAPM (Black CAPM), and risk premium methodologies. Although the witnesses argued strongly over the correctness of their competing analyses, we are not willing to rule that there can be only one correct

[51] AER (2013b). Better regulation – Explanatory statement – Rate of return guideline, December, p.85.

[52] AER (2013b), p.58.

[53] Ofgem (2010). RIIO: A new way to regulate energy networks, Final decision, October, p.40.

[54] Ofgem (2013). Strategy decision for the RIIO-ED1 electricity distribution price control, Financial issues, Supplementary annex, 4 March.

[55] Public Service Commission of Maryland (2016). *In the matter of the application of Baltimore gas and electric company for adjustments to its electric and gas base rates*, order no. 87591, case no. 9406, June, p.153.

> method for calculating an ROE. Neither will we eliminate any particular methodology as unworthy of basing a decision.

The Alberta Utilities Commission (2016) was found to apply an equity risk premium (ERP) approach as its primary method. This approach considered several financial models employed by various experts that participated in its proceeding in order to establish a fair allowed return on equity. Financial models employed by experts were comprised of CAPM, Black CAPM, bond yield plus risk premium model, predictive risk premium model and DDM.[56]

Similarly, a rate of return was computed through a formula-based approach using the ERP method by the Ontario Energy Board (2009). Specifically, the OEB considered various financial models to determine the initial ERP model or cost of equity, i.e., CAPM, Black CAPM, bond yield plus risk premium model, predictive risk premium model and DDM. [57]

The Mississippi Public Service Commission (MPSC 2009) in the US has, in addition, included the Black CAPM as one of the models used for the return on equity determination.[58] The following regulatory decisions by the New York Public Service Commission provide further evidence to the use of the Black CAPM in US regulatory decisions:

- Public Case Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service; Petition for Approval, Pursuant to Public Service Law, Section 113(2), of a Proposed Allocation of Certain Tax Refunds between Consolidated Edison Company of New York, Inc. and Ratepayers.[59]
- Public Case Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of National Fuel Gas Distribution Corporation for Gas Service.[60]

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[56] Alberta Utilities Commission (2016). 2016 generic cost of capital, Decision 20622-D01-2016, October.

[57] Ontario Energy Board (2009). Report of the board on the cost of capital for Ontario's regulated utilities, EB-2009-0084, December.

[58] Mississippi Public Service Commission (2009). Performance evaluation plan – Rate schedule "PEP-5A", Mississippi Power Company, Schedule No. 28.1, January.

[59] New York PUC 2009, LEXIS 507.

[60] New York PUC 2007, LEXIS 449; 262 PUR 4th 233.

- Public Case Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service; Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Gas Service.[61]

An expert report to the AER by Professor J. Robert Malko from Utah State University also highlighted that the Black CAPM had been presented and considered by many regulatory commissions in the US. This, for instance, included regulatory commissions in California, Colorado, Delaware, Kentucky, Maryland, Michigan, Minnesota, Mississippi, New York, South Dakota, Virginia, Washington and West Virginia.[62]

### 6.2.11 Conclusion on the Black CAPM

In summary, the Black CAPM represents a theoretical (and generally an empirical) improvement in the SL CAPM. However, as explored in the following section, its empirical performance is inferior to the Fama French model.

## 6.3 Fama-French model

This section explains the evolution of the Fama and French (1993) model (FFM) and its application.[63] The FFM augments the SL CAPM by considering the impact of size and value premiums, in addition to the market risk premium, on stock returns.

We begin by discussing the motivation for the FFM and its strengths and weaknesses, before examining the support for the model in academic literature and regulatory practice. Furthermore, we provide evidence that financial practitioners make ad hoc size and other risk premium adjustments to the SL CAPM, implicitly adopting the rationale of the FFM. We also explore the FFM's acceptance in other spheres, including its presence in finance curriculum and the 2013 Nobel Prize awarded to Eugene Fama for the development of the model. All of these sources of evidence serve to solidify the well-accepted standing of the FFM.

### 6.3.1 Emergence and evolution of the FFM

The FFM emerged in response to the poor explanatory power of the SL CAPM. Fama and French observed that high stock returns were associated with smaller listed

[61] New York PUC 2006, LEXIS 227; 251 PUR 4th 20.

[62] Malko, J.R. (2015). Statement of Dr. J. Robert Malko, June.

[63] Fama, E.F. and French, K.R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), pp.3-56.

companies and listed companies that have a high book to market value ratio. Fama and French demonstrated that when these two additional variables were incorporated into an asset pricing model the explanatory power of the model increased significantly.

The FFM operates on excess returns to the market being assessed having regard to:

- The returns on the market as a whole
- HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth portfolios.
- SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios

The FFM is expressed as follows:

$$Re = Rf + \beta j * [E(R_m) - R_f] + \beta k * [HML] + \beta l * [SMB]$$

Where:

Rf = the risk-free rate of return

E(Rm) = the expected return on the market

[E(Rm) – Rf] = the market risk premium

HML = expected high-minus-low risk premium

SMB = expected small-minus-big risk premium

βj = market excess returns beta

βk = high-minus-low factor beta

βl = small-minus-big factor beta

In contrast to the SL CAPM and the Black CAPM models, the FFM expresses the return on equity based on expected returns and two additional explanatory factors: a size factor (Small Minus Big); and a book-to-market equity factor (High Minus Low).

### 6.3.2 Strengths

The FFM retains systematic risk as an explanatory factor that explains stock returns consistent with the SL CAPM and Black CAPM.

However, the FFM better explains stock returns in comparison with either the SL CAPM or the Black CAPM. The model mostly and uniformly has statistically significant explanatory power and performs better than the SL and Black CAPM models in terms of goodness of fit (as measured by a higher $R^2$ value or by measures of forecast error). For instance, Chiah et al. (2016) (see Section 6.3.4) is the most recent Australian study to

directly compare the FFM with the SL CAPM. Using their preferred measure of model fit, they find that the use of the three-factor FFM reduces the average mean absolute forecast error from 1.68 to 1.44 (a 14% reduction) over a 5-year forecast horizon relative to the SL CAPM (the Black CAPM was not evaluated in this particular study). In other words, the better empirical performance of the FFM is such that it is less likely to understate investors' required cost of equity by the incorporation of additional risk factors in the model that are evidently being priced by the market.

FFM posits that multiple risks other than solely market risk are reflected in stock returns and that the high book-to-market and small-cap stock factors are the best available proxies for these risks.

In an Australian context, the size and value premiums in the model have been estimated using market data and delivered results consistent with US studies, particularly in relation to the value premium. This indicates that incorporating the FFM in the determination of the cost of equity estimate for the benchmark port entity, including with the SL and Black CAPMs, would provide a higher degree of confidence that the resulting estimate is robust and reflective of investor expectations.

### 6.3.3 Weaknesses

As for the SL CAPM, the FFM restricts the zero-beta rate to be the risk-free rate.

The model in the Australian market has sometimes yielded inconclusive results, particularly in respect of the high minus-low explanatory factor, although this may reflect data issues. However, Brailsford, Gaunt and O'Brien (2012) addressed these data issues and developed an Australian FFM that reconciled with US results.[64]

While the model is often employed in academic studies, it is less commonly employed in financial market and regulatory contexts, with practitioners citing challenges relating to data sourcing in some situations. However, as described earlier in this report, this reason alone should not preclude a particular approach from being "well-accepted". Our approach to applying the FFM is described further in Attachment C.

[64] Brailsford, T., Gaunt, C. and O'Brien, M (2012). The investment value of the value premium. Pacific-Basin Finance Journal, 20(3), pp.416-437.

### 6.3.4 Academic research findings

There is an extensive literature that has built up surrounding the performance of the Fama-French model, along with the empirical existence of size and value premiums. The following is an overview with particular reference to Australian experience.

By the 1980s, empirical evidence was mounting that variations in expected returns were, to a significant extent, unrelated to market betas (well before the Fama French model emerged). Fama and French (2004)[65] identify Banz (1981) as one of the first papers to uncover a size effect, namely that average returns on smaller cap stocks were higher than those predicted by CAPM.[66] Meanwhile, Stattman (1980)[67] and Rosenberg, Reid and Lanstein (1985) observed that stocks with high book-to-market equity ratios experienced returns not captured by their betas associated with market returns.[68] This was the turning point where research pursued other determinants of market returns, eventually leading to the seminal Fama and French (1993) paper.

There is extensive empirical evidence in support of the Fama and French factors. Davis, Fama and French (2000) show that the value premium, the positive relationship between average returns and book-to-market value of equity, is robust across time.[69] The estimated US premium between 1929 and 1963 (0.50 per cent per month) is almost identical to the premium between 1963 and 1997 (0.45 per cent per month). The size effect was found to be smaller (0.20 per cent per month) across their entire sample period.

In the Australian context, Gaunt (2004) demonstrates that the three-factor model offers a better explanation of observed Australian stock returns than the conventional SL CAPM.[70] He employed a longer dataset than earlier Australian contributions that returned mixed findings based on shorter, deficient data. However, in contrast to US findings, the main contributor to explanatory power was the size factor.

Gharghori, Lee and Veeraraghavan (2009) use Australian data from 1992-2005 and find evidence of both size effects and book to market ratio effects. They note that the observed

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65 Fama, E.F and French, K.R. (2004).

66 Banz, R.W. (1981). The relationship between return and market value of common stocks. Journal of Financial Economics, 9(1), pp.3-18.

67 Stattman, D. (1980). Book values and stock returns. The Chicago MBA: A Journal of Selected Papers, 4, pp.25-45.

68 Rosenberg, R., Reid, K. and Lanstein, R. (1985). Persuasive evidence of market inefficiency. Journal of Portfolio Management, 3(11), pp.9-17.

69 Davis, J.L., Fama, E.F. and French, K.R. (2000). Characteristics, covariances and average returns. Journal of Finance, 55(1), pp.389-406.

70 Gaunt, C. (2004). Size and book to market effects and the Fama-French three factor asset pricing model: evidence from the Australian stockmarket. Accounting and Finance, 44(1), pp.27-44.

R-square values are lower than those observed in the original Fama and French (1993) results for the US, but nevertheless provide important explanatory power.[71] This finding built on earlier work by Gharghori, Chan and Faff (2007) which found that Fama-French factors were capturing some form of priced risk.[72]

O'Brien, Brailsford and Gaunt (2010) consider information on 98% of all listed companies between 1981 and 2005, the most comprehensive dataset employed in the Australian literature.[73] The results also present evidence of size and book-to-market ratio effects, indicating that the FFM provides increased explanatory power relative to CAPM.

Brailsford, Gaunt and O'Brien (2012) also find evidence of a value premium in Australia, but uncover less substantive evidence of a size premium.[74] Key to their investigation is the portfolio formation technique used in the analysis. Many previous studies simply sorted stocks into arbitrary categories with an equal number of stocks. To address this, the authors formed portfolios that better represent realistic investment sets. The impact of book to market ratios is found to be systematic across all size categories. This lends support to the use of the FFM, as it shows that the findings are robust to different dataset assumptions. Abhakorn, Smith and Wickens (2013) find that the value factor, though not the size factor, helps to determine equity returns.[75]

Chiah et al. (2016) and Huynh (2017) employ the most recent datasets.[76] [77] It should be noted that these two papers employ the five-factor model, which adds terms for profitability and level of investment premiums. However, Huynh (2017) in particular observes that the five-factor model offers only marginal improvements on top of the three-factor model. Importantly, the book-to-market factor (HML) or value premium retains its explanatory power in both studies, even with the inclusion of the profitability and investment factors.

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71 Gharghori, P., Lee, R. and Veeraraghavan, M. (2009). Anomalies and stock returns: Australian evidence. Accounting and Finance, 49, pp.555-576.

72 Gharghori, P., Chan, H. and Faff, R. (2007). Are the Fama-French Factors proxying default risk? Australian Journal of Management, 32, pp.223-249.

73 O'Brien, M., Brailsford, T. and Gaunt, C. (2010). Interaction of size, book-to-market and momentum effects in Australia. Accounting and Finance, 49(1), pp.197-219.

74 Brailsford, T., Gaunt, C. and O'Brien, M (2012). The investment value of the value premium. Pacific-Basin Finance Journal, 20(3), pp.416-437.

75 Abhakorn, P., Smith, P. and Wickens, M. (2013). What do the Fama-French factors add to CCAPM? Australian National University, Centre for Applied Macroeconomic Analysis, Working Paper 23/2013.

76 Chiah, M., Chai, D., Zhong, A. and Li, S. (2016). A better model? An empirical investigation of the Fama-French Five-factor model in Australia. International Review of Finance, 16(4), pp.595-638.

77 Huynh, T.D. (2017). Explaining anomalies in Australia with a five-factor asset pricing model. International Review of Finance.

Chiah et al. (2016) also find that the SMB factor is not statistically significant. That being said, they do not conclude that the size factor is completely redundant; rather, the factor does still appear to bolster the model's capacity to explain empirical returns. This finding is not inconsistent with the results that we have generated for PoM, in which the size premium contributes substantially less to the return on equity relative to the value premium.

To verify the international applications of the FFM, Fama and French (2006) examine value premiums in 14 international markets (Australia, Belgium, Canada, France, Germany, Great Britain, Hong Kong, Italy, Japan, the Netherlands, Singapore, Spain, Sweden and Switzerland) between 1975 and 2004. International returns are found to exhibit statistically and economically significant value premiums.[78] Furthermore, the magnitudes of the effects are as substantial for the biggest stocks as they are for smaller stocks. Malin and Veeraraghavan (2004) confirmed the presence of a size effect in France, Germany and the United Kingdom, although they found no evidence of a value effect in these markets.[79]

Country-specific studies also provide backing for the use of the FFM. Nwani (2015) presented findings for 100 stocks in the United Kingdom, using monthly data from January 1996 to December 2013.[80] He detected evidence of a value effect across small and large cap stocks, suggesting that book to market ratios are an important determinant of returns. Daniel, Titman and Wei (2001) study Japanese stock returns between 1975 and 1997. They find that the observed value premium in average stock returns was even stronger in Japan than in the United States.[81] Rossi (2012) investigates the influence of factors for the Italian Stock Exchange between 1989 and 2004 and confirms the presence of a size effect.[82]

SFG Consulting reviewed leading finance journals to gauge acceptance of the FFM among finance academics.[83] They found FFM is routinely applied to estimate required returns in articles published in the Journal of Finance and the Journal of Financial

[78] Fama, E.F. and French, K.R. (2006). The value premium and the CAPM. The Journal of Finance, 61, pp.2163-2185.

[79] Malin M. and Veeraraghavan M. (2004). On the Robustness of the Fama and French Multifactor Model: Evidence from France, Germany, and the United Kingdom. International Journal of Business and Economics, 3(2), pp.155-176.

[80] Nwani, C. (2015). An empirical investigation of the Fama-French-Carhart Multifactor Model: UK Evidence. Journal of Economics and Finance, 66(1), pp.95-103.

[81] Daniel, K., Titman, S. and Wei, K.C.J. (2001). Explaining the cross-section of stock returns in Japan: Factors or characteristics. The Journal of Finance, 56(2), pp.743-766.

[82] Rossi, F. (2012). The three-factor model: evidence from the Italian stock market. Research Journal of Finance and Accounting, 3(9), pp.151-160.

[83] SFG Consulting (2014d). The Fama-French model, 13 May, p.19.

Economics which, it was noted, have both received the highest possible ratings for journals from both the Australian Council of Deans and the Australian Research Council. SFG Consulting argued that "the use of the Fama-French factors, for the purpose of estimating the required return on equity, is so widespread in the academic literature, its use as a measure of normal returns has become a matter of course."[84]

### 6.3.5 FFM in regulatory practice

We have identified several examples of regulators applying or considering the results of the FFM. The FFM has been recognised as an appropriate model by several eminent economic experts (for example, Professor Stewart Myers and Professor Julian Franks) engaged by the New Zealand Commerce Commission (NZCC).[85] Moreover, in its 2009 report concerning the estimation of the cost of capital, the NZCC stated that: [86]

> Where appropriate (e.g., where reliable data are available and where the models seem amendable to particular industries), the Commission may use evidence based on the Fama-French and DCF (or DDM) models as cross-checks on the CAPM.

In Australia, IPART has expressed a willingness to consider implementation of the FFM in the future. In the February 2018 final report of its WACC methodology review, IPART stated that:[87]

> We intend to monitor the FFM over the next five years to examine how it would perform if we adopted it instead of the SL CAPM in our WACC method.

IPART acknowledged the reasoning that the increased explanatory power of the FFM (relative to the SL CAPM) outweighed any theoretical concerns or costs of implementation, stating that:[88]

> In our view, this argument is sufficient to warrant estimation and comparison of FFM estimates, but is not sufficient reason to replace the SL CAPM as our model at this stage.

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84 SFG Consulting (2014d), p.20.

85 Franks, J., Lally, M. and Myers, S. (2008). Recommendations to the New Zealand Commerce Commission on an appropriate cost of capital methodology, 18 December.

86 New Zealand Commerce Commission (2009). Revised draft guidelines – the Commerce Commission's approach to estimating the cost of capital, 19 June, p.21.

87 IPART (2018a), p.98.

88 IPART (2018a), p.98.

These remarks from an Australian economic regulator lend credence to the implementation of a multi-model cost of equity approach. Consistent with IPART's position, PoM does not propose to remove the SL CAPM from consideration entirely; rather, the SL CAPM and FFM (along with the Black CAPM) should be considered together when determining the appropriate cost of equity for the BEE.

There is also regulatory precedent for the use of the FFM in the UK. In 2005, the then Competition Commission (CC) employed the FFM in a liquefied petroleum gas (LPG) inquiry.[89] The CC was tasked with estimating the appropriate cost of capital for a pure-play LPG supplier. The CC deemed that there was only one relevant listed UK comparator, and sought to determine whether any size premium was warranted. In this particular application of the methodology, neither the size nor value premium was found to be statistically significant. However, this in no way detracts from this example of the FFM being adopted in a regulatory setting. Regardless of whether the Fama-French factors for this specific firm were significant or not, what is clear is that the economic regulator applied and had regard to the FFM as part of its assessment.

The FFM has been used in several regulatory processes throughout the United States. For example, according to Ronald L. Knecht, the Nevada State Controller:[90]

> [W]hile there is still some apprehension about the use of the FF3F [Fama-French Three Factor] Model it has been recognised in at least three states, Massachusetts, Delaware and Nevada, when used in conjunction with other models to produce an arithmetic mean as an estimate. This approach ensures that factors that are ignored by one model are adequately addressed. Because the FF3F model is fairly new relative to other models I am not aware of any jurisdiction that has endorsed it exclusively or adopted allowed rates of return based expressly on it. Instead, the tradition in the United States is for regulatory decisions to review (or even just list) all the evidence in the record and then, subjectively balancing the merits and results of all of it, to arrive at a final conclusion as either a range of reasonableness or a point estimate.

As a former and thereby well-experienced energy regulator, Mr Knecht has employed the FFM in several state regulatory proceedings. These include:

- A 2006 hearing conducted by the Public Utilities Commission of Nevada, where the commission accepted his evidence.[91]

[89] UK Competition Commission (2005). Market investigation into supply of bulk liquefied petroleum gas for domestic use: Provisional findings report, August, Appendix K, p.7.

[90] Knecht, L. R. (2015). Statement, 19 June, para. 4.6, p.3.

[91] Application of Sierra Pacific Power Company for the authority to increase its annual revenue requirement for general rates charged to all classes of electric customers and for relief properly related thereto; Application of Sierra Pacific

- A 2014 expert evidence held before the California Public Utilities Commission, where the commission acknowledged that the FFM had "gained great currency in investment practice."[92]

Furthermore, Mr Paul R. Moul, as an expert witness before the Massachusetts Department of Telecommunication, noted the FFM as a useful approach for investigating the association between stock returns and firm size.[93] Mr Paul Hunt as an expert witness before the California Public Utilities Commission presented results using both the CAPM and FFM.[94] Artesian Water Company before the Delaware Public Service Commission highlighted findings from the FFM that was accepted by the Commission without reservation.[95] In 2007, before the California Public Utilities Commission, Mr Gary Hayes (an expert from San Diego Gas and Electric) also provided expert testimony using the FFM.[96]

The Public Utility Commission of Nevada in the state of Nevada has recognised the use of the FFM in calculating the return on capital estimates. See, for example, the Decisions in Docket No. 05-10003 and Docket No. 05-10004.[97] In 2006, Mr Knecht acted as a representative on behalf of the Nevada Public Utilities Commission and used the average of a combination of models, comprised of two dividend discount model (DDM) estimates, average of 2 CAPM/FFM and one risk premium estimate, for the calculation of the return on equity.[98] Mr Knecht, once again, acted as a representative on behalf of

Power Company for approval of new and revised depreciation rates for electric operations based on its 2005 deprecation study, 2005 Nev. PUC LEXIS 91.

92 Application of Southern California Edison Company (U338E) for authority to establish its authorised cost of capital for utility operations for 2013 and to reset the annual cost of capital adjustment mechanism 2014 Cal. PUC LEXIS 633.

93 Moul, R. P. (2005). Direct testimony of Paul. R. Moul, Managing Consultant, P. Moul & Associates, Concerning cost of equity, Commonwealth of Massachusetts Department of Telecommunications and Energy, p.50.

94 Application of Pacific Gas and Electric Company for Authority to Establish Its Authorized Rate of Return on Common Equity for Electric Utility Generation and Distribution Operations and Gas Distribution for Test Year 2006. (U 39-M); Application of Southern California Edison Company (U 338-E) for Authorized Capital Structure, Rate of Return on Common Equity, Embedded Cost of Debt and Preferred Stock, and Overall Rate of Return for Utility Operations for 2006; Application of San Diego Gas & Electric Company (U 902-M) for Authority to: (i) Increase its Authorized Return on Common Equity, (ii) Adjust its Authorized Capital Structure, (iii) Adjust its Authorized Embedded Costs of Debt and Preferred Stock, (iv) Increase its Overall Rate of Return, and (v) Revise its Electric Distribution and Gas Rates Accordingly, and for Related Substantive and Procedural Relief 2005 Cal. PUC LEXIS 537; 245 P.U.R.4th 442.

95 In the matter of the application of Artesian Water Company, Inc., for an increase in water rates 2003 Del. PSC LEXIS 51 at [8]-[11]

96 Testimony of Gary G. Hayes on behalf of San Diego Gas and Electric before the California Public Utilities Commission 2007, p.19.

97 Decisions in Docket No. 05-10003 and Docket No. 05-10004, April 26, 2006, 2006 Nev. PUC LEXIS 91.

98 Application of Sierra Pacific Power Company, 2006 Nev. PUC LEXIS 91 at [63]

the Nevada Public Utilities Commission in 2007, where he examined the return on equity using the FFM.[99]

Sarmentero and Hull (2017) examine FERC's policy regarding return on equity determinations.[100] They identify Opinion No. 551, issued in September 2016 in regard to the Midcontinent Independent System Operator, as having significant implications for FERC's methodological approach.[101] They write that:[102]

> The CAPM analysis that Opinion No. 551 relied upon used an upward adjustment based on the rationale that differences in investors' required rates of return that are related to firm size are not fully captured by beta.

In the opinion, FERC reinforced its position from an earlier 2015 opinion that "this type of size adjustment is a generally accepted approach to CAPM analyses."[103] FERC then goes on to explain that the purpose of such an adjustment is to render the CAPM analysis useful in estimating the cost of equity for companies that are smaller than the companies that are typically used to determine the MRP in the CAPM analysis.

Opinion No. 551 is subject to a rehearing of the case, but it does indicate that regulators are increasingly having regards to the merits of additional premiums that augment the CAPM, bringing them more into line with the conventions of financial practitioners.

### 6.3.6 FFM in financial practice

A measure of implicit acceptance of the FFM in finance industry practice is indicated by the fact that it is routine for industry practitioners to make additional risk adjustments in estimating the SL CAPM. Independent experts consistently estimate the cost of equity to be several percentage points higher than the estimate derived from a simple application of the SL CAPM alone. The point to emphasise here is that it is plainly common practice among finance practitioners to estimate discount rates based on risk factors in addition to systematic risk.

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99 Application of Nevada Power Company 2007 WL 2171450 (Nev. P.U.C) at [102]; and Application of Sierra Pacific Power Company, 2006 Nev. PUC LEXIS 91 at [63].

100 Sarmentero Garzon, A.I. & Hull, G.F. (2017). Developments in FERC policy for determining return on equity. Energy Law Journal, 38, pp.375-412.

101 Opinion No. 551, Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc., 156 FERC ¶ 61,234 (2016), rehearing pending.

102 Sarmentero Garzon, A.I. & Hull, G.F. (2017), p.396.

103 Opinion No. 531-B, Martha Coakley v. Bangor Hydro-Electric Co., 150 FERC ¶ 61,165 (2015), order on rehearing.

In this regard, the survey-based research by Graham and Harvey (2001) and Brounen, de Jong and Koedijk (2004) identified that significant minorities of investors adjusted their expectations based on additional risk factors including business size and market to book ratio.[104] Of the more advanced CAPM alternatives in which additional risk factors are included they found that these techniques were used mostly by large companies. In the case of Bancel and Mittoo (2014), the most recent survey, 66% of respondents consider firm size as a risk factor, while more than 45% have regard to price-book ratios (another term for market-to-book ratios) in their valuations.[105]

The Ibbottson Stocks, Bonds, Bills, and Inflation Yearbook is an industry data reference for advisors, planners, and brokers seeking to analyse asset class performance and determine the cost of capital in the US. It provides historical return figures such as equity risk premiums and includes a chapter for each of the FFM factors – quantifying the size and value premiums appropriate to specific settings.[106]

*Evidence from independent expert reports*

This section outlines our insights from independent expert reports, both in Australia and in the United States. For Australian reports, we have analysed the Connect 4 database in relation to the use of the Fama-French Model (FFM) and other adjustments to the SL CAPM. The Connect 4 database (provided by Thomson Reuters) contains independent expert reports for companies listed on the ASX. For US reports, we have consulted the EDGAR SEC filings database.

For the Australian sample, Synergies has investigated all 344 independent expert reports relating specifically to acquisitions, takeovers, divestments, demergers and merger schemes over the last five years (1 January 2013 - present).[107] Of these 344 reports, only 151 (44%) made explicit reference to the use of a WACC or discount rate, and of these only 113 (33%) provide a detailed description of their WACC methodology.

Our main findings are as follows:

- Of the 113 reports with detailed WACC calculations, we have identified 32 IE reports that make ad hoc adjustments to the conventional SL CAPM formulation.

[104] Brounen, D., de Jong, A. and Koedijk, C.G. (2004). Note that Brounen et al. collated and included summaries of the data from Graham and Harvey (2001) in their 2004 paper.

[105] Bancel, F. & Mittoo, U.R. (2014). The gap between the theory and practice of corporate valuation: Survey of European experts. Journal of Applied Corporate Finance, 26(4), pp.106-117.

[106] See Wiley Publishing (2017). Available from: http://au.wiley.com/WileyCDA/WileyTitle/productCd-1119316405.html.

[107] To facilitate an efficient interrogation of the database, we restricted our analysis to acquisitions with a deal size greater than $AUD10 million.

- a number of these reports apply size and other premiums consistent with the principles of the FFM model.
- Many IE reports adopt risk-free rates well in excess of contemporaneous risk-free rates.

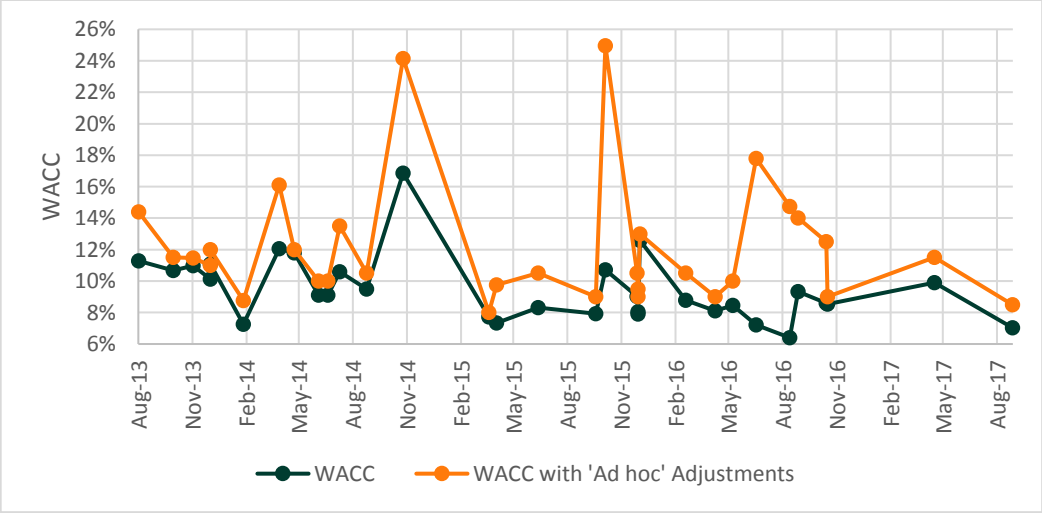
The remainder of this section elaborates on the nature of the risk premiums that we have identified, before discussing discrepancies in the use of risk-free rates.

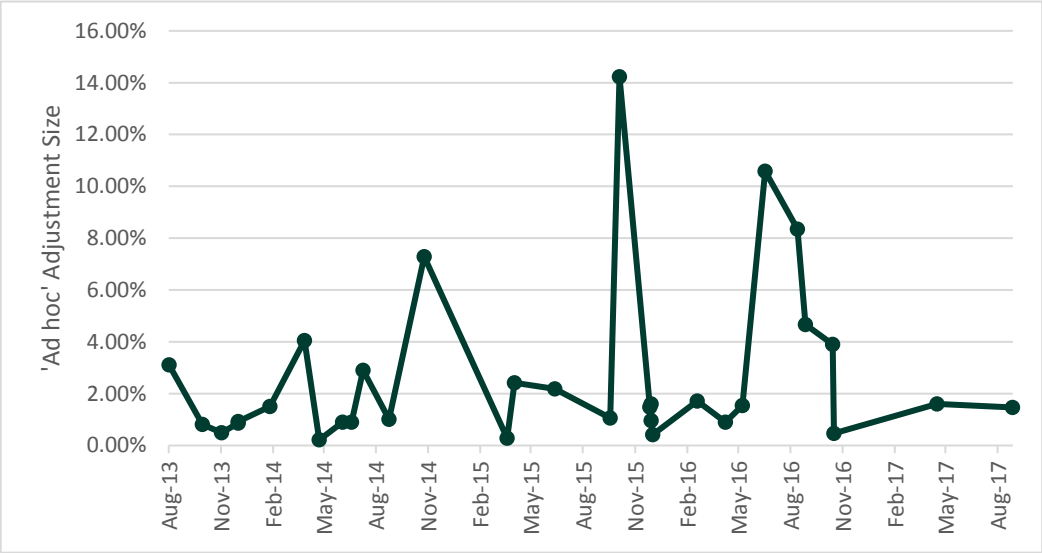
*Application of risk premiums*

In the 344 independent expert reports that we interrogated, we have not located any formal application of the three-factor Fama-French Model as it is employed in the PoM WACC report. However, we have uncovered evidence that independent experts apply size and other premiums (such as for growth prospects, product execution risk and market-imposed hurdle rates). This is consistent with the underlying rationale of the FFM, which contends that factors other than a firm's exposure to systematic risk (i.e. its beta with the market) can usefully explain returns.

In cases where size and other risk premiums are applied, the consequences for the resulting WACC are far from immaterial. Figure 2 illustrates the divergence between the actual WACC estimates used in independent expert reports and the WACC estimates in the absence of any ad hoc adjustments for risk premiums. In the upper panel, the orange line denotes the WACC estimate after incorporating the ad hoc premium adjustments, while the dark green line denotes the resulting WACC in the absence of any such adjustments. In the lower panel of Figure 2, we present the magnitude of the ad hoc adjustment, which is in effect the difference between the two lines in the upper panel.

Figure 2 Comparison of WACC estimates with and without ad hoc adjustments





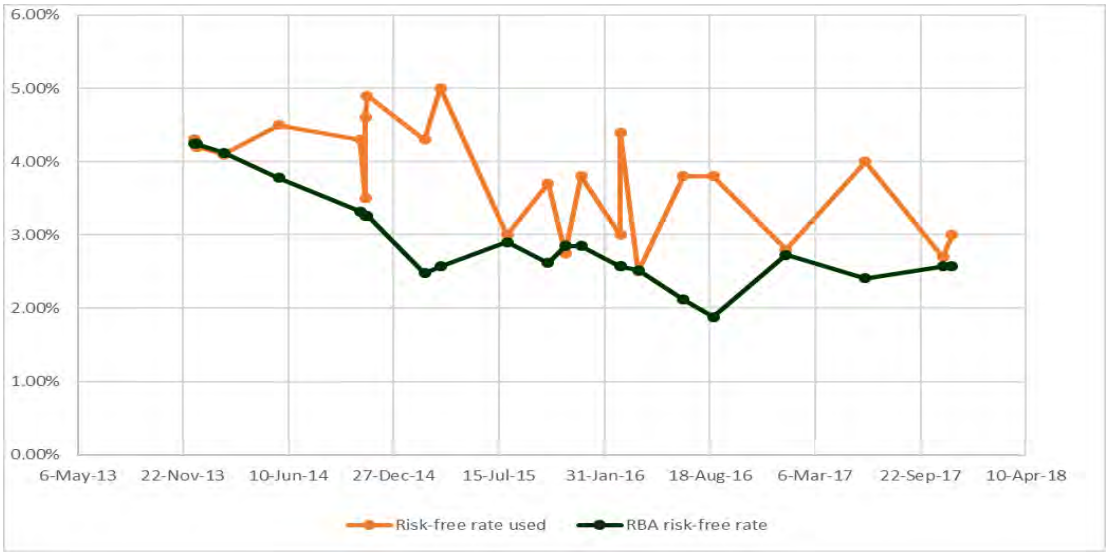

Data source: Connect 4, Synergies calculations

Across the sample, the average size adjustment was 2.65%, while the median was 1.49%. In proportional terms, this causes the ad hoc adjusted WACC estimates to be on average almost a third larger than the unadjusted WACC estimates implied by the CAPM.

*Use of higher risk-free rates*

In addition to the use of ad hoc premium adjustments, there is also clear evidence that IE reports frequently adopt risk-free rates above the contemporaneous risk-free rate as measured by the RBA. To illustrate this phenomenon, Figure 3 shows the divergence between the risk-free rate adopted in each IE report and the prevailing risk-free rate published by the RBA at the time. This is a significant finding, because it shows that industry practice diverges from the regulatory practice of calculating the risk-free rate based on a short averaging period of contemporaneous data. This will inevitably result in higher WACC estimates than those arising from regulatory processes.

Figure 3 Comparison of risk-free rates with prevailing RBA risk-free rate




Data source: RBA, Connect 4, Synergies calculations

*Evidence from US SEC filings*

Synergies has also undertaken an interrogation of all SEC filings related to mergers in the US since the beginning of 2017.[108] Over this timeframe, there were 257 such filings, and of these, 23 (approximately 9%) incorporate size premiums into their analysis.[109] Size premiums ranged from 1.0% up to 7.3%. A number of reports made reference to the annually published Duff & Phelps Size Premium.[110] Consequently, there is clear evidence that financial practitioners have regard to size premiums when evaluating a firm's cost of capital. As such, this demonstrates that ad hoc adjustments are indeed made to the conventional CAPM, as typically applied by economic regulators in Australia.

### 6.3.7 Acceptance in other spheres

When it awarded the 2013 Nobel Prize in Economics to Eugene Fama, the Economic Sciences Prize Committee said that Fama's extension of the CAPM "greatly improves the explanatory power relative to the single-factor CAPM model."[111] The Committee considered asset pricing to be "one of the fields in economics where academic research

[108] The relevant SEC form for mergers is DEFM14A – "Definitive proxy statement relating to a merger, acquisition, or disposition."

[109] We also uncovered one instance of a book-to-market adjustment.

[110] Duff & Phelps Corporation is a global valuation and corporate finance advisor.

[111] Economic Sciences Prize Committee (2013). Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013: Understanding Asset Prices, p.3.

has had the most impact on non-academic practice."[112] It went on to say that "many professional investors use factor models such as the Fama-French model to guide their portfolio decisions"[113] and that "it has become standard to evaluate [investment] performance relative to 'size' and 'value' benchmarks, rather than simply controlling for overall market returns."[114]

The FFM is taught as part of many finance qualifications, including the Chartered Financial Analyst (CFA) certification. As this is the leading professional finance qualification in both Australia and the US, it is noteworthy that course participants are required to be able to both explain and demonstrate the use of both the SL CAPM and the FFM.

### 6.3.8 Conclusion on Fama-French model

The FFM has clearly demonstrated superior empirical performance in comparison to other asset pricing models. This highlights its importance as a relevant well-accepted model in a regulatory setting, where the long-term interests of consumers are served by ensuring an infrastructure owner is adequately remunerated for its investment. Furthermore, the model has received favourable endorsements from various economic regulators, including most recently by IPART.

## 6.4 Dividend Discount Model

The DDM is a different construction from the three CAPM models in that it is underpinned by the assumption current stock prices reflect the present value of the expected future cash flows (dividends) that will be paid to investors. In so doing, its value reflects the current risk premium associated with holding the market portfolio.

The DDM is expressed as follows:

$$p = \sum_{t=1}^{\infty} d \frac{(1+g)^t}{(1+r)^t}$$

Where:

p = current stock price

d = dividend

[112] Economic Sciences Price Committee (2013), p.42.

[113] Economic Sciences Price Committee (2013), p.43.

[114] Economic Sciences Price Committee (2013), p.44.

g = expected dividend growth

r = discount rate/return on equity

The formula can be rearranged to express the return on equity (r) as a function of the stock price and future dividend growth.

### 6.4.1 Strengths

The DDM is a theoretically strong model because it does not require assumptions to be made regarding what explanatory factors drive expected returns, i.e., this model equates the present value of future dividend cash flows to the current stock price.

Findings from several empirical studies published in academic journals have found outcomes to be in line with the predictions of the model.

Reasonable specifications of the DDM produce estimates of the overall required return on equity that are more stable than the risk-free rate implying a risk premium that tends to partially offset changes in the risk-free rate, so that the estimate of the overall required return does not rise and fall one-for-one with changes in the risk-free rate. This characteristic means the DDM can potentially be used to develop forward-looking estimates of the market risk premium.

The DDM is often applied in financial market and regulatory contexts internationally.

### 6.4.2 Weaknesses

The model's assumption of constant growth in dividends for all stocks over time is likely to be unrealistic and ignores intertemporal changes in dividend yields. Determining a constant growth assumption is also challenging.

The model is only applicable to mature, stable companies who have a proven track record of paying out dividends consistently. Immature growth stocks or stocks more generally without a track record of paying dividends are not captured in the model.

The DDM is built on the assumption that the only value of a stock is the return on investment it provides through dividends rather than expectations of capital growth, which in practice is unrealistic. We have not pursued the DDM in the current case because of the limited sample of comparable Australian companies to underpin the application of the model. In contrast to the other three cost of equity models that we have examined, the use of overseas comparators for the DDM requires assumptions about key economic inputs (such as long-run growth rates). These may differ from the Australian context, making the estimates derived from the DDM less representative of the

appropriate cost of equity. Previous applications of the DDM have relied heavily upon Australian (and New Zealand) comparators for this reason.

## 6.5 Choosing a well-accepted cost of equity approach

Based on academic recognition, global regulatory and independent expert practice, we consider the following four models identified in this chapter are well-accepted such that they satisfy the Pricing Order requirements in regards to estimating the rate of return:

- SL CAPM
- Black CAPM
- FFM
- DDM.

Valuation techniques, asset pricing and regulatory practice evolve. Clearly, regulatory precedent in Australia supports the SL CAPM despite a range of known limitations. Given our assessment of strengths and weaknesses of each of the suitable cost of equity models, academic literature and the evidence of global regulatory and financial market practice, we consider it is appropriate to either:

- use values generated from a combination of well-accepted models to estimate the return on equity rather than solely relying on a single model given no single model is compelling in terms of its strengths compared to the other models; or
- if data or other constraints preclude such an approach, to explicitly allow for other approaches to be utilised in the future or to utilise various approaches as a cross check.

The following section explains how we will use a combination of models to estimate the cost of equity rather than solely relying on a single model.

### 6.5.1 Applying a multi-model approach

We have determined the cost of equity for the benchmark port entity for PoM using a combination of the three well-accepted CAPM models discussed in the preceding sections, with parameters estimated using large datasets, (these being SL CAPM, Black CAPM and FFM). We consider a cost of equity estimate calculated using a combination of these well-accepted approaches will provide a reliable estimate that satisfies all relevant Pricing Order requirements.

The DDM will be applied as a cross-check for the value of our market risk premium estimate. For this regulatory period submission, we have not included the DDM as a standalone well-accepted cost of equity estimate due to the limited comparable set on the Australian Stock Exchange (ASX), which limits the statistical reliability of the results. Instead, we have utilised the DDM as a cross check for our market risk premium estimate (which relies only on a whole of ASX analysis). The DDM contains potentially important (albeit volatile) forward-looking equity market information that can inform an appropriate MRP value.

In light of this, the outstanding methodological issue relates to the relevant weighting to apply to each of the three CAPM models, where the weights, in principle, should broadly reflect the relative strengths and weaknesses of the three models. In our view, it would be reasonable to more heavily weight the FFM than the SL CAPM and Black CAPM given its demonstrably greater predictive power in regards to required market returns. However, recognising this strength is not universally accepted, for simplicity, equal weights of one-third have been applied for each model.

Chapter 7 of our report explains how we have calculated a cost of equity estimate using the SL CAPM model. In Chapters 8 and 9 of our report we present estimates generated by applying the Black CAPM and FFM, respectively.

# 7 Estimating the return on equity using SL CAPM

| Chapter overview | | |
|---|---|---|
| 2018-19 submission | 2017-18 submission | Comments |
| **13.48%** | 13.66% | Our methodology for estimating the SL CAPM pre-tax return on equity is unchanged from the previous submission. However, a decrease in the risk-free rate and market risk premium have resulted in a slightly lower estimate compared to the 2017-18 submission. |
| **SL CAPM parameters** | | |
| **Risk-free rate: 2.74%** | Risk-free rate: 2.81% | The risk-free rate has again been calculated as a 20-day average on 10-year Australian Government bond yields, an approach frequently adopted by economic regulators. |
| **Asset beta: 0.70**<br>**Equity beta: 1.00** | Asset beta: 0.70<br>Equity beta: 1.00 | Our estimate of PoM's asset and equity betas are unchanged from last year's submission. The average and median of the comparator set, across both 5 and 10-year timeframes, reinforces an asset beta of 0.70. This corresponds to an equity beta of 1.00 assuming gearing of 30%. |
| **MRP: 7.71%** | MRP: 7.77% | Our MRP estimate remains a 50:50 average of the Ibbotson and Wright MRP methodologies, both of which are in use by Australian economic regulators. |

## 7.1 Risk-free rate

The risk-free rate is used in estimating the return on equity and debt. There are three main decisions to be made:

- the proxy used
- the term to maturity
- the averaging period.

### 7.1.1 Proxy

The Commonwealth Government bond yield is most commonly used as a proxy for the risk-free rate in Australia, including by the ESC.

Concerns have been expressed as to whether it remains the best proxy during highly volatile or uncertain market conditions, where a 'flight to quality' is often observed reflecting increased demand for Commonwealth Government bonds as a safe haven for investors, resulting in a compression of the yield.

However, we consider the Commonwealth Government bond yield remains the best proxy for the risk-free rate in an Australian context. In our view, the downward compression of WACC values that have emerged due to its application in recent years relate more to the rigidity of Australian regulators estimation of the market risk premium than to the risk-free rate itself.

### 7.1.2 Term to maturity

In an Australian context, the term to maturity most commonly applied for investors in infrastructure with long economic lives is ten years. This is consistent with the long-term forward-looking horizon over which it is assumed investors are forming their return expectations under the SL CAPM.

In Australia, the ten-year bond is the longest liquid maturity currently available. This is also the most commonly used proxy for the risk-free rate in regulatory decisions.

Two Australian regulators, the Queensland Competition Authority (QCA) and WA's Economic Regulation Authority (ERA)[115], match the term to maturity with the length of the regulatory period (which we consider is a flawed approach).

We believe the term to maturity should not be set to match the length of the regulatory period. This is because the relevant perspective is not the regulatory period but rather the views of the providers of capital (equity holders and lenders), who will be assessing an investment of this type of infrastructure over a long-term horizon. For PoM, the remainder of the 50-year lease term effectively defines the long-term investment horizon.

We have therefore assumed a ten-year term to maturity, balancing the liquidity of available long-term bond instruments in the Australian market, and the long term nature of the PoM investment.

### 7.1.3 Averaging period

The length of averaging period for the risk-free rate will depend amongst other things on whether a contemporary rate reflecting current market expectations is preferred to a longer-term average rate that will also incorporate the effects of historical market expectations.

In general, Australian and International corporate finance, academic and regulatory practice uses short averaging periods close to the commencement of each regulatory period.

This is intended to mitigate problems that may occur if there is a spike in yields on-the-day that the rate is applied. It is therefore common practice to average the rate over a short horizon, which typically ranges from between ten and forty days, noting that over such a short horizon the choice of averaging period is likely to be of little consequence. The Independent Pricing and Regulatory Tribunal (IPART) in NSW is the only

[115] Except for its determinations for rail access because the use of a 10-year CGS is seen to reflect the requirements of the WA Rail Access Code.

Australian regulator that takes into consideration longer term averages, which it does in conjunction with short term estimates.

We have not provided a detailed outline of the approach to the risk-free rate by overseas regulators, as the calculation is generally uncontentious. The typical approach taken is similar to Australia, in that regulators take a short-term average on government bonds for the given country. We note that in the UK, regulators such as Ofgem and the Competition Markets Authority may also have regard to longer-term averages of government bond yields. This has been in response to recent market conditions, during which the risk-free rate has been deemed to be below its long-run average.

### 7.1.4 Risk-free rate estimate

Our estimate is based on 10-year Commonwealth Government bond yields and has been produced over a 20-day averaging period to 31 March 2018. As the quoted rates are semi-annual, we have converted them to annual effective rates.[116] The resulting estimate is 2.74%.

## 7.2 Estimating beta

There are three key sources of information for the assessment of an entity's systematic risk, namely:

- Benchmark results from comparable entities
- First principles analysis
- Regulatory precedent.

In undertaking an empirical analysis of beta estimates, reference needs to be made to an appropriate set of listed comparators for whom equity betas can be estimated and we have explained our approach in Chapter 4 of our report. Using share price information for these companies, their equity betas are estimated using regression analysis. As the companies will have different gearing levels (and hence different levels of financial risk), these equity betas must be 'de-levered' to produce an asset beta. This approach is generally applied for the assessment of asset betas under the SL CAPM.

The comparator analysis will typically produce a range of estimates for beta, necessitating an assessment of where PoM's asset beta might sit relative to these other comparators. This assessment is facilitated by a first principles analysis, which is a

[116] Annual effective rate = (1+ semi-annual rate/2)^2 -1

qualitative assessment of PoM's systematic risk profile. This approach analyses the key factors that impact the sensitivity of the firm's returns to movements in the economy or market.

Accordingly, in practice, we see a first principles analysis helping to inform, for a particular firm (in this case, a BEE), where it is likely to sit in the range generated from an empirical assessment. Accordingly, we turn first to an empirical assessment of port related betas and then a first principles assessment of PoM.

Firstly, we consider relevant regulatory precedent.

### 7.2.1 Relevant regulatory precedent

Six Australian regulators have considered regulated revenues of transport infrastructure:

- ACCC – rail
- IPART – rail
- ERA (WA) – rail
- QCA – rail and coal terminal
- ESC – rail
- ESCOSA – rail.

All regulators have acknowledged the specific challenges the sector presents to identify comparators given the paucity of listed Australian transport entities. However, the ESC and ESCOSA have not engaged in a detailed review of comparable companies for many years and hence they have not been included in this review.

For rail businesses, Australian regulators have generally adopted an international sample of rail and port businesses (ERA for a freight rail network and ACCC for the Interstate network).

These reviews adopt an asset beta in the range we have suggested (0.65 for ARTC and 0.7 for Arc Infrastructure, formerly Brookfield Rail). This aligns with the approach we have adopted and we believe it meets the "well-accepted" threshold.

These approaches (to varying degrees of analysis) conclude that the absence of sufficient Australian transport comparators forces international comparison to ensure robust beta estimates, without the need for the intervening step of a detailed analysis of a broader set of Australian comparators.

Detailed analysis of ERA and ACCC freight rail beta precedent is presented in Attachment E of this report.[117]

### 7.2.2 Comparable companies analysis

The first step in a comparable companies analysis involves identifying an appropriate set of listed companies. In defining the BEE, the ESC contends that the Prescribed Services should be provided by a port in Australia. However, as per the discussion in Chapter 4, there are relatively few listed businesses comparable to the BEE operating in Australia. Consequently, it is necessary to rely on international comparators, as well as companies from other transport sectors. This is similar to the approach adopted by regulators in the transport and telecommunications sectors.

The sample includes relevant companies from the Marine Ports and Services classification. Marine ports and terminals are considered a primary comparator set from a first principles analysis due to similar market exposure to container freight trade. With removal of the $US100 million market capitalisation threshold, we have included six additional firms compared to last year's sample. However, terminal operators are not infrastructure providers providing Prescribed Services.

Freight railroads (in particular, North American Class I railroads) are considered a primary comparator set due to their freight-focussed business model, strong market position and below rail infrastructure services.

Additionally, we included airports in the sample. Despite having different demand drivers to ports, (less driven by cyclical economic drivers), they were close comparators to ports in their core aeronautical infrastructure-related service.

Overall, and notwithstanding the differences noted above, the international sample collectively includes companies with sufficiently comparable systematic risks to PoM that will enable a robust beta estimate to be developed for the BEE.

### 7.2.3 Beta estimation

Betas have been estimated based on five years of monthly returns, regressed against the relevant domestic share market index using Ordinary Least Squares. We also eliminated any firms with:[118]

[117] On a first principles basis, DBCT, Aurizon and the Hunter Valley and are not relevant comparators for PoM given the nature of the take-or-pay contracts and regulatory regimes in place at those assets (which differ significantly from the Pricing Order).

[118] Following beta estimation, we removed a Canadian coal terminal with very high gearing and an asset beta of 1.67 (Westshore Terminals) reducing the average and median asset beta of the sample.

- a t-statistic of less than 2 (this is considered particularly important)
- an $R^2$ less than 0.1.

The resulting equity betas were de-levered to produce an asset beta using the Brealey-Myers approach as follows:

$$\beta_e = \beta_a * (1 + D/E)$$

Where

βe = equity beta

βa = asset beta

D = proportion of debt within the assumed capital structure

E = proportion of equity within the assumed capital structure

The average gearing levels for each business were calculated using annual data over the five-year period (using the ratio of long-term debt to market value of equity).

*Results*

The median asset beta across the full sample of comparable companies was 0.69, based on a 5-year sample, while the average was 0.72. We consider a 5-year sample is well-accepted in financial markets and regulatory practice as likely to provide a robust contemporary beta estimate based on a relatively short historical data set that is reflective of contemporary market conditions. As the period of the analysis lengthens a richer data set emerges but the contemporary relevance of the estimates diminishes. Longer sample periods risk incorporating data on market conditions that is no longer relevant to beta estimates.

However, as a robustness check, we also considered average and median betas over 10 years. For this timeframe, the overall median and average beta was 0.75. This highlights the conservatism of our proposed asset beta of 0.7 as the upper bound of the range is at least 0.75.

The full comparator set exhibits a reasonably broad range of relevant and comparable businesses to the BEE. We have calculated the average and median for each sector over a 5-year period, with the estimates presented in Table 13. The full list of beta estimates for each company is presented in Attachment B.

Table 13 **Comparable companies' asset beta summary (**5-year period)

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| Full Sample | 0.72 | 0.69 | 0.15 | 1.55 |
| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
| Marine Ports and Services | 0.70 | 0.59 | 0.15 | 1.55 |
| Railroads | 0.84 | 0.86 | 0.43 | 1.15 |
| Airports | 0.65 | 0.69 | 0.33 | 1.32 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.65 | 0.57 | 0.15 | 1.19 |
| Railroads | 0.83 | 0.81 | 0.43 | 1.15 |
| Airports | 0.61 | 0.40 | 0.33 | 1.32 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.74 | 0.60 | 0.25 | 1.55 |
| Railroads | 0.86 | 0.86 | 0.82 | 0.91 |
| Airports | 0.89 | 0.89 | 0.80 | 0.98 |

**Note:** Equity betas were unlevered using the Brealey-Myers approach
**Source:** Bloomberg

We have also calculated the average and median for each sector over a 10-year period, with the estimates presented in Table 14.

Table 14 **Comparable companies' asset beta summary (**10-year period)

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| Full Sample | 0.75 | 0.75 | 0.25 | 1.66 |
| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
| Marine Ports and Services | 0.75 | 0.80 | 0.25 | 1.61 |
| Railroads | 0.87 | 0.90 | 0.41 | 1.66 |
| Airports | 0.63 | 0.64 | 0.40 | 0.90 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.62 | 0.55 | 0.25 | 1.03 |
| Railroads | 0.79 | 0.90 | 0.41 | 0.99 |
| Airports | 0.60 | 0.51 | 0.40 | 0.90 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.84 | 0.86 | 0.41 | 1.61 |
| Railroads | 1.21 | 1.21 | 0.75 | 1.66 |
| Airports | 0.82 | 0.82 | 0.82 | 0.82 |

**Note:** Equity betas were unlevered using the Brealey-Myers approach
**Source:** Bloomberg

### 7.2.4 Interpreting the comparator estimates

Within the Marine Ports and Services sector, the 5 year median asset beta across all firms in the sample is 0.59. The median asset beta for Railroads is 0.86, while the median asset

beta for Airports is 0.69.[119] These estimates compare with Damodaran (2018) of 0.77 for Transportation and 0.86 for Railroads.[120]

Caution must be exercised in applying these estimates to PoM for several reasons. The most significant issue is the potential differences between PoM and the risk profile of the comparator firms. This includes differences in the activities undertaken by each firm, geographical location, the demand risks faced by each firm (noting that some companies may be diversified across a portfolio of ports) as well as the relative betas of the markets from which each company in the sample is drawn.

As always, it is also important to remain conscious of the susceptibility of beta estimation to error, that is, the risk that the estimated betas do not actually reflect the firm's 'true' beta, particularly in light of the asymmetric consequences of regulatory error. Overall, we believe that these published betas are a reasonable guide to establish a beta for PoM.

### 7.2.5 First principles analysis

The comparator analysis in Section 7.2.3 produced a range of estimates for beta, which necessitates an assessment of where PoM's equity beta might sit relative to other comparators.

The key objective of the first principles analysis is to inform this decision through qualitatively assessing the sensitivity of the benchmark entity's free cashflows relative to movements in the general economy. It also informs adjustments that may need to be made to empirical estimates from comparator set.

The underlying drivers of demand for PoM's Prescribed Services and hence net cashflows are likely to be strongly correlated to domestic economic activity, driven by fundamentals such as the sensitivity of demand for import and export goods to movements in domestic GDP. In other words, the PoM's revenues and earnings are significantly affected by levels of domestic economic activity.

Given the benchmark beta for PoM is being assessed relative to international comparators, consideration needs to be given as to whether these demand characteristics are likely to be more or less sensitive to domestic economic activity compared to other comparators (relative to their own domestic economies). Overall, we expect that the underlying drivers of demand identified above will generally hold across most major

[119] The average asset betas are 0.70 for the Marine Ports and Services sector, 0.84 for the Railroads and 0.65 for Airports.

[120] Damodaran, A. (2018). Betas by sector (US). Available from: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html [Accessed 2 April 2018].

container and freight ports and railroads, although demand for airport related services will have a much lower covariance with GDP.

Other issues that may impact on the extent to which the port is exposed to the risk of changes in the demand for port services, such as market power and operating leverage.

To the extent that the Port of Melbourne has greater market power (assuming it was unregulated) than certain comparators, this can be expected to reduce its relative level of systematic risk. It is clear however, that the PoM is not without competition in many of its trades. Even leaving aside the impact of the Pricing Order, PoM's inability to price discriminate means that marginal trades (where it competes with Port Adelaide and Port Botany) become a material competitive constraint on PoM.

Additionally, a key factor in the minds of investors, who will be assessing risk over a long horizon, is the prospect of a second competing port for PoM. In May 2017, Infrastructure Victoria recommended that a new port be constructed at Bay West in 2055, when PoM is expected to reach its capacity of approximately 8 million TEU. Whilst it is true that the development of a second port is not currently imminent, the prospect of a second port brings substitution risk as well as potentially providing PoM's counterparties (shipping, logistics, and, to a certain extent, stevedoring companies) more countervailing power in negotiations.

Moreover, there is clearly scope for the Victorian Government to accelerate the development of a second port towards the second half of PoM's lease period as the State has the ability to bring forward the development of the second port without compensation to PoM. It is necessary to acknowledge that development of a second port is also subject to political considerations, and thus it may not be solely an economic decision. The second airport for Sydney is a prominent example of such factors contributing to the early construction of incremental infrastructure. The Federal Government has committed to the construction of a second Sydney Airport by 2026, despite the existing Sydney Airport asserting that a second airport would not be required until 2045.[121]

The highly tangible risks from a second port for PoM are evidenced by the fact that the Victorian Government initially proposed a Port Growth Regime compensation mechanism of 50 years, but ultimately opted for only a 15-year period, as it decided that it was unable to commit to the longer timeframe. Holding all other factors constant, we consider that the impact of a prospective second port should be reflected in a higher value of beta relative to the comparable companies.

[121] NSW Business Chamber (2013). Economic impact of a Western Sydney Airport. August, p.5.

Moreover, PoM has materially higher operating leverage than several of the comparators due to its high fixed capital base as a landlord port, leading to higher systematic risk.

A detailed first principles assessment is contained in Attachment D.

### 7.2.6 Conclusion: asset beta for PoM

In conclusion:

- the empirical evidence appears to directly support an asset beta estimate of at least 0.7 and up to at least 0.75. The question is whether there are any factors from the first principles analysis that suggest that PoM's systematic risk is different from the average of the sample;
- in this regard, the key differentiator is the prospect of competition from a second port, which increases PoM's exposure to trade flows reflecting domestic and international economic conditions;
- an asset beta of 0.7 is consistent with the most recent regulatory review of a similar freight business in Australia, ARC Infrastructure (formerly Brookfield Rail).[122]

Overall, we consider that an asset beta value of 0.7 is a reasonable estimate and that an asset beta of 0.75 could be justified from the analysis.

## 7.3 Market risk premium

### 7.3.1 Introduction

The market risk premium (MRP) is the amount an investor expects to earn from a diversified portfolio of investments (reflecting the market as a whole) that is above the return earned on a risk-free investment. The key difficulty in estimating the MRP arises from it being an expectation and therefore not being directly observable.

Whilst the MRP is an inherently forward-looking parameter, the difficulty with observing or inferring it from market data means that there is valuable information about its value in historical data (historical averages of excess returns from the market above the relevant risk-free rate).

A range of methods have been developed to estimate the MRP falling broadly into two approaches – historical and forward looking. These are considered in turn. In combining

[122] ERA (2017). Determination on the 2017 weighted average cost of capital for the freight and urban rail networks, and for Pilbara railways, 6 October.

approaches to determining the MRP we have had regard to the approaches adopted by financial practitioners, academic literature and Australian regulators in their assessment of the MRP.

In the 2017-18 TCS submission, the MRP estimate was based on an arithmetic average of the Ibbotson and Wright historical MRP approaches. Both of these approaches have been accepted by economic regulators in Australia. The Wright MRP is used by both the ERA and the QCA, as detailed in Section 7.3.3.

A remaining consideration is the appropriate weight that should be applied to these two MRP approaches. In current Australian regulatory practice, there is not yet a consensus on the appropriate weightings for these two methods (whether alone or in combination with other approaches). In many instances, as detailed below, the weightings applied to different methodologies are largely at the discretion of economic regulators, and are not completely transparent. Thus, in the absence of any consensus, we have applied a simple 50:50 weight to the two approaches. Given the evidence presented in the following sections, this approach is likely to be result in a conservative estimate of the MRP, given current market conditions.

### 7.3.2 Historical average methodologies

Within the historical average methodologies, there is a range of approaches that can be adopted. However, we consider the most informative measures are at two ends of a spectrum as follows:[123]

- the Ibbotson approach, which reflects the long term historical average of the difference between the return on the market and the risk-free rate (and has been the preferred method of certain Australian regulators). It assumes that the MRP remains relatively constant through time;
- the Wright approach, which assumes that the overall return on equity remains reasonably stable over time rather than the MRP. It therefore estimates the MRP as the difference between a long-term average of the (real) return on the market and the current risk-free rate. Since the GFC, this approach has gained greater regulatory acceptance.

[123] Other methods involve other parameters in the estimation. For example, the Siegel method incorporates inflationary expectations into the analysis. However, in our opinion, this undermines the very strength of historical approaches to the assessment of the MRP.

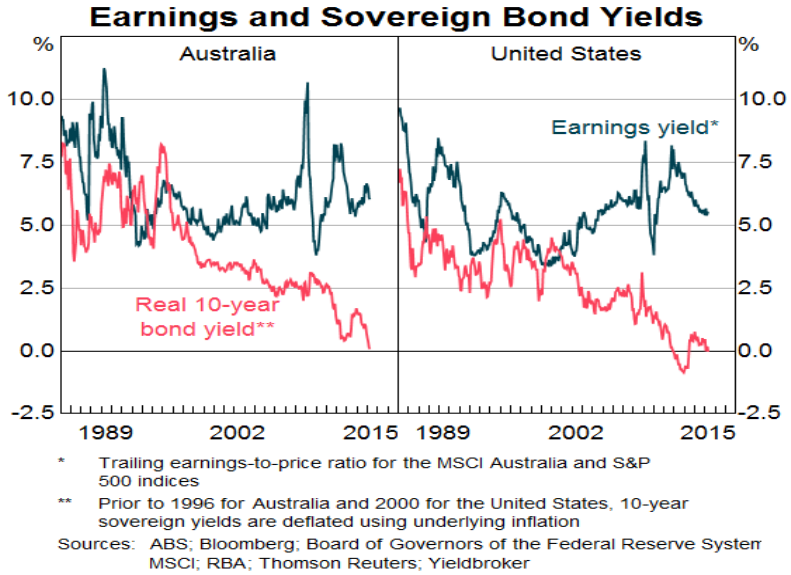
The post-GFC evidence supports the Wright approach to the determination of the MRP. This point was implicitly made by the Governor of the Reserve Bank of Australia in a speech to the Australian American Association:[124]

> But another feature that catches one's eye is that, post-crisis, the earnings yield on listed companies seems to have remained where it has historically been for a long time, even as the return on safe assets has collapsed to be close to zero (Graph 2). This seems to imply that the equity risk premium observed *ex post* has risen even as the risk-free rate has fallen and by about an offsetting amount. Perhaps this is partly explained by more sense of risk attached to future earnings, and/or a lower expected *growth rate* of future earnings.
>
> Or it might be explained simply by stickiness in the sorts of 'hurdle rates' that decision makers expect investments to clear. I cannot speak about US corporates, but this would seem to be consistent with the observation that we tend to hear from Australian liaison contacts that the hurdle rates of return that boards of directors apply to investment propositions have not shifted, despite the exceptionally low returns available on low-risk assets.
>
> The possibility that, *de facto*, the risk premium being required by those who make decisions about real capital investment has risen by the same amount that the riskless rates affected by central banks have fallen may help to explain why we observe a pick-up in financial risk-taking, but considerably less effect, so far, on 'real economy' risk-taking.

The graph the Reserve Bank Governor referred to is reproduced in Figure 4.

[124] Glenn Stevens, Address to The American Australian Association Luncheon, New York, USA – 21 April 2015.

Figure 4 Earnings and sovereign bond yields




Source: RBA

Based on this recent evidence, to the extent that an historical market return informs the MRP (which fundamentally is a forward-looking parameter), the Wright approach should be given more weight than the Ibbotson approach, at least in recent history. Indeed, the fact that the Governor of the Reserve Bank of Australia has specifically commented favourably on the very premise that underpins the Wright approach lends support to its acceptance.

Nevertheless, we have averaged the two approaches here to provide a robust and in our view conservative estimate of the MRP based on historical excess returns.

### 7.3.3 Regulatory decisions on the MRP

Table 15 summarises the most recent MRP estimates derived by Australian economic regulators. Most regulators have adopted values for the MRP greater than 6%.

Table 15 Most recent MRP estimates applied by Australian regulators

| Regulator | Date | Sector | MRP (per cent) |
|---|---|---|---|
| IPART | February 2018 | Biannual WACC update | 7.6% based on the February 2018 range from 6.0% - 9.1%. Increases to 8.0% once account is taken of uplift to risk-free rate |
| QCA | December 2017 | Rail | 7.0%[125] |
| ERA | October 2017 | Rail | 7.2% |
| ACCC | April 2017 | Rail | 6% |
| ESCOSA | June 2016 | Water | 6% |
| ESC | July 2016 | Water | 6% |
| AER | April 2018 | Electricity and Gas | 6.5% |

**Source:** Synergies based on Australian regulatory determinations

Key points to note in terms of Australian regulators' recent approved MRPs are as follows:

- IPART derives its feasible MRP range based on long-run averages and current market data. The latter value is derived from the DDM. IPART applies the mid-point of its MRP range. However, IPART's MRP estimate as a margin above the contemporary risk-free rate is greater than its reported value (7.6%) because of the higher risk-free rate assumed in its approach.[126]
- ERA's determination of an MRP range is also based on historical averages (using the Ibbotson and Wright averaging methods) and current market data using the DDM. ERA selects an MRP point estimate from within its range at each regulatory determination based on judgement and has not been transparent about the weighting it applies in reaching this position.
- Until recently, the QCA has applied four main methods to estimate the MRP, being two forms of historical averaging (the Ibbotson and Siegel averaging methods), survey evidence (including independent expert reports) and the Cornell DGM. In its December 2017 UT5 Draft Decision for Aurizon Network, the QCA has also stated that it will now have greater regard to the Wright MRP in its determinations, to which it has previously given only a low weight.[127]
- ESCOSA and ESC appear to solely rely on historical long-term averages based on the Ibbotson averaging approach.

[125] The QCA's MRP is a 4-year estimate rather than a 10-year estimate.

[126] IPART (2018b). WACC biannual update, February, p.2.

[127] QCA (2017). Aurizon Network's 2017 draft access undertaking, December, p.492.

Attachment F provides more details on Australian regulators' estimation of the MRP.

### 7.3.4 International evidence on estimating the MRP

Ofgem's consultants, Wright and Smithers (2014)[128], made the following comments in regards to establishing a value for the MRP:

> … the [UK's Competition Commission] has given at least some weight to a model in which the expected market return is assumed to have been pulled down by falls in the risk-free rate… We argued against this model, pointing to the lack of any historical stability in the risk-free rate, and hence in estimates of the market equity premium. We believe that recent events have simply added to the weight of evidence against this approach.
>
> A counter-cyclical equity premium is consistent with some more recent academic research, and with recent patterns in observable proxies for risk premiums such as corporate bond spreads. It also has the advantage of providing stability in the regulatory process.
>
> We conclude that there is no plausible case for any further downward adjustment in the assumed market cost of equity based on recent [downward] movements in risk-free rates.

Wright and Smithers conclude:[129]

> Thus both historical and more recent evidence point to the same conclusion: in contrast to the stock return there is no evidence of stability in the risk-free rate, at any maturity. As a direct implication, there is no evidence of stability of the market equity premium. Without such evidence, there is no empirical basis for the assumption that falls in risk-free rates should translate to falls in expected market returns.

The US Federal Energy Regulatory Commission (FERC) has adopted a similar stance. It was previously FERC's practice to adjust the return on equity with a 1:1 correspondence between the return on equity and changes in US Treasury bond yields. However, in light of the GFC, they have decided that this methodology may no longer "produce a rational result":[130]

> The capital market conditions since the 2008 market collapse and the record in this proceeding have shown that there is not a direct correlation between changes in U.S.

[128] Wright, S. and Smithers, A. (2014). The cost of equity for regulated companies: A review for Ofgem, p.2.

[129] Wright, S. and Smithers, A. (2014), p.15.

[130] Opinion 531, Docket EL11-66-001, FERC, June 2014, pp 77-78.

> Treasury bond yields and changes in ROE… U.S. Treasury bond yields do not provide a reliable and consistent metric for tracking changes in ROE.

In support of the Wright approach, the Alberta Utilities Commission acknowledged in 2011 that the market risk premium may be higher than its historic average due to low prevailing interest rates. This decision was supported by regression analysis, which demonstrated that the market return on equity changes by less than changes in the risk-free rate.[131]

Dobbs, Koller and Lund (2014) from McKinsey Inc. have also contributed to the debate about the MRP:[132]

> … a "rational expectations" investor who takes a longer-term view should regard today's ultra-low rates as temporary and therefore likely will not reduce the discount rate used to value future cash flows. Moreover, such investors may assign a higher risk premium in today's environment. Our conversations with management teams and corporate boards suggest that they take a similar approach when they consider investment hurdle rates. None of those with whom we spoke have lowered the hurdle rates they use to assess potential investment projects, reflecting their view that low rates will not persist indefinitely.

The NZCC calculates a tax-adjusted MRP (TAMRP) based on the median of five different methods: the Ibbotson MRP, two versions of the Siegel approach, a DGM estimate, and surveys.[133] As per our analysis in this chapter, we have significant reservations with regard to the use of the Siegel approach and/or surveys, and to a lesser extent with the use of DGM estimates at this point in time given data quality (noting that these approaches are theoretically sound).

### 7.3.5 Forward looking approaches to the MRP

The MRP is an inherently forward looking concept. Whilst historical approaches to the assessment of the MRP are transparent and relatively straight forward, the assessment of the forward looking MRP is less clear – the very nature of the process involves distilling forecast future expectations of returns. Consequently, there is a range of estimates available that apply several different methods.

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131 Villadsen, B., Vilbert, M.J. and Brown, T. (2012). Survey of Cost of Capital Practices in Canada, 31 May.

132 Dobbs, R., Koller, T. and Lund, S. (2014). "What effect has quantitative easing had on your share price?" McKinsey on Finance, Winter (49), p.16.

133 New Zealand Commerce Commission. (2016). Input methodologies review decisions – Topic paper 4: Cost of capital issues, 20 December.

As discussed in Chapter 6 of our report, in theory, the DDM reflects the market price for a security – it equates the present value of expected future dividends to the current price of the relevant security. The approach can equally be applied to estimate the market risk premium.

There are several issues to be addressed in calculating the DDM, whether for an individual security or for the market as a whole. Here, we have applied three well known approaches to the estimation of the MRP:

- Damodaran (2013), a modified two stage method;[134]
- Bank of England (2010), a multi-stage dividend discount model; and[135]
- Gordon Constant Growth Model.

We apply equal weighting to all three sub-models as we think there is sufficient differentiation between assumptions in the models to provide an appropriate estimate when they are averaged.

Table 16 presents the results of these approaches.

Table 16 Forward looking MRP estimates based on DDM (based on a zero gamma)

| Methodology | Estimate | Weighting |
|---|---|---|
| Damodaran (2013) | 7.39% | 33% |
| Bank of England (2010) | 7.41% | 33% |
| Gordon Constant Growth Model | 7.04% | 33% |
| **Weighted Average MRP** | **7.28%** | |

A key issue that prevails in the estimation of DDMs is the estimate of the long-run growth rate, to which dividend growth is assumed to converge. For example, the AER's estimate of long-run growth rate is 4.6%. In contrast, IPART applies a higher long-run growth rate assumption of 5.5%. This value assumes GDP growth of 3% and inflation of 2.5%.

McKenzie and Partington explain the importance of these assumptions in compiling DDM estimates as follows:[136]

[134] Damodaran, A. (2013). Equity risk premiums (ERP): Determinants, estimation and implications – The 2013 edition, pp.63-73.

[135] The Bank of England developed another approach in 2002. This approach is one of the methods adopted by IPART om its assessment of the MRP. However, the Bank of England (2002) approach has not been included in our analysis as it was not developed to derive implied MRPs.

[136] McKenzie, H. and Partington, G. (2011). Equity market risk premium, December, p.25.

> Clearly valuation model estimates are sensitive to the assumed growth rate and a major challenge with valuation models is determining the long run expected growth rate. There is no consensus on this rate and all sorts of assumptions are used: the growth rate in GDP; the inflation rate; the interest rate; and so on.

There is a lack of agreement around the appropriate value for the long-run growth rate. As this is a key input in DDM calculations, different estimates can lead to substantial differences in final estimates of the MRP. Any instability generated by fluctuating dividend forecasts, as well as disagreement about the assumed speed at which dividend growth converges to the long-run rate further compounds the instability of this value.

Consequently, our view is that MRP estimates based on forward-looking approaches, while theoretically appealing, tend to be significantly less stable when compared to historical approaches. For this reason, we have not applied a forward-looking MRP derived using the DDM. We have not adjusted the weighted average MRP of 7.28% from Table 16 for dividend imputation; doing so would have increased the MRP.

### 7.3.6 Estimating MRP using Market Surveys

To varying degrees, Australian regulators have referenced the outcomes of market surveys to support their preferred MRP values.

Lally (2013) notes that "the respondents to these surveys are academics, analysts, and managers rather than investors per se."[137] Hence it is unlikely that the overwhelming majority of any of the survey respondents would be employing their estimate of the MRP to reach real-world investment decisions.

The Australian Competition Tribunal has raised concerns about the use of market surveys:[138]

> Surveys must be treated with great caution when being used in this context. Consideration must be given at least to the types of questions asked, the wording of those questions, the sample of respondents, the number of respondents, the number of non-respondents and the timing of the survey. Problems in any of these can lead to the survey results being largely valueless or potentially inaccurate.
>
> When presented with survey evidence that contains a high number of non-respondents as well as a small number of respondents in the desired categories of

[137] Lally, M. (2013). Response to submission on the risk-free rate and the MRP, 22 October, p.23.

[138] Application by Envestra Ltd (No. 2), ACompT 3, para. 162-163.

expertise, it is dangerous for the AER to place any determinative weight on the results.

In our view, market surveys are not a transparent or robust approach to guiding determination of the MRP and therefore we consider that minimal weight should be attributed to them. Furthermore, the methodologies employed by respondents can depart from the conventional theory and ad hoc adjustments are common.

Attachment F of our report provides more information on market surveys.

### 7.3.7 Conclusion on the MRP

It is clear that the majority of regulators have acknowledged the limitations of solely relying upon the Ibbotson approach to assess the MRP.

Several regulators (including the ERA and QCA), the Governor of the Reserve Bank and international regulatory bodies and financial experts have explicitly or implicitly adopted the Wright approach to the formulation of the MRP. Clearly, the Wright approach is a well-accepted approach. It is arguable that forward-looking approaches based on the DDM are well-accepted, although in this instance we have used them as a cross-check given their inherent instability and the ongoing disagreement over transition and terminal growth discount rates.

Accordingly, for the purposes of estimating the MRP we have averaged the outcomes of applying the Wright and Ibbotson approaches.

Our simple weighted average estimate of the MRP based on these approaches is a value of 7.71% (assuming a gamma of 0.25) as shown in Table 17.

Table 17 Current Estimates of the MRP

| Methodology | Estimate (assuming zero gamma) | Estimate (assuming 0.25 gamma) | Weighting |
|---|---|---|---|
| Ibbotson Historical Excess Returns | 6.43% | 6.56% | 50% |
| Wright Historical Excess Returns | 8.72% | 8.86% | 50% |
| **Weighted Average MRP** | **7.58%** | **7.71%** | |

**Source:** Synergies calculations

This MRP value is below the most recent IPART update (7.6%) once account is taken of the higher risk-free rate assumed in its approach (approximately 40 basis points), resulting in an effective MRP of 8.0%.

## 7.4 SL CAPM estimate

Synergies' SL post-tax CAPM estimate and its underlying input parameter values are presented in Table 18 (assuming a gamma of 0.25 which we address in Chapter 11 of our report).

Table 18 SL CAPM post-tax cost of equity estimate

| Parameter | Value |
|---|---|
| Risk-free rate | 2.74% |
| Gearing | 30% |
| Asset beta | 0.7 |
| Equity beta | 1.0 |
| MRP | 7.71% |
| SL CAPM | 10.45% |

**Source:** Synergies

### 7.4.1 Pre-tax return on equity

Given the Pricing Order requires that the WACC estimate be expressed in pre-tax nominal terms, the following formula grosses up the post-tax Re for gamma-adjusted corporate tax to generate a pre-tax Re:

$$\text{Pre-tax Re} = \text{Post tax Re} / (1 - t * (1 - \gamma))$$

Where

$t$ = corporate tax rate = 0.3

$\gamma$ = gamma (refer Chapter 11 of our report)

Substituting the parameter values into the above formula:

$$\text{Pre-tax Re} = 10.45\% / (1 - 0.3 * (1 - 0.25))$$

$$\text{Re} = 10.45\% / 0.775$$

**Pre-tax SL CAPM Re = 13.48%**

# 8 Estimating the return on equity using Black CAPM

| Chapter overview | | |
|---|---|---|
| 2018-19 submission | 2017-18 submission | Comments |
| **13.48%** | 13.66% | Our methodology for calculating the return on equity using the Black CAPM is unchanged. The pre-tax return on equity from the Black CAPM is identical to that based on the SL CAPM. This is due to PoM's assumed equity beta of 1.00, at which point the two models provide equal estimates. |

## 8.1 Estimating the Black CAPM return on equity

### 8.1.1 Post-tax return on equity

SFG has estimated the zero-beta premium to be 3.34%. The zero-beta return is the sum of risk-free rate and the zero-beta premium. Hence, our SL CAPM estimate can be combined with this zero-beta premium to estimate the Black CAPM return on equity using the following formula:

$$Re = Rz + \beta_e * [E(R_m) - Rz]$$

Where

Rz = risk-free rate plus zero beta premium

$\beta_e$ = beta

E(Rm) = market return

**Parameter values:**

Zero beta premium = 3.34% (taken from SFG)

Risk-free rate = 2.74% (refer Chapter 7 of our report)

Market return = 10.45% (risk-free rate of 2.74% plus MRP of 7.71% from Chapter 7)

Equity beta of 1.00 (refer Chapter 7 of our report)

Substituting the parameter values into the Black CAPM formula:

Re = (2.74% + 3.34%) + 1.00 * (7.71% - 3.34%)

Re = 6.08% + 4.37%

**Post-tax Black CAPM Re = 10.45%**

### 8.1.2 Pre-tax return on equity

Given the Pricing Order requires that the WACC estimate be expressed in pre-tax nominal terms, the following formula grosses up the post-tax Re for gamma-adjusted corporate tax to generate a pre-tax Re:

Pre-tax Re = Post tax Re / (1 – t * (1 - γ))

Where

t = corporate tax rate = 0.3

γ = gamma = 0.25 (refer Chapter 11 of our report)

Substituting the parameter values into the above formula:

Pre-tax Re = 10.45% / (1 – 0.3 * (1 - 0.25))

Re = 10.45% / 0.775

**Pre-tax Black CAPM Re = 13.48%**

## 8.2 Black CAPM estimate

Our estimate of the pre-tax return on equity for the benchmark port entity based on the Black CAPM is 13.48%.

# 9 Estimating the return on equity using the Fama-French Model

| Chapter overview | | |
|---|---|---|
| 2018-19 submission | 2017-18 submission | Comments |
| **15.51%** | 15.12% | The pre-tax return on equity estimate is marginally higher compared to last year's submission. The HML beta is lower, but the MRP and SMB betas have increased. We have made a slight adjustment to our methodology for companies from countries without country-specific factors. Last year, in such instances, we regressed the company's return on global factors from the Ken French database. This year, we have retained the global estimates for the HML and SMB returns, but the market returns for the MRP factor are now based on the given company's local index. As such, the market beta estimate more closely resembles the beta estimate for the CAPM. |

The return on equity is calculated as follows:

$$Re = Rf + \beta j * [E(R_m) - R_f] + \beta k * [HML] + \beta l * [SMB]$$

Where:

Rf = the risk-free rate of return

E(Rm) = the expected return on the market

[E(Rm) – Rf] = the market risk premium (Australian estimate: 7.71%)

HML = expected high-minus-low risk premium (Australian estimate: 6.10%)

SMB = expected small-minus-big risk premium (Australian estimate: 1.93%)

βj = market excess returns beta

βk = high-minus-low factor beta

βl = small-minus-big factor beta

Note that the risk-free rate and MRP under this model match the values used in the SL CAPM. As for the SL CAPM, the FFM restricts the zero-beta rate to be the risk-free rate.

Table 19 provides our updated FFM risk factor premium estimates.

Table 19 FFM equity betas and risk factor premiums

| Risk factors | Estimated equity betas | Risk factor premiums |
|---|---|---|
| Market risk premium | 1.06 | 7.71% |
| High minus low (HML) premium | 0.11 | 6.10% |
| Small minus big (SMB) premium | 0.23 | 1.93% |

**Source:** Synergies, Brailsford, T., Gaunt, C. and O'Brien, M (2012)

### 9.1.1 Post-tax return on equity

As noted in the preceding section, the post-tax FFM formula is as follows

$$Re = Rf + \beta j * [E(R_m) - R_f] + \beta k * [HML] + \beta l * [SMB]$$

Substituting the parameter values into the FFM formula as follows:

Rf = 2.74%

βj = 1.06

$[E(R_m) - R_f]$ = 7.71%

βk = 0.11

[HML] = 6.10%

βl = 0.23

[SMB] = 1.93%

Post-tax Re = 2.74% + ((1.06 * 7.71%) + (0.11 * 6.10%) + (0.23* 1.93%))

**Post-tax FFM Re = 12.02%**

### 9.1.2 Pre-tax return on equity

Given the Pricing Order requires that the WACC estimate be expressed in pre-tax nominal terms, the following formula grosses up the post-tax Re for gamma-adjusted corporate tax to generate a pre-tax Re:

Pre-tax Re = Post tax Re / (1 – t * (1 - γ))

Where

t = corporate tax rate = 0.3

γ = gamma = 0.25 (refer Chapter 11 of our report)

Substituting the parameter values into the above formula:

Pre-tax Re = 12.02% / (1 – (0.3 * (1 - 0.25))

Re = 12.02% / 0.775

**Pre-tax FFM Re = 15.51%**

## 9.2 FFM estimate

Our estimate of the pre-tax return on equity based on the FFM is 15.51%, which is higher than the SL CAPM and Black CAPM, reflecting the incorporation of two additional risk factors that, along with systematic overall market risk, explain investors' expected return on equity for the benchmark port entity.

# 10 Estimating the return on debt

| Chapter overview | | |
|---|---|---|
| 2018-19 submission | 2017-18 submission | Comments |
| **Risk-free rate: 2.74%** | Risk-free rate: 2.81% | The risk-free rate has again been calculated as a 20-day average on 10-year Australian Government bond yields, an approach frequently adopted by economic regulators. |
| **DRP: 2.53%** | DRP: 2.54% | This year, the return on debt has been calculated using a trailing average methodology, which places a 90% weighting on the 2017 on-the-day estimate, and a 10% weighting on the 2018 on-the day estimate. Each year, 10% of the weighting on the 2017 on-the-day estimate will be refreshed with the prevailing on-the day estimate for the given year. The trailing average approach is used by several Australian regulators and will result in less volatility over time. Our position on debt raising costs is unchanged. |
| **Debt raising costs: 0.1%** | Debt raising costs: 0.1% | |
| **Return on debt: 5.37%** | Return on debt: 5.45% | |

## 10.1 Introduction and background

The Pricing Order provides no guidance regarding estimation of the return on debt beyond it being one or a combination of well-accepted approaches. Furthermore, the ESC has not made specific reference to our chosen methodology in any of its commentary. In simple terms, the return on debt calculation is the sum of the risk-free rate and an estimate of the debt risk premium consistent with the risk profile of the benchmark efficient port entity.

This approach is well-accepted in financial markets and by economic regulators in Australia and internationally, underpinned by the concept of credit spreads reflecting credit and liquidity risks associated with government and corporate bonds. A credit spread is the difference in yield (return to the investor) between two bonds of similar maturity but with different credit quality due to the different underlying risks associated with each bond. The difference in yields between a long-term government bond (assumed to be the risk-free rate) and an equivalent term corporate bond is an example of the credit spread concept.

The return on debt calculation can be expressed as follows:

$$R_d = R_f + DRP + DRC$$

Where:

Rf = risk-free rate

DRP = debt risk premium

DRC = debt raising costs

An allowance for debt raising costs could be included in the cashflows of the benchmark entity as an opex item rather than included in the Rd formula.

In applying the above return on debt formula, there are several underlying assumptions that are required including in regards to:

- risk-free rate
- notional credit rating assumption
- term to maturity
- debt management approach
- method used to estimate the debt risk premium (DRP)
- assumed debt raising costs.

Each of these parameters is estimated in the sections below after we have summarised well-accepted methodologies regarding estimation of the return on debt.

### 10.1.1 Implications of ESC commentary for return on debt

The ESC has not made any direct reference to PoM's return on debt methodology in any of its WACC commentary up to this point. As such, the reasonableness of our approach can at present only be assessed against the ESC's broader position on well-accepted, namely acceptance by at least one economic regulator.

In the 2017-18 WACC submission, we applied an on-the-day approach, which was appropriate in the context of the PoM Long Term Lease transaction and the first TCS. This year we have commenced a trailing average approach, which is currently adopted by several Australian regulators. The trailing average calculation places a 90% weighting on the 2017 return on debt estimate, and a 10% weighting on the 2018 return on debt estimate. With each subsequent year, 10% of the 2017 weighting will be refreshed with the prevailing return on debt estimate.

This approach is being adopted on the basis of its lower volatility over time, and because it is more consistent with the debt management practices of a benchmark efficient entity. It is also in line with our approach to other WACC parameters, which, where possible, are based on long-term averages. This methodology is also consistent with the approach currently in use by the AER.

Our methodology for calculating the 2018 on-the-day estimate used in the trailing average calculation is unchanged from last year's submission.

## 10.2 Well-accepted methodologies

Given the CAPM is intended to reflect expectations as of the day of analysis, it is theoretically correct to base the risk-free rate on the prevailing yield on the date of the valuation. This means that the return on debt is based on prevailing rates, set over a very

short averaging period prior to the point at which prices are reset. It then remains fixed during the regulatory period, with the regulated business managing the risk of interest rate movements.

However, problems may occur if there is a spike in yields on-the-day that the rate is applied. It is therefore now common regulatory practice to average the rate over a short horizon, which typically ranges from between ten and forty days, noting that over such a short horizon the choice of averaging period is likely to be of little consequence. The Independent Pricing and Regulatory Tribunal (IPART) in NSW is the only Australian regulator that has looked at longer term averages, which it does in conjunction with short term estimates.

Until relatively recently, Australian regulators always applied an 'on-the-day' approach to estimate the return on debt. The ACCC is the most recent example, which presented an 'on-the-day' return on debt calculation in its April 2017 HVAU Draft Decision.

Other economic regulators have now accepted the trailing average approach, including the ESC in regard to Melbourne Water, which allowed an immediate transition but based on a data series that excluded the 'GFC years' (2008-09 to 2012-13). This approach emanates from the recognition that in practice, a more efficient debt management strategy may be to maintain a staggered debt maturity profile and progressively refinance debt through time. This in turn means that the return on debt set in the WACC will therefore reflect the cost at which debt was raised or refinanced historically, resulting in a return on debt that reflects historical rates. The trailing average approach involves 'averaging in' a portion of the prevailing return on debt each year.

The ERA has also accepted the trailing average approach in recent gas network decisions,[139] although based on a 'hybrid' approach, allowing an immediate transition for the DRP and a ten-year transition for the base rate.[140]

In its recent decision for SA Water, the Essential Services Commission of South Australia (ESCOSA), determined that it will immediately transition to this approach in the first year of its new regulatory control period.[141]

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[139] Refer: ATCO Gas Australia, Dampier to Bunbury Pipeline.

[140] The rationale for this is that the benchmark efficient entity can use swap transactions to hedge the base rate component of its return on debt at each regulatory reset. However, it cannot similarly hedge the DRP.

[141] ESCOSA (2016). SA Water Regulatory Determination 2016, Final determination, June. In making this conclusion, ESCOSA noted that over the previous ten years, there would have been an immaterial difference had there been a gradual transition to the trailing average compared to the on-the-day approach.

The AER has also now transitioned to a trailing average approach as explained in its Rate of Return Guideline.[142] The 2012 rule changes made by the AEMC allowed for the return on debt to be estimated based on one of: the trailing average approach; the current on-the-day approach; or a hybrid of the two. In its 2013 Rate of Return Guideline, the AER determined that its preferred approach is the trailing average. It has employed a simple averaging approach, which means that each year, one-tenth of the prevailing ten-year bond yield would be 'averaged in' to the return on debt estimate.[143] This means that the regulated return on debt, and hence tariffs, will vary throughout the period.[144] The AER also determined that this must be implemented over a ten-year transition period.[145]

The only Australian regulator that has explicitly rejected the trailing average approach is the Queensland Competition Authority (QCA).

It is also informative to consider evidence from regulators overseas in regard to how they determine the appropriate cost of debt. A number of regulators adopt a trailing average methodology.

The NZCC has previously used a prevailing average (i.e., an on the day approach). However, in its 2016 Input Methodologies Review, the NZCC announced that it would move to a five-year historical averaging approach for the debt premium. This change applies only to the debt premium, and a prevailing average will be retained for the risk-free rate. In explaining this change of methodology, the NZCC observed that:[146]

> Firms can be exposed to any difference between the debt premium paid at the time they issue debt and the debt premium determined during the averaging window prior to the setting of the WACC.

Whereas in Australia most regulators employ data from Bloomberg and/or the RBA, the NZCC constructs a pool of publicly traded corporate bonds that are comparable to the regulated entity in question. The NZCC allows for debt issuance costs of 0.20%.

In the UK, Ofgem bases its cost of debt on Markit iBoxx Non-Financial corporate bond market indices, and applies a 10 year trailing average. The Competition and Markets

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142 AER (2013a), p.28.

143 We would consider that a more effective approach would be to adjust the changes in the benchmark debt balance, as this recognises the lumpy capital expenditure profiles that are typical of regulated businesses, that is, in a year when capital expenditure is high, more weight would be given to the prevailing return on debt in that year.

144 Alternatively, they could be adjusted via a 'true up' mechanism at the end.

145 This is seen as particularly relevant at the current time given the recent contraction in debt margins, that is, the estimate that would be produced using the 'on-the-day' approach would be lower than the trailing average, which would reflect the significant expansion in debt margins following the global financial crisis.

146 New Zealand Commerce Commission. (2016). Input methodologies review decisions – Topic paper 4: Cost of capital issues, 20 December, para. 138.

Authority has regard to evidence from yields and spreads on sterling-denominated corporate bonds issued by energy firms in the UK, along with evidence from spreads on UK corporate bonds more generally.

### 10.2.1 **Synergies' assessment**

The application of a long-term trailing average approach is more likely to approximate the debt management practices of an entity that has been subject to deterministic price regulation for a long period, but this does not invalidate the application of the on-the-day approach. This is because a regulated entity could choose to adopt a debt management practice that reflects the on-the-day approach.

Indeed, the Australian energy regulatory framework recognises that the return on debt can be estimated based on either the on-the-day approach or the trailing average approach or a hybrid of the two. This is left to the discretion of the regulated entity notwithstanding the AER's current preference for the trailing average approach.

In the context of the benchmark port entity, we consider that the choice between these approaches should reflect the preferences of the Port Licence Holder. This is because a return on debt for a benchmark efficient entity can be estimated under both the on-the-day and trailing average approaches. Based on the Port Licence Holder's guidance, this year we have transitioned to a trailing average approach, which will place a 90% weighting on the 2017 return on debt estimate, and a 10% weighting on the 2018 return on debt estimate.

## 10.3 Risk-free rate

As noted in Chapter 7, we have applied an updated estimate of the risk-free rate based on a twenty-day average of the ten-year Commonwealth Government bond yield as at 31 March 2018.

The resulting estimate is 2.74 per cent (annual effective).

## 10.4 Notional credit rating assumption

A common starting point for the notional credit rating assumption is BBB, or minimum investment grade. The most common notional credit rating assumption applied to regulated entities in Australia is either BBB or BBB+.

It is noted that in practice, this distinction often has no practical consequence given most regulators have estimated the BBB/BBB+ DRP from the broader BBB corporate bond category, which reflects BBB-, BBB+ and BBB bonds.[147]

It is also appropriate that the credit rating assumption used for the DRP should be consistent with the gearing assumption.

In Australian regulatory practice, the adoption of an investment grade credit rating for an efficient benchmark entity has not been contentious.

## 10.5 Term to maturity

Consistent with our risk-free rate calculation for the return on equity, we have assumed a ten-year term to maturity for BBB bonds, the longest available tenor (with appropriate liquidity) in an Australian context.

There are currently two robust data series available with the relevant bond yield information, Reserve Bank of Australia (RBA) and Bloomberg. These series are discussed further in Section 10.7 below.

## 10.6 Debt management approach

The options that have been adopted by Australian regulators are as follows:

- Risk-free rate based on the 10-year Commonwealth bond yield plus debt margin calculated using the prevailing cost of funds based on a short averaging period close to commencement of the regulatory period.
- Risk-free rate based on the 10-year Commonwealth bond yield plus debt margin calculated using a moving 10-year historical trailing average.
- Some form of hybrid approach, which is based on a 10-year rolling average of the debt risk premium on 10-year corporate bonds added to the 5-year swap rate prevailing close to commencement of (first) regulatory period.

The issue of the best approach to estimating the return on debt is likely to be determined by the debt management strategies of many regulated entities subject to deterministic price setting arrangements. The BEE test does not undermine this approach – rather, the question is what the cost of debt would be for the BEE given its debt management approach.

[147] The exceptions to this are the QCA and the ERA, who both employ their own 'bespoke' in house approaches to estimate the DRP.

In the case of the benchmark port entity, we consider that a trailing average approach to estimating the return on debt is now appropriate, as this methodology is more reflective of the debt management practices of a benchmark efficient entity. Unlike last year's first regulatory period, PoM will now have a time series of return on debt estimates that can be used to inform such a calculation.

The remainder of this chapter outlines how we have calculated the 2018 on-the-day return on debt estimate, before detailing how we have weighted this estimate in our trailing average calculation.

## 10.7 Debt risk premium (DRP)

The DRP is estimated based on the difference between the yield on ten-year BBB corporate bonds and the risk-free rate (averaged over the same twenty-day period).

The key issue is the data source and methodology used to estimate the ten-year BBB corporate bond yield. The majority of Australian regulators use an independent third party data source, being either Bloomberg's BVAL series or the RBA's bond yields for non-financial corporates, with the exception of the QCA and ERA. The latter employ their own in-house methodology that applies an econometric approach. The use of an independent third party data source as they are independent, reputable and robust represents a well-accepted approach.

In its October 2015 decision for Telstra, as well as its April 2017 decision for ARTC, the ACCC applied an average of Bloomberg and RBA estimates. The AER has similarly applied an average of the two in its decisions made under its current Rate of Return Guideline, which specifies that it will continue to use an independent third party data source to estimate the DRP.

### 10.7.1 RBA series

There are two issues that need to be addressed in the use of the RBA's data:

- *single day end of month estimate*: as the estimates are currently only produced on the last day of each month, there is a risk that this day was 'atypical' or influenced by a one-off event or perturbation in the market. This can be addressed by taking an average of the most recent three month-ends (January, February and March), which has been done previously by the AER[148];

[148] AER (2014a). Ausgrid, Endeavour Energy, Essential Energy, ActewAGL, Transitional Distribution Determination, 2014-15, April; AER (2014b). Transgrid, Transend, Transitional Transmission Determination, 2014-15, March.

- *average tenor less than ten years*: as noted above, to the extent that the 'ten year' estimate reflects an average bond tenor of less than ten years, it is not a ten year estimate. Accordingly, it should be extrapolated to a ten-year estimate. We have done this by using all of the RBA's data (i.e. the three, five, seven and ten-year estimates) to approximate the slope of the RBA's yield curve.

### 10.7.2 Bloomberg BVAL Curves

Bloomberg provides estimates of BBB-rated Australian corporations under its Bloomberg Valuation service, also referred to as 'BVAL'. The BVAL curves use a proprietary algorithm to derive bond prices which are then used to construct a yield curve. The inputs to the BVAL models include direct observations of bond prices through trading and historical tracking of the bond compared to comparable firms if there is thin data available for the given security. Another method used to address thin trading is that the data can be supplemented using the historical correlation of price movements with observed comparable bonds.

## 10.8 Debt raising costs

The debt risk premium reflects a premium for credit and liquidity risk. However, it does not include any allowance for the actual costs of raising debt. In practice, an efficient benchmark port entity will incur transaction and administration costs in raising and managing its debt.

### 10.8.1 Regulatory precedent

PwC has undertaken market research of Australian debt raising transaction costs, which have been applied in an Australian energy economic regulation context.[149] Incenta have subsequently applied PwC's findings in recent energy regulatory processes. PWC's study built on earlier work undertaken by Allen Consulting Group.[150] We regard this collective body of work prepared in an Australian regulatory context to provide the most authoritative evidence of debt raising costs for Australian corporates based on surveys and interviews with legal firms, banks and credit rating agencies that are involved in the corporate bond raising process.

PWC noted that during the past decade a benchmark of 12.5 basis points per annum (bppa), representing direct costs of debt raising, was developed and applied by several

[149] PwC (2013).

[150] Allen Consulting Group (2004). Debt and equity raising transaction costs, Final report, December.

Australian regulators. However, from 2004 the AER applied a methodology based on empirical observations of direct debt raising costs, which resulted in lower benchmark values in the range of 8 to 10 bppa depending on the size of the regulated network business.[151]

PwC's breakdown of direct debt transaction costs are as follows:

- Legal counsel – Master program – legal costs for the preparation of a Master Program, which becomes the base document for multiple issuances over 10 years;
- Legal counsel – Issuer's – legal fees for the preparation of documents under the Master Program;
- Credit rating agency – Initial credit rating – a fee to establish the credit rating;
- Credit rating agency – Annual surveillance – a rating agency fee for the maintenance of the credit rating each year;
- Credit rating agency – Up front bond issue – a fee charged by the rating agency when a new bond is issued;
- Registrar – Up front – an initial set-up fee charged by a bond registry organisation;
- Registrar – Annual – the annual fee charged by the registry service; and
- Investment bank's out-of-pocket expenses – the fees charged by the agents of a bank for travel, accommodation, venue hire, printing etc.

We consider this full list is relevant for the total benchmark transaction costs that would be prudently incurred by the BEE required to re-finance the debt component of the Prescribed Services Asset Base over each regulatory period. Using the above cost components, PwC derived an estimate for total debt raising transaction costs for Australian bond issues, based on the standard issue size ($250 million) and benchmark term to maturity (10 years), of 10 bppa. This estimate combines the base arrangement fee with 'other' costs in terms of an equivalent bppa. Accordingly, 10 bppa has been added to our return on debt estimate.

## 10.9 Cost of debt estimates

We consider that both the RBA and Bloomberg data series represent an independent, credible and reliable data source for return on debt estimation purposes.

[151] PwC (2013), p.6.

The different samples used for each series is likely to provide valuable information on the level of and movements in BBB bond yields. This suggests that using an average of two comparable series is likely to be a superior approach to choosing just one where there are no substantive methodological grounds to favour one series over the other.

Consequently, we consider calculating an average of the RBA and BVAL series is appropriate in estimating the cost of debt for the efficient benchmark port entity.

Assuming a risk-free rate of 2.74% and debt raising costs of 10 bppa gives an on-the-day cost of debt estimate for the benchmark efficient port entity of 4.58%. Table 20 indicates this calculation.

Table 20 2018 on-the-day cost of debt calculation

| Averaging period | RBA | Bloomberg | Average |
|---|---|---|---|
| BBB DRP based on 20 days to 31 March 2018 | 1.77% | 1.70% | 1.74% |
| Risk-free rate based on 20 days to 31 March 2018 | 2.74% | 2.74% | 2.74% |
| Debt raising costs | 0.10% | 0.10% | 0.10% |
| **2018 on-the-day cost of debt** | **4.61%** | **4.54%** | **4.58%** |

**Source:** RBA, Bloomberg, Synergies calculations

This 2018 on-the-debt estimate is then used as an input in the trailing average calculation, as displayed in Table 21.

Table 21 Trailing average cost of debt calculation

| Time period | Estimate | Weighting |
|---|---|---|
| 2017 on-the-day cost of debt | 5.45% | 90% |
| 2018 on-the-day cost of debt | 4.58% | 10% |
| **Cost of debt** | **5.37%** | |

**Note:** Assuming a risk-free rate of 2.74% and debt raising costs of 0.10%, this implies a DRP of 2.53%

**Source:** RBA, Bloomberg, Synergies calculations

Given a risk-free rate of 2.74%, and debt raising costs of 10 bppa, a cost of debt of 5.37% implies a DRP of 2.53%, which is slightly lower than the 2017 DRP estimate of 2.54%.

# 11 Gamma

| Chapter overview | | |
|---|---|---|
| 2018-19 submission | 2017-18 submission | Comments |
| **0.25** | 0.25 | We have retained our gamma estimate from 2017-18 based on a three-way average of the gamma value implied by finance theory (zero value), the equity ownership approach (0.45 value) and market valuation studies (0.25 value). In the Australian regulatory setting, IPART has recently reaffirmed its commitment to a gamma value of 0.25. |

Gamma ($\gamma$) is the value of imputation credits to investors in the BEE, where some part of corporate tax paid by this entity can be claimed as a tax credit against personal income tax. To the extent it can be accessed by investors, it forms part of the assumed equity return to investors.

As discussed in Chapter 2 of our report, the Pricing Order requires that the WACC be determined on a pre-tax nominal basis. This requires tax to be incorporated in the pre-tax nominal WACC formula which, in turn, requires an assumption to be made regarding the value of gamma and assumed required pre-tax return on equity. However, the Pricing Order provides no guidance regarding determination of this value.

Following an introductory section on the components of gamma, the remainder of this chapter discusses gamma in the context of finance theory, practical evidence of dividend imputation systems and Australian regulatory precedent. It highlights that there is a marked difference between market evidence and academic views on the *market* valuation of imputation credits (on the one hand) and the approach adopted by regulators which looks to an average valuation of imputation credits based on ATO data (on the other).

## 11.1 Introduction and background

Under a dividend imputation system, corporate tax paid prior to the distribution of dividends can be credited against the tax payable on the dividends at a shareholder level. In other words, corporate tax is a prepayment of personal tax withheld at a company level. Under Australia's dividend imputation system, only domestic shareholders can avail themselves of imputation credits.

Gamma is the product of two inputs which must be estimated:

- the proportion of tax paid that has been distributed to shareholders as franking credits (the distribution rate); and
- the value the marginal investor places on $1 of franking credits, referred to as the value of franking credits (or theta).

Gamma must take a value between zero and one depending on the assumptions made in regards to the distribution rate and theta.

Imputation credits are only available in respect of company tax paid on income subject to Australian taxation. For gamma to equal one all income must be domestically taxable. What is clear is that different shareholders value franking credits differently, as their tax status determines whether their credits can be redeemed.

If the shareholder is an Australian taxpayer, then they are subject to Australian personal income tax and can offset the prepayment of this tax at the corporate level against their own personal liabilities. If they are not subject to Australian personal income tax, such as non-residents and tax-exempt individuals or entities, then the company tax paid cannot be offset, and no additional value is therefore derived. In other words, the value of gamma is zero.

The following section reviews the changes in regulatory opinion on gamma that have occurred in recent years, before proceeding to a review of academic and financial market evidence.

## 11.2 Evidence on gamma from economic regulators

Determining an appropriate value for gamma has proven highly contentious in economic regulation and most of this debate has played out under the Australian national energy framework. Indeed, it is reasonable to conclude that there is a well-accepted approach to setting a gamma value in an Australian regulatory context but a well-accepted value for imputation credits is yet to emerge.[152]

Historically, most Australian regulators applied a value of 0.5. In its 2009 WACC guidelines review, the *Statement of Regulatory Intent* (SoRI), the AER increased the value of gamma to 0.65. Energex, Ergon Energy and ETSA Utilities (now SA Power Networks) appealed the AER's application of a gamma of 0.65 in their revenue determinations.[153]

In that review, it was accepted that the distribution rate applied should be 0.71 (reflecting the proportion of corporate tax paid that has been distributed to shareholders as franking credits), which is directly observable from Australian tax statistics. A distribution rate of 0.7 has generally been adopted by Australian regulators and is not contentious.

[152] Due to the structural differences in imputation systems elsewhere, we have confined our review to Australia.

[153] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9.

In contrast, the key issue of contention in the SoRI process and in subsequent regulatory proceedings is the value of theta (the value of franking credits). As part of the review process, the Tribunal commissioned a 'state of the art' dividend drop-off study[154] from SFG Consulting to estimate theta, which was subject to intense scrutiny. This study arrived at a value of theta of 0.35, which results in a gamma of 0.25. The Tribunal accepted this value and overturned the AER's decision. The AER subsequently applied a value of 0.25 in decisions made under its SoRI.[155]

In 2013, the AER completed its review of its WACC guidelines, resulting in the replacement of the SoRI with the Rate of Return Guideline. In that review, the AER reverted to a value of 0.5, which was revised down to 0.4 in subsequent revenue determinations using updated data. This hinged on a review of the 'conceptual definition' of theta and a dismissal of market value studies as being of any relevance in valuing theta.

The AER's approach to gamma was one of the matters successfully appealed by the NSW and ACT network businesses in the most recent revenue determination processes. The Tribunal concluded that the AER's gamma was too high and that the upper bound for the value of theta should be no more than 0.43, which reflects the utilisation rates from ATO tax statistics (which would equate to a gamma of 0.3 at a distribution rate of 0.7). It highlighted that the AER's equity ownership approach arrives at a value that is above this upper bound and therefore "the equity ownership approach overstates the redemption rate."[156] It stated that:[157]

> Given that two of the three approaches adopted by the AER [the equity ownership approach and tax statistics] are considered no better than upper bounds, it follows that the assessment of theta must rely on market studies. The Tribunal considers that, of the various methodologies for estimating gamma employed by the AER, market value studies are best placed to capture the considerations that investors make in determining the worth of imputation credits to them. [words in brackets added]

The Tribunal remitted the decision back to the AER to remake with guidance consistent with the above quote implying that gamma should be set at a value no higher than 0.3

[154] The dividend drop-off study is one of the most common empirical approaches used to estimate the value of theta. The estimate is based on an analysis of the change in share price following the payment of a dividend. One of the key difficulties with this is attributing the change in share price to the value of the dividend and the value of the franking credit that is attached to it. This leads to the statistical problem of multicollinearity.

[155] A gamma of 0.65 continued to be applied to electricity transmission network businesses because it was prescribed in the National Electricity Rules. The value of gamma is no longer prescribed in the National Electricity Rules.

[156] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para. 1093.

[157] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para. 1096.

based on utilisation rates taken from ATO tax statistics. The AER subsequently made an application for judicial review of this decision to the Federal Court.

The Full Federal Court upheld the AER's judicial review of the Tribunal's decision on theta. The Full Federal Court found that:[158]

> …the Tribunal assumed other parameters in the WACC calculations were market values that already incorporated investors' tax positions and transactions but that misconstrued the 'post tax' framework [used in the NER]. The rules required gamma to be determined consistently with the return on equity.

Subsequently, a differently constituted Tribunal affirmed the AER's distribution determination for SA Power Networks (SAPN) for its 2015-16 to 2019-20 regulatory control period. The Tribunal concluded that there is no generally accepted theoretical model for explaining the valuation of imputation credits and that the AER had reasonably considered the range of alternative approaches (and diversity of expert views) and made a judgement call. For this reason, the AER did not err in giving greater weight to the utilisation approach rather than market value approach in estimating theta.

Contributing reasons identified by the Tribunal for the difference between the SAPN decision and Ausgrid decision included:

- submissions to the SAPN hearing gave greater attention to the theoretical underpinnings of the prescribed 'vanilla WACC' framework in the NER, including whether an average or marginal investor perspective is the appropriate basis for determining theta;
- the Tribunal agreed with the AER in placing less weight on dividend drop-off studies in the estimation of the value of gamma (contrary to the Tribunal's decision in the Ausgrid appeal) given its view of significant uncertainties in extracting reliable evidence from such studies.

In contrast to the Tribunal's decision in the Ausgrid appeal, the Tribunal in the SAPN case did not find error in the AER's decision to revise its approach to estimating the distribution rate (which changed from 0.7 to 0.77), by using data from listed businesses only. The Tribunal found there is no compelling reason advanced to believe the average unlisted entity is any better or worse than the average listed entity as a proxy for the BEE.

Given this legal precedent, the AER is likely to continue with its equity ownership approach to determining gamma following the Full Federal Court's judgment, which

[158] *Australian Energy Regulator v Australian Competition Tribunal* (No 2) [2017] FCAFC 79, para. 755.

based on data as at 2015 suggests a gamma of 0.4. Central to the Full Federal Court's judgment is the belief that the WACC calculated in accordance with the NER is calculated using face values rather than market values. However, we note that whether the Officer framework used to determine the WACC under the NER adopts face or market values is disputable:[159]

> Moreover, the AER's reasoning ignores the fact that other parameters in the WACC calculations are market values that already incorporate the effects of the differences in investors' tax positions and transaction costs. As noted by Professor Gray of SFG Consulting, Estimating gamma for regulatory purposes, 6 February 2015 at 9:
>
> > In my view, gamma is no different from any other WACC parameter in this respect. For example, when estimating beta, the AER uses traded stock prices, which reflect the value of those shares to investors. That value reflects any "personal costs" that the investors bear. There is no process of adjusting share prices to reverse some of the reasons why investors value shares the way they do. The same applies to the traded bond prices that the AER uses to estimate the cost of debt. All of these prices reflect the value to investors – *all* of the considerations that are relevant to how investors value the stock are reflected in the price. [italicised emphasis in the original]
>
> Consequently, there is no inconsistency between the use of market studies to estimate the value of imputation credits and the methods used to calculate other parameters of the costs of debt and equity from market data.

It is true that the estimation of theta under market-based approaches is not without controversy (with measurement and estimation issues arising in part because of the restricted window of analysis). However, all other WACC parameters are set having regard to market values. Accordingly, the assessment of the value of gamma should be informed by approaches assessing market values.

Furthermore, the market value interpretation is more compatible with the concept of the marginal investor, whereas the redemption proportion interpretation relies on the concept of an average investor. In the context of price setting in financial markets, especially in Australia, the former is likely to be a more realistic representation. This approach is consistent with the academic findings and equity market data presented in earlier sections of this chapter.

[159] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para. 1073-4.

*Current approaches applied by other Australian economic regulators*

Australian economic regulators' positions on gamma remain mixed, with both market and non-market approaches being applied, making it difficult to identify a well-accepted approach in the context of the Pricing Order – in fact two approaches emerge involving non-market (the equity ownership approach) and market-based approaches (market value studies of theta using techniques, such as dividend drop-off studies). It is therefore clear that regulatory precedent involves two distinct approaches.

Table 22 summarises the current status of regulatory precedent.

Table 22 Current Australian regulatory status of gamma

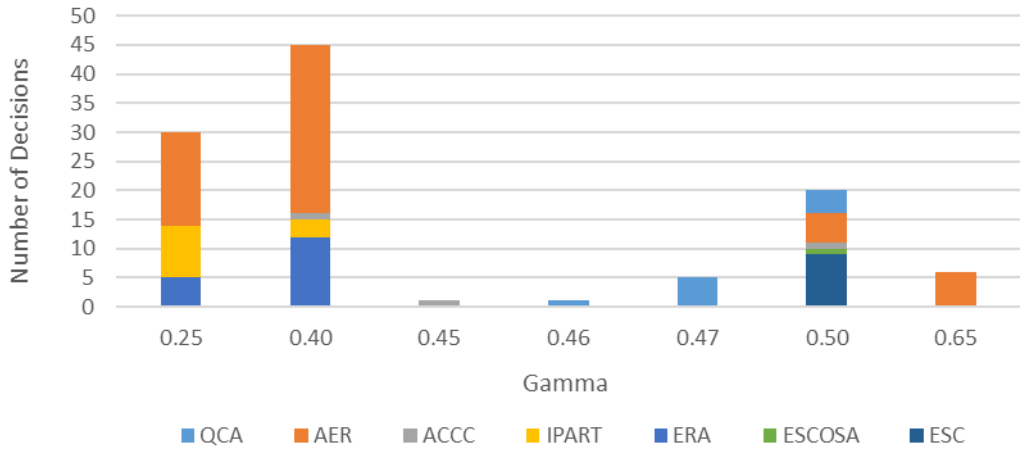
| Regulator | Current value applied | Market or non-market approach | Comments |
|---|---|---|---|
| QCA | 0.46 | Non-market | Recently revised down from 0.47. |
| AER | 0.4 | Non-market | A gamma value of 0.5 is specified in the AER's Rate of Return Guideline. However, it has applied a value of 0.4 in all its energy revenue determinations since 2013. Several of these decisions have been subject to merits review. Depending on the out-workings from these merits review processes, there is the potential for different values of gamma to apply across revenue determinations (0.4 and something between 0.25 and 0.4). |
| ACCC | 0.40 | Non-market | This was applied in the draft ARTC Hunter Valley Access Undertaking. |
| IPART | 0.25 | Market | Arrived at under a specific review of gamma concluded in 2012[160]. Re-affirmed in its 2018 WACC methodology review |
| ERA | 0.4 and 0.25 | Non-market and market | Has aligned with the AER's approach for the rail entities it regulates. This value was also maintained in its June 2016 Final Decision for the Dampier to Bunbury pipeline. However, in July 2016 the Tribunal overturned a previous ERA decision for ATCO Gas Australia, which resulted in a gamma of 0.25 being applied for this entity. |
| ESCOSA | 0.5 | Non-market | As per 2016 Final Decision for SA Water. |
| ESC | 0.5 | Non-market | As per most recent Melbourne Water decision. The ESC has not provided its rationale, other than noting in the Guidance Paper that this was consistent with its previous review. |

**Source:** Synergies based on Australian regulatory decisions

Figure 5 shows the diversity of gamma values approved by Australian regulators between 2010 and 2017.

[160] IPART (2012). Review of imputation credits (gamma), Research – Final decision, March.

Figure 5 Australian regulatory gamma decisions




Data source: Synergies based on Australian regulatory decisions
**Note:** The AER and ESC gamma values are applied across multiple decisions for the energy (AER) and water (ESC) entities that they regulate.

## 11.3 Finance theory and market evidence

### 11.3.1 Academic evidence on gamma

It is well-accepted in the academic literature that the gamma for a security where the marginal investor is foreign should be zero. We turn to a consideration of some of the key findings of this literature.

Cannavan et al. (2004) infer the value of imputation tax credits from the prices of derivative securities in Australian retail markets. Their findings are consistent with non-residents being marginal price-setting investors in large Australian firms. They argue that a company's cost of capital is not affected by a dividend imputation system.[161] Thus, if an international investor derives no value from imputation credits a company must produce the same return for a marginal stockholder irrespective of the existence of an imputation system. Feuerherdt et al. (2010) extend the analysis to Australian hybrid securities, also finding evidence consistent with a price-setting investor placing no value on franking credits.[162]

[161] Cannavan, D., Finn, F. and Gray, S. (2004). The value of dividend imputation tax credits in Australia. Journal of Financial Economics, 2, pp.167-197.

[162] Feuerherdt, C., Gray, S. and Hall, J. (2010). The value of imputation credits on Australian hybrid securities. International Review of Finance, 10(3), pp.365-401.

Lajbcygier and Wheatley (2012) test whether equity returns are related to imputation credit yields. They find no evidence that the provision of imputation tax credits lowers the return investors require on equity.[163] Furthermore, using a general equilibrium model, they demonstrate that if the domestic market is small relative to the foreign market, which is the case for Australia, the impact of imputation credits on the domestic equity premium is negligible.

In the SL CAPM, equity markets are presumed to be segmented between domestic and foreign markets to determine the cost of equity for regulated firms. In this sense, imputation-eligible domestic investors make portfolio decisions based on with-imputation credit returns, while ineligible foreign investors make decisions based on without-imputation credit returns. In an open economy, such as Australia, which represents a small proportion of global equity, the returns will be determined largely by the expectations of foreign investors.

Siau, Sault and Warren (2015) employ discounted cash-flow valuation models to assess whether imputation tax credits are capitalised into Australian stock prices. They uncover no clear evidence that imputation credits influence the level of stock prices.[164] This reinforces the notion that credits are not valued by the marginal investor, who in the context of Australia is likely to be an international investor.

In the most recent dividend drop-off study, Cannavan and Gray (2017) employ an extended dataset with improved econometric techniques in order to assess the value of imputation credits.[165] Their results reinforce earlier findings that the market values distributed imputation credits at approximately 35% of the face amount (i.e. theta = 0.35). This estimate of theta is consistent with a value for gamma of 0.25, assuming a distribution rate of 70%. Furthermore, IPART makes specific reference to this paper in substantiating its decision to retain a gamma estimate of 0.25.[166]

Gray and Hall (2006) explicitly derive the relationship between the value of franking credits (gamma) and the MRP. With a specific emphasis on Australian regulators, they demonstrate that the typical parameter estimates adopted in practice are incompatible

[163] Lajbcygier, P. and Wheatley, S.M. (2012). Imputation credits and equity returns. Economic Record, 88(283), pp.476-494.

[164] Siau, K.S., Sault, S.J. and Warren, G.J. (2015). Are imputation credits capitalised into stock prices? Accounting and Finance, 55, pp.241-277.

[165] Cannavan, D. and Gray, S. (2017). Dividend drop-off estimates of the value of dividend imputation tax credits. Pacific-Basin Finance Journal, 46, pp.213-226.

[166] IPART (2018a), p.83.

with this mathematical relationship.[167] If internal consistency within the cost of equity model is to be restored, then at least one of the parameter values needs to be modified. To restore internal consistency, the authors propose that setting gamma equal to zero is the most straightforward way of achieving this. The advantage of this approach is that no further assumptions are required about the magnitude of dividend yields. Alternatively, to support a gamma value greater than zero other parameters would have to assume implausible values.

While not necessarily the most reliable of sources, the authors cite two surveys in support of their findings. Firstly, Truong, Partington and Peat (2005) surveyed 356 listed Australian firms on their corporate finance practices: 85 per cent of respondents indicated that they made no adjustment for the value of franking credits.[168]

Additionally, Lonergan (2001) conducted a review of expert valuation reports, finding that 42 of 48 (88 per cent) used the CAPM for their cost of equity calculations without making any adjustments for dividend imputation.[169] Of the six reports that did incorporate it, only one was able to assign any non-negligible value to the company on the basis of franking credits. Although some time has passed since these surveys, there is little indication that these key sentiments have changed.

### 11.3.2 Summary

Academic research analysing market data indicates strong support for a gamma value of zero based on the assumption that in open capital markets like Australia, the marginal investor will be an international investor who gains no value from imputation credits and hence whose expected return on equity is not affected by the operation of the Australian tax imputation system.

### 11.3.3 Independent expert valuations

There is also substantial evidence that imputation credits are not valued by independent experts. In a review of market evidence on the cost of equity for Aurizon, Ernst and Young find that "there is no evidence that market practitioners (i.e. independent experts)

[167] Gray, S. and Hall, J. (2006). Relationship between franking credits and the market risk premium. Accounting and Finance, 46, pp.405-428.

[168] Truong, G., Partington, G. and Peat, M. (2005). Cost of capital estimation and capital budgeting practice in Australia. AFAANZ Conference, Melbourne, Australia, 3-5 July.

[169] Lonergan, W. (2001). The disappearing returns: Why imputation has not reduced the cost of capital. Journal of the Securities Institute of Australia, Issue 1 Autumn, pp.8-17.

take information on imputation credits into account in estimating required rates of returns."[170]

In response to a 2014 AER draft decision for Transgrid, Grant Samuel wrote that:[171]

> We have always made it clear in our reports that we do not believe that day to day market prices of Australian equities incorporate any particular value for franking credits attached to any future income stream and we have never made any adjustment for dividend imputation (in either the cash flows or the discount rate) in any of our 500 plus public valuation reports.

Furthermore, in a 2015 Independent Expert's Report for Asciano, Grant Samuel puts forward the perspective of financial markets, arguing that:[172]

> The evidence gathered to date as to the value of the market attributes to franking credits is insufficient to rely on for valuation purposes. The studies that measure the value attributed to franking credits are based on the immediate value of franking credits distributed and do not address the risk and other issues associated with the ability to utilise them over the longer term. More importantly, Grant Samuel does not believe that such adjustments are widely used by acquirers of assets at present.

Deloitte points to the lack of conclusive evidence on the value of imputation credits:[173]

> We have not adjusted the cost of capital or the projected cash flows for the impact of dividend imputation due to the diverse views as to the value of imputation credits and the appropriate method that should be employed to calculate this value. Determining the value of franking credits requires an understanding of shareholders' personal tax profiles to determine the ability of shareholders to use franking credits to offset personal income. Furthermore, the observed EMRP already includes the value that shareholders ascribe to franking credits in the market as a whole. In our view, the evidence relating to the value that the market ascribes to imputation credits is inconclusive.

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170 Ernst and Young (2016). Market evidence on the cost of equity, 22 November, p.28.

171 Grant Samuel (2015). Response to AER draft decision, 12 January, p.5.

172 Grant Samuel (2015). Independent Expert's Report, Asciano, 30 September, p.315.

173 Deloitte (2015). Independent Expert's Report, Energy Developments Limited, 3 September, p.63.

### 11.3.4 Dividend imputation policy evidence

Australia, Canada, Chile, Mexico and New Zealand are the only five countries in the Organisation for Economic Co-operation and Development (OECD) that operate a full imputation tax system where all corporate tax is credited to domestic shareholders. South Korea and the United Kingdom are operating partial imputation systems. However, as the tax credits provided in these countries are not linked to the amount of corporate tax paid, these are not true imputation tax systems.[174]

The broad international trend to removal of dividend imputation systems over the 2000s has also been reflected in tax policy considerations in an Australian context:[175]

> Dividend imputation continues to deliver benefits for Australia, particularly for smaller firms and those operating in the more closed segments of the economy. However, a continuation of the trend of increased openness, rapid growth in cross-border investment flows and greater capital mobility will reduce the benefits of imputation in the longer term.
>
> For a small, open economy that is increasingly integrated with international capital markets, providing tax relief only on dividends paid to resident shareholders will become less effective in reducing the cost of capital for companies (and hence of reduced benefit in encouraging investment) or in providing a neutral treatment of debt and equity.

These tax policy considerations are consistent with the academic and independent expert evidence in suggesting that international investors should be given a relatively large weighting in determining a gamma value in an Australian context.

### 11.3.5 Evidence of international investor interest in Australian transport and energy infrastructure

Further to the findings of academic studies discussed in this chapter, this section focusses on the resident and non-resident investor shares of equity held in major Australian transport and energy infrastructure.

Table 23 below shows only the proportion of Institutions & Strategic Holders & Individuals/Insiders. Equity from domestic manager/listed companies has been allocated fully to the domestic category even though some capital may have been foreign – there is no way to discern this from the source data.

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174 Ainsworth A. (2016). Dividend imputation: The international experience. The Finsia Journal of Applied Finance, 1, pp.58-63.

175 Commonwealth Treasury (2010). Australia's Future Tax System, Chapter B: Investment and Entity Taxation, p.199.

Table 23 Proportion of equity ownership – Institutions & Strategic Holders & Individuals/Insiders

| | | Data | | Proportion of Institutions and Strategic Holders & Individuals / Insiders | |
|---|---|---|---|---|---|
| Company | Ticker | Domestic | Foreign | Domestic | Foreign |
| Qube Holdings | ASX:QUB | 40% | 29% | 58% | 42% |
| Port of Tauranga | NZSE:POT | 56% | 3% | 96% | 4% |
| Aurizon Holdings | ASX:AZJ | 19% | 36% | 35% | 65% |
| Sydney Airport | ASX:SYD | 20% | 23% | 47% | 53% |
| Auckland International Airport Limited | NZSE:AIA | 25% | 18% | 58% | 42% |
| Transurban | ASX:TCL | 21% | 22% | 49% | 51% |
| Macquarie Atlas Roads | ASX:MQA | 30% | 34% | 47% | 53% |
| DUET | ASX:DUE | 23% | 33% | 41% | 59% |
| Spark | ASX:SKI | 21% | 25% | 45% | 55% |
| APA Group | ASX:APA | 23% | 29% | 44% | 56% |
| Min | | 19% | 3% | 35% | 4% |
| Max | | 56% | 36% | 96% | 65% |
| Median | | 23% | 27% | 47% | 53% |
| Average | | 28% | 25% | 52% | 48% |

**Source:** Capital IQ

Table 23 indicates the significant proportion of foreign equity ownership of Australian transport and energy infrastructure.

Table 24 presents a similar picture for unlisted infrastructure transactions over the last three years (based on InfraDeals data).

Table 24 Proportion of equity ownership – Unlisted infrastructure transactions

| Transaction | Sub-Sector | Date | Equity Providers | Domestic | Foreign |
|---|---|---|---|---|---|
| Loy Yang B | Generation | Dec-17 | Alinta (Chow Tai Fook Enterprises Limited) | 0% | 100% |
| NSW Endeavour Energy | Distribution | May-17 | Macquarie Infrastructure, AMP (REST), bcIMC, QIA | 57% | 43% |
| DUET | Distribution | Apr-17 | CKI | 0% | 100% |
| Alinta Energy | Utility | Mar-17 | Chow Tai Fook Enterprises Limited | 0% | 100% |
| NSW Ausgrid | Distribution | Dec-16 | AustralianSuper, IFM | 100% | 0% |
| GRail | Rail | Dec-16 | G&W, Macquarie Infrastructure | 49% | 51% |
| Port of Melbourne | Ports | Oct-16 | Future Fund, CIC, OMERS, NPS, CalPERS, GIPA, QIC | 31% | 69% |
| Asciano (Pacific National) | Rail | Aug-16 | GIP II, CPPIB, CIC, GIC, bcIMC | 0% | 100% |
| Asciano (Ports) | Ports | Aug-16 | Qube, Brookfield, GIC, bcIMC, QIA | 50% | 50% |

| Transaction | Sub-Sector | Date | Equity Providers | Domestic | Foreign |
|---|---|---|---|---|---|
| AirportLinkM7 | Roads | Apr-16 | Transurban, AustralianSuper, ADIA | 88% | 13% |
| Pacific Hydro | Renewables | Jan-16 | China State Power Investment Corporation | 0% | 100% |
| NSW TransGrid | Transmission | Dec-15 | Spark, Hastings, CDPQ, ADIA, Wren House | 35% | 65% |
| Iona Gas Storage | Energy | Dec-15 | QIC, QSuper | 100% | 0% |
| **Median** | | | | **43%** | **57%** |
| **Average** | | | | **47%** | **53%** |

**Note:** Fund managers have been classified based on the location of their head office where their underlying investor details are confidential.
**Source:** Infradeals

The data in Table 23 and Table 24 highlights at best a 50:50 split between foreign and domestic buyers of major infrastructure assets in Australia. In these circumstances, it is clear the marginal (i.e. price setting) investor is a foreign investor that will be unable to access any value from imputation credits.

It is acknowledged that domestic shareholders derive benefits from dividend imputation. However, in a valuation context, these shareholders are inframarginal – they do not set the relevant price for an infrastructure asset – available evidence suggests the price for a large Australian infrastructure asset is set by foreign investors and the market valuation of imputation credits for these investors is zero. Put another way, it cannot be concluded that the marginal investor in an efficient Australian benchmark entity is anything but a foreign investor who places no value on imputation credits.

## 11.4 Identifying a well-accepted gamma estimation approach

In attempting to identify a well-accepted approach to gamma, we have reviewed academic literature, relevant finance industry evidence (particularly from independent and expert reports), as well as Australian regulatory practice. This is consistent with our overarching position on the definition of well-accepted applied across our WACC calculations.

The first well-accepted approach is adopted from the academic literature and strongly indicates that the gamma for a security where the marginal investor is foreign should be zero given the marginal investor for the BEE is an international investor and hence, in an Australia context, unable to utilise any accrued imputation credits.

There is also substantial evidence that imputation credits are not considered by independent experts in a valuation context. Australian economic policy makers have also questioned the value of imputation credits in an economy that is small by international standards and characterised by open capital markets.

In contrast to this reasonably consistent view, Australian regulatory precedent is a highly contested area with ongoing disagreement over the value of imputation credits (theta) in the hands of investors, one of the two critical inputs into the gamma calculation.

Consequently, there are several approaches that have been applied in Australian regulatory practice. This has been reflected in a large range of gamma values from 0.25 to 0.65 that have been adopted by Australian regulators in recent years. However, what is common to all these regulatory decisions is the assumption that the marginal investor is either a resident Australian or that the identity of the marginal investor is not relevant to the assessment of the valuation of imputation credits.

In this regard, the distribution rate is relatively non-contentious and has settled around 70%. In contrast, the value of theta continues to be highly contentious and in broad terms can be estimated using the following non-market and market-based approaches:

- the equity ownership approach, which is the proportion of Australian equity held by Australian residents (given only domestic investors can utilise franking credits), or taxation approach using statistics drawn from the Australian Taxation Office on the utilisation of franking credits – which forms our second well-accepted and non-market approach; and
- market value studies, which seek to ascribe the value that investors place on theta using techniques, such as dividend drop-off studies (i.e. pre and post-dividend share prices) - which forms our third well-accepted and market-based approach.

Each of these approaches establishes a broad range of theta values and in turn a gamma value.

The second approach has been applied by some regulators, including the ESC. It provides a theta value of around 0.6 to 0.7 resulting in a gamma value of 0.4 to 0.5 (which we have averaged at 0.45).

The equity ownership approach assumes an investor that is eligible to fully utilise imputation credits they receive has a utilisation rate of 1 (ie they gain 100 percent of the "value" of the imputation credits); whereas an investor that is ineligible to redeem imputation credits has a utilisation rate of 0 (ie they gain no "value" from the imputation credits). However, this approach fails to recognise the potential for individual eligible investors to value imputation credits at less than their nominal dollar value, notwithstanding evidence to the contrary. Moreover, the equity ownership approach does not reflect a market based approach despite every other relevant parameter informing the WACC being based on a market proxy.

In contrast, the third approach relies on a market value estimate of imputation credits. An updated gamma estimate prepared by SFG Consulting that applies the methodology accepted by the Australian Competition Tribunal in 2011 continues to support a theta value of 0.35 and hence a gamma value of 0.25 (assuming a 70% distribution rate).[176]

Accordingly, we consider these three broad approaches have been well-accepted in the relevant communities of expertise. On balance, we favour the market valuation approach. However, given the pros and cons of each methodology, we have calculated an average of the three values (which are zero based on finance theory, 0.45 based on an equity ownership approach and 0.25 based on market valuation studies), which results in a gamma value of 0.23, rounded up to 0.25.

We have assigned equal weighting to each approach in the absence of a compelling basis to do otherwise. If we were to depart from this approach, we would ascribe less weight to the equity ownership approach because of its non-market orientation.

## 11.5 Conclusion

On the balance of the evidence, the issue of the valuation of imputation credits turns on whether a market valuation is adopted or whether a non-market based utilisation of imputation credits approach is adopted. We believe the issue of well-accepted means well-accepted beyond the community of regulatory agencies to embrace relevant assessments of the market value of imputation credits from the academic and finance communities.

Given the above, we consider the only truly well-accepted gamma value within the meaning of the Pricing Order is zero based on academic and contemporary Australian equity market evidence. However, the average of the three well-accepted approaches identified in this chapter recognises the market and non-market approaches to valuing utilisation credits that have emerged in an Australian regulatory context and which reflect the most contentious aspect of the value of gamma calculation.

On these grounds, we consider a gamma value of 0.25 (rounding up from an average of 0.23) for the BEE is reflective of a well-accepted approach and is consistent with the Pricing Order.

[176] SFG Consulting (2014b).

# 12 Proposed WACC estimate for BEE

The purpose of this chapter is to present the values of the key components of our pre-tax nominal WACC estimate of 11.52% for the BEE.

We also demonstrate that this WACC estimate satisfies the three stage assessment approach set out by ESC to assess compliance of PoM's WACC estimate with the Pricing Order.

## 12.1 Changes since 2017-18 TCS submission

The changes to our return on equity and debt estimates since the 2017-18 TCS submission reflect changes in market-based parameter values (e.g. risk-free rate, MRP, DRP). Our asset beta, gearing and gamma value assumptions remain unchanged.

### 12.1.1 Return on equity calculation

The return on equity estimation methodologies used to calculate our return on equity estimate of 14.16% are discussed in Sections 7, 8 and 9 of our report. This compares to a return on equity estimate of 14.14% in the 2017-18 submission.

### 12.1.2 Return on debt calculation

The underlying components of our return on debt estimate of 5.37% are discussed in Chapter 10 of our report.

### 12.1.3 WACC estimate

Our pre-tax nominal WACC estimate of 11.52% and its underlying components, based on three well-accepted return on equity models, is presented in Table 25.

Table 25 WACC estimate for PoM

| Parameter | 2017-18 TCS | 2018-19 TCS |
|---|---|---|
| Risk-free rate | 2.81% | 2.74% |
| Capital structure | 30% | 30% |
| Gamma | 0.25 | 0.25 |
| Corporate tax rate | 30% | 30% |
| | | |
| **CAPM Parameters** | | |
| Market risk premium (MRP) | 7.77% | 7.71% |
| Asset beta | 0.70 | 0.70 |
| Equity beta | 1.00 | 1.00 |
| Zero Beta Premium | 3.34% | 3.34% |
| | | |
| **Fama-French Model Parameters** | | |
| Market risk premium (MRP) | 7.77% | 7.71% |
| Value (HML) premium | 6.05% | 6.10% |
| Size (SMB) premium | 1.77% | 1.93% |
| Asset beta (Market) | 0.62 | 0.74 |
| Asset beta (HML) | 0.20 | 0.08 |
| Asset beta (SMB) | 0.11 | 0.16 |
| Equity beta (Market) | 0.89 | 1.06 |
| Equity beta (HML) | 0.29 | 0.11 |
| Equity beta (SMB) | 0.16 | 0.23 |
| | | |
| **Return on equity (pre-tax)** | | |
| SL CAPM | 13.66% | 13.48% |
| Black CAPM | 13.66% | 13.48% |
| FFM | 15.12% | 15.51% |
| Weighted return on equity (pre-tax) | 14.14% | 14.16% |
| | | |
| Debt beta | 0.00 | 0.00 |
| Debt risk premium | 2.54% | 2.53% |
| Debt raising costs | 0.10% | 0.10% |
| Return on debt (pre-tax) | 5.45% | 5.37% |
| | | |
| **Pre-tax nominal WACC** | **11.54%** | **11.52%** |

## 12.2 Satisfying ESC's compliance assessment framework

This section demonstrates how our proposed WACC estimate for the BEE satisfies the following three stages of ESC's compliance assessment framework:

- use of well-accepted approaches in its development;
- determining the overall reasonableness of the proposed WACC estimate, including having regard to the WACCs of comparable entities; and
- if any concerns arise regarding the proposed WACC estimate, a more detailed, focussed analysis of its basis will be undertaken.

### 12.2.1 Use of well-accepted approaches

Table 5 in Chapter 3 of our report outlines the evidence from economic regulators in support of the approaches that we have used. However, as detailed in Section 3.5, our view is that 'well-accepted' encompasses regulatory precedent, financial practitioner evidence and academic literature.

### 12.2.2 Overall reasonableness of proposed WACC estimate

The purpose of this section is to substantiate the reasonableness of our proposed overall WACC estimate. Firstly, we evaluate the WACC margins implied from comparable regulatory decisions identified by the ESC in its Interim Commentary. Whilst the ESC confined its assessment to regulatory decisions, we regard a broader assessment as being relevant. Accordingly, we have generated estimated WACC margins for our listed comparator set using data from Bloomberg on country-specific market risk premiums and risk-free rates, as well as firm-specific information regarding the return on debt. An overview of the methodology for the assessment of the cost of equity is located in Attachment G.

Our main findings highlight the reasonableness of PoM's WACC estimate. In regard to regulatory decisions:

- PoM's WACC margin (pre-tax nominal WACC less the risk-free rate) is situated between the WACC margins adopted by the ERA for Arc Infrastructure and Pilbara Railways.
- While there is no evidence that PoM's WACC margin should be bounded between these two entities over the longer term, we present commentary from the ERA, which demonstrates that such a premise is not unreasonable under current conditions.

In terms of listed comparators, PoM's WACC margin is:

- almost identical to the WACC margin for OECD ports;
- higher than the WACC margin for OECD airports; and
- lower than the WACC margin for Class I railroads.

This aligns with our broader view on PoM's comparator set, namely that airports form the lower bound for PoM's systematic risk exposure, while railroads are likely to represent the upper bound. The estimated WACC margin for the combined set of Class I railroads, OECD ports and airports is within 0.5% of PoM's own WACC margin (and also sits between the WACC margins for Arc Infrastructure and Pilbara Railways), again emphasising the reasonableness of the estimate.

*Comparison with other regulatory decisions*

This section compares the WACC that we have estimated for PoM with WACC estimates from comparable regulatory decisions.

In undertaking this comparison, we note that precise comparison of WACC decisions is elusive as the risk profile of each regulated entity in the transport sector differs materially.

For example, whilst the ESC included several coal related entities (namely Aurizon, ARTC's Hunter Valley network and DBCT) in its assessment in our view they represent a poor comparator for PoM. It is clear from each regulatory decision on these entities that their contractual and regulatory structure (long term take or pay contracts subject to a revenue cap form of regulation applying) materially influenced the regulator's assessment of the cost of equity. Given the similarity of the risk profiles of these businesses we have aggregated them for the purposes of our analysis.

Moreover, regulators adopt different approaches to the estimation of the cost of capital – with different values being assumed for parameters such as the averaging interval, MRP and gamma. There is inherent uncertainty on the value of these parameters noting that each exerts a significant influence on the regulator's determination of the cost of capital. It is possible regulators balance to some extent the exercise in regulatory discretion in making judgements (and tradeoffs) on these parameters.

Accordingly, we consider attempting a precise reconciliation of PoM's WACC with regulatory decisions is inviting false precision to the analysis and a more relevant insight in terms of PoM's compliance with the Pricing Order can be gained from undertaking a reconciliation on the basis of broad relativities and rankings. It also highlights the benefit

of broadening the perspective of the comparison beyond regulatory decisions for the purposes of this aspect of the ESC's assessment framework.

With these caveats in mind, we consider that adjustments should be made for transparent market based parameters where possible. For example, making adjustments for differences in risk-free rates over time enables a more appropriate comparison of regulatory decisions on the basis of WACC margins (the WACC less the risk-free rate). These calculations are presented in Table 26.

Table 26 WACC margins for transport regulatory decisions

| | Pre-tax nominal WACC | Risk-free rate | WACC margin |
|---|---|---|---|
| Coal-related entities | 6.51% | 1.95% | **4.56%** |
| ARTC Interstate Network (2008 Decision) | 13.00% | 6.39% | **6.61%** |
| Arc Infrastructure (2017) | 9.58% | 2.49% | **7.09%** |
| ARTC Interstate Network (2018 Submission) | 10.40% | 2.78% | **7.62%** |
| PoM (2018) | 11.52% | 2.74% | **8.78%** |
| Pilbara railways | 12.68% | 2.49% | **10.19%** |

**Note:** Coal-related entities consist of DBCT, Aurizon Network and the ARTC Hunter Valley Coal Network. These decisions were aggregated as the presence of take-or-pay contracts make them less comparable with the BEE.

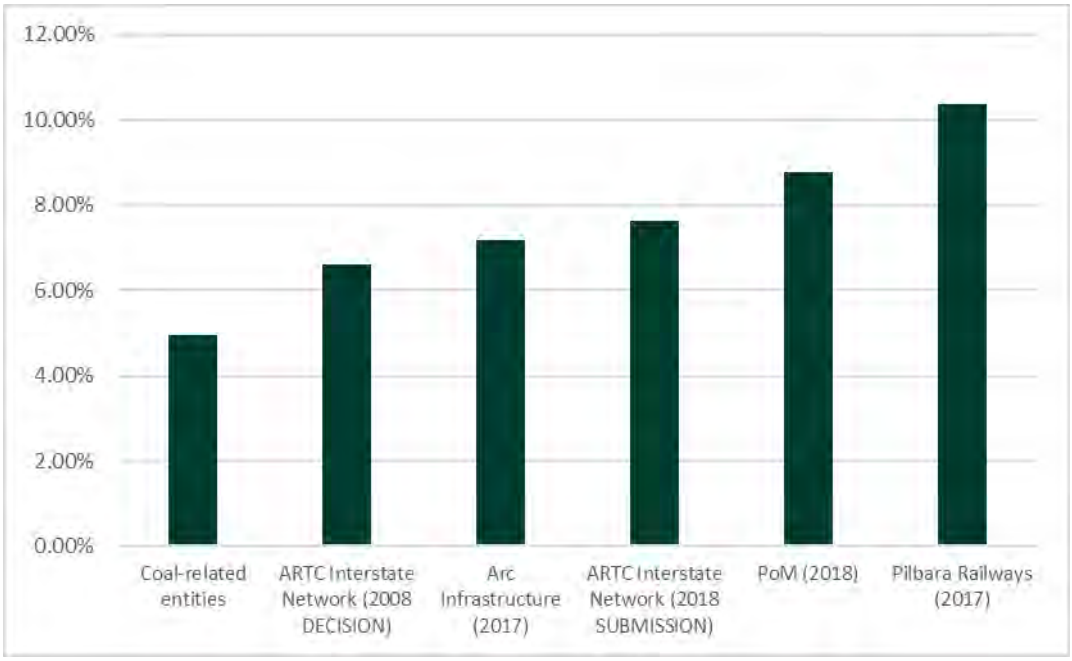
**Source:** Synergies calculations, various regulatory decisions

These WACC margins are presented in Figure 6.

Noting that the ARTC Interstate Network is still at the submission stage, the closest (although not identical) regulatory comparators for PoM are Arc Infrastructure and Pilbara Railways. This is in contrast to below rail coal assets, which are subject to lower volatility, owing to heavy-handed access arrangements based on revenue caps, which typically result in lower betas. As a result of this, it is to be expected that PoM's WACC margin sits well above such entities.

In essence, PoM's WACC margin sits between that of Arc Infrastructure and Pilbara Railways, which is appropriate given the relative risk profile of the businesses.

Figure 6 WACC margins for transport regulatory decisions




Note: The ARTC Interstate Network Access Undertaking is currently at the submission stage.
Data source: Synergies calculations, various regulatory decisions

In its 2015 decision on WACC, the ERA summarised some aspects of its 2008 WACC decision, where it explicitly recognised that Arc Infrastructure's (formerly Brookfield Rail) asset beta should sit below that of a business whose revenue source is driven by domestic-based freight operations, such as a Class I Railroad (as opposed to longer term contract-based export bulk mineral hauls) being offset by considerations of operating leverage:[177]

> In 2008 for the WestNet Rail (now Brookfield Rail) WACC determination, the Authority took the view that the equity beta for the freight network is 1.0. This was also based on the advice of ACG, who recommended a range of 1.0 to 1.15 based on 35 per cent gearing and an asset beta of 0.65 to 0.75. The sample of comparable firms included rail infrastructure businesses in the United States and Canada and listed transport infrastructure services firms in Australia and New Zealand.
>
> ACG's view was that an assumed asset beta in this range would overstate an asset beta for the freight rail system in Western Australia. This was because the above comparator companies were thought to have a higher proportion of revenues derived from intermodal traffic, which is expected to have a higher beta than the freight rail

[177] ERA (2015a), p.147. Paragraph numbers and footnote references omitted.

> system in Western Australia. Accordingly, ACG recommended an asset beta of 0.6 at a 35 per cent gearing level, giving an equity beta of 0.92.
>
> The Authority also acknowledged submissions that the high operating leverage (ratio of variable to fixed costs) of the freight-network business may, all other things being equal, contribute to a relatively high sensitivity of profits to changes in levels of demand and a higher beta value for the freight network business. However, the Authority was of the view that the Western Australian freight network is likely to have a lower beta than the comparators due to the predominance of bulk grain and minerals freight which were found to have asset betas closer to 0.45. Based on this, its view was that there was limited justification to adopt a beta value outside of the range derived from comparator businesses.

In other words, the ERA acknowledged that the the high operating leverage of the freight-network business offset a relatively lower risk profile on account of Brookfield Rail's (as it then was) reliance on export related freight activity. The ERA observed that around 85% of Brookfield Rail's freight task related to the transport of either export commodities or inputs to commodities, such as grain and alumina, with the remainder being accounted for by general freight. Whilst we do not endorse the ERA's approach, it is appropriate we adopt the reasoning for current purposes given we are essentially reconciling our proposed WACC with the outcomes of relevant regulatory processes.[178]

In this context, it is noted that PoM exhibits a much higher sensitivity to domestic economic activity than Arc Infrastructure due to its reliance on imports (over 60% in revenue terms) which are inherently correlated with domestic economic activity. Moreover, PoM's cost structure is such that costs vary insignificantly with throughput across a broad range of demand and, in this respect, it varies from rail infrastructure which has a higher level of variable cost due to throughput-driven maintenance and scheduling activities.

Adopting the ERA's logic, the nature of the trade mix and the absence of long term contracts exposes PoM to volume risk to a greater extent than Arc, especially once regard is had to PoM's inability to adjust expenditure in response to volume fluctuations.

Pilbara Railways, being single-commodity focused, is sensitive to fluctuations in commodity prices (specifically iron ore) and does have a concentrated customer base, which amplifies volume risk. However, as detailed in our first principles analysis, PoM is also subject to high levels of systematic volume risk arising from the correlation of

[178] Contract cover may indeed provide revenue certainty and mitigate volatility in the short to medium term. However, this has the consequence of masking underlying systematic risk, effectively crystallising this risk at discrete points in time.

underlying demand with economic activity as well as arising from competitive pressures from other ports (including the Port of Geelong, Port Botany and Port Adelaide), which compete with PoM for import containers, agricultural exports, and various other commodities and raw materials. This is compounded further by the prospects for a second Melbourne port (see Attachment D).

It is clear that both the Pilbara Railways and PoM face material systematic risk. However, it cannot be said that Pilbara Railways sets an upper limit for PoM.

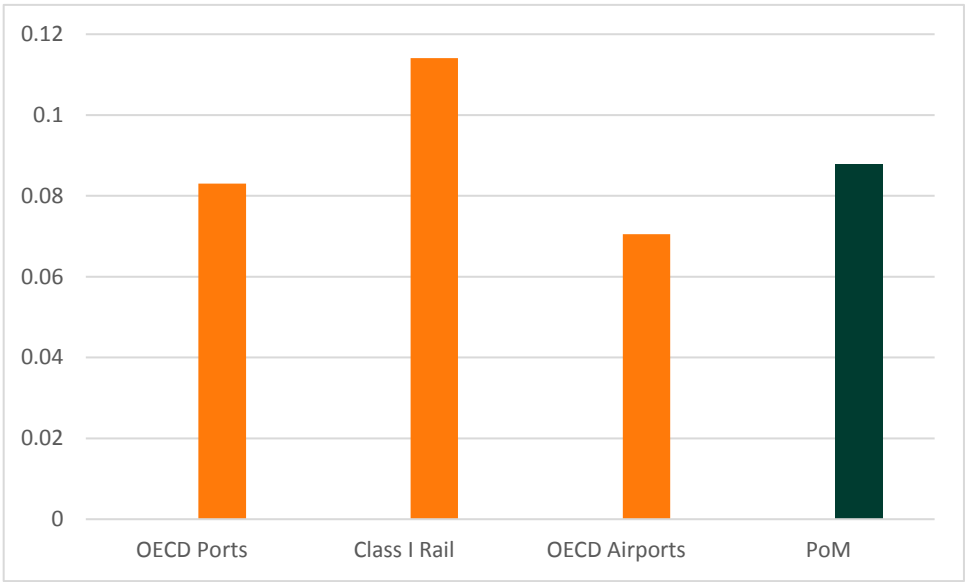
*WACC estimates for listed comparators*

Regulatory decisions provide a useful reference point for establishing an appropriate WACC range, but it is also important to consider evidence on WACC from listed comparators. In this section, we present WACC estimates for the Class I railroads, OECD ports and OECD airports from our comparator set. The calculations presented here are based on Bloomberg-generated estimates of the return on equity and return on debt. We have supplemented these with Black CAPM and FFM estimates for each of the comparators, so that the calculations are directly comparable with our multi-model approach for PoM. All calculations are expressed as pre-tax nominal estimates using country specific corporate taxation rates.

Figure 7 presents the WACC margins (based on the multi-model approach) for each of the following sectors:

- OECD ports
- Class I rail
- OECD airports
- PoM.

Figure 7 WACC margins (pre-tax nominal WACC less risk-free rate), by sector




Data source: Bloomberg, Synergies calculations

Evidently, PoM's proposed WACC margin is not inconsistent with the median sector estimates. Summaries of the approach we have taken to derive these comparative WACC margin estimates are set out below. In line with our approach for the gearing and beta analysis, we focus on median values for each sector, rather than seeking to draw comparisons with specific companies. In practice, this may be confounded by varying economic exposures, local market and trade characteristics, a company's competitive position, differing regulatory regimes and other company specific risk factors. However, estimates for each firm are provided in Attachment G.

The range of WACC margins mirrors the results of the beta analysis in Chapter 7. The WACC margin for Class I railroads forms the upper bound of the listed comparator range, while the OECD airports sample is situated at the lower bound. The WACC margin for the OECD ports sample lies in between these two sectors.

*OECD ports*

We have included 22 Marine Ports and Services companies in PoM's comparator set, but only 11 of these are from OECD countries. The median WACC margin is 8.30% which is only slightly lower than PoM's WACC margin of 8.78%.

*North American Class I railroads*

The PoM comparator set contains 7 Class I railroads (5 from the US and 2 from Canada). The median WACC margin across the sample is 11.40%. This is well above PoM's WACC margin, owing in part to the higher asset betas for these companies.

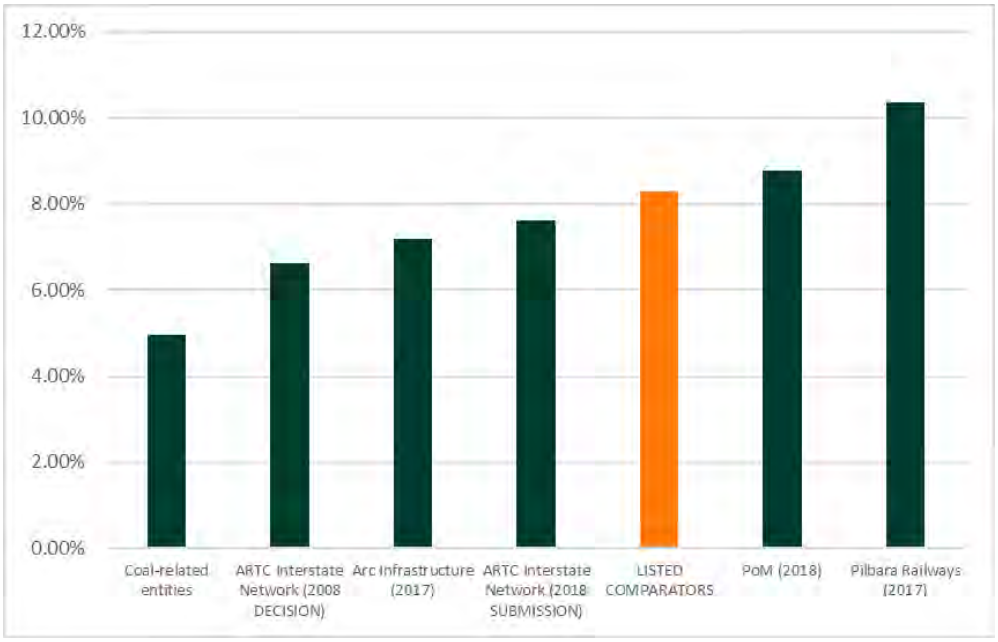
*OECD Airports*

Of the 13 airports in PoM's comparator set, 11 are from OECD countries. PoM's WACC margin (8.78%) is situated above the median of the sample (7.05%).

*Comparison of regulatory and listed comparator WACC margins*

The WACC margins from regulatory decisions and from listed comparators have both been calculated on a pre-tax nominal basis, which allows for a side by side comparison. The median WACC margin across the three sectors of listed comparators is 8.30%, which is only marginally lower than PoM's WACC margin (8.78%).

Figure 8 Regulatory and listed comparator WACC margins




Data source: Bloomberg, Synergies calculations

### 12.2.3 Detailed analysis of proposed WACC estimate

We consider that the preceding sections of this chapter demonstrate that our proposed WACC estimate satisfies the well-accepted and overall reasonableness stages of the ESC's compliance assessment framework, such that further detailed analysis of the proposed estimate is not required. Additionally, Synergies' approach to the estimation of the WACC parameters for the 2017-18 TCS was already, and for the 2018-19 TCS continues to be, in compliance with the guiding principles of this step, as we consider that these naturally form part of a robust WACC estimation process.

# A Gearing Ratios

The purpose of this attachment is to provide further details on the comparator companies that Synergies has used to develop its gearing and asset beta assumptions for the BEE.

## A.1 Characteristics of a benchmark efficient entity

The various determinants of capital structure for port service providers present challenges when defining an ideal capital structure. In defining the BEE, several key characteristics must be considered.

### A.1.1 Cash Flow Volatility

PoM is a landlord port as opposed to a port / terminal operator. As such, its business model is characterised by relatively high operating leverage, which is a capital-intensive business model with limited operating elements, and means that it has a large fixed capital base and relatively low variable costs. All things held equal, a business with operating leverage is reflected in greater sensitivity of earnings to changes in sales volumes and revenues compared to entities with low operating leverage.

PoM's historical cash flow profile has been significantly affected by levels of economic activity, which is reflective of the nature of trade activity at the port (e.g. services provided to facilitate import and export trades, which in turn are driven by domestic demand and international trade activity) and the captive trade catchment area which it services (i.e. the majority of trade originating from or destined for Melbourne metropolitan and greater Melbourne regions).

Moreover, there is some contestability in the broader trade catchment areas serviced by PoM and, in the longer term, it is expected the port may be subject to increased competition in the Melbourne market, should the Victorian Government proceed with procuring a second container port as is contemplated in the study completed by Infrastructure Victoria. In its October 2017 *Victorian Infrastructure Plan*, the Victorian Government announced that it would "undertake strategic planning to identify and prioritise future freight investment, including consideration of a second container port."[179]

[179] Victorian Government (2017). Victorian infrastructure plan, October, p.43.

### A.1.2 Investment Needs

Capital investment needs for port infrastructure assets can be characterised as "lumpy," in the sense that capacity expansions generally can only be undertaken in relatively large increments. This can lead to material variation in capital structure over time in line with the need to upgrade and expand port facilities.

### A.1.3 Debt Serviceability

The assessment techniques of credit rating agencies also provide guidance on the characteristics of a BEE. In Moody's rating methodology for Privately Managed Port Companies, their considerations include, but are not limited to, the following:[180]

- Market Position:
  - How large is the port, and to what extent does it form an essential part of the local economy?
  - Does it have an effective monopoly on port services in the region, or is it a major transhipment hub?
  - What is the quality of the connecting road and/or rail infrastructure? Are there any operational restrictions? (For example, unable to accept certain ship types, or other capacity limitations)
- Diversity of Customer Base
  - How exposed is the port to volume variation?
  - How dominant are its main customers?
- Capital Program and Financial Profile
  - How much expansion capital expenditure is planned?
  - What proportion of revenues come from non-core activities?
- Nature of Asset Ownership
  - Are all key port assets held outright in perpetuity and controlled by port management, or are they subject to short term operating leases?
- Key Credit Metrics
  - How does the port perform against key credit metrics, the most important of which are:

[180] Moody's (2016). Privately managed port companies rating methodology, 15 September.

- funds from operations (FFO) to debt ratio. FFO can be defined as cash flow from operations prior to movements in working capital. A lower FFO/Debt ratio indicates that the firm is more highly leveraged. FFO / Debt is particularly relevant to credit rating agencies – a cashflow-based gearing metric is seen to be more relevant for high cash yielding infrastructure businesses;
- interest coverage ratio is typically defined as the ratio of EBIT to interest payable on debt. As such, it measures a firm's ability to service its debt. Evaluating the interest coverage ratio of comparable companies provides an indication of the necessary interest cover required for an efficient benchmark entity.

## A.2 Comparator Companies

Table 27 lists the 5-year gearing estimates for the 51 comparator companies that emerged from the process set out in Section 5. Comparators with market capitalisations below $US100 million that have been included for the first time this year are shaded in grey.

Table 27 Gearing for full list of comparators (51 entities)

| Company | Country | OECD | Sector | Gearing |
|---|---|---|---|---|
| Qube Holdings | Australia | Yes | Marine Ports and Services | 18% |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | 4% |
| Hamburger Hafen und Logistik | Germany | Yes | Marine Ports and Services | 20% |
| Piraeus Port Authority | Greece | Yes | Marine Ports and Services | 18% |
| Thessaloniki Port Authority | Greece | Yes | Marine Ports and Services | 0% |
| Sociedad Matriz SAAM | Chile | Yes | Marine Ports and Services | 19% |
| Luka Koper | Slovenia | Yes | Marine Ports and Services | 33% |
| Isewan Terminal Service | Japan | Yes | Marine Ports and Services | 9% |
| Sakurajima Futo Kaisha | Japan | Yes | Marine Ports and Services | 27% |
| Rinko Corporation | Japan | Yes | Marine Ports and Services | 56% |
| Dongbang Transport Logistics | South Korea | Yes | Marine Ports and Services | 64% |
| Wilson Sons | Brazil | No | Marine Ports and Services | 30% |
| China Merchants Port Holding Company | Hong Kong | No | Marine Ports and Services | 23% |
| COSCO Shipping Ports | Hong Kong | No | Marine Ports and Services | 32% |
| Dalian Port | Hong Kong | No | Marine Ports and Services | 33% |
| ADSEZ | India | No | Marine Ports and Services | 22% |

| Company | Country | OECD | Sector | Gearing |
|---|---|---|---|---|
| Asian Terminals | Philippines | No | Marine Ports and Services | 0% |
| International Container Terminal Services | Philippines | No | Marine Ports and Services | 23% |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | 43% |
| Kingston Wharves | Jamaica | No | Marine Ports and Services | 10% |
| Prumo Logistica | Brazil | No | Marine Ports and Services | 56% |
| Global Ports Investments | International | No | Marine Ports and Services | 53% |
| Pakistan International Container Terminal | Pakistan | No | Marine Ports and Services | 2% |
| DP World | UAE | No | Marine Ports and Services | 28% |
| Alexandria Containers & Goods | Egypt | No | Marine Ports and Services | 0% |
| United Arab Stevedoring Company | Egypt | No | Marine Ports and Services | 0% |
| China Container Terminal Corporation | Taiwan | No | Marine Ports and Services | 34% |
| Summit Alliance Port Limited | Bangladesh | No | Marine Ports and Services | 10% |
| Aurizon Holdings | Australia | Yes | Railroads | 23% |
| CSX Corporation | US | Yes | Railroads | 24% |
| Genesee & Wyoming Inc. | US | Yes | Railroads | 32% |
| Kansas City Southern | US | Yes | Railroads | 16% |
| Norfolk Southern Corporation | US | Yes | Railroads | 23% |
| Union Pacific Corporation | US | Yes | Railroads | 13% |
| Canadian National Railway Company | Canada | Yes | Railroads | 12% |
| Canadian Pacific Railway | Canada | Yes | Railroads | 19% |
| Globaltrans Investment | International | No | Railroads | 16% |
| Container Corporation of India Limited | India | No | Railroads | 0% |
| Sydney Airport | Australia | Yes | Airports | 38% |
| Auckland International Airport Limited | New Zealand | Yes | Airports | 19% |
| Copenhagen Airport | Denmark | Yes | Airports | 13% |
| Vienna International Airport | Austria | Yes | Airports | 22% |
| Zurich Airport | Switzerland | Yes | Airports | 17% |
| Frankfurt Airport | Germany | Yes | Airports | 40% |
| Paris Airport | France | Yes | Airports | 29% |
| Grupo Aeroportuario del Centro Norte | Mexico | Yes | Airports | 13% |

| Company | Country | OECD | Sector | Gearing |
|---|---|---|---|---|
| Airports of Thailand | Thailand | No | Airports | 7% |
| Grupo Aeroportuario del Sureste | Mexico | Yes | Airports | 7% |
| TAV Havalimanlari Holding | Turkey | Yes | Airports | 31% |
| Malta International Airport | Malta | No | Airports | 12% |
| Japan Airport Terminal Co. | Japan | Yes | Airports | 17% |
| | | | **Median** | **19%** |
| | | | **Average** | **22%** |

**Source:** Bloomberg

Table 28 lists the median and average gearing ratios for our full sample of companies.

We have divided these results by sector and also distinguished between OECD and non-OECD membership. Using the full sample, the median gearing level is 19% and the average gearing level is 22%.

Table 28 Gearing by sector

| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
|---|---|---|---|---|
| Marine Ports and Services | 24% | 23% | 0% | 64% |
| Railroads | 18% | 18% | 0% | 32% |
| Airports | 20% | 17% | 7% | 40% |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 25% | 19% | 0% | 64% |
| Railroads | 20% | 21% | 12% | 32% |
| Airports | 22% | 19% | 7% | 40% |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 23% | 23% | 0% | 56% |
| Railroads | 8% | 8% | 0% | 15% |
| Airports | 9% | 9% | 7% | 12% |

**Source:** Bloomberg

# B Beta diagnostics

The purpose of this attachment is present estimates that reinforce the robustness of our beta analysis. To this end we present estimates over ten years to complement our primary estimation period of five years. We have estimated portfolio betas for each of the three industry sectors (Marine Ports and Services, Railroads and Airports), and we have also experimented with different monthly starting days for the monthly returns used in our beta estimates. Comparators with market capitalisations below $US100 million that have been included for the first time this year are shaded in grey.

Table 29 Beta Comparables over 5 and 10 year periods (51 entities)

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| Qube Holdings | Australia | Yes | Marine Ports and Services | 1.19 | 1.03 |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | 0.57 | 0.48 |
| Hamburger Hafen und Logistik | Germany | Yes | Marine Ports and Services | 0.56 | 0.89 |
| Piraeus Port Authority | Greece | Yes | Marine Ports and Services | 0.53 | 0.54 |
| Thessaloniki Port Authority | Greece | Yes | Marine Ports and Services | 0.50 | 0.62 |
| Sociedad Matriz SAAM | Chile | Yes | Marine Ports and Services | 0.83 | 0.88 |
| Luka Koper | Slovenia | Yes | Marine Ports and Services | 1.01 | 0.87 |
| Isewan Terminal Service | Japan | Yes | Marine Ports and Services | 0.15 | 0.25 |
| Sakurajima Futo Kaisha | Japan | Yes | Marine Ports and Services | 0.72 | 0.43 |
| Rinko Corporation | Japan | Yes | Marine Ports and Services | 0.39 | 0.29 |
| Dongbang Transport Logistics | South Korea | Yes | Marine Ports and Services | 0.68 | 0.55 |
| Wilson Sons | Brazil | No | Marine Ports and Services | 0.25 | 0.41 |
| China Merchants Port Holding Company | Hong Kong | No | Marine Ports and Services | 0.79 | 0.85 |
| COSCO Shipping Ports | Hong Kong | No | Marine Ports and Services | 0.52 | 0.86 |
| Dalian Port | Hong Kong | No | Marine Ports and Services | 0.81 | 0.75 |
| ADSEZ | India | No | Marine Ports and Services | 1.04 | 1.03 |
| Asian Terminals | Philippines | No | Marine Ports and Services | 0.44 | 0.60 |

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| International Container Terminal Services | Philippines | No | Marine Ports and Services | 0.56 | 0.93 |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | 0.48 | 0.53 |
| Kingston Wharves | Jamaica | No | Marine Ports and Services | 1.12 | 0.98 |
| Prumo Logistica | Brazil | No | Marine Ports and Services | 0.42 | 0.98 |
| Global Ports Investments | International | No | Marine Ports and Services | 0.59 | 0.57 |
| Pakistan International Container Terminal | Pakistan | No | Marine Ports and Services | 0.69 | 0.92 |
| DP World | UAE | No | Marine Ports and Services | 0.25 | 0.44 |
| Alexandria Containers & Goods | Egypt | No | Marine Ports and Services | 1.16 | 0.91 |
| United Arab Shipping Co SAG | Egypt | No | Marine Ports and Services | 1.25 | 1.23 |
| China Container Terminal Corporation | Taiwan | No | Marine Ports and Services | 0.60 | 0.69 |
| Summit Alliance Port Ltd | Bangladesh | No | Marine Ports and Services | 1.55 | 1.61 |
| Aurizon Holdings | Australia | Yes | Railroads | 0.43 | 0.47 |
| CSX Corporation | US | Yes | Railroads | 0.91 | 0.95 |
| Genesee & Wyoming Inc. | US | Yes | Railroads | 1.15 | 0.99 |
| Kansas City Southern | US | Yes | Railroads | 0.66 | 0.97 |
| Norfolk Southern Corporation | US | Yes | Railroads | 1.00 | 0.88 |
| Union Pacific Corporation | US | Yes | Railroads | 0.68 | 0.91 |
| Canadian National Railway Company | Canada | Yes | Railroads | 0.71 | 0.41 |
| Canadian Pacific Railway | Canada | Yes | Railroads | 1.08 | 0.71 |
| Globaltrans Investment | International | No | Railroads | 0.82 | 1.66 |
| Container Corporation of India Limited | India | No | Railroads | 0.91 | 0.75 |
| Sydney Airport | Australia | Yes | Airports | 0.36 | 0.48 |
| Auckland International Airport Limited | New Zealand | Yes | Airports | 1.02 | 0.74 |

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| Copenhagen Airport | Denmark | Yes | Airports | 0.33 | 0.49 |
| Vienna International Airport | Austria | Yes | Airports | 0.40 | 0.44 |
| Zurich Airport | Switzerland | Yes | Airports | 0.73 | 0.71 |
| Frankfurt Airport | Germany | Yes | Airports | 0.34 | 0.47 |
| Paris Airport | France | Yes | Airports | 0.35 | 0.51 |
| Grupo Aeroportuario del Centro Norte | Mexico | Yes | Airports | 0.83 | 0.90 |
| Airports of Thailand | Thailand | No | Airports | 0.98 | 0.82 |
| Grupo Aeroportuario del Sureste | Mexico | Yes | Airports | 0.69 | 0.84 |
| TAV Havalimanlari Holding | Turkey | Yes | Airports | 0.37 | 0.40 |
| Malta International Airport | Malta | No | Airports | 0.80 | 0.82 |
| Japan Airport Terminal Co. | Japan | Yes | Airports | 1.32 | 0.64 |
| | | | **Median** | **0.69** | **0.75** |
| | | | **Average** | **0.72** | **0.75** |

**Source:** Bloomberg

## B.1 Portfolio Betas

An informative robustness test for our beta estimates is to evaluate the beta for each sector using a value-weighted portfolio of the comparable companies, rather than averaging across the firms in each sector. The returns of each stock in the portfolio were weighted by market capitalisation in each month. In a similar way, the monthly market return was calculated as the weighted average of the monthly returns for each company's home country benchmark. Likewise, each company's gearing ratio was also weighted by its market capitalisation. The results from these estimates are presented in Table 30.

Table 30 Portfolio Asset Beta Estimates

| Timeframe | Marine Ports and Services (OECD) | Marine Ports and Services (Non-OECD) | Marine Ports and Services (All companies | Railroads | Airports |
|---|---|---|---|---|---|
| 5 Year Portfolio | 0.78 | 0.58 | 0.60 | 0.89 | 0.59 |
| 10 Year Portfolio | 0.91 | 0.79 | 0.83 | 0.86 | 0.62 |

**Note:** Non-OECD railroad and airport portfolios consist of only two companies each, so these results have not been presented here
**Source:** Bloomberg, Synergies calculations

As can be seen, the estimates for the Railroads and Airports sectors remain virtually unchanged from our earlier analysis. The principal discrepancy emerged from the non-OECD Marine Ports and Services sub-sample, where the portfolio beta was lower (0.58). This finding can be attributed to the portfolio weights. When weighted by market capitalisation, DP World (Average Market Capitalisation over five years = $US16.3 billion) accounts for 30% of the sample. In the individual estimations, its asset beta was calculated to be only 0.25. Over ten years, the OECD and non-OECD estimates were closer to each other, as DP World's asset beta was higher over this timeframe.

For the rail sample and the airports sample, there was virtually no difference between the portfolio asset betas and the average beta across the estimates of the individual companies. The portfolio beta over five years was 0.89 for rail, an increase of 0.05 compared to averaging. The portfolio beta for airports was 0.59, which was slightly lower than averaging across individual beta estimates. Similar results were observed over the ten-year time frame.

## B.2 Beta estimates using different monthly starting days

By default, the monthly returns used in our beta analysis are calculated at the end of each month. To add robustness to our beta estimates, we have compiled supporting beta estimates using every other day of the month, and have averaged across these individual estimates. Results over both a five-year and ten-year time frame are displayed in Table 31, and reinforce an asset beta estimate of 0.7.

Table 31 Beta estimates averaged across different starting days

| Timeframe | 31-day Average | 31-day Median |
|---|---|---|
| 5 Years | 0.71 | 0.70 |
| 10 Years | 0.74 | 0.75 |

**Note:** To accommodate different month lengths throughout the year, we have also taken averages over 28 days. This causes a difference of only 0.01 in the average for the 10 year estimates, and causes no difference in the 5 year estimates.
**Source:** Bloomberg, Synergies

The results presented in the table above are based on 31-day averages. If the given starting date falls on a weekend or public holiday in a particular month, we use the most recent trading day as an approximation. For example, where the starting day is set to be the 15th of the month, if the 15th falls on a weekend, the value from the previous trading day is used as an approximation. To accommodate different month lengths throughout the year, we have also taken averages over 28 days. This has virtually no impact on the findings.

## B.3 Comparator descriptions

The following three tables present descriptions of the comparators that we have included in our sample. Comparators with market capitalisations below $US100 million that have been included for the first time this year are shaded in grey.

Table 32 Marine Ports and Services comparators

| Company | Country | OECD | Description |
|---|---|---|---|
| Qube Holdings | Australia | Yes | Qube Holdings Ltd. is a logistics company. The Group operates in divisions covering Automotive, Bulk and General Stevedoring, Landside Logistics and Strategic Development Assets. |
| Port of Tauranga | New Zealand | Yes | Port of Tauranga Limited activities include the provision of wharf facilities, back up land for the storage and transit of import and export cargo, berthage, cranes, tug and pilotage services for exporters, importers and shipping companies and the leasing of land and buildings. The Group also operates a container terminal and has bulk cargo marshalling operations. |
| Hamburger Hafen und Logistik | Germany | Yes | Hamburger Hafen und Logistik AG (HHLA) provides services to the port in the European North Range. The Company's container terminals, transport systems, and logistic services provide a network between overseas port and European hinterland. |
| Piraeus Port Authority | Greece | Yes | Piraeus Port Authority SA manages the Piraeus harbor. The Company provides services such as loading and unloading cargo, warehousing, and transportation of cars. It provides electricity, water, and other services. Piraeus Port Authority is responsible for maintaining the port and controlling the movement of ships. |
| Thessaloniki Port Authority | Greece | Yes | Thessaloniki Port Authority SA manages the Thessaloniki harbor. The Company provides services such as loading and unloading cargo, warehousing, and offers electricity, water, and other services. |
| Sociedad Matriz SAAM | Chile | Yes | Sociedad Matriz SAAM SA through its subsidiary, operates a ports, towage, and logistics business. The Company serves clients in North and South America. |
| Luka Koper | Slovenia | Yes | Luka Koper (Port of Koper) operates a cargo port and specialized terminals in Slovenia. The Company offers handling, warehousing, distribution, processing, logistical, and other related services. Luka Koper is the only maritime cargo port in Slovenia located north on the Adriatic Sea. |
| Isewan Terminal Service | Japan | Yes | Isewan Terminal Service Co., Ltd. mainly provides port-harbor transportation services at Nagoya port. The Company transports steel products, iron ore, industrial machinery, chemical products, and various dry consumer and agricultural goods. Isewan Terminal Service also offers ground transportation and warehousing services. |
| Wilson Sons | Brazil | No | Wilson Sons Ltd., through subsidiaries, is a provider of integrated port and maritime solutions. The Company provides a set of services to participants in domestic, international trade and oil and gas industry, and has its principal operations divided into: Container Terminals, Oil & Gas Terminals, Towage, Offshore Vessels, Shipyards, Logistics, and Shipping Agency. |
| China Merchants Port Holding Company | Hong Kong | No | China Merchants Port Holdings Company Limited, through its subsidiaries and associated companies, operates ports, airports, and other container and cargo terminals around the world. The Company also manages toll roads, properties, and assets management. |
| COSCO Shipping Ports | Hong Kong | No | Cosco Shipping Ports Limited, through its subsidiaries, provides ports services worldwide. The Company operates container terminals, and provides container handling, storage, transportation, management, and stevedoring services. |

| Company | Country | OECD | Description |
|---|---|---|---|
| Dalian Port | Hong Kong | No | Dalian Port (PDA) Company Limited provides international and domestic cargo handling, transportation, transit, warehousing and other port operations and logistics services. The Company also provides oil and liquid chemicals terminal and related logistics services, tugging, pilotage, cargo handling and information technology services. |
| ADSEZ | India | No | Adani Ports and Special Economic Zone Limited operates a shipping port on the west coast of India. The Company provides cargo handling, transportation, storage, logistics, and evacuation services to energy, railway, thermal power generation and transmission, agricultural, and logistics industries. |
| Asian Terminals | Philippines | No | Asian Terminals, Inc. provides general service to the Philippine port terminals. The Company's services include general cargo handling, container terminal handling, stevedoring, and storage management services. |
| International Container Terminal Services | Philippines | No | International Container Terminal Services, Inc. (ICTSI) develops, manages, and operates container ports and terminals. The Company offers container packing, weighing, storage, inspection, cargo management, and other related services. ICTSI serves customers worldwide. |
| Hutchinson Port Holdings Trust | Singapore | No | Hutchison Port Holdings Trust is a container port business trust. The Trust invests in, develops, operates, and manages deep-water container ports in the Pearl River Delta. Hutchison Port Holdings also invests in other types of port assets such as river ports, as well as undertake certain port ancillary services that include warehousing and distribution services. |
| Kingston Wharves | Jamaica | No | Kingston Wharves Ltd receives, stores and delivers cargo through company owned piers. The Company operates in association with Caribbean Freight Forwarders and Custom Brokers Ltd. Kingston operates through its subsidiaries, Kingston Terminal Operators Ltd., Harbour Cold Stores Ltd., Western Storage Ltd., Jamaica Cooling Stores Ltd., and Security Administrators Ltd. |
| Prumo Logistica | Brazil | No | Prumo Logistica S.A. handles logistic and infrastructure activities related to the portuary sector. The Company constructs, develops and manages port complexes for business trades. Prumo Logistica offers its services throughout Brazil. |
| Global Ports Investments | International | No | Global Ports Investments PLC provides terminal operator services. The Company offers import and export logistics operations including oil products, container and other cargo operations. Global Ports operates ports and termials in Finland, Estonia and Russia. |
| Pakistan International Container Terminal | Pakistan | No | Pakistan International Container Terminal Ltd operates a container shipping facility in Karachi, Pakistan. |
| DP World | UAE | No | DP World Ltd is a global operator of container and marine terminals. The Company operates marine terminals across six continents, and generates its core revenues from handling cargo containers. DP World was founded in 1972, and operates out of its global headquarters in Dubai, United Arab Emirates. |
| Alexandria Containers & Goods | Egypt | No | Alexandria Containers & Goods specializes in container handling in Egyptian ports. The Company operates export, import and transit yards, a refer yard, cargo yard, empty container yard, and a container freight station. |
| Dongbang Transport Logistics | South Korea | Yes | Dongbang Transport Logistics Co., Ltd. provides stevedoring, forwarding, and container storage services at the local ports in South Korea. The Company also offers inland and marine transportation services. |
| Rinko Corporation | Japan | Yes | Rinko Corporation is a marine transport company based at Niigata Port. The Company also provides truck transportation, warehousing and storage, and freight handling services. Rinko also leases real |

| Company | Country | OECD | Description |
|---|---|---|---|
| | | | estate, sells and repairs construction machinery, and operates customs brokerage. |
| China Container Terminal Corporation | Taiwan | No | China Container Terminal Corporation operates container terminals. The Company's terminals are located in the ports of Kaohsiung, Taichung, and Keelong in Taiwan. |
| Sakurajima Futo Kaisha Ltd | Japan | Yes | Sakurajima Futo Kaisha, Ltd. provides marine transportation and warehousing services at the Osaka Bay areas. The Company mainly handles imported raw materials, petroleum products, and frozen food. The Company also provides land transportation, customs clearance, and insurance agency services. |
| Summit Alliance Port Ltd | Bangladesh | No | Summit Alliance Port Ltd. provide both ICD (Inland Container Depot) and CFS (Container Freight Station) services. |
| United Arab Shipping Co SAG | Egypt | No | The United Arab Stevedoring Co. operates at ports and harbors. The Company offers cargo handling, shipping, and marine transportation services. United Arab Shipping serves customers in Egypt. |

**Source:** Bloomberg

Table 33 Railroad comparators

| Company | Country | OECD | Description |
|---|---|---|---|
| Aurizon Holdings | Australia | Yes | Aurizon Holdings Ltd is a rail freight company. The Company provides coal, bulk and general freight haulage services, operating on the central queensland coal network (CQCN) and including specialized track maintenance and workshop support functions. |
| CSX Corporation | US | Yes | CSX Corporation is an international freight transportation company. The Company provides rail, intermodal, domestic container-shipping, barging, and contract logistics services around the world. CSX's rail transportation services are provided principally throughout the eastern United States. |
| Genesee & Wyoming Inc. | US | Yes | Genesee & Wyoming Inc., through its subsidiaries, owns and operates short line and regional freight railroads and provides related rail services. The Company also offers railroad switching and related services to the United States industries with extensive railroad facilities within their complexes. Genesee & Wyoming operates in the United States and Australia. |
| Kansas City Southern | US | Yes | Kansas City Southern, through its subsidiary, is the holding company for transportation segment subsidiaries and affiliates. The Company operates a railroad system that provides shippers with rail freight services in commercial and industrial markets of the United States and Mexico. |
| Norfolk Southern Corporation | US | Yes | Norfolk Southern Corporation provides rail transportation services. The Company transports raw materials, intermediate products, and finished goods primarily in the Southeast, East, and Midwest and, via interchange with rail carriers, to and from the rest of the United States. Norfolk Southern also transports overseas freight through several Atlantic and Gulf Coast ports |
| Union Pacific Corporation | US | Yes | Union Pacific Corporation is a rail transportation company. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products. Union Pacific offers long-haul routes from all major West Coast and Gulf Coast ports to eastern gateways as well as connects with Canada's rail systems and serves the major gateways to Mexico. |
| Canadian National Railway Company | Canada | Yes | Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulfur, and fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars. |

| Company | Country | OECD | Description |
|---|---|---|---|
| Canadian Pacific Railway | Canada | Yes | Canadian Pacific Railway Limited is a Class 1 transcontinental railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centers in the United States Midwest and Northeast. |
| Globaltrans Investment | International | No | Globaltrans Investment PLC offers rail freight transportation services in Russia, the CIS countries, and the Baltics. The Company also leases railcars and offers ancillary services to customers in the metals and mining, oil and oil products, and other industries. |
| Container Corporation of India Limited | India | No | Container Corporation of India Limited supplies railway cargo services, via its fleet of container trains. The Company also provides bonded warehousing services. |

**Source:** Bloomberg

Table 34 Airport comparators

| Company | Country | OECD | Description |
|---|---|---|---|
| Sydney Airport | Australia | Yes | Sydney Airport operates the Sydney, Australia airport. The Company develops and maintains the airport infrastructure and leases terminal space to airlines and retailers. |
| Auckland International Airport Limited | New Zealand | Yes | Auckland International Airport Limited owns and operates the Auckland International Airport. The Airport includes a single runway, an international terminal and two domestic terminals. The Airport also has commercial facilities which includes airfreight operations, car rental services, a commercial banking center and office buildings. |
| Copenhagen Airport | Denmark | Yes | Kobenhavns Lufthavne A/S (Copenhagen Airports A/S - CPH) owns and operates Kastrup, the international airport in Copenhagen, and Roskilde airport. The Company provides traffic management, maintenance, and security services, as well as manages the Airport Shopping Center and airport projects. |
| Vienna International Airport | Austria | Yes | Flughafen Wien AG manages, maintains, and operates the Vienna International Airport and the Voslau Airfield. The Company offers terminal services, air-side and land-side cargo handling, and the leasing of store, restaurant, and hotel airport building space to third party operators and businesses. |
| Zurich Airport | Switzerland | Yes | Flughafen Zurich AG operates the Zurich Airport. The Company constructs, leases, and maintains airport structures and equipment. |
| Frankfurt Airport | Germany | Yes | Fraport AG Frankfurt Airport Services Worldwide offers airport services. The Company operates the Frankfurt-Main, Frankfurt-Hahn and other German airports, the airport in Lima, Peru, and the international terminal in Antalya, Turkey. Fraport also provides services to domestic and international carriers including traffic, facility and terminal management, ground handling, and security. |
| Paris Airport | France | Yes | Aeroports de Paris (ADP) manages all the civil airports in the Paris area. The Company also develops and operates light aircraft aerodromes. ADP offers air transport related services, and business services such as office rental. |
| Grupo Aeroportuario del Centro Norte | Mexico | Yes | Grupo Aeroportuario del Centro Norte, S.A.B. de C.V. (OMA) operates international airports in the northern and central regions of Mexico. The airports serve Monterrey, Acapulco, Mazatlan, Zihuatanejo and several other regional centers and border cities. |
| Airports of Thailand | Thailand | No | Airports of Thailand Public Company Ltd. operates the Bangkok International Airport (Don Muang) and the New Bangkok International Airport (Suvarnabhumi). The Company also operates provincial airports in Chiang Mai, Chiang Rai, Hat Yai, and Phuket. |
| Grupo Aeroportuario del Sureste | Mexico | Yes | Grupo Aeroportuario del Sureste S.A.B. de C.V. operates airports in Mexico. The Company holds 50 year concessions, beginning in 1998, |

| Company | Country | OECD | Description |
|---|---|---|---|
| | | | to manage airports in Cancun, Cozumel, Merida, Oaxaca, Veracruz, Huatulco, Tapachula, Minatitlan, and Villahermosa. |
| TAV Havalimanlari Holding | Turkey | Yes | TAV Havalimanlari Holding AS is an airport operator. The Company operates in airports in Turkey, Georgia, Tunisia, Macedonia, Saudi Arabia and Latvia. TAV Havalimanlari provides service in all areas of airport operations such as duty-free, food and beverage, ground handling, IT, security and operations. |
| Malta International Airport | Malta | No | Malta International Airport PLC operates the Malta International airport. |
| Japan Airport Terminal Co. | Japan | Yes | Japan Airport Terminal Co., Ltd. constructs, manages and maintains passenger terminals and airport facilities at Haneda airport. The Company also operates parking-lots, souvenir shops, and duty-free stores in both Haneda and Narita airports. Japan Airport Terminal, through its subsidiaries, manages restaurants and in-flight meal services. |

**Source:** Bloomberg

## B.4 Excluded comparators

The following tables provide a list of firms that were excluded from our sample, whether because of statistical insignificance, insufficient data, or incompatibility with the BEE.

Table 35 Marine Ports and Services comparators excluded from sample

| Firm | Comments |
|---|---|
| Bremer Lagerhaus-Gesellschaft AG | Statistically insignificant |
| Eurokai GmbH | Statistically insignificant |
| Logistec Corporation | Statistically insignificant |
| Essar Ports | Statistically insignificant |
| Salalah Port Services Company SAOG | Statistically insignificant |
| Puerto Ventanas S.A. | Statistically insignificant |
| Tradia Corporation | Statistically insignificant |
| Lyttelton Port Company Limited | Statistically insignificant with partially incomplete data |
| South Port New Zealand Limited | Statistically insignificant |
| Point Lisas Industrial Port Development Corporation Limited | Statistically insignificant |
| Namyong Terminal | Negative beta |
| Mercantile Ports and Logistics Limited (MPL) | Statistically insignificant |
| Shanghai International Port | Chinese-listed (issues with openness of capital markets) |
| Ningbo Zhoushan Port Company | Chinese-listed |
| Kamigumi | Significantly diversified |
| Tianjin Port Development Holdings | Sale of materials accounts for majority of revenue |
| Tianjin Port Co. | Chinese-listed |

| Firm | Comments |
|---|---|
| Mitsubishi Logistics Corporation | Significant diversification, port and harbour operations only 10% of revenue |
| Nissin Corporation | 28% travel services and real estate, and port services are only a subset of its logistics business |
| Sumitomo Warehouse Co. | Revenue is substantially diversified |
| Xiamen Port Development Co. | Chinese-listed |
| Qingdao Port International Co. | Missing observations |
| Xiamen International Port Company | Trading business of merchandise accounted for 61.5% of revenue in FY2016. |
| Guangzhou Port Company Limited | Chinese-listed |
| Anhui Wanjiang Logistics Group Co | Chinese-listed |
| COSCO SHIPPING International (Hong Kong) | Shipping |
| Novorossiysk Commercial Sea Port | Handles mainly crude oil |
| Tangshan Port Group Co. | Chinese-listed |
| Qinhuangdao Port Company Limited | Some observations missing |
| Rizhao Port Co. | Chinese-listed |
| Sebang | Some diversification |
| Meiko | Diversification beyond port operations |
| Yingkou Port Liability | Chinese-listed |
| Westports Holdings Berhad | Insufficient observations |
| Ocean Wilsons Holdings | Holding company |
| Beibuwan Port Co. | Chinese-listed |
| Touax | Unrelated operations |
| EMS Seven Seas | Unrelated operations |
| Jinzhou Port Co. | Chinese-listed |
| National Marine Dredging Company | Not relevant – dredging |
| Chongqing Gangjiu Co. | Chinese-listed |
| Toyo Wharf and Warehouse | Port and harbour operations only 23% of revenue |
| Shenzhen Chiwan Wharf Holdings | Chinese-listed |
| Bintulu Port Holdings Berhad | Holding company |
| Muehlhan | Surface protection solutions |
| Contracting & Marine Services Company | Services and maintenance |
| Zhuhai Port Co. | Chinese-listed |
| Societe d'Exploitation des Ports, dba Marsa Maroc | Missing data |
| Westshore Terminals | Very high gearing, single commodity exposure |

| Firm | Comments |
|---|---|
| Santos Brasil Participacoes S.A. | Missing data |
| Andino Investment Holding | Statistically insignificant |
| Braemar Shipping Services | Unrelated operations |
| Daito Koun | Imports frozen foods |
| Jiangsu Lianyungang Port Co. | Chinese-listed |
| Saudi Industrial Services Company (Sisco) | Unrelated services |
| Gemadept Corporation | Shipping company |
| Vostochney Port | Missing data |
| Rinko Corporation | Almost 40% of revenue derived from hotel business, fuel and construction materials, machinery and real estate |
| Kuwait & Gulf Link Transport Co. (K.S.C) | Unrelated services |
| Sical Logistics Ltd. | Diversified into trucking and rail |
| Zhangjiagang Freetrade Science & Technology Group Co. | Chinese-listed |
| Global Ports Holding Limited | Holding company |
| Fushiki | Also runs liners |
| Sinwa Limited | Unrelated - supply, logistics and services |
| Port of Hai Phong | Missing data |
| Gujarat Pipavav Port Ltd. | Missing gearing data |
| China Dredging Environment Protection Holdings | Unrelated – dredging |
| Puertos y Logistica | Has unrelated subsidiaries - also statistically insignificant |
| Dredging Corporation of India | Unrelated - dredging |
| Overseas Commerce Ltd. | Missing data |
| Novorossyisk Grain Plant PJSC | Missing data |
| Suria Capital Holdings Berhad | Holding company |
| Gateway Distriparks Limited | Limited port exposure |
| Navkar Corporation Limited | Missing data |
| Portuaria Cabo Froward | Also involved in construction |
| Gold Bond Group | Holding company |
| General Silos & Storage | Single commodity exposure |
| Perak Corporation Berhad | Statistically insignificant |
| Nanjing Port Co. | Chinese-listed |
| Zhuhai Winbase International Chemical Tank Terminal Co. | Chinese-listed |
| Dinh Vu Port Investment & Development | Statistically insignificant |
| Harbor Star Shipping Services, Inc. | Shipping services, statistically insignificant |

| Firm | Comments |
|---|---|
| CIG Yangtze Ports Plc | Missing data |
| Luka Ploce d.d. | Statistically insignificant |
| Uljanik Plovidba DD | Very high gearing |
| Pelayaran Nasional Bina Buana Raya Tbk | Unrelated operations |
| DaNang Port Joint Stock Company | Very few observations |
| Globalport 900, Inc. | Incomplete data |
| Hai An Transport & Stevedoring JSC | Statistically insignificant |
| Luka Rijeka dd | Primarily support services |
| Dong Nai Port JSC | Statistically insignificant |
| Odessos Shiprepair Yard AD | Repair services |
| VMS Industries Ltd. | Ship dismantling |
| Comvex SA | Statistically insignificant |
| Socep S.A. | Statistically insignificant |
| Starlog Enterprises Ltd | Unrelated operations |
| exactEarth Ltd. | Satellite data services |
| Cat Lai Port JSC | Insufficient data |
| Vietnam Maritime Development JSC | Missing data |
| PT Indo Straits Tbk | Unrelated operations |
| Sutton Harbour Holdings | Not directly relevant, statistically insignificant |
| Camper & Nicholsons Marina Investments | Marinas |
| Marine Supply and Engineering Service JSC | Unrelated services |
| PT ICTSI Jasa Prima Tbk | Statistically insignificant |
| Canal Shipping Agencies Company | Shipping agency |
| Cia de Remorcare Maritima Coremar SA Constanta | Unrelated services, missing data |
| Sino-Global Shipping America Ltd. | Shipping agency |
| Jadroagent D.D. | Shipping agency |
| Doan Xa Port Joint Stock Company | Statistically insignificant |
| Western India Shipyard Limited (WISL) | Repair services |
| Bangpakong Terminal Public Company Limited | Missing data |
| Taiwan Allied Container Terminal Corp. | Statistically insignificant |
| Marsden Maritime Holdings Limited | Holding company |
| The Vegetexco Port JSC | Statistically insignificant |
| Natura Hue Chem Ltd. | Unrelated operations |
| C Security Systems AB | Communications and technology |

| Firm | Comments |
|---|---|
| JITF Infralogistics Limited | Repair services |
| Companhia Docas de Imbituba | Missing data, statistically insignificant |
| Movis Cote d'Ivoire | Ivory Coast |
| Pakistan International Bulk Terminal Limited | Insufficient observations |
| Yangtze River Development Limted | Real estate |
| Quayside Holdings Ltd | Part owner of Port of Tauranga |

**Source:** Bloomberg, Synergies analysis

Table 36 Railroad comparators excluded from sample

| Firm | Comments |
|---|---|
| VTG AG | Statistically insignificant |
| Center for Cargo Container Traffic TransContainer PJSC | Statistically insignificant |
| Ferrocarril del Pacifico SA | Statistically insignificant |
| PCC Intermodal SA | Statistically insignificant |
| East Japan Railway Company | Passenger, too diversified |
| Central Japan Railway Company | Diversified, not freight |
| West Japan Railway Company | Too Diversified |
| Kintetsu Corp | Too Diversified |
| Tokyu Corporation | Too Diversified |
| Daqin Railway Co., Ltd. | Chinese-listed |
| Hankyu Hanshin Holdings, Inc. | Passenger |
| MTR Corporation Limited | Public Transport |
| Nagoya Railroad Co., Ltd. | Passenger |
| Go-Ahead Group PLC | Buses and Taxis as well |
| Tobu Railway Co., Ltd. | Passenger |
| Odakyu Electric Railway Co., Ltd. | Passenger, Diversified |
| Keio Corporation | Passenger, Diversified |
| Kyushu Railway Company | Passenger, Diversified |
| Nishi-Nippon Railroad Co. | Passenger, Diversified |
| Keikyu Corporation | Passenger, Diversified |
| Guangshen Railway Company Limited | Chinese-listed |
| Sotetsu Holdings, Inc. | Passenger, Diversified |
| Keisei Electric Railway Co., Ltd. | Passenger, Diversified |
| Nankai Electric Railway Co., Ltd. | Passenger, Diversified |
| Cosan Logistica SA | Incomplete Data |

| Firm | Comments |
|---|---|
| Rumo S.A. | Incomplete Data |
| Rumo Logistica Operadora Multimodal S.A. | Incomplete Data |
| PKP Cargo S.A | Incomplete Data |
| China Railway Tielong Container Logistics Co., Ltd. | Diversified, Chinese-listed |
| BLS AG | Insignificant, Missing data |
| China High-Speed Railway Technology Co., Ltd. | China, Maintenance |
| FNM S.p.A | Holding company, strong public transport emphasis |
| Kobe Electric Railway Co., Ltd. | Passenger, other diversified services |
| Berner Oberland-Bahnen AG | Incomplete Data, Mountain Railways |
| Shin-Keisei Electric Railway Co., Ltd. | Bus, Real Estate |
| Jungfraubahn Holding AG | Tourism-related |
| BTS Group Holdings | Public Transport |
| BVZ Holding AG | Passenger railway |
| Shanghai Shentong Metro Co. Ltd. | Subway Transit Systems |
| Keifuku Electric Railroad Co., Ltd. | Diversified |
| Forestiere Equatoriale | Ivory Coast |
| Chichibu Railway Co., Ltd. | Passenger and Bus as well as freight |
| The Central Provinces Railways Co. Ltd. | Construction |
| Las Vegas Railway Express | Passenger |
| GMexico Transportes | Insufficient data – listed only in November 2017 |

**Source:** Bloomberg, Synergies analysis

Table 37 Airport comparators excluded from sample

| Firm | Comments |
|---|---|
| SAVE SpA | Statistically insignificant |
| Maman Cargo Terminals and Handling Ltd | Statistically insignificant |
| Toscana Aeroporti S.p.A. | Statistically insignificant |
| Aeroporto Guglielmo Marconi Di Bologna SpA | Statistically insignificant |
| Grupo Aeroportuario del Pacifico | Statistically insignificant |
| SWISSPORT Tanzania Ltd | Tanzania, Services |
| Spotlight Capital Holdings Inc | Charter Flights |
| Sichuan Haite High-tech Co., Ltd. | Chinese-listed |
| SIA Engineering Co Ltd | Maintenance |
| Shenzhen Airport Co., Ltd. | Chinese-listed |
| Shanghai International Airport Co., Ltd. | Chinese-listed |

| Firm | Comments |
|---|---|
| Servair Abidjan | Ivory Coast |
| Saudi Ground Services Company | Ground Services |
| SATS Ltd | Food and Services |
| Saker Aviation Services | Maintenance |
| Safe Bag SPA | Baggage |
| Noibai Cargo Terminal Services JSC | Cargo Handling |
| Nigerian Aviation Handling Company Plc | Baggage |
| Newrest ASL Nigeria | Related Services |
| Malaysia Airports Holdings Berhad | Holding Company |
| Macroasia Corporation | Catering |
| Macquarie Infrastructure Corporation (MIC) | Diversified |
| Korea Airport Service Co., Ltd. | Diversified |
| Xiamen International Airport Co., Ltd. | Chinese-listed |
| United Projects Co for Aviation Services KSCC | Services |
| ICTS International N.V. | Security |
| Hong Kong Aircraft Engineering Company Limited | Maintenance |
| HNA Infrastructure Company Ltd | Diversified |
| GVK Power & Infrastructure Limited | Unrelated |
| Guangzhou Hangxin Aviation Technology Co., Ltd. | Chinese-listed |
| Guangzhou Baiyun International Airport Co., Ltd. | Chinese-listed |
| Future Generation Investment Company Limited | Diversified |
| Enav S.p.A. | Navigation |
| Celebi Hava Servisi A.S. | Baggage, Traffic |
| PT Cardig Aero Services TBK | Services |
| Beijing Capital International Airport Company Limited | Significant non-aeronautical diversification |
| BBA Aviation PLC | Aftermarket |
| Bangkok Aviation Fuel Services Public Company Limited | Fuel |
| Avia Solutions Group AB | Fleet Management |
| Avantair, Inc. | Fractional Ownerships |
| Airwork Holdings Limited | Not Relevant |
| AI Airports International Ltd | Development |
| AGP CORPORATION | Air Con |
| Aerodrom Nikola Tesla AD Beograd | Insufficient Data |
| Aena S.A. | Missing Data |

**Source:** Bloomberg, Synergies analysis

# C Supplementary information on cost of equity methodologies

The purpose of this attachment is to provide additional detail on the well-accepted cost of equity approaches discussed in Section 6.

## C.1 Black CAPM

### C.1.1 **SFG Consulting's estimate of the zero**-beta premium[181]

SFG quantifies the relationship between realised portfolio returns, market returns and beta, ultimately arriving at an estimate of the zero-beta premium.

Its first step is to form portfolios. Rather than analyse returns on individual stocks, it analyses returns on portfolios of stocks to minimise the "noise" in historical stock returns.

Its second step is to perform a regression of portfolio returns every four weeks on two independent variables – beta × market returns and (1 – beta). SFG demonstrates that the coefficient on the second independent variable (1 – beta) is an estimate of the zero-beta return. To estimate the zero-beta premium, SFG subtracts the average four-weekly risk-free rate over the sample period, measured as the yield to maturity on 10-year government bonds.

Using this two-step process, SFG's estimated return on the zero-beta asset lies between the normal estimate of the risk-free rate of interest and the average market return. The zero-beta premium (the difference between the zero-beta return and the estimate of the risk-free rate) is estimated at 0.239% over four weeks or 3.34% per year.[182]

We consider this estimate is the most robust estimate of this parameter currently available in an Australian context.

## C.2 Fama-French Model (FFM)

### C.2.1 Beta factors

[181] SFG Consulting (2014a).

[182] SFG Consulting (2014a), p.27.

The FFM is based on the principle that excess returns to the market must be assessed having regard to the following three explanatory factors:

- the returns on the market as a whole;
- HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth portfolios; and
- SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios.

### C.2.2 Estimating the FFM cost of equity

The companies examined in the FFM are the same as those used for the SL CAPM analysis. Estimates of the factor premiums for the US and Japan were sourced from Professor Kenneth French's website, an internationally recognised source.[183] However, country-specific factors are not available for all firms in our sample. In these instances, we have employed global factor estimates, also acquired from the website of Professor Kenneth French. In a slight modification to last year's methodology, the global factor estimates are used for the SMB and HML returns, but the returns for the market as a whole are now based on the company's local market return, rather than the global market return. We anticipate that this will result in a more robust and stable estimate over time. Moreover, the market beta estimate for the FFM will now more closely resemble the beta estimate for the CAPM.

In the case of Australia, estimates of the factor premiums must also be constructed. For the estimates in this report, we have extended the factor premium dataset to the end of 2017, following the methodology set out in SFG Consulting (2014), which is in turn based on the approach of Brailsford, Gaunt and O'Brien (2012).

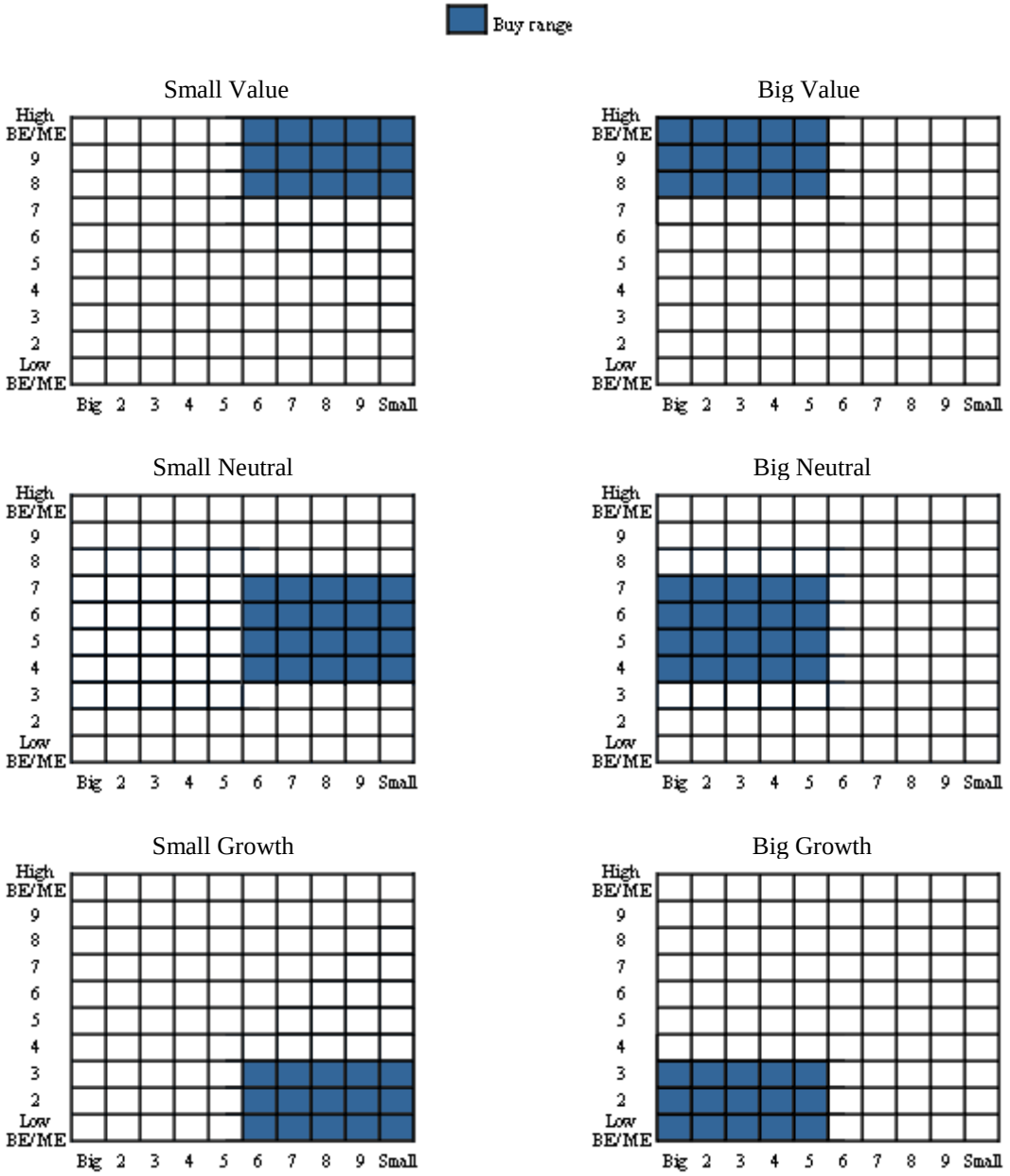
The Australian context requires careful consideration. Estimation of the small-minus-big premium involves construction of SMB portfolios, which partition the sample of firms according to market capitalisation. In Australia, this is complicated by the fact that only a small proportion of stocks can be considered "large cap." Considering this issue, Brailsford, Gaunt and O'Brien (2012) define the large stocks portfolio as the top 90% according to market capitalisation, while the small stocks portfolio comprises the smallest 10% of the market.

In regards to book-to-market ratios, firms are sorted into three categories, partitioned at the 30th and 70th percentiles. Another important consideration is the interaction between

[183] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

size and book-to-market factors. Following SFG Consulting (2014) and Brailsford, Gaunt and O'Brien (2012), our SMB and HML factors have been constructed to be independent of each other. In other words, the small and large stock portfolios have similar book-to-market values of equity, while the high and low book-to-market stocks are of similar size. This enables us to properly identify the true impact of each factor. Figure 9 illustrates the various portfolios that are created in the model.

Figure 9 Buy ranges of Fama French Benchmark portfolios




Data source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/bench_m_buy.html

### C.2.3 Model specification

Data on monthly returns, market capitalisation and book-to-market ratios for all listed firms in Australia from 1985 to 2017 (including both currently listed and now delisted) were sourced from Datastream.

Once this data was compiled, the monthly returns of each firm over five years (December 2012 to December 2017) were regressed on the monthly measures of the market risk

premium, size premium and value premium for the specific country (or the global premiums if country-specific premiums were not available), using OLS multiple regression. This does not apply to the Australian factor premium data.

These regressions yield estimates of the three Fama-French betas. These betas must then be de-levered using the firm-specific leverage. The unlevered betas are averaged across all firms in the sample, then re-levered using the benchmark port entity's target gearing of 30%.

Table 38 presents our estimated FFM asset betas.

Table 38 Fama-French asset beta estimates, by company

| Company | Country | Sector | Beta (MRP) | Beta (HML) | Beta (SMB) |
|---|---|---|---|---|---|
| Aurizon Holdings | Australia | Railroads | 0.40 | 0.08 | 0.04 |
| Sydney Airport | Australia | Airports | 0.34 | -0.24 | 0.15 |
| Qube Holdings | Australia | Marine Ports and Services | 1.11 | 0.15 | 0.07 |
| Vienna International Airport | Austria | Airports | 0.38 | -0.03 | -0.21 |
| Summit Port Alliance Ltd | Bangladesh | Marine Ports and Services | 1.54 | -0.13 | -0.99 |
| Wilson Sons | Brazil | Marine Ports and Services | 0.29 | -0.03 | -0.08 |
| Prumo Logistica | Brazil | Marine Ports and Services | 0.37 | 0.85 | 0.79 |
| Canadian National Railway Company | Canada | Railroads | 0.93 | -0.78 | -0.88 |
| Canadian Pacific Railway | Canada | Railroads | 1.23 | -0.29 | -0.04 |
| Sociedad Matriz SAAM | Chile | Marine Ports and Services | 0.90 | 0.06 | 0.74 |
| Copenhagen Airport | Denmark | Airports | 0.46 | 0.87 | 0.62 |
| Alexandria Containers & Goods | Egypt | Marine Ports and Services | 1.12 | 1.02 | -0.80 |
| United Arab Stevedoring Co | Egypt | Marine Ports and Services | 1.36 | -0.94 | 0.69 |
| Paris Airport | France | Airports | 0.29 | -0.62 | 0.01 |
| Frankfurt Airport | Germany | Airports | 0.28 | 0.08 | -0.20 |
| Hamburger Hafen und Logistik | Germany | Marine Ports and Services | 0.56 | 0.64 | 0.51 |
| Piraeus Port Authority | Greece | Marine Ports and Services | 0.61 | -0.03 | -0.16 |
| Thessaloniki Port Authority | Greece | Marine Ports and Services | 0.56 | 0.48 | 1.20 |
| China Merchants Port Holding Company | Hong Kong | Marine Ports and Services | 0.83 | -0.06 | 0.47 |

| Company | Country | Sector | Beta (MRP) | Beta (HML) | Beta (SMB) |
|---|---|---|---|---|---|
| COSCO Shipping Ports | Hong Kong | Marine Ports and Services | 0.56 | 0.32 | -0.20 |
| Dalian Port | Hong Kong | Marine Ports and Services | 0.87 | 0.04 | -0.08 |
| Container Corporation of India Limited | India | Railroads | 0.86 | -0.26 | 0.83 |
| ADSEZ | India | Marine Ports and Services | 1.13 | 0.99 | 0.51 |
| Kingston Wharves | Jamaica | Marine Ports and Services | 1.05 | 0.02 | -0.68 |
| Japan Airport Terminal Co. | Japan | Airports | 1.66 | -0.13 | -0.62 |
| Isewan Terminal Service | Japan | Marine Ports and Services | 0.31 | -0.02 | 0.61 |
| Sakurajima Futo Kaisha | Japan | Marine Ports and Services | 0.87 | 1.11 | 1.41 |
| Rinko Corporation | Japan | Marine Ports and Services | 0.44 | 0.42 | 0.44 |
| Dongbang Transport Logistics | South Korea | Marine Ports and Services | 0.70 | -0.06 | 0.44 |
| Malta International Airport | Malta | Airports | 0.81 | -0.48 | -0.78 |
| Grupo Aeroportuario del Centro Norte | Mexico | Airports | 1.02 | -0.90 | 0.20 |
| Grupo Aeroportuario del Sureste | Mexico | Airports | 0.55 | -0.25 | -0.62 |
| Auckland International Airport Limited | New Zealand | Airports | 0.94 | -0.52 | 0.35 |
| Port of Tauranga | New Zealand | Marine Ports and Services | 0.53 | -0.21 | -0.21 |
| Pakistan International Container Terminal | Pakistan | Marine Ports and Services | 0.61 | 0.48 | -0.89 |
| Asian Terminals | Philippines | Marine Ports and Services | 0.75 | 0.33 | -0.06 |
| International Container Terminal Services | Philippines | Marine Ports and Services | 0.55 | 0.46 | -0.09 |
| Hutchinson Port Holdings Trust | Singapore | Marine Ports and Services | 0.47 | -0.23 | 0.22 |
| Luka Koper | Slovenia | Marine Ports and Services | 1.03 | 0.26 | 0.90 |
| Zurich Airport | Switzerland | Airports | 0.54 | -0.37 | -0.13 |
| China Container Terminal Corporation | Taiwan | Marine Ports and Services | 0.61 | 0.25 | -0.29 |
| Airports of Thailand | Thailand | Airports | 1.03 | -0.25 | 0.08 |
| TAV Havalimanlari Holding | Turkey | Airports | 0.44 | 0.45 | 1.01 |
| DP World | UAE | Marine Ports and Services | 0.27 | -0.54 | -0.24 |
| Globaltrans Investment | International | Railroads | 1.12 | 0.17 | 1.76 |

| Company | Country | Sector | Beta (MRP) | Beta (HML) | Beta (SMB) |
|---|---|---|---|---|---|
| Global Ports Investments | International | Marine Ports and Services | 0.64 | 0.50 | 0.73 |
| CSX Corporation | US | Railroads | 0.97 | 0.17 | 0.47 |
| Genesee & Wyoming Inc. | US | Railroads | 1.16 | 0.31 | 0.50 |
| Kansas City Southern | US | Railroads | 0.71 | 0.33 | 0.10 |
| Norfolk Southern Corporation | US | Railroads | 0.99 | 0.34 | 0.41 |
| Union Pacific Corporation | US | Railroads | 0.72 | 0.30 | 0.35 |
| **Average asset betas** | | | **0.74** | **0.08** | **0.16** |

**Note:** The betas presented here have been de-levered using the same debt-to-equity ratios applied in the standard beta analysis

**Source:** Bloomberg, Synergies Calculations

# D Asset beta first principles analysis

## D.1 Introduction

The key objective of the first principles analysis is to assess the extent to which the firm's net cashflows (revenues less costs) have some sensitivity to movements in the general economy. Lally identifies a number of factors to be considered here, including: nature of the product or service; nature of the customer; pricing structure; duration of contracts; market power; nature of regulation (if any); growth options; and operating leverage.[184]

The first principles analysis is largely contextual and can inform an assessment of where beta might sit within a range (that is, does a factor put upward or downward pressure on the beta for the firm). However, this remains qualitative. Noting the inherent uncertainty in beta estimation, it is not feasible to reliably quantify the impact of a particular factor on beta in isolation of other factors.[185]

A number of these factors are also interrelated – that is, the impact of one factor on beta could either be increased or lessened by another factor. Hence, while the impact of each factor can be considered in isolation, the overall assessment will reflect the net impact of the factors in combination. The first two factors are inextricably linked and so will be considered together.

## D.2 Nature of the product/nature of the customer

Fundamental to understanding a firm's risk profile is identifying and analysing the demand for its core services. The analysis needs to be extended to the services from which the infrastructure's demand is derived, which in this case, is the demand for accessing and usage of channel and wharf assets by shipping companies and related port users. Other issues that may impact on the extent to which the port is exposed to the risk of changes in the demand for port services, such as market power and the structure of PoM's contracts with its customers, are considered separately.

*Availability of substitutes*

One of the key drivers of a firm's risk profile is the extent to which the demand for its services is exposed to competition from substitutes.

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184 Lally, M. (2004). The cost of capital for regulated entities, Report prepared for the Queensland Competition Authority.

185 This would necessitate being able to have two samples, where the firms in the samples are largely identical other than for the relevant factor.

There is clear evidence of contestability given that PoM has lost trade to Adelaide (import containers), Geelong (breakbulk) and Port Botany (agricultural exports). Moreover, PoM competes with Geelong in relation to import crude and refined oil, breakbulk cargo, bulk grain exports, dry bulk import (cement, soda ash and fertiliser). Nevertheless, a significant proportion of PoM's volumes are not contestable, with 87% and 54% of imported and exported containers, respectively, destined for or originating from the Melbourne metropolitan region.[186] However, there is clearly the prospect of competition in the form of the development of a second port serving Melbourne.

In May 2017, Infrastructure Victoria recommended the construction of a new port for Melbourne at Bay West.[187] Infrastructure Victoria's view is that the new port will not be required until 2055, as PoM has a potential capacity of approximately 8 million TEU. Mr Michael Masson, the chief executive of Infrastructure Victoria, has stated that the Bay West port could handle overflow container capacity initially, but it would be well suited to becoming Melbourne's future container port in the long term. Planning for the port is likely to begin 15 years before it is required to be operational. In short, it is possible for the State to bring forward the development of the port if it perceives it to be in the public interest to do so.

As such, given the current attention to the issue, there is no guarantee that the 2055 timeline will be maintained. Political considerations could see the implementation of the second port occur even earlier, which presents considerable risk to PoM. In particular, Infrastructure Victoria has noted that:[188]

> Increasing capacity at Webb Dock to accept ships larger than around 7,500 TEU could make it difficult for Swanson Dock's capacity to be fully utilised due to its vessel size restrictions. This may prematurely compromise the viability of Swanson Dock, unnecessarily bringing forward the need to invest in additional capacity. This can be managed through deliberate staging of infrastructure investments at Webb Dock as well as upgrades to navigation infrastructure (channels and swing basins) and changes to regulation of navigation.

Moreover, in one of its recommendations, Infrastructure Victoria highlights that further urban development is likely to hinder capacity enhancement within the existing Port of Melbourne footprint:[189]

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[186] Port of Melbourne Corporation (2009). Port of Melbourne – Management Presentation, p.16.

[187] Ackerman, I., "Go west says IV," *Lloyd's List Australia*, May 25, 2017.

[188] Infrastructure Victoria (2017). Advice on securing Victoria's ports capacity, p.16.

[189] Infrastructure Victoria (2017), p.17.

> Maintaining the Port's social licence to operate is an important consideration if capacity expansions are to be sustainably achieved. If the amenity impacts of port related freight services are not effectively managed, the Port of Melbourne may be unable to reach its optimal capacity.

Infrastructure Victoria has recommended that the Victorian Government should monitor key indicators relevant to all Victorian ports that impact planning and publish a report every five years. This report will have the objective of identifying whether PoM has the ability to meet demand for 15 years or more. In the meantime, Infrastructure Victoria has recommended measures to optimise capacity at PoM, through augmentations at Swanson and Webb Dock. Infrastructure Victoria has also recommended that the Victorian Government should not enter into any arrangement that restricts the ability to develop a second port after 2031:[190]

> There is an initial 15 year period in the Port of Melbourne lease legislation where there cannot be a second port built without compensation to the lessee. There is considerable value in the State retaining the unfettered option under the current terms of the Port of Melbourne lease legislation to develop a second container port after 15 years.

These considerations make it clear that the Victorian Government can act relatively quickly to develop a new port in the future. This will tend to increase the beta for PoM compared to other Australian capital city ports when considering the investment's 50 year lease horizon. It would put Melbourne in the unique position of being the only capital city in Australia with a competing port servicing a similar catchment area (the closest example being in Sydney with the Port of Newcastle, which is very unlikely to become a major container port) noting that Port Botany and Port Kembla are under the same ownership).

Modal substitution is limited. Domestically, there is limited competition from rail for inter-city freight movements given the distances between cities and some inherent inefficiencies in the freight rail network (lack of volume, conflict between passenger and freight networks, different track configurations and double handling charges). There is strong road competition and limited rail competition for intercity freight movements. Air services may compete for small time-sensitive freight, but generally, it is too small and expensive for regular freight movements.

[190] Infrastructure Victoria (2017), p.18.

*Income elasticity of demand for port services*

The income elasticity of demand is relevant to this assessment given the relationship between incomes (or GDP) and domestic economic activity. For PoM, the relationship is considered strong as demand for port services is inextricably linked to demand for freight goods.

PoM has indicated that demand for container imports is driven by:[191]

- population growth
- retail activity and consumer confidence
- building investment
- manufacturing industry growth.

Container exports are predominantly driven by local agricultural production and manufacturing industry growth.

All of these factors have a direct correlation with GDP. Accordingly, PoM's revenues and earnings are significantly affected by levels of domestic economic activity.

*Exchange rate sensitivities*

International trade will be sensitive to exchange rates. This is significant for beta as the exchange rate will be correlated with domestic economic activity.

*Market disruption risks*

There is a range of market disruption risks for the PoM – these risks have both systematic and non-systematic elements:

- Changes to globalisation
- Reduction in demand due to sharing economy (e.g. Uber)
- Automation of motor vehicles
- 3D printing
- Miniaturisation/Virtualisation
- Reduced manufacturing and exports (e.g. Ford, Toyota)

[191] Victorian Ports Corporation (Melbourne) (2016). Reference tariff schedule: Effective 1 July 2016, p.15.

*Implications for beta*

In general, port revenues can be expected to have a strong correlation with domestic economic activity, driven by fundamentals such as:

- the income elasticity of demand for port services and freight goods
- the sensitivity of international shipping to changes in exchange rates
- the sensitivity of demand for freight transport to domestic GDP
- market disruptions.

Given PoM's beta is being assessed relative to international comparators, consideration needs to be given as to whether these demand characteristics are likely to be more or less sensitive to domestic economic activity compared to other comparators (relative to their own domestic economies). Overall, we expect that the relationships described above will generally hold across most major container and freight ports, noting that the contribution of each to revenues will vary.

## D.3 Pricing structure

Pricing structure refers to the extent that the firm's pricing arrangements either mitigate or increase its exposure to systematic risk. For example, if a firm's cost structure comprises fixed and variable costs, an important consideration here will be the extent to which prices have a fixed and variable component that reflect this cost structure.

At the PoM, all fees are levied on a usage basis, which increases its risk profile. Of the major fees levied, the wharfage fee (charged on a per unit quantity, volume or weight basis) underscores that PoM's revenues are significantly affected by levels of economic activity.

Overall, the pricing structure significantly exposes the port to systematic volume risk, although this risk is characteristic of ports globally and is very unlikely to change during the term of the lease.

## D.4 Market power

The existence of market power will have a mitigating effect on systematic risk. This assumes that where a firm possesses market power, it is able to exercise that power to its advantage. This in turn is a function of considerations such as the degree of market power held (which in turn will depend on the availability of substitute port facilities of appropriate size and scale), the number of buyers in the market and the extent to which those buyers can exert countervailing power in negotiations.

PoM currently has market power. However, that market power is not without constraints. The regulatory environment restricts the ability of PoM to exert market power. There is clear evidence of contestability that further constrains the PoM's market power, particularly because of its inability to price discriminate which means that the benefits of price competition to capture marginal trades are transmitted across the entire PoM customer base.

Finally, the impact of the second port in the Melbourne region (as described above) clearly constrains PoM's market power. Whilst it is true that the development of a second port is not currently imminent, the prospect of a second port brings substitution risk as well as potentially providing PoM's counterparties (shipping, logistics, and, to a certain extent, stevedoring companies) more countervailing power in negotiations. Moreover, there is clearly scope for the Victorian Government to accelerate the development of a second port towards the second half of PoM's lease period as the State has the ability to bring forward the development of the second port without compensation to PoM. Holding all other factors constant, we consider this should be reflected in a higher value of beta relative to the comparable companies.

This justifies a higher beta for the port relative to comparables that do not face this same competition.

## D.5 Form of regulation

The effects of regulation on beta are unclear. In the first instance, regulatory risk is not necessarily in itself systematic as it could be avoided through diversification. However, the issue of relevance here is the extent to which regulation mitigates, or increases, PoM's exposure to systematic volume risk.

Regulation can reduce risk if it increases revenue certainty over a period. Conversely, regulatory risk can be seen as a source of risk to the extent that there is uncertainty as to how it will be applied and/or it reduces the firm's ability to adjust prices in response to changes in costs.

The general practice of Australian regulators is to assume that regulation reduces risk and accordingly will have a dampening effect on beta. However, this is unlikely to be the case for the PoM as it is likely to have its revenues significantly affected by levels of economic activity throughout the lease period.

Accordingly, there is no basis to conclude that the Pricing Order provides revenue certainty (whether during or after the period in which the TAL is in place) or mitigates exposure to systematic risk, particularly when comparing the port against comparables that are either subject to more light handed price monitoring or are unregulated.

Moreover, PoM has not and is never likely to have long term take or pay contracts in place which could mitigate the extent to which its revenues are affected by levels of economic activity.

## D.6 Growth options

Growth options refer to the potential to undertake significant new investment, particularly in new areas or products. It is argued that businesses that have a number of valuable growth opportunities in addition to their existing assets will tend to have higher systematic risk compared to firms that have limited growth options.

In the case of PoM, it is likely to undertake a number of capital projects to maintain / upgrade existing assets as well as expand the Port's capacity to service Victoria's increasing freight demand.

## D.7 Operating leverage

A high degree of operating leverage will increase the volatility of a firm's returns relative to the market, which can increase its beta.

It is understood that most ports have a relatively high fixed cost base and this is the case in relation to PoM. We would therefore expect PoM to be similar to comparator ports in this regard. However, it could be a distinguishing feature compared to, say, stevedoring services, as they are likely to have lower operating leverage. This means that holding all else constant, this would increase PoM's beta relative to those firms. A second port will materially exacerbate the impact of operating leverage on PoM's cash flow volatility.

# E Australian regulatory precedent on beta determination

The purpose of this attachment is to set out the relevant regulatory precedent for the assessment of an asset beta for Australian transport companies whose revenues and earnings are significantly affected by levels of economic activity. It focuses on the ACCC's decision on the interstate network and the relevant ERA decisions (both 2008 and 2015).

## E.1 ACCC – ARTC's Interstate network (2008)

In the ACCC's beta assessment of ARTC's interstate network (2008) it determined that the asset betas of Australian trucking, shipping and other non-rail service providers are not suitable proxies for ARTC's asset beta.[192]

Although these firms are observable and have the desirable quality that they are Australian based transport businesses, the systematic risks of these types of transport investments is likely to differ markedly to that of a below rail service provider. For this reason, the ACCC has focussed on non-regulated below rail operators operating overseas to determine whether ARTC's requested beta seems reasonable. In its view, the use of overseas firms was necessitated by the lack of non-regulated below rail operators in Australia to use as proxy companies.

Despite the fact these firms operate overseas, the ACCC identified these companies as the best proxy companies to use to estimate ARTC's exposure to systematic risk. The proxy companies chosen by the ACCC, principally operating in North America, typically have asset betas estimated at over 0.65 under the assumption of a zero debt beta as shown in Table 39 below.

However, the ACCC acknowledged that these operators may operate under slightly different conditions to ARTC, which may slightly increase their systematic risk relative to ARTC. In particular, North American railways may have higher market risk because they often compete with one another due to parallel infrastructure. Despite this, on balance the ACCC considered that North American and other overseas rail operators' asset betas generally support ARTC's argument for an asset beta of 0.65 for its Interstate Rail Network.

The ACCC's chosen beta comparators for ARTC's interstate network are presented in Table 39.

[192] ACCC (2008), p.154.

Table 39 **Comparison firms' equity and asset beta estimates**

| | Equity Beta | D/E ratio % | Asset Beta |
|---|---|---|---|
| Burlington Santa Fe Corporation | 0.969 | 41 | 0.69 |
| Canadian National Railway Company | 0.62 | 46 | 0.43 |
| Canadian Pacific Railway Limited | 0.793 | 32 | 0.60 |
| CSX Corporation | 0.822 | 72 | 0.48 |
| Genesee & Wyoming Inc | 1.54 | 28 | 1.21 |
| Kansas City Southern | 1.241 | 72 | 0.73 |
| RailAmerica | 1.498 | 133 | 0.65 |
| Union Pacific Company Limited | 1.097 | 38 | 0.80 |
| Simple Average | 1.0725 | 57.75 | 0.70 |

**Note:** Equity Betas were estimated using Bloomberg using 5 years of monthly data. The debt to equity ratio is the estimated average debt to equity ratio over the beta estimation period and was the debt to equity ratio used for delivering the equity betas. Equity betas were delivered using the Monkhouse formula.

**Source:** Bloomberg

Finally, the ACCC noted that ARTC operates under some market demand and price constraints due to inter-modal competition. This is the principle reason it operates well below its revenue ceiling on major segments. As such, it bears some market risk and if the economy does badly (or well) ARTC will lose (or gain) business and profits. This is different to a typical regulated business, such as electricity distribution or transmission, that can simply raise prices if demand drops and, therefore, bears far lower market risk.

While the ACCC considered that an asset beta of 0.65 is broadly acceptable for ARTC's interstate network, it noted this conclusion would not necessarily apply to other rail networks nor would it necessarily hold for a future regulatory review in the future.

## E.2 ERA – Arc Infrastructure, Pilbara railways and Public Transit Authority

The ERA establishes WACC estimates for Arc Infrastructure (formerly Brookfield Rail), the Pilbara railways and the Public Transit Authority.[193]

The Authority notes that choosing a relevant benchmark sample for these three entities is difficult due to the lack of close comparators of rail infrastructure trading on the Australian Stock Exchange. Only one directly comparable company is available in Australia, Aurizon, which was floated on the ASX in July 2010 as QR National. A single comparable firm leaves the Authority with an insufficient sample on which to estimate regulated cost of capital parameters.

[193] ERA (2015a).

The Authority is of the view that estimates of asset beta based on benchmark samples should ideally be relevant to the regulated rail businesses in Western Australia. In this context, the Authority considers that two aspects of relevance to a benchmark entity should be considered.

First, estimates of asset beta from the benchmark samples should provide some relevance to the economy in which the BEE is operating (in this case, the Australian economy). Second, these estimates should also provide some relevance to the industry/sector in which the efficient benchmark entity is operating (in this case, the rail industry).

The Authority considers that a benchmark sample including only Australian businesses that are comparable with rail is preferred for the purposes of its empirical studies. However, the Authority's analysis indicates that there are insufficient rail businesses comparators operating in Australia. Given empirical estimates are the only viable option for estimating the asset beta for rail businesses, the Authority is of the view that a benchmark sample including both Australian and developed countries in Europe and America is appropriate.

In this context, the ERA follows the same structured process to determine its beta comparators for each of these regulated entities, which entails first identifying Australian comparators and then due to an insufficiently small sample, extending its search to include the most comparable international entities.

### E.2.1 Brookfield Rail (2015)

The Brookfield Rail network in the south-west of Western Australia is a freight rail network that primarily transports commodities such as iron ore, grain, coal, alumina and interstate freight.

The Authority considers that a firm must satisfy the following conditions in order to belong to the Brookfield Rail benchmark sample:

- primarily involved in the transportation of goods across comparable distances;
- located in Australia or a similar developed economy;
- involved in the transportation of similar commodities to those transported on the Brookfield Rail network (that is, bulk goods, but also general freight).

The ERA indicates that it applies the following filters in the Bloomberg terminal using the Equity Screening function, such that the comparator firm must:

- operate in an OECD country that has similar political, economic and geographical similarities to Australia;
- belong to the ICB Subsector: Railroads; and
- provide sufficient pricing data to allow calculation of its equity beta and gearing.

In addition, the Authority has included comparator companies that were included in its previous WACC determinations for the Brookfield Rail network.

The Authority considers that Aurizon is the closest comparator company to the Brookfield Rail network in respect of its Australian operations and transport task. It is also listed. However, the regulatory regime differs between Brookfield and Aurizon in that Brookfield is subject to a negotiate-arbitrate regulatory regime, while the Aurizon network is subject to a revenue cap system. In addition, the use of only one comparator company may not adequately capture the risks faced by the Brookfield Rail network.

The Authority has previously accepted advice that Australian and New Zealand transport companies are relevant to inform the required equity beta, credit rating and gearing for the Brookfield Rail network. However, it considers non-rail operators to be less relevant proxy companies compared to rail network operators. Nevertheless, they provide some information of value, particularly given the small size of the sample, so are retained.

The ERA's beta comparators are presented in the following table.[194] This sample of 11 comparators is reduced from the 15 comparators used in its rate of return decisions prior to 2015. The Authority removed Auckland Airports and Infratil (a NZ investment fund with investments in energy, transport and social infrastructure businesses) from the pre-2015 benchmark sample, as well as Macquarie Infrastructure Group. Aurizon Holdings has been added to the sample.

Table 40 Comparator companies for Brookfield Rail

| Company Name | Country | Ticker | Company Description |
|---|---|---|---|
| Genesee & Wyoming | United States | GWR US Equity | Genesee & Wyoming Inc., through its subsidiaries, owns and operates short line and regional freight railroads and provides related rail services. The company also provides railroad switching and related services to United States industries with extensive railroad facilities within their complexes. Genesee operates in the United States and Australia. |
| Union Pacific Corporation | United States | UNP US Equity | Union Pacific Corporation is a rail transport company. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products. Union Pacific offers long-haul routes from all major West Coast and Gulf Coast ports to eastern gateways as well as connects with Canada's rail systems and serves the major gateways to Mexico. |

[194] ERA (2015a).

| Company Name | Country | Ticker | Company Description |
|---|---|---|---|
| Norfolk Southern Corporation | United States | NSC US Equity | Norfolk Southern Corporation provides rail transportation services. The Company transports raw materials, intermediate products and finished goods primarily in the Southeast, East and Midwest and, via interchange with rail carriers, to and from the rest of the United States. Norfolk Southern also transports overseas freight through several Atlantic and Gulf Coast ports. |
| Kansas City Southern | United States | KSU US Equity | Kansas City Southern, through its subsidiary, is the holding company for transportation segment subsidiaries and affiliates. The Company operates a railroad system that provides shippers with rail freight services in commercial and industrial markets of the United States and Mexico. |
| CSX Corporation | United States | CSX US Equity | CSX Corporation is an international freight transportation company. The Company provides rail, intermodal, domestic container-shipping, barging, and contract logistics services around the world. CSX's rail transportation services are provided principally throughout the eastern United States. |
| Canadian Pacific Railway | Canada | CP CN Equity | Canadian Pacific Railway Limited is a Class 1 transactional railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centers in the United States Midwest and Northeast. |
| Canadian National Railway | Canada | CNR CN Equity | Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulphur, and fertilizers, intermodal, and automotive products.<br>Canadian National operates a fleet of locomotives and rail cars. |
| Toll Holdings Limited | Australia | TRH NZ Equity | Toll NZ Ltd. Provides freight transport and distribution services. The Company offers transportation, long-haul bulk freight, warehousing and freight forwarding services. Toll NZ also operates passenger and freight transport vehicles that provides relocation and priority delivery services. Toll NZ conducts its business in New Zealand and Internationally. |
| Aurizon Holdings | Australia | AZJ AU Equity | Aurizon Holdings Ltd. is a rail freight company. The Company provides coal, bulk and general freight haulage services, operating on the Central Queensland Coal Network (CQCN) and including specialised track maintenance and workshop support functions. |
| Asciano Limited | Australia | AIO AU Equity | Asciano Limited is a provider of essential transport services in the rail and ports and stevedoring industries in Australia and New Zealand. The Company operates container terminals, bulk export facilities and container and bulk rail haulage services. |
| Port of Tauranga | New Zealand | POT NZ Equity | Port of Tauranga Limited activities include the provision of wharf facilities, back up land for the storage and transit of import and export cargo, berthage, cranes, tug and pilotage services for exporters, importers and shipping companies and the leasing of land and buildings. The Group also operates a container terminal and has bulk cargo marshalling operations. |

**Source:** Bloomberg, ERA Analysis.

Finally, the Authority's a priori expectation is that overseas rail operators will possess a higher level of risk, relative to an Australian railway operator, as American and Canadian railway operators for example are expected to face higher degrees of competition from alternative forms of transportation, such as roads. The Authority indicates it will therefore employ significant regulatory discretion when determining appropriate benchmark parameters for the Brookfield Rail network, with a view that its risks are at the lower end of overseas railway operators, and at the higher end of Australian and New Zealand transport companies.

The Authority estimates the asset beta for the Brookfield Rail network as being 0.7. Utilising the estimated gearing of 25 per cent, this corresponds to an equity beta of 0.9.

### E.2.2 TPI (2015)

The TPI railway transports iron ore from Fortescue Metal Groups (FMG) Cloud Break iron ore mine in the East Pilbara to TPI's port facilities at Anderson Point, Port Hedland.

Of the three Western Australian rail networks, TPI has the least number of direct comparators. Unlike, the PTA and Brookfield Rail, TPI lacks diversification and exclusively services the mining industry exposing it to the relatively high volatility of minerals markets.

The Authority notes that TPI's reliance on a single commodity – iron ore – transported across one large distance, significantly differentiates it from the Brookfield Rail network. As a consequence, not all of the companies in the Brookfield sample are appropriate as comparators to TPI. The Authority considers that only Aurizon in Australia supplemented by overseas railway operators are able to adequately capture the risks faced by the TPI rail network.

Furthermore, the Authority considers that due to TPI's exposure to only a limited number of potential users in the mining industry, TPI's risks are likely to be at the upper end of those faced by the companies contained in the benchmark sample. At the same time, the Authority considers that the US short-line rail operator Genesee & Wyoming Inc. is likely to be the best comparator for TPI. This is primarily due to Genesee & Wyoming Inc. operating class II/III short railway lines, including a number of similar lines in Australia.

The ERA's beta comparators are presented in Table 41.

Table 41 Comparator companies for TPI Network

| Company Name | Country | Ticker | Company Description |
|---|---|---|---|
| Aurizon Holdings | Australia | AZJ AU Equity | Aurizon Holdings Ltd is a rail freight company. The Company provides coal, bulk and general freight haulage services, operating on the Central Queensland Coal Network (CQCN) an including specialised track maintenance and workshop support functions. |
| Genesee & Wyoming Inc. | United States | GWR US Equity | Genesee & Wyoming Inc., through its subsidiaries, owns and operates short line and regional freight railroads and provides related rail services. The company also provides railroad switching and related services to United States industries with extensive railroad facilities within their complexes. Genesee operates in the United States and Australia. |
| Union Pacific Corporation | United States | UNP US Equity | Union Pacific Corporation is a rail transportation company. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products. Union Pacific offers long-haul routes from all major West Coast and Gulf Coast ports to eastern gateways as well as connects with Canada's rail systems and serves the major gateways to Mexico. |

| Company Name | Country | Ticker | Company Description |
|---|---|---|---|
| Norfolk Southern Corporation | United States | NSC US Equity | Norfolk Southern Corporation provides rail transportation services. The Company transports raw materials, intermediate products, and finished goods primarily in the Southeast, East, and Midwest and, via interchange with rail carriers, to and from the rest of the United States. Norfolk Southern also transports overseas freight through several Atlantic and Gulf Coast ports. |
| Kansas City Southern | United States | KSU US Equity | Kansas City Southern, through its subsidiary, is the holding company for transportation segment subsidiaries and affiliates. The Company operates a railroad system that provides shippers with rail freight services in commercial and industrial markets of the United States and Mexico. |
| CSX Corporation | United States | CSX US Equity | CSX Corporation is an international freight transportation company. The Company provides rail, intermodal, domestic container-shipping, barging, and contract logistics services around the world. CSX's rail transportation services are provided principally throughout the eastern United States. |
| Canadian Pacific Railway | Canada | CP CN Equity | Canadian Pacific Railway Limited is a Class 1 transcontinental railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centres in the United States Midwest and Northeast. |
| Canadian National Railway | Canada | CNR CN Equity | Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulphur, fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars. |

**Source:** Bloomberg Terminal, ERA Analysis

The Authority considers that an asset beta of 1.05 reflects the higher risks associated with the returns of the TPI network. When combined with the estimated gearing of 0.2, this results in an equity beta of 1.3.

### E.2.3 Public Transit Authority (PTA) (2015)

The Authority considers that a firm must satisfy the following in order to belong to the PTA benchmark sample:

- provide a service similar to passenger rail, for example toll road or commercial passenger transportation companies;
- be located in Australia or a similar OECD economy;
- be mature, hence have limited growth opportunities;
- be of similar size to the PTA.

The Authority has used the Bloomberg terminal in order to identify comparable companies for the PTA. The following filters were applied in the Bloomberg terminal using the Equity Screening function. Selected companies will:

- belong to the OECD;

- provide a reference service similar to that of the PTA (toll roads and/or commercial passenger transportation across suburban areas);
- be well established with limited growth opportunities; and
- have sufficient pricing data in order to estimate equity beta and gearing.

The ERA's beta comparators for the PTA are presented in Table 42.

Table 42 Comparator companies for PTA as returned by Bloomberg

| Company Name | Country | Bloomberg Ticker | Company Description |
|---|---|---|---|
| Transurban Group | Australia | TCL AU Equity | Transurban Group is involved in the operation of the Melbourne City Link and the Hills Motorway M2 toll roads. The Group is also involved in developing and operating electronic toll systems. |
| Atlantia SPA | Italy | ATL IM Equity | Atlantia S.P.A is a holding company with responsibility for portfolio strategies in the transport and communications infrastructures and network sectors. |
| Vinci SA | France | DG FP Equity | Vinci SA builds roads, offers electrical, mechanical and civil engineering and construction services, and operates toll roads. The Company builds and maintains roads and produces road construction materials, builds electricity and communications networks, installs fire protection and power and ventilation systems, and operates toll highways, bridges, parking garages, and a stadium. |
| Abertis Infraestructuras S.A | Spain | ABE SM Equity | Abertis Infraestraucturas S.A is an international group which manages mobility and telecommunications infrastructures through three business areas: toll roads, telecommunications infrastructure and airports. The group is present in Europe and the Americas. |
| Macquarie Atlas Roads Group | Australia | MQA AU Equity | Macquarie Atlas Roads Group manages toll roads. The Company operates toll highways in the United Kingdom, France and the United States. |

**Source:** Bloomberg Terminal, ERA Analysis.

Given the low level of systematic risk for the PTA rail network, the Authority considers that an asset beta of 0.3 is appropriate. Utilising the estimated gearing of 50 per cent, this corresponds to an equity beta of 0.6.

## E.3 **ERA's pre**-2015 beta comparators for Brookfield Rail (freight)

Based on advice from Allen Consulting Group, ERA used the following sample of Australian and international beta comparators in its rate of return decisions between 2008 and 2015.[195] A key difference in the comparator set adopted in 2008 relative to 2015 was the inclusion of airports in the former sample.

[195] Allen Consulting Group (2007). Railways (Access) Code 2000: Weighted average cost of capital, 2008 WACC determinations, October, pp.28-29.

Table 43 Relative asset and equity betas of US comparator firms

| Company | Country | Raw Equity Beta | Debt/assets ratio | Asset beta |
|---|---|---|---|---|
| Kansas City Southern | US | 1.23 | 0.70 | 0.74 |
| Union Pacific Corporation | US | 0.81 | 0.38 | 0.59 |
| RailAmerica Inc | US | 1.61 | 1.32 | 0.69 |
| CSX Corporation | US | 1.15 | 0.77 | 0.65 |
| Burlington Northern Santa Fe | US | 1.07 | 0.43 | 0.75 |
| **Average** | | | | **0.69** |

**Source:** Bloomberg, ACG Analysis

Table 44 Relative asset and equity betas of US comparator firms

| Company | Country | Raw Equity Beta | Debt/assets ratio | Asset beta |
|---|---|---|---|---|
| Canadian Pacific Railway Ltd | Canada | 0.956 | 0.48 | 0.65 |
| Canadian National Railway Company | Canada | 1.023 | 0.28 | 0.80 |
| **Average** | | | | 0.73 |

**Source:** Bloomberg, ACG Analysis

Table 45 Relative asset and equity betas of Australian comparator transport sector firms

| Company | Country | Raw Equity Beta | Debt/assets ratio | Asset beta |
|---|---|---|---|---|
| Adsteam Marine Limited | Australia | 1.238 | 0.90 | 0.65 |
| Macquarie Infrastructure Group | Australia | 0.745 | 0.31 | 0.57 |
| Patrick Corporation Ltd | Australia | 1.056 | 0.07 | 0.99 |
| Toll Holdings Limited | Australia | 0.869 | 0.22 | 0.71 |
| **Average** | | | | **0.73** |

**Source:** Bloomberg, ACG Analysis

Table 46 Relative asset and equity betas of New Zealand comparator transport sector firms

| Company | Country | Raw Equity Beta | Debt/assets ratio | Asset beta |
|---|---|---|---|---|
| Auckland International Airport Ltd | New Zealand | 0.944 | 0.26 | 0.75 |
| Infratil Ltd | New Zealand | 1.29 | 0.65 | 0.78 |
| Port of Tauranga Ltd | New Zealand | 0.873 | 0.31 | 0.67 |
| Toll NZ Ltd | New Zealand | 0.773 | 0.72 | 0.45 |
| **Average** | | | | **0.66** |

**Source:** Bloomberg, ACG Analysis

# F Market risk premium – Supplementary information

The purpose of this attachment is to provide further details of regulatory precedent and market survey evidence in regard to the market risk premium.

## F.1 Regulatory decisions on the MRP

Brief summaries of Australian regulators' approaches to estimating the MRP are presented below.

*IPART*

IPART derives its feasible WACC range from a range based on long run averages and a range based on current market data.

Under this approach, it will still use long run historical averages of the MRP, which it values at between 5.5% and 6.5%, to estimate its long run average WACC range. Its current WACC range reflects the current implied MRP, which is derived from DGM estimates.

In its most recent semi-annual update for February 2018, IPART's range for the MRP extends from 6.0% (mid-point of long term average range) to 9.1% (mid-point of current range), with a mid-point of the two ranges of 7.6%.[196]

However, IPART's MRP estimate as a margin above the contemporary risk-free rate is likely to be greater than this reported value because of the higher risk-free rate assumed in its approach (3.3%, due to its 50% weighting on the 10-year risk-free rate estimate).

*ERA (WA)*

In 2015, the ERA completed a review of the methodology it applies to estimate the WACC for rail networks. In its first Draft Determination for this review released in June 2014, the ERA's assessment of the MRP was primarily informed by historical averages and the DGM.[197] It arrived at a range of 5% to 7.5% and stated that it will apply judgement as to where it will select the point estimate at any point in time. For that Draft Determination, it proposed a value of 6%.

[196] IPART (2018b), p.2.

[197] ERA (2014a). Review of the method for estimating the weighted average cost of capital for the freight and urban rail networks, Draft determination, 5 June.

Subsequently, the ERA fundamentally changed its approach to estimating the MRP for rail networks. In a revised Draft Decision issued in November 2014, it proposed to solely rely on the Wright approach.[198] The ERA further revised its position in the Final Decision issued in September 2015 and took into consideration estimates informed by historical excess returns (Ibbotson and Wright) and DGMs.[199] It stated it is more inclined towards the Wright approach as "a strong indicator for the likely return on equity for the next 50 years, given the statistical evidence for the mean reversion of the return on equity."[200] It arrived at a final estimate of 7.3%.

It took a similar approach in its assessment for ATCO Gas, where it applied an MRP of 7.6%.[201] It applied an updated value of 7.4% in its most recent determination for the Dampier to Bunbury Pipeline.[202] In its June 2015 decision for ATCO, the ERA commented on its approach as follows:[203]

> Most significantly, the Authority has now concluded that it is not reasonable to constrain the MRP to a fixed range over time. The erratic behavior of the risk-free rate in Australia to date, and more particularly, its pronounced decline in the current economic environment, leads to a situation where the combination of a fixed range for the MRP and prevailing risk-free rate may not result in an outcome which is consistent with the achievement of the average market return on equity over the long run.
>
> The results indicated the market return on equity was stationary [consistent with the Wright approach for estimating the MRP] ... with the analysis supporting a conclusion that the MRP is non-stationary. This finding led the Authority to the important conclusion that the long run historical estimate of 6 per cent could be a poor predictor of the MRP prevailing in future regulatory periods.

We note that the changing values applied by the ERA primarily reflect changes in the DGM estimates, which are more volatile through time (compared with comparatively stable historical excess returns).

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198 ERA (2014b). Review of the method for estimating the weighted average cost of capital for the regulated railway networks, Revised draft decision, 28 November.

199 ERA (2015a).

200 ERA (2015a), p.145.

201 ERA (2015b). Final decision on proposed revisions to the Access Arrangement for the Mid-West and South-West gas distribution systems, Submitted by ATCO Gas Australia Pty Ltd, 30 June.

202 ERA (2016). Final decision on proposed revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020, 30 June.

203 ERA (2015b), p.249.

*AER*

Under the AER's Rate of Return Guideline, the AER is proposing to estimate the MRP having regard to historical excess returns, DGM estimates, survey evidence and conditioning variables.[204] The key difference from previous approaches is that it may place some weight on forward-looking DGM estimates, which could see more variability in the MRP estimate through time. Unlike previously, the AER has not stipulated the value of the MRP in the Guideline but will review it at the time of each revenue determination.

In its Explanatory Statement accompanying its Final Decision on the Guideline[205], the AER arrived at a range for the MRP of 5% to 7.5% (with historical averages informing the lower bound and DGM estimates the upper bound). It arrived at a point estimate of 6.5%, which was consistent with its post-GFC uplift previously applied under its Statement of Regulatory Intent. It set out its reasons based on the consideration of the relative strengths and weaknesses of each piece of evidence. It did not stipulate weights but stated that "greatest consideration" was given to historical averages, followed by the DGM estimates and then surveys.[206]

Unlike previously, the AER has not prescribed the MRP in its guideline, which reflects a view that it is likely to vary through time (although this does not imply that it is considered highly variable or volatile). However, it has consistently applied a MRP of 6.5% in all decisions made under that guideline since it was finalised in December 2013.

*QCA*

Until recently, the QCA has applied four main methods to estimate the MRP, being three forms of historical averaging (the Ibbotson, Siegel and Wright methods), survey evidence (including independent expert reports) and the Cornell DGM.

It had previously applied equal weights to each approach but similar to the AER, proposes a more flexible approach based on judgement. It concluded that 6.5% was the most appropriate value at the time and it has continued to apply this value in decisions made since then, including its most recent Draft Decision for DBCT, where it rejected DBCT Management's proposed MRP of 8%.[207]

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[204] The AER does not explain what it means by 'conditioning variables'.

[205] AER (2013b).

[206] AER (2013b), p.95.

[207] QCA (2016). DBCT Management's 2015 draft access undertaking, Draft decision, April.

However, in its UT5 draft decision for Aurizon Network in December 2017, the QCA approved Aurizon Network's proposed MRP of 7%. The QCA stated that it in light of stakeholder submissions, it reviewed its position on the Wright approach and will now give "more regard to estimates from the Wright method".[208] In reaching this conclusion, the QCA noted that its analysis suggesting greater stability in the MRP than the return on equity over time was "not determinative, given the limitations identified."[209]

*ESCOSA*

In its June 2016 for SA Water, ESCOSA applied a MRP of 6%, expressing a preference for historical excess returns. It considers that the DGM approach is "potentially volatile and unreliable." It also notes that this is the value it has applied to SA Water in previous determinations.

*Essential Services Commission (Vic)*

The ESC does not have any formal guidelines in place that outline its approach to assessing WACC.

We note that in its June 2016 Melbourne Water decision it applied a MRP of 6%, which was originally contained in a Guidance Paper.[210] The reasoning behind this was not provided. It reflects a preference for relying on historical excess returns to estimate the MRP.

## F.2 Market surveys

*Fernandez's surveys*

Of the surveys frequently cited by regulators is one conducted by the Spanish academic Pablo Fernandez. Frontier Economics (2016) raises the concern that this source consistently reports an MRP in the range of 6%, regardless of the conditions in financial markets.[211]

[208] QCA (2017), p.493.

[209] QCA (2017), p.493.

[210] ESC (2015). Melbourne Water 2016 price review, Guidance paper, March. We note that 6% was also applied to Goulburn Murray Water in its June 2016 decision, although for a different reason, which was the need for consistency with the ACCC's Pricing Principles for Price Determinations and Approvals under the Water Charge (Infrastructure) Rules 2010. These Pricing Principles prescribe an MRP of 6%.

[211] Frontier Economics (2016). The market risk premium: Report prepared for Aurizon Network, November.

However, in the 2017 Fernandez et al. survey, the average (median) MRP was estimated to be 7.3% (7.6%) for Australia.[212] However, in a report for the QCA, Lally (2017) argued that this Australian MRP estimate was higher than any other developed country in the survey (other than Portugal) and that the sample size was relatively small (26 responses, roughly one third of the previous year's responses).[213] Thus, there are substantial issues regarding how much weight can be placed on evidence from market surveys.

Respondents were identified as finance and economics professors, analysts and managers of companies obtained from previous correspondence, papers and webs of companies and universities, but there is no further information presented about the specific qualifications of these respondents. The survey does not ask respondents for what purpose they are using their estimate of the MRP.

Lally (2013) notes that "the respondents to these surveys are academics, analysts, and managers rather than investors per se."[214] Hence it is unlikely that the overwhelming majority of any of the survey respondents would be employing their estimate of the MRP to reach real-world investment decisions.

Another issue relates to response rates. Emails were sent to 22,500 email addresses with 2,396 emails received in reply. Whilst this is probably a reasonable response rate for an international survey, there is no real indication of how the non-response may impact upon the results.

On top of this, there is evidence that many respondents may simply base their estimates on textbooks or historical data, meaning that there is often no real value added compared to other measurements.

*Asher and Hickling Surveys*

Regulators including the ACCC also rely upon the Asher and Hickling *Equity Risk Premium Surveys*. In a summary of the survey results, Asher and Carruthers (2016) discuss the methods that survey respondents use for determining their MRP estimates:[215]

> Most people (52%) used a variety of methods for determining the equity risk premium, with forward looking measures (21%) more prevalent than historical data

[212] Fernandez, P., Pershin, V. & Acin, I.F. (2017). Discount rate (risk-free rate and market risk premium) used for 41 countries in 2017: a survey.

[213] Lally, M. (2017). Review of submissions from Frontier Economics on the WACC for Aurizon Network. 8 November, p.19

[214] Lally M. (2013), p.23.

[215] Asher A. and Carruthers, D. (2016). Equity risk premium survey 2015, Actuaries Digital, Available from: https://www.actuaries.digital/2016/05/26/equity-risk-premium-survey-2015/ [Accessed 4 May 2017].

> (17%) for the rest. The methodology for determining the ERP ranged from detailed modelling to "gut feel based on 40 years' experience". Gut feel has a bad name in some quarters … but only time will tell which method proves to be most accurate.

*KPMG Australian Valuation Practices Survey*

With regard to the KPMG *Australian Valuation Practices Survey*, 40% of participants state that they 'always' adjust the CAPM rate of return by a premium, to reflect unique risks that are not modelled in the forecast cash flows.[216] The remaining 60% report doing this at least 'sometimes', while no respondent stated that they 'never' make an adjustment. In terms of the methodology used to adjust the CAPM rate of return, 13% of respondents relied solely on the historic equity bond spreads, 26% relied solely on the expected premium, while the majority (61%) used a combination of the two.

The Australian Competition Tribunal has also raised concerns about the use of market surveys:[217]

> Surveys must be treated with great caution when being used in this context. Consideration must be given at least to the types of questions asked, the wording of those questions, the sample of respondents, the number of respondents, the number of non-respondents and the timing of the survey. Problems in any of these can lead to the survey results being largely valueless or potentially inaccurate.
>
> When presented with survey evidence that contains a high number of non-respondents as well as a small number of respondents in the desired categories of expertise, it is dangerous for the AER to place any determinative weight on the results.

In a report to Corrs Chambers Westgarth, McKenzie and Partington list several shortcomings associated with surveys:[218]

- Selecting an appropriate survey group that is representative of actual investors.
- Low response rates, and the extent to which survey authors deal with response bias.
- The lack of justification for respondents' claims
- The effect of question wording on responses – ambiguity can lead to diverse responses

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[216] KPMG (2015). Australian valuation practices survey 2015, May, p.21.

[217] Application by Envestra Ltd (No 2) [2012], ACompT 3, para. 162-163.

[218] McKenzie, M. and Partington, G. (2011), p.19.

- How respondents adjust their opinions in relation to changing market conditions

*Synergies' view*

Based on the above expert opinions, we surmise that surveys need to meet three broad criteria to provide an informed estimate of the MRP:

- they must be timely;
- there must be clarity around what question the respondents were asked to answer; and
- the survey must gauge the market's view of the MRP and not the view of a small, unrepresentative sample.

Whilst open to interpretation, there appear to be very limited circumstances where a survey would meet all three criteria and therefore would be eligible for inclusion in a robust regulatory determination on the MRP.

# G Listed comparator WACC methodology

This attachment provides further detail on the methodology for the Bloomberg-generated listed comparator WACC estimates that we presented in Section 12.2.2.

## G.1 Country risk premium

Bloomberg calculates country-specific market risk premium estimates. Bloomberg estimates do not provide full transparency, but the country risk premium is calculated as the return on the domestic market less the risk-free rate. The return on equity is therefore calculated as the risk-free rate plus the country risk premium multiplied by the equity beta.

## G.2 Return on debt

Bloomberg calculates the return on debt for each company by multiplying the risk-free rate by a debt adjustment factor. The debt adjustment factor is proprietary, but is described by Bloomberg as a debt premium specific to the credit-rating of the company. Because the risk-free rate in Japan and European countries remains low, it appears that this approach may underestimate the true return on debt for these companies. This makes the WACC estimates, especially for the port and airport samples, more conservative in nature.

## G.3 Bloomberg-generated WACC estimates

Pre-tax WACC estimates for North American Class I railroads and OECD ports and airports have been calculated using country specific corporate tax rates. We have used our estimated Fama-French betas for each company, as well as our zero-beta premium estimate for the Black CAPM, to generate multi-model WACC estimates for each of the comparators, so that the estimates are directly comparable to our WACC estimate for PoM. PoM's WACC margin is 8.78%, which is below the Class I railroad WACC margin, and similar to the OECD Ports WACC margin.

Table 47 North American Class I railroad WACC estimates

| | Bloomberg country risk premium | Bloomberg return on debt | Pre-tax nominal WACC | Risk-free rate | WACC margin |
|---|---|---|---|---|---|
| CSX Corporation | 7.08% | 3.90% | 14.25% | 2.85% | 11.40% |
| Kansas City Southern | 7.08% | 4.10% | 11.95% | 2.85% | 9.10% |
| Genesee & Wyoming | 7.08% | 4.50% | 15.57% | 2.85% | 12.72% |

| | Bloomberg country risk premium | Bloomberg return on debt | Pre-tax nominal WACC | Risk-free rate | WACC margin |
|---|---|---|---|---|---|
| Norfolk Southern Corporation | 7.08% | 3.90% | 14.31% | 2.85% | 11.46% |
| Union Pacific Corporation | 7.08% | 3.60% | 12.52% | 2.85% | 9.67% |
| Canadian Pacific Railway | 9.34% | 3.60% | 14.09% | 2.14% | 11.95% |
| Canadian National Railway Company | 9.34% | 3.00% | 10.43% | 2.14% | 8.29% |
| **Average** | | | **13.30%** | | **10.66%** |
| **Median** | | | **14.09%** | | **11.40%** |

**Source:** Bloomberg, Synergies calculations

Table 48 OECD Marine Ports and Services WACC estimates

| | Bloomberg country risk premium | Bloomberg return on debt | Pre-tax nominal WACC | Risk-free rate | WACC margin |
|---|---|---|---|---|---|
| Qube Holdings | 6.04% | 2.40% | 11.08% | 2.70% | 8.38% |
| Port of Tauranga | 6.01% | 2.20% | 8.94% | 2.86% | 6.08% |
| Hamburger Hafen und Logistik | 9.20% | 0.50% | 9.59% | 0.57% | 9.02% |
| Piraeus Port Authority | 9.44% | 0.50% | 7.63% | 0.57% | 7.06% |
| Thessaloniki Port Authority | 9.44% | 0.00% | 8.87% | 0.57% | 8.30% |
| Sociedad Matriz SAAM | 7.47% | 3.20% | 13.42% | 4.55% | 8.87% |
| Luka Koper | 12.75% | 1.00% | 12.60% | 0.57% | 12.03% |
| Isewan Terminal Service | 10.95% | 0.00% | 5.94% | 0.04% | 5.90% |
| Sakurajima Futo Kaisha | 10.95% | 0.10% | 14.48% | 0.04% | 14.44% |
| Rinko Corporation | 10.95% | 0.00% | 6.18% | 0.04% | 6.14% |
| Dongbang Transport Logistics | 11.61% | 2.80% | 9.26% | 2.64% | 6.62% |
| **Average** | | | **9.82%** | | **8.44%** |
| **Median** | | | **9.26%** | | **8.30%** |

**Source:** Bloomberg, Synergies calculations

Table 49 OECD airport WACC estimates

| | Bloomberg country risk premium | Bloomberg return on debt | Pre-tax nominal WACC | Risk-free rate | WACC margin |
|---|---|---|---|---|---|
| Sydney Airport | 6.04% | 3.30% | 6.59% | 2.70% | 3.89% |
| Auckland Airport | 6.01% | 2.80% | 10.77% | 2.84% | 7.93% |
| Copenhagen Airport | 12.45% | 1.10% | 8.75% | 0.63% | 8.12% |
| Vienna Airport | 10.67% | 0.70% | 6.96% | 0.78% | 6.18% |
| Zurich Airport | 10.47% | 0.10% | 7.13% | 0.08% | 7.05% |
| Frankfurt Airport | 9.23% | 0.50% | 5.59% | 0.58% | 5.01% |
| Paris Airports | 8.35% | 0.60% | 5.13% | 0.82% | 4.31% |
| Grupo Aeroportuario del Centro Norte (Mexico) | 6.96% | 7.50% | 17.55% | 7.55% | 10.00% |
| Grupo Aeroportuario del Sureste (Mexico) | 6.96% | 8.40% | 17.01% | 7.55% | 9.46% |
| TAV Havalimanlari Holding (Turkey) | 2.33% | 9.70% | 18.48% | 12.78% | 5.70% |
| Japan Airport Terminal Co. | 10.78% | 0% | 12.31% | 0.04% | 12.27% |
| **Average** | | | **10.57%** | | **7.27%** |
| **Median** | | | **8.75%** | | **7.05%** |

**Source:** Bloomberg, Synergies calculations