
# Determining a WACC estimate for Port of Melbourne

A report prepared in context of the Pricing Order

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# Executive Summary

The purpose of this report is to provide an estimate on the return on capital for the Port of Melbourne (PoM) for its first regulatory period 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 (the Port of Melbourne or 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.

## 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 = pre-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 capital structure that would apply to a benchmark efficient entity for POM as an entity that is in the same industry with the same risk profile as PoM in its provision of Prescribed Services.

However, we have found there are insufficient comparable businesses listed in Australia that have similar risks to the assumed benchmark efficient entity. Consequently, it has been necessary for us to follow a well-accepted alternative for such situations and rely on international comparators with comparable risks.

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 benchmark efficient entity. We then reviewed the business description for each listed company in our international sample and eliminated companies that were not comparable to the benchmark efficient entity.

## 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 precedent acquisition comparators that include major landlord ports in Australia.

Our benchmark capital structure range extends from 20% (based on the average and median of 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 31%) consistent with our approach to deriving a point estimate from other estimated ranges.

## Combination of well-accepted cost of equity approaches

Based on academic recognition and empirical fit analysis, well established market practice in the finance industry as well as by Australian and international regulators, there are a range of 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 benchmark efficient entity for PoM's first regulatory period 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 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 2017. As the quoted rates are semi-annual, we have converted them to annual effective rates.[1] The resulting estimate is 2.81%.

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

*Beta*

An asset beta of 0.70 has been estimated based on:

- A first principles analysis to inform 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 set of comparable listed companies)
- 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 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 observable and 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. Accordingly, these difficulties led us to rely upon historical data using:

- the Ibbotson approach, which calculates the market risk premium 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 market risk premium 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.

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 market risk

premium is 7.77% based on the average 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 benchmark efficient entity based on the SL CAPM is 13.66%**.**

### 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 benchmark efficient entity based on the Black CAPM is 13.66%**.**

### 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;
- SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios; and
- HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth 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.

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

**Table 1 FFM equity betas and risk factor premiums**

| Risk factors | Estimated equity betas | Risk factor premiums |
|---|---|---|
| Market risk premium | 0.89 | 7.77% |
| High minus low cap premium | 0.29 | 6.05% |
| Small minus big premium | 0.16 | 1.77% |

**Source:** Synergies

Our estimate of the pre-tax return on equity for the benchmark efficient entity based on the FFM is 15.12%.

### 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 |
|---|---|---|
| 13.66% | 13.66% | 15.12% |

**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 an average of each estimate in Table 2 results in an estimated nominal pre-tax cost of equity for the benchmark efficient entity of 14.14%.

## 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 benchmark efficient 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.

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 the 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 used an average of these two 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 available under the Australian national energy framework, we consider that the choice between the on the day and trailing average approach is appropriately made by the regulated entity provided the calculation reflects an efficient benchmark.

Table 3 shows our cost of debt estimate for the benchmark efficient entity is 5.45%.

**Table 3 Return on debt estimate for benchmark efficient entity (assuming BBB credit rating)**

| Averaging period | RBA | Bloomberg | Average |
|---|---|---|---|
| BBB DRP based on 20 days to 31 March 2017 | 2.48% | 2.60% | 2.54% |
| Risk free rate based on 20 days to 31 March 2017 | 2.81% | 2.81% | 2.81% |
| Debt raising costs | 0.10% | 0.10% | 0.10% |
| **Return on debt** | **5.39%** | **5.51%** | **5.45%** |

**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 and expert reports), as well as Australian regulatory practice.

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

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 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, such as dividend drop-off studies (i.e. pre and post-dividend share prices) - which 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, an average of the three values (which are zero based on finance theory, 0.45 based on a non-market equity ownership approach and 0.25 based on market valuation studies) results in a gamma of 0.23, which we have rounded to 0.25.

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

## Synergies' WACC estimate

Our pre-tax nominal WACC estimate for the benchmark efficient entity for PoM's first regulatory period under the Pricing Order is 11.54%. This value is consistent with the Pricing Order and the objectives of the Port Management Act.

This 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 4 presents all key parameter values for our pre-tax nominal WACC estimate.

**Table 4 Pre-tax nominal WACC estimate**

| Parameter | SL-CAPM | Black | FFM |
|---|---|---|---|
| Risk Free Rate | 2.81% | 2.81% | 2.81% |
| Zero Beta Premium | | 3.34% | |
| Capital Structure | 30% | 30% | 30% |
| Debt risk premium | 2.54% | 2.54% | 2.54% |
| Debt raising costs | 0.1% | 0.1% | 0.1% |
| Market risk premium | 7.77% | 7.77% | 7.77% |
| Size (SMB) Premium | | | 1.77% |
| Value (HML) Premium | | | 6.05% |
| Asset beta (Market) | 0.7 | 0.7 | 0.62 |
| Asset beta (SMB) | | | 0.11 |
| Asset beta (HML) | | | 0.2 |
| Debt beta | 0 | 0 | 0 |
| Equity beta (Market) | 1.00 | 1.00 | 0.89 |
| Equity beta (SMB) | | | 0.16 |
| Equity beta (HML) | | | 0.29 |
| Gamma | 0.25 | 0.25 | 0.25 |
| Corporate Tax | 30% | 30% | 30% |
| Return on equity (post tax) | 10.58% | 10.58% | 11.72% |
| Return on equity (pre-tax) | 13.66% | 13.66% | 15.12% |
| Return on debt (pre-tax) | 5.45% | 5.45% | 5.45% |
| **Post tax nominal (vanilla) WACC** | **8.68%** | **8.68%** | **9.47%** |
| **Pre-tax nominal WACC** | **11.20%** | **11.20%** | **12.22%** |
| **Average pre-tax nominal WACC** | **11.54%** | | |

# 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 first Tariff Compliance Statement (TCS) to the Essential Services Commission (ESC) under the Pricing Order.

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

## 1.1 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 benchmark efficient entity 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 4.1.1, 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.

## 1.2 Interpretation of Pricing Order provisions

The relevant provisions of the Pricing Order give important discretions to 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 benchmark efficient entity 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.

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.

The remainder of this report is structured as follows:

- Chapter 2 – choice of WACC formulation
- Chapter 3 – assumed capital structure
- Chapter 4 – analyses alternative well-accepted return on equity models
- Chapter 5 - estimates the return on equity using the SL CAPM model
- Chapter 6 – estimates the return on debt
- Chapter 7 – estimates the value of gamma
- Chapter 8 – proposes a WACC estimate for the benchmark efficient entity
- Attachment A – presents gearing ratios for our comparable companies set
- Attachment B – provides additional information on the SL CAPM
- Attachment C – provides additional information on the Black CAPM
- Attachment D – provides additional information on the Fama-French Model
- Attachment E – presents our full list of asset beta estimates
- Attachment F – presents a more detailed first principles analysis used to inform our beta assessment

- Attachment G – summarises Australian regulatory precedent on beta determination
- Attachment H – presents supplementary information on market risk premium estimates.

# 2 WACC formulation

This chapter sets out the WACC formulation we have used in our analysis having regard to Pricing Order requirements.

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

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

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.[6]

## 2.1 Chosen WACC formulation

### 2.1.1 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 = post-tax return on debt

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

E = proportion of equity within the assumed capital structure

### 2.1.2 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:

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

Where:

Re = pre-tax return on equity

Rd = pre-tax return on debt

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

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 benchmark efficient entity 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.

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 benchmark efficient entity's tax liabilities.

## 2.2 Identifying an efficient benchmark efficient entity

Under incentive-based economic regulation, the WACC is set having regard to efficient benchmarks reflective of prevailing conditions in equity and debt markets.

### 2.2.1 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 benchmark efficient entity in the Pricing Order. Consequently, there is a need to identify the key characteristics of such an entity. This involves establishing a conceptual definition for the benchmark efficient entity. 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 potential comparator entities that could be used to identify appropriate comparator entities which best resemble the conceptual benchmark efficient entity.[7]

[7] ESC (2017). Regulatory Approach to the Pricing Order – A Consultation Paper

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 cargo
- are provided by a port in Australia.

In regards to comparator entities, the ESC recognises there are no publicly-listed ports in Australia. Accordingly, it suggested the following methodology:[8]

> 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.

### 2.2.2 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:[9]

> 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

[8] ESC (2017), p.40.

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

review also provided useful guidance on the reliance on international comparators in informing the assessment of the risk profile of a benchmark efficient entity, including the degree to which:[10]

- 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);
- 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 benchmark efficient entity'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:[11]

> 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 benchmark efficient entity:[12]

> …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

[10] ERA (2015), p.22.

[11] ERA (2015), p.24.

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

> 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 benchmark efficient entity must face the risks specific to the business it is intended to replicate and the efficiencies possessed by that benchmark efficient entity are those determined by a workably competitive market. If the relevant workably competitive market is an international one, then international comparators should be used.

### 2.2.3 Synergies' benchmark efficient entity definition

Given the above considerations, we consider the benchmark efficient port entity required to be identified by the Pricing Order is a freight-focussed private sector provider of the equivalent of the Prescribed Services with a market capitalisation above US$100m.

Further, this benchmark efficient entity 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 benchmark efficient entity would not earn revenue from other sources other than Prescribed Services (which would exclude property-related assets and activities).

Ideally, the benchmark efficient entity would have reference to landlord port businesses in Australia and internationally that provide a similar range of services to the Prescribed Services bundle and hence face comparable risks. However, in practice, there are no domestic or comparable listed port entities that provide comparable services, such that a sample could be constructed that reliably estimates a benchmark gearing ratio and equity beta for the benchmark efficient entity. Hence, this has required us to identify transport entities outside of the Australian and international port sector with a comparable risk profile with PoM's Prescribed Services.

The systematic approach we have taken in determining WACC parameter values for a benchmark efficient entity with comparable risks to PoM are discussed in more detail in Chapter 3 (capital structure) and Chapter 5 (return on equity) of our report.

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

### 2.3.1 Well accepted

Under clause 4.3.1, in determining its weighted average cost of capital, the Pricing Order requires PoM to "use one or a combination of well accepted approaches that distinguish the cost of equity and debt". Thus, this necessitates careful consideration of what the term "well accepted" means within the Pricing Order to inform our approaches on cost of equity, cost of debt, and the underlying WACC parameters including capital structure. In doing so we have reflected on the following key principles:

- Consistency with the Port Management Act 1995 objectives
- The inappropriateness of limiting the discretion available to PoM under the Pricing Order
- Reflecting the Pricing Order, which is drafted in an open way

*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".[13]

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

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 benchmark efficient entity should be valued given that the efficiencies referred to in 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, but 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 reinforced by the adoption of valuation and asset pricing models by each of these communities. Regulators have adopted models developed in academia and also adopted models used by financial practitioners. Financial practitioners have also adopted and adapted models developed in academia. This suggests that regulators themselves are borrowing knowledge and learnings from these other communities. It would be inappropriate for PoM to not be permitted to use these other approaches when regulators are permitted to and clearly do so. A failure to consider these broader models may result in a failure to achieve the efficiencies referred to in the objectives of the regulatory regime.

Accordingly, consistent with the objectives of the regulatory regime, a well-accepted approach is an approach adopted by one or more of regulators (both Australian and international), the financial community and academia.

*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. 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". It allows that, should PoM's interpretation of the Pricing Order be determined to be wrong as a matter of law, and that PoM is properly found to be in significant and sustained non-compliance, the form of regulation can change and a heavier handed approach put in place of the Pricing Order framework.

These features of the regulatory regime (per the final drafting of the Pricing Order) reflect the fact that the Victorian Parliament and the ESC Minister intended there to be greater discretion afforded to PoM in interpreting the 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 setting the prices for its Prescribed Services and 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 by Australian 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 in relation to the weighted average cost of capital by academia and the financial industry. 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 in Australia are yet to adopt it. It may be that those other regulators have not had the opportunity to adopt that model at the time that the Pricing Order requires PoM to assess what is well accepted due to the requirements of the

[14] ESC (2017), p 3

regulatory regimes that they administer. Preventing PoM from being able to consider these other well accepted approaches would lead to unnecessary delays in the adoption of the model and associated inefficiencies, which would be inconsistent with the objectives of the regulatory regime.

*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 regulatory regime 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.

The natural meaning of the phrase "well accepted" is not "well accepted by Australian regulators". It is not appropriate the meaning of the phrase to be circumscribed in the manner suggested by the ESC. Instead, the phrase is broad and permits an approach that is well accepted by international 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. 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 greater discretion is required when determining the parameters of 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 regulators in those instances opted not to change their approach. The Pricing Order has been drafted reflecting this trend. However, 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. It is therefore submitted that the ESC's assessment of the Port Licence Holder's compliance with the Pricing Order should be conducted in this context.

### 2.3.2 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 discretion afforded to PoM by the Pricing Order.

*Defining well accepted*

Summarising the above considerations, the phrase "well accepted" should be interpreted considering the objectives of the regime. The objectives refer to the achievement of efficiencies that are intended to reflect the operation of a workably competitive market. To achieve these objectives, consideration should extend beyond the approaches used by regulators (both Australian and international), to encompass the approaches used by the finance community and academia. All these groups are analysing and estimating the cost of capital to correctly price it in the context of a workably competitive market. It follows that all these views and models are relevant when considering what is "well accepted" for the purposes of the Pricing Order.

[15] ESC (2017) Regulatory approach to the Pricing Order – A Consultation Paper, Port of Melbourne Regulatory Regime, p 41

Excluding certain models may result in inefficiencies contrary to the objectives set out in section 49A of the *Port Management Act 1995* (Vic).

This view is reinforced by the broad language used in the Pricing Order that does not limit the phrase "well accepted" to only those approaches well accepted by Australian regulators. If this was intended, it could have been provided for. Instead, the broad language used should be given its natural meaning resulting in those approaches well accepted by one or more of regulators (both Australian and international), the finance community or academia being able to be adopted by PoM.

Furthermore, the Pricing Order deliberately gives PoM discretion to determine its weighted average cost of capital and the well accepted approach(es) to be used. There is no reason why this discretion should be limited and doing so would be inconsistent with the trend of providing broad discretion to regulators when determining the weighted average cost of capital in other regulatory regimes to consider more than one approach.

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

### 2.3.3 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. Consequently, we have applied the following methodology, consistent with the above Pricing Order principles outlined for our definition of well accepted.

In the event, we do not identify strong, compelling arguments to give more weight to one well accepted approach over another, 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. Each subsequent period PoM will need to reassess this averaging approach and the fundamental pros and cons of each to substantiate the weights applied.

# 3 Capital structure

## 3.1 Objective

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 benchmark efficient entity 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. 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 benchmark efficient entity.

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 benchmark entity 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 evidence from comparable entities followed by relevant regulatory precedent.

## 3.2 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 a benchmark efficient entity as a port services provider offering Prescribed Services, several key characteristics must be considered.

### 3.2.1 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 its services, (i.e. majority of trade originating from or destined for Melbourne metropolitan and greater Melbourne regions). However, PoM's revenues are inherently driven by and are affect by changes in economic activity both domestically and in Australia's trading partners. 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 recently completed by Infrastructure Victoria.

### 3.2.2 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.

### 3.2.3 Debt Serviceability

The assessment techniques of credit rating agencies also provide guidance on the characteristics of a benchmark efficient entity. In Moody's rating methodology for Privately Managed Port Companies, their considerations include, but are not limited to, the following:[16]

- Market Position:
  - How large is the port, and to what extent does it form an essential part of the local economy?

[16] Moody's (2016). Privately Managed Port Companies Rating Methodology, 15 September.

  - 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:
    - 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.

## 3.3 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 benchmark efficient entity under the Pricing Order. 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.

### 3.3.1 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 previously noted, this means 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.

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

### 3.3.3 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 benchmark efficient entity 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.

## 3.4 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.

## 3.5 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.

### 3.5.1 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). However, for the purposes of the gearing assessment, we have restricted the final sample to companies with a market capitalisation greater than US$100 million.

Gearing ratios (average and median ratios) for the entities comprising our comparator set 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 5 below and included the latest available credit ratings where possible.

**Table 5 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+ | 0.21 |
| ADSEZ | India | No | Marine Ports and Services | Baa3 | BBB- | 0.26 |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | - | BBB+ | 0.04 |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | Baa1 | BBB+ | 0.40 |
| DP World | UAE | No | Marine Ports and Services | Baa2 | NR (not rated | 0.28 |
| Aurizon Holdings | Australia | Yes | Railroads | Baa1 | BBB+ | 0.21 |
| Canadian National Railway Company | Canada | Yes | Railroads | A2 | A | 0.12 |
| Canadian Pacific Railway | Canada | Yes | Railroads | - | BBB+ | 0.20 |
| CSX Corporation | US | Yes | Railroads | Baa1 | BBB+ | 0.26 |
| Kansas City Southern | US | Yes | Railroads | Baa3 | BBB- | 0.16 |
| Norfolk Southern Corporation | US | Yes | Railroads | Baa1 | BBB+ | 0.25 |
| Union Pacific Corporation | US | Yes | Railroads | A3 | A | 0.13 |
| Sydney Airport | Australia | Yes | Airports | Baa2 | NR | 0.42 |
| Vienna International Airport | Austria | Yes | Airports | Not Rated, but 2015 Annual Report claims position reflect investment grade rating | | 0.27 |
| Paris Airport | France | Yes | Airports | - | A+ | 0.31 |
| Auckland International Airport Limited | New Zealand | Yes | Airports | - | A- | 0.20 |
| Zurich Airport | Switzerland | Yes | Airports | - | A+ | 0.22 |

**Source:** Moody's

Amongst companies in our sample with an investment grade rating, **the average gearing level is 23%, while the median 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 6..

**Table 6 Gearing averages and ranges by sector**

| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
|---|---|---|---|---|
| Marine Ports and Services | 24% | 26% | 4% | 40% |
| Railroads | 19% | 20% | 12% | 26% |
| Airports | 28% | 27% | 20% | 42% |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 4% | 4% | 4% | 4% |
| Railroads | 19% | 20% | 12% | 26% |
| Airports | 28% | 27% | 20% | 42% |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 29% | 27% | 21% | 40% |
| Railroads | N/A | N/A | N/A | N/A |
| Airports | N/A | N/A | N/A | N/A |

**Source:** Bloomberg

### 3.5.2 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. Table 7 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 7 Acquisition Gearing Ratios for Australian Ports**

| Port | Acquisition Value ($ million) | Acquisition Debt (drawn) ($ million) | Acquisition Gearing |
|---|---|---|---|
| | | | |
| Port of Brisbane (2010) | 2100 | 847 | 40% |
| Port Botany / Kembla (2013) | 5070 | 2010 | 40% |
| Port of Newcastle (2014) | 1750 | 800 | 46% |
| **Average** | | | 42% |

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

## 3.6 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.

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 8 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. 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 8 Recent Australian regulatory gearing decisions for transport entities**

| Company | Regulator | Year | Gearing Ratio |
|---|---|---|---|
| Dalrymple Bay Coal Terminal | QCA (Ports) | 2016 | 0.60 |
| Dalrymple Bay Coal Terminal | QCA (Ports) | 2010 | 0.60 |
| Aurizon Network | QCA (Rail) | 2016 | 0.55 |
| Public Transport Authority - urban | ERA (Rail) | 2015 | 0.50 |
| Brookfield rail (formerly West Net rail) - freight | ERA (Rail) | 2015 | 0.25 |
| The Pilbara Infrastructure | ERA (Rail) | 2015 | 0.20 |
| V/Line | ESC (Rail) | 2012 | 0.50 |
| Pacific National | ESC (Rail) | 2012 | 0.50 |
| Vic Track | ESC (Rail) | 2012 | 0.50 |
| Metro Trains Melbourne | ESC (Rail) | 2011 | 0.55 |
| ARTC (Hunter Valley Coal Network) | ACCC (Rail) | 2011 & 2017[17] | 0.525 |
| Queensland Rail | QCA (Rail) | 2010 | 0.55 |
| ARTC Interstate Rail Network | ACCC (Rail) | 2008 | 0.50 |

**Source:** Synergies database.

The basis of Australian regulator's gearing assumption is generally an analysis of internationally comparable companies, an approach we have adopted in our report.

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

- ARTC's interstate freight network, which currently has 50 per cent gearing

[17] The ACCC's 2017 decision is at the draft not final stage.

- Brookfield Rail's freight network, which currently has 25 per cent gearing.

ERA's most recent review of the WACC to apply to Brookfield Rail, which was completed in 2015, included an updated review of the gearing levels for a set of comparator firms.[18] Its sample included the US Class 1 railways as well as a small number of other firms (including Aurizon Holdings). In the review prior to 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 the sample of firms examined at the time were generally higher in the pre-GFC environment than currently observed. As this decision is now nearly ten years old, we would give it less weight, noting the ERA's findings that resulted in the application of a lower gearing level in the most recent review for Brookfield Rail.

## 3.7 Conclusion

Considering relevant market evidence, we consider a gearing range of between 20% and 40% to be 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 and 20% for The Pilbara Infrastructure, a dedicated iron ore rail and port infrastructure provider. The Brookfield Rail decision is most relevant to the Port of Melbourne (as a freight network).

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 benchmark efficient entity may change over time in response to several factors.

For the purposes of this review, an initial gearing level of 30% has been adopted, 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%).

[18] ERA (2015).

# 4 Assessing alternative return on equity approaches

This chapter discusses relevant well accepted estimation methods, financial models, market data and regulatory precedent which PoM has had regard to in determining an appropriate return on equity model. It builds on the discussion of our interpretation of the Pricing Order in section 2.

## 4.1 Well-accepted cost of equity approaches

There are several different asset pricing models that have been used to estimate the cost of equity in financial markets, academia and regulatory processes. The Pricing Order is not prescriptive in the Port Licence Holder's choice between these models, with clause 4.3.1 requiring that:

> in determining a rate of return on capital for the purposes of clause 4.1.1(a) the Port License Holder 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.

In its Consultation Paper,[19] the ESC states that it "interprets the Pricing Order terminology 'well accepted' as the approaches commonly used in Australian regulatory practice" without providing the basis on which it has arrived at this interpretation. That is, the ESC implies that the approach to determine the cost of equity for PoM should be limited to those approaches commonly used or accepted by Australian regulators in pricing determinations. However, we consider this is inconsistent with the objectives of the regulatory regime as set out in the *Port Management Act 1995* (Vic), which is intended to act as a surrogate for the rewards and disciples normally provided by a competitive market, and the broad language used in the Pricing Order.

Accordingly, we have addressed the question of whether a given cost of equity approach is well accepted by considering a broad set of opinions from different parties for whom the cost of capital is an important consideration.

The next section identifies and assesses the merits of several cost of equity models that we consider meet the well-accepted requirement of the Pricing Order.

[19] ESC (2017).

## 4.2 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 benchmark efficient entity 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.

This list of return on equity models is not intended to be exhaustive but 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.

## 4.3 SL CAPM model

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 degearing 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-gearing" the asset beta by applying the company's assumed capital structure (in PoM's case, the gearing of a benchmark efficient entity) to finally arrive at an estimated equity beta measurement for the company.

### 4.3.1 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.

### 4.3.2 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 4.4 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.

Attachment B explores the SL CAPM methodology in more detail.

## 4.4 Black CAPM model

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

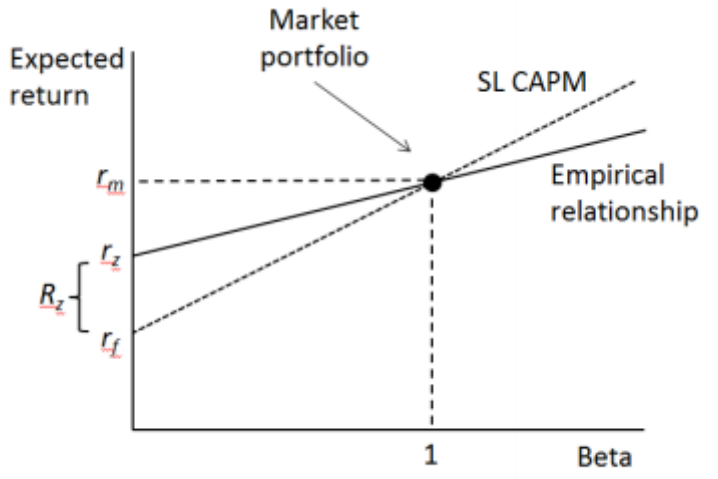
[E(Rm) – Rf] = the zero-beta adjusted market risk premium

βe = equity beta (measures systematic risk)

The relationship between the SL CAPM and Black CAPM is indicated in the below diagram.[20] 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.

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

**Figure 1 Relationship between SL CAPM and Black CAPM**




### 4.4.1 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, e.g., the United States and Canada, where it is sometimes known as the empirical CAPM (ECAPM).

### 4.4.2 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.

Attachment C explores the Black CAPM methodology in more detail.

## 4.5 Fama French model

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).

Attachment D explores the FFM and our application of the methodology in more detail. However, a summary of the key strengths and weaknesses of the FFM are provided below.

### 4.5.1 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 (a higher R2 value). 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.

### 4.5.2 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.

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 further described in chapter 7 of our report.

## 4.6 Dividend Discount Model

The DDM is a different construction to 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

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.

### 4.6.1 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.

### 4.6.2 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 is the limited sample of comparable Australian companies to underpin the application of the model.

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

Based on academic recognition, international regulatory and independent expert practice, we consider the following four models identified in section 4.7 above 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 evolves. 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 international regulatory and financial market practice, we consider it is appropriate to either:

- use values generated from a combination of 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.

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.

### 4.7.1 Applying a multi-model approach

We will determine the cost of equity for the benchmark port entity for PoM's first regulatory period 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 Fama French). 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 5 of our report explains how we have calculated a cost of equity estimate using the SL CAPM model. In Chapters 6 and 7 of our report, we present estimates generated by applying the Black CAPM and FFM respectively. The cost of equity estimate for the benchmark efficient entity based on an average of these three estimates is presented in Chapter 10 of our report.

# 5 Estimating the return on equity using SL CAPM

This chapter presents the way in which we have estimated the various parameters in the SL CAPM model.

The three parameters requiring estimation in this model are as follows:

- Risk free rate
- Beta
- Market risk premium

Our approach is discussed in the following sections.

## 5.1 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.

### 5.1.1 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.

### 5.1.2 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)[21], 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 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.

### 5.1.3 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

[21] 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.

Our estimates are produced over a twenty day period to 31 March 2017. As the quoted rates are semi-annual, we have converted them to annual effective rates[22]. The resulting estimate is 2.81%.

## 5.2 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 3 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 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 benchmark efficient entity), 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.

Finally, we consider relevant regulatory precedent.

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

### 5.2.1 Comparable companies' analysis

There are relatively few comparable listed businesses to the benchmark efficient entity operating in Australia and consequently it is necessary to rely on international comparators. This is similar to the approach adopted by regulators in the transport and telecommunications sectors.

The first step in a comparable companies'' analysis involves identifying an appropriate set of listed companies.

The sample included 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. 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 comparator 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 benchmark efficient entity.

### 5.2.2 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:[23]

- a t-statistic of less than 2 (this is considered particularly important)
- an R2 less than 0.1.

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

[23] Following beta estimation, we removed a Canadian coal terminal with very high gearing and an asset beta of 1.54 (Westshore Terminals) reducing the average and median asset beta of the sample.

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

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 0.68, based on a 5 year sample, while the average was 0.69. 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 beta was 0.75 with average 0.74. This highlights the conservatism of our proposed 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 benchmark efficient entity. We have calculated the average and median for each sector in Table 9 (5 year period) and 10 (10 year period). The full list of beta estimates for each company is presented in Attachment E.

**Table 9 Comparable companies' asset beta summary (5 year period)**

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| **Full Sample** | **0.69** | **0.68** | **0.21** | **1.17** |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.68 | 0.67 | 0.21 | 1.17 |
| Railroads | 0.83 | 0.87 | 0.45 | 1.13 |
| Airports | 0.61 | 0.55 | 0.27 | 1.15 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.66 | 0.60 | 0.21 | 1.02 |
| Railroads | 0.82 | 0.87 | 0.45 | 1.13 |
| Airports | 0.56 | 0.38 | 0.27 | 1.15 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.69 | 0.72 | 0.22 | 1.17 |
| Railroads | 0.88 | 0.88 | 0.79 | 0.97 |
| Airports | 0.88 | 0.88 | 0.75 | 1.01 |

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

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

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| **Full Sample** | **0.74** | **0.75** | **0.26** | **1.71** |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.77 | 0.86 | 0.26 | 1.10 |
| Railroads | 0.85 | 0.87 | 0.40 | 1.71 |
| Airports | 0.61 | 0.60 | 0.39 | 0.85 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.71 | 0.74 | 0.26 | 0.99 |
| Railroads | 0.76 | 0.87 | 0.40 | 0.97 |
| Airports | 0.59 | 0.49 | 0.39 | 0.85 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | **0.80** | **0.88** | **0.43** | **1.10** |
| Railroads | **1.20** | **1.20** | **0.69** | **1.71** |
| Airports | **0.78** | **0.78** | **0.75** | **0.81** |

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

### 5.2.3 Interpreting the comparator estimates

Within the Marine Ports and Services sector, the median (average) asset beta across all firms in the sample is 0.67 (0.68). The median (average) asset beta for Railroads is 0.87 (0.83). While the median (average) asset beta for Airports is 0.55 (0.61). These estimates compare with Damodaran (2017) of 0.80 for Transportation and 0.65 for Railroads.

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.

### 5.2.4 First principles analysis

The comparator analysis in section 5.2.3 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.

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 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. Not only does the prospect of a second port bring substitution risk, but it gives 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. Holding all other factors constant, we consider this should be reflected in a higher value of beta relative to the comparable companies.

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 F.

### 5.2.5 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 Brookfield Rail). This aligns with the approach we have adopted and believe it meets the "well-accepted" threshold.

These approaches (to varying degrees of analysis) conclude that the absence of enough 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.

Summaries of the ERA and ACCC beta assessments are presented at Attachment G of this report.[24]

### 5.2.6 Conclusion: Equity 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 to 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.[25]

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.

## 5.3 Market Risk Premium

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.

[24] 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).

[25] ERA (2016), Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks, and for Pilbara railways, October

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 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.

### 5.3.1 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:[26]

- 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.

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:[27]

> 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

[26] 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.

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

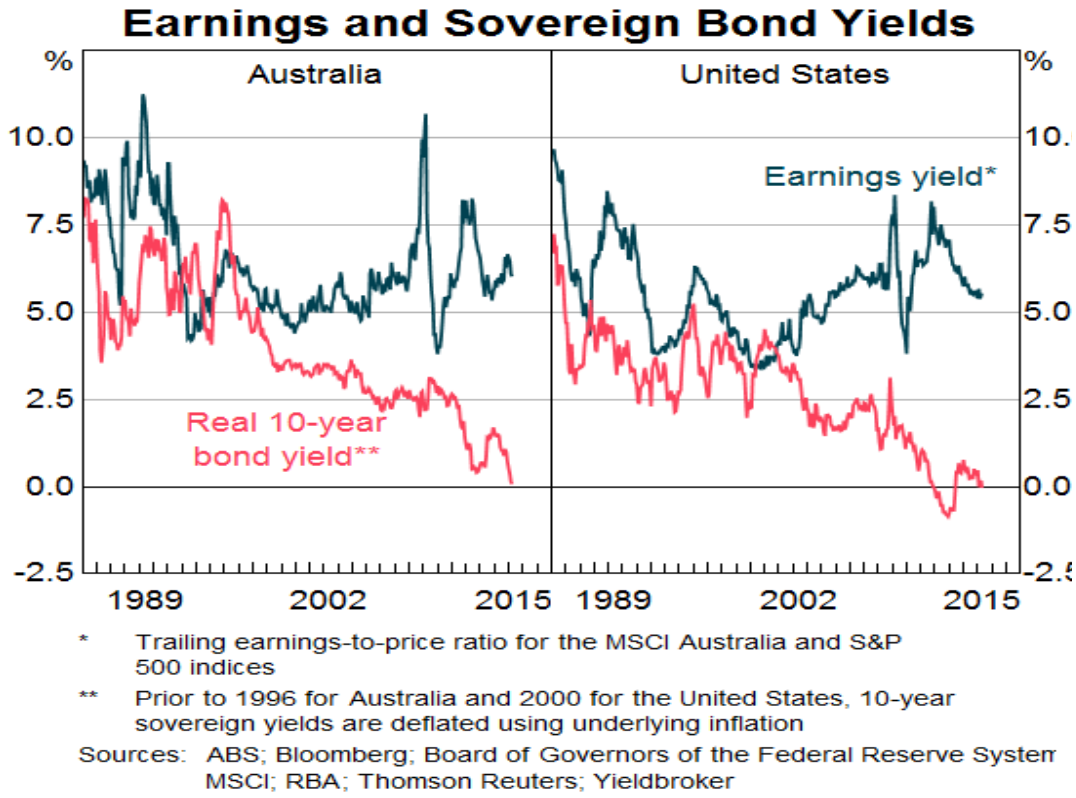
explained by more sense of risk attached to future earnings, and/or a lower expected *growth rate* of future earnings.

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 below.

**Figure 2 Earnings and sovereign bond yields**




**Source: RBA**

Based on this recent evidence, we consider that, 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 Wright approach lends support to its acceptance.

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

Relevant Australian regulatory decisions on the MRP

Table 12 summarises the most recent MRP estimates derived by Australian economic regulators. Most regulators have adopted values for the MRP greater than 6%.

**Table 11 Most recent MRP estimates applied by Australian regulators**

| Regulator | Date | Sector | MRP (per cent) |
|---|---|---|---|
| ERA | July 2015 | Gas Distribution | 7.6% |
| ERA | June 2016 | Gas Transmission | 7.4% |
| ESCOSA | June 2016 | Water | 6% |
| ESC | July 2016 | Water | 6% |
| ACCC | October 2016 | Telecommunications | 6% |
| QCA | November 2016 | Ports | 6.5% |
| IPART | February 2017 | Biannual WACC update | 7.7% based on the February 2017 range from 6.0% - 9.3%. Increases to 8.5% once account is taken of uplift to risk free rate |
| AER | April 2017 | Electricity Distribution | 6.5% |
| AER | April 2017 | Electricity Transmission | 6.5% based on a range from 5% to 7.5% set out in its Rate of Return Guideline |

**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 (7.7%) because of the higher risk free rate assumed in its approach (80 basis points). The most recent Biannual Update reports an "effective" MRP of 8.5% (adding the MRP and the

margin above the risk-free rate), which is unchanged from its July 2016 assessment.[28]

- 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.
- 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.
- ESCOSA and ESC appear to solely rely on historical long term averages based on the Ibbotson averaging approach.

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

### 5.3.2 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.

As discussed in Chapter 4 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;
- Bank of England (2010), a multi-stage dividend discount model; and[29]

[28] IPART (2017), WACC Biannual Update, February

[29] 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.

- 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 12 presents the results of these approaches.

**Table 12 Forward looking MRP estimates based on DDM (based on a zero gamma)**

| Methodology | Estimate | Weighting |
|---|---|---|
| Damodaran | 7.80% | 33% |
| Bank of England (2010) | 8.13% | 33% |
| Gordon Constant Growth Model | 6.95% | 33% |
| **Weighted Average MRP** | **7.63%** | |

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:[30]

> 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

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

derived using the DDM. We have not adjusted the weighted average MRP of 7.63% from Table 12 for dividend imputation; doing so would have increased the MRP.

### 5.3.3 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."[31] 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:[32]

> 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 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 H of our report provides more information on market surveys.

## 5.4 International evidence on estimating the MRP

Ofgem's consultants, Wright and Smithers (2014)[33], made the following comments in regards to establishing a value for the MRP:

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

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

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

> … 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 premia 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:[34]

> 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":[35]

> 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. 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.

Dobbs, Koller and Lund (2014) from McKinsey Inc. have also contributed to the debate about the MRP:[36]

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

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

[36] 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.

> … 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.

## 5.5 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 IPART), 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 7.77% (assuming a gamma of 0.25) as follows. This is below the MRP that would result from including the DDM approaches outlined above.

**Table 13 Current Estimates of the MRP**

| Methodology | Estimate (assuming zero gamma) | Estimate (assuming 0.25 gamma) | Weighting |
|---|---|---|---|
| Ibbotson Historical Excess Returns | 6.40% | 6.53% | 50% |
| Wright Historical Excess Returns | 8.63% | 9.01% | 50% |
| **Weighted Average MRP** | **7.52%** | **7.77%** | |

**Source:** Synergies calculations

This MRP value is below the most recent IPART update (7.7%) once account is taken of the higher risk free rate assumed in its approach (80 basis points), resulting in an effective MRP of 8.5%, which is unchanged from its July 2016 assessment.

## 5.6 SL CAPM estimate

Synergies' SL post-tax CAPM estimate and its underlying input parameter values are presented in Table 14 (assuming a gamma of 0.25 which we address in Chapter 9).

Table 14 SL CAPM post-tax cost of equity estimate

| Parameter | Value |
|---|---|
| Risk free rate | 2.81% |
| Gearing | 30% |
| Asset beta | 0.7 |
| Equity beta | 1.0 |
| MRP | 7.77% |
| SL CAPM | 10.58% |

**Source:** Synergies

### 5.6.1 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 (refer Chapter 2 of our report)

$\gamma$ = gamma (refer Chapter 9 of our report)

Substituting the parameter values into the above formula:

$$\text{Pre-tax Re} = 10.58\% / (1 - 0.3 * (1 - 0.25))$$

$$\text{Re} = 10.58\% / 0.775$$

**Pre-tax SL CAPM Re = 13.66%**

# 6 Black CAPM

The purpose of this chapter is to provide our estimate of the Black CAPM cost of equity estimate using relevant inputs from the SL CAPM (outlined in Chapter 5) and SFG Consulting's contemporary estimate of the zero-beta premium.

## 6.1 SFG Consulting's estimate of the zero-beta premium[37]

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.[38]

We consider this estimate is the most robust estimate of this parameter currently available in an Australian context.

## 6.2 Estimating the Black CAPM return on equity

### 6.2.1 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:

[37] SFG Consulting (2014).

[38] SFG Consulting (2014), p.27.

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

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 = 2.81% (refer Chapter 5 of our report)

Market return = 10.55% (risk free rate of 2.81% plus MRP of 7.77% from Chapter 5)

Equity beta of 1.00 (refer Chapter 5 of our report)

Substituting the parameter values into the Black CAPM formula:

Re = (2.81% + 3.34%) + 1.00 * (7.77% - 3.34%)

Re = 6.15% + 4.43%

**Post-tax Black CAPM Re = 10.58%**

### 6.2.2 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 (refer Chapter 5 of our report)

γ = gamma (refer Chapter 9 of our report)

Substituting the parameter values into the above formula:

Pre-tax Re = 10.58% / (1 – 0.3 * (1 - 0.25))

Re = 10.58% / 0.775

**Pre-tax Black CAPM Re = 13.66%**

## 6.3 Black CAPM estimate

Our estimate of the pre-tax return on equity for the benchmark port entity based on the Black CAPM is 13.66%.

# 7 Fama French Model (FFM)

The purpose of this chapter is to provide our estimate of the FFM cost of equity estimate using relevant inputs from the SL CAPM (outlined in Chapter 5) and deriving the three beta factors in the FFM using Australian and international data sources. The risk free rate and MRP under this model match the values used in the SL CAPM model.

## 7.1 Beta factors

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;
- SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios; and
- HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth portfolios.
- A full description of the FFM is presented in Attachment D.

## 7.2 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[39], an internationally recognised source. 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 the case of Australia, estimates of the factor premiums must also be constructed. For the estimates in this report, Professor Tom Smith from the University of Queensland Business School has extended this dataset to the end of 2016, following the methodology set out in SFG (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

[39] French, K.R. (2017). Current Research Returns. Available from: mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html [Accessed 21 April 2017].

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 size and book-to-market factors. Following SFG (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.

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: 7.77%)

HML = expected high-minus-low risk premium (Australian estimate: 6.05%)

SMB = expected small-minus-big risk premium (Australian estimate: 1.77%)

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 15 presents our equity betas and associated risk premiums.

**Table 15 FFM equity betas and risk factor premiums**

| Risk factors | Estimated equity betas | Risk factor premiums |
|---|---|---|
| Market risk premium | 0.89 | 7.77% |
| High minus low premium | 0.29 | 6.05% |
| Small minus big premium | 0.16 | 1.77% |

**Source:** Synergies

### 7.2.1 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 = 2.81%

βj = 0.89

$[E(R_m) - R_f]$ = 7.77%

βk = 0.29

[HML] = 6.05%

βl = 0.16

[SMB] = 1.77%

Post-tax Re = 2.81% + ((0.89 * 7.77%) + (0.29 * 6.05%) + (0.16* 1.77%))

Post-tax Re = 2.81% + 6.92% + 1.75% + 0.28%

**Post-tax FFM Re = 11.72%**[40]

### 7.2.2 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 (refer Chapter 5 of our report)

γ = gamma = 0.25 (refer Chapter 9 of our report)

Substituting the parameter values into the above formula:

Pre-tax Re = 11.76% / (1 – (0.3 * (1 - 0.25))

Re = 11.76% / 0.775

[40] Using the SFG (2015) factor premium of -0.43% for SMB and 9.97% for HML, the post-tax return on equity increases to 12.49%.

**Pre-tax FFM Re = 15.12%**

## 7.3 FFM estimate

Our estimate of the pre-tax return on equity based on the FFM is 15.12%, which is higher than the SL CAPM and Black CAPM reflecting the incorporation of two additional risk factors that along with systematic risk explain investors' expected return on equity for the benchmark port entity.

# 8 Estimating the return on debt

The Pricing Order provides no guidance regarding estimation of the return on debt beyond it being one or a combination of well-accepted approaches.

## 8.1 Introduction

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 Australian regulatory precedent regarding estimation of the return on debt.

## 8.2 Australian regulatory precedent

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 (e.g. rail and ports).

The AER, however, now applies a 10-year 'trailing average' approach as explained in its Rate of Return Guideline.[41] This approach emanated 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, meaning that the regulated return on debt, and hence tariffs, will vary throughout the period.[42]

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; and a

[41] AER (2013). Rate of Return Guideline, December, p.28.

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

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.[43] The AER also determined that this must be implemented over a ten year transition period.[44]

Other economic regulators that have accepted the trailing average approach include Victoria's Essential Services Commission (ESC) for Melbourne Water, allowing an immediate transition but based on a data series that excluded the 'GFC years' (2008-09 to 2012-13).

WA's Economic Regulation Authority (ERA) has accepted the trailing average approach in recent gas network decisions[45], although based on a 'hybrid' approach, allowing an immediate transition for the DRP and a ten year transition for the base rate[46].

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.[47]

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

### 8.2.1 Synergies' assessment

While 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, 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.

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43 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.

44 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.

45 Refer: ATCO Gas Australia, Dampier to Bunbury Pipeline.

46 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.

47 Refer: Essential Services Commission of South Australia (2016). SA Water Regulatory Determination 2016, Final Determination, June. In making this conclusion it noted that over the previous ten years, ESCOSA noted that there would have been an immaterial difference had there been a gradual transition to the trailing average compared to 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, we have applied the on-the-day approach for the benchmark efficient entity.

## 8.3 Risk free rate

As noted in Chapter 5, 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 28 April 2017.

The resulting estimate is 2.81 per cent (annual effective).

## 8.4 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 also 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.[48]

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

## 8.5 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.

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

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 8.7 below.

## 8.6 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 (first) 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.

We consider that the adoption of a 10 year trailing average approach to estimating the return on debt is likely to approximate the debt management strategies of many regulated entities subject to deterministic price setting arrangements.

However, it should be noted that this approach requires the return on debt to be updated each year, which will flow through to the annual revenue requirement. The rigidity inherent in this approach is unlikely to be attractive for an entity that wants the maximum possible financial flexibility to manage their debt portfolios within and across regulatory periods. Consequently, the long term trailing average approach could be inappropriate, for an entity with a lumpy capital expenditure profile that will require debt funding.

Consistent with the approach available under the Australian national energy framework, we consider that the choice between the on the day and trailing average approach is appropriately made by the regulated entity provided the calculation reflects an efficient benchmark.

In the case of the benchmark port entity, given the recent PoM Long Term Lease transaction and that a WACC estimate is being estimated for the first regulatory period under the Pricing Order, we consider that an on the day approach to estimating the return on debt is appropriate.

However, the appropriateness of this approach may need to be revisited over time. We consider that the trailing average debt management approach is likely to be a more reasonable longer term assumption in regards to the benchmark port entity.

## 8.7 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. We strongly endorse the use of an independent third party data source as they are independent, reputable and robust.

In its October 2015 decision for Telstra, 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.

### 8.7.1 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[49];
- *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. This is consistent with the concept of extrapolating Bloomberg's seven year yield using the paired bonds approach.

### 8.7.2 Bloomberg BVAL Curves

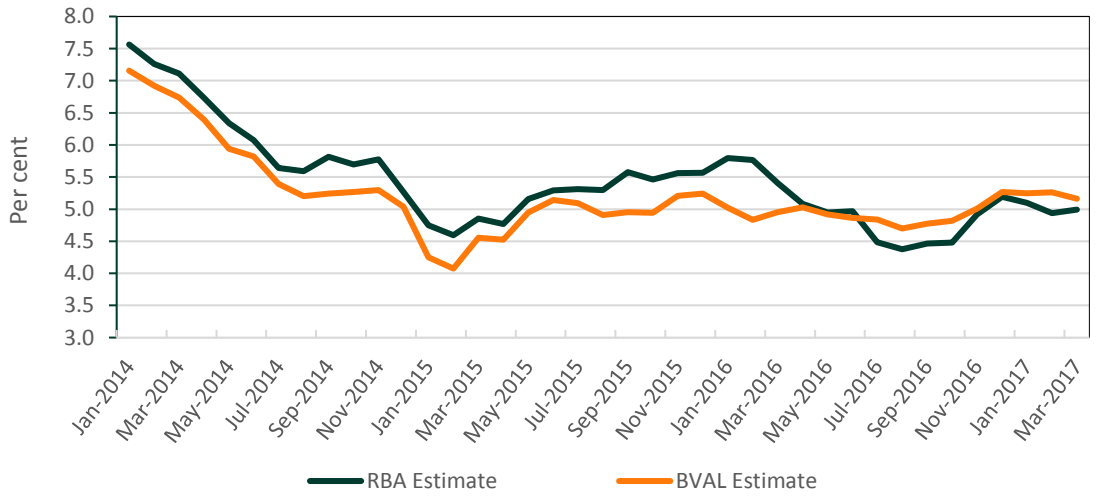
Bloomberg provides estimates of BBB-rated Australian corporations under its Bloomberg Valuation service, also referred to as 'BVAL'. The BVAL curves use a

[49] Australian Energy Regulator (2014a). Ausgrid, Endeavour Energy, Essential Energy, Actew AGL, Transitional Distribution Determination, 2014-15, April; Australian Energy Regulator (2014b). Transgrid, Transend, Transitional Transmission Determination, 2014-15, March.

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.

Figure 3 shows the historical movements in the RBA and Bloomberg BBB series.

**Figure 3 Historical RBA and Bloomberg BBB Estimates**




**Data source: RBA, Bloomberg**

## 8.8 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.

### 8.8.1 Regulatory precedent

PwC relatively recently undertook market research of Australian debt raising transaction costs, which have been applied in an Australian energy economic regulation context.[50] Incenta have subsequently applied PwC's findings in recent energy regulatory processes. PWC's study built on earlier work undertaken by Allen Consulting Group.[51]

[50] PwC (2013).

[51] Allen Consulting Group (2004). Debt and Equity Raising Transaction Costs, Final Report, December.

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 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.[52]

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 benchmark efficient port entity 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

[52] PwC (2013), p 6

arrangement fee with 'other' costs in terms of an equivalent bppa. Accordingly, 10 bppa has been added to our return on debt estimate.

## 8.9 Results

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

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 risk-free rate for the efficient benchmark port entity.

Assuming a risk-free rate of 2.81% and debt raising costs of 10 bppa gives a return on debt estimate for the benchmark efficient port entity of 5.45%. Table 16 indicates this calculation.

**Table 16 Return on debt estimate for benchmark port entity (assuming BBB credit rating)**

| Averaging period | RBA | Bloomberg | Average |
|---|---|---|---|
| 'BBB DRP based on 20 days to 31 March 2017 | 2.48% | 2.60% | 2.54% |
| Risk free rate based on 20 days to 31 March 2017 | 2.81% | 2.81% | 2.81% |
| Debt raising costs | 0.10% | 0.10% | 0.10% |
| **Return on debt** | **5.39%** | **5.51%** | **5.45%** |

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

# 9 Gamma

Gamma (γ) is the value of imputation credits to investors in the benchmark port entity, 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).

## 9.1 Introduction

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.

## 9.2 Finance theory

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.[53] 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.[54]

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.[55] 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

[53] 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.

[54] 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.

[55] Lajbcygier, P. and Wheatley, S.M. (2012). Imputation credits and equity returns. Economic Record, 88(283), pp.476-494.

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.[56] 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.

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 with this mathematical relationship.[57] 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.

Interestingly, 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.[58] 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.[59] Of the six reports that did incorporate, 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.

[56] 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.

[57] Gray, S. and Hall, J. (2006). Relationship between franking credits and the market risk premium. Accounting and Finance, 46, pp.405-428.

[58] 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.

[59] 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.

### 9.2.1 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.

## 9.3 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) take information on imputation credits into account in estimating required rates of returns."[60]

In response to a 2014 AER draft decision for Transgrid, Grant Samuel wrote that:[61]

> 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:[62]

> 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:[63]

> 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

[60] Ernst and Young (2016). Market evidence on the cost of equity, 22 November, p.28.

[61] Grant Samuel (2015). Response to AER Draft Decision, 12 January, p.5.

[62] Grant Samuel (2015). Independent Expert's Report, Asciano, 30 September, p.315.

[63] Deloitte (2015). Independent Expert's Report, Energy Developments Limited, 3 September, p.63.

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.

## 9.4 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.[64]

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:[65]

> 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.

[64] Ainsworth A. (2016). Dividend Imputation: The International Experience. The Finsia Journal of Applied Finance, 1, pp.58-63.

[65] Commonwealth Treasury (2010). Australia's Future Tax System, Chapter B: Investment and Entity Taxation, p.199.

## 9.5 Australian regulatory precedent

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.

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.[66]

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.

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[67] 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.[68]

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.

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66 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9

67 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.

68 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.

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."[69] It stated that:[70]

> 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 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:[71]

> …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.

The AER is likely to continue with its equity ownership approach to determining gamma following the Full Federal Court's judgment, which based on data as at 2015 suggests a gamma of 0.4.

However, it is unclear whether special leave will be sought to appeal the Full Federal Court's judgment in the High Court and the Full Federal Court is yet to determine another judicial review of the Tribunal's decision in Application by South Australian Power Networks where one of the grounds of review is the Tribunal's formulation on gamma (the Tribunal in this decision found that the AER was not in error).

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[69] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para.1093.

[70] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para.1096.

[71] *Australian Energy Regulator v Australian Competition Tribunal* (No 2) [2017] FCAFC 79, para 755.

Furthermore, 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. To the extent that the WACC methodology adopted considers market values, then consistent with the Full Federal Court's judgment, a gamma that reflects market values would be appropriate. In particular, we note that whether the Officer framework used to determine the WACC under the NER adopts face or market values is disputable with the Tribunal finding:[72]

> 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.

[72] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, para.1073-4.

*Approaches applied by other Australia 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. The table below summarises the current status of regulatory precedent.

**Table 17 Current Australian regulatory status of gamma**

| Regulator | Current value applied | Market or non-market approach | Comments |
|---|---|---|---|
| QCA | 0.47 | Non-market | Recently revised down from 0.5. |
| 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 | 0.45 | Non-market | This was applied in the draft ARTC Hunter Valley Access Undertaking and final Telstra Fixed Line decisions |
| IPART | 0.25 | Market | Arrived at under a specific review of gamma concluded in 2012[73]. Not revisited in its 2013 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. |

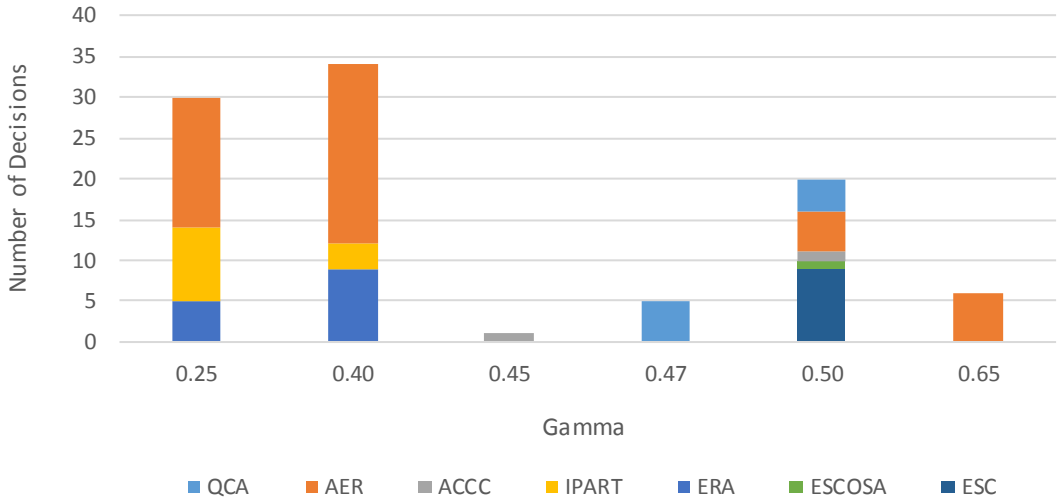
**Source:** Synergies based on Australian regulatory decisions

It is possible that other regulators will be influenced by the outcome of the current appeals for energy network businesses. In saying this, we note that some of the State-based regulators also gave no recognition to the Tribunal's previous determination made for Energex, Ergon Energy and SA Power Networks in 2011.

[73] Independent Pricing and Regulatory Tribunal (2012). Review of Imputation Credits (Gamma), Research – Final Decision, March.

Figure 4 shows the diversity of gamma values approved by Australian regulators between 2010 and 2017.

**Figure 4 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.

## 9.6 Evidence of international investor interest in Australian transport and energy infrastructure

Further to the findings of academic studies discussed in section 7.2 of this chapter, this section focusses on the resident and non-resident investor shares of equity held in major Australian transport and energy infrastructure.

Table 18 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.

**Table 18 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 18 indicates the significant proportion of foreign equity ownership of Australian transport and energy infrastructure.

Table 19 presents a similar picture for unlisted infrastructure transactions over the last two years (based on InfraDeals data).

**Table 19 Proportion of equity ownership – Unlisted infrastructure transactions**

| Transaction | Sub-Sector | Date | Equity Providers | Domestic | Foreign |
|---|---|---|---|---|---|
| NSW Endeavour Energy | Distribution | May-17 | Macquarie Infrastructure, AMP (REST), bcIMC, QIA | 57% | 43% |
| DUET | Distribution | Apr-17 | CKI | 0% | 100% |
| LPI | Land Titles Registry | Apr-17 | Hastings, First State | 100% | 0% |
| 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 | 100% | 0% |
| Port of Melbourne | Ports | Oct-16 | Future Fund, CIC, Borealis, 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% |
| 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** | | | | **50%** | **50%** |
| **Average** | | | | **51%** | **49%** |

**Source:** Infradeals

The data in Table 18 and Table 19 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.

## 9.7 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.

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 efficient benchmark entity 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).[74].

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) results in a gamma of 0.23, which we have rounded 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.

## 9.8 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

[74] SFG Consulting (2014).

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 benchmark efficient entity is reflective of a well-accepted approach and is consistent with the Pricing Order.

# 10 Proposed WACC estimate for benchmark port entity

The purpose of this chapter is to present the values of the key components of our pre-tax nominal WACC estimate of 11.54% for the benchmark efficient entity.

## 10.1 Cost of equity multi-model calculation

Table 20 presents our three cost of equity estimates as derived using the SL CAPM, Black CAPM and Fama French Model.

**Table 20 Cost of equity (pre-tax nominal) estimates by model**

| SL CAPM | Black CAPM | FFM |
|---|---|---|
| 13.66% | 13.66% | 15.12% |

**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 an average of each estimate in Table 21 results in an estimated nominal pre-tax cost of equity for the benchmark efficient entity of 14.14%. We note that applying different weightings would not materially change our estimate. For example, a relatively heavier weighting to the FFM (such as 50% for the FFM and 25% for each of the SL CAPM and Black CAPM), reflecting its stronger predictive capabilities, would result in around a 20 basis points higher weighted average cost of equity estimate.

## 10.2 Cost of debt calculation

The underlying components of our cost of debt estimate of 5.45% was presented in Table 16 in Chapter 8 of our report.

## 10.3 WACC estimate

Table 21 presents our estimates of all key input values and the resulting cost of equity and debt estimates that we have combined to derive the weighted average pre-tax nominal WACC in accordance with Pricing Order requirements.

**Table 21 WACC estimates based on well-accepted cost of equity models**

| Parameter | SL-CAPM | Black | FFM |
|---|---|---|---|
| Risk Free Rate | 2.81% | 2.81% | 2.81% |
| Zero Beta Premium | | 3.34% | |
| Capital Structure | 30% | 30% | 30% |
| Debt risk premium | 2.54% | 2.54% | 2.54% |
| Debt raising costs | 0.1% | 0.1% | 0.1% |
| Market risk premium | 7.77% | 7.77% | 7.77% |
| Size (SMB) Premium | | | 1.77% |
| Value (HML) Premium | | | 6.05% |
| Asset beta (Market) | 0.7 | 0.7 | 0.62 |
| Asset beta (SMB) | | | 0.11 |
| Asset beta (HML) | | | 0.20 |
| Debt beta | 0 | 0 | 0 |
| Equity beta (Market) | 1.00 | 1.00 | 0.89 |
| Equity beta (SMB) | | | 0.16 |
| Equity beta (HML) | | | 0.29 |
| Gamma | 0.25 | 0.25 | 0.25 |
| Corporate Tax | 30% | 30% | 30% |
| Return on equity (post tax) | **10.58%** | **10.58%** | **11.72%** |
| Return on equity (pre tax) | **13.66%** | **13.66%** | **15.12%** |
| Return on debt (pre tax) | **5.45%** | **5.45%** | **5.45%** |
| **Post tax nominal (vanilla) WACC** | **8.68%** | **8.68%** | **9.47%** |
| **Pre-tax nominal WACC** | **11.20%** | **11.20%** | **12.22%** |
| **Custom weights** | **33.33%** | **33.33%** | **33.33%** |
| **Weighted average pre-tax nominal WACC** | **11.54%** | | |

## 10.4 Consistency with Port Management Act objectives

We consider the WACC estimate presented in section 10.3 of this chapter satisfies the relevant PMA objectives.

Three of the regulatory objectives set out under section 49A of the PMA directly address the assessment of the weighted average cost of capital. These objectives broadly require the promotion of the efficient use of, and investment in, the provision of prescribed services for the long-term interests of users and Victorian consumers. Effectively this links economic efficiency and the long-term interests of consumers. The focus on long term also recognises the importance of investment decisions in serving consumer needs.

Complementing the overarching economic efficiency objective of the PMA is the objective that provides to allow the Port Licence Holder as 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. This has been the primary focus of this report and the WACC estimate that we have developed.

In this regard, the estimation of WACC is inherently imprecise and hence the probability of specifying a WACC other than the true value is high. For key parameters, such as gearing, beta, market risk premium and gamma, there is likely to be a reasonable range. However, ultimately judgement is required in choosing a point estimate to determine the WACC estimate.

We repeat the Productivity Commission's dictum of that regulatory error tends to have asymmetric consequences. In short, the consequences of setting WACC too low, and discouraging efficient investment in essential infrastructure, are most likely to be worse than setting it too high. This would in turn risk compromising achievement of the PMA objectives of economic efficiency in the long-term interests of consumers.

It is in the interests of Victorian consumers that proper account is taken of this asymmetry in the context of the inherent uncertainty surrounding the estimation of WACC. We have sought to address this balance in a manner consistent with the objectives of the PMA:

- by adopting a combination of well accepted approaches
- in respect of the SL CAPM, by arriving at a cost of capital that is broadly within the accepted range of regulatory decisions, noting the pre-tax nominal WACC is comparable with the most recent assessment of the ERA of Brookfield Rail (and below that for the Pilbara Railways)

Given the asymmetric consequences of setting the WACC too low, we have therefore applied our judgement in a way that we consider allows PoM a reasonable opportunity to earn a return commensurate with the risks involved in its provision of Prescribed Services consistent with PMA objectives.

# 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 benchmark efficient entity.

## A.1 Comparator companies

Table A.1 lists the comparator companies that emerged from the process set out in Section 3.

**Table A.1 Full list of comparators**

| Company | Country | OECD | Sector | Gearing |
|---|---|---|---|---|
| Qube Holdings | Australia | Yes | Marine Ports and Services | 0.19 |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | 0.04 |
| Hamburger Hafen und Logistik | Germany | Yes | Marine Ports and Services | 0.21 |
| Piraeus Port Authority | Greece | Yes | Marine Ports and Services | 0.19 |
| Thessaloniki Port Authority | Greece | Yes | Marine Ports and Services | 0.00 |
| Sociedad Matriz SAAM | Chile | Yes | Marine Ports and Services | 0.17 |
| Luka Koper | Slovenia | Yes | Marine Ports and Services | 0.39 |
| Isewan Terminal Service | Japan | Yes | Marine Ports and Services | 0.07 |
| Wilson Sons | Brazil | No | Marine Ports and Services | 0.31 |
| China Merchants Port Holding Company | Hong Kong | No | Marine Ports and Services | 0.21 |
| COSCO Shipping Ports | Hong Kong | No | Marine Ports and Services | 0.31 |
| Dalian Port | Hong Kong | No | Marine Ports and Services | 0.37 |
| ADSEZ | India | No | Marine Ports and Services | 0.26 |
| Asian Terminals | Philippines | No | Marine Ports and Services | 0.00 |
| International Container Terminal Services | Philippines | No | Marine Ports and Services | 0.21 |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | 0.40 |
| Kingston Wharves | Jamaica | No | Marine Ports and Services | 0.12 |
| Prumo Logistica | Brazil | No | Marine Ports and Services | 0.55 |
| Global Ports Investments | International | No | Marine Ports and Services | 0.54 |
| Pakistan International Container Terminal | Pakistan | No | Marine Ports and Services | 0.04 |
| DP World | UAE | No | Marine Ports and Services | 0.28 |
| Alexandria Containers & Goods | Egypt | No | Marine Ports and Services | 0.00 |

| Company | Country | OECD | Sector | Gearing |
|---|---|---|---|---|
| Aurizon Holdings | Australia | Yes | Railroads | 0.21 |
| CSX Corporation | US | Yes | Railroads | 0.26 |
| Genesee & Wyoming Inc. | US | Yes | Railroads | 0.32 |
| Kansas City Southern | US | Yes | Railroads | 0.16 |
| Norfolk Southern Corporation | US | Yes | Railroads | 0.25 |
| Union Pacific Corporation | US | Yes | Railroads | 0.13 |
| Canadian National Railway Company | Canada | Yes | Railroads | 0.12 |
| Canadian Pacific Railway | Canada | Yes | Railroads | 0.20 |
| Globaltrans Investment | International | No | Railroads | 0.18 |
| Container Corporation of India Limited | India | No | Railroads | 0.00 |
| Sydney Airport | Australia | Yes | Airports | 0.42 |
| Auckland International Airport Limited | New Zealand | Yes | Airports | 0.20 |
| Copenhagen Airport | Denmark | Yes | Airports | 0.15 |
| Vienna International Airport | Austria | Yes | Airports | 0.27 |
| Zurich Airport | Switzerland | Yes | Airports | 0.22 |
| Frankfurt Airport | Germany | Yes | Airports | 0.44 |
| Paris Airport | France | Yes | Airports | 0.31 |
| Grupo Aeroportuario del Centro Norte | Mexico | Yes | Airports | 0.13 |
| Airports of Thailand | Thailand | No | Airports | 0.14 |
| Grupo Aeroportuario del Sureste | Mexico | Yes | Airports | 0.04 |
| TAV Havalimanlari Holding | Turkey | Yes | Airports | 0.35 |
| Malta International Airport | Malta | No | Airports | 0.13 |
| Japan Airport Terminal Co. | Japan | Yes | Airports | 0.23 |

**Source:** Bloomberg

## A.2 Gearing Ratios

Table A.2 lists the average and median 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 average gearing level is 22% and the median gearing levels is 21%**.

**Table A.2 Gearing by sector**

| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
|---|---|---|---|---|
| Marine Ports and Services | 22% | 21% | 0% | 55% |
| Railroads | 18% | 19% | 0% | 32% |
| Airports | 23% | 22% | 4% | 44% |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 16% | 18% | 0% | 39% |
| Railroads | 21% | 20% | 12% | 32% |
| Airports | 25% | 23% | 4% | 44% |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 26% | 21% | 0% | 55% |
| Railroads | 9% | 9% | 0% | 18% |
| Airports | 14% | 14% | 13% | 14% |

**Note:** The average and median gearing over 10 years was 24%. As an additional test, we examined the gearing levels of companies that had statistically insignificant betas, but their inclusion did not have a material impact on gearing levels.
**Source:** Bloomberg

The comparator set comprises a mix of rated and unrated companies. In order to construct a comparator set that has similar gearing levels to the investment grade rating targeted for the benchmark port entity, it is necessary to compare against companies that meet this criterion.

## A.3 Moody's and Standard and Poor's Ratings

Many of the companies we have used as comparables are not rated by the major ratings agencies. For those companies that have been assigned ratings, it is possible to construct a sample of investment-grade companies.

Both Moody's and Standard and Poor's employ a similar rating methodology – there is an initial assessment of a range of factors that enable an assessment of how credit ratings metrics should be applied to an individual company.

The following table sets out the thresholds for two credit metrics, Cash Interest Coverage and FFO/Debt adopted by Moody's (noting that these criteria are only two elements of a far more comprehensive process, but they provide an important insight into the process).

**Table A.3 Selected Moody's credit metrics**

| | Aaa | Aa | A | Baa |
|---|---|---|---|---|
| Cash interest coverage | ≥8x | 6x – 8x | 4.5x – 6x | 3x – 4.5x |
| FFO/Debt | ≥40% | 25-40% | 15-25% | 10-15% |

**Source:** Moody's

The companies in our comparator set with an investment grade credit rating are set out in Table A.4 below.

**Table A.4 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+ | 0.21 |
| ADSEZ | India | No | Marine Ports and Services | Baa3 | BBB- | 0.26 |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | - | BBB+ | 0.04 |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | Baa1 | BBB+ | 0.40 |
| DP World | UAE | No | Marine Ports and Services | Baa2 | NR (not rated | 0.28 |
| Aurizon Holdings | Australia | Yes | Railroads | Baa1 | BBB+ | 0.21 |
| Canadian National Railway Company | Canada | Yes | Railroads | A2 | A | 0.12 |
| Canadian Pacific Railway | Canada | Yes | Railroads | - | BBB+ | 0.20 |
| CSX Corporation | US | Yes | Railroads | Baa1 | BBB+ | 0.26 |
| Kansas City Southern | US | Yes | Railroads | Baa3 | BBB- | 0.16 |
| Norfolk Southern Corporation | US | Yes | Railroads | Baa1 | BBB+ | 0.25 |
| Union Pacific Corporation | US | Yes | Railroads | A3 | A | 0.13 |
| Sydney Airport | Australia | Yes | Airports | Baa2 | NR | 0.42 |
| Vienna International Airport | Austria | Yes | Airports | Not Rated, but 2015 Annual Report claims position reflect investment grade rating | | 0.27 |
| Paris Airport | France | Yes | Airports | - | A+ | 0.31 |
| Auckland International Airport Limited | New Zealand | Yes | Airports | - | A- | 0.20 |
| Zurich Airport | Switzerland | Yes | Airports | - | A+ | 0.22 |

**Source:** Moody's

## A.4 Gearing Ratios of investment grade companies

Amongst companies in our sample with an investment grade rating, **the average gearing level is 23%, while the median gearing level is 22%.**

Average and median gearing by industry sector is summarised in Table A.5.

**Table A.5 Gearing averages and ranges by sector**

| | Sector Average | Sector Median | Sector Minimum | Sector Maximum |
|---|---|---|---|---|
| Marine Ports and Services | 24% | 26% | 4% | 40% |
| Railroads | 19% | 20% | 12% | 26% |
| Airports | 28% | 27% | 20% | 42% |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 4% | 4% | 4% | 4% |
| Railroads | 19% | 20% | 12% | 26% |
| Airports | 28% | 27% | 20% | 42% |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 29% | 27% | 21% | 40% |
| Railroads | N/A | N/A | N/A | N/A |
| Airports | N/A | N/A | N/A | N/A |

**Source:** Bloomberg

# B SL CAPM

The SL CAPM model is acknowledged by ESC as meeting the criterion of being well accepted and we agree with its assessment. The purpose of this attachment is to provide more details regarding the application of the SL CAPM, particularly its empirical limitations.

## B.1 Application of SL CAPM

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.[1] Brounen, de Jong and Koedijk (2004) broadened this work by extending the survey to businesses in the UK, Netherlands, Germany and France.[2] In all, these researchers confirmed the widespread use of CAPM in companies in the US and several European countries (around 60 per cent).

A number of studies have also provided evidence in support of using the SL CAPM. The results from Moyer, McGuigan and Kretlow (2001)[3] and Campbell, Lo and Mackinlay (1997)[4], 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)[5] as well as McKenzie and Partington (2014)[6] supported the use of to the SL CAPM in reports to the Australian Energy Regulator (AER).[7]

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1 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.

2 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.

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

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

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

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

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

Two of the earliest and most significant contributions were Black et al. (1972)[8] and Fama and Macbeth (1973).[9] 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.[10] 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:

> 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.[11] Burmeister and McElroy (1988) employed the S&P500 Index

[8] 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.

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

[10] 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.

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

as a proxy for the market and also rejected the hypothesis of SL CAPM.[12] 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:[13]

> 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:[14]

> 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:[15]

> 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.[16]

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

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[12] 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.

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

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

[15] 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.

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

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.

## B.2 Conclusion

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

# C Black CAPM

The purpose of this attachment is to explain the evolution of the Black CAPM (1972) and its application.[17]

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 overstate 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.

## C.1 Evolution of model

A key motivation for modifying SL CAPM is the empirical observation of low beta bias, evidence of which was discussed in Attachment B.

### C.1.1 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 overstate asset returns for companies with betas less than one, and understate 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).

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

### C.1.3 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: [18]

> '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. [19] 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 highlighted that although return on equity will be computed using the CAPM approach, evidence from other models will also be considered. Ofgem was further found stating that the CAPM should be "sense-checked by other approaches and evidence" (Ofgem 2013, paragraph 2.4.). 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.[20]

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;

> "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

[18] AER (2013). Better regulation – Rate of return guideline, December.

[19] Australian Energy Regulator (AER) 2013, *Better regulation – Rate of return guideline*, version 1, Commonwealth of Australia, December.

[20] Ofgem 2013, *Strategy decision for the RIIO-ED1 electricity distribution price control*, Financial issues, Supplementary annex, March.

Ofgem 2010, RIIO: *A new way to regulate energy networks*, final decision, October.

> method for calculating an ROE. Neither will we eliminate any particular methodology as unworthy of basing a decision".[21]

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.[22]

Similarly, a fare 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. [23]

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.[24] 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.[25]
- 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.[26]

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[21] 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.

[22] Alberta Utilities Commission 2016, *2016 Generic Cost of Capital*, decision 20622-D01-2016, October.

[23] Ontario Energy Board 2009, *Report of the Board on the Cost of Capital for Ontario's Regulated Utilities*, EB-2009-0084, December.

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

[25] New York PUC 2009, LEXIS 507.

[26] 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.[27]

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.[28]

## C.2 SFG Consulting's estimate of the zero-beta premium[29]

SFG Consulting 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.[30]

## C.3 Summary

The Black CAPM represents a theoretical (and generally an empirical) improvement in the SL CAPM but as we see in the following Attachment, its empirical performance is inferior to the Fama French model.

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

[28] Malko, J. R 2015, *Statement of Dr. J. Robert Malko*, June.

[29] SFG Consulting (2014a), Cost of equity in the Black capital asset pricing model, May.

[30] SFG Consulting (2014a), p.27.

# D Fama-French Model

The purpose of this attachment is to explain the evolution of the Fama and French (1993) model (FFM) and its application.[31] 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 evidence in support of the FFM and its application in a regulatory context, before applying the FFM to estimate a return on equity for the benchmark port entity. Implications for the Australian market are also discussed.

## D.1 Evolution of model

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

### D.1.1 Academic research findings

There is an extensive literature that has built up surrounding the performance of the Fama French model. This following is a very brief 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)[32] identify Banz (1981) as one of the first papers to

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

[32] Fama, E.F & French, K.R. (2004). The Capital Asset Pricing Model: Theory and evidence. Journal of Economic Perspectives, 18, pp.25-46.

uncover a size effect, namely that average returns on smaller cap stocks were higher than those predicted by CAPM.[33] Meanwhile, Stattman (1980)[34] 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.[35] 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.[36] 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.[37] 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 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.[38] 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.[39]

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

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

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

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

[37] 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.

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

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

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.[40] 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.[41] 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. Conversely, Abhakorn, Smith and Wickens (2013) find that the value factor, though not the size factor, helps to determine equity returns.[42]

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.[43] 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.[44]

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.[45] 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

[40] 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.

[41] 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.

[42] 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.

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

[44] 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.

[45] 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.

1997. They find that the observed value premium in average stock returns was even stronger in Japan than in the United States.[46] Rossi (2012) investigates the influence of factors for the Italian Stock Exchange between 1989 and 2004 and confirms the presence of a size effect.[47]

### D.1.2 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".[48] The Committee considered asset pricing to be "one of the fields in economics where academic research has had the most impact on non-academic practice".[49] It went on to say that "many professional investors use factor models such as the Fama-French model to guide their portfolio decisions"[50] and that "it has become standard to evaluate [investment] performance relative to 'size' and 'value' benchmarks, rather than simply controlling for overall market returns".[51]

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.[52] Of the more advanced CAPM alternatives in which additional risk factors are included they found that these techniques were used mostly by large companies.

The FFM was applied in the US court case Union Illinois v. Union Financial Group in which the judge wrote that "The advantage of using that formula is that it attempts to better account for certain factors that explain equity returns than does the original CAPM."[53]

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[46] 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.

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

[48] 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.

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

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

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

[52] 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.

[53] Union Illinois v. Union Financial Group, 847 A.2d 340 (Del. Ch. 2004), p.362.

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.

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.[54]

SFG Consulting reviewed leading finance journals to gauge acceptance of the FFM among finance academics.[55] They found FFM is routinely applied to estimate required returns in articles published in the Journal of Finance and the Journal of Financial 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".[56]

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.

## D.2 Regulatory practice

We have identified examples of regulators applying or considering the results of FFM, particularly in a US context.

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

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

[55] SFG Consulting (2014b). The Fama-French model, p.19.

[56] SFG Consulting (2014b). The Fama-French model, p.20.

the New Zealand Commerce Commission (NZCC).[57] Moreover, in its 2009 report concerning the estimation of the cost of capital, the NZCC stated that:[58]

> 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.

FFM has been used in several regulatory processes throughout the United States. For example, according to Ronald L. Knecht, the Nevada State Controller:[59]

> [W]hile there is still some apprehension about the use of the FF3F 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.[60]
- 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."[61]

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

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

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

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

[61] 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.

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.[62] Mr Paul Hunt as an expert witness before the California Public Utilities Commission presented results using both the CAPM and FFM.[63] Artesian Water Company before the Delaware Public Service Commission highlighted findings from the FFM that was accepted by the Commission without reservation.[64] 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.[65]

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.[66] 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.[67] Mr Knecht, once again, acted as a representative on behalf of the Nevada Public Utilities Commission in 2007, where he examined the return on equity using the FFM.[68]

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62 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.

63 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.

64 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]

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

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

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

68 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].

## D.3 Estimating the FFM return on equity

As previously noted, 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).

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.[69] 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.

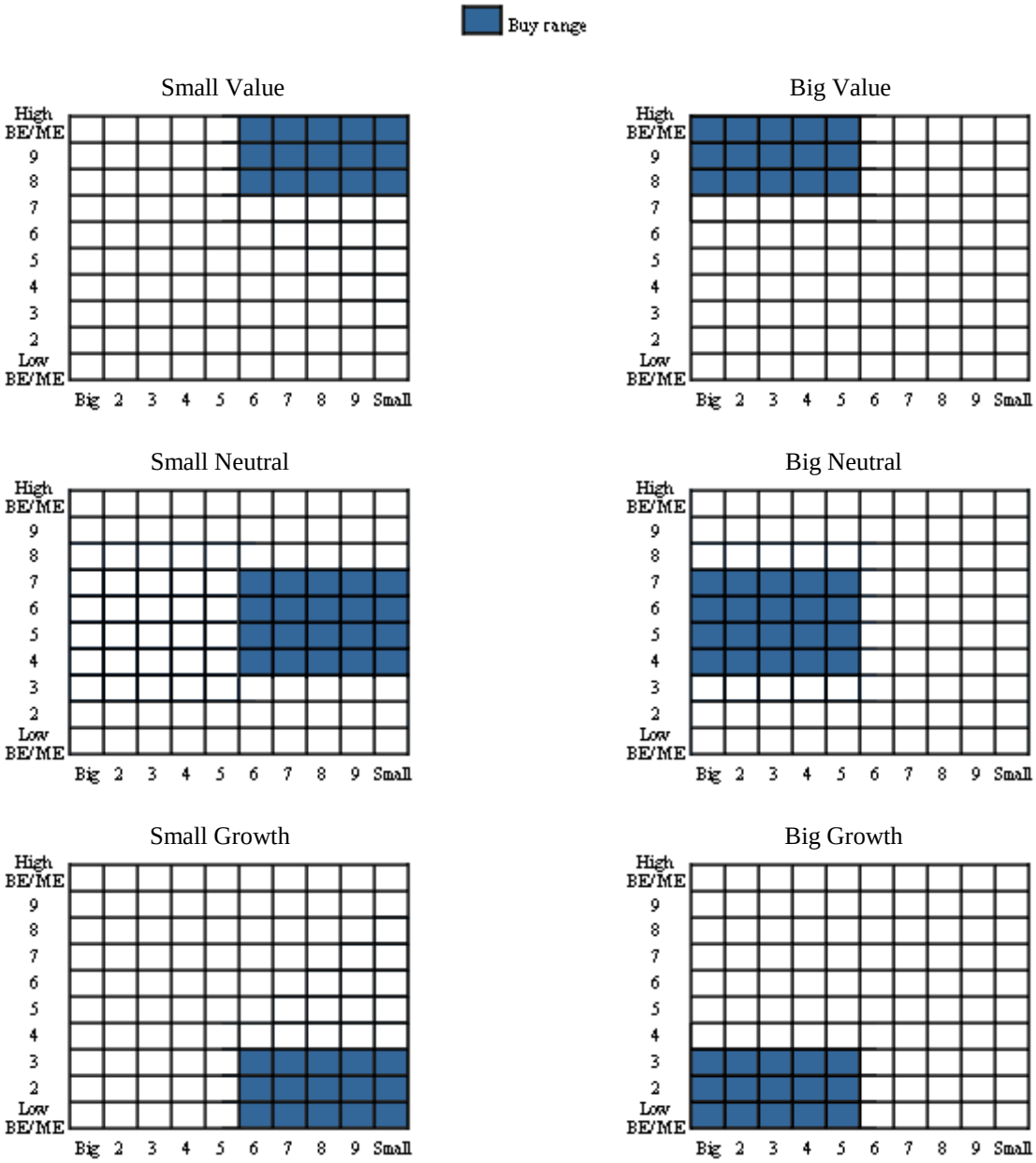
In the case of Australia, estimates of the factor premiums must also be constructed. For the estimates in this report, Professor Tom Smith from the University of Queensland Business School has extended this dataset to the end of 2016, following the methodology set out in SFG Consulting (2014), which 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 30$^{th}$ and 70$^{th}$ percentiles. Another important consideration is the interaction between 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 D.1 illustrates the various portfolios that are created in the model.

[69] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

**Figure D.1 Buy ranges of Fama French Benchmark portfolios**




**Data source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/bench_m_buy.html**

### D.3.1 Model specification

Data on monthly returns, market capitalisation and book-to-market ratios for all listed firms in Australia from 1985 to 2016 (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 (January 2012 to December 2016) 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. At this stage, it is important to note that the global data from Professor Kenneth French's website is denominated in US dollars, which means that returns for global companies must also be converted to US dollars prior to estimation. 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%.

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: 7.77%)

HML = expected high-minus-low risk premium (Australian estimate: 6.05%)

SMB = expected small-minus-big risk premium (Australian estimate: 1.77%)

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 D.1 and Table D.2 present our asset and equity betas and associated risk premiums.

**Table D.1 Fama-French asset beta estimates, by company**

| Company | Country | Sector | Beta (MRP) | Beta (HML) | Beta (SMB) |
|---|---|---|---|---|---|
| Aurizon Holdings | Australia | Railroads | 0.49 | 0.20 | 0.30 |
| Sydney Airport | Australia | Airports | 0.22 | -0.17 | 0.05 |
| Qube Holdings | Australia | Marine Ports and Services | 1.05 | 0.14 | 0.32 |
| Vienna International Airport | Austria | Airports | 0.63 | -0.05 | -0.03 |
| Wilson Sons | Brazil | Marine Ports and Services | 0.48 | 0.25 | -0.23 |
| Prumo Logistica | Brazil | Marine Ports and Services | 0.54 | 0.94 | 1.10 |
| Canadian National Railway Company | Canada | Railroads | 0.37 | -0.49 | -0.96 |
| Canadian Pacific Railway | Canada | Railroads | 0.92 | 0.46 | 0.03 |
| Sociedad Matriz SAAM | Chile | Marine Ports and Services | 0.48 | 0.21 | 0.31 |
| Copenhagen Airport | Denmark | Airports | 0.39 | 0.44 | 1.08 |
| Alexandria Containers & Goods | Egypt | Marine Ports and Services | 0.07 | 3.19 | -0.71 |
| Paris Airport | France | Airports | 0.43 | -0.21 | -0.67 |
| Frankfurt Airport | Germany | Airports | 0.42 | -0.26 | -0.10 |
| Hamburger Hafen und Logistik | Germany | Marine Ports and Services | 0.84 | 0.53 | 0.73 |
| Piraeus Port Authority | Greece | Marine Ports and Services | 1.44 | 0.70 | 0.27 |
| Thessaloniki Port Authority | Greece | Marine Ports and Services | 1.14 | 1.53 | 1.45 |
| China Merchants Port Holding Company | Hong Kong | Marine Ports and Services | 0.84 | -0.05 | 1.15 |
| COSCO Shipping Ports | Hong Kong | Marine Ports and Services | 0.72 | 0.32 | 0.53 |
| Dalian Port | Hong Kong | Marine Ports and Services | 0.58 | 0.18 | 0.36 |
| Container Corporation of India Limited | India | Railroads | 0.46 | -0.55 | 0.57 |
| ADSEZ | India | Marine Ports and Services | 0.77 | 0.32 | 0.47 |
| Kingston Wharves | Jamaica | Marine Ports and Services | 0.57 | -0.07 | -1.15 |
| Japan Airport Terminal Co. | Japan | Airports | 1.54 | -0.11 | -0.56 |
| Isewan Terminal Service | Japan | Marine Ports and Services | 0.36 | 0.32 | 0.47 |
| Malta International Airport | Malta | Airports | 0.07 | -0.27 | -0.76 |
| Grupo Aeroportuario del Centro Norte | Mexico | Airports | 0.58 | -0.58 | -0.19 |
| Grupo Aeroportuario del Sureste | Mexico | Airports | 0.04 | -0.15 | -0.69 |

| Company | Country | Sector | Beta (MRP) | Beta (HML) | Beta (SMB) |
|---|---|---|---|---|---|
| Auckland International Airport Limited | New Zealand | Airports | 0.32 | -0.72 | 0.01 |
| Port of Tauranga | New Zealand | Marine Ports and Services | 0.24 | -0.38 | 0.05 |
| Pakistan International Container Terminal | Pakistan | Marine Ports and Services | 0.80 | 0.32 | -1.47 |
| Asian Terminals | Philippines | Marine Ports and Services | 0.68 | 0.18 | -0.14 |
| International Container Terminal Services | Philippines | Marine Ports and Services | 0.59 | 0.73 | 0.65 |
| Hutchinson Port Holdings Trust | Singapore | Marine Ports and Services | 0.41 | -0.37 | 0.10 |
| Luka Koper | Slovenia | Marine Ports and Services | 0.42 | 0.07 | 1.13 |
| Zurich Airport | Switzerland | Airports | 0.55 | -0.43 | -0.35 |
| Airports of Thailand | Thailand | Airports | 0.53 | 0.05 | -0.91 |
| TAV Havalimanlari Holding | Turkey | Airports | 0.21 | 0.64 | 0.55 |
| DP World | UAE | Marine Ports and Services | 0.74 | -0.18 | -0.20 |
| Globaltrans Investment | International | Railroads | 1.22 | 0.44 | 1.19 |
| Global Ports Investments | International | Marine Ports and Services | 0.79 | 0.48 | 0.24 |
| CSX Corporation | US | Railroads | 0.83 | 0.13 | 0.33 |
| Genesee & Wyoming Inc. | US | Railroads | 0.98 | 0.35 | 0.26 |
| Kansas City Southern | US | Railroads | 0.76 | 0.50 | -0.16 |
| Norfolk Southern Corporation | US | Railroads | 0.83 | 0.27 | 0.30 |
| Union Pacific Corporation | US | Railroads | 0.58 | 0.23 | 0.30 |

**Note:** The betas presented here have been delevered using the same debt-to-equity ratios applied in the standard beta analysis

**Source:** Bloomberg, Synergies Calculations

### Table D.2 FFM equity betas and risk factor premiums

| Risk factors | Estimated equity betas | Risk factor premiums |
|---|---|---|
| Market risk premium | 0.89 | 7.77% |
| High minus low cap premium | 0.29 | 6.05% |
| Small minus big premium | 0.16 | 1.77% |

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

## D.4 Summary

The Fama French model has been criticised because of its controversial theoretical foundations. Nevertheless, it is clearly the best performing asset pricing model empirically. This superior empirical performance highlights its relevance 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.

**Table D.3 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. |
| 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. |

| Company Name | Country | Ticker | Company Description |
|---|---|---|---|
| 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.

### D.4.1 TPI

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.

ERA's beta comparators are presented in the Table D.4

**Table D.4 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. |
| 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.

### D.4.2 Public Transit Authority (PTA)

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.

ERA's beta comparators for the PTA are presented in Table D.5

**Table D.5 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 an 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.

## D.5 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.[70] A key difference in the comparator set adopted in 2008 relative to 2015 was the inclusion of airports in the former sample.

**Table D.6 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 D.7 Relative asset and equity betas of Canadian 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 D.8 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

[70] Allen Consulting Group (2007). Railways (Access) Code 2000: Weighted average cost of capital, 2008 WACC determinations, October, pp.28-29.

**Table D.9 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

# E 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.

**Table E.1 Beta Comparables over 5 and 10 year periods**

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| Qube Holdings | Australia | Yes | Marine Ports and Services | 1.02 | 0.99 |
| Port of Tauranga | New Zealand | Yes | Marine Ports and Services | 0.59 | 0.50 |
| Hamburger Hafen und Logistik | Germany | Yes | Marine Ports and Services | 0.61 | 0.91 |
| Piraeus Port Authority | Greece | Yes | Marine Ports and Services | 0.59 | 0.57 |
| Thessaloniki Port Authority | Greece | Yes | Marine Ports and Services | 0.50 | 0.62 |
| Sociedad Matriz SAAM | Chile | Yes | Marine Ports and Services | 0.93 | 0.93 |
| Luka Koper | Slovenia | Yes | Marine Ports and Services | 0.87 | 0.86 |
| Isewan Terminal Service | Japan | Yes | Marine Ports and Services | 0.21 | 0.26 |
| Wilson Sons | Brazil | No | Marine Ports and Services | 0.22 | 0.43 |
| China Merchants Port Holding Company | Hong Kong | No | Marine Ports and Services | 0.81 | 0.90 |
| COSCO Shipping Ports | Hong Kong | No | Marine Ports and Services | 0.66 | 0.86 |
| Dalian Port | Hong Kong | No | Marine Ports and Services | 0.76 | 0.80 |
| ADSEZ | India | No | Marine Ports and Services | 0.87 | 1.10 |
| Asian Terminals | Philippines | No | Marine Ports and Services | 0.76 | 0.67 |
| International Container Terminal Services | Philippines | No | Marine Ports and Services | 0.50 | 0.91 |
| Hutchinson Port Holdings Trust | Singapore | No | Marine Ports and Services | 0.45 | 0.51 |
| Kingston Wharves | Jamaica | No | Marine Ports and Services | 1.14 | 1.00 |
| Prumo Logistica | Brazil | No | Marine Ports and Services | 0.54 | 1.01 |

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| Global Ports Investments | International | No | Marine Ports and Services | 0.68 | 0.59 |
| Pakistan International Container Terminal | Pakistan | No | Marine Ports and Services | 0.86 | 1.00 |
| DP World | UAE | No | Marine Ports and Services | 0.26 | 0.43 |
| Alexandria Containers & Goods | Egypt | No | Marine Ports and Services | 1.17 | 1.04 |
| Aurizon Holdings | Australia | Yes | Railroads | 0.45 | 0.46 |
| CSX Corporation | US | Yes | Railroads | 0.95 | 0.90 |
| Genesee & Wyoming Inc. | US | Yes | Railroads | 1.13 | 0.97 |
| Kansas City Southern | US | Yes | Railroads | 0.79 | 0.95 |
| Norfolk Southern Corporation | US | Yes | Railroads | 1.00 | 0.83 |
| Union Pacific Corporation | US | Yes | Railroads | 0.67 | 0.90 |
| Canadian National Railway Company | Canada | Yes | Railroads | 0.59 | 0.40 |
| Canadian Pacific Railway | Canada | Yes | Railroads | 0.96 | 0.66 |
| Globaltrans Investment | International | No | Railroads | 0.97 | 1.71 |
| Container Corporation of India Limited | India | No | Railroads | 0.79 | 0.69 |
| Sydney Airport | Australia | Yes | Airports | 0.31 | 0.46 |
| Auckland International Airport Limited | New Zealand | Yes | Airports | 0.97 | 0.75 |
| Copenhagen Airport | Denmark | Yes | Airports | 0.34 | 0.47 |
| Vienna International Airport | Austria | Yes | Airports | 0.33 | 0.44 |
| Zurich Airport | Switzerland | Yes | Airports | 0.55 | 0.69 |
| Frankfurt Airport | Germany | Yes | Airports | 0.38 | 0.46 |
| Paris Airport | France | Yes | Airports | 0.38 | 0.49 |
| Grupo Aeroportuario del Centro Norte | Mexico | Yes | Airports | 0.89 | 0.85 |
| Airports of Thailand | Thailand | No | Airports | 1.01 | 0.75 |
| Grupo Aeroportuario del Sureste | Mexico | Yes | Airports | 0.56 | 0.84 |

| Comparables | Country | OECD | Sector | 5 Yr Asset Beta | 10 Year Asset Beta |
|---|---|---|---|---|---|
| TAV Havalimanlari Holding | Turkey | Yes | Airports | 0.27 | 0.39 |
| Malta International Airport | Malta | No | Airports | 0.75 | 0.81 |
| Japan Airport Terminal Co. | Japan | Yes | Airports | 1.15 | 0.60 |

**Source:** Bloomberg

## E.1 10 Year Betas

The report presents beta estimates over five years. These are presented again for the purpose of comparison, but as a robustness check we consider betas over 10 years. The overall average and median is slightly higher, reinforcing our proposed asset beta of 0.7.

**Table E.2 Comparables asset beta summary (10 year period)**

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| **Full Sample** | **0.74** | **0.75** | **0.26** | **1.71** |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.77 | 0.86 | 0.26 | 1.10 |
| Railroads | 0.85 | 0.87 | 0.40 | 1.71 |
| Airports | 0.61 | 0.60 | 0.39 | 0.85 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.71 | 0.74 | 0.26 | 0.99 |
| Railroads | 0.76 | 0.87 | 0.40 | 0.97 |
| Airports | 0.59 | 0.49 | 0.39 | 0.85 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | **0.80** | **0.88** | **0.43** | **1.10** |
| Railroads | **1.20** | **1.20** | **0.69** | **1.71** |
| Airports | **0.78** | **0.78** | **0.75** | **0.81** |

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

**Source:** Bloomberg

**Table E.3 Comparables asset beta summary (5 year period)**

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| **Full Sample** | **0.69** | **0.68** | **0.21** | **1.17** |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.68 | 0.67 | 0.21 | 1.17 |
| Railroads | 0.83 | 0.87 | 0.45 | 1.13 |
| Airports | 0.61 | 0.55 | 0.27 | 1.15 |
| OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |

| | Overall Average | Overall Median | Overall Minimum | Overall Maximum |
|---|---|---|---|---|
| **Full Sample** | **0.69** | **0.68** | **0.21** | **1.17** |
| | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.66 | 0.60 | 0.21 | 1.02 |
| Railroads | 0.82 | 0.87 | 0.45 | 1.13 |
| Airports | 0.56 | 0.38 | 0.27 | 1.15 |
| Non-OECD | **Sector Average** | **Sector Median** | **Sector Minimum** | **Sector Maximum** |
| Marine Ports and Services | 0.69 | 0.72 | 0.22 | 1.17 |
| Railroads | 0.88 | 0.88 | 0.79 | 0.97 |
| Airports | 0.88 | 0.88 | 0.75 | 1.01 |

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

## E.2 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 E.4

**Table E.4 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 | 0.83 | 0.54 | 0.57 | 0.87 | 0.61 |
| 10 Year Portfolio | 0.89 | 0.79 | 0.82 | 0.82 | 0.61 |

**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 (0.57). This finding can also be attributed to the portfolio weights. When weighted by market capitalisation, DP World (Average Market Capitalisation over five years = $US14.6 billion) accounts for 28% of the sample. In the individual estimations, its asset beta was calculated to be only 0.26. 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 0.87 for rail, an increase of 0.04 compared to averaging. The portfolio beta for airports was 0.61, which was identical to averaging across individual beta estimates. Similar results were observed over the ten-year time frame.

## E.3 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 E.5, and reinforce an asset beta estimate of at least 0.7 and up to at least 0.75.

**Table E.5 Beta estimates averaged across different starting days**

| Timeframe | 31-day Average | 31-day Median |
|---|---|---|
| 5 Years | 0.70 | 0.75 |
| 10 Years | 0.73 | 0.71 |

**Note:** To accommodate different month lengths throughout the year, we have also taken averages over 28 days. This has no impact on the 5 year estimates and causes a difference of only 0.01 in the median for the 10 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 no impact on the five year estimates and causes a difference of only 0.01 in the median for the 10 year estimates.

# F First principles analysis

## F.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.[71]

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.[72]

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.

### F.1.1 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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71 Lally, M. (2004). The cost of capital for regulated entities, Report prepared for the Queensland Competition Authority.

72 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 both Adelaide (import containers) and Port Botany (agricultural exports). Nevertheless, the majority 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.[73] 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.[74] 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 in 2040, 15 years before it is required to be operational. However, Infrastructure Victoria has made clear that capacity at existing commercial ports should be optimised before any investment in a second major container port. According to the Australian Logistics Council, PoM should nevertheless have an operational life of 50 years.

However, given the current attention to the issue, there is no guarantee that this 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:[75]

> 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:[76]

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[73] Port of Melbourne Corporation (2009). Port of Melbourne – Management Presentation, p.16.

[74] Ackerman, I., "Go west says IV," *Lloyd's List Australia*, May 25, 2017.

[75] Infrastructure Victoria (2017). Advice on securing Victoria's ports capacity, p.16.

[76] 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:[77]

> 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.

[77] 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:[78]

- 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)

[78] 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.

### F.1.1 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.

### F.1.2 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 clearly constrains PoM's market power. 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. Not only does the prospect of a second port bring substitution risk, but it gives 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. 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.

### F.1.3 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, the 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.

### F.1.4 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.

### F.1.5 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.

# G 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).

## G.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.[79]

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 F.1 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 G.1

[79] ACCC (2008). Access Undertaking – Interstate Rail Network Australian Rail Track Corporation, Final decision, April.

**Table G.1 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 per cent 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.

## G.2 ERA – Brookfield Rail, The Pilbara Infrastructure (TPI) and Public Transit Authority

The ERA establishes WACC estimates for Brookfield Rail, the Public Transit Authority and TPI.[80]

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.

[80] ERA (2014a). Review of the method for estimating the weighted average cost of capital for the regulated railway networks, Revised draft decision, November.

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 efficient benchmark entity 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.

### G.2.1 Brookfield Rail

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.

ERA's beta comparators are presented in the following table.[81] 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.

[81] ERA (2014a), pp 28-30.

# H Market risk premium – Supplementary information

The purpose of this attachment is to provide further details of regulatory precedent and market survey evidence in regards to the market risk premium.

## H.1 Regulatory decisions on the MRP

Brief summaries of Australian regulators' approaches to estimating the MRP are presented below.

### H.1.1 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 2017, IPART's range for the MRP extends from 6.0% (mid-point of long term average range) to 9.3% (mid-point of current range), with a mid-point of the two ranges of 7.70%.[82]

However, IPART's MRP estimate as a margin above the contemporary risk free rate is greater than this reported value because of the higher risk free rate assumed in its approach (80 basis points). The most recent Biannual Update reports an "effective" MRP of 8.5% (adding the MRP and the margin above the risk free rate), which is unchanged from its July 2016 assessment.[83]

### H.1.2 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.[84] It arrived at a range of 5% to 7.5% and stated that it will apply judgement

[82] IPART (2017). WACC Biannual Update, February.

[83] IPART (2017), WACC Biannual Update, February

[84] ERA (2014b). Review of the method for estimating the weighted average cost of capital for the freight and urban rail networks, Draft determination, 5 June.

as to where it will select the point estimate at any point in time. For that Draft Determination, it proposed a value of 6%.

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.[85] 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.[86] 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."[87] It arrived at a final estimate of 7.3%.

It took a similar approach in its assessment for ATCO Gas, where it applied a MRP of 7.6%.[88] It applied an updated value of 7.4% in its most recent determination for the Dampier to Bunbury Pipeline.[89] In its June 2015 decision for ATCO, the ERA commented on its approach as follows:[90]

> 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.

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85 ERA (2014a).

86 ERA (2015a). Final decision on the review of the method for estimating the weighted average cost of capital for the regulated railway networks, 18 September.

87 ERA (2015a). p.145.

88 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.

89 ERA (2016). Final decision on proposed revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020, 30 June.

90 ERA (2015b), p 249.

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).

### H.1.3 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.[91] 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[92], 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.[93]

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.

### H.1.4 QCA

The QCA concluded a review of its WACC methodology in August 2014. Historically, the QCA had been very reluctant to depart from its long term precedent MRP of 6%. It subsequently acknowledged that:[94]

> There is no question that market volatility increased during the GFC and that the market risk premium was probably elevated as a result. While volatility has largely

[91] The AER does not explain what it means by 'conditioning variables'.

[92] AER (2013b). Better regulation: Explanatory statement, Rate of return guideline, December.

[93] AER (2013b). p.95.

[94] QCA (2014). Cost of capital: Market parameters, Final decision, August, p.22.

subsided, the question is whether the market risk premium remains at an elevated level and to what extent.

The QCA has applied four main methods to estimate the MRP, being two forms of historical averaging (the Ibbotson and Siegel methods), survey evidence (including independent expert reports) and the Cornell DGM. Curiously, it has not applied the Wright approach. 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%.[95]

### H.1.5 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.

### H.1.6 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.[96] The reasoning behind this was not provided. It reflects a preference for relying on historical excess returns to estimate the MRP.

## H.2 Market surveys

### H.2.1 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

[95] QCA (2016). DBCT Management's 2015 draft access undertaking, Draft decision, April.

[96] 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 a MRP of 6%.

consistently reports an MRP in the range of 6%, regardless of the conditions in financial markets.[97]

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 (2003) notes that "the respondents to these surveys are academics, analysts, and managers rather than investors per se."[98] 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.

### H.2.2 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:[99]

> Most people (52%) used a variety of methods for determining the equity risk premium, with forward looking measures (21%) more prevalent than historical data (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.

[97] Frontier Economics (2016). The market risk premium: Report prepared for Aurizon Network, November.

[98] Lally M. (2013). Response to submissions on the risk-free rate and the MRP, p.23.

[99] 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].

*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.[100] 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:[101]

> 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:[102]

- 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
- How respondents adjust their opinions in relation to changing market conditions

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100 KPMG (2015). Australian valuation practices survey 2015, May, p.21.

101 *Application by Envestra Ltd (No 2)* [2012], ACompT 3, para. 162-163.

102 McKenzie, M. and Partington, G. (2011). Equity market risk premium: Report to Corrs Chambers Westgarth, p.19.

### H.2.3 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 MRP.