AUSTRALIAN RAIL TRACK CORPORATION LTD

Ref No:

1 December 2008

Mr. James Cox
Chief Executive Officer and Full Time Member
Independent Pricing and Regulatory Tribunal
PO Box Q290,
QVB Post Office NSW 1230

NEW SOUTH WALES RAIL ACCESS UNDERTAKING (NSWRAU)
Review of Rate of Return and Remaining Mine Life of Hunter Valley Mines

ARTC Submission for IPART Consultation

Dear Mr Cox

IPART has invited ARTC to provide a public submission detailing its proposals in relation to the Rate of Return to apply to the Hunter Valley Coal Network (HVCN) for 5 years from 1 July 2009, and the remaining life of coal mines served by the HVCN. ARTC understands that IPART, as part of its five year review as required under the NSWRAU, will invite stakeholder comment on ARTC's proposals, and those of RailCorp. IPART's previous review and settings for Rate of Return and remaining coal mine life was undertaken in 2004.

In response, ARTC has prepared the attached submission, incorporating separate consultancy reports prepared in relation to Rate of return and Mine. The submission and reports form a single package that can be published by IPART for consultation. If you have any queries in relation to the submission or reports please contact myself on 0882174314, sormsby@artc.com.au or Glenn Edwards 0882174292, gedwards@artc.com.au.

Yours sincerely

Simon Ormsby
General Manager Commercial

NEW SOUTH WALES RAIL ACCESS UNDERTAKING (NSWRAU)

Review of Rate of Return and Remaining Mine Life of Hunter Valley Mines

ARTC Proposals for IPART Consultation

IPART has invited ARTC to provide a public submission detailing its proposals in relation to the Rate of Return to apply to the Hunter Valley Coal Network (HVCN) for 5 years from 1 July 2009, and the remaining life of coal mines served by the HVCN. ARTC understands that IPART, as part of its five year review as required under the NSWRAU, will invite stakeholder comment on ARTC's proposals, and those of RailCorp. IPART's previous review and settings for Rate of Return and remaining coal mine life was undertaken in 2004.

To put some context around this submission and ARTC's proposals, ARTC wishes to advise IPART and stakeholders that it is currently consulting with stakeholders in relation to the development of its 2008 Hunter Valley Access Undertaking (2008 HVAU), and will submit an application to the Australian Competition and Consumer Commission (ACCC) for its approval of that access undertaking in the near future. It is ARTC's current intention that the 2008 HVAU will be approved and become effective from 1 July 2009, replacing the application of the NSWRAU to those parts of the HVCN for which ARTC is the Rail Infrastructure Owner. As such, it is possible that the Rate of Return and estimated mine life determined in this review may not ultimately become effective with respect to those parts of the HVCN for which ARTC is the Rail Infrastructure Owner. This process will entail providing further rate of return and remaining mine life assessments (to the ACCC) in its application. These assessments are likely to be different to that provided in this assessment given the very different arrangements, scope and term expected to be incorporated in the 2008 HVAU.

Also, ARTC is currently seeking industry comments in relation to a variation to the NSWRAU it is seeking in order to bring an early review by IPART of Rate of Return to apply from 1 July 2008 until approval of the 2008 HVAU or, if not approved by 1 July 2009, until the rate of Rate of Return determined in this review becomes effective. If the variation is approved by the NSW Government, IPART will undertake a further review and public consultation in relation to this interim Rate of Return. Again, given the interim nature of the Rate of Return, ARTC's assessment is likely to be different to that provided in this assessment.

Attached to this submission are reports detailing assessments of Rate of Return and remain life of Hunter Valley coal mines as follows:

- Appendix A – ARTC's Hunter Valley Coal Network – Weighted Average Cost of Capital Review prepared by Synergies Economic Consulting; and

- Appendix B - Mine Life Assessment – Hunter Valley Region – prepared by Booz & Co.

ARTC provides some overall comments regarding the preparation and findings in relation to each of these consultancies as follows.

Weighted Average Cost of Capital (WACC) – Synergies

- The Synergies assessment seeks to develop a reasonable and feasible range for WACC taking into account the risks faced by ARTC arising from the uncertain financial and economic circumstances and commercial arrangements likely to apply in relation to the HVCN. In particular, Synergies has sought to recognise the following:

    - The magnitude and nature of the substantial investment program sought by industry to meet demand for rail capacity over the next five years, where new capital expenditure is likely to treble the existing RAB value for the HVCN. A large part of the investment is expected to be undertaken to deliver capacity to enable more marginal volumes in the upper Hunter Valley region to be realised. This will increase stranding risk.

    - Current uncertainty in relation to global economic and financial conditions is likely to remain for some time. This is impacting on perceptions in the financing industry of risk in infrastructure provision affecting financing appetite and cost to that sector.

    - Commercial and operational arrangements in relation to the Hunter Valley coal chain (including Newcastle port and above rail) and affecting ARTC directly and indirectly are expected to change significantly in the next year or so. The industry is seeking greater alignment of capacity, and incentives, in relation to various elements of the chain. This increases risk for individual elements of that chain. Further, the exact nature of these arrangements, and the risks faced, is unlikely to be finalised for some time;

- Current observed settings for time based components of WACC, including the risk free rate and debt margin;

- More recent regulatory evidence, views and precedence than that available to IPART and stakeholders in 2004 has become available.

- Consequences of regulatory error tends to be asymmetric, where the consequences of setting a return too low, and discouraging efficient investment, are considered worse than setting it too high.

- It is ARTC's view that all of the above matters reasonably warrant consideration in an assessment of ARTC's WACC. It has been IPART's practice in the past to identify a feasible range of WACC for ARTC and then identify a point in that range that considers specific risks faced by ARTC such as stranding risk. In the past, IPART has set the return at around the 75th percentile in the range. In ARTC's view the risks associated with the ARTC's planned investment, the changing and unsettled nature of commercial and operations arrangements on the HVCN, and the uncertainty surrounding global economic and financial conditions warrant setting the return at least at the 75th percentile in the range.

- The range of WACC determined by Synergies is 8.84% to 10.53% real, pre-tax. ARTC proposes a regulatory rate of return of at least 10% real, pre-tax be approved by IPART. This will, of course be updated to reflect changes in the time based components of WACC applicable to 1 July 2009.

Mine Life Assessment – Hunter Valley Region – Booz & Co.

In making its assessment of remaining coal mine life applicable to mines served by the HVCN, Booz & Co. have sought to improve on the methodology that has been utilised in previous assessments undertaken by Booz Allen Hamilton in 2004 and 1999. In particular, and consistent with valid concerns expressed by some stakeholders in relation to previous assessments, Booz has not used a single point estimate of current production to determine future mine life. Instead, Booz & Co. has sought to base coal mine life on the forecasts of mine production underpinning ARTC's Hunter Valley investment strategy and coal chain capacity, both of which are variable over time. ARTC supports this approach and considers that this will result in a far more reliable estimate of average mine life than in previous assessments.

Further changes to the approach previously adopted that are intended to improve the reliability of the estimate of average mine life are as follows.

- The previous assessment included two options of considering all existing mines, and considering all existing mines and prospective mines with a possible start date over the current regulatory period. The options used by Booz & Co. consider the latter of the two previous scenarios above, and another option considering prospective mines that may come on stream beyond the 5 year regulatory period.

- Booz & Co. have developed estimates for two scenarios considering production is unconstrained over the regulatory period and beyond, and constrained over the regulatory period by Hunter Valley coal chain capacity.

- Booz & Co. has based its estimate on forecasts of mine production and capacity constraints consistent with those used by ARTC in developing the Hunter Valley Corridor Capacity Strategy (2008-18).

ARTC believes that these modifications to the methodology will result in a more reliable estimate of average mine life.

Booz & Co has retained a number of other aspects of the previous methodology including the following:

- Utilising up to date assessments of coal mine reserves;

- Utilising a weighted average to determine mine life. The previous assessments have considered an unweighted average mine life.

To assess sensitivity, Booz & Co. have developed estimates for 4 options, being:

- Option A – Unconstrained production of all mines in production currently and through to 2014.

- Option B – Constrained production of all mines in production currently and through to 2014.

- Option C – Unconstrained production of all mines in production currently, and through to 2014, and known 'prospective' mines that may commence production 2015 and beyond.

- Option D – Constrained production of all mines in production currently, and through to 2014, and known 'prospective' mines that may commence production 2015 and beyond.

Estimates of average mine life for each option are provided below.

	Average Mine Life (Years)			
	Option A	Option B	Option C	Option D
Hunter Valley Coal Network	22.5	22.8	25.2	25.5

Booz & Co. have asserted that the most reliable and realistic estimate of average mine life arises from Option B. This option considers short term capacity constraints in the Hunter Valley coal chain, production forecasts over time of all existing mines and mines due to come into production up to 2014 (the regulatory period). Booz & Co. have proposed not include 'prospective' mines beyond the regulatory period due to the speculative nature of these projects and uncertainty around reserve and production levels.

ARTC agrees with Booz & Co.'s identification of Option B as providing the most reliable and realistic estimate of average mine life. ARTC considers this estimate as being more reliable than estimates prepared in the previous assessments in 2004 and 1999.

ARTC proposes an average mine life of 22.8 years to apply to the HVCN for the regulatory period of 5 years commencing 1 July 2009.

Appendix A – ARTC's Hunter Valley Coal Network – Weighted Average Cost of Capital Review prepared by Synergies Economic Consulting; and

Appendix B - Mine Life Assessment – Hunter Valley Region – prepared by Booz & Co.

APPENDIX A

ARTC's Hunter Valley Coal Network
Weighted Average Cost of Capital Review

Synergies Economic Consulting

ARTC's Hunter Valley Coal Network

Weighted Average Cost of Capital Review: Submission to IPART

December 2008
Synergies Economic Consulting Pty Ltd
www.synergies.com.au

Disclaimer

Synergies Economic Consulting (Synergies) has prepared this advice exclusively for the use of the party or parties specified in the report (the client) and for the purposes specified in the report. The report is supplied in good faith and reflects the knowledge, expertise and experience of the consultants involved. Synergies accepts no responsibility whatsoever for any loss suffered by any person taking action or refraining from taking action as a result of reliance on the report, other than the client.

In conducting the analysis in the report Synergies has used information available at the date of publication, noting that the intention of this work is to provide material relevant to the development of policy rather than definitive guidance as to the appropriate level of pricing to be specified for particular circumstance.

Executive Summary

Australian Rail Track Corporation (ARTC) has requested Synergies Economic Consulting (Synergies) to provide an opinion on the weighted average cost of capital (WACC) for its Hunter Valley coal network (references to 'ARTC' in this document are therefore in the context of ARTC's Hunter Valley coal network only). ARTC assumed responsibility for this network in 2004 under a 60 year lease arrangement, along with the New South Wales interstate network.

The Hunter Valley produces mainly thermal coal, approximately 21% of which is used domestically for electricity generation and the balance exported. Significant growth in demand for thermal coal exports has placed significant pressure on coal supply chain infrastructure, particularly at the port. A number of strategies are being implemented via the Hunter Valley Coal Chain Logistics Team to address capacity constraints and better position the region to take advantage of this expected future demand growth.

As part of its 2008-18 Hunter Valley Strategy ARTC is expecting to spend approximately $1 billion on infrastructure enhancements and upgrades to the network over the next five years, relative to an existing Regulated Asset Base of approximately $530 million. While there is considerable optimism underpinning the current outlook for coal, only limited confidence can be placed on volume forecasts that extend beyond five years. Longer term forecasts that have been produced by ABARE highlight that the long-term demand outlook is highly uncertain, particularly for thermal coal exports, which dominate Hunter Valley coal production (and drive demand for access to ARTC's network). ARTC is therefore expected to commit significant new capital for assets with very long useful lives (and no alternative use) in a very risky investment climate.

Parameter Estimates

The WACC has been estimated using a pre-tax real framework as this is the method commonly applied by IPART. The cost of equity has been determined in accordance with the domestic Capital Asset Pricing Model, which remains the most commonly used asset pricing model despite a number of shortcomings.

It is also important to give due regard to the statistical imprecision of beta, and the asymmetric consequences of regulatory error. It is generally recognised that if prices are set too low, the resulting under-investment is worse from an economic and social perspective than if prices are set too high. This highlights the need to adopt a cautious approach in estimating beta, as well as other WACC parameters. In this context, this means erring on this side of setting WACC at the upper end of the range, rather than the lower.

One of the key drivers of WACC is systematic or non-diversifiable risk, which is reflected in the cost of equity calculation via the equity beta. In order to determine this for ARTC, we have undertaken:

- a review of comparable companies from the coal and rail industries, as well as relevant regulatory decisions; and
- a first principles analysis, which concludes that a key source of ARTC's systematic risk is its high operating leverage.

We have concluded that 0.5 and 0.6 is a reasonable range for ARTC's asset beta. The lower bound is consistent with the QCA's 2005 decision in relation to QR's central Queensland coal network and the upper bound is based on other rail regulatory decisions, as well as beta estimates from listed coal and rail firms (the average of which is still well above this bound, reflecting that the risks faced by these firms are likely to be higher than ARTC's risk profile).

As noted above, ARTC is about to commit to an investment program that is significant relative to the size of its existing Regulated Asset Base. ARTC only has certainty in relation to the revenue it will earn for the duration of the regulatory period. Beyond this, it remains exposed to the risk of a reduction in demand. This risk is not compensated via the WACC (nor is it compensated elsewhere) given the CAPM assumes that returns are normally distributed, whereas stranding risk is asymmetric, notwithstanding that some of the drivers of asset stranding risk are systematic in nature.

Apart from the total size of the investment planned by ARTC, much of the demand for this additional capacity is being created as a result of new mines that are being developed some distance from the port. As will be highlighted in the report, ARTC's systematic risk is underpinned by the risk profile of its customers. The systematic risk of coal mining companies is particularly high. This is driven by a number of factors including the sensitivity of these companies' revenues to exchange rates given they influence the competitiveness of Australia's coal exports. Demand for ARTC's services will also be influenced by this, although ARTC's revenues are protected under the revenue cap, at least for the term of the regulatory period.

If these mines are considered in isolation (recognising that most of these mines are owned by companies that already have other developments in the region), the systematic risk of these particular mines is likely to be higher than the systematic risk of established mines that are located closer to the port. Apart from being relatively new developments, given the mines are located much further from the port, they are at a relative cost disadvantage compared to their competitors who are located closer to the port (given they face higher transport costs). As a consequence, these mines are likely to be more vulnerable to an adverse movement in exchange rates and could be the first to close if there was a significant downturn in demand.

ARTC's revenues are largely protected from systematic volume risk for the term of the regulatory period. If there was to be a significant change in demand during a regulatory period, it is still possible that the regulator would revisit prices. The new mines, having a higher cost structure than the established mines, would have a higher level of systematic risk (that is, they would be more affected by economic shocks than the established mines). The new expanded network servicing the new mines would therefore also have a higher level of systematic risk than the existing network. Closure of the new mines caused by adverse economic conditions would result in stranding risk being borne by ARTC. As noted above, the stranding risk is not compensated via the WACC.

The riskiness of the investment climate currently faced by ARTC has been highlighted with the recent global financial market downturn. There are now significant concerns regarding future world economic growth, including potential revisions to growth expectations for economies in Asia, which have been fuelling much of the current boom in the demand for coal. This impact has already been seen in commodity prices and the implications for coal remain uncertain.

Even if the demand outlook remains positive, these events have highlighted the potential vulnerability of this outlook over the longer term. However, it is unlikely that this has moderated expectations on ARTC to undertake significant investments that will enhance the performance of the coal supply chain, which is in the public interest.

We are of the view that it is reasonable to provide ARTC with at least some compensation for stranding risk. However, the key question is how this compensation can be appropriately determined and applied. There are three possible ways of doing this:

1. determining a methodology to value asymmetric risk, with a view to providing compensation via the cashflows, rather than the WACC;
2. applying a subjective adjustment to the beta (or the WACC); or
3. selecting the beta estimate from towards the upper bound of a reasonable range.

The first method is the preferred approach but unfortunately a robust methodology for valuing asymmetric risk is yet to be developed (and accepted by regulators). The second method is inconsistent with the CAPM, although it is probable that this is what a number of unregulated businesses do in practice. For example, a survey by Meier and Tarhan (2006) of CFOs in the US shows that non-systematic risk does play a role in setting hurdle rates.

This leaves the third option. While an imperfect solution, it ensures that sufficient incentive is provided to ARTC to invest, recognising that investment in essential infrastructure to support Australia's export capability is in the public interest. It should not result in over-compensation provided the beta is selected from within the bounds of a reasonable range.

We note that the most recent determination by IPART regarding the rate of return to apply to the Hunter Valley network dealt with this issue by selecting a WACC from above the mid-point of the range:[1]

> IPART proposes to take account of truncation by allowing an unders and overs account system and permitting a maximum rate of return above the mid-point determined by the CAPM framework.

The environment facing ARTC's Hunter Valley coal business was quite different back in 2004, with the implications of the growth in the demand for coal yet to fully emerge. At the time, ARTC was not contemplating an investment program anywhere near the size of the expenditure it is looking to commit now.

The investment risk is a key issue facing ARTC's future capital program. ARTC is not compensated for this risk (under the CAPM-determined WACC or otherwise). In the absence of any readily accepted method to value stranding risk we are of the view that providing some uplift to ARTC ensures that it has sufficient incentive to invest in this extremely risky investment climate. In addition to the approach taken by IPART in the 2004 decision, we note that an 'uplift' in WACC was provided to the Dalrymple Bay Coal Terminal by the Queensland Competition Authority in its 2005 decision, in recognition of the significant expansion it is undertaking in the same climate.

In relation to the market risk premium, we are of the view that there is no clear economic or empirical justification for a fall in the value of the market risk premium relative to historical values. Most long-term studies of historical returns produce estimates well in excess of 6% - most likely around 7% - which shows that the

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[1] Independent Pricing and Regulatory Tribunal of New South Wales (2004), Report on the Determination of Remaining Mine Life and Rate of Return from 1 July 2004, NSW Rail Access Undertaking, p.74.

assumption that has been consistently adopted by regulators has been too low. Even if there is an expectation that the market risk premium is likely to be lower going forward (although there is currently no empirical evidence that convincingly supports this case), this does not necessarily mean that the premium has fallen significantly from these historical estimates. We are therefore of the view that a range of between 6% and 7% remains appropriate.

We also remain of the view that the value of gamma is zero, recognising that since the introduction of the 45-day rule, franking credits are now worthless to the marginal foreign investor. Assuming that the domestic market is fully segmented (and hence would ignore the presence of foreign investors) is not considered realistic and would have implications for the estimation of other market-determined parameters. There is evidence from recent reputable studies, as well as our own analysis, which rejects the hypothesis that gamma has a value other than zero.

While franking credits may have had some value prior to this tax law change (which may be reflected in estimates from studies that have spanned this decision), this is no longer the case. The early regulatory decisions which adopted a value of 0.5 (which has since become precedent) were also made prior to the introduction of the 45-day rule. We are of the view that there is sufficient evidence to now review the fundamental basis of this assumption.

We are of the view that a capital structure range of between 50% and 55% is appropriate for ARTC. This conclusion was reached after reviewing other regulatory decisions, as well as capital structures maintained by firms in similar industries.

The recommended parameter estimates for the WACC for ARTC's Hunter Valley coal network are summarised in the following table:

Parameter	Lower bound	Upper bound
Risk-free rate[a]	4.95%	4.95%
Debt to total value	50%	55%
Equity to total value	50%	45%
Debt margin[b]	3.00%	3.00%
Debt raising costs	0.125%	0.125%
Market risk premium	6%	7%
Gamma	0	0
Tax rate	30%	30%
Asset beta	0.5	0.6
Debt beta	0	0
Equity beta[c]	0.99	1.32
Cost of equity	10.88%	14.17%
Cost of debt	8.08%	8.08%
Inflation	2.73%	2.73%
Post-tax nominal WACC	9.48%	10.82%
Pre-tax real WACC[d]	8.84%	10.53%

a Based on a 20 day average for the period ending 28 November 2008.

b Based on a 20 day average for 8 year BBB bonds plus the margin between and A-rated 8 and 10 year bond, for the period ending 28 November 2008. Before debt-raising costs.

c Based on the Monkhouse formula.

d Based on the market transformation method.

We have also recommended that:

- an allowance for equity raising costs is included in the cashflows, based on an estimate of at least 5%. This is considered a lower bound as it only captures the direct costs of raising equity, not the indirect costs; and
- interest during construction is capitalised into the asset base during the construction period, based on the WACC.

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1 Introduction

Australian Rail Track Corporation (ARTC) was established in 1998 following an agreement by the State and Commonwealth Governments that a single entity should be responsible for the national interstate rail network. It is now responsible for managing the majority of the interstate rail network between Brisbane and Perth, as well as the Hunter Valley Coal Network in New South Wales. ARTC was established as a company under the Corporations Law, with all shares held by the Commonwealth Government.

ARTC is responsible for all operations on the network under its jurisdiction, including the provision of train control functions, the creation and selling of train paths to operators and the undertaking of capital and maintenance expenditures.

An important aspect of the review of ARTC's access undertaking is the rate of return, which is measured by the Weighted Average Cost of Capital (WACC). The purpose of this report is to review ARTC's WACC, which requires developing a forward-looking estimate for each of the key parameters that underpin the WACC calculation. The report is structured as follows:

- section 2 provides an overview of ARTC's business and risk profile;
- section 3 examines some fundamental methodological issues, including the use of the Capital Asset Pricing Model;
- section 4 estimates the WACC parameters;
- section 5 considers other financing costs that are not reflected in the WACC; and
- section 6 concludes the report.

The report has been prepared for submission to the Independent Pricing and Regulatory Tribunal (IPART) as part of its periodic review of the rate of return and prevailing mine life to apply to the Hunter Valley network from 1 July 2009. Appropriate recommendations in relation to the Hunter Valley Coal Network will also be submitted to the ACCC when ARTC lodges its draft Access Undertaking.

Synergies has previously prepared a similar assessment for ARTC's interstate network. The parameter estimates submitted here are the same, with the exception of capital structure and beta, which are driven by the nature of the business and its risk profile.

2 Overview of ARTC's Hunter Valley Coal Network Business

2.1 ARTC's business

ARTC was established with a charter to:

- improve performance and efficiency of interstate rail infrastructure;
- increase capacity utilisation;
- listen, understand and respond to the market;
- operate on sound commercial principles; and
- provide shareholders with a sustainable return on capital invested.

As noted above, ARTC now controls access to the majority of the national interstate network between Brisbane and Perth, either via ownership or lease of the network, or under wholesale arrangements negotiated with State Government owners of certain parts of the network. In 2004 ARTC assumed responsibility for the interstate and Hunter Valley coal networks in New South Wales under a 60-year lease arrangement. This includes management of the regional rail network outside of the Sydney Metropolitan Commuter Network. ARTC also has a licence to construct the Southern Sydney Freight Route and will be progressively assuming responsibility for other dedicated freight lines in the Sydney metropolitan area.

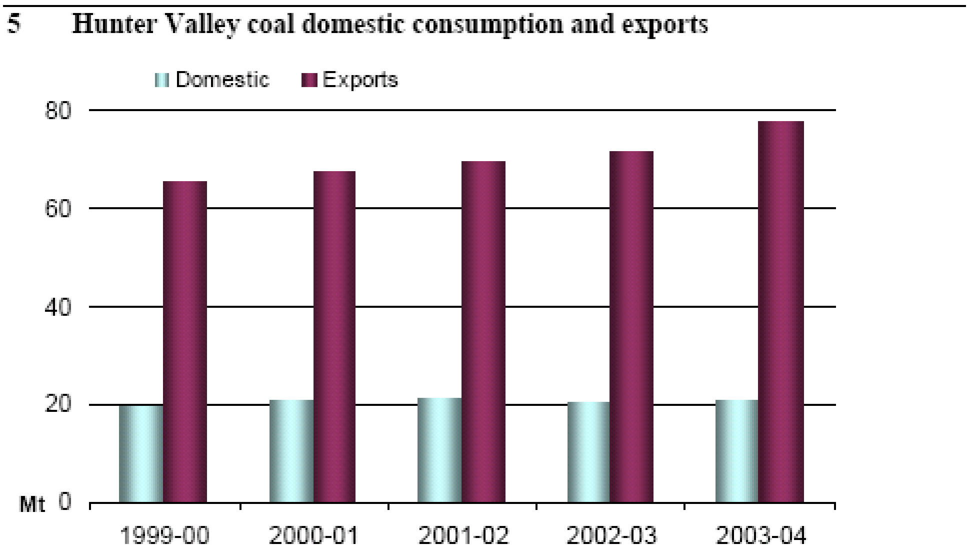
2.2 Hunter Valley Coal Network

2.2.1 Hunter Valley coal production

The Hunter Valley produced 98 million tonnes of coal in 2003-04, representing 35% of Australia's total coal production.[2] Most of this coal is thermal coal, which is used in electricity generation and other industrial applications. Approximately 21% is sold domestically for electricity generation, with the balance exported. As is evident from Figure 1 below, domestic consumption has been relatively stable while exports have been growing.

[2] Australian Bureau of Agricultural and Resource Economics (2005), Infrastructure Issues in the Hunter Valley Coal Supply Chain, ABARE Report for the Australian Government Senior Officials Group on Coal Transport Infrastructure, Commonwealth Government, p.14.

Figure 1



Source: Australian Bureau of Agricultural and Resource Economics (2005), Infrastructure Issues in the Hunter Valley Coal Supply Chain, ABARE Report for the Australian Government Senior Officials Group on Coal Transport Infrastructure, Commonwealth Government, p.15.

In 2004, throughput at the port of Newcastle was 78 million tonnes, or 10% of the world's total trade in coal.[3] The main destinations for these exports are Japan, Korea and Chinese Taipei. As evident in Figure 2, Japan accounts for most of this demand, with the Hunter Valley coal accounting for close to 36% of Japan's total imports of thermal coal in 2003.[4] ABARE identify two key factors that will influence the thermal coal outlook being:[5]

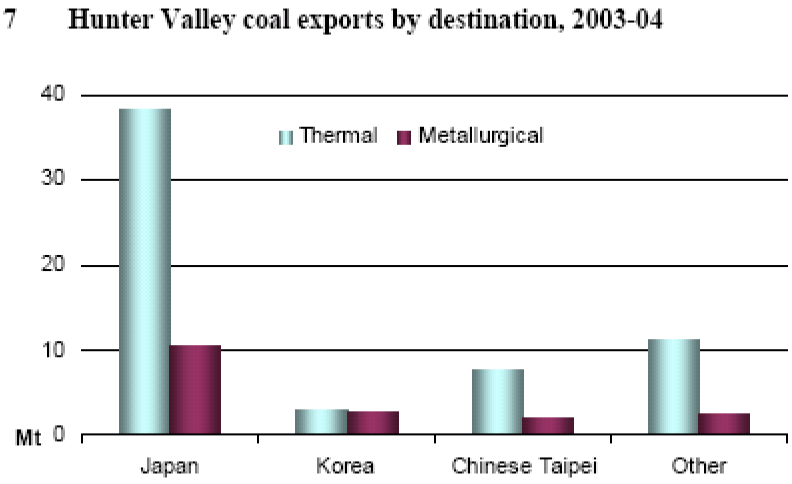
- the Kyoto protocol and the implications of this for imports from Japan; and
- the expected continued growth in demand from China, which has only become a net importer of coal relatively recently.

[3] ibid., p.11.

[4] ibid., p.15.

[5] ibid., p.2.

Figure 2



Source: Australian Bureau of Agricultural and Resource Economics (2005), Infrastructure Issues in the Hunter Valley Coal Supply Chain, ABARE Report for the Australian Government Senior Officials Group on Coal Transport Infrastructure, Commonwealth Government, p.16.

Pacific National is currently responsible for around 93% of coal delivered to Newcastle and Port Kembla. QR National commenced hauling coal in the region in 2005 and will be responsible for carrying approximately 12% of the total coal hauled in New South Wales.[6]

2.2.2 Demand outlook

ABARE predicts continuing growth in the demand for coal exports from the Hunter Valley (most of which will be thermal coal). It expects this demand to increase by approximately 2.8% per annum to around 122 million tonnes by 2015.[7]

Over the longer term, ABARE has projected that global coal trade will increase by 1.7% per annum between 2005 and 2025.[8] Relatively stronger growth is expected in metallurgical coal trade, which is forecast to increase by 2.3% per annum over that period, compared to 1.5% for thermal coal (although thermal coal will still maintain its dominant share of global coal trade, at around 71%).

This growth is being driven by demand in a number of countries, including China, Malaysia, India and Thailand. ABARE expects developing Asian countries to increase

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6 The Australian Coal Association, The Australian Black Coal Industry: Overview, www.australiancoal.com.au/Pubs/DITR_Exports_Industry_June 05-7.pdf

7 Australian Bureau of Agricultural and Resource Economics (2005), op.cit.

8 Australian Bureau of Agricultural and Resource Economics (2006), Australian Coal Exports: Outlook to 2025 and the Role of Infrastructure, ABARE Research Report 06.15, October.

their share of global coal imports from 13% to 26% between 2005 and 2025.[9] This will offset slower expected growth in the north of Asia, which is partly driven by the substitution of gas and nuclear fuels for coal in energy production.

Overall, ABARE views the demand outlook for thermal coal to be particularly uncertain, which is mainly driven by uncertainties in relation to the outlook for thermal coal trade in China, India, Indonesia, and to a lesser extent, South Africa. For example, in the case of China:[10]

> On the upside, continued strong domestic demand and capped export volumes would create export opportunities for Australian and other competing exporters to Asian markets, as would any surge in imports caused by capacity constraints in China's coal sector. On the downside for thermal coal exporters is the possibility that policies aimed at curbing the growth in coal production in China might be ineffective in stemming the onset of excess capacity. This could lead to a significant expansion in China's coal exports, particularly if China succeeded in its objective to deliver substantial improvements in energy efficiency over the medium term.

ABARE has therefore developed three alternative export growth scenarios for thermal coal for Australia, being:

- a reference case, where exports are projected to reach 184 million tonnes by 2025;
- a low case, which builds in the possibility that Indonesian and Chinese exports growth more strongly than the reference case (143 million tonnes by 2025); and
- a high case, based on higher import demand growth in India, lower net exports in China and lower export growth in Indonesia and South Africa (225 million tonnes by 2025).[11]

The alternative scenarios are shown in the figure below.

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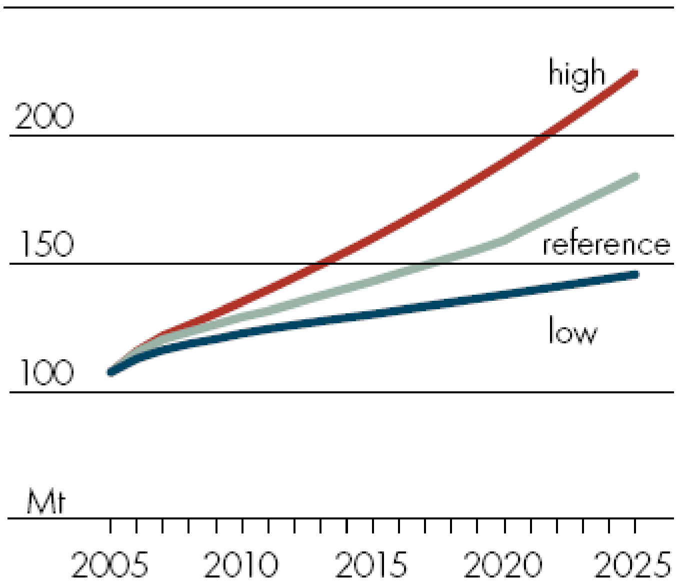
[9] ibid.

[10] ibid., p.43.

[11] ibid., pp.48-49.

Figure 3 ABARE: alternative scenarios for Australian thermal coal exports



Data source: Australian Bureau of Agricultural and Resource Economics (2006), Australian Coal Exports: Outlook to 2025 and the Role of Infrastructure, ABARE Research Report 06.15, October, p.48.

This uncertainty is particularly relevant for the Hunter Valley given the dominance of thermal coal in production and export terms. The challenge for infrastructure providers is to provide sufficient capacity to respond to demand growth, without exposing the business to significant risk of asset stranding.

2.2.3 Implications of growth for ARTC

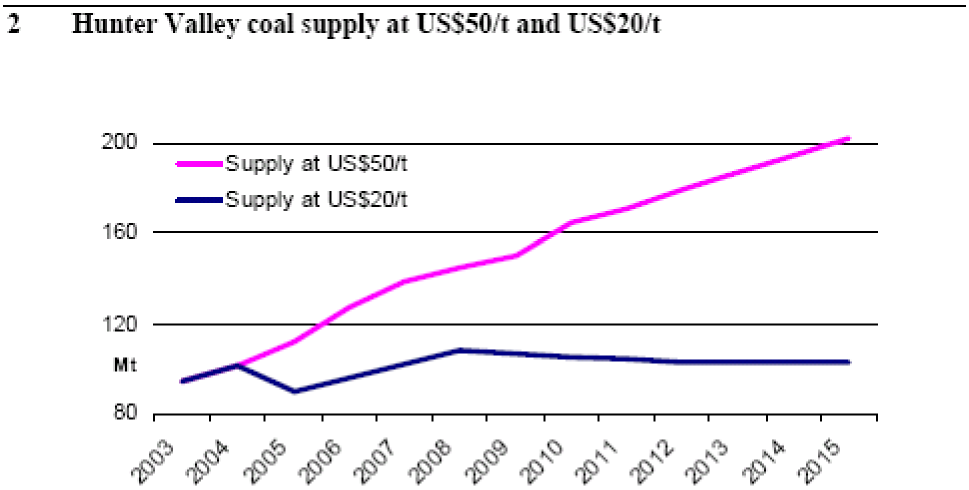
This growth in demand is placing pressures on the coal supply chain infrastructure, and any constraints here will limit the region's ability to respond to future volume growth. ARTC's currently projects throughput of around 113 mtpa in 2009, 127 mtpa in 2010, 159 mtpa in 2011, 190 mpta in 2012 and 226 mtpa in 2013 (assuming no capacity constraints at the port). This represents significant increases since the 2007-2012 version of the strategy, which in turn highlights the dynamic nature of the current environment.

In response to this, as part of its 2008-18 Hunter Valley Strategy ARTC is looking at investing approximately $1 billion in the network over the next five years.[12] While these commitments are seen as key in positioning the region to benefit from future demand growth, infrastructure owners are faced with the risk of asset stranding if this new capacity was not required (that is, if there is a downturn in the coal market, or the expected rates of growth are not achieved).

12 ibid., p.40.

Coal prices are inherently volatile. A report by ABARE examined the sensitivity of supply to different price scenarios, based on a survey of coal producers in the Hunter Valley region. It estimated two supply forecasts at a price of US$50 per tonne and US$20 per tonne. This is shown in Figure 3:

Figure 4 ABARE: alternative supply scenarios for Hunter Valley coal



Data source: Australian Bureau of Agricultural and Resource Economics (2005), Infrastructure Issues in the Hunter Valley Coal Supply Chain, ABARE Report for the Australian Government Senior Officials Group on Coal Transport Infrastructure, Commonwealth Government, p.4.

It also notes that the higher supply demand scenario would result in reductions in mine lives unless new reserves were developed. ABARE concludes:[13]

> At an average price of US$20 a tonne, Hunter Valley coal producers could supply around 103 million tonnes in 2015. At prices around a mid point price of US$35 a tonne it can be expected that approximately two-thirds of the expansion plans identified by Hunter Valley coal producers would be realised. This would bring total production to between 130 and 140 million tonnes, which is sufficient to meet the demand for coal in ABARE's high demand scenario.

The significant variation between the two price scenarios highlights a number of issues for ARTC. First, it shows the sensitivity of coal volumes to price and the willingness of producers to adjust production decisions in response to price changes. Second, it highlights the uncertainties underpinning future coal volumes and hence the degree of forecasting risk to which ARTC is exposed (which is also shown in Figure 3). Third, ARTC is exposed to significant stranding risk in committing to undertake any expansions to accommodate capacity in response to projected growth in demand. The implications of this for ARTC's WACC are considered further below.

[13] Australian Bureau of Agricultural and Resource Economics (2005), p.4.

2.2.4 Other developments in the coal supply chain

Initiatives are currently being considered to improve co-ordination in the Hunter Valley coal supply chain. The establishment of the Hunter Valley Coal Chain Logistics Team in 2004 has already delivered a number of benefits in this regard. The review recently concluded by Mr Nick Greiner also resulted in a number of recommendations being made. These recommendations are also expected to facilitate users entering into long-term contracts for below-rail capacity.

The details of this framework are still being considered by the New South Wales Government and hence the outcomes of the process remain highly uncertain. Until the timing and nature of these changes become clear, we are of the view that it is not appropriate to factor them into the analysis.

3 Methodological Considerations

3.1 WACC methodology

A firm's WACC recognises that its capital is provided by two sources, namely lenders and equity investors (that is owners or shareholders), and is equivalent to the weighted average cost of servicing the various classes of financial claims on the firm. Each source of capital or financial claim will involve different risks and hence different costs.

IPART applies a pre-tax real methodology. The pre-tax real WACC is derived using the market transformation method, which is the most commonly applied method in practice. We have therefore also applied that approach here.

3.2 Approaches for estimating the cost of equity

3.2.1 Capital Asset Pricing Model

The most commonly used approach to estimate the cost of equity is the Capital Asset Pricing Model (CAPM). While CAPM remains the most widely accepted approach to estimate the cost of equity, it has come under considerable scrutiny and is known to have a number of deficiencies.[14]

It also assumes that returns are normally distributed, which will not necessarily be the case for all investments. For example, owners of regulated infrastructure tend to face an asymmetric risk profile (that is, limited upside but potentially unlimited downside). This also means that risks such as asset stranding are not compensated via the rate of return as determined under a CAPM framework. This may necessitate supplementary treatment of those factors that are not captured as part of the CAPM. Unfortunately, risks such as stranding risk are not necessarily adequately dealt with by regulators elsewhere in the regulatory framework.

A number of alternative approaches to CAPM have therefore been postulated. However, none of these approaches are currently viewed as a superior asset pricing

[14] A key criticism is that it is a single period model that cannot be readily applied in a multi-period setting. Further, almost all of the assumptions on which it is based can be questioned. For example: (1) not all investors can borrow and lend at the risk-free rate; (2) short-selling of physical assets is generally not permitted (with the exception of derivative instruments); (3) many investors will consider the implications of taxes and transaction costs when making investment decisions; and (4) investors tend not to have homogeneous expectations regarding risk and return. On the contrary, much trading activity, and price volatility is driven by differences in expectations (and 'decision models' used by investors to form these expectations), particularly between buyers and sellers.

model to the domestic CAPM. While other methodologies are not superior to the CAPM approach, they may be used to test the reasonableness of the estimates. For example the Dividend Discount Model may be used as a check for the cost of equity or the P/E ratio may be used as a check for the equity portion of the valuation.

3.2.2 International versus domestic versions of the CAPM

Given the increasing integration of world capital markets, suggestions have also been made that it is no longer appropriate to use a domestic CAPM, which essentially assumes that the Australian market is segmented from the world market. Instead, an international version of the model should be used. It assumes that capital markets are fully integrated, with international capital flows unrestricted, and investors exhibiting no home country bias.[15] This would mean that all of its key parameters, being the risk-free rate, beta and the market risk-premium, should be estimated in an international context.

A number of versions of the model have been developed and typically require specification of the key parameters in a global market context (for example, using a global share price index instead of the All Ordinaries index).[16] As noted by the Strategic Finance Group, this is not practical:[17]

> Clearly, re-estimating all WACC parameters as they would be in the absence of foreign investment is an impossible task and this approach must be rejected. That is, all WACC parameters should be estimated as they are, not as they would be if a particular theoretical assumption were to hold.

In practice, the international CAPM has not been widely used. This is for a number of reasons:

- there are a number of alternative models that have been specified, however there remains no consensus view on which one should be used;
- the model is relatively complex to apply and its parameters are difficult to estimate, particularly the exchange rate covariances; and

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15 M. Lally (2004), The Cost of Capital for Regulated Entities: Report Prepared for the Queensland Competition Authority, p.28.

16 The model was originally developed by Solnik. Refer: B. Solnik (1974), “The International Pricing of Risk: An Empirical Investigation of the World Capital Market Structure”, in The Journal of Finance, vol.29, no.2.

17 Strategic Finance Group (2004), The Value of Imputation Franking Credits: Gamma, Report for AGL in Relation to ESC Electricity Distribution Review, p.9.

- there is no empirical evidence to suggest that it provides a better estimate of the expected cost of equity. For example, a study by Koedijk et al found that the domestic CAPM only yielded a different estimate from the international CAPM for three percent of firms in their sample.[18] They attribute this to a dominance of country factors in individual stock returns.

One of the key reasons that the international CAPM may not provide a superior estimate of the expected cost of equity is because of the continued existence of home country bias. That is, despite the globalisation of world capital markets, investors continue to favour domestic stocks.[19] This may be partly due to the information asymmetries faced by domestic investors considering investments in overseas firms. A survey by Strong and Xu also revealed that fund managers' recommendations were biased towards their home market.[20]

The fact that home bias exists does not mean that some integration of world capital markets has not occurred: what is evident is that the markets are not fully integrated. If markets are not fully integrated, then it is therefore not necessarily appropriate to apply an international CAPM. Certainly, it has not proven a superior model, and until such evidence becomes available (if and when it does), there is no basis for rejecting the domestic CAPM in favour of such an alternative. After considering the estimation difficulties and lack of empirical support to demonstrate the superiority of an international CAPM over the domestic version, Lally concludes:[21]

> …in the face of an issue like this in which the truth lies somewhere between two models, a conservative approach is desirable, i.e., choosing the model yielding the higher estimate for the cost of capital, on the grounds that understating the cost of capital may lead to businesses failing to invest, and this is the more serious of the two possible errors… Taking account of all these points, I recommend the use of a domestic version of the CAPM.

It has also been suggested that if an international CAPM is not adopted, then all CAPM parameters would need to be respecified as if foreign investors had no influence on the Australian market. However, this suggests that the Australian market is completely segmented from the world market. Given that in reality foreign investors exert

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[18] K. Koedijk, C. Kool, P. Shotman and M. van Dijk (2002), "The Cost of Capital in International Financial Markets: Local or Global?", in Journal of International Money and Finance, vol.21 (6).

[19] For example, see: R. Stulz (1999), Globalisation of Equity Markets and the Cost of Capital, National Bureau of Economic Research, NBER Working Papers, 7021.

[20] N. Strong and X. Xu (2003), "Understanding the Home Equity Bias: Evidence from Survey Data", in Review of Economics and Statistics, vol.85, pp.307-312.

[21] M. Lally (2004), op.cit., p.31.

significant influence, this is not only virtually impossible to do, but inappropriately ignores this impact.

This rate of return is being used to determine prices and will drive investment decisions that are made with regard to current and expected market conditions. It should therefore reflect the rate of return that an investor would require, rather than the theoretical return that an investor would command in either a fully segmented or fully integrated market, neither of which is an appropriate representation of the current market reality.

It is therefore recommended that the domestic CAPM is used to determine the cost of equity, estimated using readily observable market data that may be influenced by the presence of foreign investors. Expectations of future returns will be formed based on the actual environment facing investors. Specified in this way, the domestic CAPM does not unrealistically assume complete separation from global markets. The domestic CAPM will therefore serve as a better proxy for the international CAPM, without assuming that the Australian market is fully integrated with world markets.

3.3 The asymmetric consequences of regulatory error

As noted above, the return profile for a regulated entity tends to be asymmetric, given that regulation tends to limit the potential for the entity to benefit from any upside gain, while often retaining unlimited exposure to downside risk. It is also widely accepted that regulatory error tends to have asymmetric consequences. The Productivity Commission stated: [22]

> - Over-compensation may sometimes result in inefficiencies in 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 the 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.

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

In other words, the consequences of setting WACC too low, and discouraging efficient investment in essential infrastructure, are considered worse than setting it too high. Given the imprecise nature of WACC estimation (particularly in terms of a number of underlying parameters, such as beta and the market risk premium), the probability regulatory error is likely to be high. It is therefore considered important for regulators to adopt a conservative approach when estimating WACC.

Given WACC estimation is an imprecise science (particularly in relation to beta, as outlined below, which is a key driver of WACC), it is not possible to assess, even with the benefit of hindsight, whether a WACC has been set 'too high' or 'too low'. While it is extremely important to ensure that the proposed estimate is robust, observing the history of WACC reviews in regulatory processes suggests a tendency to seek a degree of precision that is simply unrealistic in practice.

In making its investment decisions the infrastructure owner will assess this based on its expectations as to what is considered a reasonable rate of return for its shareholders relative to the risks that are borne. This was tested in the review of the Dalrymple Bay Coal Terminal's (DBCT's) Access Undertaking in 2004/05, where the positions submitted by the users and the infrastructure owner were vastly different (which is a common situation faced by a regulator in a regulatory review). The WACC proposed by users represented a margin of 180 basis points above the risk-free rate. DBCT Management's proposed margin was 420 basis points above the risk-free rate (excluding an additional 1% premium sought for stranding risk). The QCA's Draft Decision was close to the user's proposed WACC, representing a margin of 236 basis points above the risk-free rate.[23]

DBCT Management rejected the QCA's Draft Decision in relation to WACC, stating that:[24]

> The Authority has identified that it is critical for the Undertaking to provide the correct incentives for DBCT Management to expand the terminal when appropriate. The single most significant factor affecting DBCT Management's incentive to expand is the allowable WACC. The Productivity Commission, amongst others, has warned of the potential "chilling effect" on investment of regulation and argued that the social costs of lower returns are considerably higher than the social costs of any over investment. This is clearly evident in the DBCT situation today.

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[23] Queensland Competition Authority (2004), Draft Decision: Dalrymple Bay Coal Terminal Draft Access Undertaking, October, p.193.

[24] Prime Infrastructure (2004), QCA Draft Decision on the Access Undertaking for the Dalrymple Bay Coal Terminal, Submission prepared by: Prime Infrastructure (DBCT) Management Pty Limited, p.68.

The DBCT review process was a particularly protracted one. At least from the perspective of some participants in the market, Prime Infrastructure's (now BBI's) threat of not expanding the terminal was seen as real, and the rate of return was seen as a key consideration in this decision.

In the Final Decision the QCA increased the WACC to represent a margin of 318 basis above the risk-free rate[25] (based on a perceived increase in the risks faced by DBCT in relation to the expansion, which is discussed further below). While we are not seeking to make any assessment of the appropriateness of the position submitted by any of the parties in this review, what it does highlight is the importance of WACC in providing an infrastructure owner with sufficient incentive to invest.

If investment does not occur, or occurs at a reduced level, the public detriment that would arise from this would be the value of the lost exports. At current (and expected) coal price levels, this value could be particularly significant.

We note that IPART's approach to dealing with this issue in setting the rate of return on ARTC's Hunter Valley coal network is to estimate a range for WACC and select the point estimate from the 75th percentile. This approach has also been applied by the Commerce Commission in New Zealand.[26]

We are of the view that the current environment presents a particularly compelling case for continuing to select a point estimate from the upper bound of a reasonable range. This is discussed further in the following chapter.

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25 Queensland Competition Authority (2005), Final Decision: Dalrymple Bay Coal Terminal Draft Access Undertaking, p.151

26 For example, refer: New Zealand Commerce Commission (2004), Gas Control Inquiry Final Report.

4 Parameters

The estimation of ARTC's cost of capital under the framework therefore requires the estimation of the following parameters:

- the risk free rate;
- inflation;
- capital structure;
- the cost of equity, which is a function of:
  - the risk free rate;
  - the market risk premium;
  - asset and equity betas;
- the cost of debt; and
- dividend imputation and tax rates.

Estimates of each of the parameters are now provided.

4.1 Risk-free rate

The risk-free rate measures the return an investor would expect from an asset with zero volatility and zero default risk. The yield on long-term Australian Commonwealth Government bonds is the best proxy for a risk-free return as the government can honour all interest and debt repayments.

The key issue for the risk-free rate is the appropriate bond maturity to adopt. Standard commercial practice is for companies to match average asset lives with bond maturity, or for long life assets, the longest dated traded bond. This allows the company to service its debt from the revenue generated by the assets without being exposed to interest rate risk. Accordingly, the 10-year (nominal) Commonwealth Government bond is typically considered the longest dated liquid bond and represents the most relevant benchmark to apply.

The next issue is the appropriate period over which the rate should be assessed. 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. However, problems may occur if there is a spike in yields on the day that the rate is applied. To overcome this possibility, an averaged yield calculated over a relatively short averaging period is applied. For this analysis, the rate (nominal) averaged over a 20-day period ending on 28 November 2008 was 4.95%.

4.2 Inflation

4.2.1 Recognition of bias in indexed bond yields

Until relatively recently most Australian regulators based the estimate for long-term inflation on the forecast implied by the difference between (ten year) nominal and indexed Commonwealth Government bond yields, using the Fisher equation[27]. While there has always been liquidity issues in the Australian indexed bond market (based on its relative size), the Government's decision to cease the issuance of indexed bonds in 2003 had a significant impact on the depth and liquidity in this market.

It is now generally recognised that a bias exists in indexed bond yields, with the significant reduction in supply relative to demand putting upward pressure on prices (and hence downward pressure on yields). This problem was acknowledged by the Commonwealth Government in a letter to the ACCC in 2007:

> The Australian Government's suspension of issuance of these inflation-linked bonds, as well as increased demand for this asset class, is likely to cause market-implied inflation estimates to exceed consensus forecasts of inflation over the medium term.[28]

In its decision in relation to SP AusNet the Australian Energy Regulator (AER) set out its reasons for departing from estimating implied inflation based on the Fisher equation. While it confirmed that a market-based approach is preferable to any other method, at the current time it is "...not aware of a reliable market based alternative that can be mechanistically applied in a similar way to these measures."[29] In the absence of a reliable market-based estimate, a forecast of inflation needs to be used.

Consideration was given to the source and horizon of the forecasts. The AER concluded that the RBA's forecasts should be given the most weight. It also acknowledged the difficulties in reliably forecast inflation over a long horizon, with the

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27 This specifies the following relationship: (1 + nominal rate) = (1 + real rate)(1+ inflation)

28 Commonwealth Treasury (2007), The Treasury Bond Yield as a Proxy for the CAPM Risk-free Rate, Letter to the ACCC, 7 August, p.1.

29 Australian Energy Regulator (2008), Final Decision: SP AusNet Transmission Determination 2008-09 to 2013-14, January, p.102.

RBA's forecasts only going out as far as two years. It therefore determined to estimate a long-term average based on the RBA's forecasts for the first two years (as published in its *Statement of Monetary Policy*), and then assuming 2.5%, being the mid-point of the RBA's target band for inflation, after that. We note that in its letter to the ACCC the Commonwealth Government had recommended basing the forecast on this mid-point:

> We therefore recommend that the ACCC uses the mid-point of the RBA's target band for inflation (that is, 2.5 per cent per annum) as the best estimate of inflation. Since the independence of the Reserve Bank Board in conducting monetary policy was formalised in March 1996, annual inflation has averaged 2.5%.[30]

4.2.2 Approach applied by IPART

In its recent June 2008 decision in relation to Sydney Water[31], IPART recognised the current bias in indexed bond yields and the departure from the Fisher approach by at least three Australian regulators. A fourth example can be provided since then, which is the ACCC's July 2008 decision in relation to ARTC's interstate network.[32] In this decision, the ACCC accepted ARTC's proposed inflation estimate of 2.5%. While the ACCC indicated that its decision may have been different were revenues likely to be closer to the ceiling, it noted the advice received by the Commonwealth Treasury and the recent approach applied by the AER.

Notwithstanding IPART's recognition of the bias, it has continued to use an estimate implied by the difference between nominal and risk-free rates, instead of an alternative forecast. It adjusted for the bias by adding a 20 basis point margin to the indexed bond yield, which in its view is sufficient compensation for their relative scarcity. The reasons it puts forward for retaining this approach are:

- capital markets value capital flows better than the Commonwealth/State Treasury or the RBA;
- one of the roles of capital markets is to value cash flows (as well as credit risk, liquidity etc);
- individual economist forecasts (or even an average of economist forecasts) may be influenced or biased in favour of the strategy of the institution they

30 Commonwealth Treasury (2007), op.cit.

31 Independent Pricing and Regulatory Tribunal (2008), Review of Prices for Sydney Water Corporation's Water, Sewerage, Stormwater and Other Services From 1 July 2008, Water – Determination and Final Report, June.

32 ACCC (2008), Final Decision, Australian Rail Track Corporation, Access Undertaking – Interstate Rail Network, July.

are originating from and/or may not be a long term view (frequently economists only look out 2 years);

- selecting which forecast to use or how to 'average' those forecasts would be subjective, lack transparency and accuracy; and
- the use of the latest government bond market based data is objective, transparent and avoids the need for assumptions regarding future inflation. The inflation forecast derived from the Fisher equation also maintains consistency with other financial parameters used in the regulatory framework.[33]

We have a number of concerns with these arguments. First, capital markets do value cash flows, and according to the efficient markets hypothesis, this value reflects all publicly available information at that point in time. However, in order for this assumption to hold, it presumes a certain degree of liquidity in the market. A lack of liquidity in the market limits price discovery and means that 'current' market prices may not necessarily reflect the current views and expectations of market participants. The implications of thin trading in stock markets have been explored extensively in the academic literature. Similar implications would apply to debt securities.

Second, the methodology employed by the AER relies on the RBA's forecasts as they are considered the most reliable. The third and fourth concerns therefore become redundant if these forecasts are used.

Third, we agree that the latest bond market data is objective and transparent. However, the key issue here is whether that data can be relied upon to set a long-term forecast for inflation, where that forecast flows directly through into prices and will be locked in until the next review. It has already been clearly acknowledged that at least at the current time, indexed bond yields cannot provide this reliable information.

As noted above, IPART acknowledges the existence of the bias and is of the view that it is adequately addressed by adding a 20 basis point margin to the indexed bond yield. The key source of information for this estimate was a study by NERA.[34] In their analysis they observed that since 2004, there has been a marked downward bias in yields on indexed Commonwealth Government bonds relative to nominal yields, coinciding with the contraction in supply.

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33 Independent Pricing and Regulatory Tribunal (2008), op.cit., p.163.

34 NERA Economic Consulting (2007), Bias in Indexed CGS Yields as a Proxy for the CAPM Risk-free Rate, A Report for the ENA, March.

They sought to estimate the bias based on the difference between the yields on Electranet's indexed and nominal bonds and Commonwealth Government securities since 2004. This analysis showed that the spread between indexed corporate bonds and indexed Commonwealth Government securities had risen relative to the spread between nominal corporate bonds and Commonwealth Government securities. The trend in and quantum of the bias varied between different maturities. However, as at March 2007, the average bias was around 20 basis points.

IPART also cite other academic studies that cite a scarcity premium of up to 20 basis points. The one example of such a study that is provided is a paper by Shen.[35] However, this paper examines the liquidity premium in indexed bonds in the US market. The US market is considerably deeper than the Australian market. The evidence there is that the liquidity premium is declining. Overall, it doesn't provide conclusive evidence on the value of the premium but shows how it appears to be declining and is likely to continue to do so as the market continues to deepen.

We question how this evidence is at all relevant here. The US market is considerably deeper than Australia (and liquidity is increasing further). This is the opposite situation to Australia, where the Commonwealth Government has ceased issuing indexed bonds and liquidity is therefore contracting.

Support for the 20 basis point premium therefore relies in the evidence provided by NERA. While we are not questioning the reasonableness of their analysis, our key concern is relying on this estimate as a long-term, forward-looking proxy for the bias (consistent with the horizon assumed for the other CAPM parameters).

We are not of the view that it can be relied upon for this purpose. It is a historical estimate that has been observed over the relatively short period since there was a significant structural change in the market (that is, the Government's 2003 decision to cease issuance). NERA's analysis generally shows that the bias has grown over this period. In some cases it has been volatile and in others it has shown a gradual upward trend.

The key question is whether this bias could widen in the future and if so, by how much. Given the market for indexed bonds will continue to contract it is reasonable to expect that this will be the case. What this means for the quantum of the bias would be extremely difficult to forecast. Further, reliance cannot be placed on studies from jurisdictions with significantly different market conditions for further evidence.

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[35] Shen, P. (2006), "Liquidity Risk Premia and Breakeven Inflation Rates:, Economic Review, Second Quarter.

4.2.3 Recommended approach

In the absence of a reliable, forward-looking measure for the bias in indexed bond yields, we therefore do not see how this market data can still be applied to derive a reasonable estimate for long-term inflation, at least at the current time. We are of the view that there are considerable risks in assuming that 20 basis points will continue to be a reasonable estimate of the bias going forward.

Most of the recent regulatory decisions in relation to inflation have departed from the Fisher approach in recognition of the bias in indexed bond yields. We are therefore of the view that the most appropriate approach at the current time is the one that has been adopted by the AER, which estimates a long-term average based on the RBA's forecasts for the next two years and the mid-point of the target range for inflation after that. This is shown in the following table.

Table 1 Inflation Forecast (from 1 July 2009)

June 2009	June 2010	June 2011	June 2012	June 2013	June 2014	June 2015	June 2016	June 2017	June 2018	Average
4%	3.25%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.73%

Source: Reserve Bank of Australia (2008), Statement on Monetary Policy, 10 November.

The resulting forecast for inflation is 2.73%.

4.3 Capital structure

Capital structure is measured here as the proportion of total assets that is funded by debt (or, debt to total value). For the purposes of WACC, this tends to be assessed based on the firm's long-term target capital structure, which is based on what is considered to be the 'optimal' long-term capital structure for the firm given its profile and the industry it operates in. In other words, the capital structure assumption could be quite different from the firm's current capital structure, as the latter will be sensitive to the stage of the firm's investment cycle and not necessarily representative of the 'efficient' long-term target that would be maintained by the firm given its risk profile.

4.3.1 Analysis

To estimate an appropriate capital structure for ARTC, we will consider the following:

- relevant regulatory decisions; and
- capital structures maintained by firms in similar industries.

Capital structure is expressed here as debt to total value, measured in market values.

Relevant regulatory decisions are summarised in the table below.

Table 2 Recent regulatory decisions in the rail industry: debt to total value

Regulator (year)	Decision	Capital structure
ACCC - Draft (2008)	ARTC (interstate network)	50%
ERA – Draft (200	WestNet Rail (freight)	35%
QCA (2005)	Queensland Rail	55%
IPART (2005)	Hunter Valley coal network	50% - 60%
ACCC (2002)	ARTC	60%

We note that the ACCC has tended to adopt a standard assumption of 60% for all regulated businesses. We do not believe that it is appropriate to assume the same capital structure assumption for firms in different regulated industries, as different industries can have inherently different business risk profiles which can also mean that the debt capacity of firms between industries will also vary.

For example, a firm involved in energy transmission or distribution is likely to face reasonably stable growth in demand over the longer term, given energy is an essential commodity for households and businesses. On the other hand, as outlined in section 2.2.2, the long-term demand outlook for ARTC's services on the Hunter Valley coal network is considerably more uncertain. If the more optimistic demand scenarios are not realised, ARTC's ability to service debt may also be reduced. This will have a particularly significant impact to the extent that additional debt has been raised to fund its anticipated investment program of approximately $1 billion. At the same time, we recognise that the capacity to service debt funding the coal network is likely to be higher than the capacity to service debt relating to the interstate network.

We have also collected capital structure data for firms in similar industries to ARTC. These firms have been selected based on their relevance to ARTC's business activities and will also be used in the assessment of beta. In compiling the sample, the emphasis was on ensuring that most it not all of the firm's business activities were relevant to ARTC. For example, while a number of firms are engaged in the same core business, some also undertake other unrelated activities (such as real estate investment). Notwithstanding that these activities may only make a relatively marginal contribution to the firm's revenues, they were still excluded from the sample. Most of these firms are from other jurisdictions. A brief description of each of the firms utilised is contained in Attachment A.

For each firm, annual capital structure data was collected for each of the last five years and then averaged. This is considered more appropriate than solely relying on the current capital structure maintained by the firm, given that it will vary through time depending on the firm's borrowing strategy and its stage within the investment cycle.

The industries examined reflect the underlying demand for ARTC's interstate network services. These industries include:

- *Coal*. This sample includes producers servicing domestic and export markets. The majority of the firms in the sample produce thermal coal.
- *Rail*. This mainly includes rail operators carrying a range of traffics, including freight, bulk minerals, grain and passengers. Some of these companies, although not all of the companies in the sample, carry coal.

The data is summarised in the following table. Caution should be exercised in interpreting averages across different jurisdictions, as factors such as the taxation regime could give rise to differences in gearing practices. While we have averaged the data across the last five years, considerable variation can still be expected.

Table 3 Capital structures observed in relevant industries

Industry	Number of firms	Average capital structure	Standard deviation
Coal	83	34%	24%
Rail	53	48%	26%

Data source: Bloomberg

4.3.2 Conclusions: ARTC

Relevant rail regulatory decisions reveal a range for capital structure of between 50% and 60% (which is the range previously applied by IPART in 2004), with the most recent (2005) decision by the QCA with respect to Queensland Rail's central Queensland coal network assuming 55%. The rail firms had an average gearing level of just under 50%. The coal firms have a lower average gearing level which is not unexpected given the business risks faced by these firms will be higher.

The capital structure decision needs to be based on an assessment of the likely level of gearing that could be maintained by an efficient benchmark firm operating in this industry. A capital structure range of between 50% and 60% is considered an appropriate starting point for ARTC. The lower bound is referenced to other regulatory decisions and the average gearing levels of a large sample of rail operators (over the past five years). The upper bound of 60% represents the ACCC's standard gearing assumption for regulated businesses.

We are of the view that an assumption of 50% to 55% is appropriate for ARTC. The reason for recommending an upper bound of 55% is because we are of the view that the business risks faced by an access provider to a coal rail network are higher than the business risks faced by say, an energy transmission or distribution business or a water business.

This is still above the gearing levels maintained by firms in the coal and rail industries and is also consistent with recent relevant regulatory decisions.

4.4 Cost of equity

Section 3 discussed a number of approaches available for estimating the cost of equity capital. The most commonly applied approach is the CAPM. Under the CAPM the required return on equity is expressed as a premium over the risk free return as follows:

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

where:

R_e = the cost of equity capital

R_f = the risk free rate of return

$[E(R_m) – R_f]$ = the market risk premium

E( ) indicates the variable is an expectation and

β_e = the systematic risk parameter (equity beta).

The CAPM produces a post-tax nominal measure of the cost of equity.

The beta in the above equation is an equity beta which represents the sensitivity of the operating cash flows generated by the assets of an entity adjusted for the effect of that entity's gearing (representing financial risk) to changes in general economic conditions compared with the market.[36]

Given that the risk free rate is readily observable (based on long term government bonds), the two key parameters relating to the cost of equity are:

- equity beta; and
- market risk premium.

These parameters are considered in turn.

[36] A value of less than one indicates the entity's operating cash flows are less sensitive than the market as a whole to changes in economic conditions whereas a value greater than one indicates greater sensitivity than the market as a whole.

4.5 Equity beta

4.5.1 Overview: systematic and non-systematic risk

According to the CAPM framework, risk can be divided into two components, being:

- systematic or non-diversifiable risk; and
- non-systematic or diversifiable risk.

Systematic risk refers to those risks that tend to be impacted by changes in general economic activity. These risks will tend to impact the whole market and hence is also often referred to as 'market risk'. Investors cannot avoid these risks through diversification.

Non-systematic risk, on the other hand, refers to risks that are unique to a particular firm or project. Because the non-systematic risks associated with different investments are not related, investors can avoid this source of risk by holding a well-diversified portfolio of investments, thus enabling the gains and losses resulting from such risks to offset each other (although the offset may not necessarily be exact).

Investors will therefore only be rewarded for bearing systematic risk via the rate of return. As non-systematic risks can be eliminated by diversification, investors cannot expect to receive any compensation for these risks via a higher rate of return. Instead, they will tend to be modelled in the cashflows.

4.5.2 Measuring systematic risk: beta

The systematic risk (β_e or equity beta) of a firm is the measure of how the changes in the returns to a company's stock are related to the changes in returns to the market as a whole. As noted above, it is the only risk factor incorporated in the CAPM.

There are two key determinants of an entity's equity beta:

- business risk arising from the sensitivity of an entity's cash flow to overall economic activity, where more cyclical cash flows are associated with higher betas; and
- financial risk arising from capital structure, where a higher level of debt implies a higher beta.

The asset beta represents the systematic risk of the ungeared entity (and as such includes no financial risk and only business risk). The equity beta incorporates both the business risk and the financial risk for an entity.

In practice, we only observe equity betas (being the estimated betas of listed companies). We do not directly observe asset betas, but we can calculate them from a combination of each observed equity beta and the level of gearing for that entity.[37] The asset beta removes the effect of gearing from the estimate of systematic risk. The following equation shows the relationship (known as the Monkhouse approach) between equity and asset betas that has been assumed for the purposes of this assessment:

$$\beta e = \beta a + (\beta a - \beta d) * \{1 - [Rd/(1 + Rd)] * [Tc * (1 - \gamma)]\} * D/E$$

where:

β_a = beta of assets

β_d = beta of debt

R_d = the cost of debt capital

T_c = corporate tax rate

γ = gamma

D/E = value of debt divided by the value of equity.

This approach is consistently applied by the ACCC and has also been applied by IPART (for example, in its recent June 2008 decision in relation to Sydney Water). We have therefore applied this approach here.

The asset beta estimates the systematic risk for the firm as a whole whereas the equity beta is an estimate of the systematic risk for equity holders based on the relevant assets together with the financial risk resulting from gearing. In other words, the equity beta takes account of the additional financial risk that equity holders bear arising from the entity's gearing. Accordingly, when assessing the beta for ARTC, we consider the systematic risk associated with ARTC's operations (or asset beta) and adjust the beta estimate to take account of the impact of gearing to derive an equity beta.

Debt beta

As equity has systematic risk, it has also been proposed that there is a systematic risk of debt, which is measured by the beta of debt. Some methods of de-levering can

37 The difference between an asset beta and an equity beta reflects the additional financial risk to a shareholder arising from the extent to which debt is used to finance the entity's assets. Because debt holders have senior claims to the entity's cash flows and assets, equity holders face an additional risk.

require estimating a debt beta. A number of approaches have been used in an attempt to do this.

A common approach to estimate the debt beta is using the structure of the CAPM:

$$\beta_d = (R_d - R_f)/(E(R_m) - R_f)$$

where:

β_d = debt beta

R_d = cost of debt.

This has the appeal of using a familiar relationship between a beta and the market risk premium (R_m –R_f). The approach attributes the debt risk premium (R_d - R_f) to systematic risk. However, a substantial determinant of the cost of debt is default risk, and it therefore unrealistic to assume the debt risk premium is related to movements only in the market.

The alternative approach is to assume the debt beta is zero. The systematic risk of debt is considered extremely low. In practical terms, when investors are pricing debt securities, their key concerns will be credit and liquidity risks, rather than systematic risk. Attempts in the literature to estimate systematic risk of debt indicate that even with companies that have little apparent risk of default, the returns to the debt are virtually independent of the returns on the market index.

Lally recommends the application of a debt beta of zero in a regulatory context:[38]

> …on account of the difficulties in estimating the debt beta, the slightness of the error in treating it as zero, the likelihood that the resulting errors are less than those arising from the Authority's current approach, and the likelihood that the errors will be of the less serious type than those arising from the Authority's current approach.

We observe that in its most recent decisions, the ACCC has consistently adopted a value of zero. IPART also applied a value of zero in its 2004 decision in relation to the Hunter Valley network.

Accordingly, we have adopted for the debt beta of zero.

4.5.3 Approaches to estimating beta

There are three basic approaches to estimating systematic risk:

38 M. Lally (2004), op.cit, p.75.

- direct estimation;
- first principles; and
- comparable companies.

An overview of each approach is now briefly provided.

Direct Estimation. If the firm is listed, regression analysis can be used to estimate the relationship between the firm's returns and the returns on the domestic share market index (such as the ASX 200). Several years of trading data is required to provide a statistically meaningful estimate.[39] As ARTC is not a listed entity, its equity beta cannot be estimated in this way.

First Principles. This approach requires analysing the factors that impact on the sensitivity of a firm's returns to movements in the economy or market. As the comparable companies analysis will tend to produce a range of plausible estimates for beta, the first principles analysis can assist in determining where the particular firm may be within that range based on its relative risk profile. We are also believe it is useful to undertake this prior to reviewing comparable companies as understanding the risk profile of the firm will help in the selection of comparable companies.

Comparable Companies. This approach begins by identifying a set of comparable companies with a similar business and risk profile that are listed on the sharemarket. Using share price information for the companies, their equity betas are estimated using regression analysis. As the companies will have different gearing levels (and hence different financial risk), these equity betas must be 'delevered' to produce an asset beta.

To estimate a beta for ARTC, we have first analysed comparable firms. These are firms that have similar business risks and have betas that can be meaningfully interpreted. To gain an appreciation of where ARTC is situated within the range, a first principles analysis has been undertaken. This will assist in refining the range, as well as to interpret where ARTC may be positioned within it.

Estimation error

Before progressing to the more detailed analysis, it is important to be aware of the susceptibility of beta to estimation error. It is not possible to directly observe a firm's true beta. Instead, estimates are obtained by regressing the historical returns of a firm's shares against the historical returns for a market index, over the same time period. It is

[39] We recommend five yeas of monthly data.

possible that there is considerable 'noise' in both data series, which can result in measurement error. This is particularly likely in the data history for the individual firm. As a consequence, the resulting data estimates can be of limited reliability and caution should be exercised in applying these estimates in a forward-looking analysis.

It is also believed that betas are mean reverting. In other words, over time, the betas of all firms will gradually move towards the equity beta of the market, which is one. This means that future estimates of beta are likely to be closer to one than current estimates.

There are a number of ways to address measurement error. As a starting point, any beta estimates with poor statistical properties should be discarded (such as a very low R^2 or a high standard error).[40] There are a number of other ways to deal with the uncertainty surrounding the estimation of beta, including:

- adjusting for thin trading, which is a common cause of measurement error, using techniques such as the Scholes-Williams technique;
- adjusting for mean reversion using the Blume adjustment[41];
- the formation of portfolios. Portfolio betas have substantially lower standard errors and yield more econometrically sensible estimations. While there are benefits in using this approach via reductions in the standard error, as more firms are used caution should still be exercised to ensure that they are relevant comparators.

A recent report by Gray et al provides a useful summary of the various methods of estimating beta, as well as their performance.[42] The study uses historical data to compare the predicted beta estimate in accordance with CAPM, with the actual equity return for the relevant forecast period. The closer the predicted estimate to the actual

40 The $\mathbf{R^2}$, or coefficient of determination, measures the explanatory power of the regression equation (that is, how much of the variability in Y can be explained by X). It takes a value of between 0 and one. For example, an R-squared of 0.7 would suggest that 70% of the variability in the individual share's returns is explained by variability in the returns on the market. The more 'noise' in the data, the less it pertains to the underlying relationship and hence the lower the R^2. The **standard error** measures the sampling variability or precision of an estimate. That is, as the estimate is derived from a sample distribution, it measures the precision of the model parameter. A lower standard error is preferred as it indicates a more precise measure. A third commonly used measure is the **t statistic**. The t statistic is calculated for each coefficient in a regression model (in this case, the beta coefficient) for the purposes of hypothesis testing. The tendency is to test the hypothesis that the regression coefficient is significantly different from zero. This is done within a specified confidence interval (for example, 95%). Generally, the t statistic should exceed two to be considered reliable. These measures have been used in this analysis to screen comparator beta estimates.

41 The impact of this adjustment is to 'draw' the value of the estimated beta closer to one. The typical adjustment is simply: Adjusted beta = (1/3 * the market beta of one) + (2/3 * estimated beta). This can be reduced to: Adjusted beta = 0.33 + (0.67 * estimated beta).

42 S. Gray, J. Hall, R. Bowman, T. Brailsford, R. Faff, R.Officer (2005), The Performance of Alternative Techniques for Estimating Equity Betas of Australian Firms, Report Prepared for the Energy Networks Association.

equity return, the better the estimation technique. A summary of the findings of the report are:

- it is preferable to use data periods of longer than four years;
- monthly observations are preferred to weekly observations;
- Blume-adjusted estimates that account for mean reversion provide better estimates;
- statistical techniques that eliminate outliers are preferred, provided the outlier is not expected to re-occur; and
- a beta estimate derived from a sample of firms in an industry is preferred to an estimate for an individual firm.

A further interesting finding was that assuming an equity beta of one for a firm generally outperformed standard regression estimates, and that this may be a more appropriate assumption for beta if data cannot be obtained over a suitably long time period.

As outlined above, it is generally recognised that regulatory error has asymmetric consequences. While it is important to give due regard to this principle when setting all WACC parameters, it is particularly important here.

The susceptibility of beta estimation to error means that a cautious approach should be undertaken. For example, as a range of reasonable estimates for a number of parameters, including beta, are specified, the point estimate should be selected from the upper end of this range.

4.5.4 Estimating ARTC's Beta

First principles analysis

Background

A first principles analysis is a qualitative assessment of ARTC's risk profile, the aim of which it to identify its systematic (or non-diversifiable) risk factors and assessing their likely impact on the asset beta. Lally identifies a number of factors to be considered here, including[43]:

[43] M. Lally (2004), op.cit.

- nature of the product or service;
- nature of the customer;
- pricing structure;
- duration of contracts;
- market power;
- nature of regulation;
- growth options; and
- operating leverage.

A number of these factors are interrelated – that is, the impact of one factor on beta could either by 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.

Nature of the product/nature of the customer

When assessing the market for rail services, it is important to consider the underlying demand for these services and the customers utilising them. The key issue to establish here is the extent to which there is some correlation between the cashflows from these activities and domestic economic activity.

These cashflows comprise both revenues and costs. As most of the costs faced by the owner of a rail network are fixed, the main driver of cashflow variability will be revenues.

As noted above, most of the coal produced in the Hunter Valley is thermal coal, approximately 21% of which is sold domestically, and the balance exported. The demand for thermal export coal is in turn driven by world economic growth, with a particular dependence on growth in major trading partners such as China and Japan. Given the importance of coal to our national export performance, thermal coal demand from these economies will ultimately impact Australian GDP.

For example, we calculated a correlation between Australian and global economic growth based on:

- annual growth in world real GDP[44]; and
- annual growth in domestic GDP (real gross domestic income, chain volume measures).[45]

Between 1990 and 2007 the correlation was 0.49. It has strengthened in more recent years, being 0.87 since 2000.

The correlation between world economic growth and Australia's domestic economic performance means that demand for export coal is to some extent systematic in nature. Further evidence of this relationship is provided by the relatively high betas of Australia's export oriented mining companies.

The remaining domestic demand for thermal coal will be underpinned by demand for electricity for both residential and industrial purposes. While residential demand for electricity will be less sensitive to domestic economic activity, industrial demand will exhibit greater sensitivity.

Overall, there is therefore some relationship between demand for thermal coal and domestic economic activity. The ultimate impact of this on ARTC's revenues will depend on its exposure to volume risk. This is largely driven by the form of regulation, which is discussed below.

In terms of costs, those costs that are variable, being operating and maintenance, will have some relationship with general movements in the domestic economy. As ARTC's costs are mainly fixed, the impact of variable costs on its systematic risk profile is therefore expected to be relatively small, although the impact of having a high fixed costs base is likely to be significant (this is discussed further below under operating leverage).

Pricing structure

In general, ARTC bases its pricing on a dollar per tonne basis. To the extent that a greater proportion of the tariff (and hence revenues) is fixed, this gives ARTC some protection in the event of economic shocks. As noted above, while ARTC is subject to a revenue cap it will be largely protected from any impact of changes in volumes of the variable component of these revenues. The main risk is that ARTC incurs costs which

44 Source: Economist Intelligence Unit. Refer: http://eid.bvdep.com/version-2008226/cgi/template.dll. Year on year growth figures.

45 Sourced from: Australian Bureau of Statistics (2008), Australian National Accounts: National Income, Expenditure and Product, Dec 2007, Catalogue 5206.0, Canberra. Year on year growth figures.

are subsequently not approved by the regulator and hence cannot be passed through to customers. This is a source of regulatory risk.

Duration of contracts with customers

ARTC's contracts with operators are relatively short. When these contracts expire, contracted volumes can be revised upwards or downwards by the customer, which will change ARTC's revenues accordingly. ARTC therefore has some exposure to volume risk in the short- to medium-term, and this exposure will continue to arise each time contracts come up for renewal.

As noted previously, one of the recommendations of the Greiner review of the Hunter Valley coal supply chain was the execution of long-term contracts with take-or-pay provisions. As the final outcomes from this process remain uncertain, it is currently unclear as to if and when this will implemented. In any case, this will have limited impact on ARTC's revenue risk to the extent that it has a ten year undertaking that is subject to a revenue cap. The key issue for ARTC is its longer term exposure to volume risk, given the horizon of the investments it is committing to extends well beyond ten years.

Market power

ARTC does have market power in relation to the Hunter Valley network, particularly when compared to its position in the intermodal network, where rail is subject to intense competition from road on parts of that network. The existence of market power will tend to mitigate systematic risk.

This market power is to some extent reduced by the potential for counterveiling power on the buyer side. As noted above, Pacific National is currently responsible for around 93% of coal delivered to Port Kembla and Newcastle and even if Queensland Rail continued to gain inroads this market, buyer concentration will always remain significant in the rail freight industry. At the same time, given there currently no viable substitutes for delivering the coal freight task in the Hunter Valley (compared to say, intermodal freight which is exposed to more intense competition from road), this will reduce the extent to which counterveiling power can be exerted by buyers.

An additional dimension to this is the co-ordinated approach that is taken to the management of coal supply chain issues with a view to maximising its efficiency and hence the region's competitiveness in world coal markets. This means that all participants in this coal chain are working towards a set of common objectives and have some influence over coal chain operations and performance.

Nature of regulation

ARTC's systematic risk will be affected by the form of regulation, as this determines ARTC's exposure to volume risk. To the extent that it is subject to a pure revenue cap it will be relatively insulated from this risk compared to a price cap. This assessment will need to be reviewed if the form of regulation changes. It is noted that in a number of regulatory decisions regulators have not sought to explicitly attribute any increment in the asset beta for a price cap over a revenue cap (and vice versa) and accordingly the implications of the form or regulation for beta remain very unclear.

In this regard, it will be important to examine other regulatory decisions, including the extent to which the form of regulation has been factored into the assessment of beta. This is considered below as part of the comparable companies analysis.

Growth options

Growth options refer to the potential to undertake significant new investment, particularly in new areas or products. Chung and Charoenwong argue that businesses that have a number of valuable growth opportunities, in addition to their existing assets (or 'assets in place'), will tend to have higher systematic risk compared to firms that don't have these opportunities.[46]

Growth options may affect the systematic risk of the business. Consider two firms of the same value. One business has few growth opportunities, so that the value of the business will largely reflect the assets in place. The other business has the same value, however has fewer assets in place but a number of growth opportunities which have some value.

Of the two firms, the one that would be most affected by economy shocks is the one that has the greater portion of its value represented by growth opportunities. The firm with the greater portion of growth opportunities would have the higher equity beta. Overall, their empirical results strongly support this hypothesis.

ARTC has a significant capital investment program over the next five years that could be regarded as growth opportunities. If ARTC was a listed company, its value would demonstrate some sensitivity to these opportunities. However, as a regulated business the rate of return it can earn on this expenditure is effectively capped by the regulator.

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46 K. Chung and C. Charoenwong (1991), "Investment Options, Assets in Place and the Risk of Stocks", in Financial Management, Vol.3.

Hypothetically, if circumstances changed significantly and the expansion was no longer deemed necessary, ARTC may decide not to proceed with this expansion. If construction has already progressed, ARTC is faced with the risk that the asset will become stranded. However, risk is asymmetric in nature (that is, asset stranding risk has little if any upside and potentially unlimited downside) and will not be compensated via the rate of return[47].

If this assessment was based on the analysis of an efficient benchmark firm (that was not regulated), it could be argued that the implications of growth options need to be recognised, regardless of the impact that regulation has on the value of the firm and its risk profile. Alternatively, if the existence of regulation is recognised as part of the assessment, the implications of this for ARTC's beta is less clear.

Operating leverage

ARTC's cost base is largely fixed, with only a relatively small proportion of its costs sensitive to volumes. This is typical for a rail infrastructure provider. High operating leverage is associated with higher systematic risk, as these fixed costs will still be incurred irrespective of actual volumes (and revenues).

As this first principles analysis is being used to determine where ARTC would be positioned with respect to a range of beta estimates sourced from comparators, the impact of operating leverage on this decision will depend on ARTC's operating leverage relative to these comparators.

We understand that ARTC's operating leverage is similar to that of other rail infrastructure providers. However, there are no other rail infrastructure providers in the comparator samples, which includes rail operators and coal mining companies. While fixed costs would still account for a reasonable proportion of these companies' cost base, they are likely to have a higher operating cost component (for example, in the case of rail operators approximately 10% of costs are likely to vary with throughput). Further, if there was a significant reduction in demand for either rail services or thermal coal, these companies can potentially 'stockpile' (or withdraw) capacity from the market and avoid incurring a higher proportion of the costs associated with this infrastructure.

It is evident from the ABARE data cited in section 2.2 above that mining companies are sensitive to export coal prices and will adjust output accordingly. Figure 4 showed that by 2015, if prices were at US$20 per tonne the total output would be around 103 million

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[47] This is because the CAPM assumes that returns are normally distributed.

tonnes. If prices rose to US$50 per tonne this output would double to around 200 million tonnes. This shows that mining companies have the incentive, capacity, and willingness, to adjust output according to market conditions.

ARTC, on the other hand, cannot avoid the high fixed costs associated with its network (even if it were able to reduce operating and maintenance expenditures in the event of a downturn in demand). The comparator companies are therefore likely to have lower operating leverage than ARTC. Hence, if all other influences were ignored (or, if it was assumed that ARTC was identical to these firms apart from operating leverage), ARTC's asset beta would be above the average of these firms.

Conclusions: First Principles Analysis

To the extent that ARTC is regulated under a pure revenue cap, it is noted that:

- maximum allowable revenue is only certain for the term of the regulatory period; and
- when operator contracts expire, committed volumes may be adjusted upwards or downwards depending on the projected underlying demand for throughput.

As will be outlined below, regulatory precedent suggests that the implications of the form of regulation for beta are unclear.

A key driver of systematic risk is ARTC's high operating leverage. This is expected to be similar to other rail infrastructure providers, although would be higher than the sample of comparator companies that have been used as part of the assessment of beta.

Comparable companies analysis

Methodology

The first step in a comparable companies analysis involves identifying an appropriate set of companies. As outlined in section 4.2, we have sourced data for a number of firms in industries that will have a similar risk profile to ARTC, being coal companies and rail operators. These industries are considered relevant because they directly underpin the demand for ARTC's rail network services.

In compiling the sample, we applied a number of filters with two key aims, being to ensure that:

- the business activities of the firm are sufficiently relevant to ARTC; and

- the sample was statistically robust, given the issues with estimation error that were outlined above. Despite the filters being applied here, estimation error will remain an issue and needs to be kept in mind when drawing any conclusions from the analysis.

The filters applied were as follows:

- at least five years of monthly data is necessary for each firm. We applied a minimum threshold of 58 observations;
- beta estimates with a t-statistic of less than 2 were excluded; and
- beta estimates with a R^2 of less than 0.1 were excluded.

We also reviewed the company descriptions and eliminated firms that engaged in other unrelated activities. We also excluded any potential outliers. For example, one Australian coal company was excluded because it had an asset beta of 3.4 (notwithstanding that this had a t statistic of 4). We did not include any Chinese firms in the dataset because of their different operating and regulatory environment. Unfortunately a number of Australian firms had to be eliminated from the sample due to the poor statistical quality of the estimates. A complete list of companies is provided in Appendix A.

Finally, relevant regulatory decisions also need to be examined.

Results

The asset beta estimates for the comparator firms by industry sector are shown in the following table.

Table 4 Beta estimates for sample of comparator firms

Firm	Asset beta	R^2	Standard error	t-statistic
Coal				
Alliance Resources Partners (US)	0.43	0.17	0.354	3.46
Arch Coal Inc (US)	1.32	0.12	0.591	2.75
Compliance Energy Corporation (Canada)	0.73	0.14	1.034	3.06
CONSOL Energy Inc (US)	1.55	0.15	0.546	3.13
Foundation Coal Holdings Inc (US)	1.44	0.19	0.641	2.98
Guizhou Panjiong Refined Coal Co (China)	0.93	0.25	0.212	4.37
Massey Energy	1.72	0.15	0.714	3.22

Firm	Asset beta	R^2	Standard error	t-statistic
Company (US)				
Peabody Energy Corporation (US)	1.75	0.23	0.526	4.12
PT Tambung Batubara Butik Asam Tbk (Indonesia)	1.22	0.22	0.305	4
Western Canadian Coal Corporation (Canada)	2.25	0.11	1.24	2.6
Yanzhou Coal Mining Company (China)	1.25	0.29	0.26	4.81
Rail				
Burlington Sante Fe Corporation (US)	0.73	0.18	0.28	3.46
Canadian National Railway Company (Canada)	0.68	0.18	0.238	3.52
Canadian Pacific Railway Limited (Canada)	0.5	0.12	0.259	2.73
CSX Corporation (US)	0.53	0.12	0.306	2.7
Genesee & Wyoming Inc (US)	1.15	0.13	0.474	2.88
Kansas City Southern (US)	0.91	0.22	0.38	4.03
Norfolk Southern Corporation (US)	1.12	0.17	0.344	4.68
Union Pacific Corporation (US)	0.99	0.3	0.267	4.84

Source: Bloomberg

There is reasonable variation within the sample, particularly for the coal industry.

The average estimates for each industry are summarised in Table 5. Most of the firms in each sample are domiciled in the US. We have therefore produced a separate average for the US firms and for all firms. Particular caution should be exercised in interpreting the average across all firms, given there are a number of different jurisdictions included.

Table 5 Beta estimates for comparator firms

Industry	Number of firms	Average asset beta	Lowest	Highest	Range of outcomes based on one standard deviation from the mean	Number of firms from the sample within one standard deviation of the mean
Coal - All	11	1.33	0.43	2.25	0.82 to 1.84	8
Coal – US only	6	1.37	0.43	1.72	0.88 to 1.86	5
Rail – All	8	0.83	0.5	1.15	0.57 to 1.08	4

Industry	Number of firms	Average asset beta	Lowest	Highest	Range of outcomes based on one standard deviation from the mean	Number of firms from the sample within one standard deviation of the mean
Rail – US only	6	0.91	0.53	1.15	0.67 to 1.15	4

Data source: Bloomberg

The betas observed for coal producers are generally higher than the estimates for rail, which is to be expected given the inherently volatile nature of commodity markets. It should also be noted that most of the rail companies in the sample carry a range of commodities and freight.

It is generally recognised that caution must be exercised in referencing foreign comparators. ACG, for example, previously recommended that foreign comparators should only serve as a secondary source of information, although should not be discarded altogether:

> While there are problems with using equity beta estimates for foreign companies (measured against their home market portfolios) for Australian activities, it is recommended in this report that, nevertheless, regard be had to these beta estimates, at least as a secondary source of information (this issue is discussed below). However, betas for foreign companies are restricted to those operating in economies with comparable legal systems to Australia, which has limited the group of comparable entities to companies from North America (USA and Canada), the UK, and Australia.[48]

There is no generally accepted method of adjusting for potential jurisdictional differences.

While we recognise that Australian firms would be considered the most relevant, if an estimate is of poor quality, we are of the view that very limited if any reliance can be placed on it. In other words, in our view, the risks associated with drawing conclusions from highly unreliable estimates exceed the disadvantages from having a sample with no domestic comparators. As the same time, we agree that caution must be exercised in interpreting estimates for foreign comparators.

As noted above, one possible means of dealing with estimation error is to form portfolios, as portfolio betas tend to have lower standard errors. The key trade-off with this is that increasing the number of firms could compromise their comparability.

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[48] The Allen Consulting Group (2002), Final Report: Empirical Evidence on Proxy Beta Analysis for Regulated Gas Transmission Activities, Report for the Australian Competition and Consumer Commission, July, p.18.

It will therefore be important to ensure that the firms retained in the sample are only those of more direct relevance to ARTC's key business activities.

The benefits of the portfolio approach are only likely to accrue where the starting sample size (before the application of any statistical filters) is large. That is, the 'savings' or improvements in the standard error is a function of the average standard error of the sample and the number of firms in the sample.[49] This is shown by the relationship:

$$\text{Standard error}_{\text{average beta}} = \frac{\text{average standard error}_{\text{ beta estimate}}}{\sqrt{n}}$$

We therefore sought to identify any 'sub-sample' in our data set that is of a reasonable size prior to the application of the statistical filters. To form a portfolio, these sub-samples would need to comprise:

- firms in the same industry and jurisdiction; and
- firms with the minimum number of required observations.

The largest 'sub-sample' was a group of seven Australian coal firms (all of which are statistically insignificant in their own right). We are of the view that this sample size is too small to form a portfolio and improve the standard error of these estimates.

[49] F. Choi (ed.)(2003), International Finance and Accounting Handbook, Third Edition, John Wiley and Sons, p.23.

Regulatory decisions

It is also important to review relevant regulatory decisions in the rail industry. These decisions are summarised in the following table.

Table 6 Rail regulatory decisions: asset beta

Regulator	Decision	Asset beta
ACCC – Draft (2008)	ARTC (interstate network)	0.65
ERA – Draft (2008)	WestNet Rail (freight)	0.6
QCA (2005)	Queensland Rail	0.5
IPART (2005)	Hunter Valley coal network	0.32 to 0.46[a]
ACCC (2002)	ARTC	0.58
ERA (1999)	WA – freight	0.32 – 0.5

a Estimated based on IPART's recommended equity beta range of 0.7 to 1, using the Monkhouse formula and assuming a debt to value ratio of 55%.

The previous decision by IPART in relation to this network recommended a range of between 0.7 and 1 for the equity beta. This decision in turn referenced the 1999 decision, concluding that the risk profile had largely remained unchanged. However, the 1999 assessment was relatively high level and relied primarily on a comparators assessment (that is, there was no first principles analysis). The recommended estimates were based on a very limited sample of three US rail operators (which have also been referenced here), the UK decision with respect to RailTrack and decisions in gas regulation.

The most recent rail access decision was the QCA's decision in relation to Queensland Rail, which was released in December 2005. This determined an asset beta of 0.5 for the central Queensland coal network.

It should also be noted that at the time of this decision Queensland Rail was still subject to a hybrid price cap form of regulation (which is between a pure revenue cap and price cap). In the QCA's decision with respect to DBCT, which was made around the same time as the QR decision, the QCA also determined an asset beta of 0.5 (based on an equity beta of 1). DBCT, which operates in the same coal transport chain as QR, is subject to a pure revenue cap.

In drawing parallels with the DBCT decision in its determination for QR, the QCA did not differentiate in the systematic risk attributable to a price cap relative to a revenue cap.

In its most recent decision with respect to gas distribution, ESCOSA accepted the advice of its consultant, the Allen Consulting Group (ACG), which was that:[50]

> …it is difficult to make fine distinctions in the equity beta for matters like the form of price control that is applied to a particular regulated entity, noting ACG's view that:
>
> - there is no empirical evidence concerning the impact on beta of price cap and revenue cap form of regulation and so any adjustment applied is speculative;
> - the form of price control is one of the factors that may differ between Envestra's South Australian gas distribution business and other regulated energy distributors, and it cannot be known whether adjusting for one factor may improve the estimate; and
> - it has not been the practice of Australian regulators to adopt different betas depending on the form of price control…

In its final decision with respect to GasNet the ACCC cited comments from its consultant, also ACG:[51]

> …we would caution against attempting to make ad hoc adjustments to proxy betas on account of perceptions of differences in non-diversifiable risk given the absence of empirical evidence on the size of the required adjustment (and whether any adjustment may be warranted at all).

The regulatory treatment of the form of regulation in the context of WACC therefore remains unclear.

Implications of investment risk

As noted previously, ARTC is facing a sizeable investment program that is being undertaken in response to unprecedented growth in the demand for coal. It is looking at committing approximately $1 billion in new capital (relative to an existing Regulated Asset Base of approximately $530 million) on infrastructure that has a very long economic life, particularly when compared to the investment horizon of the coal producing companies (who can also store production if there is a reduction in demand/prices).

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50 ESCOSA (2006), Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System, p. 70.

51 ACCC (2002), Final Decision: GasNet Australia Access Arrangement Revisions for the Principal Transmission System, p.111.

Up until very recently, there was considerable optimism underpinning the current outlook. However, the subsequent crisis in the world financial markets and fears of a global economic recession has created considerable uncertainty. There are now significant concerns regarding future world economic growth, including potential revisions to growth expectations for economies in Asia, which have been largely fuelling the rapid growth in demand.

While a significant reversal in demand expectations is considered unlikely, the current events only serve to highlight the risky investment climate for providers of coal chain infrastructure. Further, infrastructure providers are committing this capital over a very long horizon. Even if demand remains buoyant over the short to medium-term, only limited confidence can be placed on volume forecasts that extend beyond five years. As highlighted by ABARE, the long-term demand outlook is highly uncertain, particularly for thermal coal exports, which dominates Hunter Valley coal production (and drives demand for access to ARTC's network). ARTC only has certainty in relation to the revenue it will earn for the duration of the regulatory period. Beyond this, it remains exposed to the risk of a reduction in demand. There is no mechanism that currently compensates ARTC for this risk.

Previous reference was made to the QCA's 2005 decision in relation to DBCT. The parallels between the investment climate faced by DBCT and ARTC are very similar. While located in different coal chains, both are coal transport infrastructure providers looking to undertake considerable capital investment in response to the current coal boom.

We note that the significant future capital investment program faced by DBCT was taken into account by the QCA in its 2005 decision: [52]

> While the Authority is confident that the equity beta of 0.80 reasonably reflects the underlying systematic risk associated with the existing terminal capacity, the Authority, at the same time, concurs with ACG that any major expansion of terminal capacity over the short term is likely to require a higher rate of return. Even though the economics of expansion appear fundamentally sound given the currently buoyant coal market, the Authority notes that coal prices have been volatile in the past, and therefore, the volume risk for significant new capacity is real. As a consequence, the Authority's view is that investors in a major expansion of the terminal would likely require relatively higher compensation for it.

52 Queensland Competition Authority (2005), Final Decision: Dalrymple Bay Coal Terminal Draft Access Undertaking, April, p.148.

The QCA also noted that it considered whether it was in the public interest to increase the recommended beta estimate. It concluded that it was, being:[53]

> …aware of recent comments by the Productivity Commission and others that regulatory bodies should err on the high side, on the basis that the impact on the economy of under-investment exceeds the impact on the economy of higher than warranted prices being paid by customers…

The QCA therefore accepted DBCT Management's proposed equity beta of 1. This compares to an equity beta of 0.66 in the Draft Decision, and a recommended estimate of 0.8, as proposed by its consultant.

This applied notwithstanding the approval process that was implemented in relation to capacity expansions, which is seen to provide DBCT with improved certainty in relation to undertaking new investments:[54]

> …the Authority believes that this WACC provides DBCT Management with an adequate incentive to expand the terminal, particularly as it gives DBCT Management the return it sought for taking on the greater risks associated with any major expansion of DBCT. However, in the event that the terminal is not substantively expanded, the Authority will reassess the equity beta at the next regulatory review.

As outlined in section 3.2.1, the CAPM assumes that returns are normally distributed and hence does not provide compensation for asymmetric risks. However, the reality is that ARTC is expected to commit significant new capital for assets with very long economic lives (and no alternative use) in a very risky investment climate.

Apart from the total size of the investment planned by ARTC, much of the demand for this additional capacity is being created as a result of new mines that are being developed some distance from the port. As indicated previously, ARTC's systematic risk is underpinned by the risk profile of its customers. The systematic risk of coal mining companies is particularly high. This is driven by a number of factors, including the sensitivity of these companies' revenues to exchange rates given they influence the competitiveness of Australia's coal exports. Demand for ARTC's services will also be influenced by this, although ARTC's revenues are protected under the revenue cap, at least for the term of the regulatory period.

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[53] ibid., p.149.

[54] ibid., p.150.

If these mines are considered in isolation (recognising that most of these mines are owned by companies that already have other developments in the region), the systematic risk of these particular mines is likely to be higher than the systematic risk of established mines that are located closer to the port. Apart from being relatively new developments, given the mines are located much further from the port, they are at a relative cost disadvantage compared to their competitors who are located closer to the port (given they face higher transport costs). As a consequence, in the long-term, these mines are likely to be more vulnerable to an adverse movement in exchange rates and could be the first to close if there was a significant downturn in demand. In the short-term, some revisions to development plans (including expansion plans for existing mines) could be made depending on the extent to which demand conditions are seen to be moderating.

ARTC's revenues are largely protected from systematic volume risk for the term of the regulatory period. If there was to be a significant change in demand during a regulatory period, it is still possible that the regulator would revisit prices. The new mines, having a higher cost structure than the established mines, would have a higher level of systematic risk (that is, they would be more affected by economic shocks than the established mines). The new expanded network servicing the new mines would therefore also have a higher level of systematic risk than the existing network. Closure of the new mines caused by adverse economic conditions would result in stranding risk being borne by ARTC. As noted above, the stranding risk is not compensated via the WACC.

One way of looking at this issue is to consider what an unregulated business would do if it was faced with this situation. In our view, the most likely scenario would be to set the price as high as the market will bear and recover as much of its investment as possible while capacity to pay is high. Regulated businesses do not have the ability to adjust prices in response to changes in demand or capacity to pay.

We are of the view that it is reasonable to provide ARTC with at least some compensation for stranding risk. However, the key question is how this compensation can be appropriately determined and applied. There are three possible ways of doing this:

1. determining a methodology to value asymmetric risk, with a view to providing compensation via the cashflows, rather than the WACC;

2. applying a subjective adjustment to the beta (or the WACC); or

3. selecting the beta estimate from towards the upper bound of a reasonable range.

The first method is the preferred approach but unfortunately a robust methodology for valuing asymmetric risk is yet to be developed (and accepted by regulators). The second method is inconsistent with the CAPM, although it is probable that this is what a number of unregulated businesses do in practice. For example, a survey by Meier and Tarhan (2006) of CFOs in the US shows that unsystematic risk does play a role in setting hurdle rates.[55]

This leaves the third option. While an imperfect solution, it ensures that sufficient incentive is provided to ARTC to invest, recognising that investment in essential infrastructure to support Australia's export capability is in the public interest. It should not result in over-compensation provided the beta is selected from within the bounds of a reasonable range.

As noted above, we note that the most recent determination by IPART regarding the rate of return to apply to the Hunter Valley network dealt with this issue by selecting a WACC from above the mid-point of the range:[56]

> IPART proposes to take account of truncation by allowing an unders and overs account system and permitting a maximum rate of return above the mid-point determined by the CAPM framework.

This treatment is also consistent with the approach taken by the QCA in relation to DBCT, as outlined above. We are therefore of the view that it is appropriate for IPART to continue its approach of selecting a WACC from the upper bound of the range, noting that this practice has previously been applied when demand was considerably more subdued.

The environment facing ARTC's Hunter Valley coal business was quite different back in 2004, with the implications of the growth in the demand for coal yet to fully emerge. At the time, ARTC was not contemplating an investment program anywhere near the size of the expenditure it is looking to commit now.

We acknowledge that this is a less than perfect solution to this issue but it is one that takes consideration of the risk differential between the existing and new assets that is attributable to stranding risk. However, the reality is that ARTC is not compensated for this risk (under the CAPM-determined WACC or otherwise). In the absence of any readily accepted method to value stranding risk we are of the view that providing

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55 Meier, I. & Tarhan, V. (2006), "Corporate Investment Decision Practices and the Hurdle Rate Premium Puzzle", Available at SSRN: http://ssrn.com/abstract=960161.

56 Independent Pricing and Regulatory Tribunal of New South Wales (2004), Report on the Determination of Remaining Mine Life and Rate of Return from 1 July 2004, NSW Rail Access Undertaking, p.74.

some uplift to ARTC ensures that it has sufficient incentive to invest in this extremely risky investment climate.

Summary

In conclusion, therefore, the comparable companies analysis yields the following results:

- an average asset beta for the two comparator industries of 0.83 for rail operators, and 1.33 for coal (noting that these samples include firms from different jurisdictions);
- for the US firms only, an average asset beta of 0.9 for rail operators and 1.37 for coal; and
- rail regulatory decisions ranging from 0.32 to 0.65, with the most recent determination in relation to QR being 0.5 (for the central Queensland coal network). In addition, the QCA also determined an asset beta of 0.5 for DBCT, which is subject to a revenue cap.

In order to properly evaluate the implications of this for ARTC, we need to assess this against the profile suggested by the first principles analysis.

Conclusion: Asset beta estimate for ARTC

In order to be able to put ARTC's asset beta in the context of its comparators, it is useful to compare ARTC with the coal and rail firms that have been referenced based on the first principles. We have focussed on the US coal and rail firms here given they dominate the comparator samples.

Table 7 Comparison between ARTC and US coal and rail firms

Dimension	ARTC	Coal companies	Railroads
Nature of the product or service, nature of the customer	Demand for ARTC's services is based on the demand for coal, most of which is thermal coal and most of which is exported. Approximately 21% of thermal coal produced is supplied to the domestic market. This will have reasonable sensitivity with domestic economic activity (particularly industrial consumption).	These companies are subject to the same demand drivers as ARTC. The producers in the sample will service both domestic and export markets.	Class 1 Railroads transport a mix of commodities, although coal has constituted around 20% in revenue terms. Overall, demand drivers will be different depending on the commodity. These firms also have a considerably more diversified revenue base compared to ARTC.
Pricing structure	In general, ARTC bases its pricing on a dollar per tonne basis. To the extent that a greater proportion of the	Prices are driven by demand and supply conditions. Producers tend to be price takers rather than price	Prices are determined in a competitive market, although regulator can intervene if there are concerns regarding

Dimension	ARTC	Coal companies	Railroads
	tariff (and hence revenues) is fixed, this gives ARTC some protection in the event of economic shocks.	setters.	the exercise of market power. Will have fixed and variable drivers, similar to ARTC.
Duration of contracts with customers	Short to medium-term contracts.	Contract terms may vary, although long-term supply contracts are executed.	Long-term contracts.
Market power	Market power exists given ARTC controls natural monopoly infrastructure. Regulation prevents this from being exercised.	Little if any market power, although buyer concentration increases with the consolidation of mining interests.	Class 1 railroads operate in a competitive market environment. However, some participants have called for re-regulation given market power is perceived to exist wherever a single shipper or receiver is serviced by a single railroad.[a]
Form of regulation	Currently revenue cap regulation, which provides revenue certainty for term of the regulatory period.	Not relevant.	Surface Transportation Board presides over a range of non-price matters. It is also able to set maximum rates if there are concerns that a railroad has been engaging in anti-competitive conduct.
Growth options	ARTC has a significant expansion path but the return that can be earned will be limited to regulated WACC.	The presence of growth options likely to be firm-specific and will largely depend on mine life.	The presence of growth options likely to be firm-specific.
Operating leverage	ARTC has high operating leverage.	Coal companies will have lower operating leverage than ARTC.	Should have similar operating leverage to ARTC.

a Association of American Railroads (2008), Overview of US Freight Railroads, January.

Overall, we can conclude from this that:

- ARTC has similar demand drivers to the coal companies. The rail firms tend to have a more diversified revenue base, although the markets for many of the commodities carried will be more contestable;
- ARTC has some protection via its pricing structure relative to the other businesses (particularly the coal firms);
- ARTC's contract terms are likely to be shorter;
- coal producers have the least amount of market power. ARTC is likely to possess the most market power but regulation prevents exercise;
- ARTC is governed by regulation. The revenue cap provides revenue certainty but only for the term of the regulatory period. Businesses that are not regulated have more flexibility in managing their operations, including in their ability to manage risks;

- the implications of growth options are unclear for ARTC. This is likely to be firm-specific in other industries;
- ARTC and railroads have higher operating leverage compared to the coal companies.

A lower bound of 0.5 is considered appropriate based on other regulatory decisions, in particular, the QCA's 2005 decision in relation to Queensland Rail's coal network, where an asset beta of 0.5 was determined and did not distinguish between a revenue cap and a hybrid price cap.

The range of asset betas observed for rail operators and coal producing companies proxy the underlying demand for ARTC's rail network services. The demand for these services will continue to be driven by the vagaries of a single commodity market, being coal. If there was a significant downturn in this market, ARTC's high operating leverage means that it cannot readily 'withdraw' capacity or avoid its fixed costs. At the same time, on balance, these businesses are likely to have higher systematic risk than ARTC. We have therefore recommended an upper bound of 0.6 which is still well below the averages observed for these companies, and also reflects other rail regulatory decisions (in freight).

Our recommended range for ARTC's asset beta is therefore between 0.5 and 0.6.

In terms of determining a point estimate for this range, there are two main reasons why we are of the view that it should be selected from the upper bound. The first is that it gives some regard to the asymmetric consequences of error.

The second (which is also related to this first consideration), is that ARTC is about to commit to expansions which will triple the size of its existing asset base in a very risky investment climate. In the absence of any other robust mechanism for compensating for this risk, we would recommend selecting the asset beta from the upper bound. This is consistent with the approach that has previously been applied by IPART when setting the rate of return to apply to ARTC's Hunter Valley network, as IPART has selected the WACC from the upper bound of the range.

4.6 Market risk premium

4.6.1 Background

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.

Estimates of the MRP have typically relied on estimating a plausible range for the MRP using historical data, and then choosing a point (or constrained range) within this range. Under the CAPM, the MRP estimate should be forward-looking and correspond to the time frame of the asset under analysis (which tends to be long term). As it cannot be observed directly, a number of studies have sought to estimate the historical MRP. Results for Australia have tended to fall within a range of 6 to 8%, although they are sensitive to the assumptions made, particularly in terms of the time period over which they are measured.

With some commentators arguing that the value of the MRP has fallen in recent times, there has been pressure to choose an estimate from the lower end of this range. Regulators are now consistently adopting a value of 6% and movements to an even lower value have been mooted. We note that IPART has previously applied a range of between 5.5% and 6.5%.

4.6.2 Overview of the literature on MRP estimation

Two methods commonly used are to estimate the MRP are:

- survey evidence; and
- historical averaging.

Before reviewing the estimates for the MRP which have been produced, it is worthwhile briefly reviewing the claim that the value of the MRP has fallen.

Has the MRP fallen?

There is a view in the literature that the market risk premium for Australia is declining. A number of reasons have been advanced to support a reduction in the MRP. For example, it has been proposed that the integration of Australia with world capital markets will reduce the variance of returns and therefore reduce the risk premium. Other factors include a reduction in the cost of acquiring the market portfolio, the growth of derivatives markets, changes in risk aversion, changes in taxation regimes and reductions in market risk.

A number of the key studies that have proposed the decline in the MRP have come out of the US. One Australian study estimated significantly different averages for two periods, 1877-1970 and 1971 to 2000, but was unable to show that the difference between the two estimates was statistically significant.[57]

It has been suggested that the historical MRP in the US has exceeded the value that would have been suggested by conventional theory. For example, Mehra argues that using 'standard theory' to estimate risk-adjusted returns, equities should have commanded a premium of only some 1% over bank bills, whereas the actual premium observed exceeds 7% (over very long time periods).[58] This has been referred to as the 'equity premium puzzle'. However, Mehra notes that this is a 'quantitative puzzle' not a theoretical one:[59]

> …standard theory is consistent with our notion of risk that, on average, stocks should return more than bonds. The puzzle arises from the fact that the quantitative predictions of the theory are an order of magnitude different from what has been historically documented.

He argues that the choice of premium depends on the investor's planning horizon. For example, after a market downturn, the actual premium will be low, however the expected premium will be high.

Other studies include:

- Fama and French[60], who argue that estimates of expected returns based on dividends and earnings growth methodologies are most reliable and that on this basis, the 'true' value of the MRP is likely to be low; and

- Arnott and Ryan[61], who predict a fall in the US equity risk premium, arguing that historical rates of growth are not sustainable. They argue that real dividend or earnings growth cannot be sustained at a higher rate than economic growth, and that the equity premium is now likely to be negative.

While all of these authors have sought to explain why the equity risk premium observed historically is not necessarily sustainable going forward, their arguments are not sufficiently compelling to suggest that there has been a permanent reduction in the premium commanded by equity holders over risk-free investments.

57 Unpublished study by Gray and Hall cited in M. Lally (2004) , op.cit., p46.

58 R. Mehra (2003), "The Equity Premium: Why Is It a Puzzle?", in Financial Analysts Journal, vol.59, no.1.

59 ibid., p.60.

60 E. Fama and K. French (2002), "The Equity Premium", in The Journal of Finance, vol. LVII, no.2.

61 R. Arnott and R. Ryan (2001), "The Death of the Risk Premium" in Journal of Portfolio Management, vol.27, no.3.

Ultimately, investing in equities (or even a broader portfolio that is seen to be more representative of the 'universe' of investments) is inherently risky. This is particularly the case when comparing against the 'risk-free' investment, which is the benchmark for measurement of the MRP. To suggest that this premium is very low ignores the fundamental relationship between risk and return (and to suggest that is negative has no theoretical or practical foundation). Mehra was unable to resolve the 'equity premium puzzle', after being one of the first to propose its existence. Further, there is a volume of research to suggest that the puzzle does not exist. Mehra concludes:[62]

> The data used to document the equity premium over the past 100 years are as good an economic data set as analysts have, and a span of 100 years is a long series when it comes to economic data. Before the equity premium is dismissed, not only do researchers need to understand the observed phenomena, but they also need a plausible explanation as to why the future is likely to be any different from the past. In the absence of any explanation, and on the basis of what is currently known, I make the following claim: Over the long term, the equity premium is likely to be similar to what it has been in the past and returns to investment in equity will continue to substantially dominate returns to investment in T-bills for investors with a long planning horizon.

With these issues in mind, alternative estimates of the MRP will now be examined.

Survey data

Survey methods poll informed commentators (such as portfolio managers and academics) to assess expectations of the future risk premium. A number of Australian regulators have referred to survey studies in considering an appropriate value for the MRP. These include:.

- two studies by Welch[63], who surveyed academics finding a MRP for the US of 7.1% and 5.5% respectively;
- Graham & Harvey[64], who have surveyed financial officers in the US on a quarterly basis since 1996. Their most recent estimate sourced was 3.66%;

62 R. Mehra (2003), op.cit., p.67.

63 I Welch (2000), "Views of Financial Economists on the Equity Premium and Other Issues", *The Journal of Business*, 73(4), pp501-537 and Welch, I. (2001), 'The Equity Premium Consensus Forecast Revisited', Working Paper, Yale University.

64 J. Graham & C. Harvey (2005), "The Long-Run Equity Risk Premium", Duke University.

- Mercer Investment consulting[65], who surveyed brokers in Australia finding a range of 3.0-6.0%, noting that in its own advice it adopts a figure of 3.0%; and
- Jardine Fleming Capital Markets[66], who surveyed 61 respondents in Australia, of which 35 were non-academics, finding an average expected MRP of 4.73%.

Survey studies have the advantage of being forward-looking, and therefore consistent with the CAPM model, however they have a number of limitations. These estimates:

- are influenced by the volatility of recent events, which can significantly limit the reliability of these estimates as a long-term, forward-looking measure;[67]
- tend to reflect short term expectations;
- are based largely on opinions, which may not necessarily be founded on sound fundamentals; and
- are vulnerable to bias, particularly if some of the respondents have incentives to produce certain outcomes.

There is no reason to believe that surveys are any more efficient in estimating the MRP than historical averaging. Of most concern is the fact that the studies can produce estimates of the MRP that contradict economic and financial theory. For example, in a previous survey by Graham and Harvey, these CFOs believed that risk and return were negatively correlated for the one-year horizon.[68]

While acknowledging the conceptual correctness of a forward-looking method to estimate MRP, we would suggest that the available evidence available from survey results is of limited value in deriving estimates of MRP.

Historical Averaging

Historical averaging has been the most popularly employed method for estimating the MRP. Historical averaging involves observing the measured difference between the risk free rate (based on the return on government bonds) and the return on the market

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65 Mercer Investment Consulting (2002), *Victorian Essential Services Commission Australia Equity Risk Premium*.

66 Jardine Fleming Capital Partners Limited (2001) The Equity Risk Premium – An Australian Perspective, Trinity Best Practice Committee.

67 For example, the quarterly results from Graham and Harvey's survey between 2000 and 2005 range from approximately 2.8% to 4.6%.

68 J. Graham and C. Harvey (2001), Expectations of Equity Risk Premia, Volatility and Asymmetry from a Corporate Finance Perspective', working paper, Duke University.

portfolio[69] (based on the return on the share market index) over a period of time and averaging the rate. While data is readily available for this method it does rely on the assumption that the past is the best indicator of future risk.

Methodological Issues

There are a number of issues of contention regarding historical averaging. The first is the time horizon over which the historical data should be analysed. One school of thought proposes that as long a horizon as possible should be used. This assumes that investors' risk premiums have not changed over time and the average market risk premium has remained stable.

An alternative view is that only more recent data is relevant, particularly if the market has undergone significant structural change over time (for example, the introduction of dividend imputation). This approach results in an estimation problem in that estimates based on more recent data have standard errors that are too high to produce a statistically meaningful estimate. Further, conditions prevailing over a short period of time may not necessarily be an appropriate basis for a long term forecast (for example, unusually high returns or high volatility). Gray and Officer conclude:

> A long period of data provides better statistical precision (the mean estimate has a lower standard error), but data from long ago may be less representative of current circumstances. It is generally agreed, however, that the minimum period required to provide sensible estimates is 30 years.[70]

From year to year, the MRP is extremely volatile and a longer term average is required to produce a meaningful estimate.

A second issue is the averaging method - arithmetic or geometric. Arithmetic averages are more popular but arguments are made in the literature for geometric averages on the basis that are more efficient (that is, they will produce less biased estimates of the "true average"). A recent study by Hathaway noted significant differences between averages under each method, with the arithmetic mean producing an estimate of 7.2%, whereas the geometric mean estimate was 6%.[71] Hathaway therefore concludes that the geometric return is more appropriate for historical averaging, although the arithmetic average remains appropriate for future estimates as it provides an unbiased estimator of expected future outcomes.

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[69] In the case of the return of the market, it represents the universe of investments available in the marketplace.

[70] S. Gray & R. Officer (2005), A Review of the Market Risk Premium and Commentary on Two Recent Papers, A Report Prepared for the Energy Networks Association, p.21.

[71] N. Hathaway (2005), Australian Market Risk Premium, Capital Research Pty Ltd.

Gray and Officer, on the other hand, support the use of an arithmetic mean.[72] They state that the arithmetic mean is the preferred method on the basis that we are looking to estimate the expected value of the MRP. They note that a geometric mean is appropriate:[73]

> …when estimating the aggregated return from a buy and hold strategy over a long period, but that is not the purpose here. The MRP is to be used in the CAPM to compute the cost of equity expressed in annual terms. Therefore, we require an estimate of the expected return, over the next year, on the market portfolio over and above the risk-free rate. What return do we expect on the market portfolio over the next year, relative to the risk-free rate? The historical data provides us with many observations on what the market returned relative to the risk-free rate over a one-year period. To the extent that each of these observations should be given equal weight, a simple arithmetic average is appropriate.

We are of the view that an arithmetic average is the most appropriate method for estimating the MRP based on historical data. The CAPM is a single time horizon model and as such the use of a geometric average would be inconsistent with its assumptions. We have therefore used an arithmetic average in our analysis.

Estimates from Selected Australian Studies

Estimates from several Australia studies are listed in

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72 S. Gray & R. Officer (2005), op.cit.

73 ibid.

Table 6.

Table 6 Selected Australian estimates of market risk premium

Author	Year	Period	MRP (%)
Officer	1985	1882-1987	7.9
Australian Graduate School of Management	1989	1974-1983	6.3
		1977-1983	11.7
Australian Graduate School of Management	1998	1964-1995 (incl Oct 1987)	6.2
		1964-1995 (excl Oct 1987)	8.1
Hathaway	1995	na	6.6
Davis	1998	na	4.5-7.0
Dimson et al	2002	1900-2000	7.5
Hancock	2005	1974-2003	4.5-5
Hathaway	2005	1875-2005	1 year arithmetic: 7
			1 year geometric: 7
			10 year arithmetic: 7.2
			10 year geometric (adj): 6.5
		1960 - 2005	10 year geometric (adj): 4.5*
			**recommended estimate*
Gray & Officer	2005	1975-2004	7.7
		1955-2004	6.43
		1930-2004	6.58
		1905-2004	7.15
		1885-2004	7.17

Sources: QCA (2000), Draft decision on QR's Draft Undertaking, Working Paper Number 4; Lally, M. (2004), Estimating the Cost of Capital for Regulated Firms; S. Gray & R. Officer (2005), A Review of the Market Risk Premium and Commentary on Two Recent Papers, A Report Prepared for the Energy Networks Association; J. Hancock (2005), The Market Risk Premium for Australian Regulatory Decisions, The South Australian Centre for Economic Studies.

Recognising the problems inherent in individual estimates, it is common practice to refer to a range for MRP of between 6% and 8%, with the longest horizon studies estimating the MRP at above 7%.[74]

Three studies were published by Hancock[75], Hathaway[76] and Gray and Officer[77] in 2005. Gray and Officer's paper is largely a critique of the first two papers, although they have also produced their own estimates of the MRP. All studies produced estimates in excess of 6% for long-term historical averages. However, Hancock and Hathaway's recommended estimates are below 6% based on a number of 'ad hoc' adjustments made to the data.

[74] For example see: M. Lally (2004), Estimating the Cost of Capital for Regulated Firms and QCA (2000), Draft decision on QR's Draft Undertaking, Working Paper Number 4.

[75] J. Hancock (2005), The Market Risk Premium for Australian Regulatory Decisions, The South Australian Centre for Economic Studies.

[76] N. Hathaway (2005), op.cit.

[77] S. Gray & R. Officer (2005), op.cit.

Both authors produced estimates over long time periods however recommend that the time frame for estimation should be limited to the last thirty years. Ad hoc adjustments were made based on key events or trends, such as the increase in the price-earnings ratio (Hathaway) and the introduction of dividend imputation (Hancock). These adjustments were rejected in Gray and Officer's critique:[78]

> Both authors argue that events that are unanticipated and unlikely to repeat should be removed from the data set or the subject of adjustments to the historical data. Our response is that there are many events that are both unexpected and unlikely to repeat, and yet are not the subject of adjustment in either paper. The terrorist attacks of 2001 and the Asian crisis of 1997 are some examples.
>
> There are many economic events that affect stock returns. To eliminate those that are claimed to be unexpected and non-recurring would be to leave a scant and practically useless data set. Indeed it is precisely because there are unexpected events that affect markets in different ways that there exists a MRP in the first place! Rather than selectively eliminate from the data events that are considered to be unexpected, the preferred approach is to analyse a longer data set that contains both positive and negative shocks. Moreover, in a regulatory setting, this would invite an avalanche of submissions on which events were expected and which were not.

Gray and Officer produce a range of estimates for the MRP based on different time periods, all of which are significantly above 6%. The highest estimate, 7.7%, was actually observed when the timeframe was limited to the last thirty years, which is the period over which many authors have sought to claim that the MRP has fallen. Interestingly, however, Gray and Officer conclude the following:[79]

> Our conclusion is that there is nothing in the recent data nor in these papers that justifies a change in the regulatory precedent of using 6% as an estimate of the market risk premium. Indeed the mean excess market return is substantially above 6% over relatively short or long historical periods. Estimates below 6% can only be achieved by making selected adjustments to the historical data.

We find it difficult to accept the conclusion that a value of 6% should be maintained by regulators when the results of their own analysis suggest that the MRP is higher than this. It would in fact appear that the adoption of 6% is an 'accident of history', which has become so entrenched in regulatory precedent that no single regulator is necessarily prepared to correct it. In maintaining the MRP at this level, regulators also

[78] ibid., p.3.

[79] ibid.

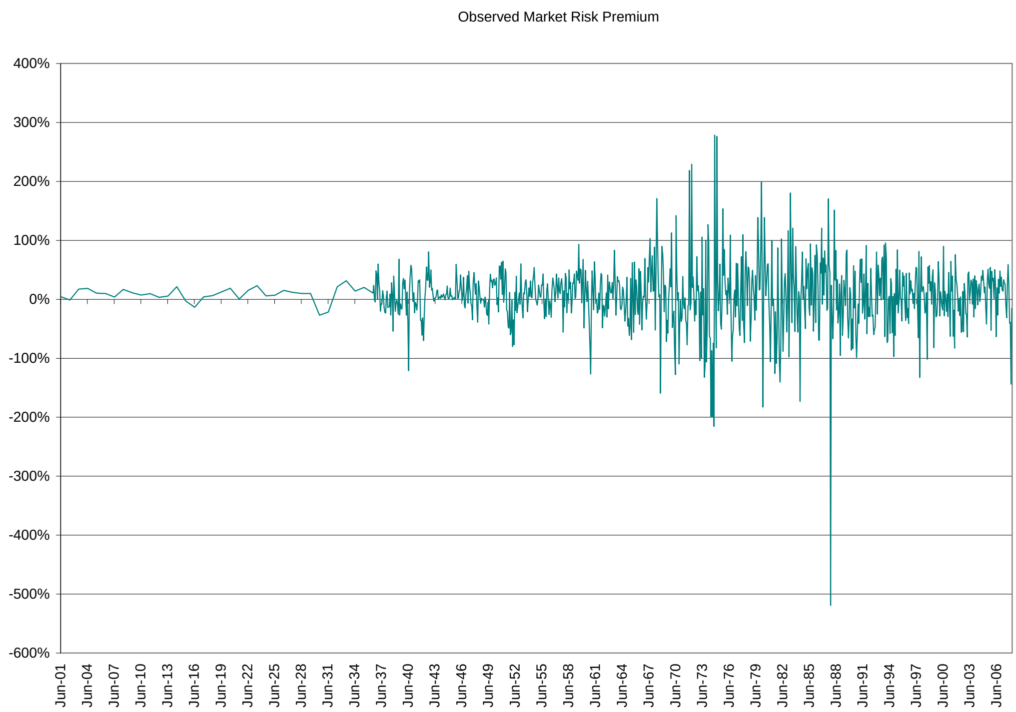
continue to rely on the arguments that the value of the MRP has fallen, however as noted above, there is little if any evidence to support this case.

Further analysis

Synergies has conducted its own analysis based on Australian equity accumulation returns and Government bond yields from June 1901 to October 2007. Prior to July 1936, data was only reported on an annual basis and hence only annual observations of each series have been used to this point. Data was reported on a monthly basis after this date so annualised monthly observations are used for the remainder of the estimation period.

Figure 5 shows the MRP for the period in question (it is clear where values change from annual to annualised monthly from 1936). The overall volatility of the MRP is immediately obvious. It is this feature of the data that makes a longer historical record preferable, of at least 30 years, when computing the average MRP.

Figure 5   Observed Market Risk Premium



Data source: Bloomberg, RBA and various publications

In computing historical averages for the estimation of an ex-ante MRP, following Gray and Officer, an arithmetic mean is used.[80] The following table contains estimates of

80 S. Gray & R. Officer (2005), op.cit.

MRP (and associated standard deviations) computed over a range of time horizons, the shortest being 16 years and the longest 106 years.

Table 8 Average MRPs

Start of Period of Averaging (to October 2007)	Average Market Risk Premium (Standard Deviation)
June 1991	8.1% (45%)
June 1981	7.2% (61%)
June 1971	6.2% (68%)
June 1961	6.4% (65%)
June 1951	6.4% (60%)
June 1941	7.1% (56%)
June 1931	6.8% (55%)
June 1921	6.8% (54%)
June 1911	6.8% (54%)
June 1901	6.8% (54%)

Source: **Bloomberg, RBA and various publications**

The estimated averages vary a great deal as additional 10 year blocks of data are included (8.1% down to 6.2%). These estimates are associated with relatively large standard deviations, with the exception of the data since 1991. Thus if one believed that the market has undergone significant change in recent times, a short horizon would be used but this would lead to an imprecise estimate of the MRP.

The preferred alternative to obtain a more precise estimate of MRP is to utilise a longer time period. There is no change in the MRP estimate of 6.8% (with relatively low standard deviation) once the time period contains data dating back to 1931.

The contentious issue of the period over which the market risk premium is to be calculated is illustrated by Bob Officer's MRP analysis from 1882 to 1987.[81] It was found that the average market risk premium was 7.94% over the entire period. For each 10-year sub-period the premium ranged from 0.36% to 11.87% (interestingly, the two extremes were consecutive periods). Clearly shorter-term premiums are highly volatile and the long-run premium is close to 8%. Unlike long-term premiums, meaningful short-term premiums cannot be estimated. What is long-term is a question that needs to be answered.

We can therefore conclude that empirically, an analysis over a period of less than 30 years will not result in a meaningful estimate. Gray and Officer conclude:

[81] B. Officer (1989), "Rates of Return to Shares, Bond Yields and Inflation Rates: An Historical Perspective", in Share Markets and Portfolio Theory, University of Queensland Press.

> A long period of data provides better statistical precision (the mean estimate has a lower standard error), but data from long ago may be less representative of current circumstances. It is generally agreed, however, that the minimum period required to provide sensible estimates is 30 years.[82]

From year to year, the MRP is extremely volatile and a longer-term average is required to produce a meaningful estimate. This casts considerable doubt over studies that are attempting to draw valid conclusions regarding the value of the MRP based on a shorter averaging period. While shorter-term studies may reflect the 'current' value of the MRP, the MRP's short-term volatility means that this estimate could well be higher, or lower, in the future. As a consequence, this short-term value cannot serve as a reliable proxy for the long-term, forward looking value of the MRP.

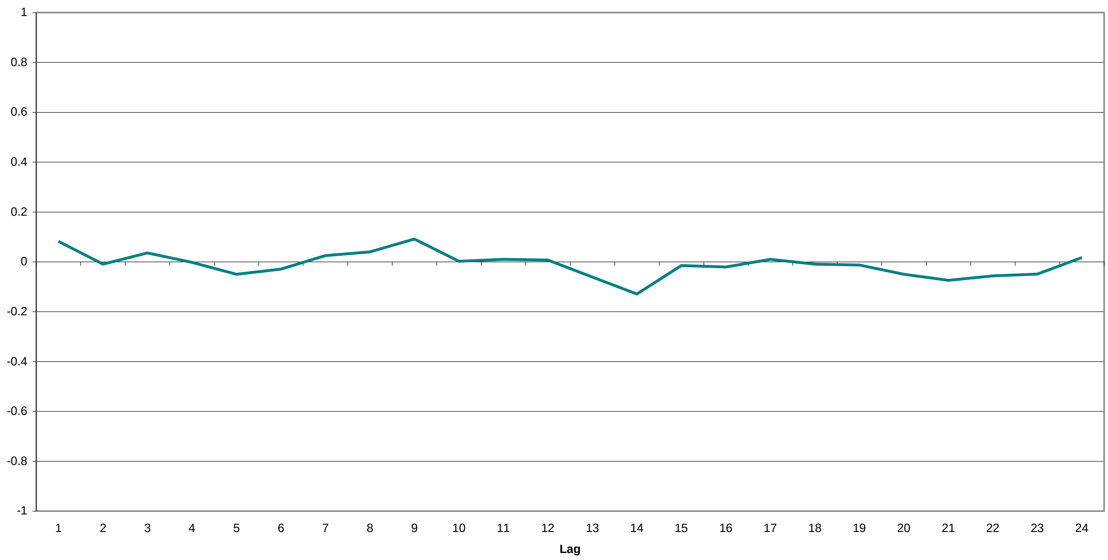
Trends in the MRP

To rely on the long-term estimate of the MRP we must be confident that deviations from the mean MRP are not persistent. To achieve this, an examination of the autocorrelations in the MRP are examined which will reveal the degree of persistence in the MRP. This analysis was based on data post July 1936 given that all subsequent data was available at a monthly frequency. If all the dataset was used this would incorrectly be assuming that all observations were equally spaced in time.

Figure 6 plots the autocorrelations in the MRP (up to a maximum lag of 24 months). It clearly shows there is very little correlation structure in the MRP, with the maximum autocorrelation coefficient being 0.09. This result indicates that the deviations from the mean of the MRP are not persistent at all. This would suggest that a longer term average of 6.2 to 6.4% is a valid estimate of the future MRP.

[82] S. Gray & R. Officer (2005), op.cit., p.21.

Figure 6 Autocorrelation of MRP (maximum lag of 24 months)



If there is clear evidence to demonstrate that structural change has occurred, and that it has impacted the value of the MRP, then it would not be appropriate to use a longer-term historical average that referenced data prior to the point in time when the structural change occurred. To date, however, no evidence has been produced to demonstrate the impact of these influences on investors' risk and return expectations, or the potential quantum of such an impact on the MRP. In any case, any estimates produced over shorter time periods cannot be considered reliable.

Conclusion: value of the MRP

The best estimate of the 'true' long-run market risk premium is the current long-run market risk premium. The MRP is volatile and as such a long-term average needs to be calculated to estimate a meaningful premium. It appears that the period of averaging needs to be at least 30 years and while longer periods change the calculated answer marginally, the advantage of a stable estimate outweigh any disadvantages of the longer time horizon.

The average is affected by the yearly movements in the MRP. While we may have good years and bad years, removing the observations in the tail has little effect on the long-term average. If one was to average over a short period then the calculated MRP would be distorted by a probable imbalance in the tail. The distribution is approximately normal and there appears to be randomness in the changes.

Estimates of the MRP in Australia confirm that the value of the MRP has remained well above 6%. Studies over various time periods have consistently produced estimates in the range of 6 to 8%. This is supported by our own analysis, which has shown that the long-term average exceeds 7%.

Arguments that the MRP has fallen appear to have emanated from recent observations of the MRP that have been estimated over a relatively short time period. Our analysis has clearly shown that the MRP is inherently volatile, and hence drawing any conclusions based on such recent estimates is potentially dangerous. Our analysis has shown that estimates based on historical data (which remains a more reliable method than using surveys) need to be based on a long-term historical arithmetic average. This average should not be adjusted for ad hoc events or possible trends.

It is possible that going forward, the postulated drivers of a lower MRP do in fact result in a reduction in the MRP. However, there is no evidence to quantify any such impact – it is in fact possible that any reduction is small and statistically insignificant.

Importantly, there is currently no theoretical or empirical basis for maintaining a value at the bottom end of the 6 to 8% range, which has now become regulatory precedent, notwithstanding the acknowledged need to have regard for the asymmetric consequences of regulatory error. Certainly, there is strong evidence to defend any move to reduce the MRP below 6%.

Historical analysis shows that the long-run MRP has been at least 6.8%. Even if some reduction in the MRP has or will occur in the future (the likely impact of which cannot be readily estimated), we would see no reason to go below a value of 6%, particularly after having regard to the asymmetric consequences of regulatory error. We believe that a lower value cannot be justified unless and until any robust empirical evidence can be produced to support it.

We therefore conclude that 6% to 7% is considered a reasonable range for the MRP.

4.7 Cost of debt

The cost of debt capital is normally calculated as the risk-free rate plus a margin for credit or default risk. Debt issuance costs are generally also incurred and these are either reflected in the cost of debt (as an addition to the debt margin) or the cashflows.

4.7.1 Debt margin

The typical approach to determining the debt margin involves:

- if the firm is unrated, assuming an appropriate 'notional' credit rating, which reflects the risk of default; and
- determining an appropriate margin based on the difference between the current cost of debt for a firm of that credit rating, and the risk-free rate. This should be estimated over the same time period as the risk-free rate.

Notional credit rating assumption

A common starting point for the notional credit rating assumption is BBB, or minimum investment grade. In regulatory decisions, assumptions between BBB and A have tended to be adopted (the ACCC has adopted a rating of A as the benchmark for transmission network service providers). In its most recent decision with respect to Queensland Rail's central Queensland coal network, the Queensland Competition Authority assumed a credit rating of BBB+. These decisions have largely been made based on comparisons with other firms. It will also be driven by the assumed capital structure.

In practice, credit rating agencies undertake an extremely detailed assessment before arriving at a rating recommendation. This analysis firstly considers the nature of the industry the firm operates in, and its inherent risks. This tends to set a cap on the maximum rating that a firm in that industry is likely to achieve.

The second part of the analysis involves a detailed examination of the firm and its capacity to service debt. While capital structure is important here, there are a number of other factors that are considered, including liquidity, profitability and debt service coverage. This analysis requires the modelling of cashflows to assess the sensitivity of debt capacity to changes in key assumptions, as well as different scenarios for the business in terms of its performance and operating environment. Finally, the quality of management is also considered, given this can impact the firm's capacity to respond to these different scenarios.

Further, the capital structure decision can be driven by the firm's desire to achieve a certain credit rating. For example, if a firm wants to achieve a higher credit rating (and hence face a lower cost of debt), it will generally need to maintain a lower capital structure. This may or may not be appropriate depending on the firm's objectives.

While it is impractical for a regulator to undertake such a detailed process (given this also requires specialist expertise), caution should be exercised when determining an assumption based on a very high level analysis. Given the asymmetric consequences of regulatory error and the need to employ a conservative approach, an assumption of BBB is therefore considered appropriate for ARTC.

Reference can also be made to the comparator firms in our sample. Most of these are US Class 1 railroads, the majority of which are rated. Current credit ratings are summarised in the following table.

Table 8 Credit ratings of US Class 1 Railways

Firm	Credit rating (as at June 2008)	Debt to total value (as at 31 December 2007)
Burlington Northern Sante Fe Corporation	BBB	21%
Canadian National Railway Company	A-	19%
Canadian Pacific Railway Limited	BBB	29%
CSX Corporation	BBB-	27%
Kansas City Southern	B+	42%
Norfolk Southern Corporation	BBB+	24%
Union Pacific Corporation	BBB	17%

Source: Bloomberg (debt to value); Standard and Poor's (credit ratings)

For the reasons outlined above, caution should be exercised in drawing any firm parallels for ARTC. The Class 1 Railways would be considered to be higher risk than ARTC's Hunter Valley network business and all firms have gearing levels well below 50%. ARTC's higher level of gearing should adequately account for this difference in risk and hence we are of the view that an assumption of BBB remains reasonable, based on a capital structure of between 50% and 55%, particularly given the size of the investment program it is about to undertake.

Estimating the debt margin

Based on this assumption, it would be normal to take the difference between the twenty day average of the yield of a ten year Commonwealth Government bond and the yield of a ten year BBB-rated bond. However, due to the sub-prime fallout and the flight of funds from higher risk bonds to lower risk bonds, the market for 10 year BBB-rated bonds is now extremely thin. Bloomberg has ceased reporting the yield of a 10 year BBB-rated bond.

In response to this problem, the alternative approach that has been employed by the Australian Energy Regulator (AER) and also accepted by the ACCC, is to observe the yield on the longest-dated BBB bond (which is currently 8 years) and add the margin between an A-rated 10 year and 8 year bond, as this is considered an appropriate proxy for the difference in yield between a BBB-rated 10 year and 8 year bond (that is, the slope of the yield curve is assumed to be similar at this end).

One of the issues that has recently been considered by IPART is whether in view of this problem, it is more appropriate to use Bloomberg or CBA Spectrum data to estimate the debt margin. In its recent Sydney Water decision, it expressed a preference to use CBA Spectrum, largely due to concerns with the infrequent reporting of BBB and BBB+ bond yields and the need to interpolate. It also notes advice provided to the ESC from the Allen Consulting Group (ACG) which concluded that "there is no systematic bias in current CBA Spectrum estimates".[83]

Concerns with the use of Bloomberg (using the interpolated estimates) versus CBA Spectrum were considered by the AER in its 2008 decision in relation to SP AusNet[84]. Its analysis compared CBA Spectrum and the interpolated Bloomberg estimates with the BBB 10 year fair value yield over the 18 months prior to the cessation of its publication. The CBA Spectrum estimates included an unadjusted and adjusted estimate, with the latter compensating for the downward bias that has been observed in its historical estimates of corporate bond yields for longer horizons.

The AER concluded that both CBA Spectrum estimates were poor proxies for the BBB 10 year, with the estimate based on the Bloomberg 8 year BBB yield plus the spread between the 8 and 10 year yields seen as producing the smallest average error.[85]

ACG had reached similar conclusions in its 2006 memorandum to the ACCC.[86] In 2008 it undertook a fresh assessment of the predictive accuracy of Bloomberg versus CBA Spectrum for the ESC.[87] ACG's assessment was based on data collected for the 20 trading days to 30 November and 31 December 2007. In producing its Bloomberg estimates, we note that its interpolation technique applied the margin between Bloomberg's 7 and 8 year bonds, which is different to the approach used by the AER.

They concluded that both CBA Spectrum and Bloomberg over-estimated, although the Bloomberg estimate had a lower error (around 4 basis points versus 13.6 to 17.6 basis points for CBA Spectrum). The over-estimate produced by CBA Spectrum contradicted previous findings that it under-estimated the long term BBB bond yield. They recommended the use of the CBA Spectrum estimates (notwithstanding the greater error) because of concerns regarding the requirement to extrapolate the Bloomberg data to obtain a ten year estimate.

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83 Independent Pricing and Regulatory Tribunal (2008), op.cit.

84 Australian Energy Regulatory (2008), op.cit.

85 ibid., p.97.

86 Allen Consulting Group (2006), "'A' Rating Debt Margin Differential Between Bloomberg and CBA Spectrum", Memorandum to the ACCC, 23 February.

87 Allen Consulting Group (2008), "Gas Access Arrangement Review 2008: Updating Estimates of Debt Margins for 2o trading days to November 2007 and December 2007", Memorandum to the Essential Services Commission of Victoria, 25 January.

We concur with the concerns expressed by both ACG and IPART regarding interpolation. However, we also note the results of the AER's analysis, which showed that the interpolated Bloomberg estimates proved the most reliable proxy for the 10 year Bloomberg fair value BBB yield over an 18 month period. Our concern with drawing conclusions from ACG's analysis is that the analysis was based on two discrete 20 day time periods (as they were requested to do). There is no reconciliation or explanation of the 'positive bias' evident in the CBA Spectrum estimate with the historical downward bias that has observed in CBA Spectrum yields, which has been attributed to the inclusion of a 'phantom' observation from the next highest credit rating category.

Again, we have concerns in taking this assessment and assuming that the 10 year BBB fair value estimates produced by CBA Spectrum no longer have a downward bias (and that it has in fact turned positive). What is not evident is that there is no bias.

We concur with IPART that this issue needs to continue to be monitored going forward (similar views have been expressed by other regulators). In the meantime, we will continue to use the methodology employed by the AER, which is based on a 20 day average of the 8 year Bloomberg BBB bond yield plus the difference between the 8 and 10 year A-rated bond yield. As at 28 November 2008, this estimate was 300 basis points.

4.7.2 Debt raising costs

The debt margin reflects a premium for credit and liquidity risk, however does not include any allowance for the actual costs of raising debt. In practice, an efficient benchmark firm will incur transaction and administration costs in raising and managing debt. It is therefore now increasingly common practice to include a separate allowance for these costs, typically as an increment to the debt margin (alternatively, they can be included in the cashflows).

Unlike the debt margin, these costs are less specific to the business, although may vary depending on the volume of debt raised and the manner in which it is raised (noting that there are some economies of scale in managing debt). Referencing previous regulatory decisions (which have sourced estimates of these costs from financial institutions) is therefore considered appropriate. Allowances approved in recent regulatory decisions are included in the following table.

Table 9 Debt margin: recent regulatory decisions

Regulator (year)	Industry	Allowance
ACCC (2008)	Rail	12.5 basis points
ERA (2008)	Rail	12.5 basis points
QCA (2006)	Electricity distribution	12.5 basis points
ESCOA (2005)	Electricity distribution	12.5 basis points
ICRC (2004)	Water	12.5 basis points
IPART (2005)	Gas	12.5 basis points
QCA (2005)	Rail and electricity distribution	12.5 basis points
ESC (2005 - draft)	Electricity distribution	12.5 basis points
IPART (2005)	Rail	12.5 basis points
IPART (2004)	Electricity distribution	12.5 basis points
QCA (2004)	Ports	12.5 basis points
ACCC (2004)	Electricity transmission	Undertaking a further review – to be treated as opex
ICRC (2004)	Rail and electricity distribution	12.5 basis points

An assumption of 12.5 basis points is now consistently applied in regulatory decisions. The most notable decision was the 2002 decision with respect to GasNet, where the Australian Competition Tribunal overturned a decision by the ACCC and allowed a margin of 25 basis points, which was submitted by GasNet.

We note that in its recent Draft Decision in relation to ARTC's interstate network, the ACCC made reference to a report by the Allen Consulting Group (ACG) [88]. Based on this report the ACCC concluded that 8.3 basis points was considered a fair allowance for ARTC's debt raising costs for the interstate network. If ARTC was expected to be pricing closer to the ceiling it would have rejected its submitted allowance of 12.5 basis points in favour of this lower estimate.[89]

The data referenced in this decision is based on the costs of a firm issuing its own debt (based on Medium Term Note issues). The analysis included underwriting fees, legal and roadshow costs, the fixed costs of obtaining an issuer credit rating, registry fees and paying fees. It was not evident that these costs included the (substantial) costs associated with establishing and running a treasury operation. These costs include staffing, compliance costs, data subscription services (such as Bloomberg and Reuters) and information technology costs. If these costs have not been included, this estimate will understate the costs of a firm issuing its own debt.

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[88] The Allen Consulting Group (2004), Debt and Equity Raising Transaction Costs, Report prepared for the Australian Competition and Consumer Commission, December.

[89] Australian Competition and Consumer Commission (2008), Draft Decision: Access Undertaking – Interstate Network, Australian Rail Track Corporation, April, p.152.

In our view, the data provided in the ACG report does not provide sufficiently compelling evidence to move from the established precedent of 12.5 basis points. Our concerns with the analysis are that:

- the estimates do not necessarily cover all of the relevant costs that would be incurred in establishing and maintaining a debt issuance facility; and

- the costs will be sensitive to the type and volume of funding obtained, and these costs are likely to vary through time.

We are also of the view that reliance should only be placed on objective data sources (ACG has sought to do this with the estimates cited above) rather than say, surveys of investment banks.

Given this, it is submitted that an allowance of 12.5 basis points remains appropriate for ARTC. This has been added to the debt margin and hence is reflected in the WACC for the purpose of this analysis, however it is noted that inclusion in the operating cashflows is an acceptable alternative.

The total debt margin is therefore 3.13%. When added to the risk-free rate of 4.95%, the resulting cost of debt is 8.08%.

4.8 Tax and imputation (gamma)

4.8.1 Background

The cost of capital is traditionally calculated on an after-corporate tax basis. With dividend imputation, 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. Gamma (γ) is the proportion of the corporate tax which can be claimed as a tax credit against personal tax, that is, it is the value of personal tax credits. Once this value has been determined, then either the WACC or the cash flows to which WACC is applied is adjusted to reflect the value of the tax credit to investors.

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.

While the distribution rate can be generally observed from taxation statistics, the value of franking credits cannot be directly observed. The value of franking credits is determined at the level of the investor and is influenced by the investor's tax circumstances. The value of gamma is between zero (no value from franking credits) and one (full value of franking credits).

Determining an appropriate value for gamma has proven reasonably contentious. Regulators are now consistently adopting a value of 0.5. We note that IPART has adopted a range of between 0.3 and 0.5. We are of the view that there is strong evidence to suggest that the value of gamma has fallen significantly, and in fact zero is now the best estimate. An overview of dividend imputation

As noted above, there are two key inputs into the estimation of gamma, which are related by the equation:

$$gamma = V \times D$$

where V is the value of franking credits[90] and D is the distribution rate.

Based on statistics supplied by the Australian Taxation Office, Hathaway and Officer estimate that approximately 71% of franking credits are distributed to shareholders.[91] However, only 32% of the distributed franking credits were redeemed.[92] This suggests that a significant number of shareholders did not utilise, or were unable to utilise, their franking credits.

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 are able to 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 relation to the redemption of credits, the major issue in the literature is therefore whose ability to redeem imputation credits is relevant for the assessment of the value of gamma. This is considered in the following section.

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90 φ is used instead of V in a number of studies

91 N. Hathaway and R. Officer (2004), op.cit.

92 Australian Taxation Office (2005), "Taxation Statistics 2002-03", Australian Government.

4.8.2 The identity of the marginal investor

Officer's seminal work on dividend imputation specified that gamma is the proportion of the *marginal* shareholder's personal income tax on dividend income that had been prepaid at the corporate level (rather than the average shareholder's). The marginal shareholder is the price-setting investor. The price at which this shareholder transacts becomes the market clearing price, or the price equating the demand for capital by the firm with supply that will determine the firm's cost of capital.

The key question is therefore the identity of the marginal investor. In open capital markets such as Australia, which have large capital requirements but an insufficient internal capital source, external capital must be drawn upon. In the context of imputation credits this means that both foreign and domestic investors will hold shares in Australian companies.

As noted above, non-resident shareholders are unable to derive any direct benefit from franking credits. Previously this could be indirectly derived via the trading of shares around dividend dates. Schemes were established by investment banks to allow foreign investors to extract value from franking credits, which relied on these investors selling their shares to domestic investors in the period leading up to the payment of the dividend (that is, before the shares go 'ex dividend', which is when the holder is no longer entitled to receive that dividend). The domestic purchasers would receive the cash dividend and franking credit, and subsequently sell the share back to the foreign investor at a small premium.

Some twelve years after becoming aware of these schemes the Commonwealth Government changed the Australian taxation law to introduce a minimum period of holding, requiring that shareholders have to be 'at risk' for a period of time in order to obtain the benefit of franking credits. This amendment, called the 45-day rule, was effective from 1 July 1997, although was not introduced until some time later (July 1999).

Under this law, investors are required to hold shares for a period of 45 days during a qualification period around the dividend event (without substantial hedging) in order to be eligible to rebate franking credits against their tax liabilities. This therefore significantly extended the window over which the previous trades between foreign and domestic investors could be made, to the extent that the extra price risk borne by the parties meant that such transactions were no longer worthwhile.

As a consequence, the return to a foreign investor comprises dividends and capital gain only, whereas the return to a domestic investor comprises dividends, capital gain and franking credits. If both foreign and domestic investors had the same expectations about the future earnings of the firm, which is a well-established tenet of economic theory, then the foreign investor would demand a lower price than the domestic investor, as the foreign investor receives a relatively lower return.

Therefore, in the presence of insufficient domestic capital it is expected that foreign investors shall be the marginal investors. As outlined above, even if the clear majority of the shareholders are domestic but there is some reasonable presence of foreign investors, then economic theory dictates that the marginal investor will be foreign because this investor will set the market-clearing price that determines the cost of capital.

In Australia, one can therefore conclude that as the price-setting investor in the 'average' firm is most likely to be foreign, franking credits will not be accorded a value in the pricing of shares. They will have value to domestic investors, but they are not the marginal investor that sets share prices. While they may have had some value prior to the introduction of the 45-day rule, there is no longer any basis for foreign investors to derive any benefit from these credits and their value in setting share prices will therefore be zero.

There is established empirical support for this proposition. For example, the results of a 2004 study by Cannavan, Finn and Gray:

> …are consistent with the notion that nonresidents are the marginal price-setting investors in large Australian firms.[93]

A recent study by Feuerherdt, Gray and Hall (2007), which was based on an analysis of the value of imputation tax credits on hybrid securities, drew similar conclusions:

> Our results are consistent with the notion that security prices are set by a marginal investor who does not value franking credits. However, it should be emphasised that our discussion of the marginal investor hypothesis does not form the basis for an assumption leading to the result. Simply, the empirical evidence is that security prices do not incorporate any value for imputation credits. Even if a theory were proposed in which security prices were set by the average investor base, the empirical result would be unchanged.[94]

It is noted that the notion that the marginal investor is foreign has not necessarily been accepted by regulators. There are two arguments that have been made here. Firstly,

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[93] D. Cannavan, F. Finn and S. Gray (2004), "The Valuation of Dividend Imputation Tax Credits in Australia", Journal of Financial Economics, p.168.

[94] Feuerherdt, Gray and Hall (2007), "The Value of Imputation Tax Credits on Australian Hybrid Securities", forthcoming publication in the International Review of Finance, p.3.

many regulated businesses have a 'unique' domestic shareholder base (for example, they are government owned businesses) and hence the marginal investor won't be a foreign investor. However, this argument is erroneous as WACC parameters are determined with reference to an 'efficient' benchmark firm. For the reasons outlined above, it is appropriate to conclude that such a firm would have at least some of its shares held by foreign investors. The other difficulty with this argument is that assuming that some companies have domestic marginal investors and others have foreign marginal investors would require segmentation of the Australian sharemarket, which is not feasible.

Secondly, it has been proposed that if we are to consider the presence of foreign investors, we should be using an international CAPM to determine the WACC, not a domestic CAPM (and hence, all parameters would need to be respecified in a global market context). For example, the QCA submitted this argument in two recent final decisions, being Queensland Rail and the Dalrymple Bay Coal Terminal, stating that if a choice is to be made, the domestic CAPM should be used as an international CAPM will produce a lower WACC and hence disadvantage the infrastructure owner. This issue was explored in section 3.2.2, where it was shown that the most appropriate model to use is the domestic CAPM and that standard practice is to recognise the presence of foreign investors in estimating parameters such as gamma. Excluding their influence is both unrealistic and impractical. For the reasons outlined above, this specification of the domestic CAPM in fact serves as the best available proxy for an international CAPM.

Further, a recent paper by Gray and Hall[95] (2006) finds that setting gamma to zero does not, unlike the values of gamma maintained by regulators, violate the deterministic relationship between the value of franking credits, the market risk premium and the corporate tax rate. Thus, taking gamma of zero is both agreed to by the theory and empirical bulk, and also is robust to the applicability of this assumption.

Other Australian tax law changes

There are a couple of other changes to the Australian tax law that are also cited as potentially impacting the value of gamma, including:

- a change in the relative tax treatment of dividends versus capital gains. Since this capital gains tax treatment has been halved, the retention of dividends by

[95] S. Gray and J. Hall (2006), "The Relationship Between Franking Credits and the Market Risk Premium", Unpublished Working Paper, University of Queensland.

companies has been viewed positively by investors, which could therefore have reduced the value of gamma to domestic investors; and

- the introduction of a tax rebate for unused franking credits in 2000. This meant that franking credits that previously could not be utilised (as they exceeded the individual's personal tax liability) now have some value. This should have increased the value of gamma to domestic investors.

While both of these changes may have had an impact on the value of gamma to domestic investors, and assist in explaining changes in the value of gamma to the *average* investor, this will have no impact on the value of gamma for cost of capital purposes if the *marginal* price-setting investor is not a tax-paying resident. The changes are therefore of no relevance when estimating the value of gamma for cost of capital purposes.

4.8.3 Empirical estimates

The introduction of the 45-day rule is a significant and permanent structural change to the Australian market. It is significant because prior to the introduction of this rule, foreign investors could derive some benefit from franking credits by trading their shares with domestic investors around dividend dates. Although this benefit may not necessarily have been equivalent to the full value, this suggests that these credits had at least some value to these investors.

Foreign investors were never able to directly benefit from franking credits - these credits were only valuable to them to the extent that they could be sold to resident tax-paying investors that could utilise them. As it is no longer possible for foreign investors to 'sell' these credits, they are now worthless to them.

In examining the literature, the main focus should therefore be on more recent studies, particularly those undertaken since the introduction of the 45-day rule (which, as noted above, was effective from 1997 yet only introduced in 1999). In 'dissecting' the literature in this way, it is important to note that the key issue is the time period over which gamma was valued.

Most of the later studies span both time periods. To the extent this is the case, and if it is accepted that the value of gamma has fallen significantly since the 45-day rule came into effect (perhaps to zero), this will produce an upward bias in the results of these studies. Before these studies are examined, a brief overview is provided of one of the most common methodologies that has been used to estimate the value of gamma.

Dividend Drop-Off Studies

One of the most commonly applied methodologies used in studies that have sought to estimate the value of gamma is the dividend drop-off approach. As a firm's share price will typically fall following the payment of a dividend (which is seen to be driven by the activities of short-term arbitrage traders), dividend drop-off studies examine the amount of the price change.

The difficulty here, however, is that it is extremely difficult to decompose this change into the value of the dividend itself and the value of the franking credits that are attached to that dividend. These variables are highly correlated, posing a number of methodological challenges for these studies. The reason for this correlation is that franking credits are linearly determined by the value of the cash dividend, as shown by:

$$\text{FC} = \text{Div x } f\left(\frac{t}{1-t}\right)$$

Where:

FC = franking credit

Div = cash dividend

f = franking proportion (or proportion of personal tax pre-paid at the corporate level)

t = the contemporaneous corporate tax rate.

This relationship will lead to a problem called multicollinearity and its presence will significantly reduce the ability to interpret the value of the estimates.

Regression analysis is used to test the existence and strength of the relationship between a dependent variable and one or more independent variables (in this case, our two independent variables are dividends and franking credits). The results of the regression will tell us the extent to which changes in the dependent variable are explained by the independent variables. If the independent variables are related, it will not be possible to isolate the impact of each of these variables in interpreting that relationship – this is multicollinearity.

It is therefore extremely important to keep this issue in mind when examining the results of dividend drop-off studies.

It is also important to note that most studies (at least in the first instance) seek to establish a value for franking credits (V). As noted above, this must be multiplied by the distribution rate to obtain a value for gamma (γ). Where we have done this below, we have assumed a distribution rate of 71%.

Overview of recent studies

Hathaway and Officer (2004)

Hathaway and Officer studied the relationship between the price change on the ex-dividend date and the cash dividend and franking credit paid, using data from 1988 to 2002.[96] Their methodology sought to isolate the additional drop-off in the share price that is attributable to the franking component from the drop-off that is due to the cash component.

They draw conclusions from the large firms for the purposes of reliability, and take credits to be priced at around 50% of their face value, giving an estimate of gamma of 0.355. In addition, they find that the market values cash dividends at around 80% of their face value.

There are a number of issues with this study. As noted previously, one of the main problems with studies of this nature is the collinearity between the two independent variables, being dividends and franking credits. Given the high degree of correlation between dividends and franking credits also means that a separation of their values is difficult. Further, there are no levels of significance reported. Given the increase in standard errors encountered in regressions with high collinearity, the significance of the results is reduced.

Beggs and Skeels (2005)

Beggs and Skeels used a similar approach to Hathaway and Officer, although producing different results.[97] Using data from the Commsec Share Portfolio database over the period from 1986 to 2004, they tested six tax regime changes on the value of franking credits. Some notable results include that:

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[96] N. Hathaway and R. Officer (2004), The Value of Imputation Tax Credits: Update 2004, Unpublished Working Paper, Capital Research Pty Ltd.

[97] D. Beggs and C. Skeels (2005), "Market Arbitrage of Cash Dividends and Franking Credits" Working Paper #947, University of Melbourne, Department of Economics.

- from 1987 to 1997, and for 2000, the value of franking credits was not shown to be significantly different from zero;
- since the last tax change (being the rebate on unused franking credits), the value of unused credits was seen to significantly increase. From 2001-2004, the value of the drop-off was 0.57. This translates to a value for gamma of 0.41; and
- the majority of the sample failed to reject the hypothesis that cash dividends are fully valued.

Whilst these results were found to be statistically significant, they should be interpreted with caution as the independent variables are again perfectly collinear, except for changes in the franking proportion and the corporate tax rate.

Bellamy and Gray (2004)

The study by Bellamy and Gray uses a similar methodology to that of Hathaway and Officer, but makes a variety of econometric extensions with an aim of improving robustness.[98] Whilst the rationale of Hathaway and Officer was preserved insofar as the stock price change was decomposed into cash dividend, franking credit and in some instances market return, eight models in total were estimated. These eight models differed in terms of whether:

- the ex-date price was kept raw or adjusted for expected returns;
- the dependent variable was defined as the drop-off ratio or the stock return; and
- the estimation was performed by ordinary least squares or weighted least squares. Under the latter, observations were weighted by their "informativeness", specifically, a higher weighting was given to higher-yielding, low-volatility stocks.

Bellamy and Gray conclude that the market places no value on franking credits and fully values cash dividends. They believe that the most robust approach to use was to adjust the ex-date price for expected returns, and give a higher weighting to more "informative" stocks (ie, higher yield, low volatility).

Further, while some recommendations are made about research design, it is not possible to separately and reliably estimate the value of dividends and franking credits. That is, irrespective of the adjustments made in an attempt to address

[98] D. Bellamy and S. Gray (2004), Using Stock Price Changes to Estimate the Value of Dividend Franking Credits, Working Paper, University of Queensland.

multicollinearity, it will always be a problem. The correlation between the two in this sample was 0.85.

Whilst this study specifically pertained to the estimation of the value of franking credits and not gamma, it is important to note that if franking credits have no value to the marginal investor then gamma must be zero, irrespective of the distribution rate.

Cannavan, Finn and Gray (2004)

Cannavan, Finn and Gray seek to test whether the introduction of the 45-day rule has impacted the value of gamma.[99] Rather than use the dividend drop-off method, they sought to infer the value of cash dividends and franking credits from the relative prices of share futures and the underlying shares on which these contracts are written, based on a no-arbitrage framework.

The authors noted that the data behaved well in-line with the no-arbitrage relationship and as such the model is substantially reliable. This is a key benefit over estimation via the dividend drop-off technique. In terms of overall conclusions, it is again found that the market fully values cash dividends, consistent with the theory.

The most fundamental conclusion is that after the introduction of the 45-day rule, the market does not value franking credits. In a manner similar to that of Bellamy and Gray, a constraint is also imposed in which the franking credits are given zero value after 1 July 1997. The finding that this constraint cannot be rejected is further support of the hypothesis that gamma is no longer valued by the market.

This study did find that franking credits were potentially valued at up to 50% of their face value prior to the introduction of the 45-day rule (suggesting a value for gamma of up to 0.36). Since then, however:[100]

> …we find no evidence of any positive value at all in imputation credits after the introduction of the 45-day rule. The increased costs and risks involved in transferring imputation credits make it infeasible to engage in this strategy even for the highest-yielding stocks…This means that in a small open economy such as Australia, the company's cost of capital is not affected by the introduction of a dividend imputation system. The company must produce the same return for the marginal stockholder whether an imputation system exists or not if the marginal stockholder receives no value from imputation credits.

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[99] D. Cannavan, F. Finn and S. Gray (2004). "The Valuation of Dividend Imputation Tax Credits in Australia", Journal of Financial Economics, 73, 167-197.

[100] ibid., p.192.

Feuerherdt, Gray and Hall (2007)

This paper tests the value of imputation credits based on the prices of hybrid securities.[101] A key reason for examining these securities is:

- the signal-to-noise ratio is considered higher than for ordinary shares, reducing the multicollinearity problem associated with the dividend drop-off methodology (which they have therefore applied here); and
- hybrid issues tend to be marketed exclusively to domestic investors. Hence, in order to address regulators' concerns regarding the relevance of foreign investors in setting the value of imputation credits, they have chosen an environment where trading is likely to be almost exclusively domestic-based.

The study uses three samples (ordinary shares, reset preference shares and convertible preference shares) over three different time periods, recognising the tax law changes relating to the introduction of the 45-day rule in 1997 and imputation credit rebateability in 2000.

The results found no evidence of mean drop-off ratios of greater than one. If cash dividends are fully valued, the franking credit has no value. This finding held across all three samples. The key conclusions from this study were cited above, being that the marginal investor is a foreign investor who does not value franking credits.

Summary of results

The results of these studies are summarised in the following table:

Table 10 Summary of Key Studies

Study	Methodology	Time Period for Estimation	Value of franking credits (V)	Value of gamma (γ)[a]
Studies pre-45 day rule				
Bruckner, Dews and White (1994)	Dividend drop-off	1987-1990	0.34	0.24
		1990-1993	0.69	0.49
Partington & Walker (1999)	Contemporaneous pricing of shares with and without franking credits	1995-1997	0.96 (average)	0.68
Recent studies				
Hathaway and Officer (2004)	Dividend drop-off	1988-2002	0.5	0.36
Beggs & Skeels (2005)	Dividend drop-off	1987-2000,2000	0	0
		2001-2004	0.57	0.41

[101] C. Feuerherdt, S. Gray & J. Hall (2007), op.cit.

Study	Methodology	Time Period for Estimation	Value of franking credits (V)	Value of gamma (γ)[a]
Bellamy & Gray (2004)	Dividend drop-off (adjusted)	1995-2002	0	0
Cannavan, Finn & Gray (2004)	Analysis of futures and physical market (no arbitrage framework)	Pre- 45 day rule	Up to 0.5 (high-yielding stocks)	0.36
		Post- 45 day rule	0	0
Feuerherdt, Gray and Hall (2007)	Dividend drop-off, hybrid securities	Pre-1997 (45 day rule) Post-1997 to 2000 Post 2000	0	0

a Assumes a distribution rate of 71%.

A number of studies have concluded that franking credits have some value, although the estimates vary considerably. More importantly:

- these studies include data from the period prior to the introduction of the 45 day-rule. This will produce an upward bias in the estimated value of gamma, given that franking credits would appear to have had some value prior to this change, and a zero value following the change; and
- a number of methodological issues have been identified. One of the most significant ones that is consistently encountered is the multicollinearity that will arise in dividend drop-off studies due to the strong relationship between the value of cash dividends and franking credits.

A number of studies have concluded that the value of franking credits is zero (or, we cannot reject the hypothesis that they have no value). One of the more notable recent works is the study by Cannavan, Finn and Gray, which, using an arguably more robust methodology than dividend drop-off studies, concluded that since the introduction of the 45-day rule, franking credits are of no value to the marginal investor.

We now summarise the results of a relatively simple diagnostic test we have undertaken as a further test of the hypothesis that the value of gamma is not different to zero.

4.8.4 Simple diagnostic

In order to circumvent the host of econometric and sampling issues involved with estimating gamma, a basic and simple behaviour test can prove fruitful. The test aims to determine whether or not the market responds, on average, differently to franked dividends from how it responds to unfranked dividends.

In particular, it tests whether or not the ratio of the ex-date price change to cash dividends is significantly greater for franked dividends than unfranked dividends. That is, if it is found that shares with franked dividends behave in a manner that is not significantly different from shares with unfranked dividends on the ex-dividend date, this would lead to the conclusion that franking credits are valued at zero (leading to a zero value of gamma).

If, on the other hand, shares with franked dividends do behave in a manner that is significantly different, it would be concluded that this difference is due to the market placing value on franking credits. If this were the case, gamma would not be zero and further empirical investigations would need to be undertaken to estimate its value.

The data used in this investigation was sourced from Bloomberg and contains observations on firms listed in the S&P ASX 200 from January 1996 to January 2006. Trusts and other entities which have a dissimilar tax structure to companies were excluded, resulting in 3188 observations in total. Whilst this sample only spanned the top 200 stocks, because ex-date behaviour is analysed it is important to exclude thinly-traded stocks from the dataset (otherwise large errors may be introduced due to lags).

There is still considerable thinness in trading in this sample: of the 3188 observations, 36% (1140) have a delay of more than one day in price observations about the ex-dividend date. However, only 96 observations have a delay of more than three days, which takes dividends paid on Mondays into consideration and these were excluded. Partially franked dividends were excluded from the examination as this avoids complications in selecting an appropriate level of franking as the cut-off point.

For the full period, there were 516 events with unfranked dividends and 2138 events with fully franked dividends. The sample standard deviations of the drop-offs ratios were such that a test for equality of variance would conclude that the standard deviations of the samples were unequal[102]. As a consequence, the common parametric test for equality of means is invalid so the simple, non-parametric paired test is used instead.

The sample of fully franked events is substantially larger that that of unfranked events, so a random sample of it is taken to produce the same number of observations, which was then paired with the full set of unfranked observations. If the theoretical hypothesis is true (that is, the market value of franking credits is zero), it should be the case that half of the fully franked drop-off ratios are greater than the unfranked drop-off ratios.

There was found to be insufficient evidence to reject this hypothesis[103] and as such it is concluded that the market responds equally to fully franked and unfranked dividends.

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[102] F-test for variance equality: $s_1 = 5.6736$, $s_2 = 1.9994$, p-value < 0.0001

[103] Paired sample test: sample proportion = 0.527, theoretical proportion = 0.50, p-value = 0.11

The same test is used for the sample of data from 1 July 1997 onwards as the parametric test is invalid[104] and the nonparametric test leads to the same conclusion[105]. This evidence that the market does, on average, respond equally to fully franked and unfranked dividends is further evidence that the market places no value upon franking credits.

This test can also be extended to see whether the drop-off for franked dividends behaves significantly differently from unfranked dividends if franking credits are valued at some proportion of their face value.[106] In this case, the proportional value will be 50% and 100%. In other words, rather than testing the hypothesis that the value of franking credits do not have a value other than zero, we are testing the hypothesis that these credits have some value, which in this case is either 0.5 or 1.

It has already been found that the market behaves the same way for franked and unfranked dividends on the ex-date, by only moving on average by the amount of the cash dividend. It is important to question, however, whether the data could perhaps disguise franking credits having a value of 50% and 100% of face value, yet still behaving as observed. If it is found that these new ratios (with franking credits assumed to be valued at 50% and 100% of face value) are significantly different across franked and unfranked dividends, this would be inconsistent with the actual market data. As such, this would imply that if franking credits had a significant nonzero value the data would not disguise this. Thus, this would provide further evidence that the market does not value franking credits.

The sample data was again restricted to observations after 1 July 1997 and to fully-franked and unfranked dividends. The same nonparametric test is used and it is found that the ratios are different across fully-franked and unfranked dividends with a half-valued franking credit[107] and with a fully-valued franking credit[108].

On this basis, we can reject the hypothesis that franking credits have a value of 0.5 or 1. In addition, we believe this is likely to be the finding irrespective of the value tested for the valuation of franking credits. This inconsistency with the result for the ratio of price decline to cash dividend only is further evidence that the market does not value franking credits.

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104 F-test for variance equality: $s_1 = 6.0972$, $s_2 = 2.0996$, p-value < 0.0001

105 Paired sample test: sample proportion = 0.528, theoretical proportion = 0.50, p-value = 0.12

106 That is, rather than consider the ratio of price decline to cash dividend, the ratio of price decline to cash dividend and some proportion of the face value of the franking credit is considered.

107 Paired sample test: sample proportion = 0.590, theoretical proportion = 0.50, p-value < 0.0001

108 Paired sample test: sample proportion = 0.595, theoretical proportion = 0.50, p-value < 0.0001

4.8.5 Conclusion

A number of studies have sought to estimate the value of gamma and the results vary considerably. The key concerns we have with some of these studies are that:

- studies using the dividend drop-off methodology need to be treated with extreme caution given the collinearity between dividends and franking credits. While Bellamy and Gray's methodology sought to adjust for this, they concluded that it is not possible to separately value the two;
- the introduction of the 45-day rule resulted in a major structural change that has fundamentally impacted the value of franking credits. Studies that seek to estimate gamma using data prior to this date will over-estimate the value of gamma.

Recent robust empirical investigations have concluded that the value of franking credits is zero since the introduction of the 45-day rule (Bellamy and Gray, 2004; Cannavan, Finn and Gray, 2004; Feuerherdt, Gray and Hall, 2007). This is based on the key assumption that the marginal investor is foreign. It is appropriate to make this assumption under the standard domestic CAPM framework, as this acknowledges the practical and significant influence foreign investors have in the Australian market.

Additionally, a basic but informative test of the market's behaviour with regards to the ex-date price response finds that for fully-franked and unfranked dividends, the market responded equally to the cash dividend only, which is further evidence of the worthlessness of franking credits. As an extension to this model, it was tested whether or not franking credits were valued by the market at 50% and at 100% of their face value, which was emphatically rejected. All in all, there is insufficient evidence to reject the theoretical hypothesis that franking credits are worthless. Fundamentally, the implication of these findings is that gamma should be set to zero. This also means that there is no basis for adopting an assumption of 0.5.

We note that in recent decisions (including its 2004 decision in relation to the Hunter Valley coal network) IPART has indicated that gamma must have a value greater than zero because the marginal investor is domestic. This in turn is based on an assumption that markets are fully segmented.[109]

As noted in section 3.2.2, not only is it considered reasonable to recognise the presence of foreign investors on Australian financial markets, but it is considered unrealistic to exclude them. The influence of foreign investors is already recognised in all market-determined parameters, including the risk-free rate, debt margin and the market risk

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[109] IPART (2008), ibid.

premium. It is therefore inconsistent to assume a full segmented market and hence ignore the presence of foreign investors when determining gamma.

On the basis of this evidence we believe that it is appropriate to assume a value of zero for gamma. This includes:

- evident difficulties in estimating a reliable value for gamma (which may be because it has no value);
- a strong theoretical foundation, being that since the introduction of the 45-day rule, franking credits are now of no value to the marginal foreign investor (whereas they may have had some value prior to this); and
- empirical evidence to support a value of zero, both from the recent literature and our own analysis which confirmed that we cannot conclude that gamma has a value other than zero.

A value of 0.5 was originally adopted in early regulatory decisions and has since become regulatory precedent. However, these decisions were made prior to the introduction of the 45 day rule, and were relying on studies that will not have assessed its potential effect on the value of gamma. We are of the view that there is sufficient evidence to now review the fundamental basis of this assumption.

5 Other financing costs (included in cashflows)

5.1 Equity raising costs

As noted in section 4.6, an allowance is generally included for the incremental costs of raising debt capital. To the extent that a firm will need to use both debt and equity to fund new investment, it is equally legitimate to include an allowance for the incremental costs of raising this additional equity. However, this allowance is best included in the cashflows, rather than the WACC.

'Pecking order' theory prescribes that when funding new investment, firms will first seek to source these funds internally. If external funding is required, the firm will tend to source new borrowings, before raising equity. Practically, the decision on how to fund new investment will depend on a number of considerations, including:

- the firm's debt capacity, based on its current capital structure (relative to the target) and its credit rating;
- the size and profile of the new investments; and
- the desirability of maintaining a constant dividend payout ratio (relative to the option of reducing the dividend payout ratio to increase retained earnings).

As previously identified, ARTC is facing a significant capital investment program over the next five years. It is likely that an 'efficient benchmark firm' facing expenditures of this scale would need to raise new equity.

It is submitted that the most appropriate approach to the assessment of the financing costs associated with new investment is to assume that a rights issue occurs to fund the equity portion of this investment (that is, that portion of the investment that cannot be funded by internally generated funds or debt).

In the GasNet decision (November 2002), the ACCC analysed five recent Australian equity raisings for infrastructure businesses. They found that the equity raising cost percentage varied with the size of the proceeds being raised but the average cost was 3.548%. Based on this finding, the ACCC allowed equity raising costs of 3.55% in the GasNet decision. Since then, Australian regulators, including the QCA, have accepted the ACCC's benchmark of 3.55% as appropriate where equity raising costs have been included.

ACG's 2004 report to the ACCC[110] reported equity raising costs of 5.25% for 22 Australian IPOs during the period 2001 to 2004. Synergies extended this study to extend the period to 2001 to 2007. Of 63 firms examined, the average equity raising cost for new capital for existing businesses was 6.26%. Equity raising costs consist of both fixed and variable costs so that the larger the equity raising the lower the average cost. For raisings of greater than $100 million, the average cost was 5.01%. These results are summarised in Table 9.

Table 9 Equity raising costs

Sample	Average Cost	Standard deviation
All firms	6.26%	2.58%
Firms raising more than $100 million	5.01%	1.8%

Note: In total there were 63 firms with 36 raising more than $100 million

It is important to note that these estimates capture the direct costs of raising equity only. It is also recognised that there are indirect costs of raising equity, which is mainly via underpricing.[111] New equity issues are often underpriced (or priced at a discount) to maximise the take-up of the issue by investors. If a discount was not applied and the firm still wanted to guarantee the success of the issue, the underwriting fee (included as part of the direct costs) would be higher.

Underwriting and underpricing are both used to guarantee the success of an issue but it is only the underwriting costs that are captured in the above estimates. We are of the view that underpricing is part of the costs of ensuring the success of an issue and hence is a legitimate cost of raising new equity. Given the above estimates are based on direct costs only, they should be regarded as representing the lower bound of estimates of equity raising costs.

5.2 Interest During Construction

The long lead time required to construct infrastructure assets requires capital to be invested well before a return is earned on the invested capital. Interest during construction (IDC costs) reflects the cost of the invested funds (both debt and equity) for the period from the commencement of construction until the assets are commissioned and generate a revenue stream.

110 The Allen Consulting Group (2004), op.cit.

111 For example, refer: I.Lee, S. Lochhead, J. Ritter & Q. Zhao (1996), "The Costs of Raising Capital", in The Journal of Financial Research, Vol. XIX, No. 1, pp. 59–74.

If the IDC costs were not allowed to be capitalised, that is, not included in the asset base to which the WACC is applied, this would result in an investment with a zero net present value (NPV) becoming a negative NPV investment. A negative NPV investment would not be undertaken. However, capitalising the IDC costs so that it is included in the asset base creates an NPV neutral situation.

IDC costs must be capitalised at the WACC, as the WACC reflects both;

- the proportion of debt and equity used to fund the investment, and
- the cost of the debt and equity components.

IDC costs are not incurred uniformly during the period of construction. In project management the 'S curve' reflects estimated construction costs incurred as scheduled over the construction life of the project. The IDC costs should be capitalised to reflect the timing of construction costs as reflected in the 'S curve'. For example, early in the construction phase, a small amount of costs are likely to be capitalised, with more IDC costs capitalised as construction progresses.

Where large amounts of capital expenditure have been required (for example, for the expansion of an infrastructure asset), Australian regulators, including the QCA[112], have allowed capitalisation of IDC costs. Given the expansion capital about to be committed by ARTC, compensation for these costs is considered appropriate here. The rate at which IDC costs are capitalised should be the WACC and the capitalisation process should reflect the expenditure profile as reflected by the S curve.

112 For example, refer: Queensland Competition Authority (2005), Final Decision: Dalrymple Bay Coal Terminal Draft Access Undertaking.

6 Conclusion: WACC Estimate

Based on the parameter estimates outlined in this report the estimated WACC for ARTC is provided in the following table.

Table 10 ARTC's WACC Estimate

Parameter	Lower bound	Upper bound
Risk-free rate[a]	4.95%	4.95%
Debt to total value	50%	55%
Equity to total value	50%	45%
Debt margin[b]	3.00%	3.00%
Debt raising costs	0.125%	0.125%
Market risk premium	6%	7%
Gamma	0	0
Tax rate	30%	30%
Asset beta	0.5	0.6
Debt beta	0	0
Equity beta[c]	0.99	1.32
Cost of equity	10.88%	14.17%
Cost of debt	8.08%	8.08%
Inflation	2.73%	2.73%
Post-tax nominal WACC	9.48%	10.82%
Pre-tax real WACC[d]	8.84%	10.53%

a Based on a 20 day average for the period ending 28 November 2008.

b Based on a 20 day average for 8 year BBB bonds plus the margin between and A-rated 8 and 10 year bond, for the period ending 28 November 2008. Before debt-raising costs.

c Based on the Monkhouse formula.

d Based on the market transformation approach.

Some of the key conclusions underpinning this estimate are that:

- we have recommended that the asset beta is selected from the upper bound of our proposed range, in recognition of the risky investment climate in which ARTC will commit approximately $1billion of capital over the next five years;
- there is no clear economic or empirical justification for a fall in the value of the market risk premium. Most long-term studies produce estimates well in excess of 6%, which shows that the assumption that has been consistently adopted by regulators is too low;
- gamma should be valued at zero, recognising that since the introduction of the 45-day rule, franking credits are now worthless to the marginal foreign investor

(noting that under the vanilla WACC formulation, this will be reflected in the cashflows rather than the WACC); and

- it is important to have regard to the asymmetric consequences of regulatory error. Given the imprecise nature of beta estimation (and the estimation of WACC more generally), a cautious approach should be taken when determining parameter assumptions.

We have also recommended that:

- an allowance for equity raising costs is included in the cashflows, based on an estimate of at least 5%. This is considered a lower bound as it captures the direct costs of raising equity only; and
- interest during construction is capitalised into the asset base during the construction period, based on the WACC.

A Comparable Companies

Table A1 Comparable companies used to assess beta

Company & Description	Debt to Value (5 year average)	Asset Beta	T-statistic
Coal Companies			
Alliance Resource Partners, L.P. produces and markets coal to United States utilities and industrial users. The Company operates its facilities in Kentucky, Illinois, and Maryland.	66%	0.43	3.46
Arch Coal, Inc. mines, processes, and markets low-sulphur coal from surface, underground, and auger mines located in the western United States and in the central Appalachian region. The Company markets its coal primarily to electric utilities.	20%	1.32	2.75
Compliance Energy Corporation develops coal resources in Canada.	77%	0.73	3.06
CONSOL Energy Inc. produces high-BTU bituminous coal, and also coalbed methane gas. The Company markets coal primarily to the electric power generation industry, and secondarily to other consumers of coal in the United States. The majority of CONSOL's mines employ longwall mining systems, which are highly mechanized, capital intensive operations with a low variable cost structure.	10%	1.55	3.13
Foundation Coal Holdings, Inc. produces coal in the United States. The Company operates in the Powder River Basin, Northern Appalachia, Central Appalachia, and the Illinois Basin. Foundation Coal produces, processes, and sells steam coal to electricity producers and sells metallurgical coal to steel manufacturers.	25%	1.44	2.98
Guizhou Panjiang Refined Coal Co., Ltd. operates in the coal mining and processing industry. The Company's products include raw coal, refined coal, blended coal, and other related products.	0	0.93	4.37
Massey Energy Company produces, processes, and sells bituminous, low sulphur coal of steam and metallurgical grades through its processing and shipping centers. The Company currently operates coal mines in West Virginia, Kentucky, and Virginia. Massey provides its coal to utility, industrial, and metallurgical customers.	25.6%	1.72	3.22
Peabody Energy Corporation mines and markets predominantly low-sulphur coal, primarily for use by electric utilities. The Company also trades coal and emission allowances.	20%	1.75	4.12
PT Tambang Batubara Bukit Asam Tbk operates in the coal mining activities. The Company activities include general survey, exploration, exploitation, production, transportation, and marketing of coal.	0	1.22	4
Western Canadian Coal Corp. acquires, explores, and develops coal properties. The Company has multi-deposit property groups in British Columbia, Canada.	31%	2.25	2.6
Yanzhou Coal Mining Company Limited operates underground mining and coal preparation and operation businesses. Its products are sold in domestic and international markets. The Company also provides railway transportation services.	0	1.25	4.81
Rail Companies			
Burlington Northern Santa Fe Corporation, through its Burlington Northern and Santa Fe Railway Company subsidiary, operates a railroad system in the United States and Canada. The Company transports a wide range of products and commodities, including the transportation of containers and trailers, coal, grain, chemicals, metals, minerals, forest products, autos, and consumer goods.	25%	0.73	3.46
Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain	20%	0.68	3.52

Company & Description	Debt to Value (5 year average)	Asset Beta	T-statistic
products, coal, sulfur, and fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars.			
Canadian Pacific Railway Limited is a Class 1 transcontinental railway, providing freight and intermodal services over a network in Canada and the United States. The Company's mainline network serves major Canadian ports and cities from Montreal to Vancouver, and key centers in the United States Midwest and Northeast.	30%%	0.5	2.73
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.	36%	0.53	2.7
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.	16%	1.15	2.88
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.	416%	0.91	4.03
Norfolk Southern Corporation owns and controls Norfolk Southern Railway Company, a freight railroad, and Pocahontas Land Corporation, a natural resources company. The railroad system extends throughout the southeastern and Midwestern United States, and the Canadian province of Ontario. Pocahontas Land manages coal, natural gas, and timber resources in the United States.	31%	1.12	4.68
Union Pacific Corporation, through its subsidiaries, operates as a rail transportation provider. The Company's railroad hauls a variety of goods, including agricultural, automotive, and chemical products, across the United States and portions of Mexico.	24%	0.99	4.84

APPENDIX B

Mine Life Assessment
Hunter Valley Region

Booz & Co.

REPORT

Mine Life Assessment - Hunter Valley Coal Network

Australian Rail Track Corporation

Melbourne

November 2008

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Executive Summary

Background

In accordance with the NSW Rail Access Undertaking (NSWRAU), the Independent Pricing and Regulatory Tribunal (IPART) is conducting a review of the Rate of Return and the Remaining Mine Life to apply for a period of 5 years from 1 July 2009, to the Hunter Valley Coal Network as defined at Schedule 6 of the NSWRAU, as leased by ARTC[1].

In developing their submission, Australian Rail Track Corporation (ARTC) has sought advice on the estimated mine life for the coal mines in the Hunter Valley that use the rail network leased to ARTC. The task is to determine the expected "average mine life" of the existing Hunter Valley coal mines as well as mines that are not in operation currently but due to come into operation over the 5 years after 1 July 2009.

Mine life expectancy is an important input to the NSWRAU in terms of expected return, where depreciation is to be calculated based on the unexpired portion of the remaining life.

Approach

There have been two previous reports into the average mine life in the Hunter Valley, in 2001 and 2004[2] which used an approach based on advice received from the DMR that indicated that the best (and simplest) method for estimating remaining mine life for a given mine was by dividing current production by marketable reserves, then calculating a simple average of the total mine lives. The 2004 study determined that the average mine life was 27.5 years.

The methodology used in the two previous studies has been adjusted to improve the quality of the analysis.

- In past studies using a simple average of the individual mine lives did not take into account the relative size of each mine and reduces the impact of mines that have a high level of throughput over their life. In this report a "Weighted Average" approach to calculating average mine life has been adopted as this takes into account the relative size of each mine.
- The previous studies used a single estimate of current production to determine future mine life. This approach is now considered to be of limited value as:
    - Current mine production is reduced by coal chain capacity constraints.
    - Mine production figures vary over time, but particularly during startup and shutdown phases.

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[1] As defined at Schedule 6 of the NSWRAU.

[2] Booz and Company has estimated Hunter Valley mine life in the past, in its reports to IPART, "Valuation of Certain Assets of the Rail Access Corporation "(2001) ("the 2001 Study") and "Review of remaining mine life under NSW Rail Access Regime " ("the 2004 Study").

- o Coal chain capacity is increasing and mine operators are investing in new equipment to increase their production.

In this study the methodology used to determine average mine life is based on the combined effect of mine production and coal chain capacity that is variable over time and an up to date assessment of coal mine reserves.

Future production estimates for each mine was obtained from ARTC/HVCCLT sources and estimates of the marketable reserves of coal at each mine in 2008 were obtained from a number of public and industry sources. Expected capacity has only been applied over the period to 2012. It is assumed that industry will invest sufficiently beyond that time such that demand forecast will be met by the supply chain.

As a sensitivity check on the average mine life in the Hunter Valley a number of "Prospective mines"[3] whose possible start date is beyond 01 July 2014 were included in the analysis to see how the average mine life calculations would be affected.

Four options were constructed to assess how the average mine life on the ARTC rail network would change under different conditions. The major variables used in each option were:

- changes to the constraints on "Coal Chain Capacity," between 2009 – 2012, and
- the inclusion of coal production from "Prospective mines".

	Key Variables used in each Option			
	Option A	Option B	Option C	Option D
Coal Chain Capacity Constrained	N	Y	N	Y
"Prospective Mines" included	N	N	Y	Y

The results of this analysis showed that Options A and B had the shortest overall average mine life and Option D the longest.

	Average Mine Life (Years)			
	Option A	Option B	Option C	Option D
Hunter Valley Coal Network	22.5	22.8	25.2	25.5

Options A and C were not supported as they do not consider the effect of constraints on coal chain capacity over the next few years. Options B and D do include the expected constraints on coal chain capacity however the effect of excluding or including "Prospective mines" can change the average mine life from 22 to 25 years across the Hunter Valley Coal Network.

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[3] There are a number of sites in the Hunter Valley where mining operations could be developed after 2014. These sites are under exploration currently, but there is no coal mine under development.

As the production estimates and start dates for each of the “Prospective mines” are considered extremely speculative, particularly in light of current uncertainty surrounding global growth and future coal demand, Option D was excluded.

Option B is therefore the recommended approach for assessing the mine life in the Hunter Valley for the period 2009 – 2014.

1. Introduction

The Australian Rail Track Corporation (ARTC) has requested Booz and Company to advise on the estimated mine life for the coal mines in the Hunter Valley that use the Hunter Valley Coal Network leased to ARTC.

1.1. Background

The Australian Rail Track Corporation (ARTC) is currently developing a submission for the IPART review of Remaining Mine Life to apply from the 1 July 2009, for a period of 5 years, to the Hunter Valley Coal Network, in accordance with the NSW Rail Access Undertaking.

Mine life expectancy is an important input to the Undertaking in terms of expected return, where depreciation is to be calculated based on the unexpired portion of the remaining life. ARTC therefore requires updated information on the estimated mine life for the coal mines in the Hunter Valley.

Mine life expectancy has been used as the basis for depreciation in the Hunter Valley for previous access arrangements.

1.2. Previous Studies

Booz and Company has estimated Hunter Valley mine life in the past, in its reports to IPART, " Valuation of Certain Assets of the Rail Access Corporation "(2001) ("the 2001 Study") and "Review of remaining mine life under NSW Rail Access Regime " ("the 2004 Study"). The 2004 study determined that the average mine life was 27.5 years

It should be noted that these reports were conducted under the corporate name of Booz Allen Hamilton Australia. Booz and Company was formed in May 2008 in conjunction with the separation of the Booz Allen Hamilton global management consulting business from the Booz Allen Hamilton U.S. Government consulting business.

1.3. Study Scope

The scope of this study is broadly in line with previous studies[4] into mine life in the Hunter Valley in that the objective is:

To determine the expected average mine life of the existing Hunter Valley coal mines as well as mines not in operation currently but due to come into operation over the next 5 years after 1 July 2009.

[4] The scope of the 2004 study was to relate to all mines which utilise the Hunter Valley rail sectors defined in Schedule 6 of the Regime for the carriage of coal for export and/or domestic purposes

1.4. Area of study

This study focuses on that part of the Hunter Valley Coal Network leased to ARTC, which is also used by mines adjacent to parts of the network owned by RIC. A separate mine life appropriate to the parts of the Hunter Valley Coal Network owned by RIC may be considered if required.

It has been the practice in previous assessments for a single mine life estimate to apply to the entire Hunter Valley Coal Network.

The area of study is shown in the diagram below.

Figure 1 – Hunter Valley Coal Network

1.5. Study timeline

The study assesses existing Hunter Valley coal mines as well as mines not in operation currently but due to come into operation after 01 Jul 2009 – 2014.

2. Factors Affecting Mine Life

The 2004 Study discussed the impact of the following issues on future mine life:

- Unit costs towards the end of mine life
- Latent capacity
- Environmental legislation
- Coal Prices

The relevance of these issues within the context of the current study is re-examined below.

2.1. Unit costs towards the end of mine life

The advice in both the 2004 and 2001 studies was it was considered unlikely that mine life would shorten dramatically after some point in time, as a result of higher costs to extract the "last tonne" of coal rather than smoothly winding down.

The 2001 Study found the relationship between the unit costs and the extraction of the "last tonne" of coal was ambiguous and neither the 2001 or 2004 studies made any allowance for its impact.

The effect of current higher coal prices provides an incentive for mine operators to continue to extract coal at a higher level of marginal cost than would have been acceptable under the lower coal prices in 2001 and 2004 therefore no allowance for its impacts have been made in the methodology set out in Section 3.

2.2. Latent capacity

In theory higher coal prices could also lead to increases in the "Marketable Reserves" of coal at each mine and increase the latent capacity at some mines.

This assumption is based on the premise that higher coal prices could allow mines to increase their marginal costs to increase the coal production through processing lower grade reserves which were not considered viable in under lower prices.

At this time no mine has restated it marketable coal reserves based on the premise that higher coal prices will make increase the level of marketable coal reserves and it is not intended that we undertake such a task in this study. The estimates in this report are based on the latest publicly available information from the mines.

2.3. Environmental legislation

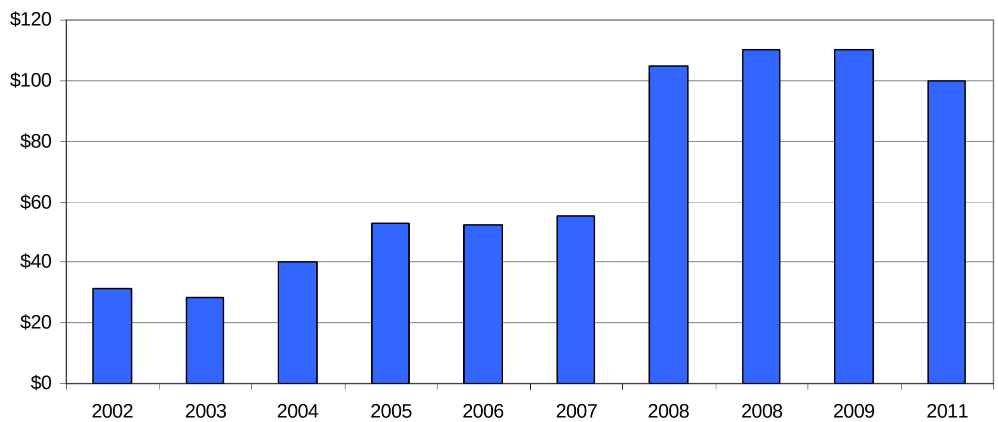
As noted in both the 2004 and the 2001 Studies, developments such as the Kyoto Protocol and/or other environmental initiatives may also impact on future mine life through affecting coal demand. The effect of such initiatives remains an issue of continuing uncertainty and no legislation currently proposed calls for any binding constraints on future coal production. As such, no allowance has been made for the imposition of environmental legislation on future coal production.

2.4. Coal Price

As noted in the 2004 study that work done for the 2001 Study indicated that actual future production is likely to be closely related to issues of price and demand.

The effect of significantly increased thermal coal prices due to higher demand for thermal coal as shown at Figure 2 has led to actions to improve both mine output and coal chain system performance.

Figure 2 – Past and Predicted Contract Price for Seaborne Thermal Coal ($US per tonne) [5]



It is noted that uncertainty surrounding demand for export coal has increased with the slow down in the global economy in recent months.

The Hunter Valley produces predominantly thermal coal which is used mainly for the generation of electricity in Japan, Taiwan and Korea and therefore the contract prices for thermal coal are not expected to decline significantly in 2009.

2.5. Coal Chain Capacity

The effect of higher demand for coal not being met by increases in supply has increased both the spot and contract prices of coal. This has in turn sparked continued investment in coal chain capacity with the identified upgrades to coal chain capacity of 185 Mt per annum in 2012[6].

Beyond 2012 there are no definitive estimates how future coal chain capacity will increase. In this analysis we have assumed that both the NSW Government and the coal industry will work to ensure that the Hunter Valley coal chain capacity will be capable of meeting demand. The expected Hunter Valley coal chain capacity is shown at Figure 3.

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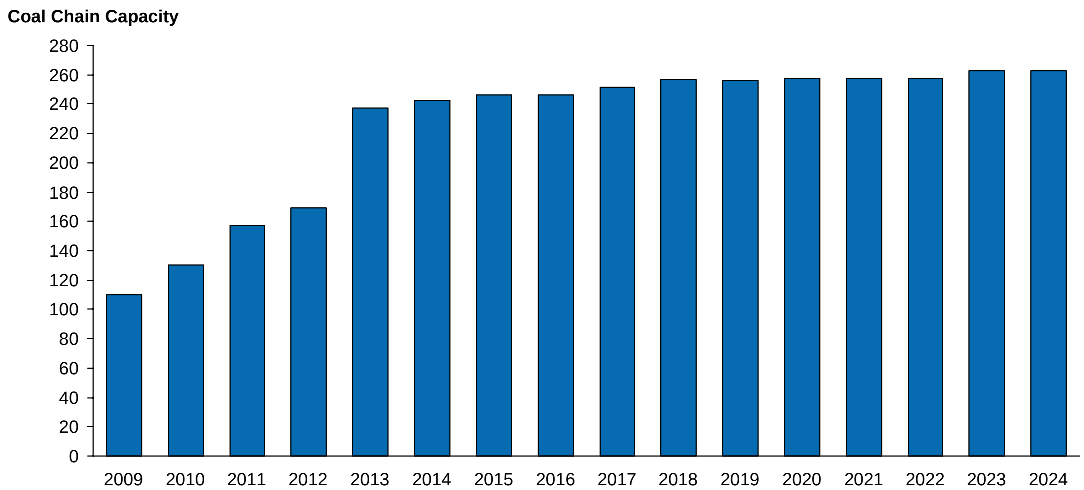
[5] Source Morgan Stanley Global Coal Update April 2008

[6] Source Coal Chain capacity data from Hunter Valley Coal Chain Logistics team reports.

Figure 3 – Coal Chain Capacity



3. Study Methodology

3.1. Approach in 2001/2004

In the 2001 and 2004 studies a relatively straight forward approach to the estimation of remaining mine life was used.

As indicated in the 2001 Study, advice received from the DMR indicated that the best (and simplest) method for estimating remaining mine life for a given mine is by dividing current production by marketable reserves. No superior methodology has since been suggested and this approach has been retained for the current study.

Estimates of future mine life were largely based on data from New South Wales 2004 Coal Industry Profile and, to a lesser extent, from discussions with the DMR and public information provided by individual mine operators, such as press releases and information from operator websites.

This approach was criticised in a submission[7] to IPART by the NSW Minerals Council which stated:

"To present a realistic picture, any evaluation of utilisation of the Hunter rail network by existing and "Prospective mines" must take into account:

- *a realistic date for commencement of production*
- *a realistic ramp-up to full production*
- *the capacity of the Hunter rail network and port to handle estimated production"*

We agree with NSW Minerals Councils comments and in this study we have developed a methodology that addresses these issues.

3.2. Limitations with previous Studies

In this study we have undertaken a review of the 2001 and 2004 studies and identified that a continuation of the methodology used in these studies was no longer appropriate. Our specific concerns are that:

- The use of a single production figure which is then held constant as a basis for estimating ongoing coal production not appropriate when each coal mine must to respond to changes in coal chain capacity and demand.
- The weighting of a mine production on a fixed basis is not appropriate when each coal mine must to respond to changes in coal chain capacity and demand.
- The modelling of a mine life based on a single full production figure is not viable given the current and future capacity constraints which lead to mine production levels that are below full production.

[7] NSW Mineral Council Submission to NSW Rail Access Regime – 20 Dec 2006

- In past studies the average mine life was calculated using a simple average of the individual mine lives in the study area. This approach does not take into account the relative size of each mine and reduces the impact of mines that have a high level of throughput over their life.

3.3. 2008 Methodology

In this study the "Weighted Average" approach to calculating mine life has been adopted as this takes into account the relative size of each mine.

The methodology used to determine average mine life is based on the combined effect of mine production and coal chain capacity that is variable over time and up to date assessment of mine reserves.

All data used in mine life calculations is at Annexes A to D.

- Individual mine production forecasts were provided to the study team, but these are considered to be commercial in confidence and have not been published in this document. All mine production data is sourced from mine operators and supplied by ARTC.
- The capacity of the Coal Chain System over time is known and matched to improvements endorsed by the coal industry and ARTC.
- Mine production in the constrained options is based on an even allocation of capacity constraints across all mines.
- Mine Reserve data is calculated at 2008 levels and is based on the latest – assessments of coal reserves. Estimates of mineral reserves are sourced from JORC based public estimates that are adjusted to ensure a common 2008 baseline. AME Mineral Economics data is used to determine where either the mine reserves are not public or the data provided is older than the AME data set. Mine Reserve data is at Annex B.

"Prospective Mines" will be included in the evaluation on a provisional basis as there are concerns about:

- The "Prospective mines" have a start date of 2015 and beyond which is outside the current study timeline of 2009-14.
- Production levels are not based on operator information but on ARTC/HVCCLT estimates.
- The estimation of Resource volumes and how they can be meaningfully converted to Mineral Reserves will affect the validity of "Prospective mines" to be included in the analysis.

4. Results

Four options were constructed to assess how the average mine life on the ARTC rail network would change under different conditions. The major variables used in each option were:

- Changes to the constraints on "Coal Chain Capacity," and
- the inclusion of coal production from "Prospective mines" .

The full results of each Option are shown at Annex C.

4.1. Option A Unconstrained production all mines in operation 2009 – 2014

Option A assumes that there are no capacity constraints on the Hunter Valley Coal Chain and that all expected mine production will move on rail to either Newcastle Port or to domestic power generators.

In this analysis none of the "Prospective mines" are included as their planned commencement dates are beyond 2014 timeline.

Table 1 – Option A Unconstrained production all mines in operation 2009 – 2014

Table Heading	Average Mine Life (Years)
Hunter Valley Coal Network	22.5

Option A has the lowest average mine life for the Hunter Valley Coal Network in for both regions as shown above. This is due to the exclusion of the large "Prospective mines" which are all in the upper Hunter Valley region and the ability for all mines to rail all their planned production.

4.2. Option B Constrained production all mines in operation 2009 – 2014

Option B assumes that there are capacity constraints on the Hunter Valley Coal Chain until 2013 and that a reduced percentage of the expected mine production between 2009 to 2012 from all regions will move on rail to Newcastle Port.

In this analysis none of the "Prospective mines" are included as their planned commencement dates are beyond 2014 timeline.

Table 2 – Option B Constrained production all mines in operation 2009 – 2014

Table Heading	Average Mine Life (Years)
Hunter Valley Coal Network	22.8

Option B has a slightly longer "Average Mine Life" across the Hunter Valley Coal Network at 22.4 years than Option A due to the reduction in total coal production as the coal chain capacity is constrained.

4.3. Option C Unconstrained production all mines including "Prospective mines"

Option C assumes that there are no capacity constraints on the Hunter Valley Coal Chain and that all expected mine production will move on rail to either Newcastle Port or to domestic power generators. In this analysis all expected production from the "Prospective mines" is included.

Table 3 – Option C Unconstrained production all mines

Table Heading	Average Mine Life (Years)
Hunter Valley Coal Network	25.2

The inclusion of production from "Prospective mines" increases the average mine life from 22.1 years to 24.8 years for two reasons.

- The first is that each mine's life is calculated from a 2009 baseline and including mines with a commencement date beyond 2009 acts to increase average mine life
- The second is that the predicted coal reserves at Maules Creek of 300Mt combined with production rates of only 5 Mt per annum leads to an effective mine life of 67 years which increases average mine life.

Under this scenario the Hunter Valley Coal Network average mine life becomes 25 years.

4.4. Option D Constrained production all mines including "Prospective mines"

Option D assumes that there are capacity constraints on the Hunter Valley Coal Chain and a reduced percentage of mine production will move on rail to Newcastle Port until 2013. In this analysis all expected production from the "Prospective mines" are included.

Table 4 – Option D Constrained production all mines

Table Heading	Average Mine Life (Years)
Hunter Valley Coal Network	25.5

Option D has the longest average mine life across the Hunter Valley Coal Network and for each region. This occurs for three reasons

- The first is that having constrained coal chain capacity from 2009 – 2012 reduces each mine's production and hence extends their individual operating lives.
- The second is that including the "Prospective mines" which have a commencement date beyond 2014 and these have high levels of reserves which act to increase the average mine life.
- The third is all coal mines will have a further reduction in their constrained rail capacity following the startup of the "Prospective mines" which have a combined predicted coal reserve of 500Mt which is added to the coal reserves to be handled by an already constrained coal chain.

5. Recommendations

The four options evaluated indicate that the average mine life on the ARTC rail network could range between 22 to 25 years depending on the capacity of the coal chain and the start date and coal reserves of "Prospective mines" .

5.1. Options A and C

Options A and C do not consider the effect of constraints on coal chain capacity and as such are not considered to be fully representative of the factors required in determining the average mine life in the Hunter Valley.

We do not recommend that these options be used to determine the average mine life in the Hunter Valley.

5.2. Options B and D

Options B and D do include the expected constraints on coal chain capacity however the effect of excluding or including three prospective coal mines can change the average mine life from between 22 to 25 years across the Hunter Valley Coal Network.

The variation in average mine life between Options B and D is significant and whilst it is recognised that Option B does not include any future mine developments there are a number of significant concerns about the start date and mine reserves that each of the "Prospective mines" has been assigned:

Each of the "Prospective mines" is currently under some form of exploratory process at this time.

- Maules Creek has measured and indicated resources of 680Mt of coal[8] but no coal reserves have been identified.[9]
- The BHP Billiton Caroona Development is a 250km^2 exploration site with only limited exploration undertaken thus far[10] and it is considered a future option by BHP to be possibly undertaken amongst a multitude of competing projects[11].
- The Watermark coal exploration area, is about 35km south-east of Gunnedah in the Gunnedah Coalfield and covers approximately 190km^2. The NSW government has completed tendering to undertake exploration but has not yet appointed a successful tenderer.

On this basis the production estimates and start dates for each of the "Prospective mines" are considered extremely speculative and we believe that Option D should be excluded.

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8 http://www.riotinto.com/annualreport2007/operationsfinancialreview/minerals_resources
9 http://www.riotinto.com/annualreport2007/operationsfinancialreview/ore_reserves/index.html
10 http://www.bhp.com/bb/ourBusinesses/energyCoal/caroonaCoalProject.jsp
11 Presentation by Marius Kloopers CEO BHP Billiton to the Melbourne Mining Club 5th June 2008

After the 5 year period, the commencement and production of “Prospective mines” may be more certain and more appropriate for inclusion at that time.

Option B is therefore our recommended approach for assessing the mine life in the Hunter Valley for the period 2009 – 2014.

It should be noted that Option B has an average mine life of 22.8 years for the Hunter Valley Coal Network which is 4.7 years less than the 2004 Study which recommended an average mine life of 27.5 years be adopted by IPART.

A reduction of 4.7 years in average mine life over a 5 year period between studies, given the past and planned increases in mine production levels and coal chain logistic system capacity is considered reasonable.

Annex A – Coal Mines examined in this study

As discussed in previous sections this report assesses the average mine life for the Hunter Valley Coal Network. The coal mines covered in this study are shown below.

Table 5 – Study Coal Mines

Ashton	Mount Arthur
Austar	Mount Pleasant
Belmont	Mount Thorley
Bengalla	Mt Owen
Bickham	Narrabri
Bloomfield	Newpac no 1
Boggabri	Newstan
Bulga	Ravensworth
Camberwell	Ravensworth Narama
Caroona – prospective mine	Rixs Creek
Cumnock no 1	Saddlers Creek
Dartbrook	Sunnyside
Donaldson	Tarrawonga
Drayton	Tasman
Duralie	Ulan
Glendell	United
Glennies Creek	Wambo
Hunter Valley Operations	Warkworth
Hunter Valley South	Watermark - prospective mine
Liddell	Rixs Creek
Mangoola	Werris Creek
Maules Creek – prospective mine	Whitehaven
Moolarben	Wilpingjong

Annex B – Mine Reserve Estimates

The marketable coal reserve data used in this analysis was obtained from one of four sources:

- AME Mineral Economics supplied the marketable coal reserves at a number of mines[12].
- New South Wales Coal Industry Profile 2006 supplied the marketable reserves at a number of coal mines[13].
- Public information on mine reserves from company websites.
- The study team made estimates based on potential resources being converted into marketable reserves for a number of "Prospective mines" .

Mine	Mine Reserve (Mt)	Data Source 1 AME Mineral Economics 2 NSW Coal 3. Company Data 4. Study Estimate
Ashton	46.2	1
Austar	42.2	2
Belmont	10.8	1
Bengalla	146.9	3
Bickham	49.7	2
Bloomfield	22	1
Boggabri	100	3
Bulga	79.4	1
Camberwell	9.6	1
Caroona	100	4
Cumnock no 1	1	1
Dartbrook	43.5	2
Donaldson	15.7	1
Drayton	50.6	2
Duralie	17	1
Glendell	23.5	2
Glennies Creek	37.9	2
Hunter Valley Operations	290	3
Hunter Valley South	300	3
Liddell	66.7	1

12 The date when the marketable coal reserves were assessed varied and a number of mines have had their reserves reduced from their original level to account for actual production between the assessment date and 2008

13 Ibid

Mine	Mine Reserve (Mt)	Data Source 1 AME Mineral Economics 2 NSW Coal 3. Company Data 4. Study Estimate
Mangoola	115.7	3
Maules Creek	300	4
Moolarben	233.8	1
Mount Arthur	228	3
Mount Pleasant	349.9	3
Mount Thorley	19.6	3
Mt Owen	209.9	1
Narrabri	300	3
Newpac no 1	56.0	2
Newstan	.4	4
Ravensworth East	7.1	2
Ravensworth Narama	13.7	2
Rixs Creek	35.3	1
Saddlers Creek	25	4
Sunnyside	5	3
Tarrawonga	26	3
Tasman	22.6	2
Ulan	179.7	1
United	8.2	1
Wambo	101.7	1
Warkworth	245.3	3
Watermark	100	4
Werris Creek	7.6	2
Whitehaven	1.8	3
Wilpingjong	248.7	2

Annex C – Hunter Valley Mine Life Estimates

Option A - Unconstrained production all mines in operation 2008 – 2014

Mine	End Year	Mine Life
Ashton	2019	11
Austar	2049	41
Belmont	2017	9
Bengalla	2026	18
Bickham	2040	32
Bloomfield	2044	36
Boggabri	2025	17
Bulga	2015	7
Camberwell	2011	3
Cumnock no 1	2009	1
Dartbrook	2017	9
Donaldson	2015	7
Drayton	2020	12
Duralie	2013	5
Glendell	2030	22

Mine	End Year	Mine Life
Glennies Creek	2020	12
Hunter Valley Operations	2044	36
Hunter Valley South	2035	27
Liddell	2022	14
Mangoola	2022	14
Moolarben	2028	20
Mount Arthur	2018	10
Mount Pleasant	2038	30
Mount Thorley	2012	4
Mt Owen	2046	38
Narrabri	2030	22
Newpac no 1	2069	61
Newstan	2009	1
Ravensworth East	2013	5

Mine	End Year	Mine Life
Ravensworth Narama	2010	2
Rixs Creek	2029	21
Saddlers Creek	2013	5
Sunnyside	2010	2
Tarrawonga	2025	17
Tasman	2016	8
Ulan	2022	14
United	2011	3
Wambo	2022	14
Warkworth	2032	24
Werris Creek	2012	4
Wilpingjong	2030	22

The Weighted Average Mine Life of all mines on the Hunter Valley Coal Network is 22.5years

Option B - Constrained production all mines in operation 2008 – 2014

Mine	End Year	Mine Life
Ashton	2019	11
Austar	2050	42
Belmont	2017	9
Bengalla	2026	18
Bickham	2040	32
Bloomfield	2044	36
Boggabri	2025	17
Bulga	2016	8
Camberwell	2012	4
Cumnock no 1	2009	1
Dartbrook	2017	9
Donaldson	2015	7
Drayton	2024	16
Duralie	2014	6
Glendell	2024	16

Mine	End Year	Mine Life
Glennies Creek	2020	12
Hunter Valley Operations	2044	36
Hunter Valley South	2035	27
Liddell	2022	14
Mangoola	2023	15
Moolarben	2028	20
Mount Arthur	2018	10
Mount Pleasant	2038	30
Mount Thorley	2012	4
Mt Owen	2047	39
Narrabri	2030	22
Newpac no 1	2070	62
Newstan	2009	1
Ravensworth East	2014	6

Mine	End Year	Mine Life
Ravensworth Narama	2010	2
Rixs Creek	2030	22
Saddlers Creek	2013	5
Sunnyside	2010	2
Tarrawonga	2025	17
Tasman	2016	8
Ulan	2022	14
United	2010	2
Wambo	2022	14
Warkworth	2032	24
Werris Creek	2013	5
Wilpingjong	2030	22

The Weighted Average Mine Life of all mines on the Hunter Valley Coal Network is 22.8 years

Option C - Unconstrained production all mines in operation 2008 – 2014 and Prospective Mines

Mine	End Year	Mine Life
Ashton	2019	11
Austar	2049	41
Belmont	2017	9
Bengalla	2026	18
Bickham	2040	32
Bloomfield	2044	36
Boggabri	2025	17
Bulga	2015	7
Camberwell	2011	3
Caroona	2021	13
Cumnock no 1	2009	1
Dartbrook	2017	9
Donaldson	2015	7
Drayton	2020	12
Duralie	2013	5
Glendell	2030	22

Mine	End Year	Mine Life
Glennies Creek	2020	12
Hunter Valley Operations	2044	36
Hunter Valley South	2035	27
Liddell	2022	14
Mangoola	2022	14
Maules Creek	2075	67
Moolarben	2028	20
Mount Arthur	2018	10
Mount Pleasant	2038	30
Mount Thorley	2012	4
Mt Owen	2046	38
Narrabri	2030	22
Newpac no 1	2069	61
Newstan	2009	1

Mine	End Year	Mine Life
Ravensworth East	2013	5
Ravensworth Narama	2010	2
Rixs Creek	2029	21
Saddlers Creek	2013	5
Sunnyside	2010	2
Tarrawonga	2025	17
Tasman	2016	8
Ulan	2022	14
United	2010	2
Wambo	2022	14
Warkworth	2032	24
Watermark *	2023	15
Werris Creek	2012	4
Wilpingjong	2030	22

The Weighted Average Mine Life of all mines on the Hunter Valley Coal Network is 25.2 years

Option D - Constrained production all mines in operation 2008 – 2014 and Prospective Mines

Mine	End Year	Mine Life
Ashton	2019	11
Austar	2050	42
Belmont	2017	9
Bengalla	2026	18
Bickham	2040	32
Bloomfield	2044	36
Boggabri	2025	17
Bulga	2016	8
Camberwell	2012	4
Caroona	2021	13
Cumnock no 1	2009	1
Dartbrook	2017	9
Donaldson	2015	7
Drayton	2020	12
Duralie	2014	6
Glendell	2030	22

Mine	End Year	Mine Life
Glennies Creek	2020	12
Hunter Valley Operations	2044	36
Hunter Valley South	2035	27
Liddell	2022	14
Mangoola	2023	15
Maules Creek	2075	67
Moolarben	2028	20
Mount Arthur	2018	10
Mount Pleasant	2038	30
Mount Thorley	2012	4
Mt Owen	2047	39
Narrabri	2030	22
Newpac no 1	2070	62
Newstan	2009	1

Mine	End Year	Mine Life
Ravensworth East	2014	6
Ravensworth Narama	2010	2
Rixs Creek	2030	22
Saddlers Creek	2013	5
Sunnyside	2010	2
Tarrawonga	2025	17
Tasman	2016	8
Ulan	2022	14
United	2010	2
Wambo	2022	14
Warkworth	2032	24
Watermark *	2023	15
Werris Creek	2013	5
Wilpingjong	2030	22

The Weighted Average Mine Life of all mines on the Hunter Valley Coal Network is 25.5 years