ARTC's Interstate Network

Weighted Average Cost of Capital Review

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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 interstate network.

ARTC is now responsible for most of the national rail network between Brisbane and Perth. In 2005/06, the interstate network accounted for 66% of ARTC's total revenues. Approximately 60% of the revenues on the interstate network come from intermodal traffic. Other traffics include: steel (17%), grain (10%), passenger (10%) and minerals (3%). The balance of ARTC's revenues comes from the Hunter Valley Coal network, which does not form part of this analysis.

Parameter Estimates

The WACC has been estimated using a post-tax nominal framework (or 'vanilla' WACC), with the cost of equity determined in accordance with the domestic Capital Asset Pricing Model, which remains the most commonly used asset pricing model despite a number of shortcomings.

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, which have undertaken:

- a review of comparable companies from the transport sector, as well as relevant regulatory decisions; and
- a first principles analysis, which reveals that ARTC is exposed to relatively high systematic risk given the strong relationship between the underlying demand for its services and domestic economic activity. ARTC has some take-or-pay coverage but this is not on all of its contracts. Further, this coverage only applies for the term of the contracts, which are relatively short. ARTC also has no market power on a number of the key transport corridors where the competition with road for intermodal traffic is most intense. It is also likely to have higher operating leverage than the comparable companies that were used in our sample.

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 societal perspective than if prices are set too high. This highlights the need to adopt a conservative 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. We have concluded that an asset beta of 0.65 is appropriate for ARTC.

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 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 have therefore adopted an assumption of 6.5%.

We are also of the view that the value of gamma of zero, recognising that since the introduction of the 45-day rule, franking credits are now worthless to the marginal foreign investor. This is evident from recent reputable studies, as well as our own analysis which rejects the hypothesis that gamma has a value other than approximately zero (and also demonstrates that franking credits do not have a value, such as 0.5 or 1).

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 have assumed a debt to value ratio of 50%. This conclusion was reached after reviewing other regulatory decisions, as well as capital structures maintained by firms in similar industries. Given the intense competition ARTC faces on parts of its interstate network, which is currently constraining its prices and hence long-term viability, we are of the view that an assumption of no more than 50% debt to value should be applied.

The parameter estimates for WACC are summarised in the following table:

Parameter	Estimate
Nominal risk-free rate[a]	5.99%
Debt proportion	50%
Equity proportion	50%
Debt margin[b]	1.19%
Debt raising costs	0.125%
Market risk premium	6.5%
Gamma	0
Asset beta	0.65
Debt beta	0
Equity beta[c]	1.29
Tax rate	30%
Equity raising costs (in cashflows)	2.25% p.a.
Cost of debt	7.30%
Cost of equity	14.35%
NOMINAL POST-TAX WACC	**10.83%**

a Based on a 20 day average for the period ending 30 April 2007; rates converted to annual effective rates

b Based on a 20 day average for the period ending 30 April 2007; assuming a notional credit rating of BBB; rates converted to annual effective rates

c Based on the Monkhouse formula

The WACC that is submitted here is higher than the WACC determined in the ACCC's 2002 decision (ignoring the impact of variables that move with the economic cycle, such as the risk-free rate and the debt margin), although we are of the view that this decision was still within the lower end of a reasonable range. The key driver of the higher WACC submitted here is the higher asset beta that has been proposed.

Since the 2002 decision, ARTC's business has changed materially after assuming responsibility for the New South Wales interstate network (the impact of the Hunter Valley coal network has been excluded in this analysis). This includes three significant interstate corridors, being Brisbane to Melbourne, Brisbane to Sydney and Sydney to Melbourne, all of which are subject to intense competition from road.

The Melbourne to Sydney market is currently the largest, carrying some 11 million tonnes per annum. As at 2004-05, rail only had a 10% share of that market. Rail has a 19% share of the Sydney to Brisbane market and a 21% share of the Melbourne to Brisbane market.

The key consequences of this are firstly, low market share can increase ARTC's sensitivities to contractions in demand (which are largely driven by the economic cycle), as it will have to fight harder for market share with very limited ability to reduce prices further. Secondly, ARTC therefore has little if any market power on these

corridors (the possession of market power is generally seen to have a dampening effect on beta). Since 2002, this has also been impacted by increased concentration on the customer side, with Pacific National now ARTC's dominant customer, although QR has been seeking to increase its presence.

This intense competition from road transport, which also constrains the prices that ARTC can charge on these corridors, is expected to continue into the future. The Productivity Commission is currently reviewing land transport pricing, which may impact the competitive dynamics between road and rail. The implications of this for ARTC are currently extremely uncertain, as are the broader implications of COAG's national reform agenda.

Contents

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. 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. The only parts of the interstate network that are not under its control (excluding certain parts of the Sydney metropolitan network that will be progressively taken over) are:

- Brisbane to the Queensland border (Queensland Rail); and
- Kalgoorlie to Perth (WestNet Rail, which has been acquired by Babcock & Brown).

The interstate network carries mostly intermodal traffic (freight), as well as steel, minerals, grain and passengers. The balance of ARTC's revenues comes from the Hunter Valley Coal network, which does not form part of this analysis.

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; and
- section 5 concludes the report.

2 Overview of ARTC's Interstate Rail 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 Interstate network

In 2005/06, the interstate network accounted for 66% of ARTC's total revenues. Approximately 60% of the revenues on the interstate network come from intermodal traffic. Other traffics include steel (17%), grain (10%), passenger (10%) and minerals (3%).

The intermodal freight market is extremely competitive. The Melbourne to Sydney market is currently the largest, carrying some 11 million tonnes per annum. As at 2004-05, rail only had a 10% share of that market.[1] Rail has a 19% share of the Sydney to Brisbane market and a 21% share of the Melbourne to Brisbane market.

[1] ARTC (2005), Annual Report: 2004-05, p.17.

In 2004-05, intermodal growth on the East-West network was 13% higher than 2003-04. Overall volume growth on this network was approximately 8.9%, compared to 5.1% in 2003-04.[2] Rail's market share on this network is around 81%. This has increased from 65% in 1995/96 as a result of competition reforms that have lowered the cost of access, as well as increased above-rail competition. ARTC has also undertaken investments on this network to improve transit times and increase service reliability. Similar benefits are yet to be achieved on the north-south network, primarily due to differences in above-rail competition.

The Bureau of Transport and Regional Economics notes that the interstate non-bulk freight task is experiencing rapid growth, at around 4% per annum.[3] By 2020, road is expected to increase its market share to around 67%, which is consistent with trends in most industrial countries. This may vary with changes in economic growth, changes in relative freight rates or the introduction of new transport modes, such as 'new rail' (being roll-on roll-off carriage of trailers from articulated trucks).

> However, much depends on the results of attempts at rail rejuvenation over the next decade.[4]

Road is particularly competitive over shorter distances.

A key issue impacting rail's competitiveness is the relative pricing of road. The intense competition from road transport has served to constrain access pricing (beyond the constraints which naturally arise by virtue of the regulation of access prices) to the extent that ARTC is unable to price access to recover the full economic costs of providing the service.

Concerns have been expressed regarding road transport pricing on the basis that this pricing does not adequately reflect the cost of the road network infrastructure that is used by heavy vehicle transport. This situation may change pending the Productivity Commission's review of land transport infrastructure pricing, however the likely outcome, and impact, of this review is extremely difficult to predict at this stage.

The other issues impacting rail's relative competitiveness are:

- transit times;
- the Sydney metropolitan rail access curfew; and

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[2] ibid., p.3.

[3] Bureau of Transport and Regional Economics (2006), Freight Measurement and Modelling in Australia, Commonwealth of Australia, Canberra, p.112.

[4] ibid., p.56.

- rail's effective integration with the other elements of the transport and distribution chain.

ARTC is currently embarking on a significant investment program to improve the performance and hence the competitiveness of the rail network, with a view to increasing market share.

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.

For the purposes of this report a nominal post-tax WACC has been estimated using the following equation, which is most commonly referred to as the vanilla WACC:[5]

$$WACC = R_e \frac{E}{E+D} + R_d \frac{D}{E+D}$$

Under this formulation, adjustments for inflation, taxation and dividend imputation need to be made in the cash flows. In other words, the impact of each of these factors is represented in the cash flows rather than through adjustments to the cost of capital. For example, expected tax payable (and expected values of imputation credits) is captured in the modelling as a cash flow in each year of the analysis. In addition, the cash flows represent the nominal (rather than real) cash flows for each year of the analysis.

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.[6]

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[5] This formulation is often referred to as "WACC 3" – see Officer, R.(1994), "The Cost of Capital under an Imputation Tax System" in Accounting and Finance, vol. 34(1), pp 1- 18.

[6] 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.

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. (Unfortunately this risk is not necessarily adequately dealt with by regulators elsewhere in the regulatory framework.)

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

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
- 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.[7] They attribute this to a dominance of country factors in individual stock returns.

[7] 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).

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.[8] 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.

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

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: [9]

- 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

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

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

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.

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, which means erring on the upside, rather than the downside.

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;
- 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 averaged over a 20-day period ending on 30 April 2007 is 5.9%.

Published bond rates, including the Commonwealth Government bond rate, tend to be quoted as nominal rates, compounding semi-annually. These rates cannot be directly compared with rates that have a different compounding frequency (say, quarterly or annually). For the purposes of WACC (as well as estimation under the CAPM framework, which is a single period model), there is no reason why semi-annual compounding should be assumed, particularly given we are meant to be considering the universe of investments.

Hence, it is considered more appropriate to convert the rate to an annual effective rate.[10] We have done this for the risk-free rate, as well as the relevant bond rate used to estimate the debt margin. Applying this methodology, the above rate is converted to 5.99%.

The other key consideration for regulatory decision-making is the environment in which the rate is set, as the risk-free rate will fluctuate with the economic cycle. The interest rate environment leading up to a draft decision is likely to be different from the environment leading up to the final decision. The rate should therefore be reset prior to the final decision. It is also recommended that prior confidential notice is given of the averaging period prior to its commencement, in the event that ARTC wants to implement strategies to hedge the interest rate risk on its underlying borrowings.

4.2 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.

4.2.1 Analysis

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

[10] The formula for this conversion is: Annual effective rate = [1+(nominal rate/number of compounding periods)]^number of compounding periods – 1.

- 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 1 Recent regulatory decisions in the rail industry: debt to total value

Regulator (year)	Decision	Capital structure
QCA (2005)	Queensland Rail	55%
IPART (2005)	Hunter Valley coal network	50% - 60%
ACCC (2002)	ARTC	60%
ERA (1999)	WA – freight	50% - 60%

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 industries, as different industries will generally have inherently different risk profiles which can also mean that the debt capacity of firms between industries will also vary.

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:

- *Rail*. This mainly includes rail operators carrying a range of traffics, including freight, bulk minerals, grain and passengers.

- *Trucking*. Firms in this sample are generally engaged in the provision of freight services, including intermodal transport. Some of these firms also offer warehousing and logistics services, which is becoming increasingly common for freight transport providers in Australia, including rail.
- *Shipping*. This sample was limited to firms that provide freight transportation services, including the shipping of containers, freight, petroleum and other commodities. A number of these companies were extremely heavily geared and could therefore potentially be considered as outliers. We have therefore examined the data with and without these firms.

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. Only a relatively small number of firms have credit ratings. It is therefore also important to examine the range of capital structures in each industry. While we have averaged the data across the last five years, considerable variation can still be expected.

Table 2 Capital structures observed in relevant industries

Industry	Number of firms	Average capital structure	Low	High
Rail	12	27%	0%	47%
Trucking	28	44%	0%	83%
Shipping	Including outliers: 54 Excluding outliers: 34	Including outliers: 71% Excluding outliers: 57%	0%	Including outliers: 96% Excluding outliers: 64%

Data source: Bloomberg

There is considerable variation in the capital structure within and between these industries, with rail operators maintaining the lowest debt to total value ratio on average, and shipping the highest.

4.2.2 Conclusions: ARTC

Relevant rail regulatory decisions reveal a range for capital structure of between 50% and 60%, with the most recent decision by the QCA with respect to Queensland Rail's central Queensland coal network assuming 55%. It is difficult to draw conclusions from the comparator data given the significant variability (and the potential differences between jurisdictions that have not been analysed in detail here), however on average, capital structures range from 25% for rail operators, through to around 60% for shipping companies. The data also provides some indication of the likely maximum level of debt that could be sustained by a firm within the industry.

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. As noted previously, a key difference between ARTC's interstate network and other regulated industries is the intense competition from road for intermodal transport on two of the three key routes in the network. The intensity of this competition has constrained ARTC's pricing to the extent that it will be difficult to maintain long-term viability, particularly if rail lost further market share.

A capital structure range of between 50% and 60% is considered an appropriate starting point for ARTC, noting that rail operators have tended to maintain gearing levels well below this. However, the competitive environment facing ARTC is quite different when compared to other Australian rail access providers. Based on this, it is recommended that the estimate is selected from the lower end of this range, being 50%.

4.3 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.[11]

[11] 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.

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.

4.4 Equity beta

4.4.1 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.

4.4.2 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.[12] 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. We have used this approach as it is consistently adopted by the ACCC:

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

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 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:

[12] 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.

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

where:

β_d = debt beta

R_d = cost of debt

R_f = risk-free rate

R_m = return on the market

$R_m - R_f$ = market risk premium (MRP).

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:[13]

> …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.

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

4.4.3 Approaches to estimating beta

There are three basic approaches to estimating systematic risk:

- direct estimation;
- first principles; and

[13] M. Lally (2004), The Cost of Capital for Regulated Entities, Report Prepared for the Queensland Competition Authority, p.75.

- 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.[14] 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 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

[14] We recommend five yeas of monthly data.

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).[15] 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[16];
- 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.[17] 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 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;

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[15] The **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.

[16] 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).

[17] 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.

- 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 conservative 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. Bowman recommends commencing from the premise that the equity beta equals one and then:[18]

> From this point, empirical, first principles and other evidence can be evaluated to determine whether an alternative estimate can be defended in preference to the benchmark value.

He also recommends that ranges be estimated as one standard deviation around the point estimate.

[18] R. Bowman (2005), Queensland Rail – Determination of Regulated WACC, Response to Reports Prepared by the Allen Consulting Group, p.10.

4.4.4 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[19]:

- 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 will be revenues (this will be

[19] M. Lally (2005), op.cit.

discussed further as part of the analysis of operating leverage), and this will therefore be the focus here. However, of those costs that are variable, being operating and maintenance, there will be some relationship between these costs and general movements in the domestic economy. Overall, the impact of variable costs on ARTC's systematic risk profile is 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).

As noted in section 2.2, ARTC's interstate revenues are dominated by intermodal traffic (approximately 60%). The balance of this revenue is represented by: steel (17%), grain (10%), passenger (10%) and minerals (3%). Each of these traffic types will now be considered (with the exception of minerals traffic, which is currently relatively marginal and is therefore unlikely to have an impact on ARTC's risk profile).

Intermodal

As outlined in section 2.2, the market for intermodal traffic is very competitive, with road particularly dominant for shorter hauls (being anything less than around 800 kilometres). While ARTC is undertaking significant investment to improve the performance of rail relative to road, competition is likely to remain intense into the future.

Intermodal transport generally involves the carriage of containers, most of which are likely to contain manufactured goods or inputs for production processes (commodities such as rice are also carried via container). It is understood that intermodal traffic is dominated by goods destined for the domestic market. ARTC has estimated that approximately 91% of this traffic is domestic (by volume), with the balance ultimately destined for export markets. This is to be expected, given that producers of manufactured goods that are destined for export are more likely to locate near a major industrial centre and export port facility. There may be some movements intrastate, however this is likely to be only over short distances.

It is also noted that most of the domestic traffic is interstate, rather than intrastate. This is likely to reflect the difficulties that rail currently faces in competing with road over shorter distances.

The demand for goods in the domestic market will have a high correlation with domestic economic activity, irrespective of whether these goods are imported or produced domestically. When the economy is buoyant, incomes rise, as does the consumption of a range of goods and services, albeit to varying degrees (with the exception of less income-sensitive commodities, such as essential food items, however these are less likely to be transported by rail). As the economy contracts, consumption

patterns will tend to exhibit a similar trend. Hence, the demand for manufactured goods is likely to broadly follow movements in the domestic economic cycle.

The fact that rail is a relatively marginal player compared to road on some parts of the network, means that any reduction in the demand for transport services (which could be purely cyclical) is likely to see rail having to fight hard to retain market share. As noted above, the intensity of competition means that prices cannot necessarily be set at a level that fully recovers costs. Implementing any further reductions in prices to maintain market share (or increase it) is therefore not feasible.

A further issue that needs to be considered here is the number of buyers on the demand side. The more concentrated the market on the demand side (that is, fewer buyers) the greater that party's countervailing market power (to the extent that the supplier possessed market power). As Pacific National is now the dominant customer on the demand side (although QR has been seeking to increase its presence), this concentration has increased.

Steel

Steel is used in a variety of applications, including manufacturing and construction. Steel for domestic use is sourced from domestic producers but is also imported. Manufacturing activity will have a strong correlation with domestic economic activity. Construction activity will also have a strong correlation with the domestic economic cycle, whether that is in the residential, commercial or industrial sectors. For example, it is well known that residential building approvals is often relied upon as a leading indicator of economic activity in Australia.

As outlined above, we would expect that export-oriented producers are likely to locate reasonably close to port facilities.[20] Hence we would not expect that a significant proportion of steel hauled on the interstate network is likely to be destined for export markets – to the extent that this is the case it is more likely to be shorter intrastate movements.

Passenger

Passenger transport only accounts for approximately 10% of ARTC's interstate network revenues and hence while it will have some impact on ARTC's risk profile, it will not be a significant driver. Passenger travel undertaken on ARTC's interstate network will be for travel between regional centres, as well as long-distance leisure travel.

[20] The key steel-making facilities are located at Port Kembla, Whyalla, Melbourne, Sydney and Newcastle.

The market for passenger travel is very competitive. With increasing competition in the aviation industry it is increasingly difficult for rail to compete with domestic airlines for market share. There are also other substitutes for rail travel, such as cars and buses. The overall demand for passenger travel services will have some sensitivity to income and will therefore be correlated with domestic economic activity.

The long-distance train travel market is a niche market. It not only competes with other transport alternatives, but it is also part of the broader tourism industry, competing with coach tours, cruising, island or resort holidays, and travel to overseas destinations. Demand for this service will be particularly sensitive to income, particularly at the luxury end of the market.

Grain

Grain also only accounts for around 10% of ARTC's total interstate network revenues. Demand for grain transport services can be quite variable and is highly seasonal. Apart from luxury items, the demand for food is largely invariant to domestic economic activity and has a low income elasticity of demand. Grain traffics would therefore make a very limited contribution to ARTC's systematic risk.

Summary: implications for systematic risk

The underlying demand for ARTC's interstate network services has a significant systematic risk element. This is dominated by intermodal traffic, the majority of which is destined for domestic markets and likely to have a strong correlation with domestic economic activity. This is further augmented by the demand for services to transport steel, as well as passenger travel (particularly in terms of the leisure travel market), both of which are also related to the domestic economy. These drivers will lead to a higher value for beta.

Pricing structure

In general, ARTC bases its pricing on a two-part tariff that includes a fixed and variable cost component (where a relatively high proportion of its cost base is fixed). 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, given the competition from road transport, ARTC is currently unable to price its intermodal services to recover the full economic costs of the services. Hence, even if it could do so, it is unlikely to be able to increase its prices in response to an increase in variable costs induced by an economic shock.

This is also likely to be the case with respect to grain and passenger services. Prices for the former tend to be constrained due to capacity to pay (at least relative to other traffics). The market for passenger services will also have a high price elasticity of demand, so if ARTC sought to increase prices to these service providers they may be unable to pass them onto customers and remain competitive.

The implications of pricing structure on ARTC's systematic risk needs to be considered in conjunction with:

- the duration of contracts with customers, including the extent to which revenues are protected by take-or-pay provisions; and
- the form of regulation. For example, a 'pure' revenue cap ensures that the regulated entity earns no more, or no less, than the maximum allowable revenue. Any cost increases are passed through, pending approval by the regulator (which will be based on prudence and efficiency).

Duration of contracts with customers

An analysis of the terms of the contracts that ARTC currently has in place revealed that these terms are short. For example, on the East-West network the average contract term is two and a half years, with terms ranging between one year and just over three and a half years. The average remaining term of existing contracts on the East-West network and New South Wales is less than a year. Most of ARTC's contracts will therefore expire in the coming years. The terms on which these contracts will be renewed remain uncertain, although we understand that significantly longer contracts are unlikely.

As noted above, tariffs are generally based on a two-part structure. There is a take-or pay element to the extent that the fixed cost component (or 'flagfall') is paid irrespective of whether or not the path is used. However, this does not necessarily apply to all traffics. There is some flexibility for the user to cancel a number of services (generally five per annum) without paying the flagfall. Grain services, as well as some intra-state freight services, tend to operate on an ad hoc basis.

The current nature of ARTC's contracts has a number of implications:

(a) Take-or-pay protection provides some protection against volume risk, at least for the flagfall component of revenues (which, as we have outlined above, is systematic in nature). However, as they are not for 100% of its revenues (and does not apply to all contracts) ARTC has some residual exposure to volume risk.

(b) This protection is only in place for the term of the contracts, which are relatively short (and most of which will be reviewed in the next year). Upon expiration,

contracted volumes could be revised upwards or downwards by the customer. Particularly given the short-term nature of ARTC's contracts, this significantly reduces any revenue certainty.

(c) ARTC will also have to renegotiate contracts that were inherited when it assumed responsibility for the NSW network. This increases uncertainty, at least in the short-term.

Market power

Most regulated businesses tend to possess some market power, which tends to be a key rationale for the declaration of a service as well as the degree of prescription in the regulatory framework. The existence of market power tends to have a mitigating effect on systematic risk and therefore suggests a lower value for beta.

ARTC is in a unique position relative to many other regulated industries in that it faces competition from road transport on a substantial part of its interstate network (in this regard, it is noted that ARTC's access undertaking was originally submitted voluntarily). This competition is particularly intense on the Sydney to Melbourne and Brisbane to Melbourne corridors. The exception is for those transport services where ARTC has more market power (because there are fewer substitutes), such as steel, minerals and grain, however these traffics only account for around 30% of ARTC's revenues.

While the Productivity Commission's review may ultimately change the dynamics of road-rail competition in the long-term, this will depend on the final recommendations are made, as well as how or when they are implemented (recognising that one possible outcome is no change). There is therefore too much uncertainty at the current time to determine the nature and extent of the impact of this review.

Overall, therefore, the 'dampening' effect that market power has on systematic risk, and therefore beta, is substantially reduced here. On this basis, to the extent that the comparator firms used to determine a range for beta also have limited market power (if any), ARTC could be seen to be no different.

Nature of regulation

Regulatory frameworks are either based on:

- a revenue cap, which insulates the regulated entity against volume risk, providing relative revenue certainty for the term of the regulatory period;

- a price cap, where prices are set for the term of the regulatory period based on forecast volumes, hence exposing the regulated entity to differences between these forecast volumes and actual throughput. While there is downside risk if volumes fall, the regulated entity is generally also able to retain the benefit of any upside; or
- some form of 'hybrid', which sits somewhere in between (for example, a price cap with volume triggers, where prices are reset if actual volumes move beyond a certain threshold relative to the forecast).

It is generally accepted that a revenue cap has lower systematic risk compared to a price cap (on the basis that any volume risk that the regulated entity is exposed to under a price cap is systematic in nature).

ARTC's current regime is essentially based on the hybrid form, although with at least one difference. As noted above, ARTC is exposed to some systematic volume risk, with a degree of protection only afforded over the relatively short terms of its customer contracts (but only for the flagfall component of its revenues and then, not for all of the traffics).

The difference between this framework and a 'typical' hybrid is that in remaining exposed to some volume risk, there is no prospect for ARTC to benefit from any upside. As noted previously, ARTC is currently unable to price all of its intermodal services to recover costs. Hence, if volumes increased, the only 'benefit' that ARTC could derive is a reduction in the extent of this under-recovery.

Overall, ARTC's beta will therefore be higher than the beta that would apply if it was subject to a pure revenue cap.

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.[21]

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

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

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.

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[22].

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.

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

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 sample. The sample represents a portfolio of companies from the transport sector, including rail operators, trucking and shipping companies. In this case, the key assets will be transport infrastructure (ie rollingstock, ships and trucks), rather than a fixed rail network. If there was a significant contraction in demand for their services, these companies could 'withdraw' some of their capacity (or fleet) from the market and avoid incurring at least some of the fixed costs associated with this infrastructure (this is particularly likely to be the case in trucking). ARTC, on the other hand, cannot avoid the 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).

These transport 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

ARTC is exposed to relatively high systematic risk on its interstate network, particularly compared to other rail infrastructure providers. One of the key drivers is the existence of volume risk that is largely systematic in nature, driven by the strong relationship between the demand for intermodal services and the domestic economy. A relationship also exists between domestic economic activity and the demand for services to carry steel, as well as leisure-based passenger travel, although they are less significant in terms of their overall influence on ARTC's revenues.

In the short-term, ARTC has some protection from this via the take-or-pay provisions apply to the flagfall component of revenues in some of its contracts. However, once these contracts expire, ARTC is fully exposed to volume risk (either through contracts being renegotiated for lower volumes or not renewed at all). If the intensity of competition from road were to increase, ARTC could lose contracts and hence revenue. At this stage, it is not possible to assess the possible implications of the Productivity Commission's review of land transport infrastructure pricing on these competitive dynamics.

The presence of market power is often seen as having a dampening effect on the systematic risk of regulated entities relative to other businesses. However, given the intensity of competition from road transport, this effect is substantially lessened here,

to the extent that ARTC's market power is likely to be similar to the other transport firms used as comparators.

Finally, ARTC is likely to have higher operating leverage relative to the other transport companies who have been used as comparators.

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. This includes rail, trucking and shipping (two air freight transport companies were also included). 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. For example, while there are a number of listed Japanese firms in the rail industry we excluded all of these as they tend to be more diversified. Further, there were a number of Chinese shipping firms in the original dataset. As this industry is heavily regulated, we excluded the firms from the sample.

We also excluded firms in the marine industry that were very highly geared. While their equity betas are delevered to remove the effect of financial risk, it is possible that this could still distort the beta estimate. Some firms are also listed on more than one exchange, so a check was made to ensure that the firm was only included in the sample

once. A complete list of companies is provided in Appendix A. Beta estimates and t-statistics for each firm are also provided.

As noted above, one possible means of dealing with estimation error is to form portfolios, as this will yield a more statistically reliable estimate. The key trade-off with this is that increasing the number of firms could compromise their comparability. However, we have still endeavoured to ensure that the firms retained in the sample are only those of more direct relevance to ARTC's key business activities. We have therefore estimated a single beta for the entire sample of firms under consideration, which should also reflect the relatively diverse nature of ARTC's underlying demand base. Observations also need to be made for each sector. Finally, relevant regulatory decisions also need to be examined.

Results

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

Table 3 Beta estimates for comparator firms

Industry	Number of firms	Average asset beta	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	12	0.66	0.5 to 0.82	9
Trucking	27	0.70	0.32 to 1.08	18
Shipping	34	0.58	0.34 to 0.82	22

Data source: Bloomberg

Again, there is considerable variation across firms in each industry. However, the average asset betas of firms in the rail, trucking and shipping industries are not that disparate, ranging between 0.58 and 0.7.

A single 'portfolio' beta has also been estimated across all firms, which was calculated as a weighted average (by the number of firms in each sector). The resulting asset beta is 0.64. Interestingly, this also approximates the average asset beta of the market as a whole (which is estimated to be around 0.65).

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

Table 4 Rail regulatory decisions: asset beta

Regulator	Decision	Asset beta
QCA (2005)	Queensland Rail	0.5
IPART (2005)	Hunter Valley coal network	0.32 to 0.46
ACCC (2002)	ARTC	0.58
ERA (1999)	WA – freight	0.32 – 0.5

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. While this represented an increase from the draft decision, we have some concerns with the basis for this decision, including:

- an assessment that the demand for QR's services has little correlation with domestic economic activity when there is in fact a strong relationship between this activity and world GDP growth. This assessment would also suggest that all export-oriented businesses have low betas, which is not the case;
- reference to comparators of questionable relevance, such as the Port of Tauranga in New Zealand and electricity distribution; and
- no regard given to the statistical imprecision of beta estimates.

Summary

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

- an average asset beta for the chosen comparators ranging between 0.57 and 0.7 (excluding air freight);
- an asset beta for the entire portfolio of firms of 0.65, which approximates the beta of the market as a whole; and
- rail regulatory decisions ranging from 0.32 to 0.58, with the most recent determination in relation to QR being 0.5 (for the central Queensland coal network).

Based on these results, a possible range for asset beta is between 0.4 and 0.7.

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

Based on the data from the comparable companies analysis, a range for asset beta of between 0.4 (as indicated by some Australian regulatory decisions) and 0.7 (based on firms in similar industries) can be observed. We are of the view that ARTC's asset beta lies towards the upper end of this range, for a number of reasons.

First, the lower bound of this range is based on the outcomes of some Australian rail regulatory decisions, including two decisions that relate to rail access providers in export coal networks. Our review of some of the arguments underpinning these decisions would suggest that the systematic risk of these entities has been understated (for example, one of the bases for the QR decision was the erroneous view that export-oriented businesses have relatively low systematic risk because of a lack of correlation with domestic economic activity). While we have sought to acknowledge these regulatory decisions in the analysis, it is possible that the floor set by the decisions is too low.

Second, as highlighted above, ARTC is exposed to significant systematic risk with most of the volumes transported on the network sensitive to domestic economic activity (with the exception of grain, which only constitutes a relatively small proportion of revenue). This risk has increased with the assumption of responsibility for the New South Wales interstate network, where rail has a very low market share on the key intermodal corridors (compared to the East-West corridor).

While there is some protection via the take-or-pay provisions applying to the flagfall component of revenues for some contracts, this is only for the relatively short duration of ARTC's customer contracts. Further, there is a reality that growth will be highly correlated with economic activity irrespective of the take or pay arrangements (due to path demand being a function of underlying volume demand). The other key conclusions from the first principles analysis that suggest a higher value for asset beta are:

- no market power on those parts of the network where ARTC is most exposed to competition from road, which typically has a mitigating effect on systematic risk for regulated entities; and
- high operating leverage, which is likely to be higher than the transport companies referenced as comparators.

Third, the significant issues associated with the estimation of beta, and the asymmetric consequences of regulatory error, suggest a conservative approach should be taken. At minimum, this requires selecting a value from the upper bound of the range.

Finally, reference is made to the average asset beta of firms in the transport industry, which will have a similar risk profile to ARTC. While there is variability in beta estimates across the sample, the average estimates for each industry clustered within a reasonably tight band. The average for this entire portfolio was 0.65.

Based on this analysis, we propose an asset beta of 0.65 for ARTC's interstate network, given the similarities between ARTC's risk profile and the profile of other companies operating in the transport sector. Using the Monkhouse formula and assuming a capital structure of 50%, this represents an equity beta of 1.29.

4.5 Market risk premium

4.5.1 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.

4.5.2 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.[23]

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).[24] This has been referred to as the 'equity premium puzzle'. However, Mehra notes that this is a 'quantitative puzzle' not a theoretical one:[25]

> …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:

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

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

[25] ibid., p.60.

- Fama and French[26], 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[27], 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.

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:[28]

> 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.

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

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

[28] R. Mehra (2003), op.cit., p.67.

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[29], who surveyed academics finding a MRP for the US of 7.1% and 5.5% respectively;
- Graham & Harvey[30], who have surveyed financial officers in the US on a quarterly basis since 1996. Their most recent estimate sourced was 3.66%;
- Mercer Investment consulting[31], 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[32], 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;[33]
- 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

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29 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.

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

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

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

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

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.[34]

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 portfolio[35] (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

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

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

> circumstances. It is generally agreed, however, that the minimum period required to provide sensible estimates is 30 years.[36]

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%.[37] 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.

Gray and Officer, on the other hand, support the use of an arithmetic mean.[38] 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:[39]

> …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.

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[36] 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.

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

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

[39] ibid.

Estimates from Selected Australian Studies

Estimates from several Australia studies are listed in Table 5.

Table 5 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%.[40]

Three studies were published by Hancock[41], Hathaway[42] and Gray and Officer[43] 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

[40] 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.

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

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

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

Hathaway's recommended estimates are below 6% based on a number of 'ad hoc' adjustments made to the data.

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:[44]

> 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:[45]

> 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

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[44] ibid., p.3.

[45] ibid.

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 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 using the ASX200 Accumulation Index as a proxy for the return on the market, and the 10 year Commonwealth Government bond for the risk free rate. Data was collected from 1900 to 2006.

Our analysis shows that the MRP depends upon the period over which it is calculated. From Table 6, it can be seen that the MRP is quite volatile if calculated over a short period of time and much more stable is calculated over a longer time period.

Table 6 Value of MRP using Different Averaging Periods

Period of Averaging	Market Risk Premium
20	3.7%
30	6.5%
40	6.8%
50	7.2%
60	7.3%
70	7.2%
80	7.2%
90	7.6%
100	7.5%
106	7.6%

The longer-term results are consistent with other studies. The short-term results are inconsistent as the calculated answer depends heavily upon the number of observations and the start date for the period of calculation.

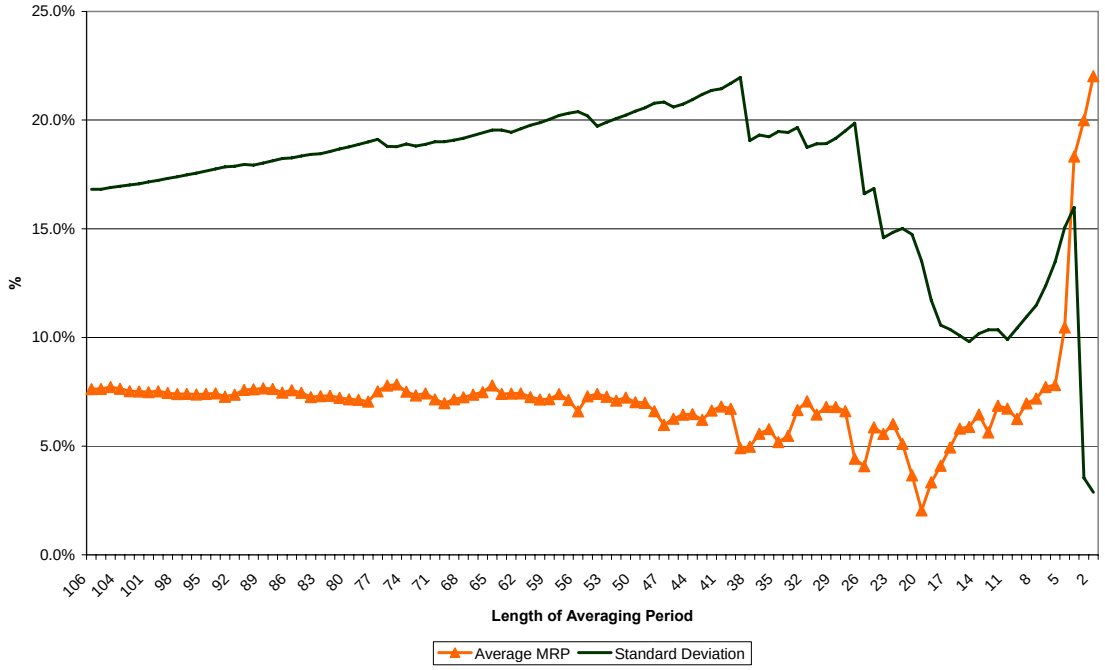
Period of analysis

As is evident from the preceding analysis, the estimate for the MRP depends on the period of averaging. It is generally accepted that this figure is between 6% and 8%. There exists no empirically supported argument for a change in this long run range.

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. [46] 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.

The volatility of short period calculations is most easily seen in the Figure 1. The MRP is calculated commencing in 2006 and going back to 1900. The lower line shows the MRP, and the higher line is its volatility (measured by standard deviation). The different averaging periods are represented on the x axis: the left-hand side represents the longest averaging period, being an average over the entire 106 years. The right-hand side represents the shortest averaging period, which is the last two years. This shows that volatility increases significantly for averaging periods less than forty years.

Figure 1Volatility of the MRP Estimate over Different Averaging Periods (from 106 yrs to 2 yrs)



We can therefore conclude that an analysis over a period of less than 40 years will not result in a meaningful MRP.

[46] 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.

Trends in the MRP

If the MRP is not trending downward, there is no statistically significant evidence to justify the market risk premium has moved below the historical 6% to 8 % range.

The earlier graph displaying the MRP shows that it appears to follow a random pattern with as many ups as downs. Table 7 below details the ten major up and down years.

Table 7 MRP over Last 106 Years: Ten Major Up and Down Years

Bottom 10		Top 10	
1982	-38.9%	1972	26.2%
1974	-32.3%	1936	26.3%
1952	-30.7%	1933	32.4%
1930	-28.5%	1943	32.5%
1988	-21.3%	1986	34.0%
1970	-16.6%	1987	34.4%
2003	-13.1%	1951	35.7%
1916	-13.0%	1960	35.8%
1931	-12.2%	1980	63.4%
1942	-11.9%	1968	75.7%

The worst year in the 106 year period was 1982 and the year with the highest MRP was 1968. Over the last twenty years there have been two years in each of the top and bottom ten: 1988 and 2003 for down years and 1986 and 1987 for the up years. Over the last fifty years there have been five years in the bottom ten and six years in the top ten. This is a fairly consistent result compared to the last twenty years. The up and down years appear to be reasonably and randomly spread.

A runs test[47] was conducted to determine randomness. The conclusion of the analysis was that with a Z factor of 1.37 the behaviour of the MRP was no different to the behaviour of numbers in a table of random numbers. There are no discernable trends or patterns that what one would not expect to find randomly. To the extent that the year-on-year value of the MRP therefore exhibits the characteristics of randomness, we cannot conclude that the MRP has trended downwards.

[47] A runs test is used to test data for randomness. It counts the frequency of runs of various lengths, where a 'run' could be a sequence of numbers with the same sign (eg a series of positive numbers). A certain number of runs is expected for the data to be seen to be random.

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 40 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 support that this has yet occurred. Further, there is nothing to indicate by how much it could fall – 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 7%. 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 6.5%, 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.

4.6 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.

4.6.1 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.

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, although only a relatively small number of firms are rated. For example, the data for the rated firms in our rail sample is summarised in the following table:

Table 8 Credit rating data from other rail firms

Firm	Credit rating	Debt to total value
Burlington Northern Sante Fe Corporation	BBB+	33%
Canadian National Railway Company	A-	24%
CSX Corporation	BBB	47%
Union Pacific Corporation	BBB	32%

Source: Bloomberg

For the reasons outlined above, caution should be exercised in drawing any firm parallels for ARTC. However, this would appear to indicate that an assumption of BBB is reasonable, noting that all firms have a capital structure below 50%.

The first principles analysis used to assess beta revealed that the risks facing the interstate network business are relatively high (noting that the first principles analysis focuses on systematic risk only, whereas a credit rating analysis will consider all risks), to the point that based on current pricing, certain parts of the network will not be economically viable in the long-term. In the absence of undertaking a more comprehensive risk assessment, there is currently no clear basis for assuming a rating higher than BBB.

Based on this assumption, we have taken the difference between the twenty day average of the ten year Commonwealth Government bond and the benchmark cost of ten year BBB-rated debt, for the period ending 30 April 2007 (sourcing data from Bloomberg). As noted previously, both rates were converted to annual effective rates. The resulting spread was 119 basis points.

4.6.2 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
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 has now been applied in a number of 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.

It is submitted that an allowance of at least 12.5 basis points is 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.

After including the debt margin of 119 basis points and an allowance of 12.5 basis points for debt-raising costs, the resulting cost of debt is 7.30%.

4.7 Tax and imputation (gamma)

4.7.1 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. However, strong evidence is accumulating to suggest that the value of gamma has fallen significantly, and in fact zero is now the best estimate.

4.7.2 An overview of dividend imputation

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

$$\text{gamma} = V \times D$$

where V is the value of franking credits[48] and D is the distribution rate.

[48] φ is used instead of V in a number of studies

Based on statistics supplied by the Australian Taxation Office, Hathaway and Officer estimate that approximately 71% of franking credits are distributed to shareholders.[49] However, only 32% of the distributed franking credits were redeemed.[50] 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.

4.7.3 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

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[49] N. Hathaway and R. Officer (2004), op.cit.

[50] Australian Taxation Office (2005), "Taxation Statistics 2002-03", Australian Government.

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.[51] 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.

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, 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[52] (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.

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

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 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.

4.7.4 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:

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

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.[53] 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.

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

Beggs and Skeels (2005)

Beggs and Skeels used a similar approach to Hathaway and Officer, although producing different results.[54] 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:

- 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.[55] 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.

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

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

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 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.[56] 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:[57]

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

[57] ibid., p.192.

> …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.

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
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

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.

4.7.5 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[58]. 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[59] and as such it is concluded that the market responds equally to fully franked and unfranked dividends. The same test is used for the sample of data from 1 July 1997 onwards as the parametric test is invalid[60] and the nonparametric test leads to the same conclusion[61]. 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.[62] 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

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

59 Paired sample test: sample proportion = 0.527, theoretical proportion = 0.50, p-value = 0.11

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

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

62 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.

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[63] and with a fully-valued franking credit[64].

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.

4.7.6 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). 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.

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[63] Paired sample test: sample proportion = 0.590, theoretical proportion = 0.50, p-value < 0.0001

[64] Paired sample test: sample proportion = 0.595, theoretical proportion = 0.50, p-value < 0.0001

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.

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.

4.8 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).

ARTC is facing a capital investment program of some $1.4 billion over the next five years (excluding AusLink funds). 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). The appropriate equity financing costs are considered in this light to be 2.25% of the funds assumed to be generated through rights issues.[65] These costs tend to be amortised over the life of the investment (and hence are most appropriately captured in the cashflows).

[65] This is the midpoint in the range of the underwriting costs for rights issues ascribed to Australia by the UK Monopolies and Mergers Commission (Monopolies and Mergers Commission (February 1999), Underwriting services for share offers: A report on the supply in the UK of underwriting services for share offers, p 63).

5 Conclusion: WACC Estimate

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

Table 11 WACC Estimate for ARTC's Interstate Network

Parameter	Estimate
Nominal risk-free rate[a]	5.99%
Debt proportion	50%
Equity proportion	50%
Debt margin[b]	1.19%
Debt raising costs	0.125%
Market risk premium	6.5%
Gamma	0
Asset beta	0.65
Debt beta	0
Equity beta[c]	1.29
Tax rate	30%
Equity raising costs (in cashflows)	2.25% p.a.
Cost of debt	7.30%
Cost of equity	14.35%
NOMINAL POST-TAX WACC	10.83%

a Based on a 20 day average for the period ending 30 April 2007; rates converted to annual effective rates

b Based on a 20 day average for the period ending 30 April 2007, assuming a notional credit rating of BBB; rates converted to annual effective rates

c Based on the Hamada formula, which assumes a debt beta of zero

Some of the key conclusions underpinning this estimate are that:

- ARTC is exposed to relatively high systematic risk on its interstate network;
- 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;
- a value for gamma of 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 conservative approach should be taken when determining parameter assumptions.

The WACC that is submitted here is higher than the WACC determined in the ACCC's 2002 decision (ignoring the impact of variables that move with the economic cycle, such as the risk-free rate and the debt margin), although we are of the view that this decision was still within the lower end of a reasonable range. The key driver of the higher WACC submitted here is the higher asset beta that has been proposed.

Since the 2002 decision, ARTC's business has changed materially after assuming responsibility for the New South Wales interstate network (the impact of the Hunter Valley coal network has been excluded in this analysis). This includes three significant interstate corridors, being Brisbane to Melbourne, Brisbane to Sydney and Sydney to Melbourne, all of which are subject to intense competition from road.

The Melbourne to Sydney market is currently the largest, carrying some 11 million tonnes per annum. As at 2004-05, rail only had a 10% share of that market. Rail has a 19% share of the Sydney to Brisbane market and a 21% share of the Melbourne to Brisbane market. These market shares are low.

The key consequences of this are firstly, low market share can increase ARTC's sensitivities to contractions in demand (which are largely driven by the economic cycle), as it will have to fight harder for market share with very limited ability to reduce prices further. Secondly, ARTC therefore has little if any market power on these corridors (the possession of market power is generally seen to have a dampening effect on beta). Since 2002, this has also been impacted by increased concentration on the customer side, with Pacific National now ARTC's dominant customer, although QR has been seeking to increase its presence.

This intense competition from road transport, which also constrains the prices that ARTC can charge on these corridors, is expected to continue into the future. The Productivity Commission is currently reviewing land transport pricing, which may impact the competitive dynamics between road and rail. The implications of this for ARTC are currently extremely uncertain, as are the broader implications of COAG's national reform agenda.

A Comparable Companies

Table A1 Comparable companies used to assess beta

Company & Description	Debt to Value	Beta	T-statistic
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.	33.3%	0.52	4.53
Container Corporation of India Limited supplies railway cargo services, via its fleet of container trains. The Company also provides bonded warehousing services.	3.1%	0.79	3.68
Clarke Inc. provides intermodal transportation and logistics services for less-than-full-load shippers who use rail as their predominant means of freight conveyance. The Company provides complete door-to-door services to shippers moving goods between various destinations within Canada, and transborder traffic to and from the United States via the railways.	30.9%	0.49	3.68
Canadian National Railway Company operates a network of track in Canada and the United States. The Company transports forest products, grain and grain products, coal, sulfur, and fertilizers, intermodal, and automotive products. Canadian National operates a fleet of locomotives and railcars.	24%	0.7	4.6
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.	36.6%	0.6	4.32
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.	47.1%	0.57	5.94
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. Genessee operates in the United States and Australia.	20.5%	1.02	4.41
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.	42.6%	0.63	4.95
Providence and Worcester Railroad Company is a regional freight railroad. The Company conducts its operations over the Northeast corridor between New Haven, Connecticut and the Massachusetts/Rhode Island border. Providence and Worcester transports a variety of commodities for its customers, including construction aggregates, iron and steel products, chemicals, and processed foods.	0	0.86	3.74
RailAmerica, Inc. owns and operates short line freight railroads in North America and regional freight railroads in Australia and Chile. The Company also owns, operates, or has an equity interest in a diversified portfolio of railroads located in the United States, Australia, Canada, Chile, and Argentina.	11.5%	0.59	3.35
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.	31.7%	0.51	4.63
Guangshen Railway Company Limited provides railroad passenger, freight transportation, railway facilities, and technical services. The Company also sells food, beverages and merchandise on aboard and in train stations.	0	0.69	3.63

Company & Description	Debt to Value	Beta	T-statistic
Trucking Companies			
KCTC provides inland transportation services, such as container and freight forwarding, bonded warehouses, and stevedoring services. The Company also provides and manages logistics services.	68.5%	0.37	2.58
T JOIN Transportation Co., Ltd. provides motor freight transportation services throughout Taiwan.	38%	0.95	8.44
Chinese Maritime Transport Ltd. operates container inland transportation. The Company also operates capesize bulkers for marine transportation through its 100% owned Singaporean subsidiaries, and it is the GSA (General Sales Agent) for Saudi Arabian Airlines.	37.4%	0.72	5.7
Taiho Transportation Co., Ltd. provides truck transportation services in the Chubu area. The Company transports mainly consumption-related cargo such as foods and liquors. Taiho operates warehousing business to integrate with comprehensive distribution systems.	42.5%	0.39	2.79
TRANCOM CO., LTD. provides freight transportation services in the Tokai region. The Company transports products for Sharp Corp., other consumer electronics makers, and cosmetic and food producers. Trancom also operates warehousing business and offers distribution information services.	11.8%	0.71	2.5
YAMATO HOLDINGS CO., LTD. mainly provides door-to-door parcel delivery services. The Company has developed a nationwide delivery system specializing in time-specified delivery. Yamato Holdings offers moving services and other comprehensive transportation services including logistics services for both domestic and overseas customers.	4.1%	0.97	5.61
MARUWN CORPORATION provides heavyweight cargo transportation services. The Company's clients include Japan Energy Corporation and Kobe Steel. Maruwn also operates international cargo transportation. The Company has product distribution centers in the Kanto, Chubu, and Kansai metropolitan areas.	61.9%	0.29	3.13
SENKO Co., Ltd. mainly provides van truckload, logistics, warehousing, freight rail and marine transportation, cargo handling, supply chain management, and moving services around the world. The Company transports construction materials, housing unit, commodity, textile products, and food stuffs. Senko's customers include Asahi Kasei, Sekisui Chemical, and Sekisui House.	54%	0.32	4.06
NIPPON KONPO UNYU SOKO CO., LTD. transports freight by rail, trucks, ships, and airplanes. The Company's freight includes automobile, automobile parts, and agricultural machinery. In addition to freight services, the Company provides warehousing and packaging services. The Company also offers customs clearing and casualty insurance services.	24.7%	0.39	3.19
FUKUYAMA TRANSPORTING CO., LTD. primarily provides van truckload services in western Japan and the Kanto areas. The Company's services include express transportation, ground small package delivery, international carrier and air cargo, and moving services. The Company is a member of Kinki Nippon Railway Group.	45%	0.46	4.37
Meitetsu Transport Co., Ltd. provides truck and courier transportation services. The Company also operates warehousing business. Meitetsu Transport is a member of Nagoya Railroad Group.	83.4%	0.17	3.45
S LINE GIFU CO., LTD. provides trucking transportation services mainly in the Tokai and Kansai areas. The Company develops on-line transport information system designed for efficient distribution services. S Line Gifu offers international door-to-door shipping services as well.	45.8%	0.34	2.58
THE KEIHIN CO., LTD. mainly provides warehousing and truck transportation services. The Company manages distribution centers and integrates them with distribution services including door-to-door parcel delivery. Keihin has overseas subsidiary and operates international intermodal transportation as well.	61.9%	0.29	2.64
Con-way Inc. is a freight transportation and logistics company. The Company has businesses in less-than-truckload and full truckload freight services, expedite, brokerage, airfreight forwarding, logistics, warehousing, supply chain management, and trailer manufacturing.	23.9%	0.57	2.74

Company & Description	Debt to Value	Beta	T-statistic
DSV A/S is the parent company for a group of companies that offer transport and logistics. The Group provides truck, ship, and plane transport services, as well as warehousing and logistic services. DSV operates in Europe, North America, and the Far East.	35.3%	0.74	5.7
Forward Air Corporation provides transportation services to air freight forwarders, air cargo carriers, and domestic and international airlines. The Company also operates a truckload business that is an irregular route, high service-level carrier that transports a wide range of commodities in both interstate and intrastate commerce.	0%	1.53	5.27
Heartland Express, Inc. is a short-to-medium haul truckload carrier. The Company transports a variety of goods, including appliances, automotive parts, paper products, retail goods, and packaged foodstuffs. Heartland operates in the United States.	0%	0.85	3.04
J.B. Hunt Transport Services, Inc. and its subsidiaries provide transportation and logistics services in the United States, Canada, and Mexico. The Company transports a variety of products including automotive parts, department store merchandise, paper and wood products, food and beverages, plastics, chemicals, and manufacturing materials and supplies.	15.1%	1.36	4.57
Knight Transportation, Inc. is a short-to-medium haul, dry van truckload carrier. The Company transports general commodities, including consumer goods, packaged foodstuffs, paper products, beverage containers, and imported and exported commodities. The Company operates throughout the United States.	1%	1.28	4.45
Landstar System, Inc. is a North American truckload carrier. The Company transports a variety of freight, including iron and steel, automotive products, paper, lumber, chemicals, foodstuffs, and military hardware. Landstar provides truckload carrier services, intermodal transportation services, and expedited air and truck services to shippers in the US, Canada, and Mexico.	9.6%	0.56	2.58
Mainfreight Limited provides and supplies freight, warehousing and logistics services throughout New Zealand and Australia. The Company provides freight forwarding services by road, rail, sea and air along with providing international freight forwarding services, customs clearance services and specialized handling of hazardous substances.	32.7%	0.56	2.93
Mubarrad (Saudi Land Transportation Company) transports freight by truck. The Company delivers goods ranging from parcels to shipments weighing up to 20 tons. Mubarrad operates throughout the Middle East.	1%	1.37	4.31
Swift Transportation Co., Inc. is a national truckload carrier. The Company operates primarily throughout the continental United States, combining regional operations with a transcontinental van operation. Swift principally transports retail and discount department store merchandise, manufactured goods, paper products, non-perishable food, beverages and containers, and building materials.	15.8%	1	3.47
Transport Corporation of India Limited provides integrated cargo transportation and logistics services. The Company provides handling of heavy-duty cargo through surface movement, door-to-door distribution for time committed cargo, and coastal shipping. The Company moves a variety of products, including raw materials, industrial products, pharmaceuticals, and agricultural products.	70.1%	0.3	3.33
USA Truck, Inc. is a medium haul, common, and contract carrier specializing in truckload quantities of general commodities. The Company operates in the continental United States, as well as in parts of Canada and Mexico. USA Truck transports a variety of products including automotive parts and materials, tires, paper, glass, chemicals, retail store merchandise, and aluminium.	43.8%	0.71	3.13
Werner Enterprises, Inc. is a transportation company that primarily hauls truckload shipments of general commodities in both interstate and intrastate commerce. The Company operates in the continental United States, as well as in Canada and Mexico.	1.8%	1.08	3.67
U.S. Xpress Enterprises, Inc. is a truckload carrier. The Company provides time-definite, expedited and dedicated truckload transportation services in long-haul and regional markets in the United States, Canada, and Mexico.	48.7%	0.66	2.7

Company & Description	Debt to Value	Beta	T-statistic
Shipping Companies			
Golar LNG Ltd is a shipping company. The Company owns and operates a fleet of LNG (liquid natural gas) tankers, and several of the vessels are under long term charter contracts. The Company has also entered in to an agreement to build additional LNG tankers. Golar transports around the world.	64.1%	0.35	5.89
Brostrom AB offers logistic services and focuses on petroleum products and chemical tanker shipping, as well as other marine services. Brostrom operates through its associated company Ivar Ships, and has more that 60 carriers at its disposal in the size range 4,000 - 80,000 deadweight tons. Brostrom operates primarily in the Atlantic and the Asian Pacific regions.	60.8%	0.25	2.48
Wilh. Wilhelmsen ASA is a shipping company. The Company is active with international maritime operations, international liner traffic, tankers and bulk carriers, car-carrying ships, logistics services, and ship management. The Company operates in Norway and internationally.	60.5%	0.28	4.38
First Steamship Company, Limited operates in the tramp shipping business. The Company mainly ships grains, coal, ore, fertilizers, and cement.	57.9%	0.57	4.32
PT Berlian Laju Tanker Tbk provides integrated sea transportation services, specializing in bulk liquid cargoes such as crude oil, fuel oil, liquefied chemicals, liquefied petroleum gas, vegetable oil, molasses, and liquefied asphalt. The Company also operates, charters, and manages ships as well as acts as an agency for shipping companies.	59.3	0.34	3.57
KYOEI TANKER CO., LTD., operates marine transportation mainly between Japan and Persian Gulf. The Company mainly deals with tanker operations. Kyoei Tanker belongs to Nippon Yusen Group and has close relations with Cosmo Oil.	57.6%	0.5	2.8
I.M. Skaugen ASA is a shipping company created from the merger of I.M. Skaugen ASA and Skaugen PetroTrans ASA. The Company operates a fleet of tankers transporting petrochemical gas and LPG. I.M. Skaugen also charters gas carriers and provides technical and maritime operating services.	57.4%	0.27	3.26
Thoresen Thai Agencies Public Company Limited owns and operates a fleet of marine transport vessels. Its vessels can be chartered on both voyage basis and time basis. The Company also provides shipping related services such as freight handling, shipping agent, and custom duty services.	56.6%	0.71	5.96
KAWASAKI KINKAI KISEN KAISHA, LTD. mainly operates coastal freight transportation between Japan, east Russia, China, and East Asia. The Company also provides domestic ferry services. Through subsidiaries, Kawasaki Kinkai Kisen operates deep sea freight transportation and leases ships and ship-related equipment as well.	57.9%	0.32	3.26
Sincere Navigation Corporation provides marine transportation services. The Company mainly ships bulk freights.	54.9%	0.33	3.65
Navigazione Montanari S.p.A. is involved in the transportation of goods by sea. Products carried include dry materials and petrochemicals.	54.4%	0.36	5.57
A/S Dampskibsselskabet Torm owns and operates tanker and bulk carriers. The Company's tanker division transports oil products such as gasoline, jet fuel, naphtha, and diesel oil, as well as other clean products, and the bulk carrier division focuses on Panamax vessels that can handle various commodities including grain, fertilizer, coal, and iron ore. Torm operates worldwide.	53.7%	0.56	4.44
The Great Eastern Shipping Company Limited owns and operates cargo ships. The Company's fleet of vessels includes bulk carriers, tankers and offshore supply vessels. The Company also acts as an agent for a number of foreign shipping companies.	53.3%	0.41	4.1
Concordia Maritime AB owns and operates oil tankers. The Company transports oil throughout the world for oil companies, OPEC countries, oil traders and other ship owners. Concordia's fleet consists of approximately eight wholly-owned tankers and four chartered vessels.	49.4%	0.41	4.21
Overseas Shipholding Group, Inc. maintains a fleet of marine transport vessels. The Company charters its ships to commercial shippers and United States and international governmental agencies. Overseas's ships are used to transport	46.6%	0.65	4.14

Company & Description	Debt to Value	Beta	T-statistic
crude oil, petroleum products, grain, coal, and iron ore.			
Teekay Shipping Corporation provides international crude oil and petroleum product transportation services to major oil companies, major oil traders, and government agencies. The Company provides its services through a fleet of medium size oil tankers worldwide.	42.7%	0.57	3.63
Shipping Corporation of India Limited owns, operates and manages a fleet of bulk carriers, international container service, liquid/dry bulk service, tankers, passenger vessels and offshore supply vessels. The Company's fleet transports primarily crude oil.	41.2%	0.56	3.06
Finnlines Oyj is a shipping company. The Company specializes in liner cargo services and operates a fleet of roro, roro-passenger, and container vessels for transportation of dry cargo containers, trailers, and passengers, as well as paper, steel, and machinery. Finnlines operates between Finland and ports in Europe and southwest Asia. The Company also provides port services in Finland.	40.4%	0.22	2.85
Kawasaki Kisen Kaisha, Ltd. operates marine cargo and passenger transportation around the world. The Company provides ocean liner, bulk carrier, car carrier, unscheduled specialized carrier, and energy transportation services. The Company also offers insurance, warehousing, and land transportation services. Items transported include automobile, grain, petroleum, coal, iron ore, and wood chip.	39.2%	0.43	2.59
Malaysian Merchant Marine Berhad is an investment holding company which provides ship management services. Through its subsidiaries, the Company provides transportation of goods by sea.	57.9%	0.85	5.26
Nippon Yusen Kabushiki Kaisha mainly provides marine transportation services and transportation management solution from international hub ports to both domestic and international ports. The Company operates container transportation, tramp and specialized carriers, and logistics and cruise lines. The Company offers scheduled and unscheduled transportation services around the world.	38.4%	0.52	4
Taiwan Navigation Co., Ltd. provides marine transportation services.	37.7%	0.6	5.59
Jinhui Shipping and Transportation Limited operates a fleet of 24 handysize ships. A handysize ship can carry between 10 to 50 thousand metric tons of cargo. The Company transports steel, iron ore, non-ferrous metals, and agricultural products. Jinhui operates in Hong Kong, Panama, Liberia, the British Virgin Islands, and the People's Republic of China.	37.1%	0.75	2.81
Irish Continental Group plc markets holiday packages and provides passenger transport, roll-on and roll-off freight transport and container lift-on and lift-off freight services between Ireland, the United Kingdom and Continental Europe.	36.7%	0.4	3.15
National Shipping Company of Saudi Arabia (NSCSA) offers transportation services. The Company transports freight by ship. NSCSA operates offices in Saudi Arabia, Dubai, Singapore, the United Kingdom, and the United States.	35.8%	0.74	6
Compania SudAmericana de Vapores S.A. provides both shipping and port services. The Company offers general and bulk cargo transport, fresh and frozen product transport, and automobile shipping services to both coasts of South America, and ports in North America, Europe, Asia, Africa, and Australia.	34.9%	0.9	5.52
Samudera Shipping Line Limited owns and operates ocean-going ships and provides containerized feeder shipping services. Through its subsidiaries, the Company also owns and charters vessels, provides sea and air freight forwarding, and operates shipping agency and container freight station services.	34.3%	0.84	4.23
Mitsui O.S.K. Lines, Ltd. provides marine transportation, warehousing, and cargo handling services. The Company operates container ship, specialized carrier, oil tankers, and ferry. Items transported include coal, iron ore, grain, logs, aluminum, cement, industrial salt, copper ore, wood chips, paper products, chem- ical products, gasoline and other petroleum products, LPG, and other cargoes.	29.5%	0.72	4.43
Knightsbridge Tankers Ltd. acquires, owns, leases, and charters double hull Very Large Crude Carriers (VLCC).	29.2%	0.9	3.1
SHINWA KAIUN KAISHA, LTD. operates specialized carriers and tramps to ship iron ore, steel, coal, crude oil, and gas. The Company is affiliated with Nippon Yusen. The Company also has close ties with Nippon Steel.	28.8%	0.88	3.42

Company & Description	Debt to Value	Beta	T-statistic
PDZ Holdings Berhad is an investment holding company. Through its subsidiaries, the Company provides container shipping and related services.	27.2%	1.2	4.43
Kirby Corporation operates a fleet of inland tank barges. The Company transports industrial chemicals, refined petroleum products, black oil products, and agricultural chemicals. Kirby also overhauls and services diesel engines employed in marine, power generation, and rail applications.	22.2%	0.55	3.94
China Shipping Development Company Limited operates crude oil and refined oil shipment, coal shipment, and dry bulk shipment along the People's Republic of China coast as well as internationally.	19.2%	0.83	3.92
Chu Kong Shipping Development Company Limited provides shipping and cargo handling services between Hong Kong and China. The Company's services include freight forwarding, wharf cargo handling, cargo consolidation, warehouse storage, and trucking. Chu Kong Shipping also provides container hauling services.	0.4%	0.95	5.28