Review of Weighted Average Cost of Capital estimate proposed by Goldfields Gas Transmission

FINAL DRAFT REPORT PREPARED FOR THE ECONOMIC REGULATION AUTHORITY

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1 Scope of this report

Frontier Economics (Frontier) is pleased to provide this Draft Report to the Economic Regulatory Authority (the Authority) in relation to proposed revisions to the Goldfields Gas Pipeline (GGP) Access Arrangement submitted by the operators of the GGP, Goldfields Gas Transmission Pty Ltd (GGT). This Draft Report addresses GGT's submission in respect of the proposed rate of return (or Weighted-Average Cost of Capital, WACC) submitted by GGT.

Frontier engaged SFG Consulting (SFG) as a sub-contractor to prepare this report on Frontier's behalf. SFG has considerable experience in regulatory determinations and has advised on WACC issues for a number of regulated entities and regulatory authorities.

1.1 Structure of this report

This Draft Report is structured as follows:

- Section 2 explains the concept of a rate of return and compares GGT's proposed rate of return with its current rate of return;
- Section 3 discusses and reviews each of the rate of return parameter estimates proposed by GGT;
- Section 4 sets out relevant references;
- Appendix A: Derivation of adjustment for franking credits;
- Appendix B: Relationship between parameters; and
- Appendix C: Economic reasonableness and plausibility.

2 Rate of return

2.1 Definition

The GGT proposal on the WACC is in terms of a pre-tax nominal definition of WACC in which the assumed value of franking credits (reflected in the "gamma" parameter) is incorporated as an adjustment to the WACC. The ERA has used this definition of WACC in a number of past determinations. Consequently, we adopt this pre-tax nominal definition of WACC throughout this report. We also note that consistency requires that this WACC must be applied to pre-tax nominal cash flows.

Formally, the pre-tax nominal definition of WACC is expressed as:

$$WACC_{\text{Pre-tax nominal}} = r_e\left[\frac{1}{1-T\times(1-\gamma)}\right]\frac{E}{V}+r_d\frac{D}{V}$$

where r_e is the equity holders' required rate of return (the total return that equity holders require, on average, in order to commit the required amount of equity capital to the firm); r_d is the debtholders' required rate of return (the total return that debtholders require in order to commit the required amount of debt capital to the firm); E/V and D/V are the estimated proportions of equity and debt capital in the capital structure of an efficiently-financed firm; T is the corporate tax rate; and γ (or "gamma") is the estimated value of a dollar of imputation credits, or what the market is prepared to pay for a $1 imputation credit at the time it is created via the payment of Australian corporate tax (specifically, gamma represents the fraction of a $1 imputation credit that is capitalised into the stock price).

GGT has proposed that the required return on equity (r_e) should be estimated using the Capital Asset Pricing Model[1] (CAPM), in which the total required return is the sum of the risk-free rate of interest (r_f) and compensation for bearing systematic risk, comprising risks associated with economy-wide events and which is also referred to as market risk or non-diversifiable risk. The equation for the CAPM in the context of equity returns is as follows:

$$r_e = r_f + \beta_e\,(r_m - r_f)$$

where r_f is the risk-free interest rate; β_e is the equity beta, which in statistical terms is the covariance of equity returns and market returns, scaled by the variance of market returns $\beta_e = \frac{COV(r_e, r_m)}{\sigma_m^2}$; and $r_m - r_f$ is the market risk premium, which is

[1] Sharpe (1964).

the compensation required by investors for bearing the systematic risk associated with the entire market (and this is also the compensation for the systematic risk from an equity investment in the average firm). The ERA has previously used the CAPM to estimate the required return on equity, and this is standard regulatory practice.

The required return on debt (r_d) is estimated with reference to the yield to maturity on corporate bonds with an appropriate credit rating, given the assumed capital structure and risks associated with the regulated asset.

2.2 GGT submission

GGT has proposed a pre-tax nominal WACC of 13.5 per cent. This WACC estimate is 90 per cent of the distance from GGT's lower bound WACC estimate of 10.7 per cent to its upper bound estimate of 13.8 per cent. The selection of a WACC estimate from close to the upper bound of the proposed range is based upon the argument that there are asymmetric costs of estimation error associated with regulated rates of return. That is, the potential impact of underinvestment associated with setting regulated rates below the true (but unobservable) cost of funds outweighs (in an aggregate social welfare sense) the impact of abnormal profits associated with setting regulated rates above the true cost of funds.

2.3 Comparison with current regulated return

The current regulated rate of return for the Goldfields Gas Pipeline (GGP) is 10.6 per cent, which represents the upper bound of the range of 8.4 – 10.6 per cent which, in its last determination, the ERA considered would comply with the *National Third Party Access Code for Natural Gas Pipeline Systems* ("the Code").

For comparison purposes we computed the pre-tax WACC which would prevail if we incorporated just the risk-free rate of 4.27 per cent and the debt margin of 3.60 per cent which form part of GGT's current submission, and leave all other parameter estimates unchanged from the prior determination.

Under these assumptions, the revised WACC range would be 8.7 – 10.7 per cent.[2] That is, the lower bound of GGT's proposed WACC range approximates the upper bound of the reasonable range from the ERA's prior determination, after updating for changes in the risk-free rate and debt margin only. These ranges and point estimates are set out in Table 1 below.

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[2] These estimates are 10 per cent of the distance between the lower and upper bounds of a WACC range of 8.5 – 11.0 per cent resulting from the ranges assumed in individual parameter estimates.

Table 1. Current and proposed regulated returns

Name	Lower bound	Upper bound	Point Estimate
ERA GGP Determination (May 2005)	8.4%	10.6%	10.6%
ERA GGP Determination (May 2005) updated for changes in risk-free rate and debt premium per GGT proposal	8.7%	10.7%	
GGT Proposal	10.7%	13.8%	13.5%

Table 1 shows that the proposed increase in the allowed return is not simply a function of the changes in financial markets pertaining to interest rates and debt premiums. Indeed these two changes effectively offset one another – government bond yields have fallen to offset the proposed increase in debt margin. Consequently, it is changes in other WACC parameters that account for the increase in the proposed allowed return.

3 Parameter estimates proposed by GGT

3.1 Background

In this section, we review the specific parameter estimates proposed by GGT in the context of empirical evidence, prior decisions of the ERA, and the recent determination of the Australian Energy Regulator (AER) in the context of electricity transmission and distribution (AER WACC Review).[3]

We note that the AER WACC Review was specifically concerned with electricity transmission and distribution firms. For this reason, firm-specific parameters such as the equity beta are not directly comparable. However, a number of WACC parameters (such as the risk-free rate, MRP, and the value of franking credits that have been distributed to shareholders) are market-wide parameters that apply across all industries and types of businesses.

GGT provides further support for this view in its response to the ERA's issues paper. GGT concludes that:

> In particular when assessing WACC parameters, which relate to individual assets and the risks associated with these assets, such as equity beta and credit rating, the parameter values should be considered on their own merits, or by comparison to other relevant comparators, such as infrastructure serving mining markets, rather than by comparison to east coast electricity networks. As such GGT does not believe it is reasonable to consider the AER electricity WACC review findings in relation to these variables. However, in the case of WACC parameters which relate to market wide factors and variables, such as the Market Risk Premium ("MRP"), GGT believes it is reasonable to consider the AER electricity WACC review while not being bound to its outcomes.[4]

Important areas of difference between the AER's proposed parameters, the previous GGP determination and GGT's present proposal are:

- **Market risk premium.** GGT has submitted an estimate of 7.0 per cent, which exceeds the AER's estimate of 6.5 per cent and the most recent value adopted by the ERA of 6.0 per cent. In its prior GGP determination the ERA adopted a reasonable range of 5.0 – 6.0 per cent.
- **Value of imputation credits (gamma).** In the Officer-WACC framework[5] that forms the basis of the regulatory regime, the estimated value of imputation credits is a firm-specific parameter, influenced by the distribution

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3 Australian Energy Regulator, 2009, Electricity transmission and distribution network service providers: Review of the weighted-average cost of capital (WACC) parameters – Final Decision, 1 May 2009.

4 GGP response to issues paper, p.5.

5 Officer (1994).

policy of the firm. GGT has proposed that an appropriate value for imputation credits is 0.20. The AER has recently adopted an estimate of 0.65, based upon an assumption that all imputation credits created by a firm are immediately distributed and that the value of distributed imputation credits for the average Australian firm should be used. The ERA has adopted a value of 0.50 in its most recent determination[6] and a range of 0.30 – 0.60 in its prior GGP determination.

- **Equity beta estimate.** The estimated equity beta for GGP is a firm-specific parameter. This premise underpins the submission by GGT that an appropriate equity beta range is 1.0 – 1.8, where the lower bound is considered to represent the risk of a typical gas distribution business, and it is submitted that GGP has relatively higher risk than the typical business. It its prior GGP determination, the ERA adopted a reasonable range of 0.80 – 1.33 for the equity beta estimate. In its recent WACC Review, the AER assumed a figure of 0.8, but an assumption of 1.0 has been most commonly adopted by regulators for gas distribution businesses.

Table 2 below sets out the values of specific WACC parameters from the recent AER WACC review, the ERA's last determination in relation to GGP, and the present GGT proposal. In some cases, specific parameter estimates are unavailable – for example, the AER has not specified estimates of the risk-free rate or debt margin. In these cases, we set out the procedure or methodology that has been adopted. For other parameters we have included information about the process used to estimate them.

[6] ERA (2009).

Table 2. Current and proposed parameter estimates

Parameter	AER WACC Review	ERA GGP Determination (May 2005)	GGT Proposal
Risk free rate	10-40 day averaging period close to start of regulatory control period	5.45% (20-day averaging period prior to start of regulatory control period)	4.27%
Equity beta	0.8	0.8 – 1.33	1.0 – 1.8
Market risk premium	6.5%	5.0 - 6.0%	7%
Capitalisation of franking credits (gamma)	0.65	0.3 – 0.6	0.2
Gearing	60%	60%	60%
Credit rating	BBB+	BBB+ (Interest coverage ratio of 2.0)	BBB-
Debt margin	Averaging period to match risk-free rate; Estimate constructed from Bloomberg data	0.980 – 1.225 (CBA Spectrum, Yields of comparable bonds, downward adjustment due to availability of offshore borrowing. Debt raising costs of 8-12 bp)	3.725% - 3.900% (Debt raising costs of 12.5 – 30 bp)
Corporate tax rate		30.7% (Average effective tax rate over prior 10 years)	30%

In the remainder of this section of the report, we examine each WACC parameter in turn. This involves a comparison of the GGT proposal with the prior determination of the ERA and the outcomes of the recent AER WACC review, together with our analysis of the relevant arguments and recommendations.

3.2 Risk-free rate

The ERA, AER and GGT agree that an appropriate estimate of the risk-free rate is the yield to maturity on ten-year Commonwealth government bonds, estimated as an average over 20 trading days shortly before the start of the regulatory control period.[7]

We agree that an appropriate estimate of the risk-free rate is the yield to maturity on ten-year Commonwealth government bonds and that an averaging period of 20 days is an appropriate way of smoothing out potential market volatility.

One particular issue is worth noting in this regard. In its recent review of WACC parameters, the AER initially proposed a term for the risk-free rate which matches the regulatory period (five years) but reversed this decision in the final determination and now remains of the view that a ten-year period is appropriate. In our view, there is no need for the term of the regulatory period to match the term to maturity of the risk-free rate. More often than not, there is a term premium amongst debt instruments, such that ten-year debt has a higher yield to maturity than five-year debt. If regulated rates of return were set such that the risk-free rate matched the regulatory period, on average there would be lower regulated prices in jurisdictions with short regulatory periods, and higher regulated prices in jurisdictions with long regulatory periods. But the regulator is attempting to estimate the price that would prevail in a competitive market, and there is no conceptual reason to think that competitive market prices would have any association with the term of the regulatory period.[8]

Finally, we note that in two recent decisions of the AER, the regulated businesses submitted that the present yield on government bonds is not an appropriate estimate of the risk-free rate. It was argued that the recent flight to quality and liquidity has squeezed yields on Commonwealth Government bonds to levels substantially below that which apply to other (almost) riskless securities such as state government bonds. This argument was rejected by the AER and is not part of the GGT submission so we do not deal with it in this report.

3.3 Market risk premium

3.3.1 Submissions from GGT and BHP Billiton

As set out above, GGT have proposed that the market risk premium be set at 7% in light of the available historical data and the current state of financial markets.

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[7] ERA (2009, p.132), AER (2009, p.173) and GGP (2009, p.15). The AER considers an averaging period of anywhere from 10 – 40 days to be appropriate. The AER also emphasised that it would only accept an averaging period as close as practically possible to the start of the regulatory control period.

[8] For a more formal discussion of this issue, see Hall (2007).

BHP Billiton (BHPB) have proposed a market risk premium of 5.75%. This estimate is the average of six estimates of MRP that have been used in equities reports published by various broking houses over the last six months.

BHPB also notes that the very strong Australian regulatory precedent has been to adopt an estimate of 6% for MRP, and suggests that the 7% estimate proposed by GGT is too high in the circumstances.

In considering this issue, BHPB proposes that:

> the market risk premium should be determined on the basis of both observed historical equity premia achieved in the market and a range of information sources on current and future expectations of equity premia.[9]

We agree with this framework for estimating an appropriate current estimate of MRP and follow it throughout this section.

3.3.2 Estimates based on historical data

In its most recent decision, the ERA adopted a market risk premium of 6.0 per cent, consistent with regulatory practice across Australian jurisdictions.[10] The AER has recently increased its estimate of the market risk premium to 6.5 per cent. In reaching this decision, it relied primarily on the long-term historical average Australian equity returns relative to government bond yields, which is around 6.0 per cent. However, it also considered the current equity prices relative to dividends are indicative of an estimate for the market risk premium above 6.0 per cent, resulting in a final estimate of 6.5 per cent.[11]

GGT has proposed a market risk premium estimate of 7.0 per cent, relying on submissions by the Joint Industry Association (JIA) to the AER.[12] In these submissions, the authors' view is that historical returns represent the best available evidence on the market risk premium, a view shared by the AER.

However, the AER report and the JIA submissions reach differing conclusions as to the historical average sharemarket returns. The AER (p.236) concludes that:

> The most recent long term historical average excess returns:
>
> - 'grossed-up' for a utilisation rate of 0.65
> - estimated (for the most part) relative to the yield on 10 year [Commonwealth Government Securities], and

[9] BHP Billiton submission, p. 36.

[10] ERA (2009, p.132).

[11] Australian Energy Regulator (2009, p.240).

[12] Value Adviser Associates (2008 and 2009).

- estimated over a range of long term estimation periods (1883-2008, 1937-2008, 1958-2008)

fall close to 6 per cent, with some estimates slightly above and some slightly below. Specifically, this leads to a range of historical excess returns between 5.7 and 6.2 per cent.

The latter submission by the JIA includes data from two sources for the period 1883 – 2008.[13] First, the authors update data published by Brailsford, Handley and Maheswaran (2008) for the last three calendar years and report a mean of 5.9 per cent, before considering the impact of imputation credit values on the historical returns series. Second, they report a mean of 7.1 per cent, relying upon data compiled by Officer and which also does not include any adjustment for returns due to imputation credits. The difference between these historical series relates to the period from 1883 – 1957, in which Brailsford et al. argue is likely to overstate the dividend yield on the broader market.

Our view is that the historical data supports an estimate of the market risk premium of at least 6.0%. This estimate is based on a risk-free rate estimated as the yield on ten-year government bonds and does not include any adjustment for the assumed value of dividend imputation franking credits.

3.3.3 The impact of current financial market conditions: Dividend yields and debt spreads

There are two important indicators that required returns on equity are relatively high in the current market. Dividend yield and default spreads on corporate debt are substantially above long-term averages, and there is empirical evidence that these variables are positively associated with future equity market returns relative to Treasury bill rates (Fama and French, 1988 and 1989; and Keim and Stambaugh, 1986).

The figure below shows historical values for these variables relative to their average levels for Australia. At 11 May 2009, the trailing dividend yield on the All Ordinaries Index was around 5.3 per cent, compared to the long-term average of 4.0 per cent,[14] and the BBB rated debt spread was around 6.3 per cent, compared to a long-term average of 1.8 per cent.[15]

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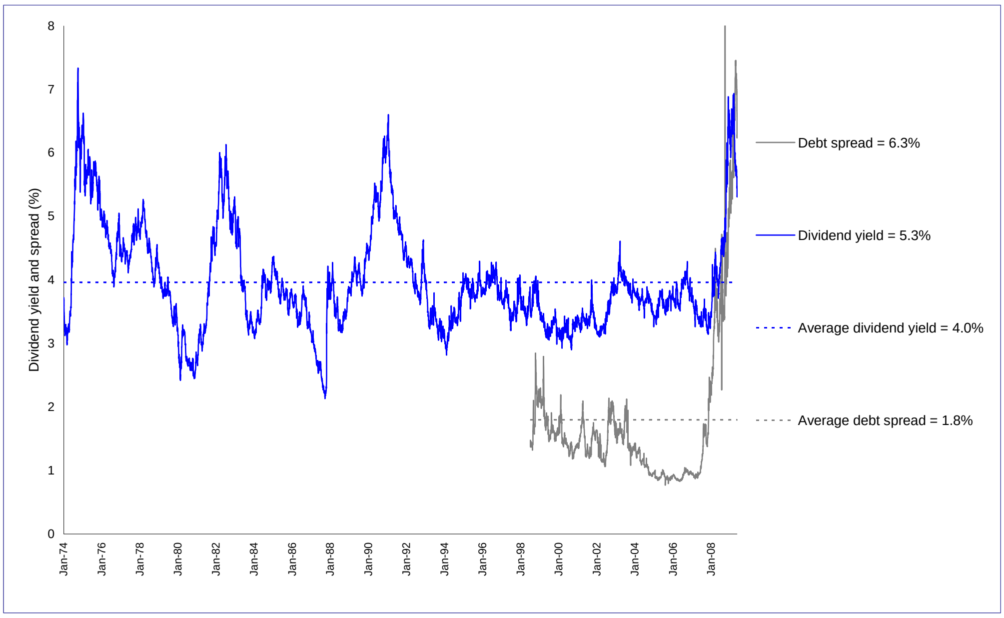
13 Value Adviser Associates (2009, Table 1, p.3).

14 Dividend yield is estimated on an annual trailing basis. To estimate the previous year's dividends we first compute the difference between the total returns and percentage price changes on the Australian market for each day of trade. Second, we convert the percentage return from dividends into a total number of points on the accumulation index attributable to the receipt of dividends. Third, we accumulate the total dividend points for the previous twelve months and divide by the ending value for the accumulation index. This provides us with an estimate of total dividends for the previous 12 months relative to the current value of the index. From 29 May 1992 – 11 May 2009 the market index is the All Ordinaries Index. From 1 January 1973 to 28 May 1992 the market index is the Datastream Total Market Australian Index.

Figure 1. Dividend yields and debt spreads in Australia



This does not imply that equity market returns can be forecast with precision or that these variables provide investors with a trading strategy which generates abnormally high returns. What it does imply is that the bond and equity market prices appear to be affected by similar risk considerations. This means that low equity prices (relative to trailing dividends) and low corporate bond prices (relative to promised repayments) reflect investors' expectations for risk and therefore their required return for bearing that risk, in both the equity and debt markets.

Of course, the high dividend yield is likely to reflect both expectations of lower dividends in 2009 compared to 2008, as well as a higher required return for bearing risk. And a component of the debt spread reflects investor expectations for default. However, these are the same measures which prior research has found to be associated with future equity market returns.

That is, the relevant finance literature establishes that required returns on equity are, on average, higher when trailing dividend yields and debt spreads are higher. At present, both of these measures are substantially higher than their average

[15] Debt spreads are estimated as the difference in the CBA Spectrum estimated yield to maturity on ten year BBB rated corporate debt and the RBA estimated yield to maturity on ten year Commonwealth government debt. There has been debate in regulatory determinations over the appropriate data sources (Bloomberg versus CBA Spectrum) for estimating yields on long-dated corporate debt, given the we rarely observe actual bonds of this type and therefore data providers extrapolate from short-term debt with higher credit ratings. However, regardless of the data source, it remains the case that debt margins are above historical averages. At the end of March 2009, the RBA estimated that BBB rated corporate debt with maturity of one to five years was trading at a yield to maturity of 5.74 per cent above government securities, compared to spreads of 0.75 – 0.84 per cent at the end of June 2005, 2006 and 2007 (RBA, April 2009).

levels. This would imply that required returns on equity are presently higher than average.

3.3.4 The impact of current financial market conditions: Option implied volatilities

Grundy (2009) summarises the findings of Lubos, Sinha, and Swaminathan (2008) who establish a relationship between option implied volatilities and required returns on equity. The option implied volatility is the estimate of the volatility of the stock market index that must be inserted into the Black-Scholes option pricing model to reconcile the model value with the traded price of stock index options.

Specifically, options trade on the ASX 200 stock index and the traded prices of these options can be observed in the market. The standard model that is used to value these options is known as the Black-Scholes option pricing model. This model has spurned a large academic literature and it is used extensively by practitioners and traders. One of the inputs to the Black-Scholes model is the expected volatility of the returns on the ASX 200 index over the life of the option. If a different estimate of volatility is inserted into the model, a different estimated value will be produced. The *implied volatility* is that estimate of volatility that produces an estimated value from the model that reconciles with actual traded prices. Lubos, Sinha, and Swaminathan (2008) establish that this implied volatility, as an estimate of the risk associated with holding the stock index, is related to required returns on equity.

A series of option implied volatilities is constructed for the Australian market by Citigroup. Grundy (2009) shows that the estimates of the implied volatility of the ASX 200 index have risen sharply in recent times.

Figure **2** is reproduced from Grundy (2009) and shows the dramatic increase in the implied volatility of the Australian market beginning in September of 2008. Grundy notes that:

> The average implied volatility over the years 1997 through 2007 is 18.28% per annum. The average implied volatility during 2008 prior to 7 September 2008 is 28.15%. The average implied volatility after that date is 44.59%.[16]

Lubos, Sinha, and Swaminathan (2008) establish that the implied volatility is related to required returns on equity. Specifically they report a positive relationship between the required return on equity and the implied volatility of stock returns at the country and world market level. Consequently, higher implied volatility estimates are associated with higher required returns on equity. Grundy (2009) concludes that the increase in implied volatilities in

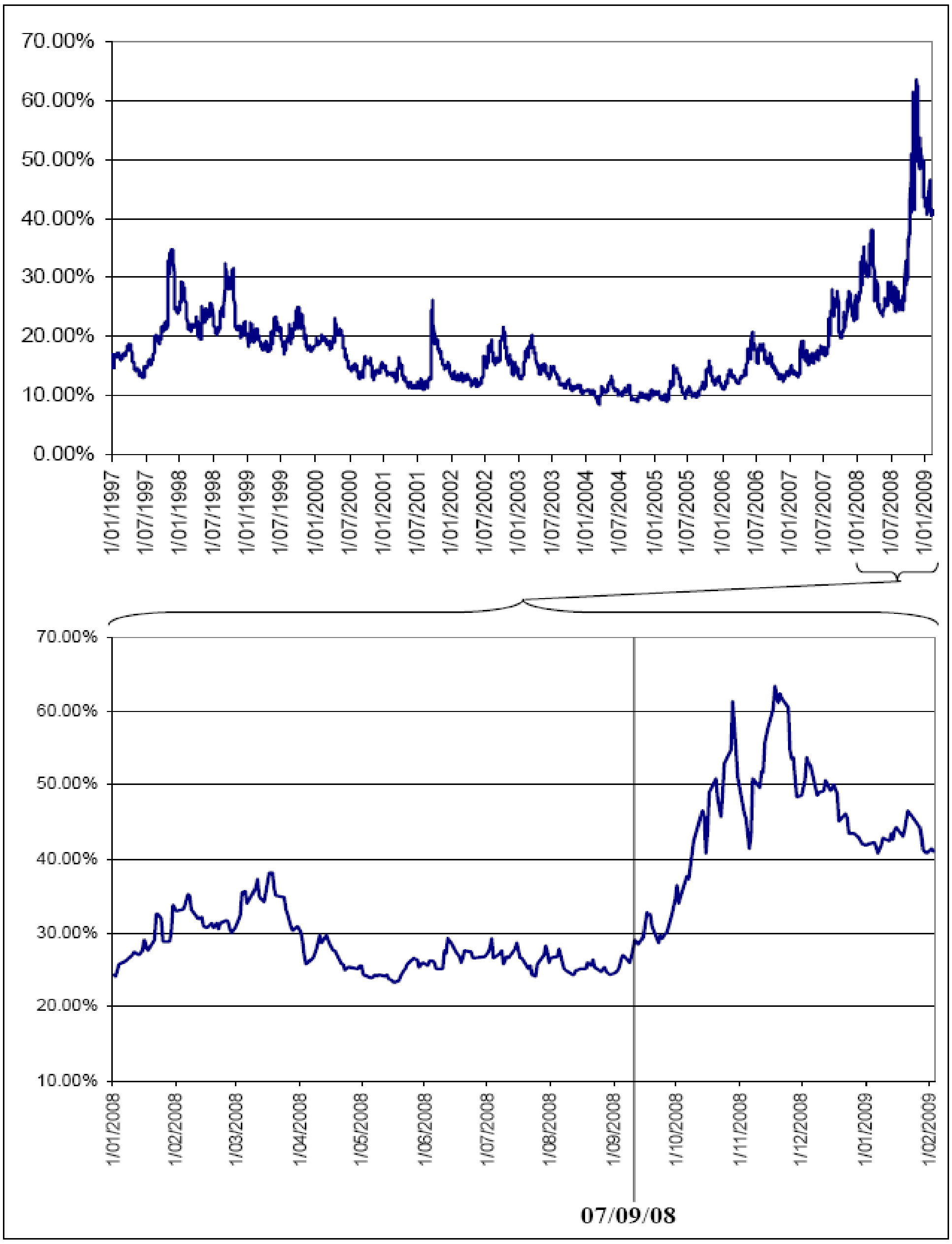
[16] Grundy (2009), paragraph 59.

Figure **2** below:

> shows that investors' assessment of the risk of the Australian equity market has increased dramatically after 7 September 2008. The results in Lubos, Sinha and Swaminathan (2008) imply that investors' required return on the Australian equity market has increased post 7 September 2008 relative to their required return in the period preceding that date.

This conclusion reinforces that of the previous section. Dividend yields, debt spreads, and option implied volatilities are all presently at levels well above their historical means. All of these results suggest that the required return on equity is presently high relative to past required returns.

Figure 2. Option implied volatility for ASX 200 index



Source: Citigroup, Grundy (2009).

3.3.5 The impact of current financial market conditions: Sell-off in equity markets

The required return on equity is, in essence, the discount rate that equates the expected future cash flows to equity to the current market value of equity. That is, we forecast expected future cash flows to equity, discount them using an estimate of the required return on equity, and the result is an estimate of the market value of equity:

$$\frac{Equity}{Value} = \sum_{t=1}^{\infty} \frac{Cash\ flow\ to\ equity_t}{(1+k_e)^t}$$

It is clear that in recent times the market value of equities has fallen sharply. From 30 June 2008 to 2 February 2009 the All Ordinaries Index fell by 35%, bringing its total decline to 50% from its peak on 1 November 2007. That is, the left hand side of the above equation has fallen by 35% since June last year.

But this fall does not necessarily imply that the required return on equity has increased. If all of the forecast cash flows to equity were reduced by 35%, the equity value would fall by 35% even if the required return on equity were unchanged. That is, if all of the cash flows to equity on the right hand side of the equation above were reduced by 35%, the total equity value would reduce by 35% even if the required return on equity (k_e) remained constant. Of course, this would require that *all* expected future cash flows are decreased by 35% – not just cash flows for a few years, but all cash flows in perpetuity.

If corporate profits are not expected to fall by this much in perpetuity, the decline in equity values could only be reconciled via an increase in the required return on equity. That is, if on the right hand side of the above equation cash flows to equity (in perpetuity) fall by less than 35%, the required return on equity would have to be higher in order to reconcile with the 35% fall in equity values on the left hand side of the equation.

In addition, CEG (2008, Para 119-120) cite evidence from the RBA that trailing and forecast price-earnings ratios in the Australian share market are "around their lowest levels since 1991."[17] The price-earnings ratio provides a measure of the amount investors are willing to pay for a dollar of earnings. The low price-earnings ratio is likely to result from two factors – reduced investor expectations for future earnings *and* an increase in investors' required return for risk.

The decline in the market's price-earnings ratio is consistent with the increase in the dividend yield (prices relative to trailing dividends), debt spreads and option implied volatilities, discussed above. These factors suggest that equity prices reflect investors' relatively high return requirements, given their perceptions of risk in the present market.

3.3.6 Conclusions and recommendations

Our view is that 6 per cent is an appropriate estimate of the market risk premium in normal market conditions – consistent with historical average returns and regulatory precedent. This is consistent with past ERA determinations (all of which include 6 per cent within the reasonable range) and with the views of the AER, who concluded in the recent WACC Review:

> The AER considers that prior to the onset of the global financial crisis, an estimate of 6 per cent was the best estimate of a forward looking long term

[17] CEG (2008) citing the RBA November 2008 Statement of Monetary Policy.

> MRP, and accordingly, under relatively stable market conditions—assuming no structural break has occurred in the market—this would remain the AER's view as to the best estimate of the forward looking long term MRP.[18]

At present, debt spreads, dividend yields, and option implied volatilities are all at abnormally high levels. This points strongly towards an increase in the market risk premium to a value above 6%. The AER concludes that:

> relatively stable market conditions do not currently exist,[19]

and consequently that:

> a MRP above 6 per cent at this time may be reasonable.[20]

There seems to be little disagreement on this point. Consequently, the central question is one of magnitude – the present estimate of MRP should be greater than 6 per cent, but what is an appropriate estimate? The AER has determined that a figure of 6.5 per cent represents an appropriate balance between adjusting the estimate upwards to account for current conditions, and providing for stability in the estimate in regulated rates of return. In its recent WACC Review, the AER concludes that:

> having regard to the desirability of regulatory certainty and stability, the AER does not consider that the weight of evidence suggests a MRP significantly above 6 per cent. Accordingly, the AER considers that a MRP of 6.5 per cent is reasonable, at this time, and an estimate of a forward looking long term MRP commensurate with the conditions in the market for funds that are likely to prevail at the time of the reset determinations to which this review applies.[21]

That is, the AER's estimate of 6.5% is not the result of a specific empirical analysis, but is based on the exercise of regulatory judgment and the desirability of regulatory stability.

GGT has proposed an estimate of 7% based on the submission of the JIA to the recent AER WACC Review. GGT contends that:

> Recent data suggests that a forward looking MRP of 7% is conservative given the financial crisis.[22]

Our view is that it is difficult to reliably model the forward-looking MRP as a function of variables that indicate present market conditions. Moreover, it is also difficult to obtain reliable estimates from the technique of reverse-engineering the implied MRP from dividend growth models (which formed part of the JIA's

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[18] *WACC Review Final Decision,* p. xiv.

[19] *WACC Review Final Decision,* p. xiv.

[20] *WACC Review Final Decision,* p. xv.

[21] *WACC Review Final Decision,* p. xv.

[22] *GGT Supporting Information, April 2009,* p. 19.

submission to the AER WACC Review). Consequently, a degree of judgment is required when estimating a reasonable range for the MRP.

Our view is that the long-term historical average of around 6 percent will always be within the reasonable range, in all market conditions. We are also of the view that the 7 per cent proposed by GGT is not unreasonable in the current market circumstances – given present levels of dividend yields, debt spreads, and option implied volatilities. Consequently, we have adopted a range of 6 per cent to 7 per cent for the market risk premium. We also note that this is consistent with the recent point estimate of 6.5% adopted by the AER as part of its review of WACC parameters.

We note that four of the six broker reports submitted by BHPB propose an MRP of 6% and that the lowest estimate (5%) is the earliest in the sample. Moreover, we also note that broker research is prepared for a different purpose (i.e., to generate broking commissions) from setting regulated rates of return. For all of the reasons set out above, our view is that 6% is an appropriate lower bound for the reasonable range in the current circumstances.

3.4 Value of imputation credits (gamma)

3.4.1 Role of the gamma parameter

Prior to the introduction of dividend imputation, equity holders received their return in two forms: dividends and capital gains. Under dividend imputation, there is a potential third component of equity return in the form of franking credits.

GGT has proposed, and the ERA has previously used, a definition of the pre-tax nominal WACC that incorporates the assumed value of franking credits, gamma, into the cost of capital. Specifically, the required return on equity, r_e, is reduced by the amount of the return that is assumed to come in the form of franking credits. The result is the following term in the WACC formula that is used by the ERA:

$$r_e \frac{1}{1-T(1-\gamma)}.$$

This formula is used to estimate the cost of capital *to the firm*. r_e is the after-corporate tax total return that is required by equity holders – this is what is estimated by the CAPM. The pre-corporate tax required return, consequently, is $\frac{r_e}{1-T}$. But the firm is not required to provide *all* of this return. A portion of that return is provided by government in the form of franking credits, and it is the balance that must be generated by the firm. Officer (1994) derives the formula that is used by the ERA. He shows that the portion of the required return on equity that must be generated by the firm is $\frac{1-T}{1-T(1-\gamma)}$, and that the balance comes from government in the form of franking credits. Consequently, the term that appears in the formula for the firm's pre-corporate tax cost of capital is

$$\frac{r_e}{1-T} \times \frac{1-T}{1-T(1-\gamma)} = r_e \frac{1}{1-T(1-\gamma)},$$

and this is what it costs *the firm* (before corporate tax) to ensure that the equity holders receive the required return. The appendix to this report sets out a simple and intuitive derivation and description of this part of the ERA's WACC formula.

That is, the assumed value of franking credits (gamma) determines the extent to which dividend imputation is assumed to reduce the firm's cost of funds.

Finally, it is generally recognised that gamma is the product of two component terms:

$$\gamma = F \times \theta$$

where F represents the distribution rate (the proportion of all franking credits that are created by the payment of Australian corporate tax that are distributed to shareholders) and θ (theta) is the value of distributed credits (the market value of a $1 franking credit that is distributed to shareholders). Consequently, to estimate gamma, we need estimates of both F and theta.

3.4.2 GGT proposal and recent estimates

GGT has proposed that imputation credits be valued at 0.2, relying upon submissions by the Joint Industry Association to the AER in their most recent WACC review. In the prior GGP determination, the ERA estimated a range of 0.3 – 0.6 for this parameter and in its most recent regulatory decision relating to water, the ERA used a point estimate of 0.5. The AER has concluded that an appropriate value for imputation credits is 0.65. Hence, there is substantial divergence regarding an appropriate estimate for this parameter, especially as the AER has concluded there is persuasive evidence to depart from the prior estimate of 0.5.

We have made a number of submissions to the AER's WACC Review in relation to gamma and our discussion in the remainder of this section draws on some of that material.

3.4.3 AER's assumption of full and immediate distribution of franking credits: F=1.

The AER's estimate of gamma of 0.65 is based on the assumption that all firms immediately distribute all franking credits at the time they are created. That is, it is assumed that all firms will immediately pay out 100% of their Australian earnings to shareholders as fully franked dividends. The clear empirical evidence on this point is that approximately 70% of franking credits created in a particular year are distributed to shareholders. On average, 30% of the franking credits that are created are not distributed to shareholders because firms systematically retain some earnings.

The AER accepts that this represents the actual behaviour of Australian firms, but concludes that gamma should be estimated *as if* all firms had 100% payout rates. The question, then, is whether the regulator is seeking to estimate the cost of capital as it *is* in the real world, or as it *would be* in a hypothetical world in which firms behave in a way quite different from that which we actually observe.

Our view is that the role of the regulator is to estimate the cost of capital as it is in the real world, and that gamma should be estimated on the basis of the observed dividend payout practice of Australian firms and not on the basis of a hypothetically assumed one that is inconsistent with the empirical data.

3.4.4 AER's reasoning in relation to theta

Having assumed that $F = 1$, the AER then required an estimate of theta. In reaching its estimative of 0.65, the AER relies upon the evidence in Beggs and Skeels (2006) and Handley and Maheswaran (2008) for its estimate of theta. Beggs and Skeels perform a dividend drop-off study, in which the value of a distributed imputation credit is estimated from share price changes around ex-dividend dates. Their estimated value of a distributed credit from July 2000 – May 2004 is 0.57. The period from July 2000 onwards coincides with a change in the tax legislation allowing non tax paying investors to receive a cash rebate for imputation credits. Previously, imputation credits could only be used to offset tax payable.

Handley and Maheswaran estimate the proportion of imputation credits which are actually redeemed by investors, which they estimate at 0.67 over the period 1990 – 2000 and 0.81 from 2001 – 2004. The authors from this paper do not conclude, however, that the proportion of imputation credits redeemed is an estimate for gamma, which represents the proportion of the face value of imputation credits which is capitalised into the stock price.

We have made submissions to the AER on behalf of the JIA as to why the figures from these papers quoted above do not represent an appropriate value for imputation credits.

3.4.5 Beggs and Skeels (2006)

With reference to the dividend drop off study of Beggs and Skeels (2006), the key issue is that the regression analysis generates both an estimated value for cash dividends *and* an estimated value for imputation credits. For the most recent period, the estimated value for cash dividends is 0.80. Hence, if the estimation technique is considered to generate a reliable measure of imputation credit value (0.57) we need to also accept that it generates a reliable measure of the market value of cash dividends (0.80).

In our view, it would be inconsistent and wrong:

a) to reduce the required return (and the regulated price) to reflect a positive value for franking credits (gamma), but

b) to not then take account of the offsetting effect of dividends being estimated to be worth only 80 cents in the dollar,

especially when these two effects are part of a single estimation exercise in which the first estimate is *conditional* on the second. If the required return is to be reduced on the basis of these estimates (as in (a)) then the effect of dividends being worth less than their face value (as in (b)) should also be taken into account. Conversely, if the value of dividends in (b) is not taken into account, then the reduction in the required return in (a) should also not be taken into account. Simply put, if the results of this study are to be relied upon, the *whole* result should be used – it would be wrong to rely on only half of the result in a way that substantially reduces the allowed return.

If we are to use the whole of this result, one must use a model for estimating the required return on equity that allows for dividends to be valued at less than their face value. In our submission to the AER on this point we note that a number of models are available for this purpose. These models have been published in the academic literature but have not been used or adopted in commercial practice.

The other possibility is to continue using the standard CAPM, which requires that dividends be valued at their full face value. In this case, one needs to re-compute the Beggs and Skeels (2006) estimate to be conditional on dividends being worth 100% of face value, rather than 80% of face value. Again, we show in our submission to the AER on this point that when the Beggs and Skeels results are adjusted to be consistent with the use of the standard CAPM (i.e., conditional on dividends being worth 100% of face value) the resulting estimate of the value of franking credits is insignificantly different from zero.

3.4.6 Handley and Maheswaran (2008)

Handley and Maheswaran (2008) estimate the proportion of franking credits that are redeemed against personal tax obligations. They use aggregate tax statistics to estimate the ration of redeemed franking credits to the total amount of franking credits that were distributed in a particular year.

The key issue here is that the utilisation (or redemption) rate of imputation credits does not provide information about their market *value*. Specifically, if 80 per cent of shares are held by Australian resident investors, we are likely to observe something close to 80 per cent of imputation credits being redeemed, regardless of whether share prices reflect zero value for imputation credits or full value for imputation credits.

For other WACC parameters, we look for evidence of market values rather than use. When estimating the risk-free rate, for example, we do not consider how many investors use government bonds, we examine their market price.

In our submission to the AER's WACC Review, we considered a simple counterfactual example as follows. Consider two Australian companies that are identical in all respects except that one operates under foreign ownership restrictions and the other does not. Specifically, suppose the first firm is prevented from raising any foreign equity. For this firm, all franking credits that were distributed would go to resident investors who could redeem them. The average redemption rate would be 100%.[23] If this were used to estimate theta (and consequently gamma) the downward adjustment to the cost of equity[24] would be much greater than even is the case where gamma is assumed to be 0.5. That is, the implication of using average redemption rates to estimate theta (and consequently gamma) is that a firm's cost of capital could be substantially reduced, relative to that of its peers, by imposing foreign investment restrictions on it. However, the exact reverse is true – less foreign investment means a lower supply of capital and consequently an *increase* in its cost. In our view, this simple counterfactual analysis provides a compelling reason why average redemption rates should be considered to have no relevance to empirically estimating from market data the effect that franking credits have on the cost of capital of Australian firms.

3.4.7 Market practice

Finally, we note that setting gamma to zero and making no adjustment for franking credits to the estimated required return on equity accords precisely with

[23] But for those that are excluded by the 45 day rule and cases where investors inadvertently neglect to redeem them at the end of the relevant tax year.

[24] The estimated pre-corporate tax required return on equity (from CAPM) is $\frac{r_e}{1-\tau}$. This is adjusted by a factor of $\frac{1-\tau}{1-\tau(1-\gamma)}$ to give $\frac{r_e}{1-\tau(1-\gamma)}$. For higher values of gamma, the downward adjustment is greater. See the appendix for an explanation of this downward adjustment.

the dominant commercial market practice. The conventional approach in the Australian market is to estimate the required return on equity using the CAPM and to make no adjustment for the assumed effect of franking credits when estimating cost of capital.[25] This is borne out by survey evidence from Australian CFOs[26] and the practice adopted in expert valuation reports.[27] [28]

3.4.8 Conclusions in relation to AER analysis

Our conclusion is that the AER analysis in relation to gamma is fundamentally flawed and should receive no weight for a number of reasons:

(a) The AER's estimate of gamma is based on an assumed dividend payout policy that bears no resemblance to that which we actually observe from Australian companies;

(b) The AER's estimate of gamma is inconsistent with the observed practice of Australian firms and independent expert valuation professionals; and

(c) The two studies relied upon by the AER to measure theta actually measure different concepts. The study by Beggs and Skeels produces estimates that are *conditional* on dividends being valued at 80% of face value whereas the CAPM-WACC framework requires estimates that are conditional on dividends being fully valued. The study by Handley and Maheswaran provides evidence that around three-quarters of distributed imputation credits are redeemed, and therefore received by Australian resident investors. It does not provide any information whatsoever about how much imputation credit value is reflected in market prices.

3.4.9 Conclusion and recommendations

We have consistently expressed the view that the evidence suggests that franking credits do not affect the cost of capital of large Australian firms. This is supported by the evidence from Cannavan, Finn and Gray (2004)[29] and an

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25 That is, the required return on equity is estimated as $r_e = r_f + \beta_e \times MRP$ and no adjustment is made to it for any assumed effect of franking credits. In this regard, I note that there is no such thing as a version of CAPM that includes a value of gamma. The CAPM is the single equation as above. Its role is to provide an estimate of the total return that is required by shareholders. The role of gamma (if it is to be set above zero) is to disaggregate that total required return into the component that is provided by government (by way of franking credits) and the component that must be provided by the firm. This disaggregation is quite separate from the CAPM, which only provides an estimate of the total required return.

26 Truong, G., G. Partington and M. Peat, 2005, Cost of Capital Estimation & Capital Budgeting Practice in Australia," *Australian Journal of Management,* 33 (1), 95 – 121.

27 Lonergan, W., 2001, The Disappearing Returns. JASSA, 1(Autumn), 8-17.

28 KPMG. (August 2005). The Victorian Electricity Distribution Businesses Cost of Capital - Market practice in relation to imputation credits Victorian Electricity Distribution Price Review 2006 – 10.

29 Cannavan, Finn and Gray (2004) estimate the value of imputation credits from the concurrent prices of ordinary shares and derivatives known as individual share futures contracts and low exercise price options. These derivatives do not entitled the holder to dividends so the difference in market value

appropriate interpretation of the evidence from a whole range of dividend drop-off studies. It is also consistent with observed market practice. Consequently, it has been, and remains, our view that the best point estimate for gamma is zero.

The submission by GGT (gamma = 0.2) reflects their view that, even if the AER's interpretation of dividend drop-off studies is accepted, then examination of more recent data implies a lower value for imputation credits.

In our view, zero must be included within the reasonable range for any estimate of gamma. Consequently, we adopt zero as the lower bound for our reasonable range. Our view is that the upper bound of the reasonable range should be set to 0.4. This is based on:

(a) An estimate of 0.57 for theta, and an estimate of 0.7 for *F*. That is, even if one fully accepts the single result from Beggs and Skeels (2006) on which the AER focuses and ignores the fact that it is conditional on dividends being valued at 80% of face value, this must be adjusted to reflect the extent to which firms actually distribute franking credits. Note that $0.57 \times 0.7 = 0.4$.

(b) The ERA's last estimate for gamma of a range of 0.3 to 0.6 and the need for a degree of regulatory stability.

Consequently, we consider the estimated value for imputation credits of 0.2 by GGT to be appropriate and that a reasonable range for this parameter, based on all of the evidence and analysis that is now available, is 0 to 0.4.

We note that BHPB has proposed a range of 0.5 to 0.65 for gamma. This is based on Australian regulatory precedent (0.5) and the most recent estimate proposed by the AER (0.65). BHPB has presented no new data or reasoning in relation to this parameter. In effect the BHPB submission simply re-states previous regulatory estimates of gamma. We have already considered these estimates, and what we consider to be the problems and internal inconsistencies involved with them, in our analysis above. That is, these past regulatory values have already been considered when arriving at our recommended range of 0 to 0.4.

between the ordinary shares and derivatives should reflect the market value of dividends during the term of the option, and any associated imputation credits. For the period July 1997 – December 1999, the estimated value for imputation credits is zero. The AER has not relied upon this evidence in its WACC review because the sample period pre-dates the cash rebate provision of 1 July 2000. However, examining the time-series of estimates from Beggs and Skeels (2006) shows that the estimated value of credits from July 1999 – July 1999 (0.42) is not significantly different from the estimated value of credits from 1 July 2000 – 10 May 2004 (0.57). The one-year period between these two time series has an estimated value for imputation credits of 0.13, which is relied upon by Beggs and Skeels to contend that the value of imputation credits increased when the cash rebate was introduced. Our view is that the time series estimates from this paper simply show sample-specific fluctuations in the estimated value of cash versus imputation credits. The market value of a fully-franked dividend of $1.00 is approximately $1 throughout the period under study.

3.5 Equity beta

3.5.1 Proposed beta and past estimates

GGT proposes an equity beta range of 1.0 – 1.8, compared to the reasonable range of 0.80 – 1.33 adopted by the ERA in its 2005 GGP determination, and estimates of 1.0 adopted by the ACCC in determinations relating to gas pipelines made from 2002 – 2008.[30]

BHPB has proposed an equity beta point estimate of 0.7. The BHPB submission notes that the GGT proposal to increase the top of the reasonable range to 1.8 is based largely on (a) a "first principles" or conceptual analysis of the risks involved with the GGP, and (b) an analysis of the beta estimates of a group of mining companies that are said to be representative of the customers of the GGP.

BHPB submits that the GGT first principles analysis is incomplete, it considers only those characteristics of the GGP that imply higher than average risk and ignores a number of characteristics that imply lower than average risk – and that the omitted "low risk" characteristics might more than offset the "high risk" characteristics that formed the basis of the GGT submission.

BHPB also submits that the GGT analysis of mining companies was inappropriate, and in the alternative that even if this was an appropriate analysis it was not properly performed.

Our analysis of the GGT proposal in the remainder of this section largely accepts these conceptual points made by BHPB. We conclude that there are indeed some characteristics of the GGP that imply higher than average risk and some that imply lower than average risk and that these factors will have an offsetting effect on the equity beta. We also conclude that the GGT equity beta analysis justifying an upper bound of 1.8 is problematic.

However, the BHPB submission is not clear about the basis for its proposed estimate of 0.7. This seems to be based only on the equity beta estimate adopted by the Essential Services Commission of Victoria in its recent gas distribution price review. Rather, the BHPB submission largely centres around conceptual reasons as to why the GGT proposed upper bound is unreasonably high.

3.5.2 GGT's Qualitative assessment

The first half of the equity beta analysis submitted by GGT relates to a qualitative assessment of why the equity beta estimate should be greater than the prior or default assumption of one. The qualitative argument of GGT is that the

[30] See Table 4, page 33 of Attachment 4 to the GGP submission, referenced here as Synergies Economics Consulting (2009) Equity beta analysis.

pipeline's customer base of mining companies carries a relatively high exposure to economic conditions. The two largest pipeline customers (which we presume are BHP Billiton and Rio Tinto) account for 41 and 18 per cent of throughput respectively. So the argument is that, if the average pipeline serving residential and industrial customers has an equity beta of one, then this particular pipeline must bear relatively more systematic risk.

Counter to this argument is the concession by GGT that 83 per cent of revenue is covered by take-or-pay contracts, so the volume risk is associated with just 17 per cent of the revenue base. The submission goes on to contend that, while 83 per cent of revenue is covered by take-or-pay contracts, the value of these contracts is contingent upon the solvency of the counterparties.

The limitation of this argument is the assertion that the incremental risk associated with the mining customer base necessarily outweighs the reduction in risk associated with long-term take-or-pay contracts. In addition, if indeed BHP Billiton and Rio Tinto are the two customers who have contracted for 59 per cent of pipeline volume, there seems minimal risk that these companies will default on their contractual obligations.[31] There have been high profile examples of mining projects being deferred, workforce reductions and some mining companies have experienced financial distress. But the submission does not contain substantive information which implies that any actual GGP contracted volume is at risk. Consequently, it is difficult to conclude from the qualitative arguments put forward that this particular pipeline bears more or less systematic risk than an average pipeline.

The submission concludes that:

> GGP's systematic risk is considered higher than other regulated gas pipeline businesses in Australia given its exposure to mining companies and activities. In the short- to medium-term, this exposure is mitigated by long-term take-or-pay contracts, however this protection is only as strong as the underlying financial strength of the counterparty.[32]

In our view, the qualitative argument in GGT's submission is insufficient to establish that the systematic risk of GGP is higher than that of the average gas pipeline business. The submission points to two key aspects of the GGP pipeline – one of which would tend to increase systematic risk (cyclical commercial customers) and one of which would tend to decrease systematic risk (long-term take-or-pay contracts). GGT has not presented any analysis to support its contention that the former effect dominates the latter. Moreover, no analysis has been presented to show how GGP compares with other pipelines on each of

[31] At the time of writing, long-term credit ratings issues by Standard and Poor's were A+ for BHP Billiton and BBB for Rio Tinto.

[32] Synergies Economics Consulting (2009), Equity beta analysis, p.27.

these metrics. Consequently, it is our view that little weight should be applied to this qualitative analysis.

We note that the BHPB submission makes a similar point. Some characteristics of the GGP implies higher than average systematic risk and some imply lower than average systematic risk. These will work to offset each other to some degree. Neither submission provides compelling empirical evidence as to which effect might dominate the other or how these effects might be quantified as against other pipelines.

3.5.3 GGT's Quantitative assessment

The GGT submission on equity beta also contains a quantitative assessment. The quantitative estimate of equity beta is derived from 19 beta estimates of Australian-listed metals and mining companies, and six beta estimates of Australian- and US-listed gas transmission and distribution companies.[33] The upper bound equity beta estimate of 1.8 submitted by GGT is derived in the following manner.

First, the submission presents an estimate of the average asset beta for eight Australian nickel, iron ore and gold producers, estimated at 2.37.[34]

Second, the estimated asset beta for GGP is estimated in the GGT submission to be 0.73, computed as $0.83 \times 0.40 + 0.17 \times 2.37 = 0.73$. The figure of 83 per cent represents the proportion of revenue contracted under take-or-pay agreements, implying that 17 per cent of revenue will fluctuate with demand from the mining sector. The figures of 0.40 and 2.37 represent the estimated asset betas provided in the submission associated with the typical gas pipeline and a representative mining customer.

Third, the GGT submission provides an estimated equity beta of 1.8 by re-levering the estimated asset beta of 0.73 according to the following equation:[35]

33 See Tables 1 – 3, pages 31 – 32 of Attachment 4 to the GGP submission.

34 See Table 2, page 31 of Attachment 4 to the GGP submission.

35 See page 10 of Attachment 4 to the GGT submission. The same equation is used in the submission to convert estimated equity betas to asset betas of the listed companies. The ERA uses a different equation in expressing the relationship between equity and asset betas, discussed below, but these differences in equations are not central to our discussion of the quantitative analysis presented in the GGT submission.

$$\beta_e = \beta_a + (\beta_a - \beta_d) \times \left[1 - \left(\frac{r_d}{1+r_d}\right) \times \tau \times (1-\gamma)\right] \times \frac{D}{E}$$
$$= 0.73 + (0.73 - 0.00) \times \left[1 - \left(\frac{0.0817}{1.0817}\right) \times 0.3 \times (1-0.2)\right] \times \frac{60}{40}$$
$$= 0.73 + 0.73 \times 1.47$$
$$= 1.80$$

This process of estimating the systematic risk of GGP, presented in the GGT submission, is unreliable on three grounds. First, the estimated asset beta of 2.37 for GGP customers is unreasonably high, for estimation reasons which we discuss in more detail below. Second, even if this was a reliable estimate of the asset beta for GGP customers, there is an assumption that the remaining 83 per cent of revenue is exposed to the typical systematic risk of a gas pipeline. That is, it assumes that the average pipeline has the same risk as a pipeline which has 100 per cent take-or-pay contracts. Third, there is an assumption that the revenue allocation amongst the fixed versus variable volume is appropriate to estimate a weighted average asset beta. Technically, this allocation should be performed on the basis of the value associated with the two volume classifications. This issue is relatively unimportant in the context of the statistical issues discussed below, and a value-based allocation would not necessarily be more reliable than a revenue-based allocation. We merely highlight that there is no acknowledgement that the revenue-based allocation is merely an approximation of the risks associated with two volume types.

The primary limitation of the quantitative analysis is that the beta estimates are generated from a sample which excludes beta estimates which were insignificantly different from zero, according to a *t*-test of statistical significance. The standard technique for estimating a company's equity beta is to perform an ordinary least squares (OLS) regression of stock returns against market returns. In this instance, this regression analysis was performed using 60 months of historical data. The resulting coefficient on market returns is the beta estimate. The regression analysis also generates a standard error, which is a measure of the imprecision of the beta estimate.

Beta estimates derived from this technique often have very high standard errors because the historical returns on an individual stock are affected to a large degree by company-specific factors. So in using comparable firm analysis to estimate the systematic risk of a given firm, it is reasonable to place relatively greater weight on beta estimates that are estimated with greater precision. A lower standard error means we have more confidence that the beta coefficient is less affected by sampling error – random events that occurred during the period under study.

The technique adopted in the GGT submission to account for imprecise beta estimates is to remove observations for which the beta coefficient divided by the standard error is less than two (that is, the *t*-statistic computed relative to a null hypothesis of zero is less than two). This means that, if there were two beta estimates with the same standard error, and therefore affected by the same degree of imprecision, there is more chance of retaining the high beta estimate than the low beta estimate. The resulting beta estimates are biased upwards.

That is, there are two reasons why the beta estimate for a particular firm might be insignificantly different from zero. First, the estimate might be so heavily contaminated by sampling error that the true relationship between stock and market returns cannot be reliably estimated. In other words, the signal to noise ratio is so low that the resulting estimate is unreliable and meaningless. The second reason for a beta estimate being insignificantly different from zero is that the true beta really is very small. It might be appropriate to exclude poorly estimated betas, but if we exclude beta estimates simply because they are small the result will be an upward bias in the average.

An empirical estimate of this bias is 35 per cent, derived from 12,031 beta estimates for 1,717 Australian-listed firms using monthly data from 1979 – 2003.[36] This problem is exacerbated by the use of a relatively short window in order to generate beta estimates. Longer estimation periods will generally produce estimates with higher statistical reliability and lower standard errors. When all available data is used to generate beta estimates, our empirical estimate of the bias associated with the *t*-statistic filter is 14 per cent.

To demonstrate the impact of the techniques used in the GGT submission for estimating equity and asset betas, we computed beta estimates for 35 companies in the S&P/ASX 200 Resources Index, excluding the 22 energy companies, using all available returns information from January 1973 to April 2009.[37] As we discussed earlier it is questionable whether this analysis of the customer base provides useful information about the systematic risk of the pipeline itself. But for completeness we present beta computations for Australian mining companies using all available returns data and without applying the *t*-statistic filter. Our estimates are presented in Table 3 below.

The average equity beta estimate for this sample is 1.5, compared to the average equity beta estimate of 2.5 reported in Appendix B of Attachment 4 to the GGT submission. The average equity beta estimate of 1.5 is due to the relatively high

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36 See Table 1 of Gray, Hall, Klease and McCrystal (2009). The average OLS beta estimate derived from four years of monthly returns is 1.16, which increases to 1.57 when the *t*-statistic filter is applied, an increase of 35 per cent. An additional filter relied upon in the GGP submission is to exclude observations in which the adjusted R-squared statistic is less than 10 per cent. The magnitude of the upward bias associated with this filter is comparable to that associated with the *t*-statistic filter. The average beta estimate in the sample of Gray et al. derived from using all available stock returns was 1.08, which increases to 1.23 if the *t*-statistic filter is applied, an increase of 14 per cent.

37 From June 1992 – April 2009, the market index used is the All Ordinaries Index. From January 1973 – May 1992 the market index used is the Datastream Total Market Index. All returns are total returns computed on a continuously-compounded basis.

beta estimates for small firms. On a market capitalisation weighted basis, the average equity beta estimate is 1.2, largely due to the estimates for BHP Billiton (1.0), Rio Tinto (1.3) and Newcrest Mining (1.1) which contribute 76 per cent to the market capitalisation of the sample. Hence, the two largest customers of the pipeline have equity beta estimates which are marginally above one, as are the estimates for the most reliable observations in the sample (those with large market capitalisations and long trading histories).

The average asset beta is computed according to the equation below, which is the unlevering equation that is favoured by the ERA:

$$\beta_a = \beta_e \frac{E}{V} + \beta_d \frac{D}{V}$$

where:

$\frac{E}{V}$ and $\frac{D}{V}$ represent the relative proportions off equity and debt financing respectively (on a market value basis), which we compute using average leverage figures over the returns estimation period for each firm;

β_e is the equity beta estimate; and

β_d is an estimate of the systematic risk of debt financing, which we set to zero, consistent with the approach of the recent decisions of the ACCC and AER.

The equally-weighted average asset beta estimate is 1.3 and the market capitalisation weighted average is 0.9. BHP Billiton, Rio Tinto and Newcrest Mining have asset beta estimates of 0.8, 0.9 and 0.9, respectively. By contrast, the GGT submission included an estimated asset beta (using a different proposed unlevering formula) for pipeline customers of 2.73.

Table 3. Equity beta estimates for Australian mining companies

Name	Months	Equity beta estimate	Asset beta estimate	Avg lev (%)	Market cap ($b)
BHP Billiton	436	1.0	0.8	29	115.1
Rio Tinto	436	1.3	0.9	21	31.3
Newcrest Mining	250	1.1	0.9	14	14.4
Fortescue Metals Group	159	1.5	1.4	7	8.9
Lihir Gold	162	0.8	0.7	9	7.2
Bluescope Steel	81	1.4	1.1	22	4.3
Sims Metal Management	209	1.3	1.2	10	3.9
Alumina	436	1.3	1.2	13	3.5
Onesteel	102	1.3	0.9	34	3.0
Aquarius Platinum	115	1.7	1.4	14	2.6
OZ Minerals	159	1.8	1.5	15	2.6
Equinox Minerals	175	1.9	1.6	13	1.7
Sino Gold Mining	76	0.5	0.5	7	1.5
Iluka Resources	250	0.6	0.5	21	1.4
Macarthur Coal	93	1.9	1.8	8	1.1
Mount Gibson Iron	250	1.7	1.1	32	0.9
Western Areas	105	1.5	1.4	6	0.9
Minara Resources	181	1.8	1.4	23	0.9
Panaust	159	2.0	1.9	7	0.7
Murchison Metals	97	1.7	1.7	0	0.7
OM Holdings	133	1.0	0.8	16	0.7
Kingsgate Consolidated	159	1.0	0.9	5	0.5
Atlas Iron	52	2.2	2.2	0	0.5
Dominion Mining	250	0.6	0.6	2	0.5
Independence Group	87	1.8	1.8	4	0.4
Gindalbie Metals	180	1.7	1.6	3	0.4
St Barbara	436	1.2	0.9	25	0.4
Straits Resources	177	2.1	1.3	37	0.4
Avoca Resources	84	0.9	0.8	3	0.4
Panoramic Resources	91	2.1	2.0	8	0.4
Kagara	112	0.9	2.5	13	0.4
Lynas	159	2.1	2.0	6	0.3
Sundance Resources	183	1.7	1.7	1	0.3
Platinum Resources	102	2.1	2.1	2	0.3
Mincor Resources	141	2.0	1.8	9	0.2
Equal-weighted average	**179**	**1.5**	**1.3**	**13**	**6.1**
Market cap wgtd avg	**358**	**1.2**	**0.9**	**20**	

If we were to estimate the pipeline's asset beta using the same weighting scheme adopted in the GGT submission, but instead using an asset beta estimate of 1.3

for a representative mining company, the resulting asset beta for the pipeline would be 0.55, computed as 0.83 × 0.40 + 0.17 × 1.3 = 0.55.

If this were then re-levered to an equity beta estimate according to the ERA's preferred re-levering equation, and assuming 60 per cent gearing, the resulting equity beta estimate would be 1.38, as shown below:

$$\beta_e = \beta_a \frac{V}{E} - \beta_d \frac{D}{E} = 0.55 \times \frac{100}{40} - 0 = 1.38.$$

If we were to use the market capitalisation weighted average asset beta estimate of 0.49 in this computation, the resulting equity beta estimate would be 1.23. This is more consistent with the argument in the submission that customer risks directly impact upon the risk of the pipeline, because it is weighted towards the major customers, BHP Billiton and Rio Tinto. The equity beta estimate of 1.23 is derived from an average asset beta of 0.49 (that is, 0.83 × 0.40 + 0.17 × 0.9 = 0.49), which is re-levered to an estimated equity beta of 1.23 as shown below:

$$\beta_e = \beta_a \frac{V}{E} - \beta_d \frac{D}{E} = 0.49 \times \frac{100}{40} - 0 = 1.23.$$

Consequently, even if we were to accept that the methodology proposed in the GGT submission for estimating the asset beta, a more appropriate estimate of the resulting asset beta would be in the order of 0.49 – 0.55, and the resulting equity beta estimate would be in the order of 1.23 – 1.38. Further, since the premise of the submission is that the asset beta of the customer base is directly related to the systematic risk of the pipeline, if this methodology were to be accepted, the appropriate beta estimates would be at the lower end of these ranges.

Our conclusion in this respect is also consistent with the BHPB submission on this point. BHPB have submitted that the set of comparable firms used by GGT is inappropriate and that a small number of firms in the set drive up the estimated equity beta.

3.5.4 Analysis of comparable firms

Ideally, an appropriate equity beta for GGP could be estimated via the analysis of a large number of listed firms that are directly comparable to GGP. However, there are no firms listed on the ASX that are pure-play gas pipeline businesses with the same mix of commercial customers and contracting arrangements as GGP. Indeed there are very few firms listed on the ASX whose operations are substantially in energy transmission and distribution.

In its recent Review of WACC Parameters, the AER considered equity beta estimates for the small number of firms that were considered to be comparable to the benchmark electricity distribution or transmission firm. Having examined the empirical data and a range of beta estimates, the AER has adopted a point estimate of 0.8.

In our view, this estimate is neither robust nor compelling. It is based on a very small number of "comparable" firms, the majority of which did not even have data available for the full estimation period. Moreover, it is generally accepted that the gas pipeline business has higher systematic risk than the electricity transmission and distribution business because of its greater exposure to commercial/industrial customers.

Consequently, it is our view that this analysis of the available set of the nearest comparable firms should not be considered to be an appropriate point estimate for the equity beta of GGP, but might be considered to represent a lower bound. That is, for the reasons set out above, our view is that it would be unreasonable to suggest that the equity beta of GGP is below the 0.8 estimate that the AER has adopted for electricity transmission and distribution firms.

3.5.5 Conclusions and recommendations

Our conclusion is that GGT has not presented persuasive evidence that the systematic risk faced by GGP is any different to that which applies to the average gas pipeline business. To conclude that it has relatively higher systematic risk relies upon an assertion that the above-average risks of its customer base outweigh any risk reduction associated with a large contractual volume associated with take-or-pay contracts. The returns data shows that small mining companies do have equity and asset beta estimates substantially above one. But for this result to flow through to higher risk for GGP requires some quantification that this relative risk exposure outweighs any relative risk reduction associated with take-or-pay contracts with large mining companies. No such quantification of this risk has been presented.

However, in our view it is reasonable to specify a range for the equity beta estimate, as the ERA did in its 2005 GGP determination, in which a range of 0.80 – 1.33 was used.

Taking all of the information available to us, our view is that an appropriate range for the equity beta estimate is 0.8 – 1.2.

This conclusion is based on:

(a) The mid-point estimate for any equity beta is 1.0, the beta for the average firm. One would only adopt an estimate different from 1.0 to the extent supported by reliable empirical analysis;

(b) The ACCC has consistently adopted an equity beta of 1.0 for gas pipeline businesses;

(c) The ERA has previously used a range of 0.8 to 1.33 for the GGP and we are unaware of any reason why its systematic risk is any higher or lower than it was previously;

(d) After considering a range of equity beta estimates for the available "comparable" firms, the AER has adopted an equity beta estimate of 0.8 for electricity transmission and distribution firms (also with 60% assumed gearing);

(e) The GGT submission on this point notes that there are some aspects suggesting that the pipeline's systematic risk is higher than that faced by the average pipeline business and some evidence that systematic risk is below average. There is no compelling evidence to suggest which of these effects might dominate the other; and

(f) Even if the approach that was submitted by GGT was adopted (which we do not accept) application of the beta estimates in Table 3 using the ERA's favoured approach for re-levering betas produces an equity beta estimate of 1.23, as explained above. In our view, there is no empirical evidence to support an equity beta higher than this.

In summary, for the equity beta range, we have adopted:

(a) A lower bound of 0.8:

a. This is consistent with the lower bound of 0.8 adopted by the ERA in its previous GGP determination;

b. This is also consistent with the equity beta point estimate recently adopted by the AER for electricity transmission and distribution companies. The AER has adopted a 60% gearing assumption for the electricity business, consistent with that proposed for GGP. Consequently, the leverage (or financial risk) component of equity beta is the same for the electricity businesses as for GGP. It is generally accepted that the gas pipeline business has higher systematic risk than the electricity transmission and distribution business because of its greater exposure to commercial/industrial customers. That is, equity beta has two components – financial or leverage risk, and the systematic risk of the operations of the particular business. The electricity businesses and GGP are considered to have the same leverage risk (i.e., 60% gearing), but the systematic risk of the business operations for GGP is considered to be at least as great as that of the electricity businesses. Consequently, the equity beta estimate of 0.8 is adopted as the lower bound of our reasonable range; and

c. It forms the lower bound of a symmetric range around a mid-point estimate of 1.0 (see below).

(b) A mid-point estimate of 1.0:

a. This is consistent with the point estimate of 1.0 that the ACCC has consistently adopted for the equity beta of gas pipelines and is also consistent with the 60% gearing assumption that is typically used;

b. The GGT submission notes that there are some aspects suggesting that the systematic risk of the GGP is higher than that faced by the average pipeline business (exposure to customers whose fortunes are cyclical and linked to broad market movements) and some evidence that systematic risk is below average (substantial longer-term take-or-pay contracts). There is no compelling evidence to suggest which of these effects might dominate the other; and

c. The equity beta of the average firm is 1.0. The systematic risk of GGP's operations is lower than that of the average firm given the nature of its business, but the benchmark level of gearing is approximately double that of the average firm listed on the ASX. That is, GGP ranks lower than the average firm on one element of equity beta and higher on the other. This is consistent with a mid-point equity beta estimate close to that of the average firm, of 1.0.

(c) An upper bound of 1.2:

a. The GGT proposal sets out a methodology for incorporating the systematic risk of the customer base into the estimate of the equity beta for GGP. If this approach is applied to the equity beta estimates in table 3 above, using the ERA's preferred re-levering formula, the result is an equity beta estimate of 1.2;

b. An upper bound of 1.2 completes a symmetric range with a lower bound of 0.8 and a mid-point of 1.0; and

c. The ERA has previously adopted an upper bound of 1.33 for the GGP. We agree that the upper bound estimate should be substantially above 1.0 given the uncertainty with which betas are estimated and the lack of listed companies that are even broadly comparable to GGP. However, our view is that the available evidence no longer supports an estimate of 1.33, even as the upper bound of the reasonable range – that the presently available evidence does not support an upper bound above 1.2.

Using the re-levering approach favoured by the ERA and a 60% gearing assumption, the equity beta range of 0.8 to 1.2 corresponds to an asset beta range of 0.3 to 0.5.

3.6 Credit rating

3.6.1 Submissions

GGT has submitted that the credit rating should be set at BBB-, based primarily on the analysis of a small set of what it considered to be comparable firms.

BHPB has submitted that the credit rating should be set at BBB+, consistent with the last GGP determination by the ERA.

3.6.2 ERA estimates of credit rating

In its 2005 GGP Determination, the ERA adopted a BBB+ credit rating for GGP. The ERA noted that:

> The Authority has assumed the appropriate benchmark for examining costs of debt for the GGP is a regulated energy utility with 60 percent gearing and a credit rating of BBB+, consistent with the Standard & Poor's standard ratios for transmission and distribution companies.[38]

3.6.3 AER estimates of credit rating

In its recent review of WACC parameters for electricity transmission and distribution businesses, the AER notes that the previously adopted value for the credit rating for transmission and distribution network service providers was BBB+ and that the Joint Industry Associations (JIA) of network service providers also proposed a BBB+ credit rating. The AER's final determination in this regard was to set the credit rating (based on a 60% gearing assumption) to BBB+.[39] In explaining this decision, the AER concluded that:

> The AER observes that the different techniques (i.e., median analysis and the best comparators approach) provide a range of credit ratings from BBB+ to A-. Given there is no clear finding from the available evidence, the AER is not persuaded at this time that the previously adopted credit rating of BBB+ should be departed from.[40]

The submissions to the AER's review of WACC parameters were quite detailed and included information regarding the key financial ratios that ratings agencies use when determining credit ratings. The AER summarises some of this information in the figure below.

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[38] GGP Amended Draft Decision, 2005, p. 63.

[39] AER WACC parameter review, p. v.

[40] AER WACC parameter review, p. xviii, (typographical errors in original have been corrected).

Table 9.4 – Electricity Distribution/Transmission: FFO/Interest Cover & FFO/Debt (%)

Comparator	Metric	2002	2003	2004	2005	2006	2007	Ave. [(a)]
ElectraNet	Interest Cover	2.0	2.3	2.8	2.3	2.5	2.1	**2.3**
	FFO/Debt	6.8%	8.0%	10%	10%	9%	10%	**9%**
	Credit Rating	BBB+	BBB+	BBB+	BBB+	BBB+	BBB+	**BBB+**
GasNet[(c)]	Interest Cover	2.0	2.0		1.9	1.8	2.5	**2.0**
	FFO/Debt	7.0%	6.8%		5.7%	5.3%	13.8%	**7.7%**
	Credit Rating	BBB	BBB		BBB	BBB	BBB	**BBB**
United Energy [(b)]	Interest Cover		1.8					**1.8**
	FFO/Debt		11.3					**11.3%**
	Credit Rating		BBB					**BBB**
Envestra[(c)]	Interest Cover	1.5	1.59	1.6	1.5	1.6	1.6	**1.6**
	FFO/Debt	3.9	4.2	4.1	3.8	4.4	4.1	**4.1%**
	Credit Rating	BBB	BBB	BBB	BBB	BBB-	BBB-	**BBB**
DUET [(b)]	Interest Cover		2.0	2.0	2.2	1.8	1.6	**1.9**
	FFO/Debt		7.4%	6.9%	8.1%	5.8%	4.0%	**6.4%**
	Credit Rating		BBB-	BBB-	BBB-	BBB-	BBB-	**BBB-**

Source: Standard and Poor's industry report cards (2002 - 2008) and United Energy Company Report Card (23 December 2008)

Notes:

(a) Median credit ratings used rather than averages.

(b) The ACG places less weight on these businesses due to the presence of the businesses's other activities

(c) These businesses are gas networks and are exposed more to volume risk.

Source: AER WACC parameter review, p. 386.

The AER also notes that prior regulatory determinations for electricity distribution and transmission have uniformly adopted a BBB+ credit rating (with 60% gearing). This is summarised in the following figure from the AER WACC Review Final Decision.

Table 9.1: Previously adopted value – credit rating level

Service provider	Source	Credit rating level
Transmission (all jurisdictions)	NER	BBB+
Distribution (NSW)	NER	BBB+
Distribution (ACT)	NER	BBB+
Distribution (Tasmania)	OTTER (2007)	BBB+
Distribution (Victoria)	ESC (2006)	BBB+
Distribution (Queensland)	QCA (2005)	BBB+
Distribution (South Australia)	ESCOSA (2005)	BBB+
Overall range		**BBB+**

Source: AER WACC parameter review, p. 347.

3.6.4 Reasoning for proposed credit ratings

GGT have proposed a credit rating of BBB- on the basis of an analysis of four comparable firms set out in the following figure.

Table 1 Standard and Poor's ratings of owners and operators of gas pipeline infrastructure in Australia (current as at 13 March 2009)

Business	Current Standard and Poor's rating
Energy Partnership (Gas) Pty Ltd	BBB-
Envestra Limited	BBB- (negative)
GasNet Australia (Operations)	BBB
WA Gas Networks	BBB-

Source: www.standardandpoors.com.au

BHPB submit that there is no justification for lowering the estimated credit rating to BBB- given that the GGP has a number of contractual arrangements in place with highly-rated counterparties who have no economical alternative fuel source. BHPB conclude as follows:

> Based on the previous regulatory pipeline determinations as summarised by GGT,54 the take-or-pay contractual agreements in place (including credit support requirements) and the current credit rating of GGT's most significant customer and owners there is no basis to support a change to BBB-.[41]

[41] BHPB submission, p. 40.

3.6.5 Analysis and recommendations

We agree with the general approach of both the ERA and AER set out above. The key elements of this approach are:

a) an analysis of the credit ratings of appropriate comparable firms; and

b) consideration of key financial ratios that would be considered by ratings agencies when determining a rating.

We note that the ERA has previously considered that the appropriate benchmark is the credit rating of "a regulated energy utility with 60% gearing." This is exactly what the AER has just estimated. Their conclusion is that a BBB+ rating is appropriate and this conclusion is also consistent with the value proposed by the regulated businesses via the JIA. However, the AER did note that "gas networks are exposed to more volume risk" and that this has a potential impact on their credit ratings.

Our view is that:

a) Credit ratings, like a number of other WACC parameters, cannot be precisely quantified, but must be estimated from the available market data. Consequently, it is more appropriate to consider an economically reasonable range than a single point estimate.

b) The credit ratings of regulated energy utilities are certainly relevant data and should be considered;

c) The extent to which a gas network might be exposed to volume risk should also be considered. This would include a consideration of the extent to which volume risk was

    1. exacerbated by having customers that were significantly exposed to cyclical economic conditions; or

    2. mitigated by take-or-pay contract arrangements;

d) Although there is not a perfect deterministic relationship between financial ratios and credit ratings, key financial ratios (such as interest coverage) should be examined to determine whether the allowed return would support the assumed credit rating. This would be done in the context of the regulatory model after the determination of the allowed return. If the allowed return was such that the interest coverage ratio in the regulatory model was 1.5, for example, an assumed BBB+ credit rating would have to be re-considered.

We note that the BBB- credit rating proposed by GGP does not consider any key financial ratios. For example, Envestra's interest coverage ratio is only 1.6.

Our conclusion is that an appropriate range for the credit rating is a lower bound of BBB to an upper bound of BBB+. This is based on assumptions of 60%

gearing and an interest coverage ratio of approximately 2.0. A lower credit rating could be justified by:

a) evidence that comparable firms with (approximately) 60% gearing *and* an interest coverage ratio of (approximately) 2.0 have credit ratings of BBB- or lower; or

b) evidence that the final allowed return is insufficient for GGP to maintain an interest coverage ratio of (approximately) 2.0.

In the remainder of this report we adopt a credit rating range from a lower bound of BBB to an upper bound of BBB+.

3.7 Debt margin

The debt margin is the difference between the yield on corporate debt with the assumed credit rating and government bonds with the same maturity. In the case at hand, this would mean the spread between the yields on ten-year government bonds and ten-year BBB+ or BBB-rated corporate bonds. It is common, and uncontroversial, that consistency demands that the debt margin should be measured over the same averaging period that is used to set the risk-free rate.

The primary issue, then, is one of estimating the yield on ten-year BBB+ or BBB-rated corporate bonds. This is a difficult task as ten-year BBB+ or BBB corporate bonds do not currently exist in the Australian market. Consequently, the task is to estimate what the yield on these bonds would be if they existed. In the following paragraphs, we review the approaches that have been proposed for this purpose and comment on their relative strengths and weaknesses.

3.7.1 CBA Spectrum

CBA Spectrum is a commercial data service that is operated by the Commonwealth Bank of Australia, specifically developed for the Australian fixed income market. It is a subscriber service with clients across the Australian and international fixed income markets. Importantly, it is the only source of direct estimates of the yields of 10-year BBB+ or BBB corporate bonds that is available in the Australian market.

3.7.2 AER views about CBA Spectrum estimates

One issue that arose in the AER's recent WACC Review is whether the CBA Spectrum estimates of the yield on 10-year BBB+ bonds are accurate and robust. On this issue, the AER referred to its decision in relation to NSW and ACT electricity transmission and distribution businesses (*NSW DNSP Final Decision*). In that decision, the AER noted that the only currently available estimate of fair value yields for 10-year BBB+ bonds is that provided by CBA Spectrum. No estimates are provided by any other data service providers. Bloomberg provides estimates of yields of BBB bonds out to a maturity of 8 years, but does not provide estimates of yields on 10-year BBB or BBB+ corporate bonds.

In the *WACC Review Final Decision*, the AER concluded that:

> The AER does not consider CBA Spectrum is an appropriate data source to estimate the cost of debt for a 10 year benchmark. The AER's reasons on this issue can be found in its recent final decision for the NSW and ACT electricity distribution determinations.[42]

In assessing whether to accept the only available estimate from (CBA Spectrum) the AER examines all Australian BBB+ corporate bonds with a term to maturity of two years or more. There are a total of nine such bonds. For five of these bonds, the AER was unable to obtain data due to the bonds being illiquid and not trading. This left the AER with four bonds to consider, with terms to maturity of 2, 3, 4, and 6 years respectively. The AER then compared estimates of the market yields of these shorter term bonds with the "fair yield" estimates reported by CBA Spectrum and those of Bloomberg.

The AER concluded that the Bloomberg fair yield underestimates the actual yield of the four bonds (on average) and the CBA Spectrum fair yield overestimates actual yields (on average). The AER notes that the magnitude of Bloomberg's underestimate is less than the magnitude of CBA Spectrum's overestimate. This leads the AER to reject the CBA Spectrum estimate outright and to assign zero weight to it.

The CBA Spectrum estimate for 10-year BBB+ bonds was the only one available in the Australian market, so its outright rejection by the AER leaves no available estimate. The AER's approach was then to create its own estimate. This new estimate is constructed as follows:

> the AER has derived the BBB+ 10 fair year yield by adding the spread between the A rated 8 and 10 year fair yields to the BBB+ 8 year fair yield.[43]

3.7.3 Submissions from regulated businesses

The NSW DNSPs argued that it was not appropriate for the AER to reject the CBA Spectrum estimate and to replace it with an estimate constructed by the AER itself. This argument was made on the basis that:

a) As the only commercially available estimate, CBA Spectrum should receive at least some weight;

b) The AER should not have outright rejected the CBA Spectrum estimate of 10-year BBB+ yields on the basis only that there is another data service that provides fair yield estimates that provide a somewhat closer

[42] *WACC Review Final Decision,* p. 43

[43] *NSW DNSP Final Decision*, p. 226.

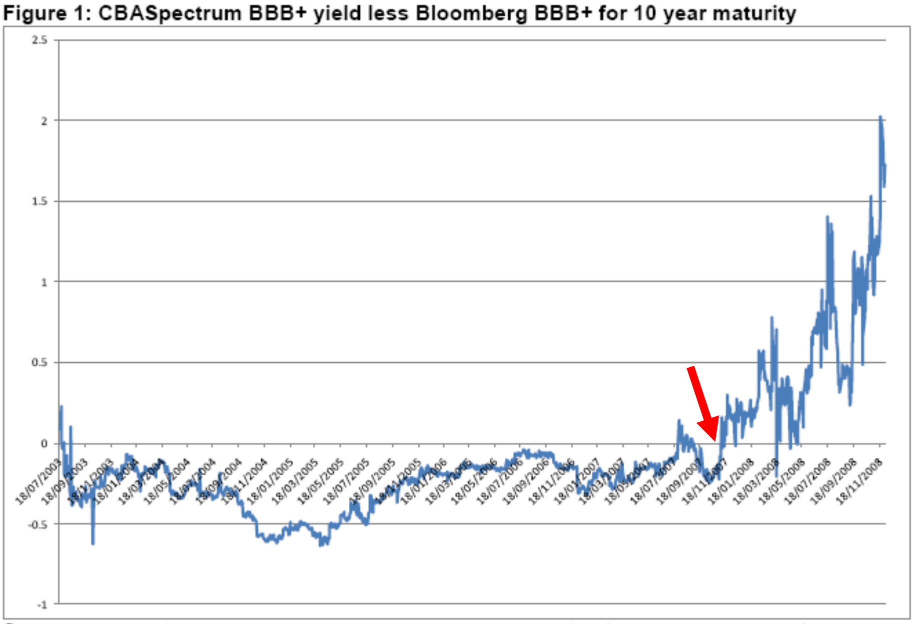
match (on average) to the observed yields of a total of *four short-term* BBB+ bonds (with maturities of 2, 3, 4, and 6 years respectively); and

c) It would be possible for Bloomberg itself to construct an estimate of the fair 10-year BBB+ yield in the same way as that proposed by the AER, but Bloomberg has decided not to do this and not to report such an estimate. If Bloomberg had considered the AER approach to be reliable, it would have employed that approach itself.

In a submission in relation to the NSW and ACT electricity transmission and distribution determinations, CEG (2009) set out the difference between CBA Spectrum estimates of the yield on 10-year BBB+ corporate bonds and the estimate obtained by applying the AER's approach to the available Bloomberg estimates. This is shown in Figure 3 below. The two approaches produce different estimates – in some periods the CBA Spectrum is greater than the AER estimate and in other periods the reverse is true.

Figure 3. Difference between CBA Spectrum and AER/Bloomberg estimates of 10-year BBB+ yield

Figure 1: CBASpectrum BBB+ yield less Bloomberg BBB+ for 10 year maturity



Source: CBASpectrum, Bloomberg, CEG analysis. Bloomberg estimate is based on AER methodology for converting 8 year BBB Bloomberg estimate into 10 year BBB. Note that CBASpectrum data for the 19 September (in the midst of the month with the most turmoil) appear to be aberrant with estimated BBB+ yields rising to 16.56%. Similarly, data for 17 July 2008 also shows a 1.6% fall followed by a 2.2% rise the next day. Data for both dates (17 July and 19 September) date has been excluded from the above and below figures.

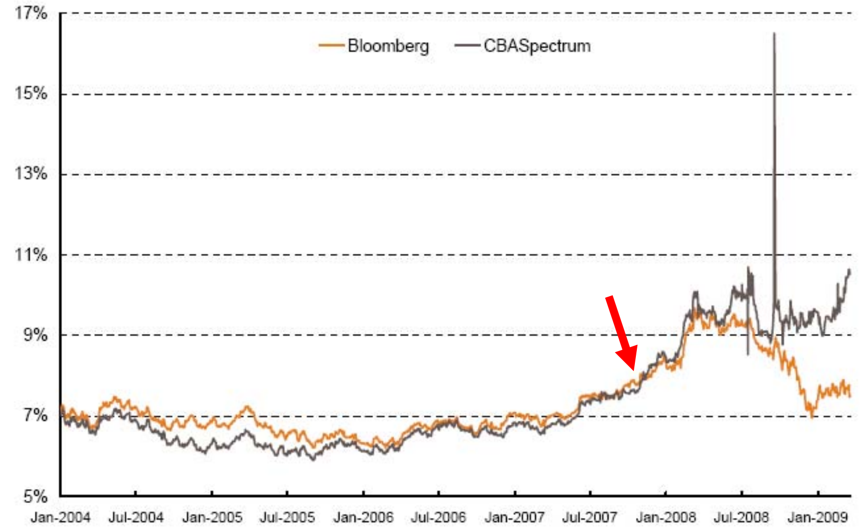
Source: CEG (2009), p. 23.

The red arrow in Figure 3 indicates the point at which Bloomberg ceased publishing its own estimates of the yield on 10-year BBB and BBB+ bonds – October 2007. Prior to this point, the estimates are obtained directly from Bloomberg. After this point, one must apply the AER methodology to create an estimate of the 10-year BBB and BBB+ yield from the yields on bonds with shorter terms to maturity and higher credit ratings. It is over this recent period that the estimates have diverged.

Further light on the divergence between the two estimates is provided in the *NSW DNSP Final Decision*. There the AER sets out the CBA Spectrum yields, estimates from Bloomberg up until October 2007, and the AER-constructed estimates after October 2007. This is illustrated in

Figure **4** below, taken from the *NSW DNSP Final Decision*.

Figure 4. CBA Spectrum and AER/Bloomberg estimates of 10-year BBB+ yield



Source: Bloomberg, CBASpectrum and AER analysis.

Source: *NSW DNSP Final Decision* (2009), p. 54.

Figure **4** shows that the CBA Spectrum and Bloomberg yield estimates were relatively consistent in the period until October 2007 – while Bloomberg was publishing estimates of 10-year BBB yields (indicated by the red arrow). The subsequent period pertains to the AER-constructed estimates using the yields on bonds with shorter terms to maturity and higher credit ratings. Over this subsequent period, the yield estimates diverge considerably. The AER-constructed estimates suggest that yields on 10-year BBB bonds initially rose during the global financial crisis, but then returned to 2004 levels. The CBA Spectrum estimates, by contrast, indicate that these yields remain high.

3.7.4 Conclusions on CBA Spectrum estimates

In the NSW and ACT electricity transmission and distribution determinations, the regulated businesses submitted that the CBA Spectrum estimates of the yield on 10-year BBB+ bonds should receive at least some weight. For the reasons set out above, it is our view that these are strong arguments.

3.7.5 Current estimates

Recall that the AER approach is to construct a new estimate of the yield on 10-year BBB debt as follows:

> the AER has derived the BBB+ 10 fair year yield by adding the spread between the A rated 8 and 10 year fair yields to the BBB+ 8 year fair yield.[44]

If that approach is applied to current Bloomberg estimates, the result is an estimate of 8.2% for the yield on 10-year BBB+ bonds.

The current AER/Bloomberg estimate and CBA Spectrum estimates are summarised in Table 4 below.

Table 4. Current estimates of debt margin

Source	Yield to maturity	Margin to 10-year government bond yield
CBA Spectrum 10-year BBB+ yield, annualised	11.1%	6.6%
CBA Spectrum 10-year BBB yield, annualised	11.6%	7.1%
AER/Bloomberg estimate of 10-year BBB yield, annualised	8.2%	3.7%

The Reserve Bank of Australia[45] publishes quarterly estimates of debt margins for corporate debt in Australia. These figures are based on the observed yields of Australian corporate bonds with 1-5 years maturity. Because these bonds have a shorter maturity than the 10-year bonds that are the basis of regulatory determinations relating to the cost of capital, they are likely to understate the debt margins for regulatory purposes.

The debt margins recently published by the RBA are summarised in Table 5 below.

[44] *NSW DNSP Final Decision*, p. 226.

[45] http://www.rba.gov.au/Statistics/Bulletin/F03.pdf.

Table 5. RBA estimates of debt margin

Date	Debt Margin
February 2009	5.03%
March 2009	5.74%
April 2009	5.38%

We note that the debt margins published by the RBA are substantially higher than those published by Bloomberg, and are lower than those published by CBA Spectrum.

3.7.6 GGT proposal

GGT have proposed a debt margin of 3.6% based on a 10-year BBB- corporate bond yield. GGT have applied the AER/Bloomberg approach to first obtain an estimate of the debt margin for 10-year BBB corporate bonds. This is because Bloomberg does not provide estimates for ratings qualifiers – it provides a single estimate for the group of BBB-, BBB and BBB+ bonds.

GGT then propose to adjust this BBB estimate to their proposed BBB- credit rating by adding one third of the difference between the estimated yield on 8-year A and BBB rated bonds, where both estimates are available from Bloomberg. Our view (set out above) is that further evidence would be required to support the proposed changed in credit rating to BBB-, in which case this step is not required.

3.7.7 Conclusions

In light of the estimates in Table 4 above, GGT's proposed debt margin of 3.6% is conservative. Estimates of debt margins based on CBA Spectrum data are considerably higher than what GGT has proposed. The AER/Bloomberg approach now produces a higher estimate for 10-year BBB bonds than has been proposed by GGT.

Of course, in the final determination, the risk-free rate and debt margin should be estimated using the same averaging period. We do not consider that the evidence presented supports a BBB- credit rating, in which case the last step of the methodology proposed by GGT is not required. The remainder of their methodology is consistent with that recently adopted by the AER and is likely to produce conservative estimates of the debt premium – to the extent that the AER/Bloomberg approach produces considerably lower estimates than those provided by CBA Spectrum.

For the reasons set out above, we do not consider it appropriate to ignore the CBA Spectrum estimates entirely. The CBA Spectrum and AER/Bloomberg estimates are currently different from one another, but in our view the reasons for relying on the AER/Bloomberg approach are flimsy at best. We do not consider it appropriate to place 100% weight on the estimates constructed by the AER from Bloomberg data and to place zero weight on the estimates from CBA Spectrum.

One of the submissions to the AER's review of ACT and NSW electricity transmission and distribution businesses proposed that an appropriate estimate of the credit rating could be obtained by taking an average of the AER/Bloomberg approach and the CBA Spectrum estimate. In the present case, the average of the AER/Bloomberg estimate and the CBA Spectrum BBB+ estimate is 5.1%. Even this mid-point estimate is considerably higher than the debt premium proposed by GGT.

In our view, the AER/Bloomberg approach should be considered to provide the lower bound of the reasonable range for the debt premium. At present, this approach produces an estimate of 3.7%.

It is also our view that some consideration should be given to the CBA Spectrum estimates – as it is a commercial data service that provides the only direct estimate of 10-year BBB and BBB+ corporate bond yields that is available in the Australian market. One way of giving at least partial recognition to the CBA Spectrum estimates is to adopt the proposal made in the ACT and NSW electricity transmission and distribution review – to take the average of the AER/Bloomberg estimate and the CBA Spectrum estimate. Doing this for the CBA Spectrum 10-year BBB+ estimate would be conservative in two respects: (a) it only gives partial recognition to the (higher) CBA Spectrum estimate, and (b) it uses a credit rating at the top of the reasonable range. This procedure produces an estimated debt premium of 5.1%. Using this estimate as the upper bound of the reasonable range would be conservative for the reasons set out above, and is consequently more consistent with regulatory stability.

This is also consistent with the most recent BBB debt premium that has been published by the Reserve Bank of Australia.

For the remainder of this report we have adopted a range of 3.7% to 5.1% for our estimate of the debt premium. In the final decision, the debt premium should be estimated using the same averaging period that is used to estimate the risk free rate. Consequently, these estimates will need to be updated using the relevant CBA Spectrum, Bloomberg and RBA data at the time.

We also note that the AER has recently applied 100% weight to the Bloomberg estimates and zero weight to the CBA Spectrum and RBA estimates. In our WACC calculations below, we provide a set of figures that is consistent with this procedure adopted by the AER.

3.7.8 Conclusion

In Table 6 below, we set out WACC parameter estimates from:

(a) The AER's WACC Review;[46]

(b) The ERA's last GGP determination in May 2005;

(c) GGP's present proposal; and

(d) Our recommended parameter estimates and ranges.

[46] Recall that the AER WACC Review was specifically concerned with electricity transmission and distribution firms. For this reason, firm-specific parameters such as the equity beta are not directly comparable. However, a number of WACC parameters (such as the risk-free rate, MRP, and the value of franking credits that have been distributed to shareholders) are market-wide parameters that apply across all industries and types of businesses.

Table 6. Current and proposed parameter estimates

Parameter	AER WACC Review	ERA GGP Determination (May 2005)	GGT Proposal	FE/SFG Conclusions
Risk free rate	10-40 day averaging period close to start of regulatory control period	5.45% (20-day averaging period prior to start of regulatory control period)	4.27% (20-day averaging period prior to start of regulatory control period)	4.27% (20-day averaging period prior to start of regulatory control period)
Equity beta	0.8	0.8 – 1.33	1.0 – 1.8	0.8 – 1.2
Market risk premium	6.5%	5.0 - 6.0%	7%	6% - 7%
Capitalisation of franking credits (gamma)	0.65	0.3 – 0.6	0.2	0 – 0.4
Gearing	60%	60%	60%	60%
Credit rating	BBB+	BBB+ (Interest coverage ratio of 2.0)	BBB-	BBB – BBB+
Debt margin	Averaging period to match risk-free rate; Estimate constructed from Bloomberg data	0.980 – 1.225 (CBA Spectrum, Yields of comparable bonds, downward adjustment due to availability of offshore borrowing. Debt raising costs of 8-12 bp)	3.725% - 3.900% (Debt raising costs of 12.5 – 30 bp)	3.7% - 5.1% (Debt raising costs to be included in cash flows rather than discount rate)
Corporate tax rate	n/a	30.7% (Average effective tax rate over prior 10 years)	30%	30%

In Table 7 below, we set out our recommended ranges for each WACC parameter and we calculate the aggregated WACC (on a pre-tax nominal basis). We set out two versions of the upper bound. The first is based on our recommended upper bounds. The second uses the AER/Bloomberg estimate of debt premium (3.7%) rather than our recommended upper bound of 5.1% (consistent with the RBA estimate or from applying some weight to the CBA Spectrum estimates). This will enable the ERA to determine the effect of adopting the AER approach to estimating the debt premium, while following our recommendations in all other respects.

Table 7. WACC and parameter ranges

Parameter	Lower Bound	Upper Bound	Upper Bound (Bloomberg Debt Margin Only)
Risk free rate	4.27%	4.27%	4.27%
Equity beta	0.8	1.0	1.0
Market risk premium	6%	7%	7%
Capitalisation of franking credits (gamma)	0.4	0	0
Gearing	60%	60%	60%
Credit rating	BBB	BBB+	BBB+
Debt margin	3.7%	5.1%	3.7%
Corporate tax rate	30%	30%	30%
Required return on equity	9.07%	12.67%	12.67%
Required return on debt	7.97%	9.37%	7.97%
WACC (pre tax nominal)	9.2%	12.9%	12.0%

We note that GGT has proposed to use an estimate of WACC that is 10% below the upper bound of what it considers to be a reasonable range. This is on the basis that the consequences of setting the regulated WACC too high outweigh the consequences of setting it too low.

It also recognises the uncertainty associated with estimating individual parameters and consequently the aggregated WACC. That is, the true cost of funds for the regulated firm cannot be precisely quantified or measured, but must be estimated using the available market data. The resulting estimate may be higher or lower than the true (but unobservable) WACC. Thus, the reasonable range should be considered to provide bounds within which the true (but unobservable) WACC might lie.

The ERA has previously noted that it is manifestly unlikely that the true (but unobservable) value of *every* WACC parameter would be at the extreme end of what was considered to be a reasonable range for that parameter. Consequently, the ERA has considered WACC estimates within the top 10% of the reasonable range to be unreasonable, as they would require *all* WACC parameters to take values close to the extreme boundaries of their reasonable ranges. That is, the GGT submission is consistent with the past practice of limiting the analysis to points within the 90^{th} percentile of the reasonable range that is developed for the WACC.

For these reasons we have computed a range that consists of the 10^{th} to 90^{th} percentiles of the reasonable ranges set out in Table 7 above. Our recommended reasonable range for the aggregated WACC is 9.2% to 12.9%. Restricting this range to the 10^{th} to 90^{th} percentiles produces a range of 9.6% to 12.5%.

If we estimate the debt premium based only on the AER/Bloomberg approach, the upper bound of the reasonable range falls to 12.0%. Restricting this range to the 10^{th} to 90^{th} percentiles produces a range of 9.5% to 11.7%.

Consequently, the 90^{th} percentile WACC estimate is 12.5% if the debt premium is based on Bloomberg, CBA Spectrum and Reserve Bank data, and 11.7% if it is restricted to Bloomberg data only.

These values are both below GGT's proposed WACC of 13.5%. The main point of difference is the equity beta, which has an upper bound of 1.8 under GGT's proposal.

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Appendix A: Derivation of adjustment for franking credits

Officer (1994) examines the effect that dividend imputation has on the cost of equity capital to a firm. He begins with the after-corporate tax required return on equity, r_e, that would usually be estimated via the CAPM. He shows that the pre-corporate tax required return on equity is $\frac{r_e}{1-T}$. He then shows that this pre-corporate tax required return on equity must be adjusted for the assumed value of franking credits (γ) by a factor of $\frac{1-T}{1-T(1-\gamma)}$. This leaves a pre-corporate tax cost of equity capital for a firm of $\frac{r_e}{1-T}\times\frac{1-T}{1-T(1-\gamma)}=r_e\frac{1}{1-T(1-\gamma)}$. This appendix provides some intuition for this adjustment.

Consider a firm that earns a $100 profit and pays $30 of Australian corporate tax, leaving $70 to be paid out as a dividend to shareholders. These shareholders will receive a $70 dividend from the firm and $30 of franking credits, which would have a value of $15 if we assume that gamma is 0.5. This is summarised in Table A.1 below.

Table A.1: Derivation of franking credit adjustment

	Example	General Expression
Firm Level		
Company Profit	100	1
Company Tax, and franking credits created	-30	T
After-tax profit and distribution to shareholders	70	$1-T$
Shareholder Level		
Dividend Received	70	$1-T$
Franking Credit	30	T
Value of Franking Credit	0.5×30	γT

Table A.1 shows that the shareholders receive a dividend of $70 from the firm. The government, via the tax system, provides a franking credit that is worth $15. Consequently, the firm is responsible for providing 70/85=82% of the total return to shareholders and the government provides the other 18%.

The CAPM provides an estimate of the *total* return that is required by shareholders. The WACC, however, requires only that fraction of the total required return that must be provided by the firm. Consequently, the estimated total required return (from CAPM) must be adjusted downward to reflect the assumed value of franking credits. In the example above, the firm was required to contribute $70 of the $85 total return to shareholders. In general, the firm must pay $(1-T)$ and government will contribute γT, so the firm's share of the total is:

$$\frac{1-T}{(1-T)+\gamma T}=\frac{1-T}{1-T(1-\gamma)}.$$

On a pre-corporate tax basis, all of the cash flows can be "grossed up" by dividing throughout by $(1-T)$. Consequently, the firm's contribution to the pre-corporate tax return is $\frac{1-T}{1-T}$ and government's contribution is $\frac{\gamma T}{1-T}$. Of course, the ratio remains the same – the firm must provide a proportion $\frac{1-T}{1-T(1-\gamma)}$ of the total pre-corporate tax return that shareholders require.

Officer (1994) also shows that an adjustment for the assumed value of franking credits can be applied to the firm's cash flows, rather than to the discount rate. The remainder of this appendix reviews Officer's derivations and shows that the intuition for the cash flow adjustment is identical to that in Table A.1 above.

Officer (1994) begins by defining after corporate tax cash flows as $X_o(1-T)$, consistent with the standard textbook treatment. Here X_o represents operating cash flows and T represents the relevant corporate tax rate. The definition of the after corporate tax discount rate that is consistent with this definition of cash flows is stated in his Equation (7) as:

$$r_i=r_E\frac{S}{V}\frac{1-T}{1-T(1-\gamma)}+r_D\frac{D}{V}(1-T) \qquad (1)$$

where:

r_i is the weighted-average cost of capital, reflecting the tax deductibility of interest and the value of franking credits,

r_E is the return on equity capital required by investors,

r_D is the return on debt capital required by investors,

$\frac{S}{V}$ is the proportion of equity finance,

$\frac{D}{V}$ is the proportion of debt finance,

T is the corporate tax rate, and

γ is the value of franking credits.

In this framework, r_D is the return that debtholders require (before personal tax) to compensate them for the risk involved in lending to the firm. Since these interest payments are tax deductible at the corporate level, the firm's after-tax cost of debt capital is $r_D(1-T)$. That is, if debtholders require a return of 7% and the corporate tax rate is 30%, the firm's after-tax cost of debt is 4.9%. Of the 7% required return, 4.9% is provided by the firm and 2.1% is effectively provided by government via the tax system.

The same applies to the cost of equity. Here, r_E is the return that equityholders require (before personal tax) to compensate them for the risk involved in owning shares in the firm. In the Australian regulatory framework, and in commercial practice, r_E is usually estimated using the Capital Asset Pricing Model (CAPM). This provides an estimate of the return that the equityholders require. As is the case for debt, there is a difference between the investors' required return and what the firm must pay if a government tax subsidy is relevant. In particular, equityholders require a total after corporate tax return of r_E. This return potentially has three components: dividends, capital gains, and franking credits. The firm is responsible for generating dividends and capital gains. Franking credits are paid by government via the tax system. Officer's WACC formula quantifies the proportion of r_E that must be generated by the firm, $\frac{1-T}{1-T(1-\gamma)}$, and the proportion that is paid by government via the imputation tax system, $\frac{\gamma T}{1-T(1-\gamma)}$. Thus, the firm's after-tax cost of equity capital is $r_E \frac{1-T}{1-T(1-\gamma)}$. Indeed this is the key contribution of Officer (1994). He derives the proportion of the required return on equity that must be generated by the firm via dividends and capital gains.

This point is well recognized in the academic and practitioner literature. Copeland, Koller and Murrin (2000, p. 134), for example, note that the WACC is "the opportunity cost to all the capital providers weighted by their relative contribution to the company's total capital." They also note (p. 134-5) that, "the opportunity cost to a class of investors equals the rate of return the investors could expect to earn on other investments of equivalent risk. The cost to the company equals the investors' costs less any tax benefits received by the company (for example, the tax shield provided by interest expense)." In a dividend imputation system, the government may also subsidize equity returns via the payment of franking tax credits.

In the detailed numerical example in his Appendix, Officer (1994, pp. 11 - 17), shows how the CAPM can be used to derive a required return on equity of 17.7% and that the firm's cost of equity is:

$$r_E \frac{1-T}{1-T(1-\gamma)} = 17.7\% \frac{1-0.39}{1-0.39(1-0.5)} = 13.4\% \qquad (2)$$

using the parameter values assumed in the example. That is, the imputation tax system has reduced the firm's cost of equity capital by 4.3% in this case. The value of this reduction in the firm's cost of equity is capitalized into the stock price. In this case, the value of equity increases from $120 million (under a classical tax system) to $158.361 million (under an imputation system in which $\gamma = 0.5$). Officer demonstrates that the equityholders' required return does not change. What changes is the proportion of this return that must be generated by the firm. In a classical system, the firm has to generate all of this return. In an imputation system, the government funds some of this required return (in fact 4.3%) which reduces the firm's after tax cost of equity from 17.7% to 13.4%. That is, the CAPM tells us what return equityholders require (a return that is measured after company tax but before personal tax) and Officer (1994) derives the proportion of that return that must be generated by the firm, $\frac{1-T}{1-T(1-\gamma)}$.

Precisely the same proportions apply to the pre-corporate tax required return on equity, $\frac{r_e}{1-T}$. This must be adjusted by the same factor of $\frac{1-T}{1-T(1-\gamma)}$. This leaves a pre-corporate tax cost of equity capital for a firm of $\frac{r_e}{1-T} \times \frac{1-T}{1-T(1-\gamma)} = r_e \frac{1}{1-T(1-\gamma)}$.

Alternatively, Officer (1994) also shows how the value of franking credits can be incorporated in the firm's cash flows rather than the discount rate. In his Equation (12), Officer defines the vanilla WACC as:

$$r_{iii} = r_E \frac{S}{V} + r_D \frac{D}{V}. \tag{3}$$

This discount rate should be applied to cash flows defined as in his Equation (11):

$$(X_0 - X_D)(1 - T(1-\gamma)) + X_D, \tag{4}$$

where X_D represents interest payments to debtholders.

That is, under an imputation system, the cash flow to equity holders is:

$$(X_0 - X_D)(1 - T(1-\gamma)). \tag{5}$$

Without imputation $(\gamma = 0)$, the cash flow to equity holders would be:

$$(X_0 - X_D)(1 - T). \tag{6}$$

Thus, the component of the cash flow to equity that is due to the value of franking credits is the difference between the two:

$$(X_0 - X_D)\gamma T. \tag{7}$$

Therefore, the proportion of the total cash flow to equity that is due to franking credits is:

$$\frac{(X_0 - X_D)\gamma T}{(X_0 - X_D)(1 - T(1-\gamma))} = \frac{\gamma T}{1 - T(1-\gamma)}. \qquad (8)$$

This is the same proportion of the cost of equity that was due to franking credits, as derived above. That is, if we prefer to incorporate the value of franking credits in the discount rate, we can conclude that $\frac{\gamma T}{1 - T(1-\gamma)}$ proportion of the cost of equity is paid by the government via franking credits. If we prefer to put the value of franking credits into the cash flows instead, we conclude that $\frac{\gamma T}{1 - T(1-\gamma)}$ proportion of the total cash flow to equity is paid by the government via franking credits. In both cases, the balance, $\frac{1-T}{1 - T(1-\gamma)}$, must be generated by the firm itself. All of this applies equally whether cash flows are defined a after-corporate tax or before-corporate tax.

Appendix B: Relationship between parameters

There are a number of relationships between WACC parameters that must be considered when determining whether a proposed set of parameters is internally consistent. In this section, we review the important relationships and comment on how a decision-maker can determine whether a particular set of parameters is internally consistent.

Gearing, credit rating and debt margin

The first, and most obvious, relationship between WACC parameters involves gearing, credit rating and debt margin. When a ratings agency examines a firm, one of the key considerations is the gearing level. Obviously, higher gearing leads to a lower credit rating, other things being equal. Consequently, the assumed credit rating must be consistent with the assumed gearing level. To ensure that this is the case, one can examine the credit ratings assigned to comparable firms *and* the gearing levels of those firms. Other things equal, more weight would be assigned to those comparable firms that had gearing levels closer to the gearing assumed for the benchmark firm.

A closely related point is that the relationship between credit rating (which depends on gearing) and the debt margin. The relevant debt margin obviously depends on the assumed credit rating, which in turn depends on the assumed gearing level.

Gearing and equity beta

In its recent WACC Review, the AER notes that a firm's systematic risk (its equity beta) will depend "on its business activities and its level of financial leverage."[47] That is, a proposed equity beta reflects (a) the business activities of the benchmark firm; and (b) the assumed financial leverage of the benchmark firm.

The *WACC Review Final Decision* also sets out the approach that AER proposes to disaggregate the equity beta into these two components:[48]

$$\beta_e = \beta_a \left(1 + \frac{D}{E}\right)$$

[47] *WACC Review Final Decision*, p.239.

[48] *Explanatory Statement*, p.202; *WACC Review Final Decision,* p. 265.

where β_a is the asset beta, which reflects the systematic risk of the business activities of the benchmark firm but not the effect of leverage, and $\left(1+\frac{D}{E}\right)=\left(1+\frac{60}{40}\right)=2.5$ at the assumed 60% level of financial leverage.

When comparing beta estimates of comparable firms, an adjustment must be made for any difference in gearing or leverage. By choosing comparable firms in the same industry as the benchmark firm, we have controlled for business activities – the first element of equity beta. But we have not yet controlled for leverage – the comparable firm may have more or less leverage than what is assumed for the benchmark firm.

For example, suppose the beta estimate for a comparable firm is 1.0, that the comparable firm has 50% gearing, and that the benchmark firm is assumed to have 60% gearing. In this case we would need to unlever the equity beta of the comparable firm to obtain the asset beta:

$$\beta_e = \beta_a\left(1+\frac{D}{E}\right)$$

$$1.0 = \beta_a\left(1+\frac{50}{50}\right)$$

in which case the asset beta $\beta_a = 0.5$. This is an estimate of the systematic risk of owning equity in the firm if there was no prior-ranking debt finance.

Next, this asset beta must be re-levered to the assumed gearing of the benchmark firm. In this case we have:

$$\beta_e = \beta_a\left(1+\frac{D}{E}\right)=0.5\left(1+\frac{60}{40}\right)=1.25.$$

Now we have an estimate of the equity beta that controls for (a) business activities (by selecting a comparable firm from the same industry) and (b) leverage (by re-levering the equity beta estimate to the assumed gearing of the benchmark firm).

Consequently, there is a link between the assumed gearing of the benchmark firm and the assumed equity beta – higher gearing, other things equal, leads to a higher equity beta. In the case at hand, the regulatory precedents in relation to equity betas do not need to be re-levered as they are already uniformly based on 60% gearing. However, differences in leverage do need to be taken into account when considering estimates of equity betas of specific comparable firms.

Capitalisation of franking credits (gamma) and market risk premium

The CAPM produces an estimate of the equilibrium required return on equity:

$$r_e = r_f + \beta_e \times MRP$$

Prior to the introduction of dividend imputation, the return to equityholders came in two forms: dividends and capital gains. Under an imputation system, however, there is a third component of returns: dividend imputation franking credits.

When estimating MRP, the standard approach is to take the difference between the return on a broad stock index (e.g., All Ordinaries accumulation index) and the yield on ten-year government bonds. The stock index includes dividends and capital gains, but ignores franking credits. Consequently, standard estimates of the market risk premium must be "grossed up" to reflect the assumed value of franking credits. This point is now well-accepted and uncontroversial. For example the AER, in its recent WACC Review, talks about a "gross up for imputation credits" when estimating MRP.[49]

This total required return from CAPM can be disaggregated into (a) the return delivered in the form of dividends and capital gains, and (b) the return delivered in the form of dividend imputation franking credits.

Officer (1994) is the paper that sets out the framework for Australian regulatory return estimates. It is this paper that derives the post-tax nominal WACC formula used by the ERA to determine allowed returns on capital. One of the key contributions of Officer (1994) is the disaggregation of the required return on equity into the component that is provided by government in the form of franking credits and the component that must be generated by the firm itself. Officer shows that a fraction $\frac{1-T}{1-T(1-\gamma)}$ of the total return to equity is delivered in the form of dividends and capital gains and the remainder is delivered in the form of franking credits. In this equation, T represents the relevant corporate tax rate and γ represents the extent to which the creation of a $1 franking credit (by the payment of $1 of Australian tax) is reflected in the stock price.

This same term appears in the post-tax nominal WACC formula that is used by the ERA. A simple and intuitive derivation of this term is set out in the appendix to this report.

If $T = 0.3$ and $\gamma = 0.65$, as in the AER's recent WACC Review, we have:

49 P. 177.

$$\frac{1-T}{1-T(1-\gamma)} = \frac{1-0.3}{1-0.3(1-0.65)} = 0.78,$$

in which case 78% of the return to equity comes in the form of dividends and capital gains and 22% is assumed to be via franking credits. That is, share prices are assumed to be set so that dividends and capital gains provide 78% of the total required return and the other 22% comes from franking credits.

Now suppose that the risk-free rate is 5% (just by way of example) and the market risk premium is set to 6.5%, as in the AER's recent WACC Review. In this case, the required return on equity for the broadly diversified market portfolio (which has a beta of 1.0 by definition) is:

$$\begin{aligned} r_e &= r_f + \beta_e \times MRP \\ &= 5\% + 1.0 \times 6.5\% = 11.5\%. \end{aligned}$$

If $T = 0.3$ and $\gamma = 0.65$, 22% of this total return is assumed to come from government in the form of franking credits. That is, of the total required return of 11.5%:

a) 2.53% is assumed to come in the form of franking credits, and

b) the remaining 8.97% must be generated by the firm in the form of dividends and capital gains.

This further implies that the market risk premium of 6.5% is made up of:

a) 2.53% from government by way of franking credits, and

b) 3.97% from the firm in the form of dividends and capital gains.

That is, within the Officer CAPM WACC framework, there is a deterministic link between the estimates of the capitalised value of franking credits (gamma) and the market risk premium. Other things equal, a higher assumed value for gamma requires a higher estimate of the market risk premium. These two parameters are inextricably linked and cannot be estimated separately.

Appendix C: Economic reasonableness and plausibility

The need to perform reasonableness checks

In our view, it is important to assess the economic reasonableness and plausibility of the outcomes of the WACC estimation exercise. That is, a series of reasonableness checks should be performed to determine whether the final WACC, required return on equity, and required return on debt are reasonable and plausible – relative to one another, and relative to current conditions in financial markets.

In this regard, we note that the AER states that it supports the view that:

> economic reasonableness or the plausibility of the estimates[50]

are key criteria for estimating WACC parameters.

Moreover, there appears to be broad agreement that one of the central tests of economic reasonableness or plausibility of parameter estimates is a comparison of the relative returns to debt and equity. In the *WACC Review Final Decision*,[51] the AER concludes that:

> The AER agrees that, given the residual risk resulting from greater uncertainty of cash flows borne by equity holders, economic reasonableness would imply that the cost of equity would be greater than the cost of debt. Accordingly, to ensure that service providers are provided with a reasonable opportunity to recover efficient costs the regulatory return on equity should be greater than the regulatory cost of debt (at least on average).[52]

Check #1: The relative returns on debt and levered equity in the benchmark firm

An investor who holds a debt security from its inception to its maturity knows exactly what payments they will receive and exactly when they will receive them – but for a default by the firm (e.g., caused by the bankruptcy of the firm). But for such a default, investors receive a guaranteed series of payments. Consequently, the risk facing such an investor is that the firm will default on its obligations to make the contractual series of payments that has been agreed upon. For

[50] *Explanatory Statement*, p.48: Australian Energy Regulator, 2009, Electricity transmission and distribution network service providers: Review of the weighted-average cost of capital (WACC) parameters – Explanatory Statement, 10 December 2008.

[51] Australian Energy Regulator, 2009, Electricity transmission and distribution network service providers: Review of the weighted-average cost of capital (WACC) parameters – Final Decision, 1 May 2009.

[52] *WACC Review Final Decision,* p. 42.

investment grade bonds (those rated BBB or above) the probability of default is very low. Table C.1 below sets out historical default rates by ratings category, as published by Standard and Poor's.

Table C.1. Cumulative default probabilities by rating

Credit rating	Default within 5 years	Default within 10 years	Recovery Rate
AAA	0.01%	0.45%	68.34%
AA	0.03%	0.80%	59.59%
A	0.61%	1.94%	60.63%
BBB	2.99%	6.10%	49.42%

Source: Standard and Poor's Corporate Ratings Criteria; Elton, Gruber, Agrawal and Mann (2001).

For example, Table C.1 shows that historically less than 1% of A-rated corporate bonds have defaulted within 5 years and less than 2% have defaulted within 10 years. Even when a default does occur, bonds that were rated A have recovery rates of more than 60%, so the loss suffered by the investors is in the order of 40%. Put another way, an investor holding an A-rated bond over the course of a 5-year regulatory control period historically has faced a 99.4% chance of receiving exactly the scheduled set of coupon and principal payments specified in the bond contract. Consequently, the risk involved in an investment grade debt investment is quite limited.

By contrast, equity investors are guaranteed nothing. They hold a residual claim that ranks after the debt holders and are only entitled to some return after the debt holders have received everything they are due. In short, an equity investment in a particular firm is considerably riskier than a loan made to the same firm. Consequently, shareholders (who have a residual claim and no guarantee of any return) require a higher expected return than debt holders (who receive a series of known fixed payments, but for the case where the firm is unable to pay its debts as and when they fall due – in which case the debt holders still receive half [or more] of what they are due and equity holders receive nothing).

The conclusion from this discussion is that an investor who holds investment grade debt in a firm faces much lower risk than an investor who holds a residual equity claim. Consequently, it is economically unreasonable and implausible to expect that investors would require a lower return from this higher risk equity capital than they would require from the relatively much lower risk investment grade debt.

Check #2: The relative returns on debt and unlevered equity in the benchmark firm

A second reasonableness check that should be performed is to compare the assumed required return on debt in the benchmark firm with the required return on equity in an unlevered benchmark firm. In the present case, this would involve a comparison of the relative returns on:

a) The 60% first-ranking, fixed-rate debt claim on the benchmark firm; and

b) A 100% equity claim on the benchmark firm – the return on unlevered equity in the benchmark firm.

The required return on unlevered equity is the return that shareholders would require in order to commit equity capital to the benchmark firm if there was no prior-ranking debt. If the firm was unlevered (i.e., had no debt financing) the shareholders would own the entire firm and would be entitled to 100% of the net cash flows of the benchmark firm. This unlevered equity claim over the firm is, by definition, riskier than any debt claim over the same firm – and consequently must require a higher expected return. This is because debt holders in the benchmark firm are contractually bound to receive a fixed series of known payments, whereas equity holders simply receive their share of whatever the firm might be able to generate.

Of course, we cannot have unlevered equity *and* a 60% debt claim in the same firm at the same time. Nevertheless, it is possible to estimate the implied returns on each of these investments in the benchmark firm from the parameter estimates and framework for unlevering equity betas set out above. The estimates of the required returns on these two investments can then be compared with the relative risks of the two investments as a test of economic reasonableness and plausibility.

The key point here is that the unlevered equity claim over the firm certainly has higher systematic risk than a contractually guaranteed fixed-rate loan to the benchmark firm that has an assumed BBB or BBB+ rating. Consequently, the required return must be higher for the unlevered equity claim.

Moreover, if it were the case that the benchmark firm could be financed entirely by equity holders who required returns that were substantially lower than the returns that debt holders required (under contractual terms at a fixed interest rate), it would be quite irrational for the benchmark firm to have 60% debt finance – because the entire firm could be financed with equity at a lower cost.

Check #3: Relative returns for non-resident investors

We have noted above that in the Officer CAPM-WACC framework a fraction $\frac{1-T}{1-T(1-\gamma)}$ of the total return to equity is assumed to come in the form of dividends and capital gains, with the remainder coming from government in the form of franking credits. Non-resident investors receive no benefit from franking credits, so the total return available to non-resident shareholders is:

$$r_e \frac{1-T}{1-T(1-\gamma)}.$$

The two reasonableness checks set out above should be conducted separately for non-resident investors. That is:

a) the return on levered equity available to non-resident investors in the benchmark firm should be compared with the estimated return on debt in the benchmark firm; and

b) the return on unlevered equity available to non-resident investors in the benchmark firm should be compared with the estimated return on debt in the benchmark firm.

If the results suggest that non-resident investors can earn a higher return on fixed-rate contractual debt than they can obtain on levered or unlevered equity in the same benchmark firm, the plausibility of these estimates must be questioned.

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