Goldfields Gas Pipeline Access Arrangement 2009

Equity Beta Analysis

March 2009

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Contents

1 Introduction

The purpose of this paper is to assess an appropriate equity beta for APA Group's Goldfields Gas Pipeline (GGP). This assessment is based on generally accepted commercial and regulatory practice.

In setting the rate of return, regard must be given to the relevant provisions of the *National Third Party Access Code for Natural Gas Pipeline Systems* (the Code), which are as follows:

> 8.30 The Rate of Return used in determining a Reference Tariff should provide a return which is commensurate with prevailing conditions in the market for funds and the risk involved in delivering the Reference Service (as reflected in the terms and conditions on which the Reference Service is offered and any other risk associated with delivering the Reference Service).
>
> 8.31 By way of example, the Rate of Return may be set on the basis of a weighted average of the return applicable to each source of funds (equity, debt and any other relevant source of funds). Such returns may be determined on the basis of a well accepted financial model, such as the Capital Asset Pricing Model. In general, the weighted average of the return on funds should be calculated by reference to a financing structure that reflects standard industry structures for a going concern and best practice. However, other approaches may be adopted where the Relevant Regulator is satisfied that to do so would be consistent with the objectives contained in section 8.1.

The key implications of these provisions are that the rate of return needs to:

- reflect the risks of the relevant business. Regulators tend to assess this with reference to the 'efficient benchmark firm' (the definition of which may be contentious);
- reflect prevailing market conditions; and
- be developed with reference to generally accepted methodologies (including the Capital Asset Pricing Model).

This paper is structured as follows:

- section 2 considers some methodological issues;
- section 3 undertakes a first principles analysis;

- section 4 undertakes a comparable companies analysis; and
- section 5 concludes with the recommended beta.

2 Methodology

2.1 Systematic and non-systematic risk

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

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

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

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

Investors will therefore only be rewarded for bearing systematic risk via the rate of return. As non-systematic risks can be eliminated by diversification, investors cannot expect to receive any compensation for these risks via a higher rate of return. Although an investor can avoid non-systematic risks via diversification, they are not unimportant from the firm's perspective. Non-systematic risks will tend to be modelled in the cash flows.

A key assumption underpinning the CAPM is that returns are normally distributed, that is, they are symmetric. This means that compensation for risks that are asymmetric in nature (for example, downside risk with limited or no upside) is not reflected in a CAPM-derived cost of equity.

A number of risks faced by regulated businesses are asymmetric, including a key risk to a provider of major infrastructure, which is the risk that demand falls so materially that assets are stranded. Stranding risk is a very real risk to a regulated infrastructure provider given a regulator will generally 'optimise' capacity that is not needed to provide the regulated service based on reasonable projections of demand. While the Code contains provisions such as the Speculative Investment Fund (which is used for capacity that is not currently needed), this provides no protection to a pipeline owner if

there is a permanent and material reduction in demand. This may be considered unlikely for a gas pipeline serving a number of different markets, but is possible, particularly for a pipeline that is solely dependent on the mining sector.

It is reasonable to provide GGP with at least some compensation for the asymmetric risks that are borne by the business. However, the key question is how this compensation can be appropriately determined and applied. There are three possible ways of doing this:

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

The first method is the preferred approach. However, it depends on the existence of a robust methodology that has been applied based on a reasonable set of assumptions. This is the solution that is being proposed for the GGP and is the subject of a separate paper prepared by Synergies entitled "Goldfields Gas Pipeline: Quantification of Asymmetric Risk".

The second method is inconsistent with the CAPM, although it is probable that this is what a number of unregulated businesses do in practice. For example, a survey by Meier and Tarhan (2006) of CFOs in the US shows that non-systematic risk does play a role in setting hurdle rates[1], which also suggests that 'gross ups' could occur for asymmetric risks (whether systematic or non-systematic).

This leaves the third option. While an imperfect solution, it ensures that sufficient incentive is provided to infrastructure owners to invest. It should not result in over-compensation provided the beta is selected from within the bounds of a reasonable range.

The implications of stranding risk for beta were considered by the ACCC in its 1998 decision in relation to the Victorian gas pipeline system. While the ACCC was not convinced that stranding risk was significant in the context of that pipeline system (which services a mix of residential, commercial and industrial customers), it stated:

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

> Nevertheless, the Commission does acknowledge that all of these risks are difficult to quantify. Accordingly it has adopted the suggestion of financial experts at the WACC forum, that they are taken account of by choosing beta estimates towards the top end of the plausible range.[2]

Thus, if assets are subject to asymmetric risks then compensation in some form is required.

As noted above, the preferred form of compensation is an explicit cash flow adjustment. However, selecting a beta from the upper bound of the range would be recommended if it is decided that compensation will not be provided in the cash flows.

2.2 Asset and equity betas

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

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

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

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

In practice, we only observe equity betas (being the estimated betas of listed companies). We do not directly observe asset betas, but we can calculate them from a combination of each observed equity beta and the level of gearing for that entity. The asset beta removes the effect of gearing from the estimate of systematic risk.

There are a number of ways of converting between asset betas and equity betas. It is not clear if the Economic Regulation Authority (the Authority) has a preferred method. The

[2] ACCC (1998), Final Decision: Access Arrangement by Transmission Pipelines Australia Pty Ltd and Transmission Pipelines Australia (Assets) Pty Ltd for the Principal Transmission System, Access Arrangement by Transmission Pipelines Australia Pty Ltd and Transmission Pipelines Australia (Assets) Pty Ltd for the Western Transmission System, Access Arrangement by Victorian Energy Networks Corporation for the Principal Transmission System, October, p.59.

methodology used in its 2005 decision in relation to the Goldfields Gas Pipeline (GGP) was not published. The most recent decision published by the Authority in relation to WACC was for the freight and urban railway networks (June 2008). In this decision the Brealey and Myers formulation was used as this was the approach applied by the Authority's consultant.

An approach that has been widely used in practice (including by the ACCC) is the Monkhouse formula:

$$\beta_e = \beta_a + (\beta_a - \beta_d) * \{1-[R_d/(1+R_d)] * [T_c * (1 - \gamma]\} * D/E \qquad [1]$$

where:

β_a = beta of assets

β_d = beta of debt

R_d = the cost of debt capital

T_c = corporate tax rate

γ = gamma

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

In the absence of any clear precedent established by the Authority we have applied the Monkhouse approach in this analysis. In any event, the differences between the approaches are typically minor.

2.2.1 Debt beta

The application of the Monkhouse formula requires the adoption of an assumption for the debt beta. A debt beta of zero should be applied because there is currently no robust way of estimating a value that measures the systematic risk of debt. An assumption of zero has therefore been recommended for the purpose of this analysis. This is generally consistent with regulatory practice.

A more detailed discussion on this issue is contained in Attachment A.

2.2.2 Approaches to estimating beta

There are three basic approaches to estimating systematic risk of equity, which are outlined in the Box below.

Box 1 Approaches to estimating systematic risk

1. Direct Estimation. If the firm is listed, regression analysis can be used to estimate the relationship between the firm's returns and the returns on the domestic share market index (such as the ASX 200). At least several years of trading data is required to provide a statistically meaningful estimate.

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

3. First Principles. This approach analyses the factors that impact on the sensitivity of a firm's returns to movements in the economy or market. It can be used for two main purposes. First, it can be used to assist in the selection of comparable companies. Second, as the comparable companies analysis will tend to produce a range of plausible estimates for beta, the first principles analysis can assist in determining where the particular firm may be within that range based on its relative risk profile.

APA Group is a listed entity so it is possible to estimate a beta for the firm as a whole. However, the GGP is only part of a much larger portfolio of energy-related businesses held by the APA Group, which includes interests in over 10,000 kilometres of gas transmission pipelines, gas distribution networks, coal seam gas processing plants, gas-fired power stations, gas storage facilities and two high voltage direct current electricity interconnector systems.[3] As the risk profile of the GGP will be different from the risk profile of the entire (diversified) group, the beta estimate for APA Group cannot be relied upon as an estimate of the beta for GGP.

2.2.3 Estimation error

Problems in estimating beta

Before progressing to the more detailed analysis, it is important to be aware of the susceptibility of beta to estimation error. It is not possible to directly observe a firm's true beta. Instead, estimates are obtained by regressing the historical returns of a firm's shares against the historical returns for a market index, over the same time period. As with any statistical estimate, it is measured with uncertainty. This uncertainty is likely to be more pronounced for individual firms. As a consequence, the resulting data estimates can be of limited reliability and caution should be exercised in applying these estimates in a forward-looking analysis.

[3] APA Group, http://www.pipelinetrust.com.au/1/1-1set.html. While we understand that APA has recently divested some of these assets the beta we have estimated will reflect this portfolio composition. The assets that were divested tended to have annuity characteristics (that is, stable cash flows with limited growth prospects). In any case we understand this only equates to around 5% of revenues so we expect that this is unlikely to have a material impact on its beta estimate.

There are a number of ways to address measurement error. As a starting point, any beta estimates with poor statistical properties[4] should be discarded (this is discussed further below). There are a number of other ways to deal with the uncertainty surrounding the estimation of beta, including:

- adjusting for thin trading, which is a common cause of measurement error, using techniques such as the Scholes-Williams technique;
- adjusting for mean reversion (i.e. the tendency for equity betas to move towards the equity beta of the market over time) using techniques such as the Blume and Vasicek adjustments[5]; and
- the formation of portfolios. Portfolio betas have substantially lower standard errors and yield more precise estimates of beta. While there are benefits in using this approach via reductions in the standard error, as more firms are used caution should still be exercised to ensure that they are relevant comparators.

A report by Gray et al provides a useful summary of the various methods of estimating beta, as well as their performance.[6] The study uses historical data to compare the predicted beta estimate in accordance with the CAPM, with the actual equity return for the relevant forecast period. The closer the predicted estimate to the actual equity return, the better the estimation technique. A summary of the findings of the report are:

- it is preferable to use data periods of longer than four years;
- monthly observations are preferred to weekly observations;
- Blume-adjusted estimates that account for mean reversion provide better estimates;

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

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

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

- statistical techniques that eliminate outliers are preferred, provided the outlier is not expected to re-occur; and
- a beta estimate derived from a sample of firms in an industry is preferred to an estimate for an individual firm.

Approach applied in this review

There are a number of measures we have implemented here in an attempt to address estimation error.

First, we have constructed estimates for a sample of firms that are considered to be of the most relevance to GGP.

Second, we eliminated any firms that did not have five years of monthly share price data. A summary of the rationale for using monthly data, and not say, weekly, is provided in the following Box.

Box 2 Rationale for the use of monthly observations

Because shares are traded relatively infrequently it is not always possible to obtain a precise measurement of return. If returns could be measured continuously then the return on an individual security (R_{it}) and the return on the market (R_{mt}) would be a perfectly matched pair so that regressions of R_{it} and R_{mt} would give precise beta estimates. Because prices for shares occur and are reported at distinct random intervals an accurate calculation of returns is almost impossible. If correct returns cannot be measured it becomes very difficult to calculate correct betas.

One of the issues that needs to be considered is the interval over which the return on the asset is measured. In many cases trades in a specific share do not occur every day. It follows that the time period or lag over which observations are taken may result in some of information being ignored.

This problem does not depend on infrequent trading. Much of the research has focused upon daily information. This research argues that beta estimates, particularly in the short term, vary according to the lag period used to measure the returns.

Research has shown that the 'interval effect' on beta estimation is that as the interval is shortened:

- beta falls for relatively thinly traded securities; and
- beta rises for relatively thickly traded issues of securities.

Cohen, Hawawini, Maier, Schwartz and Whitcomb (1983) and Fung, Schwartz and Whitcomb (1982) have conducted studies in the United States, France and Australia and they see the true beta is a function of the lag period taken to measure returns and the size of the firm. Both variables (lag and firm size) are seen as indicators of the frequency of trading in a particular security.

There is no reason why non-trading should be confined to one day or week. When daily prices are used it is easy to understand why beta estimates fluctuate. A small fluctuation in price would be quite substantial in terms of day to day changes and day to day estimations. However as the time periods for measuring returns are extended, the expectation is that more stability would enter the measurement and smaller fluctuations occur in beta estimates. With smaller fluctuations R_{it} and R_{mt} should have a stronger relationship. Hence the longer the interval, the stronger is the relationship.

Third, we eliminated any estimates from the sample that had a t-statistic of less than two (see footnote 4 above for an explanation of the t-statistic).

The reason we have applied these filters is because regression analysis is a statistical procedure that is commonly used to estimate beta in the absence of being able to observe the 'true' value of that beta. The explanatory power of the resulting estimate is of fundamental importance. If the resulting estimate has relatively low explanatory power, we cannot be confident that the estimate provides any valuable information regarding the true value of that beta.

The Asymmetric Consequences of Error

It is generally recognised that regulatory error has asymmetric consequences. The Productivity Commission stated:[7]

> - Over-compensation may sometimes result in inefficiencies in timing of new investment in essential infrastructure (with flow-ons to investment in related markets), and occasionally lead to inefficient investment to by-pass parts of the network. However, it will never preclude socially worthwhile investments from proceeding.
>
> - On the other hand, if the truncation of balancing upside profits is expected to be substantial, major investments of considerable benefit to the community could be forgone, again with flow-on effects for investment in related markets.
>
> In the Commission's view, the latter is likely to be a worse outcome.

In other words, the consequences of setting WACC too low, and discouraging efficient investment in essential infrastructure, are considered worse than setting it too high.

The estimation of WACC is inherently imprecise and hence the probability of specifying a WACC other than the 'true' value is high. For key parameters such as beta and the market risk premium, there is likely to be a range of reasonable estimates rather than a precise value (specific issues in estimating beta are considered in the following section). The Australian Competition Tribunal ('the Tribunal') recognised the range of reasonable outcomes within which a Reference Tariff determination could fall:

> …there is no single correct figure involved in determining the values of the parameters to be applied in developing an applicable Reference Tariff. The

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

> application of the Reference Tariff Principles involves issues of judgement and degree. Different minds, acting reasonably, can be expected to make different choices within a range of possible choices which nonetheless remain consistent with the Reference Tariff Principles.[8]

In reality, there is a high probability that the true value of the WACC for a regulated entity may be higher or lower than the estimated value.

Typically, based on our best estimate for WACC we would expect the balance of consequences to be approximately equal (that is, if the consequences of too high a WACC are the same as the consequences of too low a WACC, and the probability of either consequence is the same, the expected value will be zero). However, if the consequences are asymmetric (in this case, the consequence of an under-estimate is worse than the consequences of an over-estimate), then if the probability of either outcome was equal, the expected value will be negative. We therefore need to adjust the probabilities in order to achieve an expected value of zero, which necessitates ensuring that the probability of the worse outcome is lower.

Given the asymmetric consequences of regulatory error, it is therefore important to lower the risk that the true value is higher than the estimated value as this is considered to have more severe social and economic implications. One way this can be achieved is by selecting a value towards the upper end of the range of reasonable values.

[8] Application by GasNet (Australia) Operations Pty Ltd [2003] ACompT 6, para 29.

3 First Principles Analysis

3.1 Overview

The GGP is a 1380 kilometre pipeline extending from the Carnarvon Basin in Western Australia to the north-east Pilbara and Goldfields regions. The pipeline is 88.2% owned by the APA Group (the remaining interest is held by Babcock and Brown Infrastructure) and is maintained and operated by APA Group. The pipeline is part of a portfolio of energy transmission assets held across Australia by the APA Group. A map of these assets is provided in the Attachment.

As at January 2009, the total reserved capacity of the covered pipeline is around 38 petajoules per annum. It is primarily used for energy generation for the mining industry.

3.2 Methodology

A first principles analysis is a qualitative assessment of the pipeline's risk profile, the aim of which is to identify its systematic (or non-diversifiable) risk factors and assess their likely impact on the asset beta. Lally identifies a number of factors to be considered here, including[9]:

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

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

A number of these factors are interrelated – that is, the impact of one factor on beta could either be increased or lessened by another factor. Hence, while the impact of each factor can be considered in isolation, the overall assessment will reflect the net impact of the factors in combination. The first two factors are closely linked and so will be considered together.

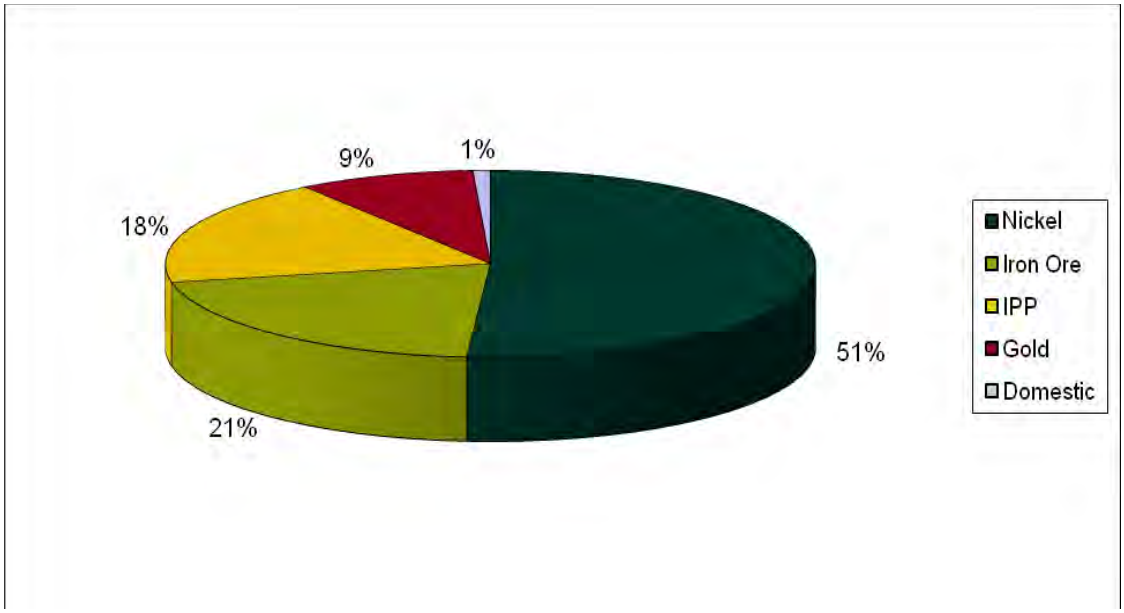
3.3 Analysis

3.3.1 Nature of the product/nature of the customer

For the purpose of beta, the objective of understanding the underlying market for the relevant product is to identify the key drivers of demand and the extent to which these drivers have a relationship with domestic[10] economic activity.

As noted above, the demand for gas transported via the pipeline is dominated by the mining industry. The following chart shows the composition of the underlying demand based on current annual throughput of the covered pipeline.

Figure 1 Goldfields Gas Pipeline: Underlying Demand (2009)



Data source: APA Group, based on 2009 Average Maximum Daily Quantities
IPP = Independent Power Producer

This shows that 51% of the gas transported via the pipeline is destined for end users in nickel mining and processing. Iron ore accounts for approximately 21% (with only

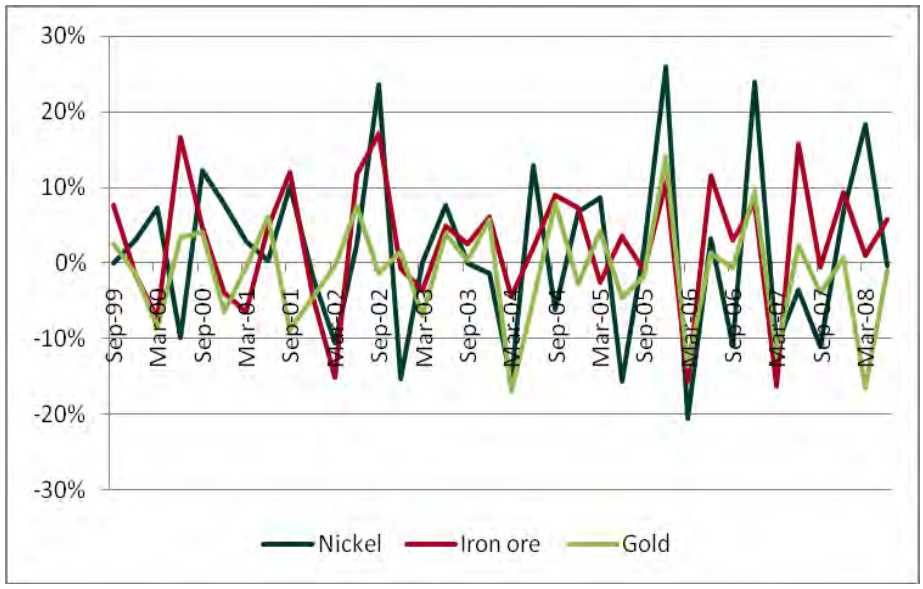
[10] 'Domestic economic activity' in this context refers to generally activity occurring in the Australian economy.

two major end customers). One shipper (based on ultimate parent company ownership) comprises 41% of the pipeline's throughput. The next largest shipper accounts for 18% and the remainder are responsible for less than 10% each (with a number less than 5%).

It is also important to note that most of the throughput that is not directly linked to a specific mining venture in the above chart (being the 'Independent Power Producers' (IPP) and 'Other' categories) are largely supplying energy to industrial and commercial end-users that are servicing, or dependent upon, the mining sector. Energy supplied to communities for residential use would also be impacted by significant changes in mining activity as the size of the workforce directly and indirectly involved in mining changes. Hence, we can conclude that the vast majority of the demand for the pipeline's services will be derived from the mining industry.

Mineral commodity markets are inherently volatile. Quarterly growth in production for nickel, iron ore and gold in Western Australia since 1999 is summarised in the following figure.

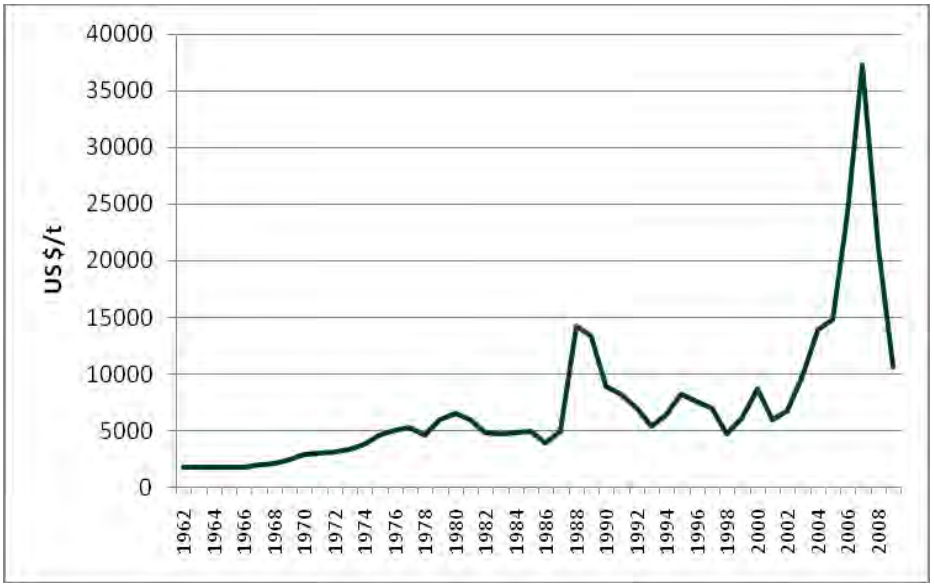
Figure 2 Production Growth: nickel, iron ore and gold in Western Australia



Data source: Department of Mines and Petroleum, Government of Western Australia, http://www.dmp.wa.gov.au/1521.aspx#1559.

Of the markets served by the GGP, changes in production will be influenced by world prices, particularly world nickel prices, which reached historical highs in 2006/2007 and have subsequently dropped, as shown in Figure 3.

Figure 3 World nickel price: 1962 to 2009



Note: 2009 price is a forecast

Data source: http://www.abare.gov.au/publications_html/data/data/data.html#acs.

Relationship between export-oriented businesses and domestic economic growth

When estimating beta the interest is in the correlation between the firm's returns and domestic economic activity. Hence, it may be assumed that export-oriented firms have low systematic risk (because their output is destined for export rather than domestic markets). As will be shown below, such an assumption is erroneous.

As much of the mineral production in the Pilbara and Goldfields region is destined for export markets, the demand for pipeline services is sensitive to world economic growth. The key question is whether there is any linkage between the returns of businesses that are largely export-oriented and domestic economic growth.

In our view, this linkage clearly exists for exporters of key commodities. For example, in December 2008 iron ore constituted 14.2% of Australia's merchandise exports (second behind coal).[11] This in turn provides an important link to domestic economic growth. As an open, commodity-driven economy Australia is closely linked to the world economy and the performance of the Australian economy is strongly influenced by the performance of its major commodity export industries.

This is particularly the case in Western Australia. In 2006/07, Western Australia's resources sector accounted for:

[11] Australian Bureau of Statistics (2009), International Trade in Goods and Services, Australia, December 2008, Catalogue 5368.0, p.22.

- $53.4 billion in production value;
- 88% of its export income;
- around 30% of its Gross State Product;
- $2.1 billion in state royalties; and
- direct and indirect employment growth of more than 215,000.[12]

In 2007, mining projects in Western Australia accounted for 65% of the total value of projects in the state, and 67% of mining projects nationally.[13]

The relationship between domestic and world economic growth can be examined by looking at the correlation between domestic GDP and global economic growth. We have estimated this using:

- annual growth in world real GDP[14]; and
- annual growth in domestic GDP (real gross domestic income, chain volume measures).[15]

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

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

While commodities have been experiencing strong growth in recent years, the global financial market crisis has created major uncertainty in relation to world economic growth, including a reduction in demand for key commodities such as iron ore and nickel. This has had a swift and significant impact on the mining sector, with mines already scaling back production, cutting staff and/or reviewing future developments.

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12 P. Hynch (2008), The Resource Sector Perspective on the Proposed ETS, Chamber of Minerals and Energy, 4 December.

13 Department of Treasury and Finance (2008), Western Australian Economic Summary, 2008 No.1, Government of Western Australia.

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

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

Conclusion: Nature of the product/nature of the customer

To summarise: the demand for the pipeline's services is driven by the mining sector, in particular, nickel, iron ore and gold. The commodity sector is inherently volatile:

- while most of the production is exported, the demand for minerals exported from Western Australia is linked to domestic economic activity (particularly at the state level) given the importance of the mining industry to economic performance; and
- the vulnerability of industries servicing the mining sector is highlighted by the current (and future potential) fallout from the global financial crisis.

The GGP is unique compared to other regulated pipelines in Australia (there are other pipelines that have similar risk profiles to GGP but they are either only subject to light-handed regulation or are unregulated). Most of the regulated pipelines are underpinned by broad based residential, commercial and industrial demand (a summary of decisions for other regulated pipelines is provided below). The demand for gas for residential purposes will be less sensitive to changes in economic conditions. Commercial and industrial demand will be more sensitive to economic growth, with the longer-term trend influenced by changes in the energy intensity of industry. Demand by users that only operate in the mining sector will be more sensitive again.

The ultimate impact of this on the pipeline's systematic risk profile will depend on the form of regulation and contracting arrangements, which is discussed further below.

3.3.2 Pricing structure

The tariff charged to GGP pipeline users has three components, being:

1. a toll charge, which is levied on the quantity of reserved pipeline capacity;
2. a capacity reservation charge, which is a function of reserved pipeline capacity and the distance over which gas is transported; and
3. a throughput charge, which is based on the actual quantity of gas transported (and the distance over which it is shipped).

The first two components are fixed charges that are recovered on a take-or-pay basis. They comprise around 83% of the total tariff. This effectively means that 17% of the pipeline's revenues are volume-sensitive.

The implications of this are that if there is a reduction in activity at a particular mine, the revenue impact is not significant (although not immaterial). However, the tariff

structure does not protect the GGP in the case of complete curtailments in activity, which can result from mines being closed altogether. (Note that, assuming solvency, mines under care and maintenance will have to pay toll and reservation charges while contracts remain on foot, although no throughput charge would be paid). For example, in January 2009 Oz Minerals announced that it is placing its Scuddles mine at Golden Grove under care and maintenance. This will reduce Oz Minerals' operating costs by $15 million.[16]

There is at least one example since 2000 when a mine has closed and defaulted on its contractual obligations. There are two recent cases where closures resulted in contracts not being renewed. It is possible that other examples will emerge in future, particularly given the current environment.

If there is a significant downturn, the higher cost mines will be the first to curtail their operations. The nature of mine infrastructure means that it is possible to 'mothball' capacity for extended periods of time. The GGP cannot 'mothball' its capacity in this way.

3.3.3 Duration of contracts with customers

Given the relative riskiness of the pipeline's customer base, contractual certainty would be considered particularly important. Most the pipeline's capacity is currently sold under long-term contracts (over 80% of throughput is supported by contracts with terms in excess of ten years). For mining customers, contract terms will also be influenced by the expected remaining life of the mine (and by whether the mine is considered "marginal" or "base load").

Long-term take-or-pay contracts significantly reduce the pipeline's sensitivity to demand changes (which as noted above, is systematic in nature). In the long-term, however, the degree of protection provided is a function of the underlying creditworthiness of the customer. Take-or-pay obligations cannot be enforced if an entity has become insolvent. Further, depending on the nature of the contract, a company may not necessarily need to be insolvent before it can walk away from its obligations under the contract.

This risk is particularly high for smaller mining companies. It is understood that obligations are often supported by bank guarantees but that these are only for a very short-term. Consequently in the long-run, the take-or-pay arrangements do not mitigate sensitivity to demand to any great extent.

[16] Business Spectator, "Oz Minerals to Place Scuddles Mine on Care and Maintenance", 13 January 2009.

3.3.4 Market power

Regulated gas transmission assets are assumed to have natural monopoly characteristics to the extent that it would not be economic for a third party to construct and maintain a facility which provides a similar service. Particularly given the remote location of this pipeline and the significant distances travelled, this may be expected to be the case with the GGP. However this market power can be tempered by:

- the availability of substitutes for gas as an energy source; and
- significant concentration and counterveiling power on the buyer side.

In terms of buyer concentration, Lally observes:[17]

> In respect of gas pipeline businesses, they seem to be local monopolists but their monopoly power may be diluted by the counterveiling power of their large customers and the presence of competing power sources. So, if monopoly power affects beta, then the effect of any such counterveiling power and competing energy sources would be to mitigate that beta effect.

It is understood that some of the users of the GGP do have potential alternative energy sources, such as diesel generation. This is particularly the case for those mines that were in existence prior to the construction of the pipeline. Based on data supplied by APA, approximately 35% of GGP throughput[18] is for users that have dual fuel capability (and one has back-up diesel generation). This proportion cannot be considered immaterial. Furthermore, installation of dual fuel or diesel generation is generally not technologically problematic; the decision is a purely commercial decision.

Other energy alternatives are currently being tested in the region, the most notable being solar power. More than 1900 solar panels are currently being installed in the Pilbara. The Horizon Energy project will provide at least 60% of the power to the towns of Marble Bar and Nullagine. This could provide an important benchmark for the use of solar power in this region.[19]

In the case of the pipeline, the customer base is dominated by a small number of large industrial mining customers. As noted above, one corporate entity currently accounts

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[17] M. Lally (2004b), The Weighted Average Cost of Capital for Gas Pipeline Businesses, Report Prepared for the New Zealand Commerce Commission, University of Wellington, p.36.

[18] Based on maximum daily quantities for the calendar year 2009, for the covered pipeline.

[19] The West Australian, World First Energy System for the Pilbara, 11th December, http://www.thewest.com.au/default.aspx?MenuID=146&ContentID=112771.

for around 41% of total throughput and another is responsible for 18%. The larger mining companies are often backed by significant resources, particularly when it comes to contract negotiations. This has also been evidenced in recent years in relation to issues such as access to private rail networks, for example the iron ore rail lines owned by BHP Billiton and Rio Tinto in the Pilbara.

Market power tends to have a dampening effect on beta. However, given the degree of customer concentration and counterveiling power we expect that GGP market power is considerably diluted, which serves to reduce any impact that market power would otherwise have on beta.

3.3.5 Nature of regulation

The form of regulation can also impact systematic risk as it can influence the extent to which the regulated business is exposed to volume risk. It may be argued that a business that is governed by a price cap form of regulation is exposed to more systematic risk than a business that is subject to a revenue cap (which would mean that a business that is subject to a price cap is more likely to be towards the upper bound of a reasonable range of beta values). This is because a revenue cap ensures that in each year of the regulatory period, the regulated business will earn its annual revenue requirement (no more, no less). As the GGP is currently subject to a price cap, no revenue is guaranteed.

We observe, however, that while theory would prescribe that form of regulation should have an impact on beta, historically regulators have not sought to explicitly attribute any increment in the asset beta for price cap regulation over revenue cap regulation. This is at least partly due to the difficulties in being able to measure the potential impact of this risk difference on the beta estimate. In its recent Draft Decision in relation to electricity rates of return the AER concluded that there is no persuasive evidence to differentiate beta on the basis of the form of regulation (which concurred with the positions submitted by both the Major Energy Users and the Joint Industry Associations).[20]

Accordingly, the implications of the form or regulation for beta remain unclear. What this may suggest is that if a range of reasonable outcomes for beta is identified, a form of regulation that retains exposure to systematic volume risk suggests that the point estimate should be selected from the upper end of this range. This is in addition to selecting a point estimate from the upper end of the range in order to:

[20] Australian Energy Regulator (2008), Electricity Transmission and Distribution Network Service Providers: Review of the Weighted Average Cost of Capital (WACC) Parameters, Explanatory Statement, December, p.194.

- recognise asymmetric risks if they are not quantified in cash flows or otherwise addressed;
- recognise the asymmetric consequences of regulatory error in determining a rate of return, as outlined in section 2.2.3. .

In this case the key mitigating factor for the pipeline in relation to its exposure to systematic volume risk is its long-term take-or-pay contracts. The systematic volume risk borne by the pipeline is equal to the 17% of revenue that is variable. This residual risk is not mitigated by the form of regulation. Overall, however, while this exposure is not insignificant, the degree of protection provided through the contracts is high, although noting that the effectiveness of this mitigating factor is ultimately limited to:

- the extent to which a counterparty can rescind its obligations under the contract if it places a mine under care and maintenance or closes it altogether; and
- the financial strength of the counterparty.

3.3.6 Growth options

Growth options refer to the potential to undertake significant new investment, particularly in new areas or products. Chung and Charoenwong argue that businesses that have a number of valuable growth opportunities, in addition to their existing assets (or 'assets in place'), will tend to have higher systematic risk compared to firms that don't have these opportunities.[21]

The impact of growth options on beta in a regulatory context is not necessarily clear. If this assessment was based on the analysis of an efficient benchmark firm (that was not regulated), it could be argued that the implications of growth options need to be recognised, regardless of the impact that regulation has on the value of the firm and its risk profile. Alternatively, if the existence of regulation is recognised as part of the assessment, then the presence of growth opportunities may arguably be excluded.

The pipeline's future growth opportunities will depend on expected growth in demand. As noted above, the demand outlook is particularly uncertain at the current time, noting that any investment decision made by the pipeline which results in the expansion capital being covered will always carry a considerable degree of stranding risk (given the investment horizon is very long-term).

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

It is understood that the pipeline is currently near its operational capacity and hence capital expenditure would be required to accommodate any significant growth in demand (although potentially some of this capacity growth may be not be covered by regulation). This in turn is likely to be influenced by domestic and world economic growth.

However, given the uncertainties in relation to the future growth in demand for the covered pipeline, as well as the treatment of growth options in a regulated context, we have not sought to factor them into this analysis.

3.3.7 Operating leverage

All gas transmission businesses have a high fixed cost base (where fixed costs include capital costs and fixed operating costs), and hence high operating leverage (with the only variable costs being compressor fuel (if paid for by the pipeline) and some operating costs). High operating leverage is associated with higher systematic risk, as these fixed costs will still be incurred irrespective of actual volumes (and revenues). It is understood that the pipeline's operating leverage is between 90 and 95% (compared to a 'fixed' revenue component of 83%).

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

The pipeline's operating leverage is not likely to be materially different from the average of other gas transmission businesses. However, to the extent that it is being compared to other energy network and distribution businesses, they will typically have lower operating leverage (and hence a lower beta, all other things being equal).

The implications of differences in operating leverage for beta is considered further in section 4.

3.3.8 Conclusions: first principles analysis

In conclusion, we can make the following observations about GGP's exposure to systematic risk:

- the demand for GGP's services is derived from the demand for commodities, as mining companies dominate its ultimate end-customer base (particularly in gold, nickel and iron ore). As much of the production in the Pilbara and Goldfields region will be destined for export markets, demand will be sensitive to this world economic growth. This in turn provides an important link to domestic economic

growth because as an open, commodity-driven economy Australia is closely linked to the world economy;

- industrial mining users are particularly sensitive to global economic growth, as is evidenced following the global financial crisis. This contrasts with other regulated gas pipelines in Australia which service a mix of residential, industrial and commercial customers;
- GGP's revenues are partially protected by long-term contracts with take-or-pay provisions, at least in the short-term. However, GGP remains exposed depending on the financial strength of the entity given these obligations cannot be enforced if the counterparty becomes insolvent. In some cases, counterparties may also rescind their obligations if the mine is temporarily or permanently closed;
- counterveiling buyer power will reduce GGP's market power; and
- GGP's operating leverage is high, which is typical for other gas pipeline businesses and is likely to be higher than other energy networks. It will also be higher than our mining industry comparators, evidenced by their ability to mothball operations in the event of a downturn.

In conclusion, 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.

4 Comparable companies

4.1 Selecting the comparator sample

4.1.1 Methodology

The first step in a comparable companies analysis involves identifying an appropriate set of companies that are of relevance to GGP. As outlined in the previous section, the GGP is unusual because, unlike other regulated pipelines, almost all of the gas transported is destined for end users in the mining industry.

We note that in its previous review Goldfields Gas Transmission (GGT) submitted that given this demand profile, it is more appropriate to rely upon the beta values of the pipeline's end customers rather than the estimated betas of other gas pipeline businesses. This argument was rejected by the Authority, arguing that GGT had not provided any evidence demonstrating that the high volatility in returns is reflected in the demand for energy and hence the revenues and profits of a gas transmission business servicing this sector:

> …the Authority is of the view that GGT has not established either that the beta values of Users of the GGP provide a better basis for estimating a beta value for the GGP business than the beta values of other gas transmission businesses…[22]

It stated that establishing this:

> …would require that a relationship be established between the volatility of returns to the pipeline Users and the demand for pipeline Services.[23]

The relationship between the demand for the relevant commodities and the demand for pipeline services can be established by the simple application of logic, as outlined in the preceding section. Change in the demand for commodities must flow through to changes in the inputs used in the commodity production process, of which energy is a key input. However, we acknowledge that GGP's revenues will not be as volatile as changes in the demand for the underlying commodities, largely because of the protection afforded by its long-term contracts which are underpinned by take-or-pay obligations. As noted previously, the degree of protection this provides depends on:

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[22] Economic Regulation Authority (2004), Amended Draft Decision on the Proposed Access Arrangement for the Goldfields Gas Pipeline, para 287.

[23] ibid.

- the extent to which end-users can rescind a contract if they temporarily or permanently close a site; and
- the financial strength of the end user who holds that obligation and then only for the term of that obligation.

We do not agree that this justifies dismissing mining companies as irrelevant comparators because in the long-term the demand for pipeline services will almost solely be driven by the performance of the mining sector. This relatively unique demand profile means that the beta of the GGP will exceed the betas of other pipelines that service a mix of residential, commercial and industrial customers. This was acknowledged by the Authority in its previous review of GGP's WACC:

> The Authority also considers that as that gas transmission markets for the major transmission pipelines in Western Australia are predominantly markets for the supply of gas to mining and mineral processing activities, rather than supply to households and diversified businesses, the Western Australian gas transmission pipelines may be exposed to a greater level of systematic risk than transmission pipelines and distribution systems in the eastern states of Australia.[24]

At the same time, we are not submitting that the beta of the GGP would be as high as the betas of its end users. We are of the view that it is appropriate to look at both. We have therefore examined two sectors in our analysis, being:

- mining companies; and
- energy transmission and distribution businesses.

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

- the business activities of the firm are sufficiently relevant to GGP, placing emphasis on firms involved in gas transmission and distribution; and
- the sample was statistically robust, given the issues with estimation error that were outlined above. Despite the filters being applied here, estimation error will remain an issue and needs to be kept in mind when drawing any conclusions from the analysis.

The filters applied were as follows:

[24] Economic Regulation Authority (2005), Final Decision on the Proposed Access Arrangement for the Goldfields Gas Pipeline, para.30.

- at least five years of monthly data is necessary for each firm. We applied a minimum threshold of 60 observations; and
- beta estimates with a t-statistic of less than 2 and R^2 of less than 0.1 were excluded (refer footnote 4).

The most relevant comparators will be Australian firms although after statistical filters are applied, this may yield a very small number of estimates. This is particularly an issue in the energy infrastructure sector, where we were only able to source a small number of firms meeting our requirements. The firms in our sample are only those firms that are currently operating (in their current form) and for whom 60 monthly observations of data could be collected.

Significant caution should also be exercised in relying upon foreign comparators and preference should be given to those jurisdictions that have (at least broadly) similar economic, commercial and regulatory structures.

A complete list of companies is provided in Appendix B. All data was sourced from Bloomberg.

4.1.2 Formation of portfolios

As outlined above, the formation of portfolios is seen as one means of dealing with estimation error. The benefits of the portfolio approach are only likely to accrue where the starting sample size (before the application of any statistical filters) is large. That is, the 'savings' or improvements in the standard error is a function of the average standard error of the sample and the number of firms in the sample.[25] This is shown by the relationship:

$$\text{Standard error}_{\text{average beta}} = \frac{\text{average standard error}_{\text{beta estimate}}}{\sqrt{n}} \qquad [2]$$

We are also of the view that it is only appropriate to form portfolios comprising firms in the same industry and jurisdiction. This means that the portfolio approach can only be applied where there is sufficient number of firms in the same industry and jurisdiction that still have the requisite number of observations (we consider that a sample of at least 20 firms is needed). In the case of gas transmission and distribution companies, this number of firms will not be able to be sourced in the same jurisdiction. This may, however, be feasible for mining companies.

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

Given the number of listed Australian mining companies we were able to limit our sample in this sector to domestic firms. Given only four out of 23 firms failed the statistical filter, we did not consider it necessary to form a portfolio.

4.2 Results

4.2.1 Mining companies

Our sample of mining companies includes diversified miners as well as producers of nickel, iron ore and gold. We did not include single commodity producers that mined commodities that are not produced in the pipeline's service area (such as coal only companies).

There were 23 Australian companies in the metals and mining sector for which the requisite 60 monthly observations could be obtained. 19 of these were statistically significant. A summary of the results for the entire sample is provided in the following table. The summary results presented are asset betas, not equity betas.

Table 1 Asset betas: Australian metals and mining companies

Average	Minimum	Maximum	1 standard deviation range	Number within 1 standard deviation range
2.22	0.87	4.12	1.32 – 3.13	13 out of 19

Source: Bloomberg

As expected, there is significant variability in the asset betas for firms in this sector.

The firms in the sample span a range of commodities, and include large diversified miners such as BHP Billiton, Rio Tinto and single commodity producers. As noted above, the end-consumers of the GGP mainly produce nickel, iron ore and gold. It is therefore useful to examine companies that mainly produce these commodities. This reduced the sample size to eight.

The only two firms in the sample that are current end-users of the pipeline are BHP Billiton and Rio Tinto. While it is relevant to include them in the sample, we have not sought to focus on these specifically given they are large, diversified companies with global operations. The asset betas for our sample are summarised in Table 2.

Table 2 Asset betas: Australian nickel, iron ore and gold producers

Average	Minimum	Maximum	1 standard deviation range	Number within 1 standard deviation range
2.37	0.87	3.63	1.44 – 3.31	5 out of 8

Source: Bloomberg

The outcomes are similar although slightly higher. This could simply reflect that the sample is less diversified.

4.2.2 Gas utilities

While there were 37 firms in this sector with the requisite 60 monthly observations that are primarily engaged in the distribution or transmission of gas, as at December 2008. 26 of these are statistically significant. Unfortunately, most of these firms are in jurisdictions that are not considered appropriately comparable, such as South America.

There are only two Australian firms in the sample – APA Group and Envestra. Two other Australian firms that we examined – SP AusNet and the Spark Infrastructure Group (both of whom are in the electricity sector) – could not be utilised as they did not have the minimum 60 months of data.

There are four US firms that could be utilised as a cross check (noting that some of these have retail arms, in addition to transmission and distribution). The asset betas for these firms are summarised in the following table.

Table 3 Asset betas: gas transmission and distribution companies

Company	Equity beta	Average Debt to equity	t statistic	R^2	Asset beta
Australian firms					
APA Group	0.81	1.66	4.13	0.23	0.31
Envestra	0.64	2.51	3.28	0.16	0.18
US firms					
AGL Resources	0.3	0.76	2.78	0.12	0.17
Atmos Energy Corporation	0.48	1	4.18	0.23	0.24
Equitable Resources	0.88	0.21	3.92	0.21	0.73
Southwest Gas Corporation	0.63	1.12	4.7	0.28	0.3

Source: Bloomberg

All asset betas, with the exception of one, are particularly low. The implications of this for GGP will be considered below.

4.3 Other regulatory decisions

4.3.1 Other Australian gas transmission decisions

Relevant regulatory decisions also need to be examined. The following table summarises equity beta outcomes for regulated gas transmission businesses in Australia (it is considered appropriate to compare equity betas given a gearing assumption of 60% is almost universally applied to regulated energy businesses).

Table 4 Regulatory Decisions: Gas Transmission and Distribution

Decision (Year)	Regulator	Equity beta
Gas Transmission		
Central West Pipeline (2000) (Note: greenfields)	ACCC	1.5
Parmelia Pipeline (2000) (Note: now unregulated)	OffGAR	1.33
Moomba to Adelaide Pipeline (2001) (Note: now unregulated)	ACCC	1.16
Tubridgi Pipeline (2001) (Note: now unregulated)	OffGAR	1.33
Amadeus Basin to Darwin Pipeline (2002)	ACCC	1.0
Moomba to Sydney Pipeline (2003) (Note: now subject to light-handed regulation)	ACCC	1.0
Dampier to Bunbury Pipeline (2005)	ERA	0.8-1.2
Goldfields Gas Pipeline (2005)	ERA	0.8-1.33
Roma to Brisbane Pipeline (2006)	ACCC	1.0
Dawson Valley Pipeline (2007)	ACCC	1.0
Victoria Gas Transmission System (2008)	ACCC	1.0

The average equity beta is slightly higher than one. This in turn reflects the 'average' profile of a gas pipeline's end user base, which is a mix of residential, commercial and industrial customers.

As noted previously, in its previous decision in relation to the GGP the Authority determined that its risk profile was higher than other gas transmission pipelines given its predominant exposure to end users in mining and mineral processing. Apart from the GGP, other pipelines that were considered to have a higher risk profile by the relevant regulator include:

- *Central West Pipeline:* At the time of the decision, it was a new pipeline without substantial foundation contracts or an established market. It had limited diversity in its customer base, with a small number of commercial users accounting for most

of the volume. These users tend to be concentrated in agricultural commodity processing which, like mining, may be seen to be more volatile than a broader customer base.

- *Parmelia Pipeline (coverage now revoked):* This pipeline transports gas from the gas fields in the northern Perth Basin to industrial customers in the South-West. It was considered to have a higher level of risk because of its small size, its limited number of users and its dependence on production from a limited number of fields.
- *Tubridgi Pipeline (coverage now revoked):* This is a small 'feeder' pipeline located at the production end of the gas supply system, which in turn means there is a limited number of potential users relative to a downstream transmission or distribution system.
- *Dampier to Bunbury Pipeline:* The Authority has noted that given that the markets for gas transmission in Western Australia are dominated by mining and mineral processing, they may be exposed to higher levels of systematic risk than their counterparts in the eastern states.
- *Allgas and Envestra (Queensland)*: It was determined that the Queensland distributors are likely to be exposed to higher systematic risk than distribution businesses in the other states because they have a much higher proportion of commercial and industrial consumption to total consumption (which in turn is more sensitive to domestic GDP growth than residential consumption).

As noted above, the dominance of mining and minerals processing in the end-user base of gas pipelines in WA will result in exposure to higher systematic risk than pipelines in the eastern states that service a mix of residential, commercial and industrial customers. This exposure is particularly concentrated in the case of the GGP. For example, while the Authority acknowledged the difference in relative risk (between pipelines in WA and the eastern states) in its decision in relation to the Dampier to Bunbury Pipeline (DBP), this pipeline does also transport natural gas to residential, commercial and industrial customers in Perth and other major regional centres.

The Authority noted a possible distinction between the potential risk profile of the DBP and GGP, "due to the very narrow market for the GGP"[26], although in the absence of any evidence to confirm this concluded that the upper bound for its equity beta range may only be "marginally greater". Even though differences in systematic risk may clearly be evident between businesses, the difficulties in accurately quantifying these

[26] Economic Regulation Authority (2005), op.cit., para.32.

differences are a fundamental problem. This highlights the fact that beta estimation is imprecise, notwithstanding the array of statistical techniques available in an attempt to improve this precision. While we concur that it is important to ensure that the analytical process is as robust as possible, if the theory supports a difference in risk these differences need to be appropriately rewarded.

4.3.2 The ESC's 2008 decision

Another notable recent regulatory decision is the ESC's 2008 decision in relation to the Victorian gas distribution businesses, where it determined an equity beta of 0.7. This was based on analysis undertaken by the Allen Consulting Group (ACG), which observed a reduction in beta estimates for its sample of Australian energy-related businesses. The work that was done by ACG at the time largely reflected the terms of reference that was provided to them for their review (which was limited to a statistical analysis).

ACG has subsequently undertaken further work for the Joint Industry Association in response to the review of WACC parameters for electricity transmission and distribution businesses by the AER.[27] This analysis revealed increases in the equity betas since their last review was undertaken. ACG was also asked to comment on the extent to which there was persuasive evidence before the AER to departure from the previously adopted equity beta value of 1 for electricity transmission and distribution businesses. ACG concluded that there was no persuasive evidence.

Our particular concern with the ESC's decision was that it accepted the results of the data analysis without any consideration of what might be driving the market evidence or whether the results appeared reasonable within a wider context and based on current market conditions. While the Code requires that the rate of return must be based on the "prevailing conditions in the market for funds" this does not mean that sole reliance can be placed on a statistical process that remains vulnerable to estimation error notwithstanding the techniques that are applied to improve the quality of the estimates. The ESC's decision was devoid of any discussion of the factors that might drive the systematic risk of these businesses or how that might compare to the risk of the market as a whole. In our view, the pursuit of statistical precision that appears to remain the preoccupation of most regulators has completely distracted attention from the need to ensure that the results of any data analysis are adequately supported by theory.

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[27] The Allen Consulting Group (2009), Australian Energy Regulator's Draft Conclusions on the Weighted Average Cost of Capital Parameters: Commentary on the AER's Analysis of the Equity Beta, Report to the Energy Networks Association, Grid Australia and Australian Pipeline Industry Association, January.

4.3.3 The AER's Current Review of Electricity Transmission and Distribution

While we have made some reference to the current review of WACC for electricity transmission and distribution businesses by the AER, the regulatory precedent we have focussed on are decisions in relation to gas. Nonetheless, the potential implications of the AER's review for GGP need to be considered.

In our view, the AER's Draft Decision is particularly controversial, mainly because it proposes to depart from established precedent in a number of areas, including beta, in the absence of persuasive evidence. This decision is currently only in draft form and a Final Decision is expected by May 2009. These concerns may be addressed in the AER's Final Decision.

We share the significant concerns that have been raised by the Joint Industry Association and its consultants. While regard must be given to regulatory precedent in reviewing the WACC parameters for a regulated business, including the methodology and approach used to develop each parameter, any recommendations we would make in relation to GGP are based on the extent to which we view the precedent as reasonable. In our view, the presumption of an equity beta of one for electricity transmission and distribution remains reasonable. We will therefore rely on this as the most relevant precedent for the purpose of this review.

5 GGP's beta estimate

As outlined in section 1, the Code requires that the rate of return needs to:

- reflect the risks of the relevant business;
- reflect prevailing market conditions; and
- be developed with reference to generally accepted methodologies (including the Capital Asset Pricing Model).

As demonstrated in section 2, this analysis is based on generally accepted methodologies, including the Capital Asset Pricing Model (notwithstanding its known limitations). The approach taken to address the first two requirements is outlined below.

5.1 Assessing the relevant business risks

In terms of the first requirement, the first principles analysis demonstrated that GGP's returns are ultimately driven by the performance of the mining sector in Western Australia. It was concluded that:

- the demand for GGP's services is derived from the demand for commodities, as mining companies dominate its ultimate end-customer base (particularly in gold, nickel and iron ore). As much of the production in the Pilbara and Goldfields region will be destined for export markets, demand will be sensitive to this world economic growth. This in turn provides an important link to domestic economic growth because as an open, commodity-driven economy Australia is closely linked to the world economy;
- industrial mining users are particularly sensitive to global economic growth, as is evidenced following the global financial crisis;
- GGP's revenues are partially protected by long-term contracts with take-or-pay provisions, at least in the short-term. However, GGP remains exposed depending on the financial strength of the entity given these obligations cannot be enforced if the counterparty becomes insolvent. In some cases, counterparties may also rescind their obligations if the mine is temporarily or permanently closed;
- counterveiling buyer power will reduce GGP's market power; and

- GGP's operating leverage is high, which is typical for other gas pipeline businesses and is likely to be higher than other energy networks. It will also be higher than our mining industry comparators, evidenced by their ability to mothball operations in the event of a downturn.

As the first principles assessment is largely qualitative it does not in itself yield a range of estimates for beta. However, what it does do is enable comparisons to be made with other relevant businesses or sectors, as well as the risk profile of the market as a whole. The quantitative assessment is based on the examination of comparable companies.

5.2 Quantifying the beta estimate

As noted previously, the Code prescribes that the WACC must reflect the risks of the relevant business and prevailing market conditions. In this context, it is also important to highlight that estimating betas using current market data remains fraught with difficulties, notwithstanding the range of statistical techniques that are now applied in an attempt to improve the quality of the estimates.

GGP's risk profile is unique relative to other regulated pipelines (and the 'average' pipeline business). We also note that the GGP is the only regulated pipeline that has a materially different risk profile to other regulated pipeline businesses. For the comparable companies analysis we therefore examined two industry sectors that were considered most relevant to the GGP, being:

- Australian mining companies; and
- gas transmission and distribution (which included foreign comparators given the very small number of listed Australian comparators).

The Authority expressed concerns with the beta estimate submitted by GGT as part of the previous review, which placed reliance on the betas of mining companies.[28] Clearly GGP is in the business of gas transmission and has a different risk profile to mining companies. However, mining companies are the customers for the GGP and just as clearly, GGP's revenues and returns must have some dependency upon mining operations.

We have sought to address the relationship between the demand for the GGP's services and the mining sector as part of the first principles analysis detailed in section 3. However, if the Authority's expectation is that this relationship be somehow reliably

[28] Economic Regulation Authority (2004), Amended Draft Decision on the Proposed Access Arrangement for the Goldfields Gas Pipeline, July, p.60.

quantified, this is seeking a level of precision that is simply not realistic. Beta estimation is not a precise science. Unfortunately, there is no robust, mathematical adjustment that can be applied to the benchmark equity beta for a gas transmission business to reflect the impact of the risk of GGP's underlying customer base. This does not preclude a subjective adjustment based upon an assessment of the relationship between the GGP and mining operations.

We therefore propose to assess the beta for GGP in the following way. First, as GGP is a gas transmission business we will assess an appropriate benchmark beta for an 'average' gas transmission business as a starting point. Second, we will consider what adjustment needs to be made to this beta to reflect the unique risk profile of the GGP based on its exposure to the mining sector.

5.2.1 Beta of an average gas pipeline business

To determine the beta of an average gas pipeline business, reference is made to our sample of gas transmission and distribution businesses. Unfortunately, after applying the relevant data filters our final sample size was very small, constituted by two Australian firms and four US firms. The variability in betas observed across this sample was large.

The US firms were included due to the lack of Australian data. They are only considered broadly comparable and given the issues in using foreign comparators, we would not seek to place any significant reliance on them.

We have a number of concerns with relying on estimates from such a small sample, particularly given the statistical imprecision of beta. Using a small sample loses all of the advantages of a large sample. With a large sample, idiosyncratic characteristics are diversified away and all that remains is the business risk that is common to the entire sample. With a small sample, the diversification effect is not complete so that the sample average is distorted by business specific risks.

The sample we have relied upon has included similar comparators to those considered as part of the AER's review (notwithstanding their main focus was electricity), however our sample is even smaller because we have only included firms that were listed as at December 2008 (with only two of the four Australian firms satisfying this requirement). In relation to the AER's sample Professor Stephen Gray of SFG Consulting concluded:

> In summary, it is difficult to imagine any set of estimates faring worse on these "key objective criteria." In my view, this indicates that the data that is required to produce reliable estimates simply does not exist. The estimates that have been

> produced are neither plausible nor economically reasonable and should not be afforded material weight.[29]

The conclusion drawn in three detailed reports prepared by the Joint Industry Association's consultants, including SFG, the Allen Consulting Group[30] and CEG[31], was that there is no persuasive evidence to conclude that the equity beta for an electricity distribution or transmission business is less than one. We concur with this conclusion.

The next question is the whether the beta of a gas transmission or distribution business would be different from the beta of an electricity transmission or distribution business. We see no reason why the beta of a gas transmission business would be less than the beta of an electricity transmission business. Indeed, the Queensland Competition Authority concluded that the beta of a gas distribution business is higher than the beta of an electricity distribution business, because gas is a 'fuel of choice':[32]

> The Authority is of the view that, in many instances, gas is a fuel of choice, while everyone generally connects to electricity. Because it is a fuel of choice, it faces competition from other sources of energy such as electricity and LPG. As such, the Authority accepts that the gas distributors will be subject to a greater level of systematic risk than the electricity distributors and that a higher equity beta is justified.

We are therefore of the view that an equity beta of at least one remains the most reasonable estimate for the typical gas transmission business with 60 % gearing serving a broad mix of residential, commercial and industrial customers.

It is useful to consider this conclusion in the context of the risk of the market as a whole. An equity beta of one is equivalent to the equity beta of the market as a whole. However, the average gearing level of the market is considerably less than 60% (it is around 30%[33]). If an equity beta of one was delevered based on 60% gearing, it would produce an asset beta of 0.4. The average asset beta of the market is currently around

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29 SFG Consulting (2009), op.cit., p.17.

30 The Allen Consulting Group (2009), Australian Energy Regulator's Draft Conclusions on the Weighted Average Cost of Capital Parameters, Commentary on the AER's Analysis of the Equity Beta, January.

31 CEG (2009), op.cit.

32 Queensland Competition Authority (2006), Final Decision – Revised Access Arrangement for Gas Distribution Networks: Allgas Energy, p.75.

33 SFG Consulting (2009)., p.10.

0.7[34]. An equity beta of one for gas transmission business with 60% gearing therefore reflects that:

- the business or asset risk is less than the market average; however
- leverage is higher than the market average.

In our view, this outcome is economically and commercially reasonable.

5.2.2 Beta for GGP

Our next question is where the beta of GGP sits relative to the benchmark of one. Reference is therefore made to our sample of mining companies.

As shown in Table 2, the average asset beta of our sample of mining companies is:

- 2.22 (for the entire sample); and
- 2.37 (for gold, nickel and iron ore only). This is considered the most relevant sample to the GGP.

The underlying variability in the betas is high. However, we do have a reasonable sample size (all of which are statistically significant Australian firms) and hence can have some confidence in these estimates when seeking to draw conclusions about the betas of firms in this sector.

These beta estimates are significantly above the beta of an average gas pipeline business as would be expected given their different risk profile. The risk of these businesses has become even more pronounced in the current market environment, with mines prepared to reduce production or close operations, depending on where they are on the cost curve (or because of other factors beyond their control).

As noted above, there is no robust mathematical approach that can be applied to adjust the 'gas transmission risk' beta (of one) for the impact of GGP's exposure to the mining sector. As we have previously stated, what we do know is that approximately 83% of GGP's revenues is subject to take-or-pay arrangements (noting the possibility of business failure). The remaining 17% is variable. In the short to medium-term, or for the duration of the existing contracts, it is this 17% of revenues that will definitely be influenced by activity in the mining sector. However, the fact that this 17% of revenues is sensitive to demand from the mining sector does not necessarily imply that 17% of

[34] ibid.

GGP's *returns* are sensitive to activity in this sector (noting its very high operating leverage, for example).

We are therefore faced with the situation where we know that at least some of GGP's returns will be positively correlated to returns in the mining sector – albeit a relatively small proportion (at least in the short to medium-term) – however the extent cannot be precisely quantified. We know that the impact of this correlation in terms or returns is likely to be above zero, but not necessarily higher than 17% (assuming that all contracts remain on foot).

We can use these proportions to derive a 'weighted' asset beta for GGP, assuming that:

- the asset beta to apply to the 'mining sector risk' is 2.37, which is the average asset beta of the gold, nickel and iron ore businesses; and
- the asset beta to apply to the 'average gas pipeline risk' is 0.4.

On this basis, the range could lie between:

- an asset beta of 0.4 or an equity beta of 1 (assuming 60% gearing) – this assumes that none of GGP's returns are influenced by the performance of the mining sector; and
- an asset beta of 0.73 or an equity beta of 1.8 – this assumes that 17% of GGP's returns are influenced by the performance of the mining sector.

We recommend that the point estimate is selected from the upper bound of the range (that is, between the mid-point, 1.4, and 1.8). The reasons for this are:

- the fact that price cap regulation exposes the GGP to greater volume risk in the long-term compared to a revenue cap; and, more importantly,
- the asymmetric consequences of error. If a rate of return is set too low it will result in underinvestment. Such underinvestment will have greater economic and social consequences than overinvestment.

It should also be noted that to the extent asymmetric risks are not quantified in the cash flows they should also be taken into account by selecting a point estimate from the upper bound of the range (in addition to the other considerations outlined above). In the current regulatory process Synergies understands that asymmetric risk has been quantified in the cash flows.

Notwithstanding the difficulties in precisely estimating the relationship between GGP's returns and the volatility of mining sector returns, we acknowledge that any analysis needs to be as robust as possible. At the same time, it would be inappropriate

to assume no relationship simply because it is not possible to accurately quantify it, although it is evident that such a relationship exists. We are of the view that having at least some regard to the risk profile of the underlying industry is an appropriate approach to apply when the business is servicing a specific industry or sector and hence its demand is almost completely derived from the demand for the underlying product or service.

Given the inherent difficulties in not being able to precisely estimate this relationship, the approach we have taken is conservative. It still assumes that the vast majority of the GGP's returns are driven by the same factors that influence the returns on an average gas transmission business. In seeking to adjust for the fact that its underlying risk profile is significantly different from other gas transmission pipelines (particularly regulated ones), we have only assumed that a very small proportion of its returns are sensitive to the performance of its underlying customers. This is considered very conservative because:

- the GGP has very high operating leverage;
- it assumes that all existing contracts remain on foot for their entire term (that is, there are no permanent or temporary mine closures); and
- contracts may not be renewed upon expiration.

Given the asymmetric consequences of error and the significant uncertainty facing the mining sector in Western Australia, it is important to ensure that some recognition of this risk is reflected in the rate of return to apply to the GGP.

A Debt beta

A.1 Treatment of debt beta in other regulatory decisions

The application of the Monkhouse formula requires the adoption of an assumption for the debt beta, which is a measure of the systematic risk borne by debt holders.

Notwithstanding that the CAPM was developed in the context of equity markets, not debt markets, a common approach to estimate the debt beta has been to use the structure of the CAPM:

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

This has the appeal of using a familiar relationship between beta and the market risk premium ($E(R_m) - R_f$). The approach attributes the total of the promised debt risk premium ($R_d - R_f$) to systematic risk. However, given it is recognised that a substantial determinant of the cost of debt is non-systematic default risk, this approach will significantly over-estimate the value of the debt beta.

An alternative approach is to assume the debt beta is zero. In a report prepared for the Queensland Competition Authority (QCA), Lally recommends the application of a debt beta of zero in a regulatory context:[35]

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

The ACCC considered this issue in the development of its *Statement of Principles for the Regulation of Electricity Transmission Revenues* (Statement of Principles).[36] It noted the uncertainty surrounding the estimate of the debt beta, particularly given that it was not generally used by investors, and that different approaches yield different outcomes. It determined that it would apply a value of between 0 and 0.2. Importantly:

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

[36] Australian Competition and Consumer Commission (2004), Decision: Statement of Principles for the Regulation of Electricity Transmission Revenues – Background Paper, December.

> …the ACCC considers that the debt beta is immaterial as long as the same value is used in the de-levering and re-levering process.[37]

Presumably for this reason, the issues surrounding estimation of the debt beta have received little if any attention in recent regulatory reviews. A number of the state-based regulators have applied a value of zero and in many decisions the assumption is not stated at all (this may or may not imply that a value of zero has been adopted). The two exceptions to this are the QCA (who has assumed 0.1 to 0.12) and the Independent Competition and Regulatory Commission (who has assumed 0.06).

The preferred approach of both the ACCC and the AER is to adopt a value of 0.[38]

We note that the Authority has previously derived the debt beta using the CAPM-based approach, although its previous decision in relation to the GGP was silent on this matter (including the value of the debt beta). This approach was applied to GGP by the Independent Gas Pipelines Access Regulator in 2001. The Authority did apply a value of zero in its most recent WACC decision in relation to the freight and urban railway networks.[39]

A.2 Implications for this review

The fundamental deficiency of using the CAPM-based approach to derive the debt beta is that it will always overstate the debt beta given the debt margin is largely driven by non-systematic risk factors. This situation is exacerbated at the current time given the blow-out in credit spreads that have occurred due to conditions in global financial markets, with an increase in the debt margin resulting in a significant increase in the debt beta.

As noted above, the debt beta estimate is not considered an issue provided the same estimate is used in the de-levering and re-levering process. However, that in turn implies that the regulated entity's beta is being set with direct reference to the comparator data. When a higher value of debt beta is applied, for example, it will result in a relatively higher value for the de-levered asset betas (the comparators), and a lower equity beta when the regulated entity's asset beta is re-levered. In other words, this will prove 'immaterial' if the regulated entity's asset beta is set with *direct* reference to the comparator estimates.

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[37] ibid.

[38] Australian Energy Regulator (2008), op.cit., p.201.

[39] This was not explicitly stated in the Final Decision, however the Authority noted that this assumption had been applied in the Draft Decision. It is also implied by the final parameter assumptions adopted by the Authority based on the application of the Brealey-Myers formula.

This will not always be the case, particularly if the risk profile of the business is different to its comparators. More importantly, the fundamental issue here is whether there is a sound economic basis to support a higher value for the debt beta. As noted above, the cost of debt is largely driven by non-systematic default risk. There is no evidence to suggest that the expansion in credit spreads is due to an increase in the systematic risk of debt (that is, an increase in the covariance between the return on debt securities and the return on the market).

More specifically, this implies that there has been a global transfer of risk from equity holders to debt holders. There is no evidence that this has occurred nor is there any plausible reason why this would be the case. The more realistic scenario is that the systematic risk of debt has not changed and the movements in credit spreads are based on changes in perceived default risk (worsened by signalling problems associated with trading in the market for debt)[40].

In any case, as outlined above, given that the debt beta itself cannot be readily estimated the actual influence of systematic risk on corporate bond yields remains unknown.

What this highlights is the significant issues associated with deriving the debt beta using the CAPM (which, as noted above, was not designed for application to debt markets). The sensitivity of the debt beta estimate to changes in the debt margin assumes that these changes are solely driven by systematic risk. If this relationship does not hold, which we are firmly of the view is not the case, it can actually produce an outcome which has no theoretical support and in fact may contradict what is more likely to be the case in practice.

The difficulties in estimating debt beta have been recognised by others (for example by Lally, as outlined above). There is currently no robust, accepted methodology of deriving a reliable estimate for the debt beta. Given any CAPM-derived estimate will always overstate the value of the debt beta given the extent to which the debt margin is driven by non-systematic risks, this methodology must be discarded. While we acknowledge that the debt beta may have some positive value, in the absence of any reliable methodology to measure it we are of the view that it should be set at zero.

While setting beta at zero is not controversial in the context of recent regulatory decisions in Australia, it is important to emphasise that this is not because the issue "doesn't matter" provided the same debt beta assumption is used in the de-levering

[40] That is, given the heightened uncertainty associated with corporate debt investors perceive the desire of a debt holder to sell that debt as a 'signal' that the debt holder has inside information about the negative quality of the debt.

and re-levering process. This could be seen to imply indifference between applying the CAPM-derived debt beta (which is consistently applied in the de-levering and re-levering process) and using a debt beta of zero. Given the contradictory outcomes that a CAPM-derived beta can produce, it should be discarded.

In our view, a debt beta of zero should be applied because there is currently no robust way of estimating a value that measures the systematic risk of debt only. This is particularly important given the asymmetric consequences of error. An assumption of zero has therefore been recommended for the purpose of this analysis.

B Comparable Companies

Firm	Equity Beta	Average Debt to Equity	t-statistic	R^2	Asset beta
Australian mining companies					
Alumina Limited. Alumina Limited is an Australian resource company that produces alumina. The Company owns about forty percent of Alcoa World Alumina and Chemicals through a joint venture with Alcoa.	2.08	9.15%	8.565	0.559	1.91
BHP Billiton. BHP Billiton Limited is an international resources company. The Company's principal business lines are mineral exploration and production, including coal, iron ore, gold, titanium, ferroalloys, nickel and copper concentrate, as well as petroleum exploration, production, and refining.	1.31	6.63%	6.519	0.423	1.23
BlueScope Steel. BlueScope Steel Limited is a steel company operating in Australia and New Zealand that serves the building and construction, manufacturing, automotive, and packaging industries worldwide. The Company manufactures and distributes hot and cold rolled coil, plate, tinplate, and coated products such as pre-painted steel and zinc/aluminium alloy-coated steel.	1.54	25.3%	4.984	0. 3	1.23
Fortescue Metals. Fortescue Metals Group Limited is involved in the exploration of iron ore through its East Pilbara Iron Ore Project in Western Australia.	3.63	18.1%	5.125	0.312	3.08
Independence Group. Independence Group NL is a gold and nickel mining and exploration company. The Company's exploration projects are located in Western Australia, South Australia, and the Northern Territory.	2.49	0.5%	5.594	0.351	2.48
Kingsgate. Kingsgate Consolidated Limited is a gold mining and exploration company with operations focused in Thailand at the Chatree gold project. The Company also explores for silver and other metals.	1.37	2.2%	3.495	0.174	1.34
Kagara Ltd. Kagara Limited specialises in the mining and extraction of zinc. The Company's exploration projects are located in Queensland and Western Australia and include Walsh River, Admiral Bay, Balcooma, Muldiva and Mount Garnet.	4.34	5.4%	6.895	0.451	4.12
Mincor. Mincor Resources NL is a nickel mining and exploration company with operations in the Kambalda Nickel District in Western Australia. Through a joint venture, the Company operates the Miitel and Wannaway nickel mines in Kambalda. The Company also has operations in projects located in Guinea, Tanzania and Fiji.	3.19	1%	7.265	0.476	3.16
Mt Gibson. Mount Gibson Iron Limited is an iron ore exploration and production company. The Company holds mining leases covering hematite and magnetite deposits at Mount Gibson in Western Australia.	3.89	7.6%	5.997	0.383	3.63
Minara. Minara Resources Limited and its subsidiaries are principally involved in the exploration, development and mining of nickel/cobalt metal from its Murrin Murrin Joint Venture operations in Western Australia.	2.41	1.72%	5.6	0.351	2.37
Newcrest. Newcrest Mining Limited is a gold mining, exploration and production company. The Company's exploration projects include Telfer and Boddington which are located in Western Australia. The Company also is developing and exploring at the Cadia Hill and Ridgeway projects in New	0.99	14.55%	2.985	0.133	0.87

Firm	Equity Beta	Average Debt to Equity	t-statistic	R^2	Asset beta
South Wales and the Gosowong project in Indonesia.					
OM. OM Holdings Limited is the holding company of OM Holdings Group, which processes and sells specialized metal materials in Australia. The Group's products include ferroboron, boric acid, magnesium sulphate and ferroalloys. The Group also sells manganese, chrome and other minerals to ferroalloy industries in China.	2.07	33.51%	2.59	0.104	1.56
Onesteel. OneSteel Limited manufactures steel long products and distributes metals in Australia. The Company produces structural, rail, rod, bar, wire, pipe and tube products along with distributing sheet and coil, piping systems, plate and aluminium products. The Company's products are utilized by the construction, mining, rail and other manufacturing industries.	1.69	27.64%	6.034	0.386	1.33
Oz Minerals. OZ Minerals Ltd. is an international mining company. The Company has interests in mining for zinc, copper, gold, silver, nickel, and lead. Oz Minerals' mining operations are located Asia and Australia and the Company also have exploration interests in Americas, Europe, and Africa.	2.54	12.51%	6.725	0.438	2.26
Panoramic. Panoramic Resources, Ltd. is a mining company that explores for and mines copper nickel, and cobalt in the Kimberley region of Western Australia.	2.76	8.36%	6.03	0.385	2.56
Platinum. Platinum Australia Limited owns and operates platinum mines in Australia and South Africa.	3.14	1.61%	5.022	0.303	3.09
Rio Tinto. Rio Tinto Limited is an international mining company. The Company has interests in mining for aluminium, borax, coal, copper, gold, iron ore, lead, silver, tin, uranium, zinc, titanium dioxide feedstock, diamonds, talc and zircon. Rio Tinto's various mining operations are located in Australia, New Zealand, South Africa, the United States, South America, Europe and Indonesia.	1.71	13.82%	5.864	0.372	1.51
Straits Resources. Straits Resources Limited is involved in exploration, production, and sale of copper, coal and gold. The Company primarily produces copper from its Girilambone Mine and explores for coal through its exploration of the Sebuku project in Indonesia.	3.19	28.47%	7.42	0.487	2.49
Western Areas. Western Areas NL is an exploration company that is involved in the development of the Fox Nickel mine and the exploration of nickel sulphides, platinum group metals and gold.	2.45	19.38%	5.164	0.315	2.06
Gas transmission and distribution					
APA Group. APA Group has interests in a portfolio of high-pressure gas transmission pipelines in Australia which transport natural gas.	0.81	166.44%	4.13	0.227	0.31
Envestra Limited. Envestra Limited operates natural gas distribution networks and transmission pipelines in South Australia, Queensland and the Northern Territory. The Company's networks distribute gas to households and businesses in Adelaide, Brisbane (north of Brisbane River), Alice Springs and various regional centres in South Australia and Queensland.	0.64	251.47%	3.276	0.156	0.18
AGL Resources Inc. AGL Resources Inc. primarily sells and distributes natural gas to customers in Georgia and southeastern Tennessee. The Company also holds interests in other energy-related businesses, including natural gas and electricity marketing, wholesale and retail propane sales, gas supply services, and consumer products.	0.3	76.26%	2.78	0.118	0.17
Atmos Energy Corp. Atmos Energy Corporation distributes	0.48	100.86%	4.177	0.231	0.24

Firm	Equity Beta	Average Debt to Equity	t-statistic	R^2	Asset beta
natural gas to utility customers in several states. The Company's non-utility operations span various states and provide natural gas marketing and procurement services to large customers. Atmos Energy also manages company-owned natural gas storage and pipeline assets, including an intrastate natural gas pipeline in Texas.					
Equitable Resources, Inc. Equitable Resources, Inc. is an integrated energy company with emphasis on Appalachian area natural-gas supply, transmission and distribution. The Company, through its subsidiaries, offer natural gas products to wholesale and retail customers.	0.88	20.8%	3.922	0.21	0.73
Southwest Gas Corp. Southwest Gas Corporation purchases, transports, and distributes natural gas to residential, commercial, and industrial customers in portions of Arizona, Nevada, and California. The Company also provides construction services to utility companies, including trenching and installation, replacement, and maintenance services for energy distribution systems.	0.63	112.35%	4.7	0.276	0.3