Systematic risk of Aurizon Network

Response to reports and submissions to the Queensland Competition Authority

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1. Context

In August 2012 we prepared a report for Aurizon Network in which we prepared an estimate of its systematic risk (commonly referred to as "beta"). In that report, entitled *Systematic Risk of QR Network,* we reached a conclusion that the systematic risk of the network was consistent with an equity beta estimate of 1.00, and an asset beta estimate of 0.55.[1]

To place this conclusion in context, the most recent conclusion of the Queensland Competition Authority ("QCA") with respect to the systematic risk of Aurizon Network is an equity beta of 0.80, and an asset beta of 0.45.[2] As an approximation for the typical firm in the market, this firm has an equity beta of 1.00 and an asset beta of 0.77, incorporating the QCA assumptions for debt beta and corporate taxes, and assuming leverage of 30%.[3]

We have been asked to respond to three papers presented to the QCA, each of which contends that the equity beta of Aurizon Network should be less than one. Those three papers, and their conclusions, are listed below:

- *Review of regulatory capital structure and asset beta/equity beta for Aurizon Network (Incenta Economic Consulting, 2013)* reached the conclusion that an equity beta of 0.73 and an asset beta of 0.42 were appropriate.[4] The report was prepared for the QCA. The report also concludes that gearing of 55% is appropriate.

- *Aurizon access undertaking: Risk allocation analysis (Castalia Strategic Advisors, 2013)* reached the conclusion that an equity beta of 0.60 was appropriate, which is equivalent to an asset beta of 0.36 at 55% gearing.[5] The report was prepared for the Queensland Resources Council ("QRC").

- *Review of Aurizon Network's draft access undertaking (McKenzie and Partington, 2013)* reached the conclusion that our report did not support a proposed adjustment of Aurizon Network's beta to a value of one.[6] The report reaches no conclusion on what would be an appropriate beta estimate. The report was prepared for the QRC and covers a number of issues relating to the cost of capital.

In this response focus on the major sources of disagreement between the analysis we conducted, and the analysis that is contained in each of the three reports listed above. We comment only briefly, or not at all, on issues of disagreement that are less material to the overall conclusions on equity beta. The main reason for the different risks assessments relate to how best to account for uncertainty over this parameter estimate. We respond to each report in turn.

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[1] The asset beta is an estimate of the systematic risk a business would incur if there was no debt in its capital structure. The equity beta is an estimate of the systematic risk which includes the incremental risk associated with fixed financing costs. The relationship between the equity beta and the asset beta, using the equation adopted by the Queensland Competition Authority ("QCA") is as follows, assuming 55% leverage, an effective corporate tax rate of 15%, and a debt beta of 0.12. $\beta_e = \beta_a \times \left[1 + \frac{D}{E} \times (1-\tau)\right] - \beta_d \times \frac{D}{E} \times (1-\tau) = 0.55 \times \left[1 + \frac{0.55}{0.45} \times (1-0.15)\right] - 0.12 \times \frac{0.55}{0.45} \times (1-0.15) = 1.12 - 0.12 = 1.00$. In our report we assumed gearing of 60% and an effective corporate tax rate of 30%. At an asset beta of 0.55 this also results in an equity beta of 1.00.

[2] QCA (2010, p.50) $\beta_e = \beta_a \times \left[1 + \frac{D}{E} \times (1-\tau)\right] - \beta_d \times \frac{D}{E} \times (1-\tau) = 0.45 \times \left[1 + \frac{0.55}{0.45} \times (1-0.15)\right] - 0.12 \times \frac{0.55}{0.45} \times (1-0.15) = 0.92 - 0.12 = 0.79$.

[3] $\beta_e = \beta_a \times \left[1 + \frac{D}{E} \times (1-\tau)\right] - \beta_d \times \frac{D}{E} \times (1-\tau) = 0.77 \times \left[1 + \frac{0.30}{0.70} \times (1-0.15)\right] - 0.12 \times \frac{0.30}{0.70} \times (1-0.15) = 1.04 - 0.04 = 1.00$.

[4] Incenta Economic Consulting (2013, p.17).

[5] Castalia Strategic Advisors (2013, p.2).

[6] McKenzie and Partington (2013, p.31).

2. Econometric analysis undertaken by Incenta Economic Consulting

2.1 Interpretation of information

The approach taken by Incenta was similar to the approach we undertook to estimating beta. The analysis in both reports relies upon regression analysis of excess stock returns on excess market returns. In other words, we both make an estimate of beta on the basis of the association between stock returns and market returns in the past.

The reason this analysis is particularly challenging in the case of Aurizon Network is that there are no pure-play, Australian-listed regulated rail networks. So beta estimates for Aurizon Network are informed by listed firms that share some of the characteristics of an Australian, regulated rail network.

This leads to the first area of disagreement between the analysis we conducted, and the analysis performed by Incenta – sample selection. Our conclusion on beta was informed by three different samples of listed firms: (1) Australian-listed energy networks; (2) Australian-listed industrial transportation firms; and (3) U.S.-listed railroads. The conclusion on beta reached by Incenta was informed by (1) a sample of energy and water businesses listed in Australia and overseas, and (2) a sample of toll road businesses listed in Australia and overseas. The conclusion on beta was also informed by a beta estimate from an independent expert, Grant Samuel for the Dalrymple Bay Coal Terminal. Incenta compiled beta estimates for firms in other industries (coal, rail, and airports) but these beta estimates were given zero weight in reaching a conclusion.

The second area of disagreement relates to estimation issues. In both sets of analysis there is a set of beta estimates compiled simply by regressing excess stock returns on excess market returns. We also introduce estimation techniques that incorporate additional firm characteristics into the estimate of systematic risk. These characteristics were the size of the firm (measured by market capitalisation), the ratio of book value of equity to market value of equity, market value leverage, and industry classifications of FTSE. The use of these latter estimation techniques as motivated by the concept that firms with similar characteristics could have similar beta estimates, and that industry classifications are just one relevant characteristic. The firm's size, book-to-market ratio and leverage could also be relevant to risk. The Incenta report disagrees with this analysis on the basis that the primary reason for alternative beta estimates under these technique was the use of FTSE industry classifications, rather than size, book-to-market ratio and leverage. (Note that the use of FTSE industry classifications is in addition, and not instead of, the grouping of firms into energy networks, industrial transportation or railroads.)

For the purposes of this response, which is intended to focus on the major areas of disagreement, we do not consider this alternative analysis any further. If we place 100% reliance on the single factor relationship between excess stock returns and excess market returns, our conclusion is an asset beta estimate of 0.52, and an equity beta estimate of 0.93. This results from placing 50% weight on Australian-listed energy networks ($\beta_a = 0.33$), Australian-listed industrial transportation ($\beta_a = 0.66$), and U.S.-listed railroads ($\beta_a = 0.75$).[7]

The means that the difference in beta estimates from our analysis and that conducted by Incenta are asset beta estimates of 0.52 versus 0.45, and equity beta estimates of 0.93 versus 0.73. There is just a 15% difference in the estimate of how much systematic risk the assets of Aurizon Network is exposed

[7] Note that we rely upon an assumption that the effective corporate tax rate is 15% in un-levering and re-levering, compared to our prior assumption that the effective corporate tax rate is 30%. We also rely upon gearing for Aurizon of 55% compared to our prior assumption of 60%. As mentioned earlier the impact of these assumptions is almost exactly offsetting.

to, and the difference is almost entirely due to how much weight should be attributed to different samples.[8] So the differences in conclusions comes down to interpretation of the empirical estimates.

In Table 1 we present the asset beta estimates compiled by Incenta from analysis of returns. The table contains the median beta estimates from Table 5.3 of the Incenta report because Incenta's overall conclusion of an asset beta of 0.42 is formed with respect to the median for Energy & Water Networks. Incenta does not apply specific weights to different estimates in reaching its conclusion. Rather, the upper bound of a range is estimated with respect to Tollroads (β_a = 0.49), and the lower bound of a range is estimated with respect to an estimate for DBCT made in an independent expert's report (β_a = 0.35). Incenta makes it clear that no consideration is given to its estimates for Coal, Rail and Airports in reaching its conclusion.

In the table we also report what the asset beta estimate would be if different weights were applied to different industry sectors. The reason for this is to illustrate the fundamental difference in the way we have interpreted regression-based beta estimates, compared to the way these were interpreted by Incenta. The difference in approach is summarised in the paragraphs below.

We identified three sets of comparable firms that shared some characteristics with Aurizon Network, and which were likely to be indicative of systematic risk. Two of these samples were listed in Australia (Energy Networks and Industrial Transportation), so are exposed to conditions affecting the Australian economy. Two of these samples were drawn from industry sectors that Aurizon Limited itself is contained in (Industrial Transportation and its sub-sector, Rail), so will have some similarity in business models and cost structures to Aurizon Network. One of these sample is regulated in a very similar regime to Aurizon Network (Energy Networks) and another sample has some firms regulated in a similar regime (Industrial Transportation includes some regulated infrastructure). Given that there are no listed firms that can be considered ideal comparable firms to Aurizon Network, our approach is to apply weights to the beta estimates on the basis of relevance and reliability.

The approach of Incenta was to place almost sole reliance on the one industry sector that it considered best matched the risk of Aurizon Network, namely Energy & Water Networks (we consider the lower and upper bounds of a range separately). This comparability is based upon regulatory arrangements, and places no reliance upon products, customers, cost structure or any other industry characteristic. The approach of Incenta was to determine that regulated Energy & Water Networks met a hurdle for comparability in regulation, so this was given weight in reaching a conclusion. Even though other industry sectors, were considered by Incenta to share some characteristics that are similar to Aurizon Network, namely Airports, Rail and Coal, they were given no consideration in reaching a conclusion because the regulatory comparison criteria was not close enough.

[8] There are other less important estimation differences. First, we rely upon all available returns information, which can extend as far back as 1976, while Incenta relies only upon 10 years of returns estimation on the basis that over a "long period of time there may be significant changes in market relationships, operating characteristics of firms, regulatory arrangements, and the composition of the Australian stock market itself (p.47)." We do not want to debate the merits of an appropriate time period in this submission as this is not the major reason for differences in conclusions. We previously addressed the general question of whether truncating data in beta estimation increases estimation error and found that estimation error reduces if more data is used (Gray, Hall, Klease and McCrystal, 2009). But it has been standard practice in regulation to exclude the very unusual period associated with the technology bubble, which is one reason relied upon by Incenta for a 10 year estimation period. Second, we compiled beta estimating using returns every four weeks, and performed the analysis 20 times, because beta estimates can fluctuate materially depending upon the start point at which a returns series is computed. Incenta acknowledged the need to re-compute beta estimates using different start dates, but compiled beta estimates on a monthly basis (meaning that the length of the returns period changes because months have different numbers of days) rather than a four-weekly basis. We note that this analysis is not "more sophisticated (p.45)" than our analysis. It is different but it is not more sophisticated. If the objective is to estimate returns using a period that is consistent for every returns interval, our method is appropriate. If the objective is to estimate returns using periods that have different numbers of days, as calendar months do, then the Incenta method is appropriate.

Table 1. Beta estimates compiled by Incenta and overall estimates under different weights.

Sample	Firms	β_a	Weight applied to Energy & Water					
			100%	90%	80%	70%	60%	50%
Coal	10	1.35	0	1	2	3	4	5
Rail	7	0.89	0	2	4	6	8	10
Airport	6	0.63	0	3	6	9	12	15
Tollroad	7	0.49	0	4	8	12	16	20
Energy & Water	77	0.42	10	90	80	70	60	50
Overall asset beta			0.42	0.45	0.48	0.50	0.53	0.56
Other industries	30	0.70	0	10	20	30	40	50
Energy & Water	77	0.42	100	90	80	70	60	50
Overall asset beta			0.42	0.45	0.48	0.50	0.53	0.56
Equity beta at 55% gearing			0.73	0.79	0.85	0.90	0.96	1.02

In other words, the approach taken by Incenta is sequential. The first question is whether the firm is regulated in a manner similar to Aurizon Network. If yes, the second question is whether the industry is sufficiently comparable to a rail network. But this second question never enters the analysis because Airports, Rail and Coal did not meet the first threshold. Because the second question did not matter in the end (there are no listed, regulated rail networks) the only criteria ultimately applied by Incenta in determining a beta estimate was the form of regulation.

The approach we undertook was based upon an understanding that the characteristic of a firm being regulated is relevant to risk, but other aspects of the firm's business model and industry are also relevant to risk. The relevance of regulation and industry imply placing some weight on different samples which share different levels of comparability to Aurizon Network.

Returning to the figures reported in Table 1, we applied some weight to the asset beta estimates for the non-Energy & Water businesses, within the range of 0% to 50%. Amongst the other sectors, this weight was allocated to Tollroad, Airport, Rail and Coal firms according to a respective split of 40%, 30%, 20% and 10%. So, for example, in the 5th column of the table there is a weight of 90% applied to Energy and Water, with the remaining 10% weight applied to Tollroad, Airport, Rail and Coal in a split of 4%, 3%, 2% and 1%. This allocation is intended to reflect our interpretation of Incenta's views on the relevance on those different industries, on a relative basis. In short, Tollroads are more relevant than Airports, Rail and Coal. According to this split, the non-Energy & Water assets have a weighted average beta estimate of 0.70.

The point of this analysis is to demonstrate that placing any material reliance on firms outside of the Energy & Water segment leads to beta estimates that approximate those submitted by Aurizon Network and those implied by our analysis.[9] Specifically, columns 7 and 8 of the table show that, if industries other than Energy & Water were considered to have 30% to 40% relevance, the asset beta estimate would lie within the range of 0.50 to 0.53 (and the associated equity beta would lies within the range of 0.90 to 0.96). At 35% weight on these other industries, the asset beta estimate would be 0.52, and the implied equity beta would be 0.93.

This means that the difference in beta estimates (asset betas of 0.45 versus 0.53, and equity betas of 0.73 versus 0.93) can be attributed to differences in how information is used to make decisions involving uncertainty. According to the Incenta use of information, Airports, Rail and Coal were too remote according to one criteria (regulation) to be afforded any consideration, which leaves regulated

[9] As mentioned previously, we comment separately upon the reliance of an estimate of beta for DBCT contained in an independent expert report.

utilities as the determinant of risk (Energy & Water) and Tollroads allocated a role in determining an upper bound. According to the process we used to analyse information, industries were given weight in decision-making to account for their relevance. Under this approach, if 35% weight was placed on industries other than regulated utilities, the beta estimates are in line with those already considered.

Of course, other weights can be applied, in comparison to those we used in compiling Table 1. But this does not mean that a better alternative is to argue that one sample of firms (that is different to Aurizon Network) should be given sole consideration over another set of firms (that is different to Aurizon Network). This criteria places undue emphasis on the nature of a regulated asset at the expense of any other characteristic associated with comparable firms. This includes the business model and customer base of a rail network and the regulated returns of airports and tollroads (even though the nature of regulation is different, these firms do not have free reign to earn monopoly rents). The basis for this almost sole reliance on regulation as a criteria for comparability is considered in the subsequent section.

2.2 Regulation and risk

In the Incenta report there is reference to a number of academic studies in which the researchers examined the relationship between systematic risk and regulation. We discuss the results of some of these studies below. But at the outset we need to make two points perfectly clear. The impact of regulation on a rail network has not been a feature of any empirical study referenced in the Incenta report. It is not the case that empirical evidence supports the exclusion of listed rail networks from consideration on the basis that regulated rail networks have lower risk than unregulated rail networks – Incenta had empirical estimates of systematic risk for regulated rail networks they would use it directly. All of the conclusions about the relationships between regulation and risk are based upon analysis in other industries.

Furthermore, it is not the case that the submission of Aurizon Network and our conclusions were that Aurizon Network faces the same risk as a U.S.-listed railroad. We estimated an asset beta of 0.75 for U.S.-listed railroads and Incenta estimated an asset beta of 0.89 for Rail. An asset beta estimate of 0.52 represents 31% lower asset risk than our asset beta estimate for rail, and 42% lower risk than the Incenta estimate for rail. The lower asset beta estimates for Aurizon Network, compared to other railroads, makes sense because of Aurizon Network's relatively higher target gearing. So it is not the case that either the Aurizon Network submission, or our analysis, ignored the impact of risk differences of listed rail firms. It is the case that these risk differences were given appropriate consideration in reaching a conclusion.

Consider in more detail the relationship between regulation and risk, with reference to the academic research cited by Incenta and summarised in Table 2.[10] In this consideration, note that there was zero weight given to listed rail firms by Incenta, primarily on the basis that regulation is different for the comparable rail firms compared to Aurizon Network. Incenta reaches the conclusion that alternative forms of regulation are not associated with differences in asset betas. It is on the basis of this conclusion that it relies upon a sample of 70 listed energy and water networks in different markets as a benchmark for the systematic risk of Aurizon Network.[11] In contrast, the most important criteria used by Incenta to place no reliance on listed rail companies is that the prices charged by Aurizon Network are regulated under a revenue cap, and the take or pay contracts struck between Aurizon Network and its customers are likely to lead to revenue being recovered.[12]

[10] The relevant section is entitled "Impact on form of regulation" on pages 17 to 19 of the Incenta report.
[11] Incenta (2013, pp. 65 – 66).
[12] Incenta (2013, p. 25).

This means that is regulatory and contractual arrangements that underpin the rationale to rely on the beta estimates of listed energy and water companies (in different industries to Aurizon Network) and place no reliance on beta estimates of listed rail companies (in the same industry as Aurizon Network). Yet Incenta found that different regulatory regimes (revenue cap, price cap or otherwise) were not associated with differences in beta estimates.

There is a logical inconsistency in this conclusion. According to the literature cited by Incenta, differences in regulation imply different degrees of confidence that revenue will be received. High powered regulation (such as price cap regulation) implies lower probability that revenue is received. Medium-powered regulation (such as revenue cap regulation) implies relatively higher probability that revenue is received. And low-powered regulation (such as rate of return regulation) implies the highest probability that revenue is received. Incenta finds that differences in regulation had no impact on asset beta. Then, in consideration on Aurizon Network, Incenta discusses the nature of regulation (a revenue cap) and contractual arrangements (take or pay contracts), and determines that these factors lead to a high probability that projected revenue is received, so this should lead to lower beta estimates.

If we consider the papers cited by Incenta, there is an increasing amount of data analysed as time progressed – more firms were considered in more countries in more industries. A careful review of the evidence shows that is it consistent with Incenta's conclusion that the form of regulation does not appear to be associated with differences in systematic risk estimates. In the two most comprehensive studies (Gaggero, 2012; Rothballer, 2012) there is large-sample evidence of this conclusion across industries and markets. Gaggero (2012) finds no difference in the beta estimates, or indeed the profit variation over time, of regulated utilities subject to low, medium or high powered incentives. The estimates reported by Rothballer (2012) show no difference in asset beta estimates for infrastructure firms subject to an incentive regime (including price caps and revenue caps), compared to a low-powered regime, when the regulator is independent of government. The two earlier studies do not really tell us anything about the relationship between the power of the regulatory regime and incentives, for reasons presented in Table 2.

In conclusion, the evidence on the relationship between regulation and systematic risk estimates (cited by Incenta) does not demonstrate any relationship between regulations which alter the uncertainty over the revenue stream and estimates of systematic risk. The primary basis upon which listed firms in industries other than energy and water (and, in particular, rail) is given no weight by Incenta is that regulation and contractual terms reduce uncertainty over the revenue stream. If reducing uncertainty over the revenue stream has not been shown to have a relationship with systematic risk, then this conclusion is inappropriate and weight should be applied to industries other than energy and water, and especially, weight should be given to listed rail networks.

Table 2. Summary of results on the relationship between regulation and risk

Article	Result
Alexander, Mayer & Weeds (1996) – World Bank Working Paper	**From 1990 to 1995 U.K.-listed utilities had *higher* asset beta estimates than U.S.-listed utilities.** The conclusion of the paper is "that high-powered incentives appear to be related to higher systematic risk, while low-powered incentives imply low market risk." But the sample is predominantly U.K.-listed companies (operating under a more powerful RPI – X regime and U.S.-listed companies (operating under a less powerful rate of return regime). This limitation is acknowledged by the researchers.
Grout and Zalewska (2006) – Journal of Financial Economics	**From 1 July 1997 to 12 August 1999, when there was discussion about moving from an incentive regime to a profit-sharing regime, there was a relative reduction in the equity and asset beta estimates for a sample of 15 regulated firms in the UK compared to a control sample of 18 non-regulated firms. The effect can be equally attributed to a windfall tax imposed on UK Utilities at exactly the same time as the period under study.** As with studies relating to a particular time period there is the potential for contemporaneous events to be the underlying cause for an observed effect. On 1 May 1997 there was a change in government in the U.K. The new Labour government imposed a windfall tax on U.K. companies that were previously privatised, based upon the market value at privatisation and the operating profits in the four years after privatisation. The U.K. Windfall Tax was enacted on 2 July 1997 and required payments in equal instalments on 31 December 1997 and 1998.[13] For example, the tax on the average water utility was estimated at 10% of market value, and at 24% for Hyder.[14] Furthermore, in 1999 the U.K. water regulator announced price cuts of 12% from 2000, from consultation that occurred during 1998 and 1999, the first time prices were cut since privatisation.[15] Given these two events – a change in government and associated tax, and large price reductions, it is hardly surprising that company returns were less associated with overall market returns during this two year period.
Gaggero (2012) – Bulletin of Economic Research	**From 1995 to 2004 there was no difference in the beta estimates of regulated utilities subject to low, medium or high powered incentives.** In supporting analysis, the researcher finds that profits do not exhibit any different variation across the regulatory regimes.
Rothballer (2012) – PhD thesis, Technical University of Munich	**From 2005 to 2009 for 764 infrastructure firms regulated by an independent regulator in an incentive regime (which includes price caps and revenue caps) the characteristic of the firm being regulated has no impact on asset beta.**[16] There are off-setting factors. In general, regulation is associated with lower asset beta (–0.115). But this is offset by the impact of an incentive regime operated by an independent regulator (+0.109).[17]
Incenta (2013)	**From July 2012 to June 2013 regulated energy firms in Australia, NZ and the UK had *lower* asset beta estimates than regulated energy utilities listed in the U.S. and Canada. Within these two samples there was no difference in asset beta estimates amongst different regulatory regimes.** In the Australia, U.K. and N.Z. sample, price-cap and revenue-cap regulated firms had almost identical mean and median asset beta estimates. In the U.S. and Canada sample, decoupled, cost of service and incentive regulated firms had almost identical mean and median asset beta estimates.

[13] http://www.irs.gov/Businesses/Coordinated-Issue-Utility-Industry-United-Kingdom-Windfall-Tax-(Effective:---May-22,-2002). The validity of the tax for U.S. companies has been the subject of legal argument since it was enacted. See also Chennel (1997) for a detailed description.

[14] Thomas (2000).

[15] Ofwat (1999).

[16] Rothballer (2012, Table. 6.4, Column 3, p. 155).

[17] The coefficients are +0.010 for the incremental impact of an incentive regime, –0.091 for the incremental impact of an independent regulator and +0.190 for the interaction of an independent regulator in an incentive regime.

2.3 Range for beta estimates

The range of systematic risk estimates considered appropriate by Incenta spans an upper bound of 0.49 for the asset beta (equivalent to an equity beta of 0.87) and a lower bound of 0.35 (equivalent to an equity beta of 0.59).[18] The upper bound is the regression-based estimate from the Tollroad sample. The lower bound is an estimate for DBCT compiled by Grant Samuel in an independent expert report.[19]

In the independent expert report, the equity beta estimate of DBCT is within a range of 0.7 to 0.8. The justification for this selection of the equity beta is that "[w]hile this appears low, none of the other listed ports are regulated and in Grant Samuel's view, the regulated nature of the assets (and the certainty of its cash flows) warrants a lower beta."[20] This equity beta estimate is used in conjunction with an estimate for leverage within the range of 60% to 70%.[21] The gearing assumption is justified on the basis that "[a] higher debt/value ratio of 60-70% has been adopted for DBCT on the basis that it can support higher gearing given the regulated and certain nature of its cash flows."

This represents the extent of the justification for the selection of an equity beta estimate below the estimate for overseas-listed ports businesses, and for the selection of gearing above the leverage for those businesses. The authors of the report simply decided on estimates for equity beta and decided on gearing levels.[22]

In the same report there is also a beta estimate for WestNet Rail within the range of 1.0 to 1.1,[23] used in conjunction with leverage of 20 to 25%.[24] Both the beta estimate and the leverage ratio are based upon analysis of listed rail operators in North America. WestNet Rail is described in the expert's report as (emphasis added):

> "**a rail infrastructure and rail access provider** operating in Western Australia with a 49 year agreement (39 years remaining) to lease track from the Western Australian Government. …
>
> **WestNet Rail is regulated by the Western Australian Economic Regulation Authority. Revenue is based upon revenue floors or ceilings for line segments.** The next floor and ceiling review is due in June 2012. To date the regulation has had little direct impact as all customers have negotiated contracts outside the regime and gross revenues by line have been generally below regulated revenue ceilings.
>
> Since 1999 freight volumes hauled have increased from 29 million tonnes to 50 million tonnes as a result of resource development in Western Australia and growth of interstate freight traffic. Today, iron ore, bauxite and alumina make up 60% of materials travelling on WestNet Rail while the annual grain load is relatively small, averaging less than 7 Mtpa. Approximately half of the products transported (by value) are **exported through Western Australian ports.**

[18] Incenta (2013, pages 3 to 4, 16 to 17, and 60 to 61).
[19] Grant Samuel (2010).
[20] Grant Samuel (2010, Appendix 1, p. 10).
[21] Grant Samuel (2010, Appendix 1, p.14).
[22] These conclusions could have been informed by quantitative analysis that is not detailed in the report, but this is what we can observe from the report itself.
[23] Grant Samuel (2010, Appendix 1, p.10).
[24] Grant Samuel (2010, Appendix 1, p.14).

> Revenue is generated from access charges paid by above-rail operators or directly by underlying customers. It is **largely stable, underpinned by long term access agreements with its customer base.** WestNet Rail has access agreements with major corporate customers (including a long term access agreement with QR National). The key users of the WestNet Rail network for mineral transportation include Cliffs Natural Resources, Alcoa, Worsley Alumina, Minara Resources and Mt Gibson Iron.
>
> WestNet Rail's volumes are **highly leveraged to Asian demand for commodities** and grain production. In the year ended 30 June 2010 EBITDA improved 6% to $109.8 million as a result of stronger iron ore demand from Asia, continuation of intermodal volumes as the Western Australian economy has improved and a strong grain harvest.[25]

This description contains a number of characteristics that are similar to Aurizon Network, which also provides rail infrastructure to major customers under long-term agreements who export commodities to Asia. Yet when Incenta considered the comparability of regulated rail assets in Western Australia it stated that:

> The other rail assets regulated by the Economic Regulation Authority (ERA) are not relevant to Aurizon Network, as they refer to assets that have significantly different systematic risks (e.g. iron ore haulage in the case of Pilbara Infrastructure, and subsidised city commuter rail in the case of the Public Transport Authority).[26]

So we have the following conclusions on what is relevant information. A regulated port in Queensland, used to export commodities to Asia, provides some relevant information for estimating systematic risk, as it is used to estimate a lower bound of a range. It is relevant because it has a similar regulatory framework and reliability over revenue. Regulated rail networks in Western Australia, used to export commodities to Asia, are irrelevant for estimating systematic risk – they have no bearing on either the point estimate or range for beta. The Incenta report also provides a compilation of beta estimates by regulators for rail networks in New South Wales but makes no comment on the relevance or otherwise of these estimates for a point estimate or a range for beta estimates.

The entire basis for use of one independent expert report to inform the lower bound of a range for beta, and making no use of beta estimates for rail operations either from the same export report, estimates by regulators, or estimates from empirical data, is predicated on the following choices:

- The empirical evidence is that variation in regulations leading to different degrees of certainty over revenue have no relationship with estimates of systematic risk. This evidence is ignored, and a decision is made that firms with stable revenue streams from regulation and contracts have low betas. This is the choice made in the independent expert's report with respect to the beta estimate for DBCT.

- It is appropriate to place reliance on one report's estimate of systematic risk, without consideration of the systematic risk estimates

- A Queensland port is sufficiently similar to a Queensland rail network to be relevant. A rail network in Western Australia is so remote in terms of comparability that it is irrelevant.

[25] Grant Samuel (2013, pp. 30 to 31).
[26] Incenta (2013, p.67).

This highlights the fundamental area of disagreement between the interpretation of the information in the Incenta report, and the submission made by Aurizon and the analysis contained in our report. The process for evaluating information adopted by Incenta is to apply a threshold of comparability in terms of regulation and contractual arrangements (which DBCT was considered to meet) and only after this threshold was met should we consider other industry characteristics. Even under this sequential criteria it is unclear whether rail assets in Western Australia are considered irrelevant on the basis of revenue and contractual arrangements, or on the basis of industry characteristics. Regardless, we do not consider it appropriate to apply this relevant/irrelevant distinction to different pieces of information.

2.4 Systematic risk, non-systematic risk and gearing

In the Incenta report, conclusions on beta are reached jointly with conclusions on appropriate gearing. Incenta documents estimates of leverage for different industries, which includes the following gross leverage estimates: Tollroads – 59%, Airports – 50%, Energy – 46%, Water – 40%, Railroad – 23%, Coal Mining – 24%. Incenta states that Aurizon Network can support gearing of 55% on the basis of its regulatory framework and stable cash flows. It also states that Aurizon Network's ability to support higher gearing than U.S.-listed railroads is an indicator that its asset beta is likely to be lower than the asset beta of U.S.-listed railroads.[27]

This statement is consistent with the submission of Aurizon Network, and the beta estimates from our analysis. Our asset beta estimate from a single factor model for Aurizon Network is 0.52, which is well below the asset beta estimate of 0.89 reported by Incenta for rail firms and the estimate of 0.75 we reported. Incenta prefers an asset beta estimate for Aurizon Network of 0.42 because rail firms are considered too remote in terms of comparability to be considered irrelevant. Yet if the low gearing of U.S.-listed railroads provides support for the *exclusion* of this set of firms from consideration, by the same logic the high gearing of Tollroads and Airports is support for the *inclusion* of these firms for consideration.

This is an extension of the sequential manner in which industries are considered to be either relevant or irrelevant for consideration. Airports are considered irrelevant because of light-handed regulation, and Tollroads are only used to construct an upper bound because regulation is not close enough to the framework applied to Aurizon Network. The gearing of these industries suggests that they should have high stability of operational profits, but they are still not assigned weight in reaching a conclusion on beta because they did not overcome the first hurdle of regulatory comparability.

[27] Incenta (2013, p. 53).

3. Comparison of regulatory decisions undertaken by Castalia Strategic Advisors

The second report we have been asked to respond to is *Aurizon Access Undertaking: Risk Allocation Analysis*, by Castalia Strategic Advisors. The recommendation of this report is that, assuming 55% leverage, an appropriate equity beta for Aurizon Network is 0.6. The basis for this conclusion is that Aurizon Network has less risk than other regulated networks (the Sydney Desalination Plant, Electranet, Gasnet, Aurora Energy and Telstra's fixed line network) and those businesses were assigned equity betas within the range of 0.7 to 0.8 by regulators, in conjunction with 60% leverage. If Aurizon Network has less risk than other regulated networks, and had the same leverage of 60%, it should have an equity beta less than 0.7. Adjusting the lower bound of 0.7 for leverage of 55%, the implied equity beta is 0.64. So on the basis of this lower bound the report concludes that equity beta of 0.6 is appropriate for Aurizon Network.[28] This is consistent with an asset beta of 0.36.

In order to place this report in context, and to focus on the major issues of disagreement (as with our response to the Incenta report), we first lay out the following conclusions:

- According to our analysis of Australian-listed energy networks, Australian-listed transportation firms, and U.S.-listed railroads, and relying on the single-factor regression estimates, the asset beta is estimated at 0.52 and the equity beta is estimated at 0.93.

- According to the Incenta analysis of energy networks listed in Australia and overseas, and relying on the single-factor regression estimates, the asset beta is estimated at 0.42 and the equity beta is estimated at 0.73.

- According to the Castalia comparison of beta estimates by regulators, the asset beta is estimated at 0.36 and the equity beta is estimated at 0.60.

The potential risk exposure considered in the Castalia analysis is partitioned into seven risks associated with revenue, expenditure, inflation, stranding and bypass, regulatory, political, and force majeure. The consideration of these risks is performed entirely on the basis of a qualitative assessment of regulation and contractual terms. As discussed previously, the empirical evidence does not support the idea that businesses operating across high- versus low-powered regulatory regimes has a clear relationship with estimates of systematic risk. The Castalia analysis is premised on the assumption that if we think about how rules and contractual terms should affect revenue and costs, then we can easily rank firms according to systematic risk. But this is not supported by empirical evidence.

With respect to the five individual cases considered by Castalia, we have the following conclusions which apply to the systematic risk of assets (that is, the risk comparison listed below is independent of leverage – the asset beta estimates listed below are based upon the QCA re-levering assumptions):[29]

- Telstra ($\beta_a = 0.49$) and GasNet ($\beta_a = 0.42$) have significantly greater risk than Aurizon Network; and

- Aurora ($\beta_a = 0.42$) , Electranet ($\beta_a = 0.42$) and the Sydney Desalination Plant ($\beta_a = 0.37$) have greater risk than Aurizon Network.

This means that businesses classified as having significantly greater risk than Aurizon Network have an asset beta estimate, on average, of 0.45, and businesses classified as having greater risk than Aurizon Network have an asset beta estimate, on average, of 0.40. The main risk considerations in the Castalia report that lead to these conclusions are, firstly, considerations of expenditure risk, secondly,

[28] Applying the QCA un-levering formula as described previously, at an equity beta of 0.7, leverage of 60% and an effective tax rate of 15%, the asset beta is 0.37. If this asset beta is re-levered assuming 55% leverage the equity beta is 0.64.

[29] Castalia Strategic Advisors (2013), Table 5.1, Box 6.1 and Table 6.1.

consideration of revenue risk, and with relatively less weight assigned to the remaining risks. This conclusion does not appear in the report, but is consistent with the relative risk assessments in that report. For example, the only way Electranet can be classed as having greater risk than Aurizon Network is if expenditure and revenue risks are more important than regulatory risks; the only way Sydney Desalination Plant can be considered to not have significantly greater risk than Aurizon Network is if expenditure and revenue risks are given greater risk than the remaining risks.

There are two limitations of the rationale which underpins the conclusions. Consideration of any of these issues could easily lead to results that are consistent with an asset beta estimate of 0.52, and the associated equity beta estimate of 0.93.

First, revenue risks and expenditure risks are assessed purely on the basis of regulation and contractual terms. The presumption is that if one business is regulated under one set of terms, or writes a contract, which will reduce revenue volatility for *that* business it implies that the overall risk will be lower than for another business. But regulations and contracts are *outcomes* of the risks facing each business. Regulations and contracts differ across business because there are differences across those businesses. So you cannot simply assume that, all else equal, risk is different across firms because we can observe their rules and contracts. In the forum in which the results were presented the quote was made "it doesn't matter if you put a train on it." This underscores the presumption that the fundamental risks facing the comparator firms are the same, and that if we partition those firms into different types of rules and contracts we can assess their relative risks. This is the likely reason why the empirical evidence does not show a difference amongst systematic risk across businesses operating under different regulations – regulations reflect assessments of business risks, they do not operate independently of firm and industry characteristics.[30]

Second, there is no quantitative assessment of possible financial outcomes from differing risk exposure, either with reference to cash flows or returns. The basis for the measurement of beta using historical stock returns is that returns capture the combined impact of all risks facing the firm, which includes risks affected by rules and contracts. There are limitations associated with the reliability of beta estimates from returns, sample size and comparability, as discussed previously. But in returns we at least have a measurement of how much one type of risk if offset by another type of risk. Another way to think about risk measurement is an assessment of theoretical asset value associated with different outcomes – scenario analysis or large-scale simulations (that is, many scenarios) – in which there is a measurement of how returns would be affected by risk exposure. However, the analysis presented in the Castalia report relies upon neither historical returns information, nor asset value estimates in different scenarios. It merely compiles a set of possible risk exposures, embeds an assumption that risks outside of rules and contractual terms are about the same, and then layers on top a relative risk assessment in qualitative terms.

In sum, the Castalia relative risk assessment relies upon a premise that is not supported by empirical evidence (rules and contracts can be easily used to assess relative risk), makes no allowance for the likelihood that rules and contracts reflect risks (rather than just add or subtract to risks), and contains to quantitative measurement of how much revenue and expenditure variation Aurizon Network might be exposed to and how this is associated with beta.

[30] Aurizon Network has performed a separate assessment of its relative risk exposure under the risk partition used in the Castalia report. This assessment demonstrates that an assessment of relative risks cannot be assessed independently of other firm and industry characteristics.

4. Response to the commentary by McKenzie and Partington

The final report we have been asked to respond to is entitled Review of Aurizon Network's draft access undertaking by McKenzie and Partington (2013). In this paper we respond to the discussion of equity beta in Section 3 of that report. The conclusion of that report is that "we see no evidence to support Aurizon's proposed adjustment of beta to a value of one."[31] As with our previous discussion we constrain our response only to the main issues of disagreement affecting conclusions on the beta estimate. So we only consider beta estimates with respect to the one factor model, and leave aside McKenzie and Partington's critique of our analysis that relied upon more firm characteristics.[32] The report raises two main issues with respect to beta estimation that we consider in turn.

First, the report takes issue with reliance on the use of U.S.-listed railroads as a set of comparator firms. The basis for this concern is that U.S.-listed railroads have lower leverage than railroads from Europe and Japan. U.S.-listed railroads also have less leverage than the gearing of 55% assumed for Aurizon Network. So the report states that "the comparator firms are different from railroads in some fundamental respect."[33] The report then extends this conclusion to suggest that a low weight be attached to the betas estimates for Australian-listed transportation firms.

Consistent with previous discussion in this paper, there needs to be consideration of how much weight to assign to different, imperfect comparator samples. Listed energy and water networks also comprise a different, imperfect comparator sample. It is fine to say that there could be something different about U.S.-listed railroads, which was acknowledged in the original analysis. But this does not imply that even more weight be placed on other comparator firms. The report by McKenzie and Partington does not reach a conclusion on this issue, apart from the implication that we placed too much weight on one set of firms versus another.

Second, the report highlights that beta estimation is a complex process and beta estimates are made with imprecision. In the introduction to Section 3, the report highlights that an important determinant of beta will be how exposed Australia's economy is to the global economy. The report goes on to say that regulators have taken a view that regulated utilities are appropriate comparators for regulated railroads. The report falls short of expressing a view as to whether this regulatory view is correct, or whether any consideration should be given to businesses other than utilities. The report also uses the words "adjustment of beta to a value of one" but falls short of stating that the value of 0.8 previously used is the best estimate of systematic risk.

The implication of our analysis is that, if we only consider the single-factor model beta estimates, Aurizon Network would have an asset beta of 0.52 and an equity beta of 0.93. Aurizon Network would have less systematic risk than U.S.-listed railroads (according to our beta estimates and those relied upon by McKenzie and Partington and Incenta) and less systematic risk than the average firm in the market, and more systematic risk than a listed energy and water network (according to our beta estimates and the figures reported by Incenta). In the absence of a conclusion on how much weight to apply to quantitative measurement, we are not sure what conclusions can be drawn from the analysis presented by McKenzie and Partington.

[31] McKenzie and Partington (2013, p. 31).

[32] We point out, however, that in the literature summarised in Table 2 there are many instances in which the researchers consider the relationship between size, book-to-market ratio, leverage and beta. There appears to be agreement that these characteristics are plausible determinants of systematic risk.

[33] McKenzie and Partington (2013, p. 28).

5. Conclusion

Beta estimation for use in the CAPM is challenging because estimates from historical returns are imprecise and it is challenging to find a large sample of listed firms with similar characteristics. With respect to Aurizon Network this issue is particularly challenging because there appears to be no listed rail networks that are considered to be highly comparable in terms of regulation and contractual terms. The analysis we submitted to the QCA addressed this limitation by compiling beta estimates from samples which each shared some characteristics with Aurizon Network, and placed weights on those estimates according to an overall assessment of relevance and reliability.

The approach taken by the analysis conducted for the QCA by Incenta applies a threshold test for inclusion on the basis of comparability of regulation and contractual terms. The only sub-sample of firms considered to meet this threshold was a sample of listed energy and water businesses, and the implied asset beta and equity beta estimates are 0.42 and 0.73, respectively. If any material weight is applied to other samples (either in our report or the report of Incenta) the results are consistent with asset beta and equity beta estimates of 0.52 and 0.93, respectively.

The reason this threshold rationale is inappropriate is because it places very high reliance on a presumption that regulation and contractual terms have a reliable association with beta estimates. This runs contrary to empirical evidence that has not found a relationship between different degrees of revenue certainty from regulation and beta estimates. The idea that we can simply make an assessment of revenue certainty on the basis of rules and contracts, and this implies high or low beta, is not supported by the data. The use of the threshold test, and its limitations, is highlighted by the reliance by Incenta on a beta estimate for a regulated port (DBCT) by an independent expert, but the lack of reliance on a beta estimate for a regulated rail asset (WestNet) by the same independent expert in the same expert report. The beta estimate for the port is used to assign a lower bound value but the beta estimate for the rail asset is not considered to have any relevance.

The focus on rules and contracts is taken further in analysis conducted for the QRC by Castalia Strategic Advisors. According to their analysis, asset and equity beta estimates of 0.36 and 0.60 are appropriate. This conclusion is founded on a qualitative assessment of rules and contracts, with the beta estimates formed on a relative comparison with other regulatory decisions. There is no quantitative assessment of how rules and contracts are associated with stock returns, nor is there a quantitative assessment of how rules and contracts would impact upon returns in any scenario. Importantly, there is a presumption that rules and contracts are formed independently of underlying risks. The likely reason we have not observed beta estimates that differ across firms that, in theory, could have different security of revenue, is that regulations and contracts reflect underlying risks. They are not simply layered on top of underlying risks.

The commentary by McKenzie and Partington highlights that the challenge associated with comparable firm analysis for Aurizon Network. The authors state that U.S.-listed railroads are different to Aurizon Networks (but so are energy and water networks, which is why the beta estimates we reported lie between estimates for those samples). The report states that regulators of rail assets have previously relied upon beta estimates for energy networks (but reaches no conclusion as to whether it agrees with this reliance or how much weight should be assigned to listed rail assets or other transport businesses).

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