



**QCA Cost of Capital Consultation:
Equity Beta Issues**

**Further supplementary report to the Queensland
Resources Council**

20 January, 2014

1 Introduction

Castalia has previously prepared a report for the QRC in relation to Aurizon Network's relative exposure to risk under its regulatory framework when compared with other regulated businesses in Australia, particularly electricity and gas businesses.¹

Our analysis showed that, when compared across the range of key risks, Aurizon has a lower risk than our case study businesses, but that the equity betas set by regulators for each of the four case study entities are well below the lower end of the range proposed by Aurizon Network. Based on this analysis, we conclude that Aurizon Network's equity beta should be lower than 0.7 based on 60 percent gearing, which is equivalent to an equity beta of 0.6 at Aurizon Network's 55 percent gearing.

Since our report in December 2013, Incenta has prepared a report for the QCA which includes a first principles analysis of Aurizon Network's systematic risk, and an estimate of its equity beta based on this first principles analysis.² Castalia has been asked by the QRC to comment on that report.

Summary of Castalia comments on the Incenta report

There are many aspects of the Incenta report with which we agree. Castalia strongly supports Incenta's use of a first principles approach to assessing the equity beta in preference to reliance on empirical evidence. This is very similar to the approach taken by Castalia in its previous report.

We support Incenta's use of a first principles approach as the most transparent, robust and reliable means of determining a beta value, consistent with the QCA's prior practice.

We also agree with Incenta that a comparison with Australian regulated energy and water utilities is to be preferred to the approach proposed for Aurizon Network by SFG, which:

- includes a large number of non-regulated, international and other comparator companies (including Class 1 Railways) which operate with fundamentally different operational and business risks to Aurizon Network or other Australian regulated businesses; and
- because many such comparators are unregulated, beta estimates must be derived from indirect empirical analysis of market returns, which SFG itself acknowledges involves a number of complex assumptions. This further undermines the reliability of the resulting betas used for comparison purposes.

Finally, we support Incenta's clear conclusion that on a first principles basis, US Class 1 Railroads are not relevant comparators as the nature of those businesses, and their respective risks, are fundamentally different to that of Aurizon Network.

While we agree that regulated energy and water businesses in Australia are likely to be the closest and most appropriate comparators, we maintain the view expressed in our previous report that these businesses are likely to be **more** risk-exposed than Aurizon Network, due to differences in the form of regulation which further insulate Aurizon

¹ "Aurizon Access Undertaking: Risk Allocation Analysis: Report to Queensland Resources Council", Castalia, October 2013

² "Review of Regulatory Capital Structure and Asset / Equity Beta for Aurizon Network: Report to the Queensland Competition Authority", Incenta Economic Consulting, 9 December, 2013.

Network. This will mean the re-levered equity beta values for these other regulated entities should act as an ‘upper bound’ for the Aurizon Network equity beta value.

Areas of disagreement with the Incenta report

While we agree with much of the Incenta report, there are three key aspects of Incenta’s approach to the estimation of equity betas with which we disagree.

Those areas are:

- The inclusion of toll roads in the sample of firms and its use as an upper point in the determination of a mid-point beta estimate. A ‘first principles’ assessment of these businesses (in the same way as Incenta undertook for Class 1 Railways) demonstrates that toll road firms are fundamentally different to Aurizon Network or other Australian regulated utility businesses, with much higher business risks. These firms are, therefore, unsuitable as comparators or point estimates in any sample used to determine a beta range for Aurizon Network
- The inclusion of international energy businesses in the sample, for a range of reasons, including the general unreliability of international beta comparisons and the related assumption that the type of regulation applying to international businesses do not have an impact on equity beta (or can be adequately compared); and
- The use of simulated monthly beta estimates. Without a theoretical basis to explain the results reached by Incenta, we are uncertain if their methodology corrects or adds to a bias. Without further analysis to understand the factors leading to the result, it would therefore be extremely unsafe to rely upon this unconventional methodology.

Each of these issues has the following effect upon the resulting asset and equity beta calculations:

Table 1.1: Analysis of comparator energy firms

	Asset beta	Equity beta
Incenta position	0.42	0.73
Removing toll roads	0.39	0.67
Removing international energy and other comparators	0.31	0.51
Applying a conventional approach to calculation	0.27	0.42

Using the Conine equation with 55 percent gearing, a debt beta of 0.12 and gamma of 0.5

These issues are discussed in further detail in the remaining sections of this report.

2 Inclusion of Toll Roads

Incenta included toll roads in the sample used to estimate the asset beta for Aurizon Network. This toll road beta estimate provides the upper point estimate from which a mid-point equity beta is then calculated.

Unlike Class 1 Railways, Incenta did not undertake any detailed or ‘first principles’ assessment of the business or operating risks of toll roads and their comparability to Aurizon Network. At most, Incenta found that toll roads “*share some similar risk characteristics to Aurizon Network*”, although these were not explained. Rather, Incenta acknowledged that toll roads have “*significantly more volume risk*”.

The seven toll roads included in their sample have an estimated asset beta of 0.49 using their simulated month methodology. Incenta states that this “defines the upper bound” of the range of asset betas for Aurizon Network. This range is then used to justify the selection of a ‘mid-point’ asset beta estimate of 0.42.

On a “first principles” basis we disagree that toll roads are a suitable comparator for Aurizon Network and thus that the 0.49 asset beta estimate is in any way relevant in setting the upper bound point estimate for the asset beta range.

In our previous report we noted that one of the effects of regulation is, to some extent, to insulate firms from normal business risks. This occurs through features in the regulatory framework such as:

- Regular periodic regulatory resets of costs (capital, operating and financial) and demand in response to changing circumstances
- Pass through mechanisms where costs change unexpectedly
- Revenue caps that reduce demand risk; and
- Protection from bypass or stranding risks through a fixed asset base.

That is to say, regulation acts to insulate regulated firms from demand and, in the case of revenue cap regulation, also from price risks.

Toll roads, by contrast, have **none** of these features. Toll roads have no protection against business risks as they are subject to:

- Construction risks as they are usually awarded a greenfields concession
- Changes in their costs—that is capital, operating and financial costs
- Demand risk both initially when the toll road is constructed and throughout their life as patronage levels and traffic patterns change; and
- Bypass or stranding as other roads and transport modes are developed

The governance and institutional framework of toll roads offers very little if any protection against normal business risks.

Moreover, to the extent that price regulation exists it has the effect of **increasing** these risks for toll road firms. Where price caps are put in place by regulation (or commercial agreement with government), toll road firms remain exposed to all of the above risks and costs but are restrained from the freedom to vary prices to respond to these risks and costs in the manner that would be available to an unregulated firm.

Put simply, the nature of price regulation as it applies to toll roads has precisely the opposite effect on business and operating risks as does the regulation of Aurizon Network—it increases rather than mitigates those risks.

On this first principles basis we therefore see no points of congruence between toll roads and regulated firms in regard to regulatory risks and thus these firms are not suitable comparators to be used for the estimation of the asset beta of Aurizon Network.

A powerful illustration of the unsuitability of toll roads as a comparator is the large number of toll roads in Australia, the United States and internationally that have experienced financial difficulty in recent years. In Box 2.1 we detail a sample of those toll roads.

Box 2.1: Toll Road bankruptcies and restructuring

Australian toll road bankruptcies have included:

- Clem7
- Lane Cove Tunnel
- Cross City Tunnel; and
- BrisConnection

In the United States investors have struck about \$27 billion in U.S. toll-road deals since 2003, according to estimates compiled by The Wall Street Journal. Some, particularly those made after 2008, appear to be on solid financial ground. Others, mostly made before 2008, have almost all failed or required financial restructuring.

- American Roads (operator of smaller toll roads across the US, largely owned by Macquarie-managed investment fund) filed for Bankruptcy
- SH 130 Concession Co., operator of toll roads around Austin, Texas, since 2007, is restructuring over \$1.1 billion debt
- Indiana Toll Road (75-year lease to a firm created by units of Macquarie and Ferrovial) is filing for Chapter 11 protection
- The South Bay Expressway outside San Diego (built by a company owned by a Macquarie-managed investment fund that leased the concession in 2003) sought Chapter 11 bankruptcy protection in 2010, citing construction delays and insufficient traffic to make payments on \$510 million of debt
- Australia's Transurban, the operator of Pocahontas 895 outside Richmond, Va., handed over the 8.8-mile toll road's concession to a group of its European creditors.

The Chicago Skyway's operator, jointly owned by Ferrovial and Macquarie units, and the operator of the Dulles Greenway near Washington, D.C., owned by Macquarie units, aren't in peril. But they carry about \$1 billion in debt apiece, and last year each spent more than 75 percent of their operating income making debt payments.

Spain was once lauded for having a large network of first class privately financed toll roads. Six toll roads have entered bankruptcy proceedings since May 2012, when the Madrid-Toledo (AP-41) toll road was the first.

By contrast we can find few if any examples of regulated infrastructure firms that have experienced financial difficulties, restructuring or bankruptcy over the same time period.

For this reason, not only are toll roads unsuitable comparators for regulated businesses, they would also have beta's inflated by their recent track record of poor performance.

Removing toll roads from Incenta's sample (but leaving our other methodological concerns unchanged) would reduce:

- The range of the asset beta from 0.35 to 0.49, to 0.35 to 0.42
- The midpoint from 0.42 to 0.39; and
- The equity beta from 0.71 to 0.67.

3 International Energy Businesses

The Incenta beta estimates for Aurizon Network includes a large number (70) of United States and other international energy businesses in the sample.

Incenta have used this data on the basis that those firms are suitable comparators for Aurizon Network as they are regulated businesses and that the differing forms of regulation applied to these businesses has no material impact on equity beta. Incenta have undertaken empirical analysis that they claim shows that the form of regulation doesn't matter.

We disagree with the inclusion of international energy businesses for three reasons:

- There are methodological issues with comparing betas derived from different markets
- The majority of the international energy businesses' used by Incenta in the sample are fundamentally different businesses consisting of both regulated and unregulated functions; and
- Both Incenta's empirical analysis and first principles analysis of lack of impact of the form of regulation on beta are unconvincing.

We address each of these issues in the remainder of this section.

3.1 Use of beta's from international markets

Asset betas are derived by delevering equity betas that have been calculated as the covariance of the particular stocks return against the overall market return.

For this reason, betas are only comparable when the variance is measured against the **same** market—that is, comparisons of betas derived from different markets are not valid. A cursory examination of the top ten companies and weightings of the Australian, New Zealand, United Kingdom, United States and Canadian markets—the markets for the firms chosen by Incenta—shows that the market characteristics are quite different. Accordingly, the volatility and level of returns in each market would be different.

For a valid comparison of betas derived from different markets a correction could be applied—for example by measuring the covariance of each stock against a single market or using an adjustment factor that measured the covariance of each market against a single market. There is no evidence that Incenta (or SFG in their analysis for Aurizon Network) have applied such a correction.

3.2 US energy and railway businesses are different

One of the difficulties faced by regulators in estimating the beta for a regulated firm is that comparator firms—even within the same industry sector—are unlikely to be pure regulated entities.

As an example the US railroad companies used by Aurizon Network as comparators are all vertically integrated operations that encompass both below rail and above rail activities as well as, potentially, a raft of other unregulated operations. As such they are not suitable comparators for the 100 percent regulated below rail activities of Aurizon Network.

Similar issues exist for the other comparators chosen for Incenta's analysis. In Table 3.1 we have undertaken a high level analysis of the non-regulated activities of a sample of the international electricity and gas firms used by Incenta in their sample and listed in Appendix A of their report.

Table 3.1: Analysis of comparator energy firms

Name of Firm	Pure regulatory play?	Other Activities
AGL Resources Inc	No	Vertically integrated gas retail and distribution utility with retail, wholesale and storage services.
CenterPoint Energy	No	Vertically integrated gas and electricity utility with retail gas sales and wholesale gas processing functions
Edison International	No	Vertically integrated electricity utility covering generation, transmission, distribution and retail
Integrus Energy Group	No	Vertically integrated gas and electricity utility covering generation, distribution and retail plus CNG fuelling services
Northeast Utilities	No	Vertically integrated gas and electricity utility covering generation, distribution and retail
PPL Corp	No	Vertically integrated gas and electricity utility covering generation, distribution and retail and United Kingdom electricity distribution
TC Pipelines LP	Yes	Regulated gas transmission
WGL Holdings	No	Vertically integrated gas and electricity utility covering distribution, retail and energy services
Asciano	No	Above rail operator with ports and stevedoring activities
Canadian Pacific Railway	No	Above and below rail operator with intermodal and port facilities
Kansas City Southern	No	Above and below rail operator
Union Pacific Corp	No	Above and below rail operator

Source: various company websites

It is immediately apparent that, of all of the sampled firms, only one is a regulated, functionally or structurally separated entity that is, therefore, directly comparable with Aurizon Network.

Thus, even otherwise regulated US energy businesses have radically different characteristics and structures to that of Australian regulated network businesses—almost all are vertically integrated with material unregulated retail and unregulated generation functions and other unregulated energy service functions.

3.3 Impact of the form of regulation

Finally, Incenta suggest that the form of regulation has little material effect on equity beta. We disagree with their finding for two reasons:

- It is unsafe to attempt to ‘categorise’ regulatory regimes in a way that properly reflects their differences, many of which have a significant effect on risk and, therefore, equity betas. This has the result that, even if categories are adopted as Incenta has sought to do, it is not possible to safely assume that regulators in different jurisdictions mean the same thing, or adopt the same approach when applying such regulatory regimes. We do not agree with Incenta that the form of regulation does not matter in this assessment. To the contrary, we consider the form of regulation the most significant single contributor to the systematic risk of regulated firms.
- The factors revealed by decomposition of equity betas tend to support and not rebut the hypothesis that the form of regulation does have an impact on beta.

For this reason, we conclude that it is unsafe to seek to include international regulated entities in any sample. To safely and properly compare firms for the purpose of determining an equity beta for Aurizon Network requires a detailed understanding of the regulatory environment, the regulator and the market. This is best undertaken by limiting any comparator sample to Australian regulated energy and water firms, which is what we suggest is the most conventional and appropriate approach to adopt in this case.

We discuss our views further in the remainder of this section.

3.3.1 The form of regulation is important and not suited to simplification

So, does the form of regulation matter? In our previous report for QRC we suggest that since regulation has the effect of at least partially insulating companies from normal business risks (and it’s only monopolies or near monopolies that are regulated), the form of regulation does matter. This is because the major risk for regulated companies becomes regulatory risk and not business risk and this should have a significant impact on the beta.

The Incenta report concludes that there is no evidence to suggest that businesses subject to price/revenue cap regulation have different asset betas to those subject to traditional cost of service regulation.³ However, Incenta’s empirical estimates for Australian, NZ and UK businesses (subject to price/revenue cap regulation) are significantly different from those for North American businesses (subject to decoupled, cost of service or incentive regulation).⁴

We think Incenta’s conclusion on this point should be viewed with caution as it would appear inconsistent with the empirical results which suggest a significant form of regulation effect.

Further, in our view the Incenta approach is too high level and does not pay adequate regard to important differences in the way in which regulatory regimes apply in different jurisdictions. The Incenta conceptual analysis is premised on reducing the form of regulation to a small number of categories —price cap, revenue cap, decoupled, cost of service and incentive based.

However, regulation is more complex and varied than this simplified list of categories. Incenta partially acknowledge this and note that some of the firms included in the analysis that are described as decoupled firms that operate under an incentive framework

³ Incenta report, p 66.

⁴ Incenta report, Table 5.5

and are included in both categories. Conceptually this isn't correct. As the objective of the analysis is to find differences in beta between different categories, the same firm cannot appear in multiple categories.

However, even if these duplicate firms were excluded, the problem remains that regulators may use different terminology to characterise the same form of regulation and even with apparently similar regulatory frameworks there are differences due to:

- **Detailed form of regulation**—even within a grouping such as “price caps” there are many different variations that directly impact the allocation of risks to the regulated business and thus would have an impact on the asset beta. Some examples of the differences include:
 - A price cap regime may express prices in either real terms (usual for Australian regulators) or nominal terms (usual for United States regulators). Thus, in the case of nominal prices, the firm bears inflation risk whereas there is no inflation risk if the price cap is expressed in real terms
 - Allowed operating expenditure may be entirely fixed for the period or there may be options to pass through certain types of increases—for example electricity costs in the case of Aurizon Network. Further, there may be options to re-open regulatory determinations under certain circumstances if costs exceed regulatory allowances. These options change the risk allocation between the firm and its customers
 - Capital expenditure may be either automatically added to the regulatory asset base (RAB) at the end of the regulatory period or only added if the expenditure passes some type of ex post prudency test. In some frameworks, major capital expenditure projects may be pre-approved. All of these options materially changes the risks of the regulated businesses
 - Operating and capital expenditure may be the subject of various designs of efficiency benefits sharing schemes where regulated businesses are incentivised to achieve efficiency gains by allowing them to keep a specified portion of the gains over a number of regulatory periods
 - There may be some concept of an ex post review of actual performance against regulatory allowances so that some part of any gains made are subject to a clawback arrangement; and
 - The length of the regulatory period may also vary and this will impact risk allocation to the regulated business. This is because—all else being equal—the length of the period determines the timing lag for the pass through of increased costs or changes in demand. For example under U.S. style regulation electricity and gas businesses can typically seek a new pricing determination annually in response to changed circumstances, whereas in Australia determinations are typically fixed for 5 years versus 7 years in the United Kingdom.

All of these different options exist in the regulatory toolkit even where the nominal form of regulation is the same. All have the potential to change the allocation of risks between the regulated business and its customers, so all could potentially have an impact on the beta of the regulated firm

- **Nature of regulator**—Even where regulators perform broadly the same task, and in many cases use apparently similar approaches, the nature of the

regulator and the legislative framework under which the regulator operates can be markedly different leading to differences in the risks borne by regulated business. Some examples of the differences in the nature of the regulator are:

- **Independence.** Some regulators are completely independent of Government and have considerable autonomy, others perform a role similar to an advisory body or expert panel and make recommendations to governments
- **The amount of discretion.** Some regulators have a high degree of discretion with their legislative framework setting out broad principles only, others have a much more prescribed role with the legislative framework describing in great detail the approach to the task of regulation. In Australia, state regulators such as QCA and IPART tend to fall into the first category, others such as the AER operate under a highly prescriptive set of rules
- **Review mechanisms.** While almost all regulators in English Law jurisdictions are subject to judicial review, the availability of merits review or otherwise has an impact on regulatory risk. While the nature and availability of merits review varies widely, in the jurisdictions where it exists it is likely to have an influence on the nature of regulatory risks in that it potentially provides a mechanism to address any clear regulatory decision making failures
- **The stability of the regulatory regime.** Some regulatory framework—such as that applying to United States electricity businesses—are well developed having evolved over the last 100 or so years. Others are newer or have been subject to continuous and relatively major changes—for example electricity network regulation in New Zealand; and
- **The competency and resourcing of the regulator.** All regulators aren't equal in their competency or the resources—both internal and external—that they have to perform their task.

These are all examples of the differences between regulators performing apparently similar tasks with a similar broad regulatory methodology that may lead to a different allocation of risks between regulated businesses and their customers; and

- **Different external environment**—for a utility with high growth, a regulator may use discretion to incentivise investment, whereas for a stable utility a regulator may focus more on cost reduction and incentivising operating efficiencies.

We have not attempted to isolate these factors and differences for the framework and the classification applied to each of the 70 firms used by Incenta in their analysis. Such a task would be difficult and would likely be unproductive as it would result in a large number of regulatory categories, each with a small number of firms.

We suggest that the Incenta analysis, that concludes that there is little difference in the betas of firms regulated under different regulatory frameworks, results from simplistic and crude demarcations between regulatory models that fails to pay sufficient attention to critical differences and regulatory choices and does not provide compelling evidence that the form of regulation does not have an impact on betas.

Indeed, we suggest that Incenta’s conclusion fails the “common sense” test. That is, to take only a few simple regulatory features such as price cap vs revenue cap, the length of the regulatory period, or the availability of ex post capital expenditure adjustments—it is self-evident that these have a material effect on the degree of ‘riskiness’ associated with a regulated firm’s cashflows. To conclude that these regulatory differences do not have any influence on the beta of firms cannot reflect robust analysis.

Accordingly, we respectfully submit that the QCA should consider this evidence with a great degree of caution.

In our view, the QCA should limit its comparison to other regulatory firms where it is able to confidently assess the nature of the regulatory regime, and the manner in which it is applied, within its market context. It is common ground between all experts in the UT4 process, for the parties and the QCA, that the best and closest comparators in this regard are Australian regulated energy and water utilities.

We reaffirm the first principles analysis in our previous report that showed that Aurizon Network is at the low end of the regulatory risk scale when compared to its Australian peers. This we think is the only appropriate comparison and suggest that Aurizon Network’s beta should not be higher than other Australian regulated energy and water businesses.

3.3.2 Decomposition of equity beta

Incenta put forward a number of hypotheses to support their view that the form of regulation has little impact on asset beta and thus justify the use of international firms with different forms of regulations as comparators.

One hypothesis put forward by Incenta is based on the work of Campbell and Shiller (1988), Campbell and Mei (1993), and Campbell and Voulteenaho (2004) which characterised beta as being composed of a cash flow component and a discount rate component. This is an alternative to the conventional decomposition of the asset beta into a revenue beta and a variable cost beta. Incenta’s hypothesis is that

... the simple decomposition of the asset beta into revenue and cost betas is flawed because it ignores the other – and possibly more important – factor that causes systematic risk, namely variation in the discount rate that investors apply to a particular project. This alternative hypothesis is that volatility (covariance) in cash flow contributes very little to the asset beta of an average firm – and even less to the asset beta of utility firms – so that a change in regulation that alters the volatility of, say revenue, would not be expected to have a material effect on asset beta estimates

Incenta suggest that the cash flow component has a “relatively small influence” on total asset beta and thus that the form of regulation would only have a small influence.

We suggest that this misinterprets Campbell and Voulteenaho’s work. They describe the decomposition as:

“The value of the market portfolio may fall because investors receive bad news about future cash flows; but it may also fall because investors increase the discount rate or cost of capital that they apply to these cash flows”

However, their work is entitled “Bad Beta, Good Beta” and they characterise each component of the beta differently stating:

The return components can also be interpreted approximately as permanent and transitory shocks to wealth. Returns generated by cash flow news are never reversed subsequently, whereas returns generated by discount rate news are offset by lower returns in the future. From this perspective it should not be surprising that conservative long term investors are more adverse to cash flow risk than to discount rate risk.

They state that the cash flow risk gives rise to the “bad” beta having a higher price of risk while discount rate risk is the “good” beta having a lower price of risk.

For an illustration of this concept consider the impact, on a regulated firm, of errors in decisions by the regulator:

- To disallow capital expenditure on a past project on the basis that the expenditure was not prudent. This decision means that the expenditure isn’t added to the RAB and results in a permanent loss of wealth for the firm; and
- To set a weighted average cost of capital (WACC) for the next regulatory period that is below the firm’s view of an appropriate return. This will only result in a temporary loss of wealth as the decision will likely be different in the next regulatory period.

Clearly, a rational investor would require greater compensation for the first risk than the second.

Our analysis of Campbell and Voulteenahe’s work supports our view that the form of regulation should have an effect on beta in two ways:

- First, the form of regulation is likely to be seen by investors as providing important information on the magnitude of future cash flows—and that changes in cash flow cause a permanent change in the value of a firm. Thus a regulatory framework that results in highly secure cash flows is likely to result in a lower beta; and
- Secondly, the form of regulation is likely to be an important source of information about the discount rate that investors apply to the cash flows—that is, it is a measure of the relative risk of the regulatory framework and regulatory action is the key that will impact investors. As an example, a regulatory framework with a merits review mechanism is likely to have a lower beta than one with only judicial review as investors will perceive that the risk of an erroneous regulatory decision is reduced.

This analysis reveals that, contrary to Incenta’s view, the decomposition of beta into discount rate and cash flow components doesn’t support the case for inclusion of international comparators on the basis that the form of regulation does not have a material effect on the equity beta.

We also note that another more conventional decomposition of the asset beta also suggests that the form of regulation matters. Under that decomposition the asset beta is decomposed into the:

- Nature of product or service offered (essential/discretionary or high priced/low priced); and
- Operating leverage (fixed costs as a % of total costs).

Applying this conventional decomposition to Aurizon Network would suggest that:

- In regard to the nature of the product, as electricity and gas are somewhat more essential than coal to the Aurizon Network, beta might be slightly higher

than a regulated utility. However, we note that most coal exported from Queensland is steaming coal used for electricity generation in other countries; and

- In regard to operating leverage, Aurizon Network would be slightly lower than gas or electricity networks as operating costs would be expected to be slightly higher as a percentage of total costs, so the Aurizon Network beta should be slightly lower.

On this basis the unleveraged beta should be reasonably similar for Aurizon Network and regulated Australian firms.

3.4 Conclusion

We conclude that international energy or other international regulated firms should not be included in any sample of comparator firms used for the purpose of determining an asset beta or equity beta for Aurizon Network.

We do not agree with Incenta that these firms ought to be included on the basis that the form of regulation does not materially influence the equity beta of firms.

We do not agree with Incenta that these firms ought to be included on the basis that the form of regulation does not materially influence the equity beta of firms.

In reaching this view, we note that there is a significant difference between the asset betas estimated by Incenta for energy businesses subject to different forms of regulation:

- The median asset beta estimated by Incenta for US and Canadian firms (subject to decoupled, cost of service or incentive regulation) was 0.41; and
- The median asset beta for Australian, NZ and UK regulated firms (subject to price or revenue caps) was 0.31.

For the reason set out above, both as a matter of principle and common sense, we expect that the main reason for this difference is that there are a number of important differences between Australian, NZ and UK energy businesses and those in North America—chief amongst which, we expect, would be differences in the form of, and approach to the application of, regulation. It would therefore be unsafe for the QCA to accept the inclusion of all international energy firms (particularly those in North America) in its sample for the calculation of an equity beta for Aurizon Network.

In our view, the conventional approach of looking only to Australian regulated energy and water firms (about which all experts agree) is to be preferred.

An asset beta of 0.31 (the median of the Australian NZ and UK energy firms) results in an equity beta of 0.51.

4 Simulated Monthly Beta Estimates

In the Aurizon Network UT4 submission, SFG, Aurizon Network’s consultants estimated equity betas from a variety of markets as the average of an arbitrary 20 working day month and repeated its analysis 20 times using 20 different starting dates. This, they stated, was done because there is an end of month effect in financial markets that distorts returns.

Incenta concur that an end of month effect exists and performed a similar, but more sophisticated analysis using a random pseudo month based on a distribution based on the actual trading days in the months of the period—as described in Appendix B of their report.

Incenta concluded that its results were “relatively close” to SFG’s much simpler 20-day month assumption.

The effect of the Incenta approach is to increase the asset beta over a conventional end of month calculation. For example, the mean of the 70 energy stocks used by both rises from 0.36 to 0.41—an increase of around 14 percent.⁵

Neither SFG nor Incenta advance any theory or rationale why such an end of month adjustment is necessary beyond stating that market returns are distorted by the effect.

In our view, if returns for the market as a whole are idiosyncratic around the end of the month then—on average—returns for an individual stock or sample of stocks should show a similar pattern. If this were so then there would be no impact on beta as the returns of an individual stock at month end should—to some extent—mirror the returns of the overall market. It isn’t obvious that a sample of stocks such as that used by SFG should show a consistent bias in returns at the end of month as claimed that would result in a lower beta if month end data only is used.

We accept that there are a number of studies that show that returns in financial markets are not evenly distributed across time—there are intraday, day of the week, end of the month, month of the year, and year end anomalies.

While there is clear evidence of such anomalies, (for example 55 percent to 70 percent of total monthly returns in a short window of 1 to 4 days), there is no consensus on the cause.

The end of month effect (EOM) or time of month (TOM as referred to in the literature) has been ascribed variously to:

- End of month salary payments and payments of other liabilities by firms
- Increased liquidity
- Clustering of earnings announcements; and
- Clustering of scheduled macro-economic news at the beginning of the month.

None of these theories explain why equity beta should be significantly different—and biased only in one direction—when calculated on a random monthly basis rather than an end of month basis.

For the equity beta to vary in the manner suggested by SFG and Incenta, the market portfolio would have to be made up of two types of stock:

⁵ Incenta report Table 5.3

- Those that have an exaggerated EOM effect compared to the market as a whole and thus their beta rises at EOM; and
- Those that have little EOM effect compared to the market as a whole and thus their beta falls at EOM.

The Incenta data, showing that their simulated month beta estimates are higher than conventional EOM estimates by around 14 percent, suggests that most or all of the 70 firms in the sample fall into the second category. This does not seem credible as one would expect that if stocks vary in regard to the magnitude of the EOM effect then a sample of 70 stocks should show—on average—somewhat similar variation.

Given that there is no consensus on the cause of the EOM effect that is observed in many—but not all—markets, it’s difficult to explain why a sample of stocks consistently doesn’t conform fully to the “normal” end of month pattern. Neither SFG nor Incenta has done so.

This adjustment or correction for the EOM effect is just one of a large number of adjustments and assumptions that are routinely made in the estimation of betas. It may be the case that a number of the assumptions and adjustments have an influence on this EOM effect. SFG, Aurizon Network’s consultant, summarises the process in a report to the AER as⁶:

For example, an analyst estimating equity beta would need to make a series of determinations including those set out below:

- a. Which empirical method, or variation of regression analysis, to use (e.g., ordinary least squares (OLS), weighted OLS, least absolute deviation (LAD) and so on);*
- b. Whether to apply any statistical correction for non-synchronous trading (e.g., Scholes-Williams, Dimson);*
- c. Whether to apply any statistical correction for bias (e.g., Vasicek, Blume);*
- d. Whether to use discrete or continuously compounded returns;*
- e. Which market index to use as the independent variable;*
- f. Whether to include an assumed value of franking credits as part of the return;*
- g. What frequency of data to use (e.g., daily, weekly, monthly);*
- h. What length of data to use (e.g., 4 years, 7 years, 10 years);*
- i. Whether to include or exclude certain periods that are thought to be unrepresentative (e.g., the technology bubble period);*
- j. Whether to use a method to screen out or down-weight the influence of outlier data points, and if so, which method to use;*
- k. Which firms to include in the set of comparables;*
- l. Whether foreign firms should be included in the analysis, and if so how;*
- m. When computing portfolio estimates, whether to use equal- or value-weighted average returns or median returns;*

⁶ “The reliability of empirical beta estimates: Response to AER proposed revision of WACC parameters, Report prepared for ENA, APIA, and Grid Australia”, SFG Consulting, 1 February 2009

n. Which re-levering formula should be used to adjust equity beta estimates to the level of gearing assumed for the benchmark firm;

o. What level of gearing to use for the benchmark firm. That is, what is the efficient level of gearing for an efficiently financed electricity distribution or transmission firm? This cannot be known for sure, and must itself be estimated.

The estimation of equity betas from empirical data is acknowledged as being the result of a large number of decisions, assumptions, simplifications and corrections—all of which can have a material outcome on the results.

The EOM adjustment made by Incenta results in a material and persistent upward bias in beta for the sample of firms chosen. This isn't logical as individual firms—or a sample of individual firms—should on average be subject to the same EOM effect as the market as a whole.

Conclusion

The effect of the EOM modelling undertaken by Incenta is a material increase in the asset beta over a conventional EOM calculation (an increase of around 14 percent).⁷

We conclude that in the absence of any other credible theoretical explanation for the results it is not clear if the EOM adjustment Incenta proposed is removing a bias or adding a bias. Given the anomalous outcome and the material effect this has on the result, it would be unsafe for the QCA to adopt this methodology to seek to derive an equity beta for Aurizon Network unless further work is done that establishes the cause of the result.

Without the work being undertaken, the QCA should adopt a conventional approach to the calculation of the equity beta in line with its practice to date (and that of other Australian regulators).

Once a conventional equity beta calculation is adopted, our asset beta of 0.31 (adjusted for the removal of toll roads and international energy and other comparators) reduces by 14 percent to 0.27.⁸

⁷ Incenta report Table 5.3

⁸ We have assumed that the Australia energy firms have the same end of month adjustment as the larger sample of 70 energy firms.