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The economic impact of QR's proposal not to include an adjustment to refund or recoup differences in tariffs:

Stage 1 Report

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1. INTRODUCTION

I have been engaged by the Queensland Competition Authority (QCA) to provide an independent opinion on the economic impact of Queensland Rail's (QR's) proposal not to include an adjustment to refund or recoup any differences between the interim tariff, which has applied since the expiry of the last set of approved prices set by the QCA (established for the period ending 30 June 2013), and the QCA's approval of a new tariff.

I have been instructed to consider the impact on access seekers[1] to the extent that they reasonably expected differences between these tariffs would be either refunded or recouped through the inclusion of an adjustment.[2] The focus is on whether the change proposed by QR can have a future impact on economic efficiency and in particular on future investment (dynamic efficiency) and on the operation and use of the network (productive and allocative efficiency). These are some of the factors that the QCA is required to have regard to when approving a draft access undertaking.[3] The analysis provided is necessarily prospective, as any foregone payments from access to QR are essentially transfers.

This task will be completed in two stages. This is the first stage report that sets out a conceptual framework and uses it to consider the issues at hand. The second stage entails reviewing the Stage 1 report to consider any relevant matters raised in submissions to the QCA.

For the reasons presented below, my view is that QR's proposal has the potential to impact future investment by access seekers. The mechanism through which investment may be affected is via an increase in regulatory uncertainty, which in turn can impact the internal rate of return of future projects.

The key argument is that this increase in uncertainty is not inherent to the provision of access to rail. That is, such an increase is not being generated by demand, cost or technological uncertainty but rather by QR's proposal itself.

[1] The term "access seeker" means a party who is seeking new or additional access rights, while an "access holder" means a party who holds access rights. The discussion in this report refers to "access seekers", although the analysis applies equally to both access seekers and access holders.
[2] See also http://www.qca.org.au/getattachment/003c436b-bd7a-45a8-bcfd-287a17ec2028/QCA-Queensland-Rail-s-2015-DAU-Request-for-com.aspx
[3] See Section 138 of the *Queensland Competition Authority Act* 1997.

There are at least two ways in which QR's proposal may increase regulatory uncertainty. First, it may create a perception amongst access seekers that the regulatory process favours QR through a 'heads I win, tails you lose' situation. That is, access seekers have no certainty that QR will apply these arrangements symmetrically. Indeed, QR's proposal reflects an increased likelihood that the new tariff will be lower than the existing, interim tariff, and that the proposal would not have been put forward if tariffs were likely to increase instead.

Second, deviating from the expectations of including an adjustment to refund or recoup differences in the tariffs, in a way that benefits QR, can also increase the perceived risk associated with the overall regulatory framework.

In my assessment, the lack of an adjustment is unlikely to impact adversely on future allocative or productive efficiency (static efficiency). The reason is that any additional amount paid by access seekers will essentially be a sunk cost and should not impact, except for a knife-edge case which will be explored in Section 2.1 below, on the future efficient use of the existing network.

This report is organised as follows. Section 2 introduces a stylised conceptual framework which represents the investment decisions of access seekers. This framework is used to explore the likely impact of QR's proposal on dynamic efficiency. Section 2.1 then considers a special case where static efficiency may also be affected. Section 3 places the results from Section 2 in the context of the literature on regulatory risk and investment by way of a brief literature review. Section 4 then provides concluding remarks.

2. A CONCEPTUAL FRAMEWORK

The conceptual framework developed below is centred on a simple example. Thus, by construction, this example is a stylised, simplified representation of the economic issues faced by stakeholders. However, this example will allow me to explore the likely impact of QR's proposal on dynamic and static efficiency.

In this example, an access seeker is required to make an investment in order to ensure that it can produce and sell a particular quantity over two periods. A possible interpretation is that access seekers face quasi fixed costs that allow them to ship a particular amount of coal.

In particular, by investing an amount I at period 0, an access seeker is able to ship and sell Q units of coal at a fixed price P in each of periods 1 and 2. The marginal (unit) cost of production is equal to c. The access seeker's cost of capital is exogenous and given by ρ.[4]

The per-unit tariff is equal to γ in period 1. However, this is an interim tariff and the new tariff is revealed at the beginning of period 2. At period 0, based on previous experience, the access seeker assesses that there is a 50 per cent probability that the new tariff will be equal to $\gamma + \varepsilon$ and a 50 per cent probability the new tariff will be equal to $\gamma - \varepsilon$, where $\varepsilon \leq \gamma$ is a positive constant.

The access seeker believes that the access provider will either provide a reimbursement for any difference between the interim and new tariffs if the former exceeds the latter, or receive a recoupment if the latter exceeds the former. Thus, in addition to paying the new tariff at the end of period 2, the access seeker expects to either receive a refund of εQ (with 50 per cent probability) or to pay an additional amount equal to εQ (with 50 per cent probability). While access seekers will likely also face uncertainty about future demand or costs, the focus here is solely on the additional regulatory uncertainty created by the access provider.

[4] Some authors define regulatory risk as the increase in the cost of capital caused by regulation. See, for example, H. Ergas, J. Hornby, I. Little and J. Small, 2001, "Regulatory Risk," A paper prepared for the ACCC Regulation and Investment Conference, Manly, 26-27 March 2001. Here, however, the cost of capital is exogenous and the impact is instead on investment; a project that would be undertaken in the absence of a specific regulatory risk fails to go ahead under the said risk.

The access seeker is assumed to be risk neutral and thus indifferent between say receiving 1 dollar with certainty and a lottery that pays 0 with probability 50 per cent and 2 dollars with probability 50 per cent.

The focus in this stylised example is on the impact of an increase in regulatory uncertainty on the access seeker's decision to invest. This is different from the standard focus in the regulatory economics literature, which studies the impact of different regulatory regimes on investment by the regulated access provider,[5] or the optimal access price in the presence of downstream competition.[6]

While regulatory uncertainty faced by access seekers may not have been studied extensively by the regulatory economics literature, it is a common policy concern. It has been raised, for example, in the context of access to the local loop in telecommunications and to the National Broadband Network.

In the example described above, the access seeker, who faces some uncertainty about the tariff, will invest if the internal rate of return (r^*), exceeds its cost of capital (ρ)**.** The value of $r^*$is such that the expected net present value of the investment is equal to zero:

$$(1)\quad E[NPV] = -I + \frac{[P-(c+\gamma)]Q}{1+r^*} + \frac{1}{2}\frac{[P-(c+\gamma-\varepsilon)]Q}{(1+r^*)^2} + \frac{1}{2}\frac{[P-(c+\gamma+\varepsilon)]Q}{(1+r^*)^2} + \frac{1}{2}\frac{\varepsilon Q}{(1+r^*)^2} - \frac{1}{2}\frac{\varepsilon Q}{(1+r^*)^2} = 0$$

The expected net present value is simply equal to the expected discounted value of the net revenue stream in periods 1 and 2 plus the expected discounted value of the refund/recoupment of the difference between the period 1 interim tariff and the tariff revealed at the beginning of period 2. Given the symmetry in expected payoffs, equation (1) can be simplified to:

[5] See, for example, F. Camacho and F. M. Menezes, 2009, "Access pricing and investment: a real options approach", *Journal of Regulatory Economics* 36(2), pp. 107-126 or G. Guthrie, 2006, "Regulating Infrastructure: The Impact on Risk and Investment." *Journal of Economic Literature* 44(4), pp. 925-972.
[6] See, for example, T. Kao, F. Menezes and J. Quiggin, 2015, 'Optimal access regulation with downstream competition,' Journal of Regulatory Economics 45(1), pp. 75-93.

$$(2) \quad E[NPV] = -I + \frac{\hat{R}}{1+r^*} + \frac{\hat{R}}{(1+r^*)^2} = 0$$

Where $\hat{R} = [P - (c+\gamma)]Q$, and by assumption $I < 2\hat{R}$.

Solving (2) for r^* yields:

$$(3) \quad r^* = \frac{-(2I - \hat{R}) + \sqrt{\hat{R}^2 + 4\hat{R}I}}{2I}$$

As long as $r^* \geq \rho$, the access seeker undertakes the investment.

I now consider the internal rate of return, $\hat{r}$, under a different regime in which the access seeker believes that the access provider will only seek a recoupment if the new tariff is $\gamma + \varepsilon$ and will not offer a refund if the new tariff is $\gamma - \varepsilon$. This is akin to a 'heads you win, tails I lose' situation.

The value of $\hat{r}$ can be calculated by solving the following equation:

$$(4) \quad E[NPV] = -I + \frac{[P-(c+\gamma)]Q}{1+\hat{r}} + \frac{1}{2}\frac{[P-(c+\gamma-\varepsilon)]Q}{(1+\hat{r})^2} + \frac{1}{2}\frac{[P-(c+\gamma+\varepsilon)]Q}{(1+\hat{r})^2} - \frac{1}{2}\frac{\varepsilon Q}{(1+\hat{r})^2} = 0$$

Equation (4) simplifies to:

$$(5) \quad E[NPV] = -I + \frac{\hat{R}}{1+\hat{r}} + \frac{\hat{R}}{(1+\hat{r})^2} - \frac{1}{2}\frac{\varepsilon Q}{(1+\hat{r})^2} = 0$$

Solving (5) for $\hat{r}$ yields:

$$(6) \quad \hat{r} = \frac{-(2I - \hat{R}) + \sqrt{\hat{R}^2 + 4\hat{R}I - 2I\varepsilon Q}}{2I}$$

It is clear that $\hat{r} < r^*$. This implies that there will be projects that would have gone ahead under the recoupment/refund regime, but that will not go ahead under the 'heads you win, tails I lose' scenario. As this uncertainty is being created by the access provider it is avoidable.[7]

Diagrammatically, one can see the impact of the change in Figure 1. The internal rate of return is equal under both regimes when $\varepsilon=0$, but $\hat{r}$ declines with increasing ε. In the case shown, $r^* > \rho$, so the access seeker will always invest under the first regime. However for sufficiently high ε, $\hat{r} < \rho$ and the access seeker does not invest under the second regime.

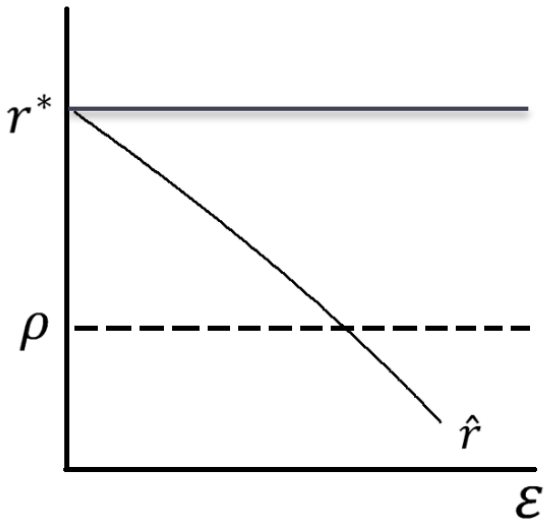

Figure 1: Impact on Investment

This simple stylised example illustrates the potential negative impact on future investment of a change from a regime in which access seekers expect any differences between interim and final tariffs to be recouped or refunded to a regime where there are no refunds and only recoupment.

I note that in this simple example, with a risk neutral access seeker and symmetric outcomes, if the access provider instead could commit neither to refund nor to recoup any difference in tariff, there would be no impact on investment. This, however, is a limitation of the example rather than a general result.

[7] In contrast to increases in risk driven by fundamentals such as demand or costs.

There are many ways in which an unanticipated change can reduce investment even if the upside and downside risks are originally symmetric. For example, suppose that the access provider obtains some new information about the likely change between the interim and final tariff. That is, suppose the provider gets to choose between two regimes: complete recoupment/refund or no recoupment/no refund and that both policies would yield the same *ex ante* level of uncertainty if the access provider chooses its policy at the start of period 1. However, if the access provider can instead choose its policy at the start of period 2, before the final tariff is announced, and it has more information that comes to light during period 1, then it will choose the complete recoupment/refund policy if it expects the final tariff to rise and no recoupment/no refund if it expects the tariff to fall. Then access seekers may infer that the process favours the access provider as it chooses what regime it wants. This could lead to a situation where there is some positive expected recoupment payment from the access seeker to the provider, discouraging investment by the access seeker. Note that the simple model above can be considered the 'extreme' case of this where the provider is able to perfectly predict the change in access price at the start of period 2.

More broadly, one would expect that any unanticipated change in regime could be translated into greater regulatory risk. There are two ways this might occur. From the perspective of an access seeker, the tariff setting process is in some sense random, so it has some probability distribution. The change in regime could change the distribution so that the 'new' distribution yields unambiguously higher tariffs (this was the case in the simple example above).[8] Alternatively, the change may not increase expected tariffs but instead increase risk.[9] In this case a risk-averse access seeker may be dissuaded from investing by the riskier regime.

Alternatively, a change in regime may be associated with a perceived increase in the risk of the regulatory framework as a whole. Assuming that the inclusion of an adjustment was previously proposed by QR this would be considered to be an integral part of the regulatory framework, as any unanticipated change could be interpreted as a lack of stability of the system and, therefore, evidence of a riskier framework overall. As Ford and Spiwak (2014) argue, in the context of

[8] This is a case of a first-order stochastic dominance shift in the probability distribution. See A. Mas-Colell, M. D. Whinston and J. R. Green (1995), "Microeconomic Theory", Oxford University Press, p. 195.
[9] This is a case of a second-order stochastic dominance shift in the probability distribution. See A. Mas-Colell, M. D. Whinston and J. R. Green (1995), "Microeconomic Theory", Oxford University Press, p. 197.

broadband investment, '*certainty must have an element of stability, which comes from a credible commitment to a long-term policy*.' [10]

The impact of the potential instability in the regulatory environment on firms' investment decisions has been documented by Fabrizio (2012).[11] She studied the pattern of investments in renewables generation assets in the US electricity industry and showed that firms invested less in new assets in states that had previously passed and repealed legislation to restructure the electricity industry, suggesting that perceived regulatory instability impacts adversely on investment.

2.1 The unlikely impact on static efficiency

This subsection explores the possibility that, if an investment was made with an expectation of an adjustment as explained above, and if such an expectation turned out not to be fulfilled, then a highly leveraged firm may not be able to repay its debt and have to cease operations even though its net revenue before interest is positive.[12]

To see this, we focus again on the stylised example above and assume that the access seeker borrowed an amount $D = I$ at the firm's cost of capital ρ to be repaid at the end of period 2. We relax the assumption that both changes in the tariff are equally likely. The firm makes the investment and the creditor lends *I*, both in the expectation that there will be a refund/recoupment. For this to happen, it must be the case that the firm expects to receive a return greater than or equal to its cost of capital, and the creditor expects to be repaid the principal at the end of period 2, plus interest (the cost of capital) sufficient to compensate it for any risk of default.

Now consider the firm's situation at the end of period 1 or the beginning of period 2 when it learns that the new tariff is equal to $\gamma - \varepsilon$ but that there will not be a refund of the additional amount paid in period 1 (εQ). This was not anticipated by the creditor or the firm.

[10] G. S. Ford and L. J. Spiwak (2014), "The Unpredictable FCC: Politicizing Communications Policy and its Threat to Broadband Investment," *Phoenix Center Perspectives* 14-05, p.2.
[11] K. Fabrizio (2012), "The Effect of Regulatory Uncertainty on Investment: Evidence from Renewable Energy Generation."
[12] This requires a firm and its creditor to accept some risk of default even under the original refund and recoupment regime. However, they may be willing to do this if, for example, the probability of the low tariff state is relatively high. This is discussed further in footnote 11.

Under these circumstances, the access seeker at the end of period 1 receives net revenue equal to $\hat{R}$ and anticipates receiving $\hat{R} + \varepsilon Q$ at the end of period 2. Thus, at the end of period 1, the access seekers expect to receive an amount (gross of interest) equal to:

$$\hat{R}(1+\rho) + \hat{R} + \varepsilon Q.$$

The access seeker's expected income (gross of interest) at the end of period 2 if a refund was provided would be equal to:

$$\hat{R}(1+\rho) + \hat{R} + \varepsilon Q + \varepsilon Q.$$

It follows that under the following conditions

$$\hat{R}(1+\rho) + \hat{R} + \varepsilon Q + \varepsilon Q \geq I(1+\rho)^2 \geq \hat{R}(1+\rho) + \hat{R} + \varepsilon Q,$$

the access seeker will not be able to pay its debt at the end of period 2 in the absence of a refund – and therefore would have to cease operations at the end of period 1 when this information becomes available, whereas it would be solvent in the presence of a refund.

This example shows that the change in regime can impact negatively on efficiency as a firm ceases to operate even though it is efficient to operate as its incremental cost is lower than its incremental revenue. Of course, the conditions under which such an event may happen are stringent.[13]

Such a knife-edge example is included here for completion and to illustrate that static efficiency can be compromised by a change in regime only under very specific conditions.

[13] Note that the firm would fail if the final tariff was higher than the interim tariff. This is why we must relax the assumption that both tariff states are equally likely. If the probability of the low tariff state is sufficiently high, then it may be the case that both a prudent firm and a prudent creditor are willing to accept this risk (which will be reflected in ρ). It can be shown that, for this to be true and for the change in regime to put the firm at risk of default, the low tariff state must be more likely than the high tariff state (the exact threshold probability depends on the other parameters).

3. A BRIEF REVIEW OF THE LITERATURE ON REGULATORY RISK AND INVESTMENT

The notion that risk created by regulation will impact on investment is well accepted in economics. As indicated in Section 1, the usual approach is to consider the impact of regulatory risk on the regulated firm and not on access seekers. However, as the conceptual framework developed in Section 2 suggests, access seekers' investment decisions can also be adversely impacted by regulatory risk and, therefore, the literature reviewed in this section is relevant for assessing the change proposed by QR.

In particular, the economics literature examines how different features of the regulatory framework that are associated with regulatory risk, such as the timing of the price reviews, the nature of price regulation (e.g., price cap versus rate of return) and regulatory governance (e.g., regulator's independence from government, discretionary power or ability to commit to long term policies) affect investment by the regulated firm. Guthrie (2006) provides a comprehensive survey of this literature.

For example, Morana and Sawkins (2000)[14] examined the London stock market's response to the 1994 Ofwat Price review. They showed that there was a significant reduction in share price volatility for eight of the ten water companies subsequent to the announcement of revised price-caps. They concluded that investors' expectations were quickly adjusted to reflect confidence in the credibility and political sustainability of the price review. The relevance of a stable regulatory regime is also documented by Ishii and Yan (2011)[15] in the context of US electricity generation investment and more broadly by Égert (2009)[16] who presents some empirical results that suggest that the overall coherence of a regulatory environment is important for supporting investment.

Broadly speaking, the overall conclusion from this literature is that regulatory risk may delay investments or distort them towards less capital intensive projects than is socially optimal.[17] While the three features of regulatory frameworks mentioned above directly affect the regulated firm,

[14] C. Morana and J. W. Sawkins (2000), "Regulatory Uncertainty and Share Price Volatility: The English and Welsh Water Industry's Periodic Price Review," *Journal of Regulatory Economics* 17(1), pp. 87-100.
[15] J. Ishii and J. Yan (2011), "Investment under Regulatory Uncertainty: US Electricity Generation Investment 1996-2000," mimeo. Available at https://www3.amherst.edu/~jishii/files/regrisk_2011b.pdf.
[16] B. Égert (2009), "Infrastructure Investment in Network Industries: The Role of Incentive Regulation and Regulatory Independence," *OECD Economic Department Working Paper No. 688*.
[17] See also D. Sutherland, S. Araujo, B. Egert and T. Kozluk (2011), "Public Policies and Investment in Network Infrastructure," *OECD Journal: Economic Studies*, Volume 2011 (1), pp. 161-183, and E. Couper, J. Hejkal and A. Wolman (2003), "Boom and Bust in Telecommunications," *Federal Reserve Bank of Richmond Economic Quarterly*, Fall.

they also have an impact on access seekers. For example, under a revenue cap regime, access seekers face volume risk, whereas such risk sits with the access provider under a pure price cap regime. The choice of price regulation can therefore impact on the access seekers' incentives to invest. Similarly, an unstable regulatory regime can also influence these incentives. The large literature linking the lack of commitment by a regulator (for example to full cost recovery) to an increase in regulatory risk [18] is also relevant here as unanticipated changes in regulatory practices by the access provider can be seen in a similar vein.

The negative relationship between perceived increased regulatory risk and investment is not limited to infrastructure assets. Bittlingmayer (2001),[19] for example, confirmed this relationship by examining the impact of regulatory uncertainty driven by levels of competition law enforcement across 21 major industry groups in the US from 1947 to 1991.

[18] See, for example, R. J. Gilbert and D. M. Newbery (1994), "The Dynamic Efficiency of Regulatory Constitutions," *The RAND Journal of Economics*, 25(4), pp. 538-554; J. Stern (2014), "The Role of the Regulatory Asset Base as an Instrument of Regulatory Commitment," *European Networks Law and Regulation Quarterly*, pp. 29-41; and D. Helm (2009), "Infrastructure investment, the cost of capital, and regulation: an assessment," *Oxford Review of Economic Policy*, 25(3), pp. 307-326. Newbery (2002) *Privatization, Restructuring, and Regulation of Network Utilities,* The MIT Press, also provides an extensive discussion of the problem of regulatory commitment.

[19] G. Bittlingmayer (2001), "Regulatory Uncertainty and Investment: Evidence from Antitrust Enforcement," *Cato Journal* 20(3), pp. 295-325.

4. CONCLUDING REMARKS

It is well accepted in regulatory economics that regulatory risk can impact adversely on investment. For example, regulatory risk can lead a regulated firm to delay or cancel investment, or to choose an inefficiently low level of investment. While this principle is often stated in terms of the impact on investment by the regulated firm, I have explained above how it can also be applied to access seekers, for whom the regulated access price is part of their cost structure. In this context, regulatory risk about the access price can adversely impact on an access seeker's future investment decisions.

Through a simple example, I have demonstrated how a decision by QR not to include an adjustment to refund the difference between the interim and the new tariffs can adversely impact on future investment. Under the assumption that access seekers expected the inclusion of the adjustment charge a change in policy by QR can create asymmetric risk; a perception that the regulatory process favours QR so that in the event that access prices increase, there will be recoupment, but in the event that access prices decrease, there will not be a refund.

Such a change in policy can also lead to a perception of an unstable regulatory process, which may be translated into an increase in regulatory risk. Under both cases, investment projects that would go ahead under the expectation of an adjustment to refund/recoup, may not go ahead if there is a change in policy.