COMPETITION ECONOMISTS GROUP

Issues from submissions
UCLL and UBA

Final

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COMPETITION ECONOMISTS GROUP

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1 Introduction

1. Chorus has asked CEG for its opinion on a number of matters relating to submissions[1] made in response to the Commerce Commission's (Commission's) draft determinations on pricing of the UCLL and UBA services, in relation to:

   - asset valuation and optimisation;
   - technology risk;
   - population growth considerations in terms of demand calculations;
   - price trends; and
   - consideration of issues arising in relation to the calculation of the WACC parameters, including the time at which it is calculated.

2. We consider the issues arising from the submissions below.

[1] Including: WIK Submission In response to the Commerce Commission's "Draft pricing review determination for Chorus' unbundled bitstream access service" and "Draft pricing review determination for Chorus' unbundled copper local loop service" including the cost model and its reference documents, 20 February 2015 (hereafter "WIK"); and Network Strategies, Final report for Spark New Zealand and Vodafone New Zealand, Commerce Commission Draft Determination for UCLL and UBA, A review of key issues, 20 February 2015 (hereafter "Network Strategies").

2 Asset valuation and optimisation

3. This section responds to each of the questions arising from the submissions made on the Commerce Commission's draft determination in terms of asset valuation and optimisation. In this section we consider the role of regulatory predictability, the use of an ORC valuation as opposed to a depreciated value, the difference between greenfields and brownfields optimisation and, finally, the choice of technology in forward-looking cost models.

What is your opinion on the role of regulatory predictability in forward-looking cost modelling?

4. We understand that WIK has indicated that regulatory predictability has no meaning in the context of conducting a TSLRIC pricing exercise for the first time. WIK state:

> *If a modelling exercise is conducted for the first time the criterion of "regulatory predictability" is relatively meaningless with regard to the outcomes of the model. Therefore this criterion does not provide any meaningful guidance to make the choice between various valuation approaches which are at the disposal of the Commission.*

5. We disagree.

6. As we have previously indicated, whilst this is the first time that the Commission has implemented a bottom-up modelling exercise for these services, it has set prices for these regulated services by having regard to bottom-up modelling exercises in other jurisdictions.[2] These might reasonably provide a guide to interested parties of how the Commission might have approached its own bottom-up modelling exercise.

7. Setting prices based on forward-looking costs mean that past prudent decisions may be optimised (colloquially, 'bygones are bygones') – this might be thought of as the regulatory asset base being reset at the start of each regulatory period only have regard to the current costs of providing the service. Nevertheless, the consistent application of this approach over time yields regulatory predictability in the form of expected cost recovery. In other words, if done consistently over time, that is, using the same approach to optimisation (i.e., greenfields technology choice) and accounting for that in allowed depreciation, it will achieve expected financial capital maintenance. The principle of expected financial capital maintenance is central to the notion of regulatory predictability and all good regulatory practice.

[2] CEG, *Non-replicable assets and forward-looking cost,* August 2014, para [7]

8. We note that this principle is inherent in academic attempts to define forward-looking costs. For example, Salinger (1998) defines forward-looking costs in the following terms:[3]

> *The forward-looking cost of a good is the current price that makes the expected net present value of current investment equal to 0, subject to the constraint that future prices will be set so that the expected net present value of all future investments will be 0 in any period in which investment is to occur. In periods when no investment occurs, prices are set so that demand equals available capacity.*

9. This definition contains a number of important elements that we will come back to. In particular, pricing at forward-looking costs today requires consideration of how forward-looking costs will be set in the future. In practice this determines the profile of depreciation required to have prices at forward-looking cost. In addition, the definition highlights the need for a time consistent approach to optimisation which, as discussed below, would exclude WIK's partial brownfields approach to optimisation.

Will using an ORC valuation lead to assets that are "overvalued" or "economic compensation twice"?

10. No, it would not be expected to be the case.

11. Moreover, the concepts of 'value' and 'economic compensation' in a regulatory environment are inherently dependent on the terms of the regulation. In regulatory regime that prescribes that prices are set as the forward-looking costs, the value of the assets and the appropriate economic compensation for the owner are determined solely by the forward-looking costs of providing services using those assets. Therefore, any assertion of over-valuation or more than economic compensation is likely based on an abstraction from the reality that the value of these assets are determined by the regulatory environment in which they operate. By adopting, and consistently applying, an ORC valuation with economic depreciation, the Commission should set an appropriate return for the regulated service to achieve the aims of the Telecommunication Act for the regulated service.

12. Nevertheless, Network Strategies and WIK argue that revaluation of existing assets, particularly those that are fully depreciated in accounting terms, will lead to double compensation for Chorus. For example, WIK state:[4]

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3 Salinger (1998) "Regulating Prices to Equal Forward-Looking Costs: Cost-Based Prices or Price-Based Costs?" *Journal of Regulatory Economics*, volume 14, page 149-163.

4 WIK at para [45]

> *… the FAR reveals that a variety of assets or even asset classes are fully depreciated (remaining net book value below 5% of GBV) or significantly depreciated (net book value below 20%) but still in use. Such asset categories include […] CNZRI. For those assets Chorus will receive an economic compensation twice if the ORC approach is generally applied. Users already in the past have fully compensated and paid for the economic value of these assets and the Commission is requesting that today's and tomorrow's users will have to pay for the use of these fully depreciated assets once more. This double-recovery of costs over time is not related to some tiny and unimportant asset classes. It is related to the most relevant parts of the existing asset base.*

13. Even if the legal requirements of the Act are set aside, there are two flaws in WIK's logic and the conclusion reached as to the forward looking cost of the regulated service.

14. First, WIK are assuming that Chorus has actually achieved revenue recovery that is above the implied depreciation schedule in the accounts (plus a fair return on capital). This is not obviously true, nor is it easy to determine, particularly with the separation of Telecom New Zealand. It would require a backward-looking calculation of whether Chorus had received an economic return on its assets, to test the assertion of double recovery. Given the use of back-loaded tilted annuity depreciation to set past prices, prices today (toward the end of an assets life) are inevitably going to look profitable in an accounting sense relative to costs determined based on front-loaded depreciation as is used in the net book value referred to by WIK. This apparent profitability is misleading, since much of the apparent cost recovery implied by the front-loaded depreciation profile may not in fact have taken place.

15. For example, the following chart compares the annual revenues required for an investment of $100[5] over its 20 year life with a 10% return on capital using three different depreciation profiles: tilted annuity with a positive tilt[6], straight-line depreciation[7] and diminishing value depreciation[8]. It shows that because returns under the tilted annuity are back-loaded, annual revenues would appear high relative to revenues that would be determined using front-loaded depreciation such as straight-line and diminishing returns, even though the return over the life of the asset is the same.

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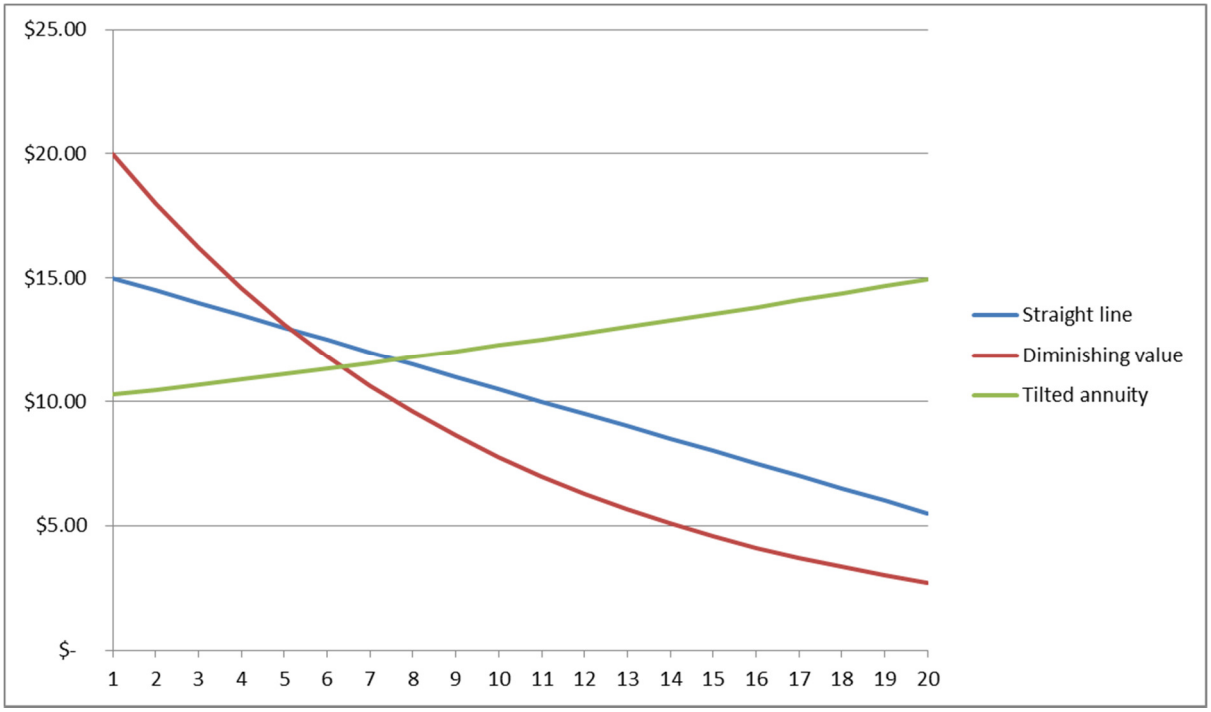
5 Operating expenditures are assumed to be zero.

6 Calculated using a conventional tilted annuity formula as used in the TERA model.

7 With nominally constant depreciation in each year.

8 Diminishing value depreciation is calculated as $(BookValue - SalvageValue) x \frac{200\%}{AssetLife}$

Figure 1: Returns with alternative depreciation schedules



16. Second, the assessment of profit fails to take into account the risk faced by investors in Chorus via the regulatory regime. Unlike under Part 4, revaluation gains and losses are not 'treated as income' in the year that they occur. A forward-looking regime sets prices based on expected revaluation gains and losses, but there are no true ups for when realised gains and losses vary from expectations.[9] This exposes consumers and investors to the risk of substantial unexpected price fluctuations.

17. It should also be remembered that along with revaluations within TSLRIC come optimisations. Chorus may have prudently incurred costs in the past that are simply written-off in the forward-looking regime. For example, WIK do not appear to have accounted for the under-recovery in the book value of copper cable (and other assets) that would result from its own recommendation to optimise assets for those that an HNE/HEO would deploy, which may well offset areas of accounting over-recovery.

18. In any event, as we discussed above, the questions posed by WIK of unanticipated windfalls and double recovery are irrelevant to a forward-looking regime in which 'bygones are bygones'. This is because the starting point for a forward-looking cost calculation is the current (optimised) replacement costs, whether or not it is then adjusted to reflect fact that existing assets are not new. Our view is that the annualised cost of non-replicable assets should be modelled based on the optimised replacement cost of those assets over their full economic life using economic

9 When revaluation gains are treated as income, prices need to fall to reflect that gain (and vice versa for revaluation losses).

depreciation (e.g., a tilted annuity) as this is what is required with a forward-looking TSLRIC calculation. We discuss the equivalence of using a depreciated and undepreciated valuation to determine annuity compensation in the following section.

Will using optimised replacement cost for existing assets be generous to Chorus?

19. Both Network Strategies and WIK suggest that the Commission is being generous and/or that Chorus will receive some sort of windfall as a result of the fact that replacement costs are used in the tilted annuity formula instead of depreciated replacement costs.

20. This is incorrect, using a forward-looking depreciated asset value (i.e., DORC) or undepreciated asset valuation (i.e., ORC) will give the same result when economic depreciation (such as a titled annuity formula) is used to determine the capital component of prices/compensation. The level of annuity compensation depends on the value of the asset to be recovered and the remaining life of the asset over which it is to be recovered. As an asset approaches the end of its useful life, its value falls however, this is offset by the reduction in the remaining life. Therefore, the annuity compensation is independent of the age of the asset.

21. To understand this, recall that DORC is justified on the basis that it is the valuation methodology that would leave the hypothetical operator indifferent between using existing assets and building new assets. The value of the hypothetical operator's assets is ORC, and the price charged by the operator must be such as to ensure that the NPV of the future income stream over the life of those assets is equal to the ORC. Having determined the income stream for the hypothetical operator assets, the DORC value for the existing assets can be constructed as the NPV of the first 'n' years of that stream, where 'n' is the remaining life of the existing asset. Assuming identical operating costs, this value would leave the hypothetical operator indifferent between purchasing and using the existing assets and building new assets.

22. Importantly, this outcome does not result in a windfall to the operator of the existing assets as they only receive the compensation over the remaining life of the existing assets.

23. This property of annuity compensation is reflective of what might be seen in competitive market pricing. In competitive markets, such as commodity markets, the price that producers can charge is the same regardless of whether the assets used to produces the goods are 'old' or 'new'. For example, a milk delivery business that has recently bought a new truck will be unable to charge a different price for deliveries than another business using an old truck (assuming the quality of service is the same).

Is WIK's proposed brownfields approach internally consistent?

24. WIK propose that the Commission apply a 'pragmatic' 20% reduction in the optimised replacement cost (ORC) produced by the TERA model.[10] WIK argue that this is consistent with the view that prices should reflect the opportunity cost of existing assets. WIK state:

> *There needs to be a clear understanding of what opportunity costs in this context mean. The proper answer can be and has to be developed from the decision behaviour of a rational operator. A profit-maximising operator would re-use existing assets for the deployment of a new network as long as the opportunity cost of using existing assets are lower than the greenfield investment cost at an ORC level.*

25. In our view WIK's proposal is internally inconsistent because it:

    a. proposes something other than forward looking costs for 'reused' assets - Specifically, WIK propose that compensation for these assets be based on valuing them on an indexed historic cost basis taking into account accumulated depreciation.[11] Depending on how 'accumulated depreciation' is calculated relative to how TSLRIC annuity depreciation has previously been determined, this proposal runs the risk that it will set compensation that is below the forward-looking costs of those assets; and

    b. ignores the forward-looking cost of changing technologies when deciding that assets are <u>not</u> going to be re-used - WIK propose that the MEA can be selected independently of the assessment of the least-cost technology such that even if copper is currently the least-cost technology, at some future time the MEA can be changed to fibre or FWA without ensuring the expected cost of stranding the current technology is allowed for in current prices.[12]

26. This approach, by definition, will mean that prices will be set below forward-looking costs because the efficient operator will receive no compensation for the stranding effect of new technologies being adopted when it would be more efficient for it to continue to use the previously determined efficient technology. In summary, under WIK's proposal, when the technology of the efficient operator is changed, the

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10 WIK at para [59]

11 This was WIK's view in its previous report. See WIK In response to the Commerce Commission's "Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services (9 July 2014)" August 2015 at para [16]

12 WIK at para [80]

compensation for reusable assets is truncated to some historic cost value but for assets that are not reusable, no future compensation is allowed.

27. To consider this further, imagine a network optimally designed at time t_0. This could be the actual network or, equally, it could be a 'hypothetically efficient' network designed for the purpose of a past regulatory determination. Now consider a scenario where at time t_5 the optimally designed network differs from the previously efficient network. This might be because an alternative technology is now sufficiently low cost such that, if starting from scratch and not influenced by any past investments, it would be employed by a new entrant efficient operator. Call this deployment of a new technology mix - 'greenfields' efficient.

28. In this circumstance, there arises an immediate logical tension:

    - it is greenfields efficient to deploy a new technology mix; but
    - if there are pre-existing assets (from an old technology deployment) the least cost way of giving effect to the greenfields efficient technology will be to 'reuse' some of the old assets.

29. Leaping to the second conclusion, as WIK does, is problematic because, if we take into account the existence of previous deployments of assets in a consistent manner, then what is a "greenfields efficient" technology mix need not be efficient. For example, at time t_0 we may decide that fibre to the node is efficient but that fixed wireless access (FWA) is too costly to deploy and instead determine the efficient technology involves delivering the "last mile" using cable (either fibre or copper). However, at time t_5 we may determine that the greenfields efficient technology is now FWA for the last mile but that the design deeper into the network is broadly unchanged (i.e., fibre backhaul from the node).

30. One might then be tempted to conclude the hypothetical efficient operator would simply use the pre-existing backhaul network but would simply install FWA to replace cabling in the last mile. But, of course, FWA was only determined to be efficient on a greenfields basis. If there is existing cabling already in place then it is likely that building FWA to replace that would not be efficient (at the very least, it would be efficient in fewer places than would be the case under a greenfields assessment).

31. We consider that WIK has proposed an internally inconsistent position. WIK have argued that the costing should be based on a greenfields choice of technology with more or less unconstrained access to pre-existing assets if that is 'cheaper'. The basis on which WIK would determine whether an existing asset is 'cheaper' than a new asset is whether a vaguely defined notion of 'written down value' is lower than replacement cost.

32. WIK first motivates the use of pre-existing assets (ducts) on the grounds that these assets already exist and, therefore, "a hypothetically efficient operator" would

efficiently reuse them rather than replicate them. WIK also argues that where pre-existing assets are used these should be costed on a different basis to newly installed assets (although exactly how the costings are different is not described). Were WIK to apply this logic consistently its network design and costing would need to change substantially.

33. It is, of course, absolutely correct that, given sunk assets already exist to provide a service, it would, in general, be inefficient to replicate them. However, this does not simply apply to ducts, but equally to the cabling in them and all other elements of the network that already exists. In this context, it would only ever be efficient to put alternative modern equivalent assets in place where:

- installing and maintaining alternative assets has a lower present value cost notwithstanding that sunk assets already exist to provide the service (and only need to be maintained and not installed); or
- the alternative assets provide a sufficiently different (better) quality of service than the existing sunk assets that would justify the incremental expense of installing the new assets despite the existence of sunk assets.

34. However, WIK is not applying the above logic consistently in its analysis. WIK needs to be consistent about whether they are estimating the cost of a hypothetically efficient operator:

- designing an efficient network *given the existence of sunk assets*? or
- designing an efficient network *based on the assumption that it would need to be built from scratch*?

35. WIK needs to have as its guiding principle one, and only one, of these approaches to network design. It cannot 'mix and match' approaches – especially not in a manner that results in lower costings than would be delivered by either.

36. If WIK were consistently applying the former principle, then WIK would only be proposing the building/installation of new assets where this is efficient given the prior existence of sunk assets. But this is clearly not what WIK is proposing. After first discussing the efficiency of using pre-existing sunk assets, WIK goes on to promote the wide scale adoption of MEA in the network design. In doing so WIK is essentially cherry-picking how it approaches assessments of efficient network design. On one hand it is saying that efficient network design should be based on what is efficient given the existing network (e.g., reuse existing ducts). In the next breath, it is saying that efficient network design should be based on what would be most efficient assuming that all investments had to be made afresh. In our view, there is no economic logic to support WIK's mix-and-match approaches.

Should the least cost technology be based on the lowest annualised cost?

37. No. WIK have asserted that it should be based on the lowest annualised cost. WIK state:

> *According to the UBA model[100] the FTTH/FWA access network represents a CAPEX value of $ [...] CNZRI million p.a.[101] The copper access network on the other hand represents a CAPEX value of $ [...] CNZRI million.[102] In terms of total annual cost (as the sum of annualized CAPEX, OPEX and non-network related cost) the 2015 cost of the FTTH network amounts to $ [...] CNZRI million[103] and the cost of the copper network to $ [...] CNZRI million.[104] Thus, the 2015 total cost of the FTTH network exceed the corresponding cost of the copper network by 14.2%. On the basis of these model based calculations it looks like that the cop-per access network technology generates lower costs than the fibre access technology.*

38. This is self-evidently wrong in our view as it will not provide the HEO/HNE with the expected NPV of compensation that reflects its efficient costs and it will incorrectly delay the switch to the least cost technology. In order to recover efficient costs, the forward-looking price cannot simply swap to the lowest of the tilted annuities for each technology as WIK's proposal would have the Commission do. Such a methodology must result in a NPV of compensation that is lower than efficient costs, i.e., that is lower than the NPV of compensation that the HEO would require in order to provide the regulated service.[13]

39. As discussed in our earlier report, to achieve objective forward-looking cost for the HEO/HNE, the Commission must determine the technology based on the lowest NPV of costs and then derive an interdependent time path for compensation that takes into account the time at which a new technology becomes 'least cost' on a greenfields efficient basis. This is not the point at which the technology specific tilted annuities cross over. At this point, the shift to the new technology has been incorrectly delayed.

[13] See CEG, *Uplift asymmetries in the TSLRIC price*, Public Version February 2015, para [80] – [86] for further discussion of this issue.

3 Technology risk

40. In this section we discuss issues relating to technology risk that lead to asset stranding.

Does the beta calculation proposed by the Commission adequately take account of technological change given technological change is a risk faced by all telecommunication companies?

41. No, technological change creates diversifiable risks that have no bearing on the asset beta for a project. Exposure to asset stranding due to technological change may, or may not, have an impact on a project's beta. However, either way, technological change will unambiguously raise exposure to diversifiable risk that is not compensated in the CAPM – but nonetheless requires compensation equal to the expected cost of asset stranding in the cash-flows.

42. This is no different to other diversifiable risks such as the diversifiable risk associated with a coin toss. As a result of a coin toss an investor might be paid $1 for a head and $0 dollars for a tail – with an expected return of $50c. This is diversifiable (has zero beta and is therefore 'riskless' in the CAPM sense) because an investor can invest in a large number of coin tosses such that the average return can be guaranteed to be very close to 50c.

43. However, it is clearly a mistake to argue the investor needs no compensation for the risk of a tail and so should be willing to pay $1 for the right to the coin toss (i.e., should be prepared to pay $1 to receive back $0/$1 with 50% probability). Diversifiable risks need to be compensated based on the actuarially expected costs of exposure to the risk. They do not require any additional CAPM risk premium but they *do* require compensation based on expected costs.

44. Asset stranding from technological change, clearly has a component of diversifiable risk and clearly requires compensation based on the expected cost of asset stranding. It may, or may not, require additional compensation to this through a higher CAPM risk premium if asset stranding is also correlated with the return on the market. However, even if this is so, and even if the effect is already captured in the measured asset beta, this does not obviate the need to provide compensation for the expected cost of asset stranding.

45. Despite this point being well recognised in the economic literature and in regulatory proceedings, WIK state:[14]

> *All telecommunications network operators face the same or at least a similar risk of technological change. We do not agree with the Commission's assessment that technological change (including the risk of asset stranding) represents an asymmetric risk for telecommunications operators. Technological change is anticipated by the market and represents a systematic risk in telecommunications. It is properly reflected and measured in the asset beta of the WACC formula.*

46. The building block of modern finance theory is the capital asset pricing model (CAPM). The primary insight of the CAPM is that uncertainty in the returns of an asset does not necessarily imply that the asset is 'high risk' and requires a high rate of expected return. Rather, it is the contribution of an asset to the overall uncertainty of the investor's portfolio that determines its risk and therefore expected return.

47. The CAPM is a commonly used tool to reward regulated firms for market risk. In the CAPM, market risk is captured in the asset beta. The asset beta captures the sensitivity of the cash flows generated by the firm's assets to fluctuations in the market (or the economy in general). It represents the systematic or non-diversifiable risk. This can be thought of as the amount of cash-flow variation that investors (e.g., the HEO) could not eliminate by holding a fully diversified portfolio of investments – both inside and outside the telecommunications sector.

48. Additional (project specific) investment risk may need to be reflected in prices for services to ensure that investors can reasonably expect to receive their required CAPM return. In particular, investors' expected returns may fall below their required CAPM return if there is a risk of asset stranding due to, say, technological obsolescence. Seeking to compensate for this risk by allowing a higher equity beta in the CAPM would be inconsistent with the principles on which CAPM is based and may lead to confusion and error.

49. Modern finance theory (reflected in the CAPM) implies that the probability of technological obsolescence due to technological change is not relevant to determining investors' expected returns unless the probability of technological obsolescence is somehow correlated with returns available on other assets. The CAPM provides the expected return required by investors based on probability weighted cash flows. Consistency with the CAPM requires that the risk of technological obsolescence is reflected in probability weighted cash flows.

50. To see this, consider a simple example of an investor making an investment of a $1 that has a beta of 1 such that investors in the asset require the market return which we assume to be 8% p.a., i.e. an asset whose owners would require an 8% p.a. return

[14] WIK at para [78]

given the CAPM risk. However, imagine that investment has a 50% probability of 'failure' in one year's time which will be determined by a coin toss – where (to take an extreme example) the effect of failure is that the asset becomes worthless and the entire value of the investment is lost. It can be shown with simple algebra that investors will then require a 116% return on the investment if it does not fail. In particular, this can be seen algebraically as:

Expected return = 8% = 0.5 x (-100%) + 0.5 x 116%

51. For investors to expect a return of 8% (which they require to undertake the investment), they will therefore need to achieve a 116% return where obsolescence does not occur. The reason for this higher level of return where the investment succeeds is to compensate for the 50% probability of catastrophic failure in which the entire asset becomes worthless. As this catastrophic failure is determined by a coin toss they are by definition no CAPM risks associated with it, but there are nevertheless risks that that need to be compensated in order for investment to occur.

52. Put another way, in order for regulated prices not to result in monopoly profits, prices must be set such that the discounted value of expected cash-flows is equal to zero. That is, the discounted value of expected revenues (at regulated prices) must be to be equal to the discounted value of expected expenditures. As a matter of finance theory, this discounting must be undertaken using the expected return investors require from the investment (i.e. 'the CAPM return'). This is the rate at which investors will rationally discount the future cash-flows for a project.

53. If there is a positive probability of asset stranding then the probable cost of this must be included in the modelled cash-flows and allowed revenues be set higher compared with a scenario in which there is no risk of stranding. By setting allowed revenues above the discounted value of expected expenditures the regulator is effectively including in an asset owner's revenues not just their expected expenditures but also an estimate of the actuarially fair cost of self-insuring against the prospect of asset stranding (e.g., due to technological obsolescence). The difference between the discounted value of allowed revenues and the discounted value of expected expenditures is, in effect, the cost of an insurance premium that the investor is writing to itself.

54. It is therefore our view that the asset beta does not account for technological risk that would lead to asset stranding.

Should technological risk be accounted for elsewhere, if it is not in the asset beta?

55. Yes, it must be accounted for in the cash flows of the HEO otherwise prices are being set below forward-looking costs. This could be done by scenario modelling cash flows for the HEO based on different technological developments and applying probability

weights to determine the price. Alternatively, the Commission may seek to adjust the depreciation profile to reflect expected technological change. Or, as we discussed in our earlier paper, it could apply a general uplift to the price to account for these risks.[15]

56. The risk that Chorus (or the HEO) faces with respect to the optimisation of technology undertaken by the Commission in its choice of the MEA must be taken into account in the cash flows, otherwise an asymmetry arises such that the expected revenues will be less than the expected costs, which will deter investment.

57. If the Commission sets the level of annuity depreciation based on the current MEA's single-technology tilts, as it TERA has done in the modelling, the effect will be as follows:

- when technological change is slower than expected, the HEO will recover exactly the efficient costs determined by the Commission (i.e., it will earn revenue based on the current MEA); but
- when technological change is faster than expected, the HEO will recover less than the efficient cost.

58. This asymmetry arises because when the Commission optimises the choice of technology it only ever *writes down* the value of assets due to technological change. If price trends that reflect the change in input prices for the current MEA (i.e., do not reflect possible changes in the MEA in the future) are used as the basis of the depreciation, whenever technology change occurs it will imply a write-down of the asset that is more than was allowed in the depreciation charge. This is because technological change will only ever lower costs.

59. Expected future changes to lower cost technologies are an essential element of the forward-looking costs of using the current efficient technology, as they will write down the future value of investment that are efficient today.

[15] CEG, *Uplift asymmetries in the TSLRIC price*, February 2015

4 Demand

60. In this section we answer Chorus' questions relating to demand for the regulated service.

Will population growth result in a material reduction in the unit cost over the regulatory period?

61. Network Strategies argue that with population growth the unit cost of the HEO would fall over the five-year regulatory period. Network Strategies argue this would occur because of increased infill from medium density development and a slowing in fixed to mobile substitution. For example, Network Strategies state:[16]

> *A constant demand scenario also ignores the recent trend for population growth in urban areas to be addressed via infill housing and medium density developments in business areas*

62. Network Strategies provide an estimate that the unit cost of providing the UCLL might decrease by 9% over the regulatory period.[17]

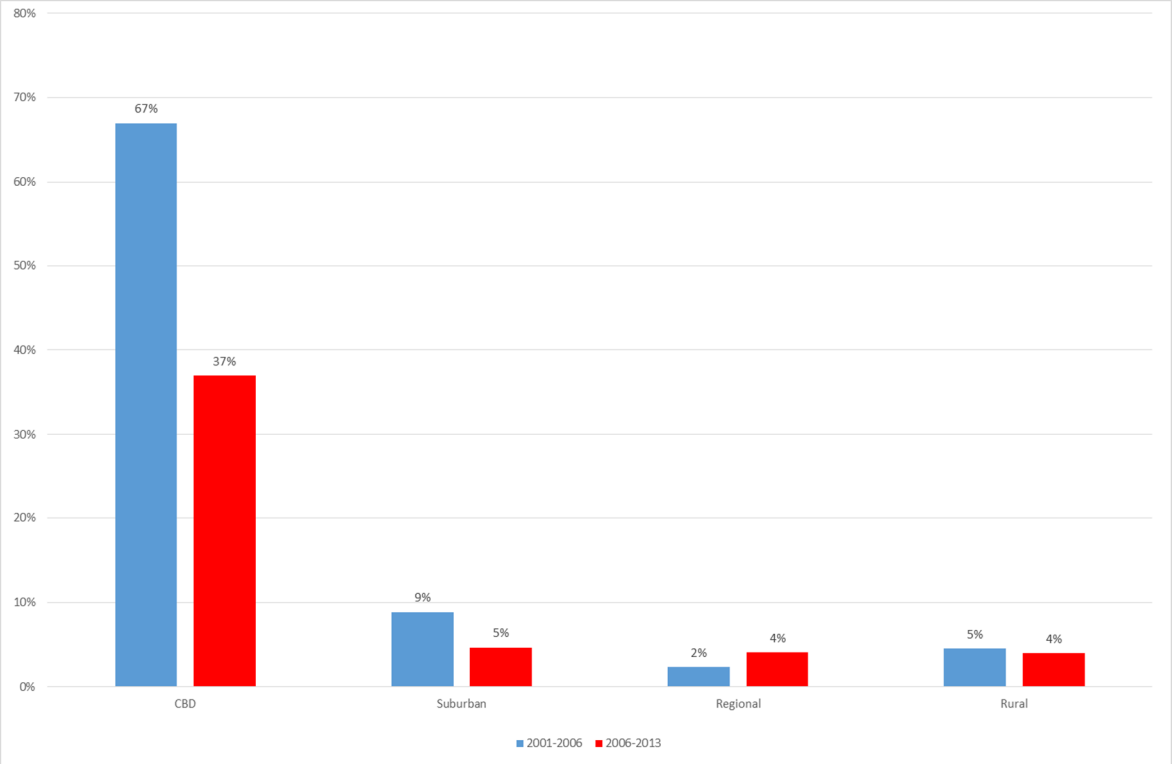
63. Ultimately it is an empirical question, but one that cannot easily be answered within the TERA model because it would require spatial projections of the growth in demand for fixed line services in New Zealand over time. This data is unlikely to be available. Nevertheless, the historical evidence indicates that the issue may not be as material as indicated by Network Strategies. Data from Statistics NZ show that whilst population growth in New Zealand over the past decade has largely been in urban areas, the population growth rate in regional and rural areas has not been materially different from the growth rate in suburban areas (see the figure below).[18]

16 Network Strategies, page 12.

17 Network Strategies, page 21.

18 The high growth rates in CBD areas reflect the low population level in those areas, of around 11,000 people in all of New Zealand in 2001.

Figure 2: Population growth rate by area



Source: Statistics New Zealand, CEG Analysis

64. Rural areas contribution a relatively greater proportion of unit costs in telecommunications networks.[19] As such the net effect of growth in both urban and rural areas may mean that a constant demand growth assumption, or at least an assumption of growth in a uniform distribution, may be a reasonable approach to account for growth in demand over the regulatory period.

65. This is because whilst growth in urban areas will reduce unit costs (though not to the extent indicated by Network Strategies because they assume no increase in fixed costs), population growth in rural areas will tend to raise unit cost across New Zealand. The net effect is that unit costs may not materially fall, however, ideally this would be empirically tested.

19 Productivity Commission (Australia), Population Distribution and Telecommunications Costs, Staff Research Paper, Productivity Commission (Australia), August 2000.

5 Price trends

Are the price trends proposed by Network Strategies and WIK reasonable?

66. Network Strategies state that:[20]

> *With a five-year regulatory period, the Commission is obliged to have a view on how prices may change over that time.*

67. For the reasons discussed in our earlier report on price trends we disagree with this statement.[21] Forward-looking prices must achieve NPV=0 over life of current and future investments. Where the assets used in the modelling have lives that are extend beyond the regulatory period and are overlapping, this necessitates NPV=0 must be established in perpetuity. When this requirement is coupled with the use of a tilted annuity form of depreciation that assumes a constant annual change in costs/prices, the price trends must be based on expected changes beyond the regulatory period. [22]

68. Therefore, we would tend to disagree with some of the recommendations of Network Strategies, including not have regard to Australian benchmarks because they are not 'current' and the reliance on forecasts growth rates for the period 2014-2019 as the basis of setting the price trends. Nevertheless, in terms of Network Strategies' recommendations for adjustments to the price trends used in the TERA model there do not appear to be material differences with our recommendations.

[20] Network Strategies, page 51.

[21] CEG, *Evidence on price trends*, February 2015

[22] In this section we discuss single-technology price trends only.

6 WACC

What is the appropriate risk free rate to use if the prices are backdated to 1 December 2014?

6.1.1 Short term vs long term approach to estimating the risk free rate

69. In our view it is a serious error to implement the CAPM using a short term estimate of the prevailing risk free rate with a long term estimate of the long term market risk premium.[23] In our view, there are only two internally consistent applications of the CAPM:

- Estimate a long term average risk free rate and pair this with an estimate of the long term average market risk premium (MRP); or
- Estimate a short term risk free rate (say, over a single month) and pair this with an estimate of the MRP that prevails in the same month.

70. These approaches result in an internally consistent application of the CAPM – where the risk free rate and MRP are both measured over consistent periods. In the first approach, the risk free rate and MRP are both averages across a range of market circumstances that have prevailed in the long term. In the second approach, the risk free rate and the MRP are both estimates that prevail at a given point in time.

71. The problem with the Commission's approach is that it proposes to combine a short term estimate of the risk free rate with a long term average estimate of the MRP. This creates the potential for an "abnormal" or "extreme" estimate of the risk free rate to be paired with a "normal" or "average" estimate of the MRP. As discussed in previous reports, and as further detailed below, the risk free rate and the MRP tend to move in the opposite direction. Periods of high risk aversion cause a flight to safety - driving down risk free yields at the same time that risk premiums are rising. The Commission's proposal does not reflect this.

72. In our view, we are currently in precisely such a "bout" of high risk aversion about the status of the Eurozone and the potential for Greece to exit the Euro ("Grexit"). This is driving down the yield on safe assets globally – as has happened in the past when

[23] The assumption is that the value of the MRP can be determined independently of, and prior to, the observation of the value of the risk free rate is not correct. In fact, it is mathematically incorrect to do so. This is because the risk free rate is a constituent element of the MRP, which is defined as market return on equity less the risk free rate; such that the MRP cannot logically be determined prior to the observation of one of its two constituent elements.

the market feared Greece and other Eurozone countries had a high probability of leaving the Euro.

73. The Commission's approach is, in our view, particularly likely to result in material mis-estimation of the risk free rate if it is applied to an averaging period that is affected by these fears (as is the period at the time of writing). The period prior to 1 December 2015 is less affected by such heightened financial market anxiety and, consequently, it less likely to lead to as material error when applying the Commission's approach. This evidence upon which we draw this conclusion is discussed further in section 6.1.3.

74. However, before going on to explain this, section **Error! Reference source not found.** immediately below details why any attempt to estimate a short term prevailing return on equity using the CAPM should be undertaken prior to the start of the period over which prices will be set.

6.1.2 Back-dating the WACC calculation – regulatory practice

75. It is well accepted regulatory practice that the cost of equity should be set at the beginning of the period over which that cost of equity will apply (ie the period which the price is effectively determined at). That is, defining a regulatory period as the period over which prices are regulated,[24] the cost of capital used should be the best estimate of the cost of capital at the beginning of that period. Accordingly, if UCLL and UBA prices are to be back-dated then the WACC parameters should also be calculated at the period the prices are back-dated to (ie their effective date). The Commerce Commission, Professor Lally and the Australian Energy Regulator all argue that this is necessary to satisfy the NPV=0 criterion. For example, the Commerce Commission has maintained this position since at least June 2009: [25]

> *Whenever the Commission resets the risk-free rate part way through the regulatory cycle, the maturity of the risk-free rate will not match the horizon over which those rates will apply (namely, the remaining duration of the regulatory cycle), thus violating the NPV = 0 principle (see Section 4.1.4).*
>
> ....
>
> *In the regulatory context, the Commission will typically be setting firms' prices or evaluating returns over a given horizon — the regulatory period. The term of the interest rate used to set prices or assess returns should*

[24] Which is the only economically meaningful definition and the definition that underpins the quotes relied on below.

[25] Commerce Commission, Revised Draft Guidelines, The Commerce Commission's Approach to Estimating the Cost of Capital, paragraph 127, 145 and 146.

match the length of this horizon otherwise the present value to the firm will, in general, be positive or negative.28,29 In other words, NPV = 0 would be violated, and the firm would, in expectations, earn supernormal profits or losses.

For this reason, the Commission intends to match N to the length of the regulatory period, which could vary across industries and regulated instruments, rather than standardising it to ten years or any other length of time.

76. This is the same position that the AER, based on advice by Professor Lally, adopted in its most recent rate of return guideline. In that guideline the AER has adopted the view that the averaging period for the cost of equity should be as close as possible to the beginning of the regulatory period. In its Rate of Return Guideline the AER states:[26]

On the risk free rate averaging period, the AER proposes to adopt a period that:

- *is short—specifically, 20 consecutive business days in length*
- ***is as close as practicably possible to the commencement of the regulatory control period.*** [Emphasis added]

77. The explanatory statement to the Rate of Return Guideline states:[27]

For the following reasons, using a CGS yield estimated ***as close as practical to the commencement of the regulatory control period is consistent with the CAPM****. Inputs to a model should be appropriate for use in that model, so individual equity parameters in this decision should be consistent with the CAPM framework.*

…

Associate Professor Lally advised:

> *In relation to the Sharpe–Lintner model, this model always requires a risk free rate prevailing at a point in time for some subsequent period rather than a historical average and* ***application of the model to a regulatory situation would require the risk free rate prevailing at the beginning of a regulatory period.***

…

[26] AER, Rate of Return Guideline, p. 15.

[27] AER, Explanatory Statement to the Rate of Return Guideline, Dec 2013, pp. 77-78.

*As noted above, the CAPM theoretically requires the risk free rate be an 'on the day' rate—**literally, the first market price on the first day of the access arrangement period**. However, as Lally explained:*

> *… the use of this transaction would expose the regulatory process to reporting errors, an aberration arising from an unusually large or small transaction, and a rate arising from a transaction undertaken by a regulated firm for the purpose of influencing the regulatory decision.*

*A short averaging period (for example, 20 business days) **as close as practically possible to the commencement of the access arrangement period** provides a pragmatic alternative—violating the theoretical requirements of the model **only to a small extent**. Lally states:*

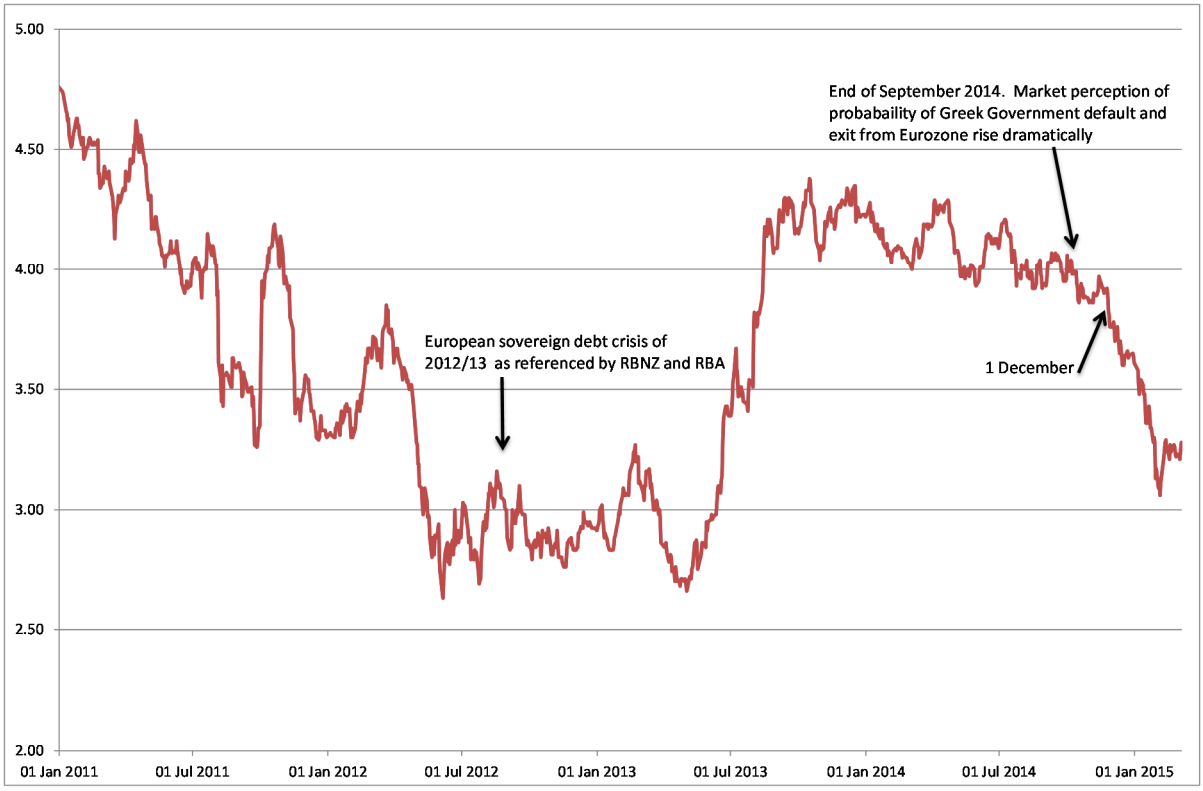
> ***The use of the CAPM in a regulatory situation requires that the risk free rate and the MRP must be the rates prevailing at the beginning of the regulatory period.** However pragmatic considerations suggest that the risk free rate be averaged over a short period close to the beginning of the regulatory period.* [Emphasis added.]

78. Were the Commerce Commission to estimate the risk free rate part way through the pricing is effectively in place, and in so doing, depart from its and other regulators' standard practice, then it would be making this departure from standard practice when it is known that to do so will result in a materially lower risk free rate (discussed below). In addition to NPV neutrality issues this would also raise the potential for perceptions of "cherry picking" the averaging period and would raise questions about "cherry picking".

6.1.3 Risk free rates and current market conditions

79. The empirical effect of choosing an averaging period part way through the averaging period is likely to result in a materially lower estimate of the risk free rate than if rates are estimated in the period immediately prior to the beginning of the regulatory period. Noting that the Commission uses NZ Government bond yields as its measure of the risk free rate, Figure 3 below demonstrates that these yields are currently materially lower than around 1 December 2014.

Figure 3: NZ 5 year government bond rates



Source, RBNZ, CEG analysis

80. Moreover, based on currently available information, estimating the risk free rate during the period over which prices are being set will likely result in an estimate that is extreme – with New Zealand Government bond yields at unprecedentedly low levels. This is illustrated in Figure 3 above.

81. Moreover, the radical decline in NZ Government bond yields is consistent with the analysis presented by CEG, referencing analysis by the RBA, that CGS yields are driven down in periods of heightened risk aversion and increased levels of perceived levels of risk. Therefore, the periods of unusually low risk free rates, such as prevail at the time of writing, should be paired with unusually high market risk premium. RBA Governor Glenn Steven's described one such event in the middle of 2012 and is quoted in our March 2013 report:[28]

> *But, as we said at the last hearing, sorting out the problems in the euro area is likely to be a long, slow process,* ***with occasional setbacks and periodic bouts of heightened anxiety.*** *We saw one such bout of anxiety*

[28] Statement by the Reserve Bank of Australia (RBA) Governor (Glenn Stevens) to the House of Representatives Standing Committee on Economics on the 24th of August 2012. Quoted in section 6.4 of CEG's March 2013 report for Chorus: Response to Commerce Commission UCLL/UBA WACC consultation paper.

> *in the middle of this year, when financial markets displayed increasing nervousness about the finances of the Spanish banking system and the Spanish sovereign. The general increase in risk aversion saw yields on bonds issued by some European sovereigns spike higher, while those for Germany, the UK and the US declined to record lows. This 'flight to safety' also saw market yields on Australian government debt decline to the lowest levels since Federation. [Emphasis added]*

82. In the June 2012 Monetary Statement the Reserve Bank of New Zealand (RBNZ) made the following similar statements:

> *Since the March Statement, global equity markets, commodity prices and the New Zealand dollar have fallen sharply. **Investor preference towards lower risk assets** has driven government bond yields in many countries to fresh lows, including the United States, Germany, Australia and New Zealand, while government bond yields for troubled nations like Italy and Spain have risen sharply.*(Page 9)

> *Ten-year government bond yields reached fresh lows for Germany, United States, United Kingdom, Australia and New Zealand, among other countries, **reflecting the flight to perceived low risk assets**.*(Page 11)

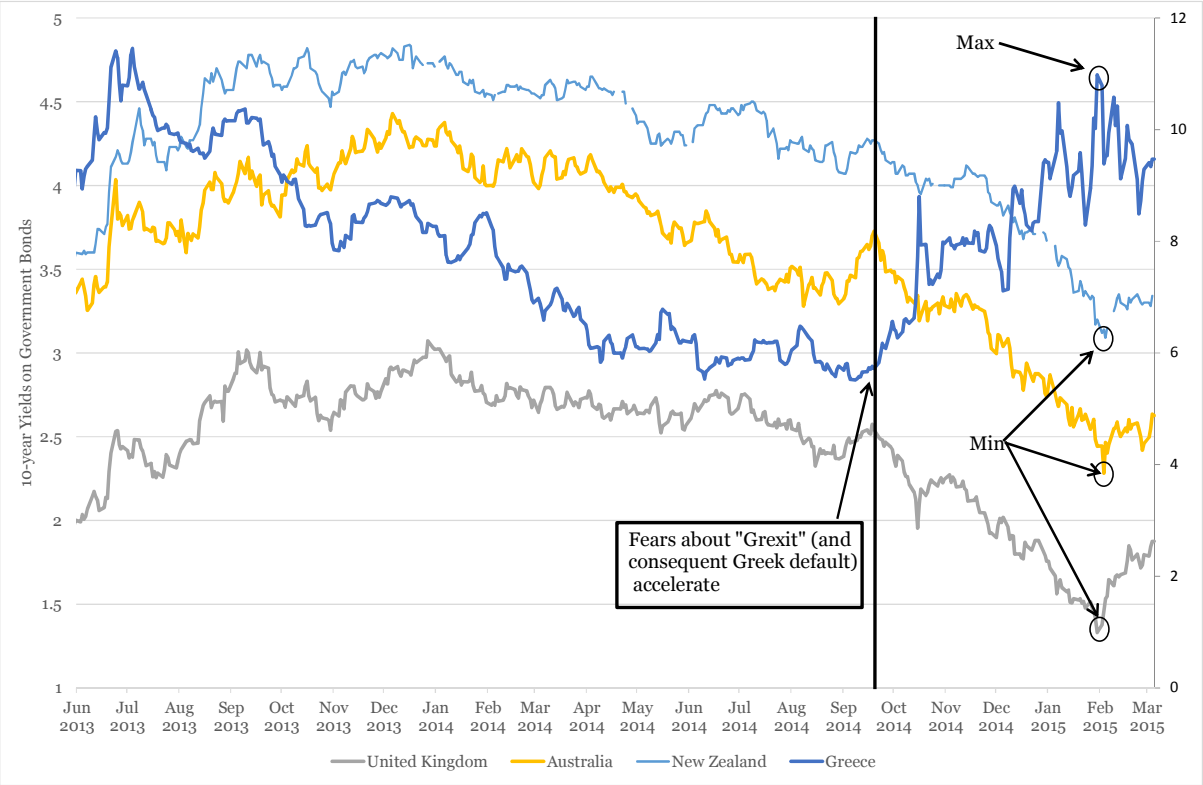
83. Financial commentators more generally have made consistent observations. For example, former IMF economist writing in the Financial Times states:[29]

> *On the other hand, if ELA stops, all Greek banks will collapse and Grexit is inevitable—a global shock likely bigger than Lehman's.*

84. In this context, we have examined the relationship between New Zealand, Australian and UK 10 year nominal Government bond yields with the yield on equivalent maturity Greek government debt. This shows a striking correlation between the dramatic fall in yields on New Zealand (and other safe assets) yields and rising yields on Greek government debt (where the latter is used as a proxy for fears about Greece's exit from the Euro).

[29] Peter Doyle, The unwitting euro enforcer…, 18 February 2015. Available at: http://ftalphaville.ft.com/2015/02/18/2119460/the-unwitting-euro-enforcer/

Figure 4: Yields on New Zealand (and other low risk sovereign) debt vs yields on Greek government debt



Source: Bloomberg, CEG analysis

85. It can be seen that the point at which fears about "Grexit" accelerate is coincident with the point at which yields on New Zealand (and Australian and UK) government debt begin their sharp decline to historically unprecedented levels. This is not just evident in the general pattern of yield movements but also in the minimum and maximum values. Over the period in question, Greek yields reached their peak on Friday 30 January 2015. On the same day, UK yields reached their lowest value and New Zealand/Australian yields reached their lowest value two/three trading days later.

86. The heightened fear of "Grexit" is clearly influencing global capital markets causing a flight to the safety. Whether this will be a temporary bout of heightened uncertainty or more long lived is impossible to tell.

87. There is no reason to believe heightened fears of 'a global shock likely bigger than Lehmans" would lead to lower cost of equity in New Zealand; yet this is what the Commerce Commission's proposed cost of equity methodology would give rise to if an averaging period for the risk free rate was set in current market conditions. In order to avoid this the Commission must set an averaging period for the risk free rate that is more representative of normal market conditions (such as a period before December 2014 – consistent with its own reasoning and practice as set out above) or it must pair such a low risk free rate with a high market risk premium.

Is it sensible to overlook the 5 year period prior to 2009 on the basis this was affected by the GFC and instead place greater weight on the period 2009-2014?

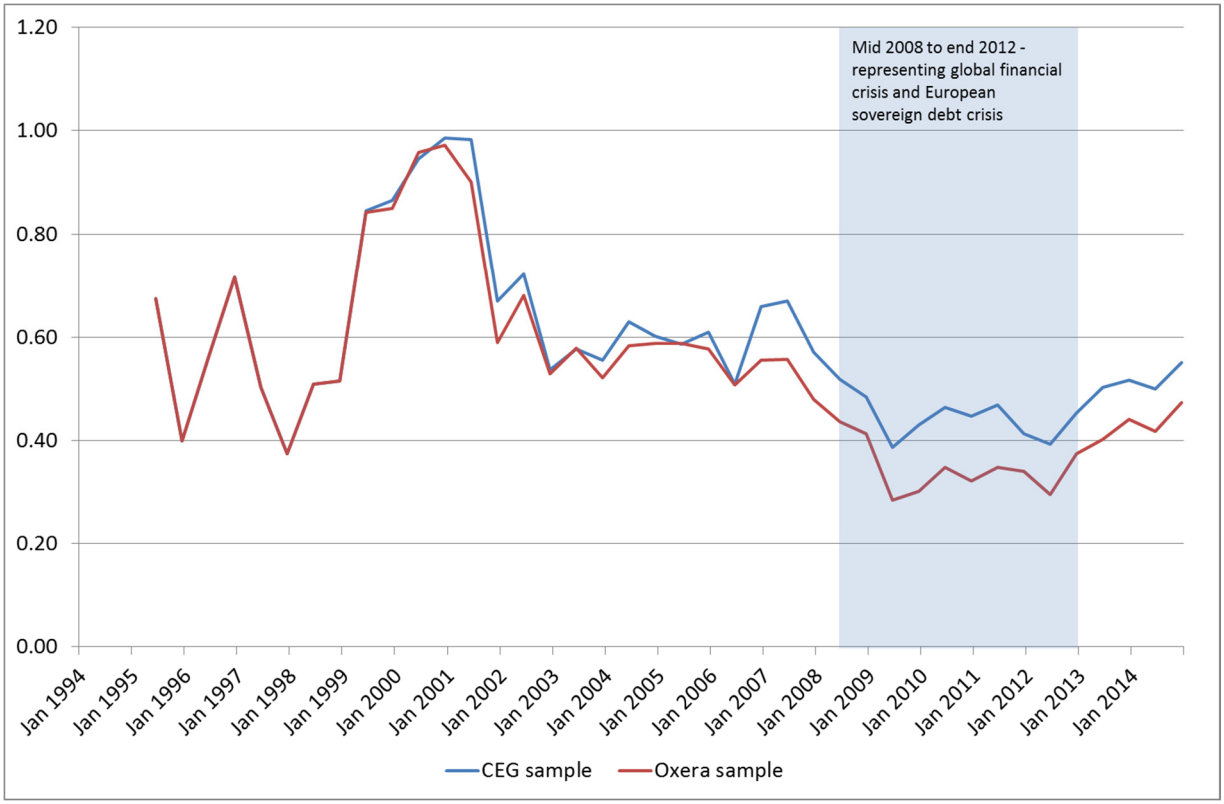
88. Network Strategies states that estimates of asset beta taken from the five year period ending April 2009:

> *…are likely to have been distorted by the global financial crisis, and as such there is a case that this period should not be considered at all by the Commission.*[30]

89. It is correct that the global financial crisis, and the subsequent European sovereign debt crisis, materially affected measured asset beta for fixed line telecommunication businesses (and other non-financial corporations). However, as made clear, in our February report, the effect was to depress betas. Moreover, the relevant time period was from mid-2008 onwards until late 2012. This was illustrated in Figure 1 of our February 2015 report which is reproduced below.

[30] Network Strategies, page 68

Figure 5: Time series of six month beta estimates



Source: Bloomberg data, CEG analysis

90. It is simply inconsistent with the facts for Network Strategies to argue that the asset betas measured to April 2009 were artificially raised by the global financial crisis. The evidence clearly illustrates that the onset of the global financial crisis was associated with an abrupt fall in asset betas which has been reversed in the most recent data.

91. Moreover, the theoretical channel through which this depression of asset betas operated is well understood. During the global financial crisis and the subsequent European sovereign debt crisis equity betas for firms operating in the financial sector were raised – as one would expect during financial crisis. The mathematical consequence of this is that equity betas for all other firms were depressed (noting that the average beta must be equal to 1.0 by definition). The inverse relationship between telecommunication and finance sector betas during this period was clearly illustrated in Figure 2 of our February 2015 report – also reproduced below.

Figure 6: European finance vs telecommunications betas

Source: Bloomberg data, CEG analysis

92. Network Strategies assertion is not based on any factual analysis and is inconsistent with the facts as surveyed above and reported on in more detail in section 2.1 of our February 2015 report.

Is it also sensible to take the median average, rather than the mean, from the sample set?

93. Network Strategies states: [31]

> *Even when carefully selecting data observations that comply with well-defined criteria, the data analyst would not be surprised to obtain some variation within the data. We would support the use of the average from sufficiently large samples, however if the sample is small, then we cannot be as confident that the data points are an accurate representation of the variation that would be observed in a larger sample, and thus any extreme values may have a distortionary effect on the result. Such data points are called 'influential' observations and in effect are more important to the*

[31] Network Strategies, page 68.

> *result than any other data point within the sample. It is simple to determine whether a data point is influential – calculate the average both including and excluding that data point. If there is a significant difference, then it is clear that the result is strongly influenced by that single data point. As we do not wish to assign a higher weighting to particular data points, for that reason in small samples we prefer the use of the median.*

94. The position that Network Strategies is setting out here is illogical. We are interested in the expected value of asset beta from the population of possible asset betas for fixed line telecommunication businesses. The mean of our sample provides the best estimate of the expected mean of the population.

95. Network Strategies view that the median should be used to avoid assigning "a higher weighting to particular data points" is obviously wrong. The mean gives equal weight to every data point. The median gives 100% weight to one or two data points (if the sample size is odd). It is not correct to claim that the median is to be preferred because it gives a more even weighting.

96. Moreover, Network Strategies raises the possibility that there might be particularly influential observations in the sample. If there were, this would not be a basis for rejecting the use of the mean as the value should capture the influence of those observations.

Is it right to say that regulated firms are insulated from windfall gains and losses in such a way that this should be taken into account in the level of the asset beta?

97. Spark has submitted the following in support of a view that the Commerce Commission should give most weight to low equity betas estimated over the period April 2009 to April 2014:[32]

> *We think it is appropriate to take account of the data from the full ten year period, and to apply some weight to the most recent period as described in paragraph 162. There are a number of reasons why we believe that the Commission should consider placing most weight on the recent period.*
>
> ...
>
> *A regulated firm has some level of buffering of risk, at the cost of reduced flexibility in its ability to adjust to fluctuations. Shareholders in that firm will receive a return reflecting the fact that* ***regulatory pricing will largely insulate them from windfall capital losses over the period****, and limit their exposure to the possibility of windfall gains over the same period.* ***We***

[32] Spark, UBA and UCLL FPP pricing review draft decision, February 2015, p. 20.

> ***think this should be the reasonable expectation of shareholders in a regulated infrastructure company such as Chorus.***
>
> *The conditional relationship between return and beta for lower beta companies generally means that when excess market return is positive, a share with a lower average beta gains a lower average return, while when excess market return is negative, it gets a higher average return than higher beta companies.* ***In the absence of the ability to increase prices above a regulated cap, the lower systematic risk for a regulated infrastructure company also reduces the risk that shareholders will receive less than the expected return. This would be the reasonable expectation of an investor in respect of the returns on regulated services.*** *[Emphasis added.]*

98. There are three key problems with the position put by Spark above. First, the five year period ending April 2014 is not the most recent period. As noted above, the most recent betas are materially higher and well above the levels in the period to April 2014.

99. Second, Spark is simply asserting that regulation lowers risk without actually describing the mechanism by which this occurs. When Spark makes this assertion there is no distinction made between the type of regulation and the industry that is being regulated. Spark appears to be relying on a perception of low risk associated with regulation of the kind applied under the Input Methodologies to natural monopoly energy infrastructure businesses; where, amongst other protections, a regulatory asset base is maintained and businesses actual capital expenditure is added to that asset base for the purposes of future recovery and where the business is able to adjust prices periodically to take account of changes in its *actual* costs and *actual* demand.

100. This is simply not the regulatory framework that Chorus operates under. TSLRIC regulation exposes Chorus to materially more risk that its prices/revenues will not match its costs. Spark asserts that "regulatory pricing will largely insulate them from windfall capital losses over the period" but provides no discussion of the mechanism by which this actually will occur under TSLRIC regulation.

101. Third, the sample from which the asset betas are estimated by Oxera are regulated fixed line telecommunications providers (many of whom are regulated under frameworks more similar to the Input Methodologies and can therefore be expected to have lower risk than Chorus). Even accepting Spark's belief that regulation lowers risk, there is no basis for concluding that the period with the lowest betas for regulated businesses is the most relevant. If regulation tends to lower risk then this will be reflected in all asset betas. Given that the businesses have been regulated over the entire period, the reason for low asset betas in the period to April 2014 cannot reasonably be argued to be because this better reflects the impact of regulation.

Would setting the period of debt longer (in this case 2 years longer) than the regulatory period lead to windfall gains?

102. Network Strategies states: [33]

> *We recommend that the Commission assumes a term that matches the regulatory period rather than exceeds it. This option avoids the inconsistencies inherent is selecting different time-periods for the two key components of the cost of debt. In addition it is a more conservative (or mid-point) option which recognises that as the WACC will be re-set at the end of the regulatory period a risk avoidance strategy for providers of regulated UCLL/UBA services would involve aligning debt as closely as possible with the regulatory term. Thus setting a term for the debt premium in excess of the regulatory period simply may lead to windfall gains, as highlighted by the Commission's statement in relation to the IMs.*

103. This is, for the reasons previously set out by Lally and ourselves, wrong. It is well accepted that attempting to mature and re-issue all debt at the beginning of the regulatory period would be an extremely high risk strategy and would expose the business to unacceptable finance risk. Rather, debt issuance and maturity must be staggered to efficiently manage refinance risk.

104. It is therefore impossible (or, at the least, highly inefficient) for a business to follow the practice recommended by Network Strategies. As set out in previous reports, and as the New Zealand regulated entity before the Commission demonstrates, we are aware of no listed regulated businesses with long lived assets that does not seek to manage a staggered debt portfolio.

105. There is no reason for the business to align its debt maturity to the length of the regulatory period because, with a staggered portfolio, it will not be reset at the rate determined by the regulator (assuming the regulator sets an 'on the day' rate at the beginning of the regulatory period as is the Commerce Commission's intention). In this context, the appropriate maturity to assume is the maturity of debt that we observe businesses actually managing. We believe this is 10 years based on international evidence from fixed line telecommunications providers. The Commission's draft decision adopts 7 years based on New Zealand gas, electricity and airport businesses. There is no evidence supporting Network Strategies proposal to adopt 5 years.

[33] Network Strategies, page 65.