Compensation for systematic risks

Prepared for
Chorus

15 July 2019

Final report: Public version

www.oxera.com

Contents

Figures and tables

Executive summary

Oxera has been asked to prepare two expert reports on behalf of Chorus New Zealand Limited ('Chorus') in response to the New Zealand Commerce Commission's ('the Commission') emerging views on the future regulatory framework for fibre services.

This expert report focuses on the systematic risks faced by a notional stand-alone Chorus fibre fixed line access services (FFLAS) division and the appropriate weighted average cost of capital (WACC) required by investors to compensate for those risks.

When estimating the WACC, the widely used capital asset pricing model (CAPM) states that investors should be compensated only for the systematic risk that they face, as non-systematic or idiosyncratic risks are diversifiable.

Therefore, for the purposes of the FFLAS regulation that will be introduced in 2022, the New Zealand Commerce Commission (the Commission) will need to set the following three WACC parameters for FFLAS:[1]

- asset beta—a measure of the systematic risk of the business;[2]
- leverage—a measure of financial risk: greater leverage implies greater financial risk and a higher equity beta;
- credit rating.

Following the approach in the Part 4 IMs, the Commission is proposing that the values of these parameters are based on a comparator analysis, as companies with similar business characteristics are expected to have a similar exposure to systematic risk.

Chorus services consist primarily of FFLAS and the copper access services that are currently regulated by the Commission. An estimation of the asset beta for FFLAS based on the Commission's preferred approach would require a listed pure-play comparator whose risk and return characteristics are similar to those of the Chorus fibre network on a stand-alone basis.

[1] New Zealand Commerce Commission (2018), 'New regulatory framework for fibre', 9 November, para. 7.99.
[2] Equity beta is de-levered to estimate the asset beta, which measures the systematic risk exposure of the business while controlling for the impact of leverage on systematic risk.

However, given the absence of listed pure-play fibre comparators, it is necessary to identify any differences in systematic risk that may exist between FFLAS and other services provided by comparators (e.g. copper), and if necessary adjust the estimated asset beta from comparators to reflect the systematic risk of a stand-alone fibre network.

In our 2014 report for the Commission, we assessed the systematic risk characteristics of fibre access and copper services and concluded that Chorus as an integrated services provider of both copper and fibre has a natural hedge on any developments in technology and economic conditions that may affect the profitability of a stand-alone fibre operator. We further stated that a separate fibre owner might in theory have a higher asset beta than Chorus, but that Chorus itself as an integrated provider of access services is likely to retain access to customers regardless of the pace of the shift to fibre.[3]

Taking into consideration our earlier conclusions, this report assesses the systematic risks faced by a notional stand-alone FFLAS provider and estimates the appropriate asset beta for FFLAS based on a group of relevant comparators.

A detailed assessment of the risk characteristics of fibre and copper access services suggests the following.

- Fibre access services are exposed to substantially higher risk than copper access services, due to their significant demand risk, operational leverage and longer-term cash flows. Moreover, the risk is highest during the construction and early growth phase of the project and decreases as the network matures, implying a higher fibre asset beta in the early phases of the investment.

  1. Demand for fibre access services is likely to be more responsive to changes in the economy, with fibre uptake and upgrades to premium fibre services increasing faster than expected during expansions and slower than expected during recessions due to the higher cost and greater value added (high speed and data allowance) services provided by the fibre access network. Moreover, customers will have the option to downgrade from premium to anchor fibre services in economic downturns, increasing the systematic risk exposure of fibre. Over time, as the uptake of fibre increases, and the fibre market matures, the

[3] Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', June, p. 56.

demand risk will reduce. Nonetheless, some demand risk will continue to exist and is expected to come from other competitive technologies, such as fixed wireless or 5G. Academic evidence suggests that there is a positive relationship between competition risk (i.e. demand risk due to competition) and systematic risk.[4] However, we note that not all of the competition risk is systematic in nature, as some risk is diversifiable.

2. All else being equal, assets with a higher operational leverage[5] face greater systematic risk than assets with a lower operational leverage. This is because profits of an asset with a higher operational leverage will be more sensitive to changes in demand. As a network matures, operational leverage decreases and asset beta decreases (i.e. systematic risk decreases). Therefore, asset beta for fibre would be highest during the projects' construction and growth phase. Over time, as the network matures and take-up of fibre increases, operational leverage would decrease, leading to a decline in asset beta.

3. Long-lived projects are likely to be exposed to greater systematic risk than shorter projects due to the increased exposure to economic uncertainty in long-term cash flows extending far into the future. An implication is that assets with longer lives are likely to have longer break-even periods than those with shorter lives. At present, fibre network assets are expected to have longer useful lives than the existing copper network assets, and therefore are expected to have a higher asset beta.

4. The decline in asset betas over time is evident from regulatory precedent. For instance, in the 2014 FAMR decision Ofcom considered the fibre-to-the-cabinet (FTTC) network to be part of 'Rest of BT' which had an asset beta of 0.83.[6] In the 2018 WLA decision, FTTC was considered to be part of 'Other UK Telecoms' with an asset beta of 0.65.[7]

[4] Lee, C., Liaw, K. and Rahman, S. (1990), 'Impacts of Market Power and Capital-Labor Ratio on Systematic Risk: A Cobb-Douglas Approach', *Journal of Economics and Business*, **42**, p. 240; Chen, K., Cheng, D. and Hite, G. (1986), 'Systematic Risk and Market Power: An Application of Tobin's q', *Quarterly Review of Economics and Business*, **26**:3. Subrahmanyam, M. and Thomadakis, S. (1980), 'Systematic Risk and the Theory of the Firm', *The Quarterly Journal of Economics*, **94**:3.
[5] Operating leverage can be defined as the ratio of fixed costs to total costs (which include both fixed and variable costs)—the higher the proportion of fixed costs, the higher the operating leverage.
[6] Ofcom (2014), 'Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 – Annexes', 26 June, Table A14.1 and para. A14.262.
[7] Ofcom (2018), 'Business connectivity market review', 2 November, p. 206, Table A21.1.

Similarly, the asset beta range for mobile services was set at 0.9–1.44 in 2004[8] compared to 0.55–0.75 in 2014.[9]

5. To estimate the asset beta of FFLAS at inception (i.e. in 2011), one simple approach would be to assume a linear extrapolation of the asset beta estimates at different points in time. For instance, using the Ofcom fibre asset betas at the 2018 WLA and 2014 FAMR decisions gives an extrapolated asset beta of c. 0.95[10] in 2011. We note that this estimate is higher than the Crown Fibre Holdings (2011) estimated asset beta range of 0.5 to 0.8 for fibre investments in New Zealand.[11]

In the absence of listed pure-play fibre companies, we undertake an assessment of the potential comparators for fibre. In the first instance, we analyse the comparator sample assessed by CEPA and expand it to include telecoms providers in several developed Asia-Pacific countries (Japan, Singapore and Hong Kong).[12] Next, we apply the following filters to the total comparator sample (note that these filters are also consistent with our 2014 report for the Commission).

- We exclude international companies that generate less than 50% of their revenues from their core geographies, as exposure to exchange rate risks and various regulatory regimes is likely to pollute the asset beta analysis.[13]
- We exclude companies with illiquid stocks[14] that have zero trading volume (i.e. have not traded) on more than 20% of the total trading days in the past year or have significant bid–ask spreads (greater than 1%).[15]

In addition, we exclude companies that appear to be in financial distress (i.e. have gearing of above 90% in the last year).[16]

[8] Ofcom (2004), 'Wholesale Mobile Voice Call Termination', 1 June, para. B44.
[9] Ofcom (2017), 'Mobile call termination market review 2018-21', Annexes 1–14, para. A10.15.
[10] Given that the Ofcom asset beta estimate in 2018 (0.65) is approximately 20% lower than the asset beta estimate in 2014 (0.83), and assuming that the same relationship holds across the asset betas between 2011 and 2014, this suggests an asset beta estimate of approximately 0.95 for the initial investments.
[11] See 'CFH Response to Select Committee Questions', https://www.parliament.nz/resource/0000164729, accessed 10 July 2019, p. 4.
[12] In undertaking the comparator assessment, we have not comprehensively reviewed each comparator in the CEPA comparator sample but have instead focused on the noticeable issues with the sample. Similarly, our proposed additional comparator list is not exhaustive (i.e. it is possible that other relevant comparators exist that have not been identified).
[13] This filter excludes five companies.
[14] A necessary condition for beta estimates is that the markets for companies' securities are sufficiently liquid. Illiquidity imposes additional trading costs on investors, breaching the assumption in the CAPM of zero transaction costs.
[15] This filter excludes seven companies.
[16] This excludes one company, Frontier Communications, which has a gearing of around 99%.

These filtering criteria exclude some existing comparators (for instance, satellite companies) in the CEPA sample, and include other comparators. Moreover, to avoid double-counting, we exclude Orange Belgium from the CEPA sample as both the parent company (Orange) and Orange Belgium were included in the sample. The final list of comparators is presented in Table A1.1 of Appendix 1.

The risk assessment of fibre relative to copper and the comparator analysis suggest that there is insufficient evidence to conclude that tower companies (and satellite operators) described by CEPA as 'wholesale' companies are better comparators for fibre than integrated companies.

CEPA's central argument, that 'wholesale' providers are likely to be 'closer in nature'[17] to the Chorus fibre network because their long-term contracts provide revenue certainty similar to the revenue cap regime of Chorus, fails to consider that the revenue cap regime provides a revenue ceiling, not a floor. The revenue cap will not provide protection against demand risk arising from demand/volume fluctuations that prevent Chorus from generating the forecast revenues.

In the absence of sufficient evidence to justify the higher weight that is implicitly placed on the 'wholesale' providers by splitting the sample, it is more appropriate to weight the comparators equally by estimating the asset beta based on the total sample.

The asset beta range based on the two consecutive 5-year and the recent 2-year asset betas of the total sample estimated over different frequencies (daily, weekly and monthly for the 5-year samples and daily and weekly for the 2-year sample) is between 0.46 and 0.57.

As telecoms is a fast-paced industry with frequent technological advancements, and the comparator sample is smaller in size over the 2009–14 period, to inform our point estimate of asset beta for fibre we assign more weight to the asset betas estimated over the more recent 5-year and 2-year periods by taking an average of all the asset betas estimated over the three periods (2009–14, 2014–19, 2017–19). This gives a point estimate of 0.52 for the asset beta.

Furthermore, we note that the comparator sample consists of well-diversified companies that own and operate differing combinations of copper, fibre, mobile,

[17] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 26.

and other telecoms assets, which was also acknowledged by CEPA.[18] Given that a proportion of these comparator companies consist of mature and lower-risk businesses (e.g. copper), it is likely that the asset beta for a stand-alone FFLAS would lie above the midpoint of the asset beta range estimated from the comparator sample.

The median credit rating based on the comparator sample is BBB, and the average gearing is 30%. Our 2014 report for the Commission recommended a credit rating of BBB+/A- and a notional gearing of 40% for copper access services based on comparator analysis and regulatory precedent.[19]

Given that credit ratings take into account both systematic and non-systematic risk, and that a stand-alone FFLAS provider will have greater exposure to both types of risk than copper and other mature networks, a target credit rating of BBB and a target gearing of 30%, consistent with the comparator sample, seem to be appropriate. This is also in line with the recent regulatory precedent—for instance, Ofcom assumes a BBB credit rating for BT in the UK.

Local fibre companies (LFCs) have a similar systematic risk exposure to a notional Chorus fibre business. The competitive threat from other technologies (copper, fixed wireless and mobile networks) is broadly similar for both LFCs and Chorus, implying that a sector-specific asset beta would be appropriate for fibre companies in New Zealand.

[18] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 22.
[19] Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', June, p. 3.

1 Introduction

1.1 Oxera has been asked to prepare two expert reports on behalf of Chorus New Zealand Limited ('Chorus') in response to the New Zealand Commerce Commission's ('the Commission') emerging views on the future regulatory framework for fibre services.

1.2 This expert report discusses the systematic risks faced by a notional Chorus fibre fixed line access services (FFLAS) division and the appropriate weighted average cost of capital (WACC) required by investors to compensate for those risks.

1.3 When estimating the WACC, the widely used capital asset pricing model (CAPM) states that investors should be compensated only for the systematic risk that they face, as non-systematic or idiosyncratic risks are diversifiable. Under the CAPM framework, the return required by equity investors consists of the risk-free rate plus a premium to invest in the risky assets, as follows:

$$E(R) = R_f + \beta * ERP$$

1.4 The premium is estimated as equity beta (β) times the market risk premium (ERP), where the equity beta reflects the sensitivity of the return on the asset to the return on the market portfolio, a measure of systematic risk. An asset with greater sensitivity to changes in the economic outlook would have a higher equity beta than an asset with lower sensitivity.

1.5 Therefore, for the purposes of FFLAS regulation, the New Zealand Commerce Commission (the Commission) decided to set the following three weighted average cost of capital (WACC) parameters for FFLAS:[20]

- asset beta—a measure of the systematic risk of the business;[21]
- leverage—a measure of financial risk: greater leverage implies greater financial risk and a higher equity beta;
- credit rating.

[20] New Zealand Commerce Commission (2018), 'New regulatory framework for fibre', 9 November, para. 7.99.
[21] Equity beta is de-levered to estimate the asset beta, which measures the systematic risk exposure of the business while controlling for the impact of leverage on systematic risk.

1.6 The values of these parameters are based on comparator analysis, as companies with similar business characteristics are expected to have a similar exposure to systematic risk.

1.7 Chorus services consist primarily of FFLAS and the copper access services that are currently regulated by the Commission.

1.8 FFLAS consists primarily of fibre broadband services delivered to the end-users over layer 2 network assets using Gigabit Passive Optical Networks (GPON) technology. While FFLAS also includes some peer-to-peer (P2P) services, such as dark fibre access service (DFAS) and, in the future, unbundled fibre access, the FFLAS network is deemed to be designed primarily to meet the demand for fibre broadband (GPON) services. As at 31 December 2018, fibre broadband (GPON) services represented 97.7% of all FFLAS connections.[22]

1.9 In our 2014 report for the Commission, we assessed the systematic risk characteristics of fibre access and copper services, and concluded that Chorus as an integrated services provider of both copper and fibre has a natural hedge on any developments in technology and economic conditions that might affect the profitability of a stand-alone fibre operator. We further stated that a separated fibre owner might have a theoretically higher beta than Chorus, but that Chorus itself as an integrated provider of access services would be likely to retain access to customers regardless of the pace of the shift to fibre.

1.10 Taking into consideration our earlier conclusions, and following the approach in the Part 4 IMs, in this report we assess the systematic risks faced by a stand-alone FFLAS and estimate the appropriate asset beta for FFLAS based on a sample of relevant comparators.

1.11 To estimate the systematic risk (i.e. the asset beta) of a stand-alone FFLAS, we need data on a listed pure-play fibre operator whose risk and return characteristics are similar to those of the Chorus fibre network. However, given the absence of listed pure-play fibre comparators, it is necessary to identify and capture the differences in systematic risk that may exist between copper and fibre services to ensure that the estimated asset beta from comparators (who provide integrated services) is adjusted to reflect the systematic risk of a stand-alone fibre network.

[22] Chorus FY19 half-year report.

1.12 The remainder of this report is structured as follows.

- Section 2 discusses the risk characteristics of a stand-alone fibre network relative to the legacy copper network, and how this risk changes over time.
- Section 3 describes the Commission's methodology for estimating the asset beta and reviews the comparator analysis conducted by CEPA.
- Section 4 estimates the asset beta and discusses the appropriate credit rating and gearing for a stand-alone FFLAS.

2 Risk assessment of fibre versus copper

2.1 The risk characteristics of a project vary over its lifetime. Risks are highest during the construction phase when there is greatest uncertainty regarding project uptake and profitability, and tend to decrease in the growth phase (when revenues/cash flows increase) and stabilise as the revenues stabilise—i.e. when the investment reaches steady state or the market matures. This applies to systematic risks as well as diversifiable risks. We note that this was also recognised by CEPA in its report for Ofgem:

> Construction is higher risk than operations, so we expect the asset beta for [...] is higher than for a blended construction and operation phase project, all other things being equal.[23]

2.2 Therefore, the risk of fibre is likely to have been highest in 2011, when construction started, and to decrease over time with the uptake of fibre (i.e. increase with the penetration rate).

2.3 The 2016 Brattle Group report for the European Commission considered that the systematic risk of Next Generation Access (NGA) fibre services was driven by:

- systematic demand risks;
- capital leverage;
- long-term payoffs.[24]

2.4 The report concluded that the **systematic** risk faced by fibre network was higher than that of the legacy copper network and therefore required a WACC premium. The premium was estimated as an uplift to the asset beta for the copper network, where the uplift measured the relative revenue volatility of fibre over copper. This uplift for systematic risks is separate from, and should not be confused with, the fair bet 'delta' above the WACC which is discussed in Oxera's companion expert report on compensation for asymmetric type 2 risks.

2.5 Ofcom's recent proposals also considered fibre to be higher risk than copper, and resulted in a higher asset beta relative to copper. However, Ofcom noted that the risk factors would decrease over time as take-up of fibre increased.[25]

[23] CEPA (2018), 'Review of cost of cost of capital ranges for new assets for Ofgem's networks division', 27 July, p. 54.
[24] The Brattle Group (2016), 'Review of approaches to estimate a reasonable rate of return for investments in telecoms networks in regulatory proceedings and options for EU harmonization'.
[25] Ofcom (2017), 'Wholesale Local Access Market Review – Annexes', 31 March, para. A16.142.

The proposals recognised that the risk factors for the fibre network were much higher in the past, stating that:

> Overall, we consider that the systematic risk for NGA services stemming from the income elasticity of demand is likely to be greater than for copper access. While the systematic demand risk of NGA services may have been higher in the past, it is likely to have reduced over time…[26]
>
> …the expected payback period may have resulted in a higher asset beta for NGA activities at the time of the initial investment[27]

2.6 Thus, as per Ofcom's conclusion above, the overall asset beta for FFLAS would be higher than copper and would decrease over time.

2.7 CEPA's 2019 report for the Commission discussed the following risk factors that affect the systematic risk of fibre service providers in New Zealand:[28]

- demand risk;
- growth opportunities;
- operating leverage;
- asset-stranding;
- company size;
- long-lived investments;
- other risk factors, including counterparty risk, market weight and monopoly power.

2.8 However, CEPA's analysis does not reach a concrete conclusion on the relative risk characteristics of fibre versus copper.[29] It does not agree with a vast majority of regulatory decisions that are of the view that fibre access services have higher systematic risk exposure than copper services.

2.9 The National Regulatory Authorities (NRAs) that have assessed the risks of fibre vs copper and allowed a WACC premium for fibre based on its higher systematic risk include the Authority for Consumers and Markets (ACM) in the Netherlands, the Autorità per le Garanzie nelle Comunicazioni (AGCOM) in Italy, the Agencija za pošto in elektronske komunikacije republike Slovenije

[26] Ibid., para. A16.153.
[27] Ibid., para. A16.160.
[28] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 22.
[29] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 25.

(AKOS) in Slovenia, the Czech Telecommunications Office, Comisión Nacional de los Mercados y la Competencia (CNMC) in Spain, the Danish Business Authority (DBA) in Denmark, the Belgian Institute for Postal services and Telecommunications (BIPT) in Belgium, and the Institute Luxembourgeois De Régulation (ILR) in Luxembourg.[30,31]

2.10 CEPA comments on these regulatory decisions as follows:

> We note that regulators in other jurisdictions have cited greater variability of demand as a reason for a higher WACC allowance for fibre networks, compared to legacy copper networks. However, our observation is that these judgements appear to be based primarily on an intuition that demand for fibre services is generally 'riskier' than for legacy networks, rather than conclusive evidence.

2.11 Moreover, CEPA considers demand risk due to competitive threat to be completely non-systematic:

> In particular, we do not consider stranding risk related to competition from alternative services to be systematic in nature.[32]

2.12 Regarding operating leverage, CEPA does not consider that a higher operating leverage would lead to a higher systematic risk for fibre services or a higher asset beta for Chorus. According to CEPA's report, the effect of operating leverage on asset beta would be dampened due to Chorus being regulated under the revenue cap regime:

> For Chorus, the effect of operating leverage on the asset beta will also be impacted by the nature of its revenue cap, based on a building blocks model. Under this model, the revenue that Chorus is able to recover is linked to its allowed RAB and projected efficient operating costs, regardless of fluctuations in demand. As a result, even if Chorus' operating leverage were higher than that of the LFCs or the comparator sample, the effect of this on earnings volatility would be reduced.[33]

2.13 The Commission's 2019 technical paper agrees with CEPA's analysis and does not consider the impact of operating leverage on asset beta.[34]

2.14 Moreover, the Commission agrees with CEPA's views on demand risk and does not consider it to be generally systematic:

> Demand and subsequent stranding risk can be systematic or non-systematic. Our view, consistent with CEPA's view, is that we do not consider stranding risk from

[30] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 76;
[31] BIPT (2018), 'Projet de décision du conseil de l'ibpt concernant le coût du capital pour les opérateurs puissants en belgique', August, p. 20.
[32] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 30.
[33] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 29.
[34] Commerce Commission New Zealand (2019), 'Fibre regulation emerging views: Technical Paper', 21 May, para. 422.

> competition between a supplier and other services is generally systematic in nature…[35]

2.15 The Commission also assumes a similar WACC for fibre for the pre- and post-implementation period:

> Our emerging views on the WACC for the losses calculation are: …
>
> To apply the same asset beta when determining the WACC in both the pre and post-implementation period.[36]

2.16 In light of this debate, we assess the relative risk characteristics of fibre and copper networks and how these evolve over time (in section 2E). In particular, we focus on the following risks:

- the high elasticity of demand of fibre versus copper;
- the high operating leverage of fibre and the impact on asset beta;
- the long-term cash flows of fibre versus copper.

2A High income elasticity of demand for fibre services

2.17 Demand for fibre services is likely to be more responsive than demand for copper services to changes in the economy, due to the higher cost and greater value added (high-speed) services provided by the fibre network relative to the legacy copper network. Below we discuss the potential evolution of demand risk over time and the impact of regulatory mitigation measures on this risk.

2A.1 Demand risk and how it evolves over time

2.18 Suppose there are two scenarios: one where the economy and incomes grow faster than expected, and the second where economic growth is slower than expected.

2.19 In the first scenario, assuming the presence of a competing alternative network, the demand for the higher value added fibre services relative to copper will be greater than expected and consumers will switch from copper to fibre at a faster rate. Moreover, consumers on an existing anchor fibre package are likely to upgrade to premium fibre services.

2.20 In the second scenario, when the economy and incomes grow slower, the demand for the high value added fibre services will slow down. Customers on the copper network will be hesitant to switch to the higher-cost and higher

[35] Commerce Commission New Zealand (2019), 'Fibre regulation emerging views: Technical Paper', 21 May, para. 422.
[36] Commerce Commission New Zealand (2019), 'Fibre regulation emerging views: Technical Paper', 21 May, para. 515.

value added fibre network. It is also possible (although unlikely) that customers will downgrade their existing copper network packages, which would reduce revenues for the copper network. Similarly, it is possible that existing fibre customers on premium packages will downgrade to anchor services.

2.21 In addition, during an economic slowdown, fibre services with their higher cost and greater value added features are likely to be viewed as a luxury good instead of an essential service, implying that fibre uptake is likely to slow down.

2.22 These dynamics suggest that the speed of fibre uptake and the upgrade of different fibre packages will depend on the economic cycle, indicating a higher systematic risk for fibre. On the other hand, the demand for copper is likely to be countercyclical during economic expansion and relatively stable during economic slowdown, indicating a lower systematic risk for copper. This suggests that the asset beta of fibre will be higher than that of copper.

2.23 This is consistent with the views of regulators in various jurisdictions, which have allowed a higher WACC for fibre networks relative to copper networks due to the higher variability of demand for fibre. As mentioned above, CEPA disagrees with the regulatory precedent of a higher WACC for fibre on the basis that the riskier demand for fibre is based on 'intuition' and not conclusive evidence. We note that, in the absence of listed pure-play fibre operators whose data cannot be used to quantify the systematic risk differences between fibre and copper, as the next best alternative it is important to take into consideration sound economic arguments that indicate greater demand risk for fibre relative to copper and adjust the asset beta for fibre accordingly.

2.24 We note that, over time, as fibre penetration increases and the copper network is phased out, fibre access services will become more of an essential good with lower income elasticity of demand, and the relative systematic demand risk for fibre will reduce. However, it is important to note that the telecoms industry operates in a fast-paced environment where future technology and changing consumer preferences have significant potential to make existing networks obsolete.

2.25 With an increase in the popularity of fixed wireless and 5G networks across the globe, fibre will face a competitive threat from these networks in the future. When 5G is rolled out, it is expected to be faster, cheaper and more accessible than the fibre network.[37] Therefore, it has the potential to become a significant competitive threat for fibre, leading to asset stranding risk.

2.26 The impact of competition on the cost of capital has been extensively researched by market practitioners and academics. A variety of measures for competition and market power have been used, with theoretical studies concluding that there is a negative relationship between the level of monopoly power and beta. For example, Lee, Liaw and Rahman (1990) state that:

> A higher degree of monopoly power in the product market will unambiguously lower the systematic risk of a firm, ceteris paribus...Based on the CAPM, the firm with a higher market power in its product market can raise capital at a lower cost (by means of a lower required rate of return).[38]

2.27 Other research has reached similar conclusions. For example, Subrahmanyam and Thomadakis (1980) state:

> Among firms using the same production technique, those with higher (lower) monopoly power will exhibit lower (higher) betas. Thus, irrespective of the source of uncertainty, monopoly power unambiguously reduces beta.[39]

2.28 The relationship runs in reverse, such that, as competition increases, the systematic risk of the competing firms increases. However, we note that not all of the demand risk due to competition is likely to be systematic in nature, as some is diversifiable.

2.29 Currently, fixed wireless as a proportion of total broadband is growing in New Zealand. It grew from [✂]% in January 2016 to [✂]% in January 2019 (see Figure 2.1 below). Moreover, the total fixed wireless market has a high expected growth rate (of almost [✂]%) from FY2019 to FY2024. Thus, it seems that fibre access services will continue to face some demand risk due to competition from fixed wireless and 5G networks in the future.

Figure 2.1 [✂]

2.30 Given the difficultly in accurately predicting the impact of innovative products on consumer preferences and demand, the current projected growth estimates of fixed wireless in New Zealand should be interpreted with caution as outturn can be different from forecast. If the uptake of the fixed wireless and 5G technologies is higher than forecast, the competitive threat to fibre will be

[37] See Mundy, J., '5G vs fibre - Will 5G replace fibre broadband?, 5G.co.uk newsletter, https://5g.co.uk/guides/5g-vs-fibre-broadband/, accessed 3 July 2019.
[38] Lee, C., Liaw, K. and Rahman, S. (1990), 'Impacts of Market Power and Capital-Labor Ratio on Systematic Risk: A Cobb-Douglas Approach', *Journal of Economics and Business*, **42**, p. 240.
[39] Subrahmanyam, M. and Thomadakis, S. (1980), 'Systematic Risk and the Theory of the Firm', *The Quarterly Journal of Economics*, **94**:3, p. 447.

higher, leading to greater risk. However, as stated previously, not all of this risk is likely to be systematic in nature.

2A.2 Regulatory mitigation

2.31 CEPA assumes that the revenue cap regime that Chorus is subject to, combined with the 'wash-up' mechanism, provides a buffer from demand fluctuations and thereby reduces exposure to systematic risk. We note that this is not true as the revenue cap regime provides a revenue ceiling, not a floor. It does not protect against systematic risk arising from demand/volume fluctuations that prevent Chorus from recovering its forecast revenues as there is no external source of funding to cover any demand shortfall.

2.32 Moreover, there is a lack of specification from the Commission on how the wash-up mechanism will work in practice, which reduces its value as a risk-reduction mechanism in the eyes of investors. For more detail on the wash-up mechanism, see section 3E in our report on compensation for asymmetric risk.

2B Operating leverage

2.33 Operating leverage can be defined as the ratio of fixed costs to total costs (which include both fixed and variable costs)—the higher the proportion of fixed costs, the higher the operating leverage.

2.34 A fibre network that is expected to incur additional capital expenditure in the future, as connections are laid out and take-up of fibre increases, is likely to have a higher operating leverage than a mature legacy copper network, with a relatively low proportion of fixed costs.

2.35 According to finance theory, all else being equal, a higher operating leverage will lead to a higher asset beta and vice versa. As stated by Berk and DeMarzo (2014):

> … [a] factor that can affect the market risk of a project is its degree of operating leverage, which is the relative proportion of fixed versus variable costs. Holding fixed the cyclicality of the project's revenues, a higher proportion of fixed costs will increase the sensitivity of the project's cash flows to market risk and raise the project's beta. To account for this effect, **we should assign projects with an above-average proportion of fixed costs**, and thus greater-than-average operating leverage, **a higher cost of capital.**[40] [emphasis added]

2.36 Box 2.1 reproduces a numerical example from Berk and DeMarzo (2014) to illustrate this point.

[40] Berk, J. and DeMarzo, P. (2014), *Corporate Finance*, third edition, Pearson, p. 420.

Box 2.1 Illustration of the relationship between operational leverage and systematic risk

Consider a project with expected annual revenues of NZ$100 and costs of NZ$10 in perpetuity. The costs are completely variable, so that the profit margin of the project will remain constant.

Suppose the project has a beta of 1.0, the risk-free rate is 1%, and the expected return of the market is 5%.

The expected cash flow of the project is then NZ$100 - NZ$10 = NZ$90 per year. Given a beta of 1.0, the appropriate cost of capital is r = 1% + 1.0(5% - 1%) = 5%. Thus, the present value of the project if the costs are completely variable is NZ$90/5% = NZ$1,800.

If, instead, the costs are fixed, we can compute the value of the project by discounting the revenues and costs separately. The revenues still have a beta of 1.0, and thus a cost of capital of 5%, for a present value of NZ$100/5% = NZ$2,000. Because the costs are fixed, we should discount them at the risk-free rate of 1%, so their present value is NZ$10/1% = NZ$1,000.

Thus, with fixed costs the project has a value of only NZ$2,000 - NZ$1,000 = NZ$1,000. What is the beta of the project now?

We can think of the project as a portfolio that is long[41] the revenues and short[42] the costs. The project's beta is the weighted average of the revenue and cost betas, or:

$$\beta_{Project} = \beta_{Revenues}\frac{Revenues}{Revenues - Costs} - \beta_{Costs}\frac{Costs}{Revenues - Costs}$$

$$= 1.0\frac{2{,}000}{2{,}000 - 1{,}000} - 0\frac{1{,}000}{2{,}000 - 1{,}000}$$

$$= 2.0$$

Given a beta of 2.0, the project's cost of capital with fixed costs is WACC = 1% + 2.0(5% - 1%) = 9%. To verify this result, note that the present value of the expected profits is then NZ$90/9% = 1,000.

[41] A long position—also known as long—is the buying of a stock, commodity, or currency with the expectation that it will rise in value.
[42] A short position is the selling of a stock, commodity or currency with the intent of buying it later at a lower price to realise a profit.

As this example shows, increasing the proportion of fixed versus variable costs can significantly increase a project's beta—i.e. systematic risk (and reduce its value).

Source: Oxera analysis reproduced from Berk, J. and DeMarzo, P. (2014), *Corporate Finance*, Pearson, third edition, p. 420.

2.45 This implies that a project will have the highest asset beta during the construction and growth phase due to a higher proportion of fixed costs (contractual commitment to undertake CAPEX) relative to total costs.

2.46 Over time, as construction is completed and the project moves into the operational phase, operational leverage will decrease, leading to a decline in asset beta.

2.47 The decline in the asset beta from the construction phase to the operational phase could be linear or non-linear depending on the planned CAPEX and cash flows.

2C Long-term cash flows

2.48 Long-lived projects are likely to be exposed to greater systematic risk than shorter projects due to the increased uncertainty in long-term cash flows extending far into the future. An implication is that assets with longer lives are likely to have longer break-even periods than those with shorter lives. As the value of the investment is affected by expectations regarding the future macroeconomic conditions, the longer-duration projects are subject to greater uncertainty stemming from changes in the real economy and the political and regulatory landscape than shorter-duration projects. This results in a higher asset beta for long-lived projects.

2.49 The fibre network will have long-term cash flows relative to the legacy copper network due to the longer remaining economic lives of fibre assets. Therefore, the asset beta of fibre would be higher than that of copper.

2.50 We note that this point is acknowledged by the Brattle Group in its report for the European Commission:

> …the value of long-lived investments like a new NGA network will be more sensitive to changes in macroeconomic conditions, and hence will have a higher beta, than a legacy network.[43]

[43] The Brattle Group (2016), 'Review of approaches to estimate a reasonable rate of return for investments in telecoms networks in regulatory proceedings and options for EU harmonization', p. 12.

2.51 CEPA does not consider long-lived assets to be a determinative factor in contributing to a higher asset beta, based on the assumption that legacy networks may deploy their assets beyond their useful lives and the copper networks own other products (ducts, rights of way and operating knowledge) that would increase the value of the project. CEPA substantiates this argument by giving the example of satellite operators that own slots under international law and therefore simply replace their existing satellites once they reach the ends of their useful lives (i.e. become obsolete).

2.52 In drawing these comparisons, CEPA implies that copper networks can be upgraded to increase their useful lives similarly to those of satellite locations as in the above example. We note that this is not a completely accurate comparison. Copper networks may have the right to continue operating the copper network, but over time, as fibre penetration increases, the copper network is destined to become obsolete. The associated ducts, rights of way and operating knowledge may derive value from being redeployed to support the fibre network, but not by continuing to be available for a stand-alone copper network. The useful lives of the copper assets and the associated cash flows cannot be increased by simply upgrading the network, as fibre customers are unlikely to switch from fibre to copper, making the investment unprofitable.

2.53 At present, fibre assets are expected to have longer useful lives than the existing copper assets and therefore merit a higher asset beta.

2D Risk of fibre pre- and post-implementation of regulation

2.54 As stated previously, the risk characteristics of a project vary over its lifetime. In particular, the risk characteristics of fibre can be divided into two periods: the construction and early growth phase; and the steady state.

Table 2.1 Risk characteristics of fibre over time

	Construction and early growth phase	Steady state (2022 onwards)
Demand risk	High	Lower than growth phase but still higher than copper due to the competitive threat from fixed wireless (a proportion of this risk will be systematic in nature with the remainder being diversifiable)
Risk due to operational leverage	High	Lower than growth phase
Long-term cash flows	High	Lower than growth phase but still higher than the copper network due to longer remaining useful asset lives

Source: Oxera analysis.

2D.3 Pre-implementation risk (construction and early growth phase)

2.55 In the pre-implementation period, the demand risk is high due to the uncertainty in demand and the competitive threat from copper. An economic slowdown is likely to slow the uptake of fibre as consumers reduce spending and become hesitant in switching from the lower-cost, lower-value copper network to the greater-value, higher-cost fibre network.

2.56 In the construction and early growth phase, the fibre network is being rolled out and the uptake of fibre is increasing, so costs consist mainly of CAPEX to lay out the network and install connections. In this phase, fibre has high fixed costs relative to total costs (i.e. it has a high operating leverage) and therefore a high asset beta. The fixed costs are high due to the CAPEX required to lay out the network. We note that installation costs (i.e. CAPEX incurred) to connect homes and businesses to the network could be considered variable as they depend on the rate of the fibre uptake.

2.57 In the pre-implementation period, the useful lives of the assets will be longer and therefore the uncertainty around cash flows will be higher.

2.58 The high operating leverage, the high demand risk and the longer-term cash flows in the construction and early growth phase indicate a greater systematic risk and therefore a higher asset beta for fibre.

2D.4 Post-implementation (steady state)

2.59 In the steady state phase (2022 and beyond), the fibre penetration rate is expected to be high (around [✂]%),[44] indicating a mature fibre market with reduced demand risk due to the reduced competitive threat from copper. In this phase demand risk will continue to exist but is expected to come from other technologies, such as fixed wireless or 5G, although we note that not all of this risk is systematic in nature, with some risk being diversifiable.

2.60 In the steady state, with high fibre penetration rates, the majority of the CAPEX will have been completed, and the operational leverage of fibre will be lower in the steady state than in the construction and early growth phase, leading to a lower asset beta in the steady state.

2.61 The risk from long-term cash flows in the steady state will be lower than in the construction and early growth phase, but will still be higher than, for instance,

[44] Based on forecast data from Chorus.

the current copper network due to the longer remaining useful lives of the fibre assets.

2D.5 Regulatory evidence on pre- and post-implementation asset beta

2.62 Regulatory evidence suggests that the asset beta for fibre will be higher in the construction phase than in the operational phase, and will decrease over time.

2.63 A decline in asset beta for fibre over time is evident from Ofcom's determinations, which used 0.83 asset beta for fibre in its 2014 fixed-access market review (FAMR) decision[45] and 0.65 asset beta in its 2018 wholesale local access (WLA) decision.[46] Similarly, the asset beta range for mobile services was set at 0.9–1.44 in 2004[47] and reduced to 0.55–0.75 in 2017.[48]

2.64 To estimate the asset beta of FFLAS at inception (i.e. in 2011), one simple approach would be to assume a linear extrapolation of the asset beta estimates at different points in time. For instance, using the Ofcom fibre asset betas at the 2018 WLA and 2014 FAMR decisions gives an extrapolated asset beta of c. 0.95 in 2011.[49] We note that this is higher than the 2011 Crown Fibre Holdings estimated asset beta range of 0.5 to 0.8 for fibre investments in New Zealand.[50]

[45] Ofcom (2014), 'Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 – Annexes', 26 June, Table A14.1 and para. A14.262. Ofcom considered the fibre-to-the-cabinet (FTTC) network to be part of 'Rest of BT' which had an asset beta of 0.83
[46] Ofcom (2018), 'Business connectivity market review', 2 November, p. 206, Table A21.1. In the 2018 WLA decision, FTTC was considered to be part of 'Other UK Telecoms' with an asset beta of 0.65.
[47] Ofcom (2004), 'Wholesale mobile voice call termination', 1 June, para. B44.
[48] Ofcom (2017), 'Mobile call termination market review 2018-21', Annexes 1–14, para. A10.15.
[49] Given that the Ofcom asset beta estimate in 2018 (0.65) is approximately 20% lower than the asset beta estimate in 2014 (0.83), and assuming that the same relationship holds across the asset betas between 2011 and 2014, this suggests an asset beta estimate of approximately 0.95 for the initial investments.
[50] See 'CFH Response to Select Committee Questions', https://www.parliament.nz/resource/0000164729, accessed 10 July 2019, p. 4.

3 Assessment of asset beta

3.1 According to Commission guidelines,[51] the asset beta estimation consists of six steps.

1. Identify a relevant comparator sample.
2. Estimate the equity beta for each comparator.
3. De-lever the equity beta to get the estimated asset beta.
4. Calculate the average asset beta for the sample.
5. Apply any adjustments for regulatory differences or differences in systematic risk across comparators to the average asset beta for the sample.
6. Re-lever the average asset beta for the sample to an equity beta estimate using the Commission's assumed notional leverage.

3.2 In this section, we focus on the first step—identification of the relevant comparator sample. We outline the main issues with the comparator sample chosen by CEPA (2019) and identify some other relevant comparators that have not been included in the CEPA comparator sample. We also assess the comparability of a stand-alone Chorus FFLAS asset beta with that of LFCs.

3.3 In undertaking the comparator assessment, we have not comprehensively reviewed each company in the CEPA comparator sample but instead have focused on the more prominent issues in CEPA's analysis. Similarly, our proposed additional comparator list is not exhaustive (i.e. it is possible that other close comparators exist that may not have been identified based on our filtering criteria).

3A Appropriate comparators for stand-alone Chorus FFLAS

3.4 In the absence of pure-play fibre companies, we undertook an assessment of the potential comparators for stand-alone Chorus FFLAS. In the first instance, we analysed the comparator sample assessed by CEPA and expanded it to include telecoms providers in the following developed Asia-Pacific countries: Japan, Singapore and Hong Kong.

[51] New Zealand Commerce Commission (2016), 'Input methodologies review decisions - Topic paper 4: Cost of capital issues', December, pp. 60–61.

3.5 To be consistent with our 2014 report for the Commission, we applied the following filters on the total comparator sample.

- We excluded international companies that generate less than 50% of their revenues from their core geographies.
- We excluded companies with illiquid stocks that have zero trading volume (i.e. have not traded) on more than 20% of the total trading days in the past year, or have average bid–ask spreads above 1%.
- In addition, we excluded companies that appear to be in financial distress and had gearing of above 90% in the last year.

3.6 Our filtering criteria excluded some existing comparators (for instance, satellite companies) in the CEPA sample and included other comparators. Moreover, to avoid double-counting, we excluded Orange Belgium from the CEPA sample as both the parent company (Orange) and Orange Belgium were included in the sample. The final list of 49 comparators is presented in Table A1.1, and excluded companies are listed in Table A1.2, Table A1.3 and Table A1.4 of Appendix 1.

3.7 Based on the risk assessment of fibre relative to copper and the comparator analysis, there is insufficient evidence to conclude that tower companies (and satellite operators) described by CEPA as 'wholesale' companies are better comparators for fibre than integrated companies.

3.8 CEPA's central argument, that 'wholesale' providers are likely to be 'closer in nature'[52] to the Chorus fibre network because their long-term contracts provide revenue certainty similar to the revenue cap regime of Chorus, fails to consider that the revenue cap regime provides a revenue ceiling, not a floor. The revenue cap will not protect against demand risk arising from demand/volume fluctuations that prevent Chorus from generating the forecast revenues.

3.9 Therefore, the Chorus revenue cap regime cannot be considered analogous to the long-term contracts of the tower and satellite companies.

3.10 In the absence of sufficient evidence to justify the higher weight that is implicitly placed on the 'wholesale' providers by splitting the sample, it is more

[52] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 26.

appropriate to weight the comparators equally by estimating the asset beta based on the total sample.

3B Comparison of stand-alone Chorus FFLAS asset beta with local fibre companies

3.11 The CEPA risk assessment of LFCs suggests that they have a similar exposure to systematic risk to that of Chorus fibre. Among other factors, CEPA states that LFCs have a similar underlying income elasticity of demand to Chorus, but unlike Chorus they are not subject to a revenue cap which increases the relative demand risk for LFCs. We note that the demand risk faced by LFCs is unlikely to be greater than that of Chorus, as the revenue cap regime does not act as a demand buffer in all circumstances.

3.12 Furthermore, LFCs state that they face greater demand risk from copper, fixed wireless and other networks operating in LFC areas, and therefore that a sector-wide asset beta will not capture their systematic risk exposure adequately.[53]

3.13 However, a stand-alone FFLAS will face similar demand risk from other technologies (copper, fixed wireless). As the demand risk exposure of LFCs and Chorus FFLAS is similar, a sector-wide asset beta would be appropriate to capture the total systematic risk exposure of fibre access services in New Zealand.

[53] Commerce Commission New Zealand (2019), 'Fibre regulation emerging views: Technical Paper', 21 May, para. 440.

4 Estimation of asset beta

4A Estimation of asset beta

4.1 The asset beta ranges of our selected comparator sample are presented in Table 4.1 below. We have estimated the asset betas for the additional comparators using an approach that we consider to be consistent with how CEPA has done its analysis. We have not re-estimated the asset betas for the companies that CEPA has used.

4.2 The asset betas of additional comparators are presented in Table 4.2.

Table 4.1 Average asset betas

	Total sample (average)
5-year	
2014–19 (daily)	0.55
2014–19 (weekly)	0.54
2014–19 (monthly)	0.48
2009–14 (daily)	0.57
2009–14 (weekly)	0.54
2009–14 (monthly)	0.55
2-year	
2017–19 (daily)	0.48
2017–19 (weekly)	0.46
Range	0.46–0.57

Note: Analysis based on the comparator sample presented in Table A1.1.

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

Table 4.2 Asset betas of additional comparators

	StarHub Ltd	HKBN Ltd	Singapore Telecommunications	Nippon Telegraph & Telephone	KDDI Corp
5-year					
2014–19 (daily)	0.45	0.21	0.72	0.55	0.75
2014–19 (weekly)	0.37	0.25	0.64	0.45	0.64
2014–19 (monthly)	0.49	0.25	0.67	0.34	0.54
2009–14 (daily)	0.54	–	0.77	0.50	0.78
2009–14 (weekly)	0.45	–	0.69	0.40	0.66
2009–14 (monthly)	0.34	–	0.56	0.28	0.72
2-year					
2017–19 (daily)	0.45	0.17	0.49	0.51	0.64
2017–19 (weekly)	0.41	0.24	0.42	0.38	0.36

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

4.3 The Commission’s approach is to estimate betas over two consecutive 5-year periods. In line with this approach, we have estimated the betas for additional comparators for the 2009–14 and 2014–19 periods. The asset beta range based on the total sample estimated over different frequencies[54] is between 0.46 and 0.57.

4.4 As telecoms is a fast-paced industry with frequent technological advancements (and given that the comparator sample is smaller over the 2009–14 period), we have assigned more weight to the asset betas estimated over the recent 5-year and 2-year periods by taking an average of all the asset betas estimated over the three periods (2009–14, 2014–19, 2017–19) to provide an asset beta estimate of 0.52.

4.5 The comparator sample consists of well-diversified companies that own and operate differing combinations of copper, fibre, mobile, and other telecoms assets, which was also recognised by CEPA.[55]

4.6 Given that a proportion of these comparator companies consist of lower-risk businesses (i.e. copper), the asset beta for a stand-alone FFLAS is likely to lie above the 0.52 midpoint of the asset beta range estimated from the comparator sample.

4B Credit rating

4.7 The listed comparators identified based on our filtering criteria have credit ratings ranging from CCC to AA-, based on Standard and Poor's (S&P) ratings. The average credit rating is BBB (see Table 4.3 below).

[54] We estimate daily, weekly and monthly betas for the 5-year sample and daily and weekly betas for the 2-year sample.
[55] CEPA (2019), 'Cost of capital for regulated fibre telecommunication services in New Zealand: Asset beta, leverage, and credit rating', p. 22.

Table 4.3 Credit rating frequencies

	Total number of comparators
AA-	1
A+	1
A	2
A-	2
BBB+	5
BBB	6
BBB-	2
BB+	3
BB	3
BB-	2
B+	1
B	3
Total	**31**

Note: The credit ratings come from Standard & Poor's. 18 companies did not have a rating available.

Source: Oxera analysis based on data from Bloomberg.

4.8 The Oxera (2014) report for the Commission recommended a credit rating of BBB+/A- and a notional gearing of 40% for copper access services based on comparator analysis and regulatory precedent.[56]

4.9 Given that a stand-alone FFLAS provider will have greater risk exposure than a copper provider, a target credit rating of BBB and a target gearing of 30% (see section 4C below) consistent with the comparator sample seems appropriate. This rating is also in line with recent regulatory precedent—for instance, Ofcom targets a BBB credit rating for BT in the UK.

4C Gearing

4.10 Gearing is estimated as net debt to enterprise value. In line with CEPA's analysis, where companies have negative net debt, gearing is assumed to be zero. The average gearing of the comparator sample is around 30% (see Table 4.4 below).

4.11 An assumed notional gearing of 30% for a stand-alone FFLAS provider is consistent with the comparator sample and the higher risk of fibre relative to copper.

4.12 Chorus had gearing of 53% in 2018 and a credit rating of BBB. As Chorus's business is more diversified than a stand-alone FFLAS provider and also contains a mature copper network, it would be expected to have higher debt

[56] Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', June, p. 3.

capacity than a stand-alone FFLAS provider. It is therefore not appropriate to place additional weight on the Chorus gearing (apart from including it in the comparator sample) to inform the estimate of the notional gearing for a stand-alone FFLAS provider.

Table 4.4 Gearing

	Total comparator sample
Average gearing	33%

Note: Average gearing is estimated based on data as at 31 December 2018.

Source: Oxera analysis based on data from Bloomberg.

A1 Appendix

A1.1 Table A1.1 shows the asset betas of our final comparator sample of 49 companies based on our filtering criteria. Table A1.2 to Table A1.4 show the comparator companies that were excluded based on the liquidity, percentage of revenues outside core geography, and financial distress (gearing) criteria.

Table A1.1 Comparator sample

	5 year			2 year	
	2014–19 (daily)	2014–19 (weekly)	2014–19 (monthly)	2014–19 (daily)	2014–19 (weekly)
American Tower Corporation	0.48	0.45	0.41	0.30	0.26
Crown Castle	0.40	0.38	0.25	0.30	0.32
INWIT	–	–	–	0.49	0.57
Rai Way	–	–	–	0.57	0.65
SBAC	0.51	0.51	0.40	0.31	0.34
AT&T	0.41	0.41	0.33	0.42	0.45
BT Group	0.65	0.52	0.38	0.46	0.27
CenturyLink	0.41	0.45	0.40	0.37	0.37
Cincinnati Bell	0.42	0.51	0.53	0.39	0.55
Cogent Communications Holdings	0.70	0.77	0.77	0.67	0.71
Consolidated Communications Holdings	0.40	0.44	0.38	0.36	0.42
DNAOyj	–	–	–	0.58	0.44
ElisaOyj	0.65	0.58	0.40	0.56	0.39
Hellenic Telecommunications Organisation	0.70	0.65	0.58	0.71	0.77
Iliad	0.64	0.57	0.38	0.61	0.51
Koninklijke KPN	0.53	0.47	0.43	0.48	0.44
MasmovilIbercom	0.23	0.31	0.48	0.52	0.31
MNF Group	0.40	0.59	0.50	0.11	0.54
Orange	0.55	0.50	0.43	0.39	0.35
Proximus	0.61	0.58	0.46	0.55	0.32
QSC	0.54	0.66	0.63	0.43	0.59
Retelit	0.63	0.88	1.05	0.94	1.28
Shenandoa Telecommunications Company	0.77	0.68	0.44	0.62	0.51
Spark	1.06	0.93	0.73	0.83	0.68
Sprint Corporation	0.54	0.49	0.30	0.46	0.30
Sunrise	–	–	–	0.43	0.33
Swiss Com	0.50	0.45	0.44	0.54	0.41
TalkTalk	0.50	0.53	0.49	0.38	0.27
TDC	0.25	0.29	0.31	0.08	0.02
Tele2	0.67	0.60	0.54	0.63	0.52
Telecom Italia	0.37	0.36	0.41	0.33	0.40
Telefonica Deutschland Holdings	0.56	0.62	0.58	0.42	0.35
Telekom Austria	0.24	0.24	0.32	0.28	0.30
Telephone and Data Systems	0.66	0.75	0.68	0.53	0.55
Telia Company	0.57	0.49	0.40	0.45	0.38

Telstra	0.53	0.49	0.56	0.45	0.40
T-Mobile US	0.56	0.52	0.35	0.56	0.51
TPG Telecom	0.72	0.65	0.58	0.69	0.76
TrilogyInternational Partners	–	–	–	0.25	0.45
US Cellular Corporation	0.63	0.72	0.63	0.54	0.45
Verizon Communications	0.38	0.36	0.27	0.31	0.26
Vocus	0.70	0.66	0.32	0.86	0.73
Vodafone	0.68	0.67	0.64	0.68	0.64
ZayoGroup Holdings	–	–	–	0.46	0.52
StarHubLtd*	0.45	0.37	0.49	0.45	0.41
HKBNLtd*	0.21	0.25	0.25	0.17	0.24
Singapore Telecommunications*L	0.72	0.64	0.67	0.49	0.42
Nippon Telegraph & Telephone C*	0.55	0.45	0.34	0.51	0.38
KDDI Corp*	0.75	0.64	0.54	0.64	0.36

Note: * Indicates the additional comparators from Singapore, Hong Kong and Japan.

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

Table A1.2 Liquidity filter, excluding companies

	5 year			2 year	
	2014–19 (daily)	2014–19 (weekly)	2014–19 (monthly)	2014–19 (daily)	2014–19 (weekly)
Gamma	–	–	–	0.35	0.50
Go	0.72	0.57	0.63	0.67	0.53
Hutchison Telecommunications	0.15	0.06	0.36	0.13	-0.05
KCOM Group	0.30	0.33	0.05	0.35	0.30
Manx Telecom	0.19	0.20	0.28	0.19	0.37
Siminn	0.46	0.38	0.23	0.56	0.58
Sonaecom	0.37	0.49	0.54	0.15	0.25

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

Table A1.3 Proportion of revenues filter, excluding companies

	5 year			2 year	
	2014–19 (daily)	2014–19 (weekly)	2014–19 (monthly)	2014–19 (daily)	2014–19 (weekly)
Deutsche Telekom	0.45	0.49	0.50	0.30	0.30
Telefónica	0.52	0.51	0.51	0.47	0.47
Telenor	0.64	0.62	0.49	0.54	0.41
Orange Belgium	0.41	0.43	0.31	0.38	0.24
Eutelsat	0.32	0.33	0.35	0.27	0.24
SES	0.40	0.38	0.37	0.30	0.26

Note: Deutsche Telekom, Telefónica, and Telenor are excluded on the basis that more than 50% of the revenues are generated abroad. Orange Belgium is excluded as the parent company (Orange) is already in the sample. Eutelsat and SES are excluded as the majority of revenues come from satellite.

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

Table A1.4 Gearing filter, excluding companies

	5 year			2 year	
	2014–19 (daily)	2014–19 (weekly)	2014–19 (monthly)	2014–19 (daily)	2014–19 (weekly)
Frontier Communications Corporation	0.29	0.40	0.44	0.08	0.13

Source: Oxera analysis based on CEPA (2019) and Bloomberg data.

www.oxera.com