Second review of submissions on the WACC for UCLL/UBA

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1   Introduction

Following the publication of the Commission's draft decision[1] and Oxera's review report of the expert submissions on the WACC for UCLL and UBA,[2] the Commission received a second round of submissions and cross-submissions from stakeholders. These submissions presented updated analysis and raised questions regarding the appropriateness of Oxera's methodology in estimating the beta for the provision of UCLL and UBA services in New Zealand. Oxera has reviewed these submissions and the concerns raised by the various experts. The submissions provide opinions on the updated and alternative evidence that Oxera could have considered in determining the range that should be interpreted from the international comparator sample.

The key issues raised by the submissions were:

- asset betas for fixed-line telecommunications services measured over the last five years have been depressed due to the effects of the global financial crisis and the European sovereign debt crisis, and asset betas for global telecommunications companies have recently risen (discussed in section 2);

- the asset beta estimate advocated by the Commission is out of line with other international regulatory decisions for fixed-line telecommunications business (discussed in section 3);

- the target credit rating should be BBB– (discussed in section 4).

A common concern in the responses was the potential impact of the global financial crisis on asset betas for telecommunications companies and the possibility that betas for telecommunications companies might have been unduly influenced over the period of the analysis. They also suggest that, more recently, beta values have risen in line with long-term average beta values from comparator companies.

Oxera has updated its analysis and, in this regard, is not persuaded to change its approach on the appropriate time period to consider for the analysis. It has previously been recognised by some stakeholders that Oxera's approach to focusing on the more recent data from comparators is appropriate in light of the relatively limited comparator sample in initial years and the various global capital market events affecting the quality of the data.[3]

Furthermore, while comparator analysis presents a valuable cross-check to Chorus's beta analysis, none of the responses provide evidence to suggest why it may present a superior alternative.

The remainder of this report addresses these issues in more detail.

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[1] Commerce Commission New Zealand (2014), 'Cost of Capital for the UCLL and UBA pricing reviews – draft decision', 2 December.

[2] Oxera (2014), 'Review of expert submissions on the WACC for UCLL/UBA services', 4 November.

[3] Network Strategies (2014), 'Expert reports on WACC for UCLL and UBA FPP', 21 July, p. 23; PwC (2014), 'Submission on Commerce Commission's Expert's paper: Review of the beta and gearing for UCLL and UBA services', 21 July, para. 26.

2 Time period of analysis: impact of global financial crisis and European sovereign debt crisis

2.1 Recap and summary of conclusions

Oxera's initial report, published in June 2014, recommended a range of 0.30–0.45 for the asset beta to be used for UCLL and UBA services in New Zealand. This was primarily based on the market data available for Chorus (for which data was available from November 2011).[4] The range was also supported by the average two- and five-year betas of the refined international comparator set for the most recent estimation window ending in April 2014.

The majority of the submissions in response to Oxera's initial report agreed with our approach on the history of data to consider for the beta analysis, with the exception of Dr Hird (CEG), who argued that asset betas be estimated based on 20 years of data going back to 1994.

Oxera's response report[5] highlighted several valid reasons for excluding the older periods of the analysis in estimating the beta from the comparator sample and using Chorus's market estimate as a focal point for the analysis. While there were arguments for and against adopting a longer-term dataset, on balance, Oxera continued to consider the more recent data to be more appropriate in setting a beta to be effective from 2014.

In the second round of stakeholder submissions (summarised in section 2.3) CEG and L1 Capital produced evidence to suggest that the most recent estimation period might have been affected by the European sovereign debt crisis, and that in the months since our initial analysis, betas for telecommunications companies had increased.

In responding to the arguments presented by the submissions in this report, Oxera has updated its earlier analysis for Chorus and the international comparator set. While Oxera is not persuaded to revise its methodology, our analysis indicates that the daily and weekly beta values for Chorus have diverged (0.30 and 0.49, respectively) with the possibility of the weekly statistic being less reliable. However, given the mixed evidence from the Chorus beta estimates, and an indication that the betas for the international comparator set have increased marginally, Oxera is minded to widen its range to 0.30–0.50.

The rest of the section expands on Oxera's updated analysis and responses to the submissions.

2.2 Updates to the analysis

Oxera has updated its asset beta analysis for Chorus and the comparator set since the first report (which considered evidence until 10 April 2014), and the new cut-off date is 16 March 2015.

Evidence on Chorus beta

As a first step to updating the asset beta analysis, Oxera observed the developments in Chorus's share price and asset beta since April 2014. Figures 2.1 and 2.2 below chart the movements in the share price and two-year daily equity beta and gearing for Chorus.

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[4] Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', 23 June.
[5] Oxera (2014), 'Review of expert submissions on the WACC for UCLL/UBA services', 4 November.

Figure 2.1   Chorus share price
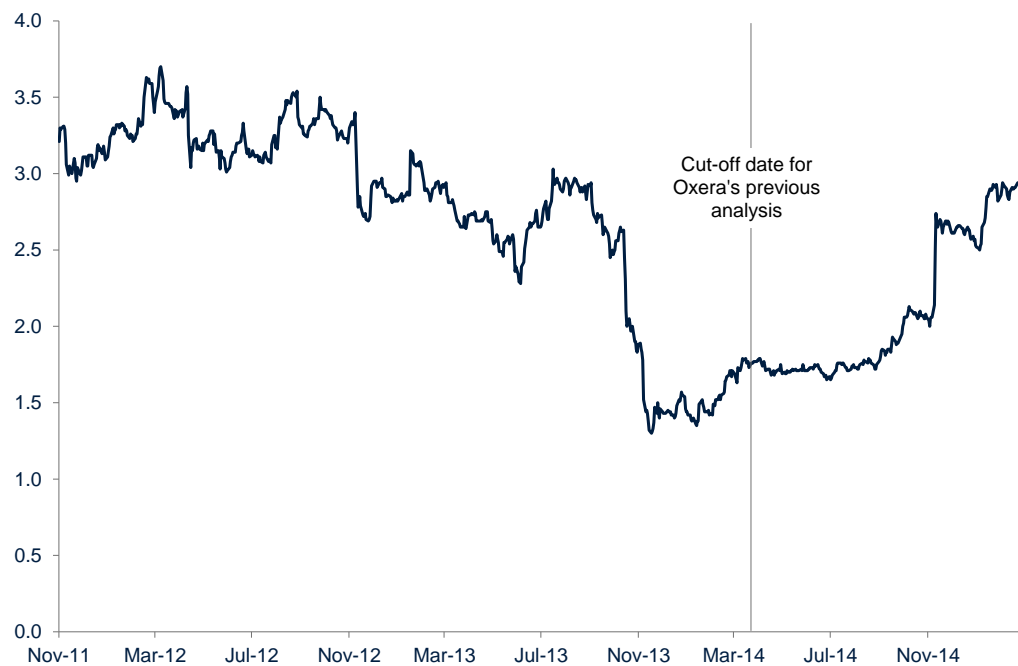
Source: Oxera analysis based on Datastream. The cut-off date for the analysis is 16 March 2015.

Figure 2.2   Two-year daily equity beta and gearing for Chorus
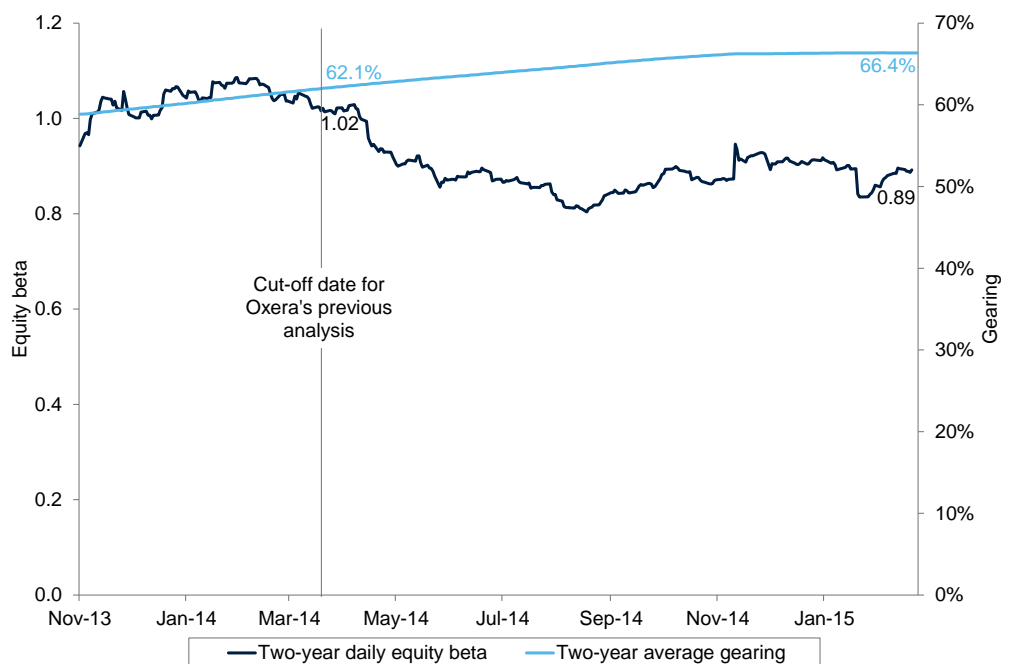
Source: Oxera analysis based on Datastream and Bloomberg. The cut-off date for the analysis is 16 March 2015.

As illustrated above, in the 11 months since Oxera last conducted its analysis, Chorus's share price has recovered. Chorus's two-year equity beta has declined from 1.02 to 0.89, while the two-year average gearing level has increased marginally.

As a result, the two-year daily asset beta for Chorus has declined from 0.39 in April 2014 to 0.30 in March 2015, as shown in Figure 2.3.

Figure 2.3   Two-year asset beta for Chorus
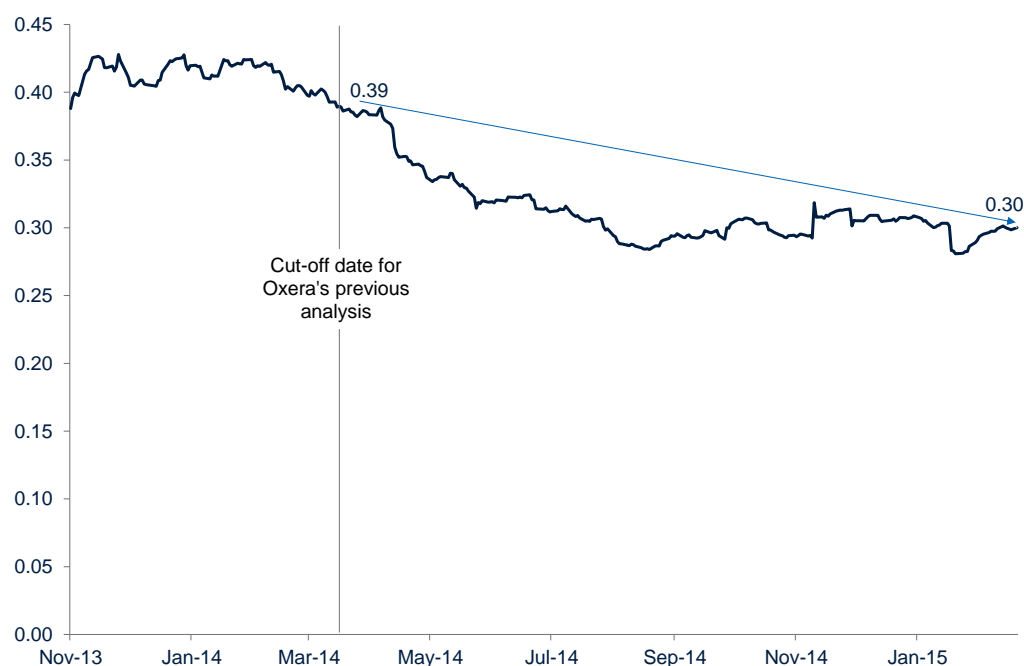
Source: Oxera analysis based on Datastream and Bloomberg. The cut-off date for the analysis is 16 March 2015.

Oxera has also updated the two-year weekly asset beta estimates for Chorus. Our previous daily and weekly analysis of the Chorus beta yielded broadly consistent results (0.39 and 0.38, respectively). However, our more recent updates indicate that the results have diverged considerably.

In contrast to the decline in daily beta estimates, the weekly asset beta for Chorus exhibits an increase from 0.38 in April 2014 to 0.49 in March 2015. This divergence in asset beta estimates over the same time period, but different estimation frequencies, is unusual. This merits further investigation and Oxera has undertaken statistical analysis to better understand the data.

Oxera has applied the same gearing value to the daily and weekly estimates of Chorus's equity beta to obtain the asset beta, and the discrepancy between the two estimates mainly stems from the equity as analysed below.

As mentioned in Oxera's original report on betas, there have been periods of sharp one-off changes in the Chorus share price. Moreover, the largest of the falls in the share price are likely to have been related not to general market conditions but to the sensitivity of Chorus's equity value to certain critical regulatory decisions in respect of its copper business.[6] In evaluating the effect of these one-off movements, Oxera has considered alternative formulations of the ordinary least squares (OLS) methodology that might provide an alternative basis for beta estimation and might limit the potentially distortive effects of such movements. Oxera has adjusted Chorus's daily and weekly beta estimates for volatility (see Appendix 3 for further details) to check whether the betas obtained from the standard OLS methodology are robust.

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[6] See Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', 23 June, section 3.

Figure 2.4 illustrates the two-year daily and weekly OLS and volatility-adjusted equity betas for Chorus.

Figure 2.4   Two-year daily and weekly equity betas for Chorus
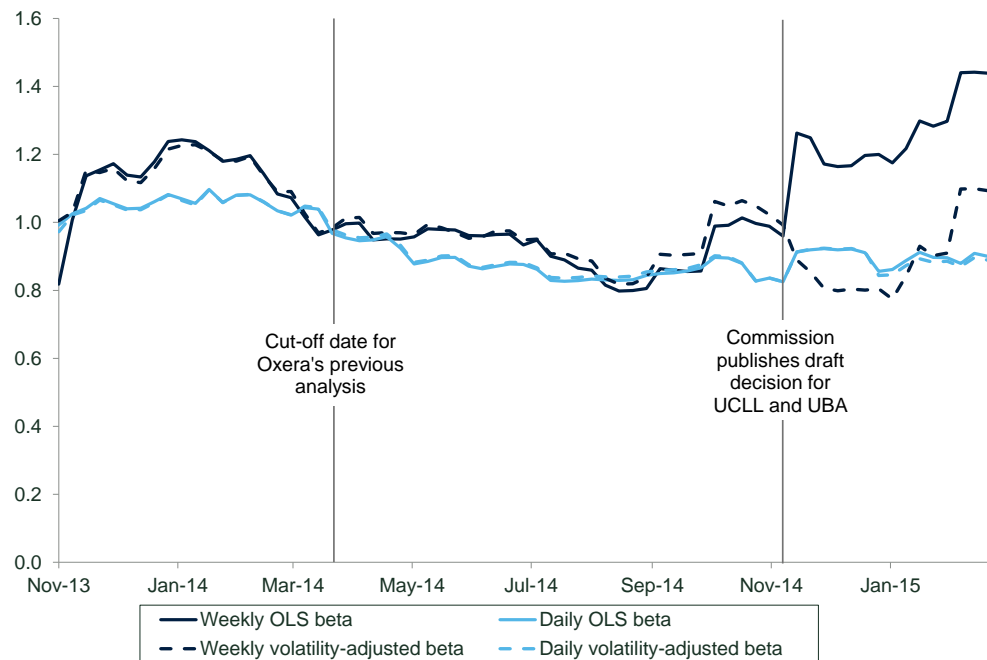
Source: Oxera analysis based on Datastream and STATA programming. The cut-off date for the analysis is 16 March 2015.

The figure above shows that the two-year daily equity betas based on both methodologies are consistent for the entire time period of the analysis. With regard to the two-year weekly estimates, the OLS and the volatility-adjusted betas were broadly consistent up until 2 December 2014—i.e. the date on which the Commission published its draft determination. More importantly, until this date, the daily and weekly beta estimates for Chorus were also relatively consistent in terms of value and trends.

Following the publication of the draft determination, the reactions of Chorus's stock price appear to have led the weekly equity beta estimate to be unusually volatile and to diverge significantly from the daily beta and volatility-adjusted weekly beta. While Chorus's stock price has exhibited large one-off changes to the Commission's publications in the past, these have not appeared to materially alter the beta calculations.

Figure 2.5 below charts the two-year weekly OLS and volatility-adjusted asset betas for Chorus. It shows that adjusting for volatility leads to a significantly lower estimate of 0.37 for the beta for Chorus.

Figure 2.5   Two-year weekly asset betas for Chorus
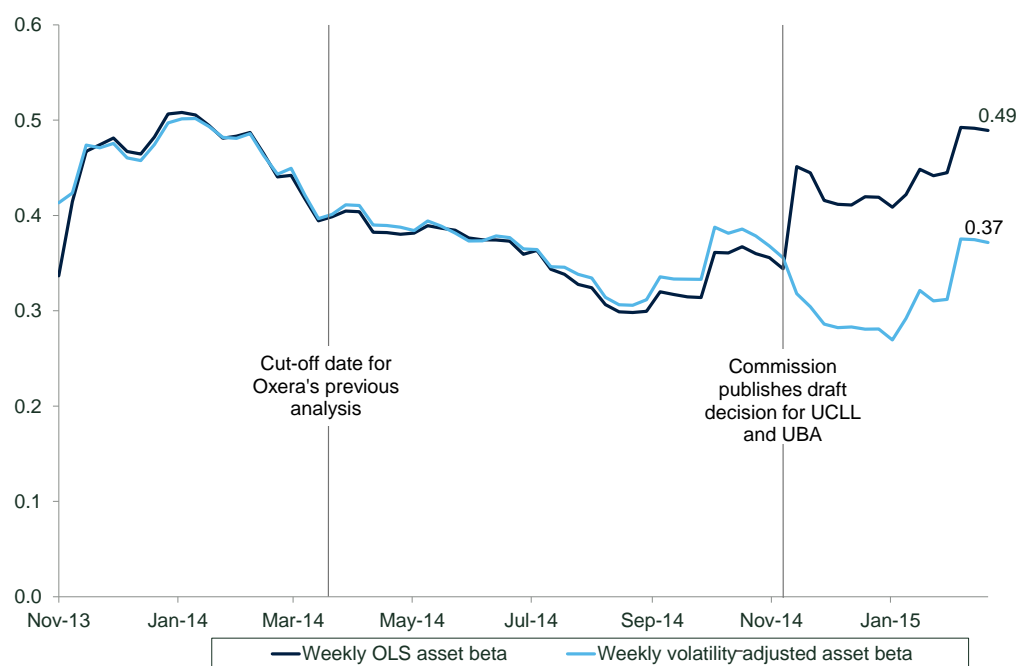
Source: Oxera analysis based on Datastream and STATA programming. The cut-off date for the analysis is 16 March 2015.

While Oxera does not suggest that the OLS weekly beta estimates are wrong, given the high volatility of the estimates, leading to divergent trends with respect to daily and volatility-adjusted betas, these values need to be interpreted with caution.

Overall, there is a marked decline in the daily asset beta for Chorus, which is offset by an equally significant increase in its weekly asset beta (although the weekly data appears to be less reliable). Although Oxera's preferred approach is to focus primarily on daily beta estimates, it would not be prudent to entirely ignore the evidence from the two-year weekly betas, and a minor revision in the upper bound of the range may be warranted.

Evidence on betas for comparator companies

In order to update the comparator analysis, Oxera conducted a validity check on all of the comparators to ensure that they were still suitable.[7] As a result of market developments since 10 April 2014, Portugal Telecom has undergone a significant financial restructuring and experienced a period of dramatic stock price decline. In light of this, we have elected to remove PT from our comparator set on the basis that these events may give rise to unreliable recent beta estimates (see Appendix 4 for details).[8]

Tables 2.1 and 2.2 below present updates to the five- and two-year asset beta calculations, respectively. As before, these results assume the debt beta to be zero.

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[7] Network Strategies raised a point regarding the exclusion of Deutsche Telekom from the refined comparator sample. This point was previously addressed in Oxera's November 2014 report and no new arguments have been raised.
[8] The comparator beta results are not very sensitive to the exclusion of Portugal Telecom.

Table 2.1   Five-year asset beta calculations (assuming a zero debt beta), 1994–2015

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.63	0.70	0.70	0.43	**0.45**	0.60	0.63	0.67	0.41	**0.46**	0.66	0.68	0.66	0.39	**0.43**
Belgacom			0.46	0.42	**0.46**			0.36	0.44	**0.51**			0.45	0.35	**0.52**
BT Group	1.09	0.98	0.56	0.61	**0.70**	0.91	0.82	0.48	0.64	**0.70**	0.82	1.15	0.53	0.58	**0.69**
CenturyLink	0.43	0.50	0.46	0.37	**0.36**	0.56	0.50	0.43	0.37	**0.38**	0.67	0.49	0.35	0.42	**0.42**
Chorus															
Cincinnati Bell	0.40	0.72	0.37	0.26	**0.28**	0.58	0.76	0.40	0.28	**0.28**	1.04	1.00	0.52	0.33	**0.33**
Cogent Communications			*0.90*	*1.01*	***0.95***			*1.12*	*1.08*	***0.96***			*1.14*	*1.17*	***1.24***
Colt Group			*0.78*	*0.80*	***0.76***			*0.73*	*0.87*	***0.82***			*0.98*	*1.05*	***0.92***
Deutsche Telekom		0.85	0.29	0.22	**0.28**		0.45	0.27	0.21	**0.30**		0.41	0.24	0.19	**0.38**
Elisa			0.52	0.39	**0.42**			0.49	0.44	**0.48**			0.65	0.37	**0.45**
FairPoint Communications															
Frontier Communications	0.17	0.33	0.44	0.29	**0.32**	0.16	0.34	0.52	0.32	**0.38**	0.15	0.78	0.56	0.30	**0.39**
Hawaiian Telecom															
Hellenic Telecommunications Org.			0.61	0.45	**0.54**			0.57	0.51	**0.58**			0.55	0.57	**0.68**
Iliad			0.65	0.35	**0.39**			0.85	0.34	**0.32**			1.26	0.46	**0.59**
Koninklijke KPN		0.62	0.37	0.25	**0.31**		0.52	0.37	0.26	**0.35**		0.65	0.45	0.13	**0.24**
Lumos Networks															
Orange		0.67	0.35	0.38	**0.42**		0.55	0.32	0.37	**0.42**		0.73	0.26	0.34	**0.44**

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom		1.45	0.66	0.45	**0.56**		1.34	0.63	0.49	**0.71**		1.27	0.51	0.35	**0.66**
Swisscom		0.43	0.46	0.34	**0.36**		0.29	0.49	0.33	**0.34**		0.13	0.50	0.34	**0.38**
TDC			0.13	0.23	**0.29**			0.23	0.22	**0.31**			0.25	0.21	**0.26**
Telecom Corporation of New Zealand			*0.94*	*1.13*	***1.21***			*0.82*	*0.83*	***1.04***			*0.64*	*0.71*	***0.89***
Telecom Italia		0.37	0.37	0.22	0.22		0.37	0.38	0.21	**0.23**		0.51	0.37	0.13	**0.19**
Telefónica	*0.80*	*0.99*	*0.52*	*0.48*	***0.48***	*0.80*	*1.01*	*0.53*	*0.46*	***0.46***	*0.76*	*1.06*	*0.44*	*0.43*	***0.46***
Telekom Austria			0.50	0.33	**0.27**			0.49	0.37	**0.30**			0.38	0.22	**0.22**
Telenor			*0.56*	*0.65*	***0.61***			*0.46*	*0.66*	***0.66***			*0.54*	*0.70*	***0.54***
TeliaSonera			*0.68*	*0.55*	***0.56***			*0.66*	*0.55*	***0.55***			*0.73*	*0.46*	***0.44***
Telstra		0.72	0.36	0.34	**0.43**		0.51	0.35	0.23	**0.37**		0.64	0.36	0.12	**0.48**
TW Telecom			*0.68*	*0.81*	***0.75***			*0.95*	*0.80*	***0.71***			*0.90*	*1.05*	***0.87***
Verizon Communications	0.51	0.57	0.59	0.38	**0.41**	0.57	0.41	0.62	0.32	**0.41**	0.53	0.41	0.61	0.40	**0.51**
Windstream Holdings				0.30	**0.31**				0.35	**0.35**				0.31	**0.27**
Average (all comparators)	0.58	0.71	0.54	0.46	0.48	0.60	0.61	0.55	0.46	0.50	0.66	0.71	0.57	0.45	0.51
Average (refined comparators)	0.54	0.69	0.47	0.35	**0.39**	0.56	0.58	0.47	0.36	**0.41**	0.65	0.68	0.50	0.33	**0.43**
Average (refined comparators excluding Portugal Telecom)					**0.38**					**0.39**					**0.41**

Note: Italics indicate firms that are excluded from the refined comparator set. The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand but for consistency purposes Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

Table 2.2   Two-year asset beta calculations (assuming a zero debt beta), 1994–2015

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.59	0.91	0.67	0.50	**0.45**	0.55	0.94	0.63	0.51	**0.43**
Belgacom			0.41	0.52	**0.51**			0.36	0.47	**0.59**
BT Group	1.03	0.76	0.54	0.74	**0.74**	0.95	0.70	0.45	0.66	**0.80**
CenturyLink	0.39	0.51	0.44	0.34	**0.36**	0.58	0.54	0.41	0.35	**0.46**
Chorus				0.39	**0.30**				0.38	**0.49**
Cincinnati Bell	0.39	0.45	0.34	0.23	**0.30**	0.56	0.47	0.38	0.32	**0.36**
Cogent Communications		*0.00*	*1.15*	*0.96*	*0.86*		*0.13*	*1.28*	*0.87*	*0.74*
Colt Group			*0.71*	*0.69*	*0.83*			*0.66*	*0.58*	*1.01*
Deutsche Telekom		0.74	0.29	0.30	**0.48**		0.36	0.26	0.31	**0.55**
Elisa		0.39	0.48	0.38	**0.50**		0.43	0.43	0.47	**0.69**
FairPoint Communications				0.26	**0.36**				0.17	**0.33**
Frontier Communications	0.19	0.38	0.42	0.26	**0.36**	0.14	0.42	0.50	0.36	**0.57**
Hawaiian Telecom				0.36	**0.38**				0.28	**0.33**
Hellenic Telecommunications Org.		0.88	0.54	0.69	**0.79**		0.91	0.49	0.75	**0.72**
Iliad			0.49	0.38	**0.57**			0.70	0.11	**0.31**
Koninklijke KPN		0.44	0.34	0.35	**0.50**		0.35	0.34	0.45	**0.45**
Lumos Networks				*0.48*	*0.56*				*0.28*	*0.72*
Orange		0.52	0.34	0.44	**0.52**		0.36	0.30	0.45	**0.52**

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom	1.16	1.22	0.54	0.33	**0.70**	1.06	1.26	0.54	0.38	**0.89**
Swisscom		0.32	0.38	0.42	**0.35**		0.32	0.40	0.45	**0.35**
TDC		0.64	0.07	0.30	**0.32**		0.69	0.15	0.34	**0.35**
Telecom Corporation of New Zealand			*0.89*	*1.27*	*1.11*			*0.76*	*0.94*	*1.02*
Telecom Italia		0.28	0.31	0.23	**0.24**		0.25	0.33	0.26	**0.27**
Telefónica	*0.83*	*0.86*	*0.49*	*0.47*	*0.47*	*0.82*	*0.90*	*0.49*	*0.47*	*0.50*
Telekom Austria		0.54	0.47	0.33	**0.22**		0.36	0.48	0.47	**0.32**
Telenor		*0.80*	*0.51*	*0.63*	*0.74*		*0.63*	*0.42*	*0.63*	*0.76*
TeliaSonera		*0.98*	*0.60*	*0.54*	*0.60*		*0.64*	*0.59*	*0.56*	*0.63*
Telstra		0.56	0.33	0.48	**0.59**		0.29	0.34	0.50	**0.57**
TW Telecom		*0.33*	*0.82*	*0.61*	*0.61*		*0.34*	*1.17*	*0.58*	*0.65*
Verizon Communications	0.47	0.72	0.60	0.47	**0.47**	0.46	0.55	0.62	0.54	**0.52**
Windstream Holdings			0.45	0.29	**0.27**			0.46	0.44	**0.40**
Average (all comparators)	0.63	0.60	0.50	0.47	0.52	0.64	0.54	0.52	0.46	0.56
Average (refined comparators)	0.60	0.60	0.42	0.39	**0.45**	0.61	0.54	0.43	0.41	**0.49**
Average (refined comparators excluding Portugal Telecom)					**0.44**					**0.47**

Note: Italics indicate firms that are excluded from the refined comparator set. The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand but for consistency purposes Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

The updated estimates of five- and two-year daily asset betas for the refined comparator set (excluding Portugal Telecom) presented above indicate a range of 0.38–0.47. The upper bound of the range is primarily dominated by the two-year weekly beta estimates. The remaining four beta estimates for the comparators—i.e. all the frequencies for the five-year estimates and the two-year daily beta estimates—lie within the 0.30–0.45 range for asset betas proposed in Oxera's initial report.[9] However, Oxera notes that the average for the refined comparator set has increased for all time-periods and frequencies since April 2014.

Table 2.3 below presents average two and five-year beta values for all and refined comparators on an annual basis and Figure 2.6 represents the data for the refined comparator set graphically.

Table 2.3   Average asset beta values for the comparator set (1999–2015)

Year	Refined comparators					All comparators				
	Five-year asset betas			Two-year asset betas		Five-year asset betas			Two-year asset betas	
	Daily	Weekly	Monthly	Daily	Weekly	Daily	Weekly	Monthly	Daily	Weekly
1999	**0.54**	**0.56**	**0.65**	**0.60**	**0.61**	*0.57*	*0.59*	*0.66*	*0.63*	*0.64*
2000	0.62	0.69	0.72	0.79	0.85	*0.65*	*0.72*	*0.75*	*0.80*	*0.86*
2001	0.72	0.71	0.74	0.88	0.83	*0.75*	*0.75*	*0.76*	*0.91*	*0.87*
2002	0.69	0.62	0.64	0.71	0.53	*0.72*	*0.65*	*0.67*	*0.78*	*0.61*
2003	0.70	0.61	0.72	0.58	0.46	*0.72*	*0.63*	*0.74*	*0.61*	*0.48*
2004	**0.69**	**0.58**	**0.68**	**0.60**	**0.54**	*0.71*	*0.61*	*0.71*	*0.60*	*0.54*
2005	0.64	0.53	0.62	0.57	0.53	*0.67*	*0.57*	*0.68*	*0.58*	*0.57*
2006	0.61	0.50	0.58	0.59	0.58	*0.63*	*0.53*	*0.61*	*0.59*	*0.61*
2007	0.59	0.54	0.60	0.55	0.53	*0.62*	*0.59*	*0.67*	*0.61*	*0.62*
2008	0.49	0.50	0.46	0.48	0.51	*0.55*	*0.59*	*0.63*	*0.57*	*0.62*
2009	**0.47**	**0.47**	**0.50**	**0.42**	**0.43**	*0.54*	*0.55*	*0.57*	*0.50*	*0.52*
2010	0.42	0.43	0.43	0.36	0.36	*0.51*	*0.52*	*0.52*	*0.45*	*0.45*
2011	0.41	0.41	0.41	0.32	0.33	*0.50*	*0.51*	*0.51*	*0.45*	*0.45*
2012	0.38	0.38	0.37	0.36	0.36	*0.48*	*0.48*	*0.48*	*0.46*	*0.46*
2013	0.36	0.36	0.37	0.35	0.33	*0.47*	*0.46*	*0.47*	*0.44*	*0.42*
2014	**0.35**	**0.36**	**0.33**	**0.39**	**0.41**	*0.46*	*0.46*	*0.45*	*0.47*	*0.46*
2015*	**0.38**	**0.39**	**0.41**	**0.44**	**0.47**	*0.48*	*0.50*	*0.51*	*0.52*	*0.56*

Note: *Excludes Portugal Telecom. The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

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[9] See Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', 23 June, section 3.

Figure 2.6   Average asset beta values for the refined comparator set (1999–2015)
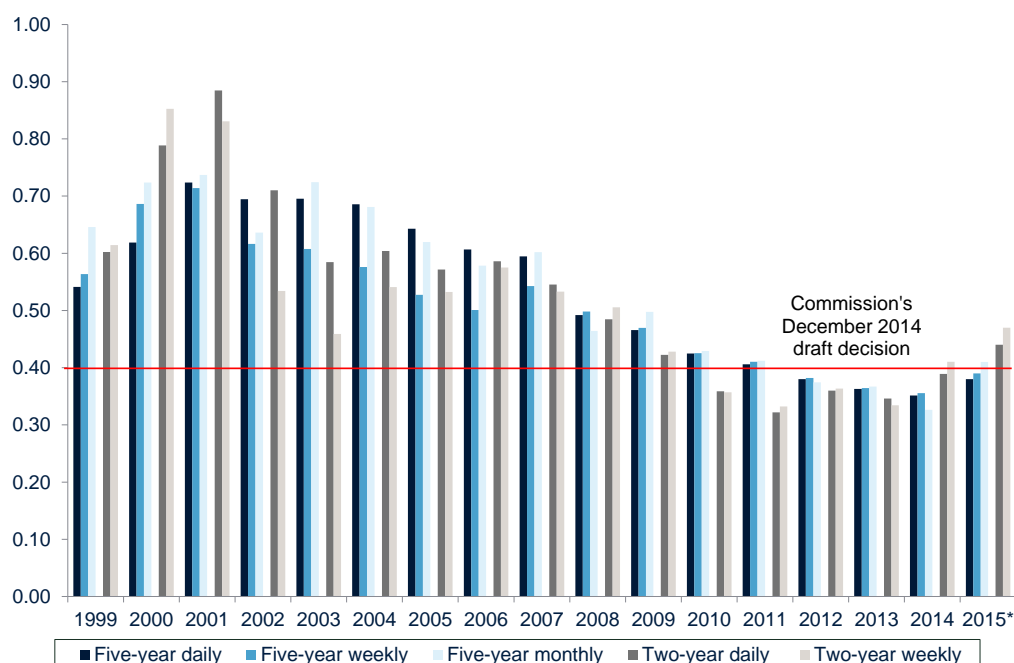
Note: *Excludes Portugal Telecom. The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

2.3   Summary of submissions

A key issue raised in the submissions concerns the appropriate time period of the analysis and the impact of the crises on asset betas for telecommunications companies. In its submission, CEG, on behalf of Chorus, argues for the asset betas to be estimated using data from a 21-year period, 1994–2015. It relies on new evidence, which, it asserts, demonstrates that the betas in the telecommunications sector are distorted by movements in the financial sector and that telecommunications asset betas are now higher than those witnessed during the crisis period. It states:

> The empirical evidence presented in this report shows that asset betas for fixed line telecommunications businesses have not remained at the historically lower levels experienced during the global financial crisis and subsequent European sovereign debt crisis. This period of crisis, which substantially overlaps with the five year period relied upon by the Commission, cannot be considered to be representative of future expected economic conditions that will prevail over Chorus' first regulatory period.[10]

It further considers evidence from the relationship between European finance and telecommunications betas to conclude that there exists an inverse relationship between telecoms and finance sector betas. Lastly, it asserts that the sovereign debt crisis in Europe ended in late 2012 based on the spreads on government debt yields between Germany and those countries affected by the sovereign debt crisis, after which asset betas for telecommunications businesses have risen.

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[10] Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February, para. 27.

Chorus's submission largely echoes the points raised by CEG.

L1 Capital's submission, in suggesting that the telecommunications sector has suffered from a flight to quality effect, contends the following:

> L1 would contend that the 2009-2014 has in every way been as exceptional as the preceding 14 year period considered by Oxera. The Global Financial crises ushered in an extraordinary period of near zero interest rates, extreme liquidity and a chase for global yield as returns on fixed income assets compressed returns. As large, liquid telecommunication companies offering higher than average dividends and predictable revenues, the equities in the Oxera comparator set benefited from a reduction in the required rate of return as investors sought fixed income proxies.[11]

However, L1 Capital does not provide any evidence of telecommunications companies offering higher-than-average dividends or more predictable revenues.

Lastly, Network Strategies' submission considered the Commission's approach of using average asset betas for the five years to 2009 and to 2014 and stated the following:

> In our view the results from the earlier period 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.[12]

Network Strategies' view effectively suggests that the Commission should consider average asset betas only over the most recent five-year period.

2.4 Oxera's analysis of submissions

Among the new analysis presented by CEG, and in contrast to the trend in asset betas for Chorus, is evidence pertaining to a rise in comparator asset beta values in recent months based on six-monthly betas.[13]

CEG's approach to estimating betas in this regard contradicts its reasoning elsewhere, which argues for consistency with the Commission's Input Methodologies. It considers six-monthly daily betas, whereas the Commission has relied on longer-term weekly and monthly betas. Furthermore, as demonstrated in Figures 2.2–2.4 of Oxera's first response report,[14] comparator asset betas are volatile and can change considerably over short periods of time. Oxera considers two- and five-year periods to be more suitable for estimating asset betas.

As noted in Oxera's previous response,[15] there are several valid reasons for excluding the older periods of the analysis in estimating the beta from the comparator sample. Indeed, some of the respondents in the first round of submissions (e.g. Network Strategies and PwC) largely agreed with Oxera's approach.

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[11] L1 Capital (2015), 'Letter to Commerce Commission New Zealand', 20 February, p. 10.
[12] Network Strategies (2015), 'Commerce Commission Draft Determination for UCLL and UBA', 20 February, p. 68.
[13] Figure 1 in Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February.
[14] Oxera (2014), 'Review of expert submission on WACC for UCLL/UBA', 4 November.
[15] Oxera (2014), 'Review of expert submission on WACC for UCLL/UBA', 4 November.

One of the key reasons for omitting the initial periods from the analysis was the size of the comparator sample in the initial years of the analysis. The respondents have not allocated much weight to this consideration.[16]

To reiterate the analysis on the size of the comparator sample previously presented by Oxera, the comparator sample increased by over three times between 1999 and 2009. Between 2009 and 2014, the sample size increased by a further 20%.[17]

The rest of this sub-section addresses the points raised by the respondents in detail.

Relationship between the systematic risk of telecommunications and finance sectors

CEG presented a chart depicting European finance and telecommunications betas to demonstrate an inverse relationship between the betas of the two sectors. At the outset, this argument seems counterintuitive to CEG's support for including the analysis for the periods ending in 1999 and 2004, the periods affected by the 'dot-com bubble'.

CEG argues that:

> …a mathematical truism that flows from the fact that the average beta for the market portfolio is by definition 1. If financial sector betas are heightened, then other betas must on average decline.[18]

While Oxera does not contest the theoretical basis for the general argument put forward by CEG, globally, the relationship between the systematic risk of the telecommunications and finance sectors is not as pronounced as asserted by CEG.

As an example, assuming that the impact of the global financial crisis was at least as pronounced in the USA as in Europe, any relationship observed between the telecommunications and financial sectors in Europe should also be evident in US markets. Figure 2.7 extends CEG's analysis in the European markets[19] to the US market. As evidenced below, the inverse relationship that CEG observed between the telecommunications and financial sectors in Europe does not appear to hold in US markets. While there appears to have been some degree of reversion in telecommunications betas in Europe, although the betas for the US financial sector have decreased (as in Europe), there does not appear to have been a similar and obviously offsetting increase in betas for US telecommunications firms.

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[16] CEG briefly raises this point in its submission, but does not discuss why including time periods where the size of the comparator set is particularly small would enhance the results of the analysis.

[17] Based on valid comparators for the calculation of two-year asset betas.

[18] Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February, para. 32.

[19] See Figure 2 in Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February.

Figure 2.7   US finance vs telecommunications betas
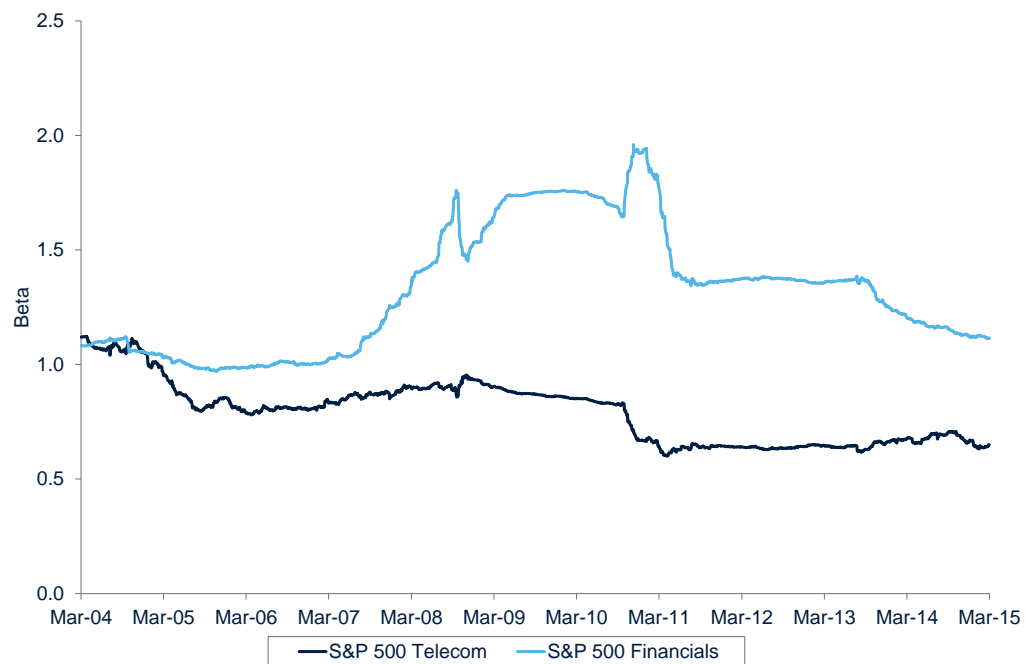
Note: Betas represent two-year daily betas for the representative sector indices calculated against the S&P 500 index. CEG's analysis relied on six-monthly daily betas. Oxera has used two-year daily beta calculations. The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis based on data from Datastream.

Approximately one-third of Oxera's refined comparator set is comprised of US telecommunications companies, and almost half are non-European. Hence, drawing any broad conclusions based on a relationship observed only in European markets would not be advisable.

Given the geographical discrepancy between the results, it appears that the most relevant country to consider for any such analysis would be New Zealand. It might be informative to consider the implications of similar analysis in New Zealand and the potential influence that this has had on the Chorus beta. Figure 2.8 presents the analysis.

Figure 2.8   New Zealand finance vs telecommunications betas
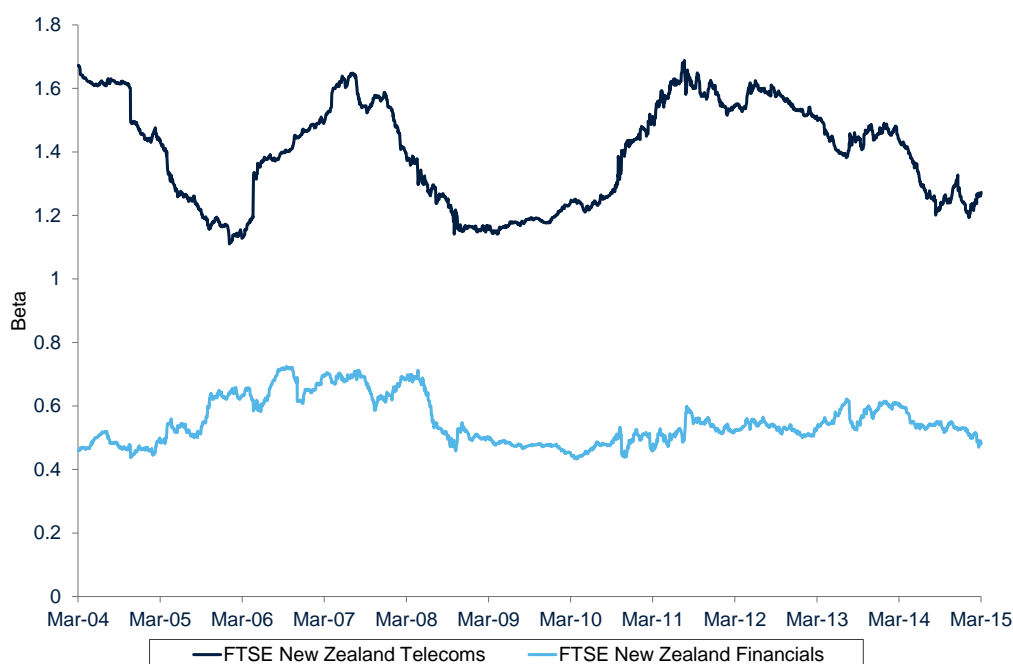
Note: Betas represent two-year daily betas for the representative sector indices calculated against the NZX50 index. CEG's analysis relied on six-monthly daily betas. Oxera has used two-year daily beta calculations. The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis based on data from Datastream.

As shown in Figure 2.8, the impact of the global financial crisis on the New Zealand financial sector has been much less pronounced than in Europe and the USA. More importantly, as in US markets, the relationship observed between betas of finance and telecommunications sectors in Europe is not evident in New Zealand. If anything, there appears to be a direct rather than an inverse relationship between the two sectors.

To the extent that distortions of this type exist, due to a dominant sectoral shift within the benchmark index, it might be possible to construct an alternative beta assessment that attempts to offset such distortions. However, Oxera is not aware of any regulator having undertaken such an exercise in assessing the asset beta of telecommunications businesses or other sectors. At this point, Oxera considers that such analysis would be disproportionate, and not in line with observed practice.

Impact of the global financial crisis and European sovereign debt crisis on asset betas of telecommunications companies

CEG's analysis suggests that the global financial crisis that began in mid-2007 and lasted until mid-2009 depressed asset betas for telecommunications companies.

While Oxera has not attempted to establish the relationship between the financial crises and asset betas of telecommunications companies, we agree that the asset beta analysis for the period ending in 2009 might have been affected by the global financial crisis; hence, we have previously proposed that the five-year period ending in 2009 be allocated less weight than the most recent five-year period. The direction or magnitude of this impact has not been analysed by Oxera and is not entirely clear; however, given that the 2007–09 financial crisis was a global phenomenon, on average, it is likely to have had a

similar impact across the global set of telecommunications companies considered by Oxera for the comparator analysis.

With respect to the European sovereign debt crisis, the duration of the crisis and its impact on asset betas of European telecommunications companies is less conclusive.

Oxera has not conducted an in-depth analysis of the impact of the European sovereign debt crisis on the telecommunications sector. As mentioned previously, Oxera's comparator set is based on a selection of global telecommunications companies, half of which are non-European, and it is unlikely that the betas of these firms would be affected by the European sovereign debt crisis.

CEG appears to contend that the European sovereign debt crisis concluded by the start of 2013, based on the decline in government yields for certain eurozone economies.[20] If this were the case, then Oxera's updates to the two-year asset beta analysis presented in this report, which only consider post-crisis data (i.e. since March 2013), would be most relevant.

Yields on debt issued by most European sovereigns have indeed stabilised in recent months. However, recent developments regarding Greek borrowing, and indeed views of credit rating agencies, appear to suggest that the sovereign debt crisis in Europe may not be over. Figure 2.9 below charts the evolution of credit ratings for a selection of eurozone governments that were directly affected by the sovereign debt crisis.

Figure 2.9   Historical credit ratings for eurozone governments
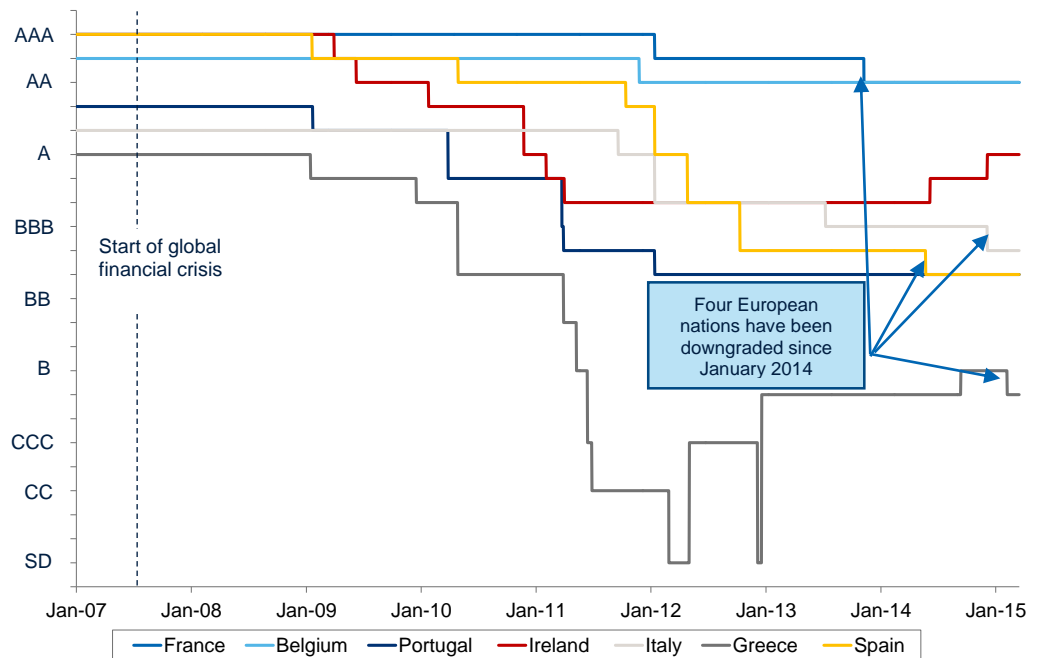
Note: The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis based on data from Standard & Poor's.

As shown in Figure 2.9, the current credit ratings for all of the countries represented are lower than those prevalent at the onset of the financial crisis. In

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[20] See Figure 3 in Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February.

particular, Belgium, France, Portugal, Italy and Spain are at their lowest level of credit rating since the crisis began, with France, Italy and Spain being downgraded in 2014. Greek debt continues to be rated as non-investment grade. Oxera notes that the recent spike in Greek bond yields (as evidenced in Figure 3 in CEG's report), and the subsequent credit downgrade in February 2015, would suggest that the crisis is not over.

The evidence presented in Figure 2.9 does not necessarily support CEG's assertion regarding the duration of, and emergence from, the European sovereign debt crisis. It is not straightforward to conclude whether asset betas for European telecommunications firms were depressed by the sovereign debt crisis in Europe.

2.5   Oxera's assessment

This section has discussed the arguments raised by CEG, Chorus and L1 Capital regarding an upward revision in the asset beta for Chorus, based on: an observed increase in asset betas for telecommunications firms since April 2014; an inverse relationship observed between the betas for European finance and telecommunications firms; and a hypothesis that the global financial crisis followed by the European sovereign debt crisis had led to comparator asset betas being depressed.

The main arguments for retaining the asset beta range as proposed in Oxera's initial analysis are as follows.

- **The evidence on movements in Chorus's beta considering the daily and weekly betas gives rise to a similar central estimate to the one that was previously observed**. This masks a significant widening of the Chorus beta range in the period since April 2014—the two-year daily asset beta for Chorus has declined substantially; the two-year weekly beta has increased but needs to be interpreted with caution given the significant volatility. Adjusting for volatility results in a beta estimate in line with Oxera's previous analysis.

- **No unambiguous and well-evidenced relationship in support of telecommunications betas being depressed due to movements in the financial sector**. The argument that there is an inverse relationship between the systematic risk of finance and telecommunications is not consistently demonstrated across the world. While it may hold in Europe, Oxera's assessment of the evidence in the US and New Zealand markets suggests no such distortive effect on telecommunications betas.

- **The evidence suggesting that the European sovereign debt crisis had a depressive effect on the asset risk for telecommunications firms is inconclusive**. It is not obvious that there was a depressive effect or that the crisis in Europe is over. Recent movements observed in asset betas for European telecommunications firms, combined with developments in sovereign creditworthiness, suggest that the impact of the crisis is not as straightforward as suggested by CEG and it is not obvious that it would support an upward bias.

The main arguments for changing the asset beta range are as follows.

- **The increased breadth of the Chorus beta range might suggest that Oxera adopt a broader range**. As noted above, the range for Chorus's asset beta is broader than it previously was. In the period since December 2014, the two-year weekly asset beta for Chorus, as estimated by the OLS methodology, has diverged substantially from the daily beta, with the most

recent updates suggesting that the value has increased from 0.38 in April 2014 to 0.49 in March 2015. While Oxera would advise caution with regard to this value, estimating betas is difficult and we would not assert that the weekly beta is somehow incorrect.

- **Decline in the average Chorus beta value based on daily and adjusted weekly asset beta values**. Oxera's analysis suggests a marked decline in the daily asset beta value for Chorus (0.30), which, when combined with the adjusted weekly beta estimate (0.37), would suggest narrowing the range by decreasing the upper bound.

- **Marginal increase in comparator betas**. Oxera notes that while most of the comparator beta values remain within the bounds of the original range, the estimates themselves have increased. For example, in the period since April 2014, the two-year weekly asset betas for the refined comparator set have increased from 0.41 to 0.47.[21] However, in the specific case of UCLL and UBA, there are limitations to the role of international comparator analysis, as there are no pure-play comparators to Chorus.

While there were some interesting points raised by respondents, Oxera does not consider any of the points to be sufficiently well-evidenced and is not persuaded to fundamentally change its approach to estimating asset betas.

On balance, having carefully considered all the arguments and the additional analysis, recent data suggests greater uncertainty, which needs to be reflected in a wider range.

Oxera's updated view of the asset beta range suggests a marginal increase to the upper bound of its previous range and recommends a range of 0.30–0.50. However, the top of the range, which is primarily based on the two-year OLS weekly beta estimates for Chorus, should be allocated limited weight and a plausible point estimate is likely to lie towards the middle of the range.

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[21] The updated value of 0.47 excludes Portugal Telecom from the refined comparator set.

3   Comparison with international regulatory precedent

3.1   Recap and summary of conclusions

A new issue raised by respondents relates to the Commission's point estimate for the asset beta for UCLL and UBA services relative to the spectrum of international regulatory determinations for the telecommunications sector. The Commission's point estimate of 0.40 is at the lower end of this spectrum, which ranges from 0.39–0.60.

Oxera has previously presented analysis on international regulatory precedent for asset beta determinations in the telecommunications sector and highlighted the wide range (0.38–0.60) over which these determinations have been made.[22] Since then some of the regulatory decisions have been updated, but the range for the determinations remains unchanged.

CEG and L1 argued that the Commission's point estimate was not consistent with the average regulatory determination in other jurisdictions and needed to be revised.

Given that the range for regulatory determinations remains unchanged since Oxera's previous response, and the average of regulatory determinations falls within Oxera's updated range, Oxera is not persuaded to further revise its asset beta range.

3.2   Summary of submissions

CEG objected to the Commission's estimate, stating:

> We consider that the evidence set out … supports a view that the Commission's proposed position on asset beta, as informed by advice from Oxera, is not in line with the positions of other international regulators of fixed line telecommunications businesses. In our view, our long term estimate of asset beta of 0.50 is consistent with this evidence.[23]

Chorus presented analysis on the most recent regulatory determinations in 2014, suggesting an increase in regulatory determinations in support of a higher asset beta.[24]

L1 Capital's views echoed those of CEG:

> The Commission's asset beta of 0.4 is lower than almost every other European regulatory precedent on asset betas as highlighted by Oxera on page 23 of its report. As Oxera notes the range of regulatory determinations is 0.38 to 0.60 with an average determination of 0.47. There is no logical basis for asset betas to differ so materially between NZ and European regulators given the comparators firms are a mix of very similar European and American telecoms and most of the decisions are recent.[25]

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[22] Oxera (2014), 'Review of expert submissions on the WACC for UCLL/UBA services', 4 November, Appendix 1.
[23] Competition Economists Group (2015), 'WACC parameters in the UCLL and UBA draft decision', February, para. 71.
[24] Chorus (2015), 'Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' Unbundled Copper Local Loop and Unbundled Bitstream Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)', 20 February, p. 155.
[25] L1 Capital (2015), 'Letter to Commerce Commission New Zealand', 20 February, p. 11.

3.3 Oxera's analysis of submissions

At the outset, it should be noted that while some the asset beta values for international regulatory precedent data presented in Oxera's November 2014 analysis have been superseded by more recent regulatory determinations, the overall range and the average estimate from international regulatory precedents, as represented in Table 3 of CEG's report, are consistent with Oxera's previous analysis.

There are various valid reasons for the observed differences between regulatory decisions for asset betas in different jurisdictions. Indeed, if every regulator were to refer to determinations made by fellow regulators in other jurisdictions, it is likely that the asset beta spectrum for international regulatory precedent would be much narrower, if not a single point estimate. The fact that the two bounds of the range for regulatory precedents are both attributable to European regulatory decisions in neighbouring countries contradicts L1 Capital's argument regarding the lack of logical basis for the difference between New Zealand and European regulators.

First, and most importantly, the Commission's point estimate for Chorus's asset beta lies within the range of asset beta determinations by other international regulators. As such, it is not out of line with international precedent. To the extent that the Commission's estimation methodology is logical, well-explained and robust, its determination is valid.

Second, regulators do not adopt identical approaches or consider the same evidence in arriving at their determinations. Each regulator allocates different weights to various sources of evidence as it deems prudent and relevant to its jurisdiction. Indeed, it is not essential that they do so as long as their individual methodologies are robust and logical.

By way of example, below, Oxera discusses the approaches adopted by four regulators whose decisions span the range of international determinations.

At the lower end of the spectrum. the Australian Competition & Consumer Commission's (ACCC) approach to determining the asset beta for Telstra is primarily based on five-year monthly and weekly asset betas for 23 global comparators while also giving weight to Telstra's observed beta value and an opinion that the appropriate range for the equity beta of a regulated utility is between 0.41 and 0.68.[26] In contrast, OPTA's (the independent post and telecommunications regulator in the Netherlands) assessment of the asset beta for fixed-line operations in the Dutch markets is derived from a peer group of just three international comparators based on a three-year daily sampling period.[27] The point estimates for the asset beta determinations by the ACCC and OPTA are 0.42 and 0.39, respectively.

Towards the middle and higher end of the spectrum, Ofcom (the UK telecommunications regulator) considers two-year daily betas as most relevant and includes UK network utilities within its comparator set. Additionally, Ofcom considers a debt beta of 0.10.[28] ComReg (the Irish communications regulator) relies on data for two- and five-year rolling asset betas for seven European comparators while also relying on European regulatory precedent. In contrast to

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[26] Australian Competition & Consumer Commission (2011), 'Inquiry to make final access determinations for the declared fixed line services – Final Report', July, pp. 64–6.
[27] The Brattle Group (2012), 'The WACC for mobile, fixed-line, and cable termination rates', 15 March, pp. 20–1.
[28] Ofcom (2014), 'Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 – Annexes', 26 June, Annex 14.

the Ofcom approach, ComReg considers a zero debt beta.[29] The asset betas for fixed-line telecommunications in the UK and Ireland were determined to be 0.50 and 0.55, respectively.

The examples of regulatory methodology presented above demonstrate that there is no single solution to estimating the asset beta for fixed-line telecommunications, and that regulators in different jurisdictions adopt different approaches. While they may take into account determinations by regulators in other jurisdictions, this does not necessarily present a focal point for their estimates.

3.4   Oxera's assessment

CEG, Chorus and L1 Capital argued that the Commission's determination for the asset beta for a hypothetical efficient operator providing UCLL and UBA services was close to the lower bound, and therefore out of line with the spectrum of determinations by other international telecommunications regulators. They advocated a higher asset beta in line with the average observed beta from regulatory precedent.

The main arguments for not revising the asset beta estimate for UCLL and UBA services further upwards, based on the determinations of other international regulators, are as follows.

- **The Commission's proposed estimate lies within the range of asset beta determinations from other telecommunications regulators**. While there have been some updates to regulatory determinations in recent months, the overall range for international regulatory precedent remains unchanged and the Commission's point estimate of 0.40, which lies within that range of 0.39–0.60, is not an outlier.

- **Regulators consider a variety of evidence and methodologies in determining the asset beta**. There is no single appropriate methodology for estimating the asset beta of a fixed-line telecommunications operator. Estimation methodologies vary considerably between regulators and as long as the approach is logical, well-evidenced, robust and broadly consistent with other regulatory precedent, the resulting estimates are valid.

In summary, while regulatory precedent provides a useful cross-check to other sources of evidence for beta analysis, it is not necessary that the average determination provide a focal point for the point estimate of the asset beta in any particular jurisdiction.

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[29] ComReg (2014), 'Review of Cost of Capital – Mobile Telecommunications, Fixed Line Telecommunications, Broadcasting (Market A and Market B)', 11 April, pp. 53–4.

4   Credit rating

Chorus cites a report by Moody's in order to establish a link between the credit rating and leverage levels of telecommunications operators suggesting that the higher the credit rating of a telecommunications firm, the lower its book value of gearing. In doing so, it argues that the Commission should use a credit rating of BBB–.

It states the following:

> Based on the CEG comparator group, and taking account of the practice of regulators such as ACCC and Ofcom, the Commission should use a credit rating of BBB–.
> Oxera is incorrect that the link between credit rating and leverage ratio across the comparator sample is relatively weak, thus suggesting that credit rating and gearing level are unrelated. This is illustrated by a recent report issued by Moody's which shows that the higher the credit rating of a telecommunications firm, the lower its debt/book capitalisation.[30]

Oxera has compared the book debt to capital ratio for the comparator firms (as presented in Figure H2 in Chorus's report[31]) with the latest credit ratings as assigned by Moody's. Table 4.1 presents this data in ascending order of book debt to capital ratio.

Table 4.1   Credit rating and book debt to capital ratio for the refined comparator set

Comparator firm	Book debt to capital ratio (%)	Moody's long-term credit rating
Belgacom	40.88	A1
Iliad	47.84	NR
Hawaiian Telecom	51.84	NR
AT&T	52.84	Baa1
Verizon Communications	54.74	Baa1
CenturyLink	57.11	Ba1
Telstra	58.49	A2
TDC	58.96	Baa3
Elisa	60.92	Baa2
Hellenic Telecommunications Org.	61.95	Ba3
Orange	62.46	Baa1
Swisscom	65.14	A2
Telecom Italia	65.19	Ba1
Deutsche Telekom	66.47	Baa1
Frontier Communications	68.05	Ba3

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[30] Chorus (2015), 'Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' Unbundled Copper Local Loop and Unbundled Bitstream Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)', 20 February, p. 163.

[31] Ibid., p. 159.

Comparator firm	Book debt to capital ratio (%)	Moody's long-term credit rating
Telekom Austria	69.05	Baa2
Koninklijke KPN	73.95	Baa3
Chorus	76.00	Baa3
Portugal Telecom	81.63	WR
Windstream Holdings	91.93	NR
BT Group	n.a.	NR
Cincinnati Bell	n.a.	B2
FairPoint Communications	n.a.	B2

Note: NR relates to not rated by Moody's. WR relates to rating being withdrawn.

Source: Oxera analysis based on Bloomberg and Chorus (2015), 'Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' Unbundled Copper Local Loop and Unbundled Bitstream Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)', 20 February, p. 159.

As is evident from Table 4.1, the inverse relationship between the book value of debt to capital, as described by Moody's, is not apparent. For example, Chorus and TDC are both rated Baa3 by Moody's but have a book debt to capital ratio of 76% and 59%, respectively. Alternatively, both Swisscom and Telecom Italia have a book debt to capital ratio of 65% but are rated A2 and Ba1, respectively—i.e. a difference of five notches.

While it may be the case, in principle, that the gearing of a company influences its credit rating, in practice, credit rating agencies consider a wide array of variables in determining a company's credit rating. Oxera has previously presented analysis demonstrating that, without controlling for other factors, the evidence does not suggest a meaningful relationship between the credit rating and market gearing of comparator firms.[32]

In summary, the evidence presented by Chorus in support of a target credit rating of BBB– is contradicted by market data, and Oxera continues to advocate a target credit rating of A–/BBB+.

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[32] See Oxera (2014), 'Review of the beta and gearing for UCLL and UBA services', 23 June, section 5.

5 Conclusion

In this report, Oxera has reviewed the second round of expert submissions provided to the Commission and, in particular, the argument that the asset betas for comparator firms have increased in the period since April 2014.

Our updated analysis in response to the evidence provided by the submissions on the asset beta is as follows.

- **Oxera has updated its range for the asset beta for UCLL and UBA services in New Zealand to 0.30–0.50**. In the period since April 2014, there has been heightened uncertainty regarding the beta for Chorus. This may also suggest placing marginally greater importance on comparator analysis. Reflecting the updated data suggests a broader range than that previously presented by Oxera. However, Oxera places limited weight on the upper bound of the range and the point estimate of the asset beta for UCLL and UBA services in New Zealand is likely to lie towards the middle of the range.

  The table below summarises the movements in asset betas since April 2014.

Table 5.1   Summary of asset beta movements for Chorus and the refined comparator set

Asset beta	April 2014	March 2015*
Chorus		
Two-year daily	0.39	0.30
Two-year weekly	0.38	0.49
Refined comparator set		
Five-year daily	0.35	0.38
Five year weekly	0.36	0.39
Five year monthly	0.33	0.41
Two-year daily	0.39	0.44
Two-year weekly	0.41	0.47
Oxera range	**0.30–0.45**	**0.30–0.50**

Note: * Data for refined comparator set excludes Portugal Telecom.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

- **The evidence regarding a distortive effect on telecommunications betas due to movements in the financial sector and the European sovereign debt crisis is not coherent or conclusive**. The relationship between the risk of finance and telecommunications sectors in Europe is not evident in the USA or New Zealand, and there is no obvious indication that the European sovereign debt crisis had a depressive effect on the betas for telecommunications firms.

- **There is no new evidence from international regulatory precedent to suggest that the Commission's point estimate of Chorus's asset beta is an outlier**. The Commission's estimate of 0.40 remains within the updated range from regulatory precedent. Regulatory methodologies for assessing the asset beta can vary significantly and it is not essential that determinations

should focus around the average value of international regulatory asset beta determinations.

- **Oxera continues to advocate a target credit rating of A–/BBB+**. The evidence put forward by Chorus is not consistent with market data and does not provide any reason to reconsider our previous arguments.

A1 Updates on comparator leverage

Table A1.1 presents updates to the observed market leverage of comparator firms.

Table A1.2 presents two- and five-year leverage for refined and all comparators on an annual basis from 1999–2015.

Table A1.1   Leverage for comparator firms

Comparator firm	Two-year leverage (2015)	Five-year leverage (2015)
AT&T	28%	27%
Belgacom	19%	17%
BT Group	21%	32%
CenturyLink	50%	45%
Chorus	66%	n.a.
Cincinnati Bell	76%	76%
Cogent Communications	12%	15%
Colt Group	(22%)	(32%)
Deutsche Telekom	45%	49%
Elisa	23%	23%
FairPoint Communications	73%	n.a.
Frontier Communications	59%	58%
Hawaiian Telecom	47%	n.a.
Hellenic Telecommunications Org.	28%	49%
Iliad	9%	12%
Koninklijke KPN	51%	50%
Lumos Networks	47%	n.a.
Orange	52%	50%
Portugal Telecom	40%	47%
Swisscom	25%	29%
TDC	37%	38%
Telecom Corporation of New Zealand	15%	21%
Telecom Italia	75%	75%
Telefónica	48%	47%
Telekom Austria	55%	50%
Telenor	18%	15%
TeliaSonera	23%	23%
Telstra	16%	20%
TW Telecom	22%	22%
Verizon Communications	28%	30%
Windstream Holdings	62%	58%
Average (all comparators)	**37%**	**35%**
Average (refined comparators)	**43%**	**42%**
Average (refined comparators excluding Portugal Telecom)	**43%**	**42%**

Note: Italics indicate firms that are excluded from the refined comparator set. The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis, based on Bloomberg and Datastream.

Table A1.2   Average leverage for comparator firms (1999–2015)

Year	Refined comparators		All comparators	
	Two-year leverage	Five-year leverage	Two-year leverage	Five-year leverage
1999	18%	19%	19%	20%
2000	19%	20%	19%	20%
2001	26%	26%	25%	25%
2002	34%	31%	35%	32%
2003	43%	35%	44%	37%
2004	40%	34%	42%	36%
2005	33%	34%	35%	36%
2006	30%	34%	31%	36%
2007	29%	33%	28%	34%
2008	31%	31%	29%	31%
2009	37%	33%	33%	31%
2010	43%	35%	38%	31%
2011	40%	37%	35%	33%
2012	44%	40%	38%	34%
2013	47%	43%	40%	37%
2014	47%	43%	40%	36%
2015*	43%	42%	37%	35%

Note: *Excludes Portugal Telecom. The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015.

Source: Oxera analysis, based on Bloomberg and Datastream.

A2   Telecommunications comparators: updates to analysis of equity and asset beta standard errors

This appendix presents updated estimates for the weekly and monthly standard errors for the equity and asset betas for the comparator set, as shown in Tables A2.1–A2.4.

Table A2.1   Current and historical standard errors for five-year equity betas of the Chorus comparator set

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.04	0.04	0.02	0.02	0.02	0.09	0.11	0.06	0.05	0.05	0.14	0.21	0.11	0.10	0.12
Belgacom			0.03	0.02	0.03			0.05	0.05	0.06			0.09	0.11	0.14
BT Group	0.05	0.06	0.03	0.04	0.04	0.11	0.13	0.08	0.08	0.08	0.19	0.26	0.18	0.16	0.17
CenturyLink	0.04	0.04	0.03	0.03	0.03	0.09	0.10	0.08	0.07	0.07	0.16	0.25	0.13	0.14	0.17
Chorus															
Cincinnati Bell	0.06	0.10	0.05	0.06	0.06	0.15	0.23	0.10	0.13	0.14	0.28	0.57	0.20	0.25	0.29
Cogent Communications			*0.11*	*0.05*	*0.05*			*0.33*	*0.14*	*0.11*			*0.72*	*0.27*	*0.23*
Colt Group		*0.11*	*0.06*	*0.05*	*0.05*		*0.28*	*0.14*	*0.11*	*0.11*		*0.58*	*0.33*	*0.20*	*0.24*
Deutsche Telekom		0.08	0.02	0.02	0.03		0.16	0.06	0.05	0.06		0.32	0.11	0.12	0.14
Elisa			0.03	0.02	0.02			0.07	0.05	0.05			0.13	0.09	0.12
FairPoint Communications															
Frontier Communications	0.05	0.05	0.03	0.04	0.05	0.11	0.12	0.07	0.10	0.12	0.17	0.23	0.11	0.22	0.29
Hawaiian Telecom															
Hellenic Telecommunications Org.			0.03	0.03	0.03			0.06	0.07	0.06			0.11	0.13	0.12
Iliad			0.04	0.03	0.03			0.09	0.07	0.07			0.17	0.14	0.17
Koninklijke KPN		0.06	0.02	0.05	0.05		0.16	0.06	0.11	0.12		0.36	0.10	0.22	0.27
Lumos Networks															
Orange		0.05	0.02	0.02	0.02		0.14	0.06	0.05	0.06		0.31	0.13	0.12	0.15

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom		0.04	0.03	0.03	0.05		0.09	0.06	0.08	0.12		0.12	0.10	0.15	0.18
Swisscom		0.03	0.02	0.02	0.02		0.08	0.04	0.04	0.05		0.17	0.08	0.08	0.09
TDC			0.04	0.03	0.03			0.06	0.06	0.06			0.12	0.13	0.14
Telecom Corporation of New Zealand			*0.04*	*0.06*	*0.07*			*0.09*	*0.11*	*0.14*			*0.13*	*0.18*	*0.23*
Telecom Italia		0.04	0.03	0.03	0.03		0.08	0.06	0.06	0.07		0.17	0.12	0.11	0.11
Telefónica	*0.02*	*0.02*	*0.02*	*0.01*	*0.01*	*0.05*	*0.06*	*0.04*	*0.03*	*0.03*	*0.07*	*0.14*	*0.09*	*0.06*	*0.07*
Telekom Austria			0.03	0.03	0.03			0.05	0.06	0.07			0.10	0.14	0.15
Telenor			*0.03*	*0.02*	*0.02*			*0.06*	*0.05*	*0.05*			*0.12*	*0.09*	*0.12*
TeliaSonera			*0.02*	*0.02*	*0.02*			*0.06*	*0.04*	*0.04*			*0.13*	*0.10*	*0.10*
Telstra		0.05	0.03	0.03	0.03		0.11	0.07	0.07	0.07		0.24	0.12	0.14	0.15
TW Telecom			*0.06*	*0.04*	*0.04*			*0.14*	*0.08*	*0.08*			*0.24*	*0.18*	*0.19*
Verizon Communications	0.04	0.04	0.02	0.02	0.02	0.09	0.09	0.05	0.05	0.06	0.14	0.19	0.09	0.13	0.13
Windstream Holdings				0.03	0.04				0.07	0.08				0.18	0.23
Average across time for refined comparator set	0.04					0.08					0.17				
Average across all comparators and time	0.04					0.09					0.17				

Note: The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand, but, for consistency purposes, Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

Table A2.2   Current and historical standard errors for two-year equity betas of the Chorus comparator set

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.06	0.06	0.03	0.05	0.05	0.14	0.16	0.07	0.12	0.12
Belgacom			0.03	0.06	0.06			0.07	0.11	0.14
BT Group	0.08	0.06	0.05	0.07	0.07	0.17	0.15	0.11	0.14	0.14
CenturyLink	0.05	0.06	0.04	0.08	0.06	0.13	0.15	0.12	0.18	0.16
Chorus				0.16	0.17				0.42	0.45
Cincinnati Bell	0.08	0.20	0.06	0.13	0.12	0.20	0.49	0.15	0.34	0.27
Cogent Communications		*0.36*	*0.08*	*0.09*	*0.09*		*1.19*	*0.19*	*0.18*	*0.20*
Colt Group	*0.14*	*0.13*	*0.07*	*0.10*	*0.10*	*0.43*	*0.35*	*0.17*	*0.23*	*0.19*
Deutsche Telekom	0.10	0.10	0.04	0.05	0.06	0.19	0.19	0.09	0.14	0.12
Elisa		0.06	0.05	0.04	0.05		0.14	0.10	0.09	0.09
FairPoint Communications				0.13	0.11				0.36	0.26
Frontier Communications	0.07	0.09	0.04	0.11	0.10	0.16	0.26	0.10	0.26	0.21
Hawaiian Telecom				0.09	0.08				0.20	0.17
Hellenic Telecommunications Org.		0.05	0.04	0.05	0.04		0.10	0.08	0.10	0.06
Iliad			0.04	0.06	0.08			0.08	0.14	0.19
Koninklijke KPN	0.06	0.05	0.03	0.14	0.10	0.16	0.14	0.08	0.35	0.22
Lumos Networks				*0.15*	*0.15*				*0.37*	*0.37*
Orange		0.07	0.03	0.05	0.06		0.29	0.09	0.14	0.15

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom	0.04	0.06	0.04	0.06	0.11	0.08	0.14	0.09	0.13	0.25
Swisscom		0.03	0.03	0.04	0.04		0.06	0.06	0.08	0.08
TDC		0.07	0.05	0.05	0.06		0.15	0.09	0.12	0.12
Telecom Corporation of New Zealand		*0.05*	*0.06*	*0.10*	*0.11*		*0.13*	*0.13*	*0.21*	*0.22*
Telecom Italia		0.04	0.04	0.06	0.06		0.11	0.09	0.14	0.15
Telefónica	*0.03*	*0.03*	*0.02*	*0.02*	*0.02*	*0.08*	*0.08*	*0.06*	*0.05*	*0.06*
Telekom Austria		0.08	0.04	0.06	0.06		0.14	0.07	0.15	0.13
Telenor		*0.05*	*0.04*	*0.05*	*0.05*		*0.11*	*0.08*	*0.11*	*0.10*
TeliaSonera		*0.05*	*0.03*	*0.03*	*0.04*		*0.13*	*0.08*	*0.08*	*0.09*
Telstra		0.07	0.04	0.05	0.04		0.16	0.08	0.11	0.09
TW Telecom		*0.23*	*0.07*	*0.06*	*0.07*		*0.69*	*0.15*	*0.14*	*0.18*
Verizon Communications	0.06	0.06	0.03	0.05	0.05	0.13	0.16	0.06	0.12	0.12
Windstream Holdings			0.04	0.08	0.09			0.09	0.20	0.20
Average across time for refined comparator set	0.07					0.15				
Average across all comparators and time	0.07					0.17				

Note: The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand, but, for consistency purposes, Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg, Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

Table A2.3   Current and historical standard errors for the five-year asset betas of the Chorus comparator set

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.04	0.04	0.02	0.01	0.01	0.07	0.09	0.04	0.04	0.04	0.11	0.18	0.09	0.08	0.09
Belgacom			0.02	0.02	0.02			0.05	0.04	0.05			0.08	0.09	0.12
BT Group	0.05	0.04	0.02	0.02	0.02	0.11	0.09	0.05	0.05	0.05	0.18	0.19	0.12	0.10	0.11
CenturyLink	0.03	0.03	0.02	0.02	0.02	0.07	0.06	0.05	0.04	0.04	0.11	0.15	0.08	0.08	0.09
Chorus															
Cincinnati Bell	0.05	0.05	0.02	0.01	0.01	0.12	0.12	0.03	0.03	0.03	0.22	0.30	0.07	0.06	0.07
Cogent Communications			*0.08*	*0.05*	*0.04*			*0.22*	*0.12*	*0.09*			*0.49*	*0.22*	*0.20*
Colt Group			*0.06*	*0.07*	*0.07*			*0.14*	*0.14*	*0.14*			*0.33*	*0.27*	*0.32*
Deutsche Telekom		0.05	0.01	0.01	0.01		0.10	0.04	0.03	0.03		0.20	0.06	0.06	0.07
Elisa			0.03	0.02	0.02			0.06	0.04	0.04			0.10	0.07	0.09
FairPoint Communications															
Frontier Communications	0.02	0.02	0.01	0.02	0.02	0.05	0.06	0.03	0.04	0.05	0.07	0.11	0.06	0.09	0.12
Hawaiian Telecom															
Hellenic Telecommunications Org.			0.02	0.01	0.01			0.04	0.03	0.03			0.08	0.06	0.06
Iliad			0.04	0.02	0.03			0.08	0.06	0.07			0.17	0.12	0.15
Koninklijke KPN		0.03	0.02	0.02	0.02		0.08	0.04	0.06	0.06		0.18	0.07	0.11	0.14
Lumos Networks															
Orange		0.02	0.01	0.01	0.01		0.06	0.03	0.03	0.03		0.13	0.07	0.06	0.07

Comparator firm	Daily					Weekly					Monthly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom		0.03	0.02	0.01	0.03		0.07	0.04	0.03	0.06		0.10	0.07	0.07	0.10
Swisscom		0.03	0.02	0.01	0.01		0.07	0.03	0.03	0.03		0.15	0.07	0.06	0.06
TDC			0.02	0.02	0.02			0.04	0.04	0.04			0.07	0.08	0.08
Telecom Corporation of New Zealand			*0.03*	*0.05*	*0.05*			*0.07*	*0.09*	*0.11*			*0.10*	*0.13*	*0.18*
Telecom Italia		0.01	0.01	0.01	0.01		0.02	0.03	0.02	0.02		0.05	0.05	0.03	0.03
Telefónica	*0.02*	*0.02*	*0.01*	*0.01*	*0.01*	*0.04*	*0.05*	*0.03*	*0.02*	*0.02*	*0.05*	*0.10*	*0.06*	*0.03*	*0.04*
Telekom Austria			0.02	0.01	0.01			0.03	0.03	0.03			0.07	0.07	0.07
Telenor			*0.02*	*0.02*	*0.02*			*0.05*	*0.04*	*0.05*			*0.10*	*0.08*	*0.10*
TeliaSonera			*0.02*	*0.01*	*0.01*			*0.05*	*0.03*	*0.03*			*0.12*	*0.08*	*0.08*
Telstra		0.04	0.02	0.02	0.02		0.10	0.05	0.05	0.05		0.21	0.09	0.11	0.12
TW Telecom			*0.03*	*0.03*	*0.03*			*0.07*	*0.06*	*0.06*			*0.13*	*0.14*	*0.15*
Verizon Communications	0.03	0.03	0.02	0.02	0.02	0.07	0.07	0.04	0.04	0.04	0.11	0.13	0.07	0.09	0.09
Windstream Holdings				0.01	0.01				0.03	0.03				0.07	0.09
Average across time for refined comparator set	0.02					0.05					0.10				
Average across all comparators and time	0.03					0.06					0.11				

Note: The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand, but, for consistency purposes, Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg and Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

Table A2.4   Current and historical standard errors for the two-year asset betas of the Chorus comparator set

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
AT&T	0.05	0.05	0.02	0.03	0.03	0.11	0.14	0.05	0.09	0.09
Belgacom			0.03	0.05	0.05			0.06	0.09	0.11
BT Group	0.07	0.04	0.03	0.05	0.06	0.17	0.09	0.07	0.10	0.11
CenturyLink	0.04	0.03	0.02	0.04	0.03	0.09	0.09	0.06	0.09	0.08
Chorus				0.06	0.06				0.16	0.15
Cincinnati Bell	0.07	0.06	0.02	0.03	0.03	0.17	0.14	0.05	0.08	0.07
Cogent Communications		*0.03*	*0.07*	*0.08*	*0.08*		*0.10*	*0.16*	*0.16*	*0.17*
Colt Group			*0.07*	*0.14*	*0.12*			*0.16*	*0.32*	*0.23*
Deutsche Telekom		0.05	0.02	0.03	0.03		0.09	0.05	0.07	0.07
Elisa		0.04	0.04	0.03	0.04		0.09	0.08	0.07	0.07
FairPoint Communications				0.03	0.03				0.07	0.07
Frontier Communications	0.03	0.04	0.02	0.04	0.04	0.07	0.10	0.04	0.09	0.09
Hawaiian Telecom				0.04	0.04				0.10	0.09
Hellenic Telecommunications Org.		0.04	0.03	0.03	0.03		0.07	0.05	0.05	0.05
Iliad			0.04	0.06	0.07			0.08	0.13	0.17
Koninklijke KPN		0.03	0.02	0.06	0.05		0.08	0.05	0.15	0.11
Lumos Networks				*0.07*	*0.08*				*0.17*	*0.20*
Orange		0.03	0.02	0.02	0.03		0.10	0.05	0.06	0.07

Comparator firm	Daily					Weekly				
	1999	2004	2009	2014	2015	1999	2004	2009	2014	2015
Portugal Telecom	0.04	0.04	0.02	0.02	0.07	0.08	0.09	0.05	0.04	0.15
Swisscom		0.03	0.02	0.03	0.03		0.06	0.04	0.06	0.06
TDC		0.04	0.03	0.03	0.04		0.09	0.05	0.07	0.07
Telecom Corporation of New Zealand			*0.05*	*0.09*	*0.10*			*0.10*	*0.17*	*0.19*
Telecom Italia		0.01	0.01	0.01	0.02		0.03	0.03	0.03	0.04
Telefónica	*0.02*	*0.02*	*0.02*	*0.01*	*0.01*	*0.06*	*0.06*	*0.04*	*0.02*	*0.03*
Telekom Austria		0.04	0.02	0.03	0.03		0.07	0.04	0.07	0.06
Telenor		*0.04*	*0.03*	*0.04*	*0.04*		*0.08*	*0.06*	*0.09*	*0.09*
TeliaSonera		*0.05*	*0.03*	*0.03*	*0.03*		*0.11*	*0.06*	*0.06*	*0.07*
Telstra		0.06	0.03	0.04	0.03		0.13	0.06	0.09	0.08
TW Telecom		*0.05*	*0.05*	*0.05*	*0.06*		*0.16*	*0.10*	*0.11*	*0.14*
Verizon Communications	0.05	0.04	0.02	0.04	0.04	0.10	0.10	0.05	0.09	0.09
Windstream Holdings			0.02	0.03	0.03			0.04	0.07	0.08
Average across time for refined comparator set	0.04					0.08				
Average across all comparators and time	0.04					0.09				

Note: The cut-off date for the analysis is 10 April in each relevant year of the analysis and 16 March for 2015. Telecom Corporation of New Zealand has been rebranded as Spark New Zealand, but, for consistency purposes, Oxera has retained the old trading name in this report.

Source: Oxera analysis based on Bloomberg and Datastream and Hird, T. (2014), 'Response to Commerce Commission UCLL/UBA WACC consultation paper', March, p. 13.

A3   Methodology for estimating volatility-adjusted betas

This section explains the methodology used to obtain the volatility-adjusted betas presented in section 2 and Figure 2.4.

Finance literature has previously recognised that the expected volatility can differ on a daily (or weekly) basis. In particular, stock market volatility is expected to disproportionately increase following a stock price decline. This is recognised as the 'leverage effect'.[33]

The leverage effect has implications for beta estimation, as equity betas are estimated to capture the systematic component of a company's return and not the volatility of its idiosyncratic return. The OLS estimation of betas does not address this problem, as it assumes that volatility of excess returns is constant.

In order to account for variable volatility of excess returns, Oxera considers a simple model, in which volatility of excess returns depends on whether the market declined during the previous period (e.g. day or week). The more volatile observations are then attributed a lower weight in estimating the volatility-adjusted beta. Essentially, this adds an additional parameter to the standard specification based on the OLS methodology.

The volatility-adjusted beta estimation itself is done by applying the principles of the maximum likelihood method. It involves choosing the parameter values (i.e. beta, excess return volatility following a market decline and excess return volatility following a market growth) such that the probability of observing the returns data is maximised, assuming a normal distribution.[34] Thus, the observations associated with large excess return volatility have less of an impact on the estimate of the beta.[35]

Once the two different beta specifications—i.e. OLS and volatility-adjusted—are estimated, it is possible to compare which fits the data better using the 'likelihood ratio' test. In this particular case, the 'likelihood ratio' test indicates that the volatility-adjusted beta is statistically justified at a 5% level of significance for the period after December 2014.

Figures A3.1 and A3.2 below, illustrate the weekly and daily beta estimation samples. Figures A3.3 and A3.4 highlight the impact of major regulatory announcements on the returns for Chorus.

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[33] For examples, see Glosten, L.R., Jagannathan, R. and Runkle, D.E. (1993), 'On the relation between the expected value and the volatility of the nominal excess return on stocks', *Journal of Finance*, **48**, pp. 1779–801; Nelson, D.B. (1991), 'Conditional heteroskedasticity in asset returns: A new approach', *Econometrica*, **59**, pp. 347–70; Engle, R.F. and Ng, V.K. (1991), 'Measuring and testing the impact of news on volatility', NBER working paper series, NBER working paper #3681.

[34] Assuming a normal distribution is consistent with standard approach. It can be shown that Maximum Likelihood method yields the same estimates as OLS for the standard beta specification.
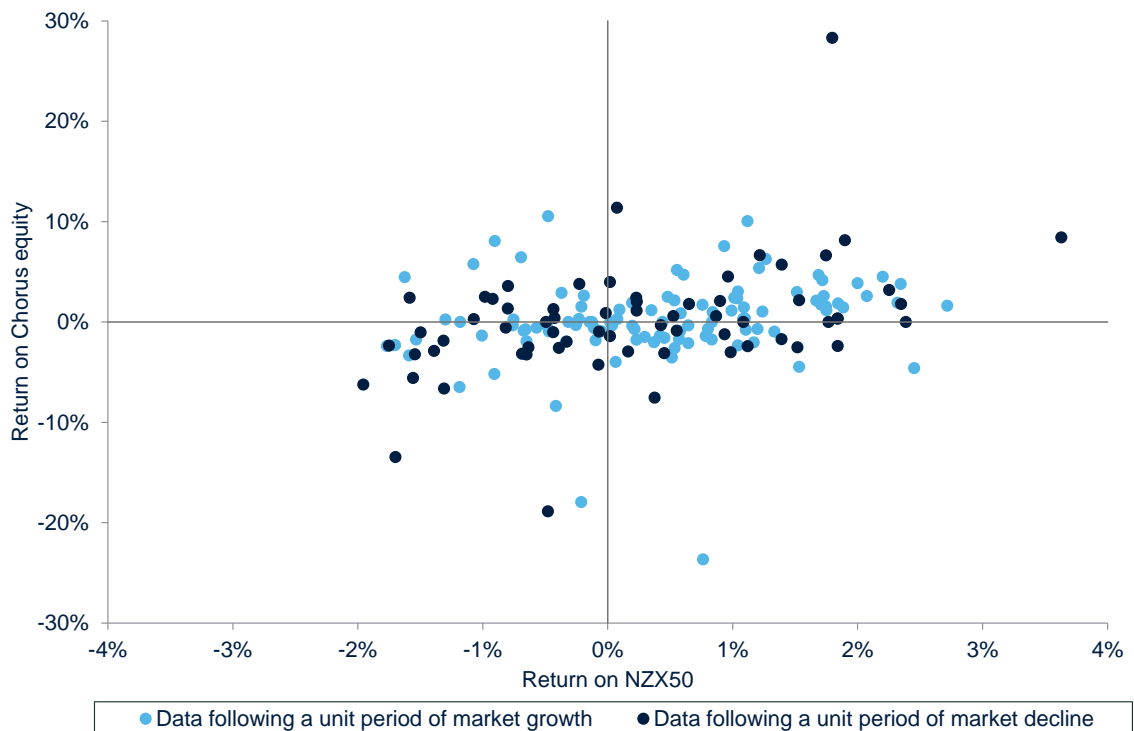
[35] In practice, the estimation is done in an econometric package, for example STATA.

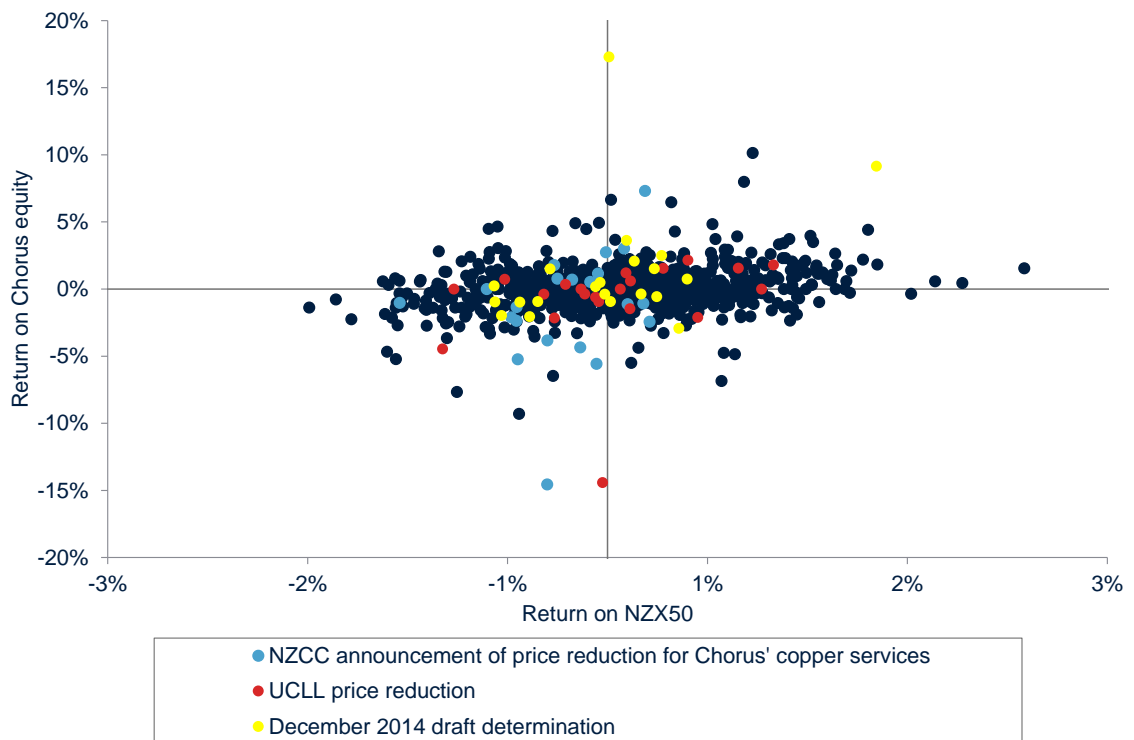**Figure A3.1 Scatter plot of Chorus stock price daily returns against market daily returns**
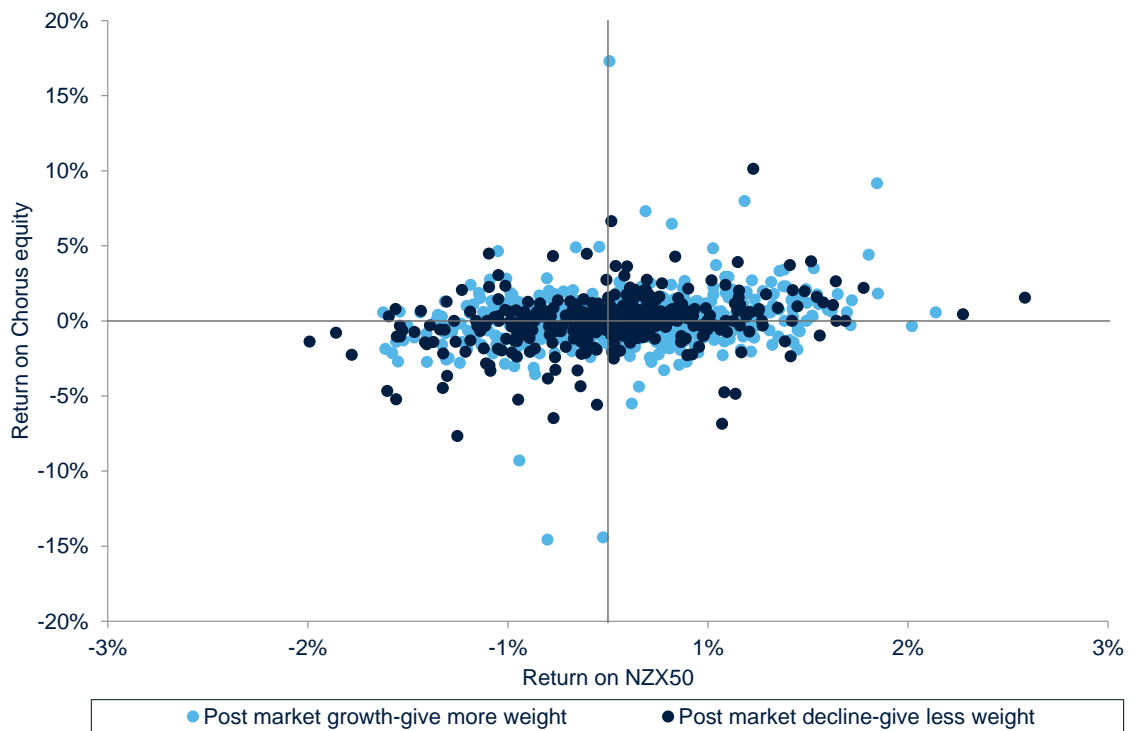
Source: Oxera analysis based on Datastream and STATA.

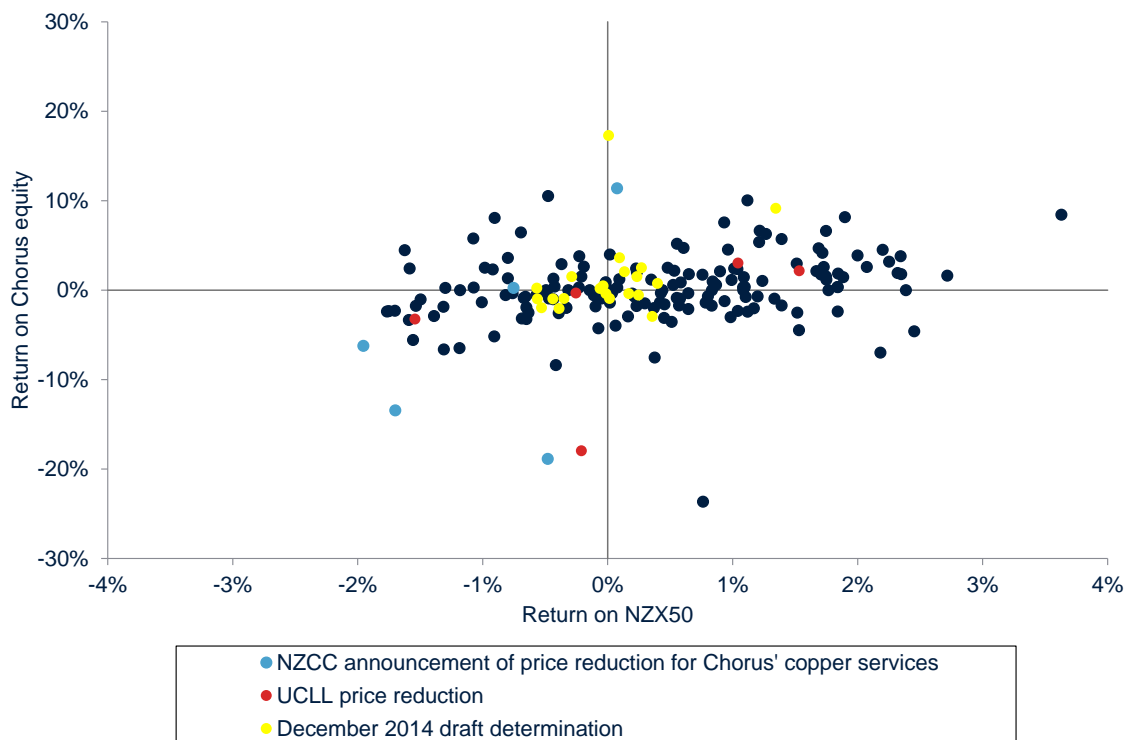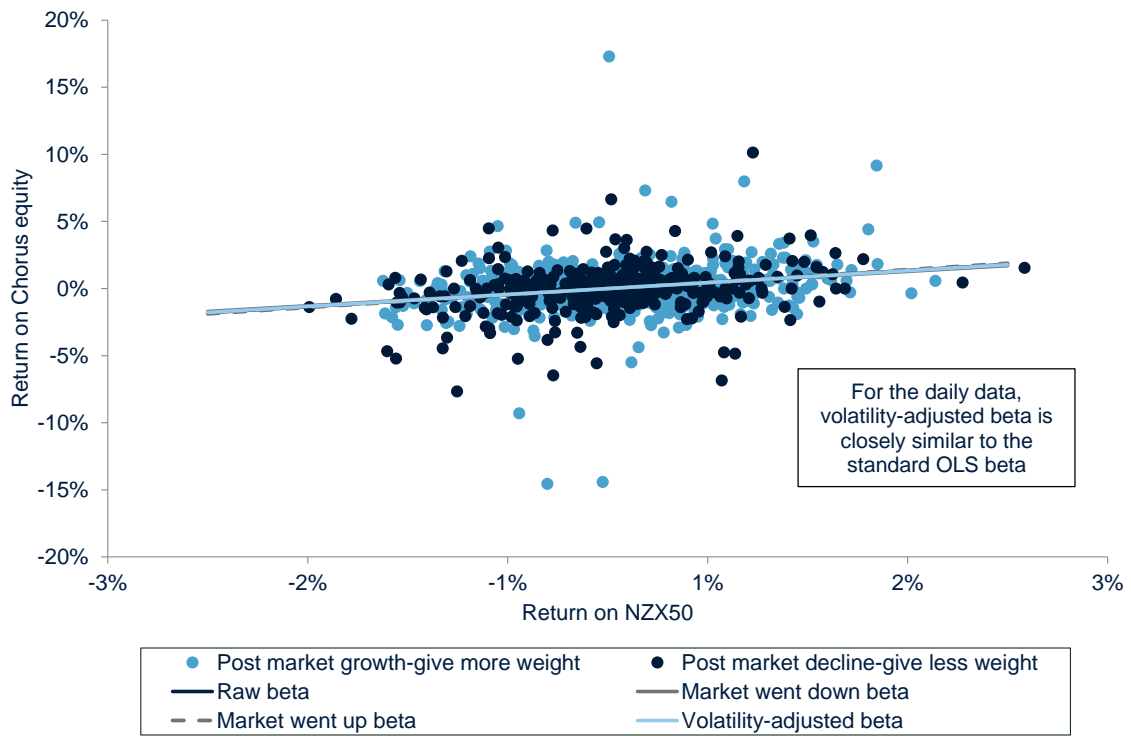**Figure A3.2 Scatter plot of Chorus stock price weekly returns against market weekly returns**

Source: Oxera analysis based on Datastream and STATA.

Figure A3.3 Scatter plot of Chorus stock price daily returns against market daily returns

Source: Oxera analysis based on Datastream and STATA.

Figure A3.4 Scatter plot of Chorus stock price weekly returns against market weekly returns

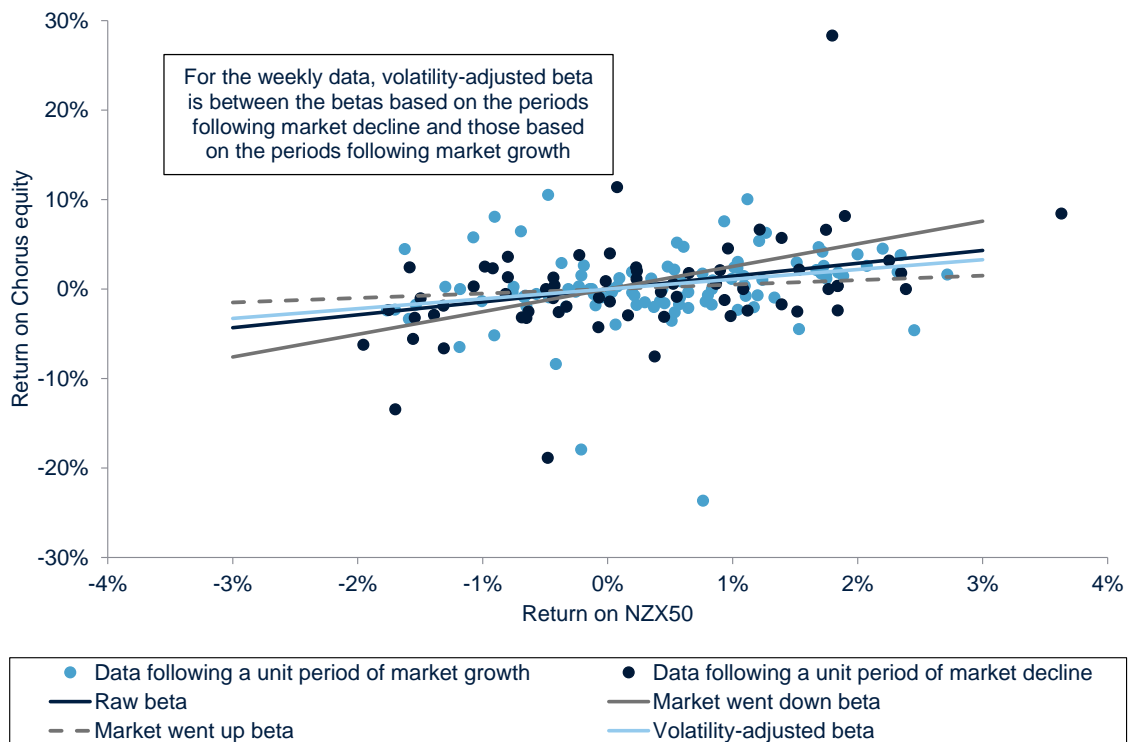Source: Oxera analysis based on Datastream and STATA.

For the analysis presented in Figures A3.5 and A3.6, Oxera first splits the data into periods following a market decline and periods following market growth, and then estimates the betas for Chorus based on these data samples separately (using the OLS methodology). Oxera also estimates the volatility-adjusted beta on the combined dataset. Figures A3.5 and A3.6 illustrate the volatility-adjusted beta estimate, in relation to those obtained from the split datasets.

Figure A3.5 Scatter plot of Chorus stock price daily returns against market daily returns

Source: Oxera analysis based on Datastream and STATA.

**Figure A3.6 Scatter plot of Chorus stock price weekly returns against market weekly returns**

For the weekly data, volatility-adjusted beta is between the betas based on the periods following market decline and those based on the periods following market growth

- Data following a unit period of market growth
- Data following a unit period of market decline
- Raw beta
- Market went down beta
- Market went up beta
- Volatility-adjusted beta

Source: Oxera analysis based on Datastream and STATA.

As evidenced above, while the volatility-adjusted beta is not significantly different from the standard OLS beta for the daily data, there is a visible difference for the weekly estimation frequency and the volatility-adjusted beta lies between the betas obtained from the split datasets.

A4   Developments in market data for Portugal Telecom

Figures A4.1 and A4.2 show the developments with Portugal Telecom's financial data.

Figure A4.1   Gearing data for Portugal Telecom since 10 April 2014
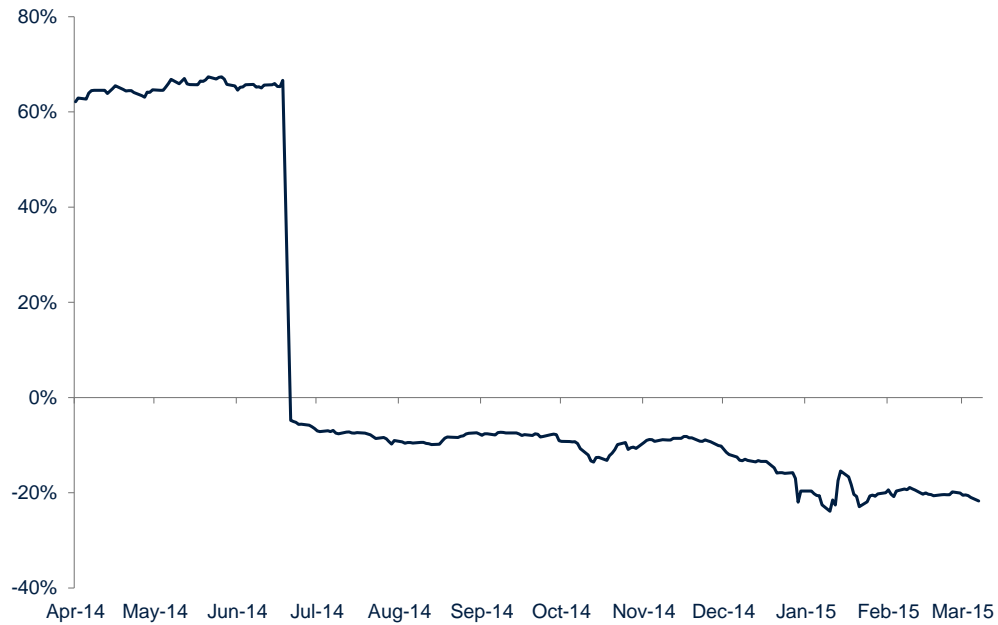
Note: The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis based on Bloomberg.

The steep fall in gearing is most likely to be a result of financial restructuring after the merger between Portugal Telecom and Oi, which was completed in summer 2014. Portugal Telecom was subsequently sold again, in January 2015.[36] During this period of trading, Portugal Telecom's stock price lost nearly 75% of its value (see Figure A4.2).

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[36] See Pearson, S. (2015), 'Brazilian telecoms: let the battle begin', *Financial Times,* 23 January.

Figure A4.2   Movements in Portugal Telecom's stock price since 10 April 2014 (€)

Note: The cut-off date for the analysis is 16 March 2015.

Source: Oxera analysis based on Datastream.

While these are not fundamental criteria to exclude Portugal Telecom from the comparator set (and Portugal Telecom still satisfies the criteria for inclusion as set out in Oxera's original report), the highly volatile financial data due to major corporate restructuring means that the beta estimated from the most recent share price data may not be a reliable measure of the underlying business risk.

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