The WACC for KPN and FttH

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ACM

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I. Introduction and Summary

The Dutch Authority for Consumers and Markets (ACM) needs to apply a Weighted Average Cost of Capital (WACC) for regulating a range of telecom related services, and for carrying out its duty of economic oversight of other telecoms activities. In this context, the ACM has commissioned The Brattle Group to calculate the WACC for:

1. KPN Telecom;
2. Fibre-to-the-Home (FttH);

The ACM has asked us to apply its WACC methodology for KPN. We also applied this methodology in a May 2013 report where we estimated the WACC for wholesale broadband (in practise KPN's WACC) and also for Fibre-to-the-Office (FttO).[1] In this report, we update our May 2013 estimate of the KPN's WACC, and develop a new methodology for estimating the WACC for FttH. The ACM has asked us to estimate the WACC based on the latest data available.

In broad terms, the methodology for KPN's WACC applies the Capital Asset Pricing Model (CAPM) to calculate the cost of equity. The CAPM expresses the cost of equity for a business activity as the sum of a risk-free rate and a risk premium. The size of the risk premium depends on the systematic risk of the underlying asset, or project, relative to the market as a whole.[2]

The risk-free rate is calculated based on the three-year average yield on 10-year Dutch and German government bonds. This results in a risk-free rate of 1.49%. The ERP is calculated using long-term historical data on the excess return of shares over long-term bonds, using data from European markets, and considering other evidence on the ERP from Dividend Growth Models. In more detail, the methodology specifies that the projected ERP should be based on the average of the arithmetic and geometric average realised ERP. In the current case, we have applied the 'raw' historical ERP without making any of the standard downward adjustments. Hence, in effect we have increased our estimate of the ERP because of evidence

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[1] The WACC for Wholesale Broadband and FttO, The Brattle Group, Dan Harris and Cosimo Fischietti, 29 May 2013. Hereafter referred to as the 'May 2013 report'.

[2] Further information on assumptions and theory underlying the CAPM can be found in most financial textbooks; see Brealey, Richard; Myers, Stewart; Allen, Franklin; *"Principles of Corporate Finance.*

from dividend growth models, relative to a situation where we apply the standard downward adjustments. This results in an ERP over bonds of 5.0%.

KPN's recent financial history presents some specific issues when estimate a forward looking gearing and beta. As we explained in our May 2013 report, during 2012-2013 in particular, KPN's share price declined and its gearing increased to high levels. KPN eventually restored financial balance by undertaking a €4 billion rights issue. However, the last three years have involved substantial fluctuations in KPN's gearing. Accordingly, to estimate KPN's likely future gearing, we use KPN's latest actual gearing of 42%, rather than an average of the last three years (58%). We also find evidence that KPN's financial difficulties have depressed its beta, an effect we noted in our May 2013 report. In the May 2013 report, we estimated KPN's beta by looking at the betas of similar firms or 'peers'. In the current report, our preferred option is to estimate KPN's future beta by using a two-year daily sampling period which excludes the period of KPN's financial difficulties, rather than using the three-year period specified by the method. Using a two-year daily sampling period results in an asset beta of 0.45, and an equity beta of 0.69. Table I-1 summarises the overall parameters of the WACC calculation, which yield a nominal pre-tax WACC of 6.06%. The methodology requires that the nominal WACC is converted to a real WACC using an estimate of inflation based on both past and predicted inflation. We convert the nominal WACC to a real WACC using an inflation estimate of 1.5%, which results in a real WACC of 4.49%.

Table I-1: KPN's Current WACC

2014 tax rate	[1]	25.00%	KPMG corporate tax table
Debt/Asset	[2]	42.00%	Section II.B
Debt/Equity	[3]	72.41%	[2]/(1-[2])
Asset beta	[4]	0.45	Section II.D
Equity beta	[5]	0.69	[4]x(1+(1-[1])x[3])
Risk free rate	[6]	1.49%	Section II.C
ERP	[7]	5.00%	Section II.E
After-tax cost of equity	[8]	4.96%	[6]+[5]x[7]
Pre-tax cost of debt	[9]	5.30%	Section II.A
Nominal after-tax WACC	[10]	4.54%	(1-[2])x[8]+[2]x(1-[1])x[9]
Nominal pre-tax WACC	[11]	6.06%	[10]/(1-[1])
Inflation	[12]	1.50%	Assumed
Real pre-tax WACC	[13]	4.49%	(1+[11])/(1+[12])-1

WACC FOR FttH

In our May 2013 report we noted that the WACC for FttO is likely to be higher than the WACC for wholesale broadband (KPN's WACC), because of the higher ratio of fixed to variable costs (so called operating leverage) in a newer fibre network relative to a mature copper network.

However, there are reasons to think that FttH may have even higher systematic risk than FttO. This is mainly because FttO tends to be built 'on demand' whereas FttH is built in anticipation of demand, and is therefore more vulnerable to lower outturn demand due to for example an economic shock.

We were unable to find a 'pure play' listed FttH operator form which we could estimate a WACC directly. As a result we have investigated reasonable ways to modify the KPN's WACC to make it suitable for the FttH activity.

We have reviewed statements by the European Commission and decisions of other telecoms regulators with respect to FttH. The Commission recommended that regulators apply a premium to the WACC for investments in FttH, but to date only France, Spain, Italy and Lithuania have implemented this recommendation. Risk premiums for FttH are 5.0% in France, 4.81% in Spain and 4.4% in Italy. Lithuania does not disclose the size of the fibre WACC premium it applies. However, we note that these premia compensate operators not only for the higher systematic risk of FttH investment but also for non-systematic investment risks, including "uncertainty relating to the costs of deployment, civil engineering works and managerial execution". In this exercise, we are aiming to estimate the premium required to compensate for systematic risk only – that is, risk that an investor could not reduce by holding a diverse portfolio of projects and shares.

To test whether premia for FttH applied by other regulators would be reasonable in the Dutch context, we have used KPN's Discounted Cash Flow (DCF) model of an investment in an FttH network. We investigate the effect of both a lower than expected final adoption rate for FttH rate and a delayed adoption of FttH on the Internal Rate of Return (IRR) of an FttH investment. We find that a reduction in the final adoption rate from 60% to 40% will reduce the IRR of the project from 7.85% to 3.50%. This drop of just over four percentage points is consistent with the premia offered by other European telecoms regulators.

However, in our view the drop in the IRR reflects not only systematic risk but also the risk that telecom operators have overestimated customers demand for FttH more generally. A scenario which seems to better reflect systematic risk is one where the ultimate adoption rate

is the same as the base case, but where the final adoption rate is reached three years later than the base case due to an economic shock. This scenario lowers the IRR by about 2 percentage points, suggesting a premium of 2 percentage points could be justified. However, this is only correct if the delay will occur with 100% certainty. If the chance of an economic delay is only 50%, then a premium of only 1% would seem justified.

We also note that in our May 2013 report we recommended a premium for FttO of 1 percentage point, and that the risk premium we estimate for FttH in this report should be added to the FttO premium. This is because the FttH activity has the same systematic risks that we identified for FttO – for example increased operating leverage because of large investment commitments – plus additional systematic risks which are captured by the 1 percentage point premium we discuss above. Given this, and the premia established for FttH by other regulators, we recommend a premium of two percentage points for the FttH WACC over the KPN WACC. The two percentage point premium over the KPN WACC can be thought of as the 1 percentage point premium already identified for FttO, plus another 1 percentage point to compensate for the additional systematic risks that apply to FttH. We note that our estimation is lower than FttH premia recommended by the other NRAs. However, this is because their premia include both systematic and non-systematic risk while our goal is to quantify only the systematic risk related to the FttH activity.

II. KPN WACC

II.A. Cost of Debt

The ACM methodology specifies that we should use KPN's actual or 'embedded' cost of debt when estimating the WACC. Accordingly, as in the May 2013 report, we have calculated KPN's cost of debt as the weighted average coupon cost of all Euro denominated KPN bonds outstanding as of 21st April 2015. We do not account for the cost of non-Euro denominated debt. The logic is that bonds issued in non-Euro currencies are for KPN's own risk, and that if the interest rate on these bonds is higher or lower than that on Euro nominated bonds, then the cost or benefit of this should not be reflected in the WACC that ACM will apply for regulatory purposes. This results in a weighted average debt cost of 5.15%, as calculated in Table II-1.

Table II-1: KPN's Embedded Cost of Debt as of 21/04/2015

Date of issue	Maturity	Type	Currency	S&P rating	Outstanding €million	Coupon rate %	EUR bonds	EUR bullet
[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]
Outstanding KPN bonds as of 21 April 2015								
22-Jun-2005	22-Jun-2015	Bullet	EUR	BBB-	1,000	4.00		
13-Nov-2006	17-Jan-2017	Bullet	EUR	BBB-	750	4.75		
2-Apr-2008	15-Jan-2016	Bullet	EUR	BBB-	645	6.50		
4-Feb-2009	4-Feb-2019	Bullet	EUR	BBB-	750	7.50		
30-Sep-2009	30-Sep-2024	Bullet	EUR	BBB-	607	5.63		
21-Sep-2010	21-Sep-2020	Bullet	EUR	BBB-	723	3.75		
15-Sep-2011	4-Oct-2021	Bullet	EUR	BBB-	500	4.50		
1-Mar-2012	1-Mar-2022	Bullet	EUR	BBB-	615	4.25		
1-Aug-2012	1-Feb-2021	Bullet	EUR	BBB-	361	3.25		
14-Mar-2013	n/a	Perpetual	EUR	BB	1,100	6.13		
EUR bonds								
Total (€million) [1]							7,051	5,951
Wtd average (%) [2]							5.15	4.96
Admin fees (%) [3]							0.15	0.15
Cost of debt (%) [4]							5.30	5.11

Notes and sources:
[A] to [F]: Outstanding KPN bonds denominated in euros as of 21/04/2015.
[1]: Sum [F]. [H] includes all EUR bonds whereas [I] includes only EUR Bullet bonds.
[2]: Weighted average [G] by [F]. [H] includes all EUR bonds whereas [I] includes only EUR Bullet bonds.
[3]: Assumed.
[4]: [2]+[3].

The methodology specifies an additional allowance of 15 basis points to cover the costs of issuing debt, for example banking, legal and agency fees. Hence, the final cost of debt is 5.30%.

If we were calculating the cost of debt using the yield to maturity on KPN's traded bonds, then we would only include 'bullet' bonds with definite maturity dates.[3] This is because other

[3] A 'bullet bond' makes a final payment of the face value of the bond at a defined date.

types of bonds have either variable or uncertain maturity dates, which give bonds different risk profiles and hence result in different interest rates that are not associated with the risk of underlying business.[4] The average debt cost for bullet bonds is 4.96%, which is lower than the overall debt cost, 5.15%. However, since this is an embedded cost of debt calculation, we include all the outstanding bonds in the estimation for the cost of debt.

Figure 1 illustrates that about €1 billion of debt may be re-financed in 2015. We have derived a forward curve for the current cost of debt for Eurozone firms with a Standard & Poors (S&P) Credit rating of BBB, similar to KPN's rating.[5] Figure 1 illustrates that an allowed cost of debt of 5.30% would allow KPN to make a substantial financial gain from refinancing debt, since KPN's allowed cost of debt is over 450 basis points higher than we would expect a BBB rated firm to pay.

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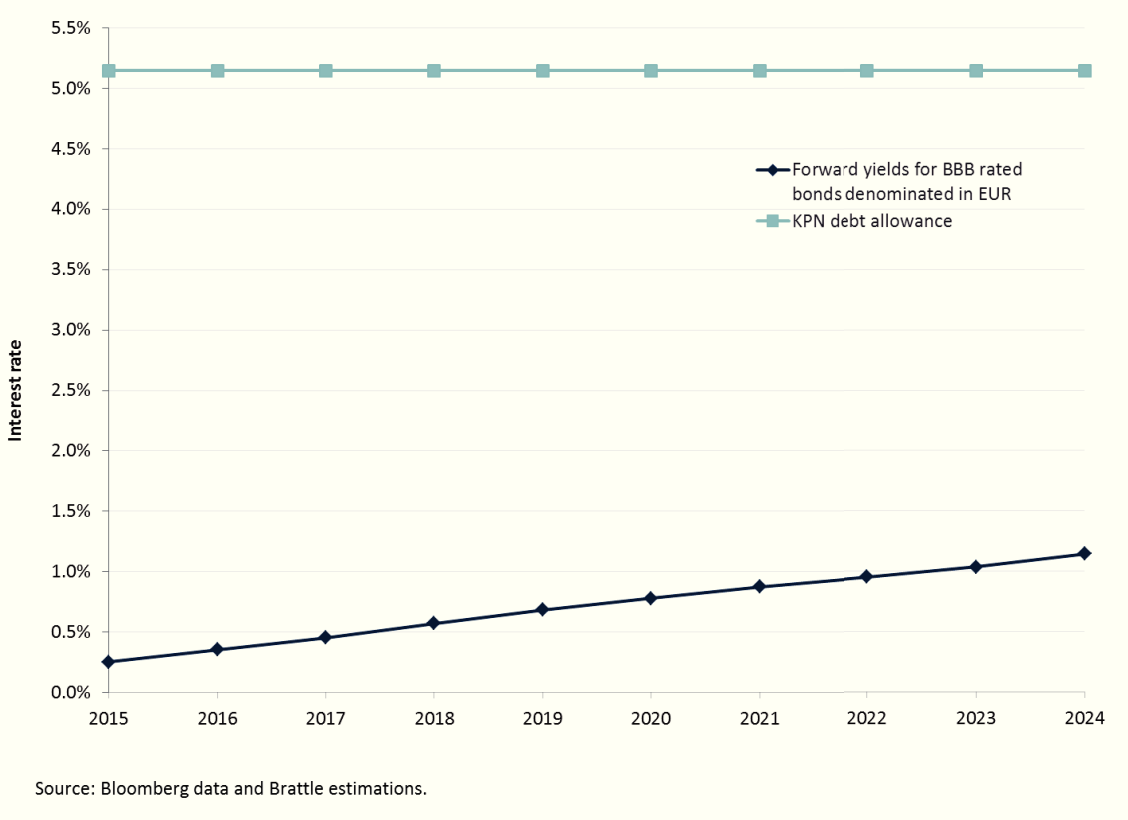
[4] A perpetual bond has no specified maturity date but is usually callable with a protection period. This means that the bond issuer could redeem the bond at some point after the protection period expires.

[5] Forward curve is derived based on bond yields for BBB-rated, euro-denominated bonds for European industries. We use bond yields from 01/04/2015 until 21/04/2015.

Figure 1: Forward Cost of BBB-rated Debt Compared to KPN's Allowed Cost of Debt



Source: Bloomberg data and Brattle estimations.

II.B. GEARING

We follow standard practise to calculate KPN's gearing – the ratio of net debt to net debt plus equity – using data from Bloomberg.[6] We also account for the presence of KPN's long-term operating leases, which can affect the apparent gearing of the firm.[7] Failure to account for the operating leases could give the impression that some firms have higher gearing than others, whereas in practice this only reflects a different choice between the use of debt or an operating lease.[8]

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6 Net debts: total company debts and liabilities less cash and cash equivalents.

7 We discount the operating leases using use yields on generic BBB-rated, EUR-denominated bonds for European industrial firms. See calculation details in Appendix I.

8 Note that if all firms applied the same approach and uniformly used operating leases, we would not need to worry about this issue. The operating lease would simply be another fixed cost. It is the flexibility to choose between debt and operating leases which creates the potential problem.

Since the method requires the use of a three-year beta, we have examined KPN's gearing level over the period from Q2 2012 to Q1 2015 inclusive. KPN's gearing increased from 58% to 74% in Q1 2013 and has been decreasing afterwards. The three year average ratio is 58%.

The increase in gearing during 2012 was mainly driven by KPN's falling share price. Subsequently, in 2013 KPN raised €4 billion in new equity through a rights issue. KPN used the new equity to pay off debt, with the result that after the rights issue KPN's net debt was 2.4 times EBITDA at the end of 2013, compared to 2.7 times EBITDA at the end of 2012.[9] The sale of E-plus in 2014 further reduced net debt.[10] By Q1 2015 KPN had reached a gearing ratio of 42% (see Figure 2). It seems reasonable to assume that KPN would keep this gearing ratio in future so as to maintain its credit rating at investment grade.[11] Hence, we recommend using 42% as the gearing level for the WACC estimate.

In general we note that KPN's WACC will be relatively insensitive to the assumed level of debt. Assuming a higher degree of debt, and hence giving more weight to the relatively low cost of debt, will be offset by the increase in the cost of equity which results from the higher gearing. Moreover, KPN is allowed its actual cost of debt. A credit downgrade, and an increase in the market cost of KPN's debt, would not affect KPN's actual cost of debt. However, it is conceptually important to choose a level of gearing that is consistent with the assumed credit rating, if only to carry out the financeability test illustrated in Figure 1.

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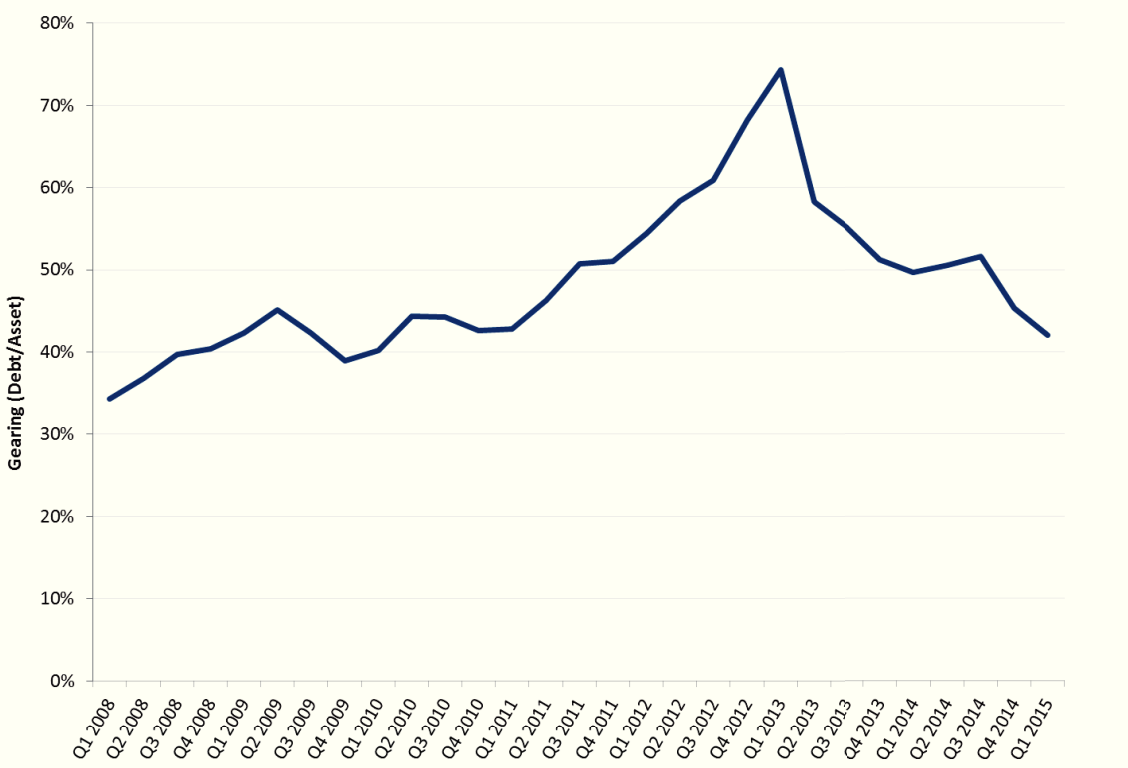
9 KPN 2013 Annual report, p.156.

10 KPN 2014 Annual report, p.22.

11 KPN 2014 Annual report, p.156.

Figure 2: KPN's Gearing Ratio



Source: Bloomberg data, KPN annual reports and Brattle calculations.

II.C. The Risk Free Rate

The methodology specifies a risk-free rate based on a three-year average of the 10 year German and Dutch government bonds. As discussed in our November 2012 report for the ACM,[12] the method uses a simple average between Dutch and German bonds because this reflects a trade-off between choosing a truly risk-free rate on the one hand and considering the extra information that Dutch bonds give about country-risk on the other. Figure 3 below shows the movement of the bond yields over the prior three years. We note that, as a result of the economic crisis and subsequent easing of monetary policy, both the risk-free rate and the spread between Dutch and German 10-year bond yields have declined substantially over the three year reference period.

The three-year average yield is 1.63% for the 10-year Dutch government bond and 1.35% for the 10-year German government bond. This yields a simple average risk-free rate of 1.49%.

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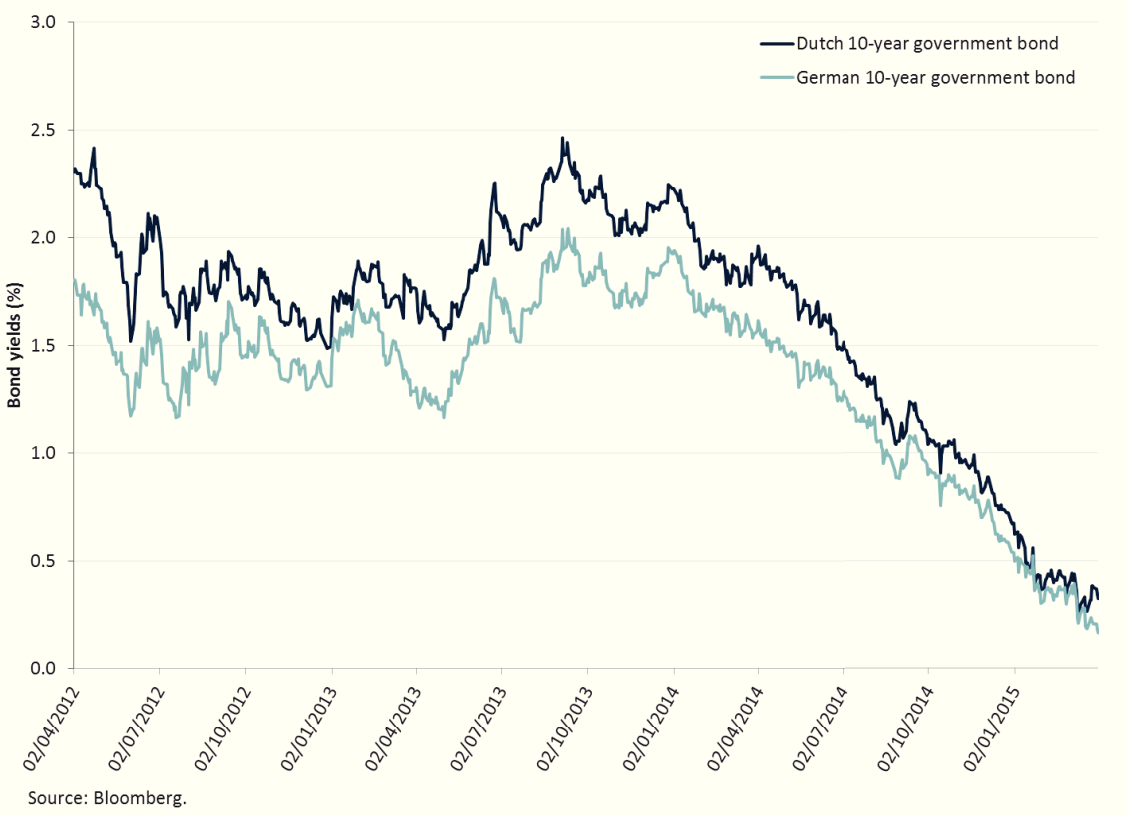
12 Calculating the Equity Risk Premium and the Risk-free Rate, The Brattle Group, Dan Harris, Bente Villadsen, Francesco Lo Passo, 26 November 2012,

Figure 3: Yield on Dutch and German Government 10 Year Bonds



Source: Bloomberg.

II.D. BETA

II.D.1. Market Indices

The method specifies that KPN's beta must be measured as the covariance between the company returns and the returns of an index representing the overall market. We are of the opinion that a hypothetical investor investment in a Dutch firm would likely diversify their portfolio within the single currency zone so as to avoid exchange rate risk. Accordingly, to calculate betas we use a broad Eurozone index for the European companies.[13]

II.D.2. Rolling Beta

The methodology specifies a three year daily sampling period for the beta. By the end of the Q1 2015, the simple Ordinary Least Squares (OLS) three year daily equity beta estimate is 0.69. The average gearing ratio over the three-year period is 58%, and this results in an asset beta of 0.34.[14] This is relatively low compared to the betas of its European peers. In a recent

[13] Euro Stoxx index is used in the analysis.

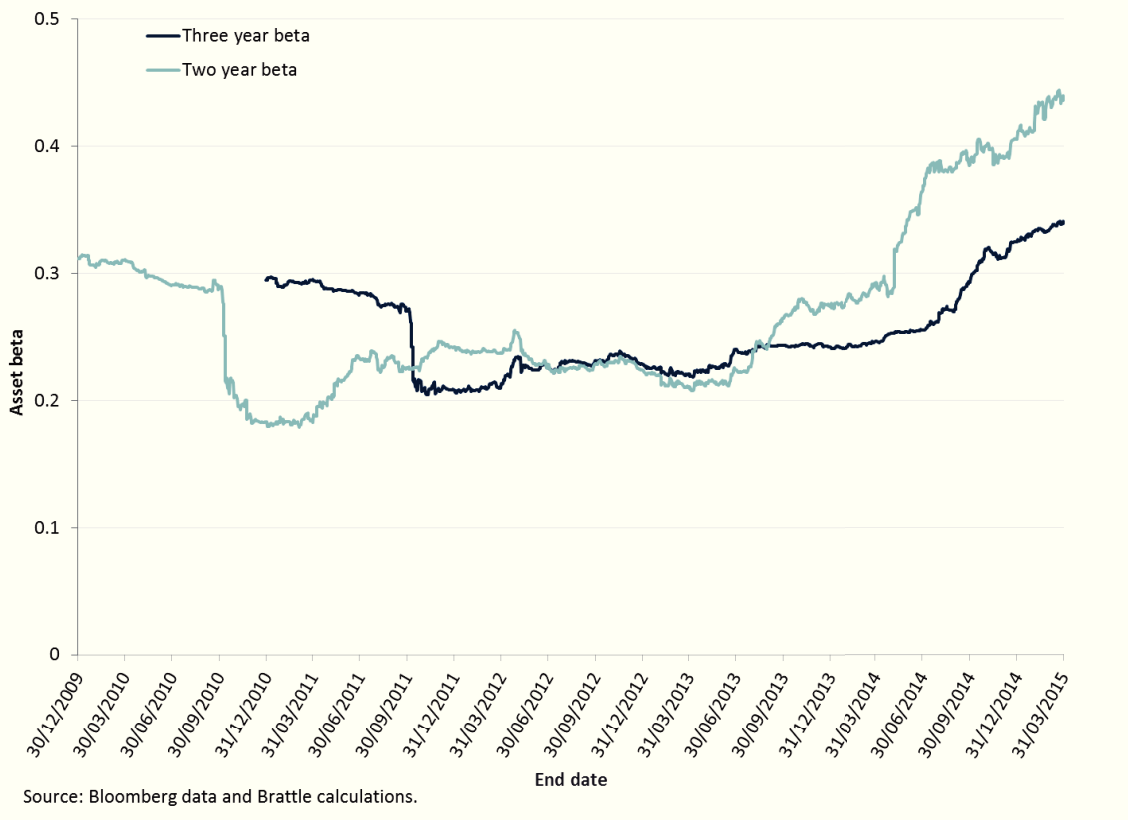
[14] Asset Beta = Equity Beta / (1 + (1-Tax) x Debt / Equity)) = 0.69 / (1+ (1-25%) x 58% / (1-58%)) = 0.34. The average tax rate over the three year period is 25%.

report for Ofcom, the UK telecoms regulator, Brattle estimated that the average asset beta for the UK telecoms firms ranged from 0.58 to 0.67, and for European wireless operators the asset beta ranged from 0.51 to 0.59.[15] Our concern is that KPN's relatively low three-year asset beta low is driven by the tail-end of the financial problems KPN encountered in 2012. In our May 2013 report on the WACC for wholesale broadband, we also concluded that KPN's beta was depressed by its financial difficulties. We noted that KPN's share price would be reacting very strongly to news about the firm's financial health, and would be relatively insensitive to wider macroeconomic news driving the market. This appeared to depress KPN's beta, which was significantly lower that similar telecoms firms. In our May 2013 report, we concluded that the problem was so severe that it was better to estimate KPN's future beta by reference to a group of peers. This resulted in an estimated asset beta of 0.42.

Figure 4 illustrates that our assessment that KPN's beta was depressed by its financial difficulties was correct, as both the two-year and three-year asset betas have increased since May 2013. Figure 4 also shows that the two-year rolling beta is significantly higher than the three-year beta toward the end of the period. In our view, this is because toward the end of the period considered the two-year beta excludes the period of KPN's financial difficulties, and any depressing effects that these had on the beta. Accordingly, we think that in this instance the two-year daily beta gives the best estimate of KPN's expected beta. Using KPN's two-year beta is also better than estimating a beta from a peer group, because KPN's beta reflects its actual mix of businesses. The two-year equity beta as of March 31st 2015 is 0.79, which given the average gearing over the two-year period of 51% results in an asset beta of 0.44, significantly higher than the three-year asset beta of 0.34. Hence, we proceed with the WACC calculation using a two-year (unadjusted) asset beta of 0.44.

[15] The Brattle Group, "Estimates of Equity and Asset Betas for UK Mobile Owners", January 2015, Table 7 and Table 13, assuming zero debt beta.

Figure 4: Two-year and Three-year Rolling Asset Beta



Source: Bloomberg data and Brattle calculations.

II.D.3. Vasicek adjustments

The Vasicek adjustment is a statistical adjustment which aims to avoid extreme estimates of beta, which could be statistically unreliable, by 'pulling' beta estimates toward an estimate of beta that is thought to be more reliable – the 'prior expectation' for beta. The methodology applies the Vasicek adjustments to KPN's observed equity beta. This adjustment takes account of a prior expectation of the equity beta. In this case, we have used a prior expectation of the beta of 1.0, which is the market average. We considered applying the critique of Lally,[16] which among other things argues for using a prior expectation of the beta which is specific to the activity in question. However, we could find no objective way of determining the prior expectation of beta. Accordingly, we have adopted the more neutral assumption of the prior expectation of a prior expectation of beta of 1.0.

The Vasicek adjustment moves the observed beta closer to 1 by a weighting based on the standard error of the beta, such that values with lower errors will be given a higher weighting. The prior expectation of the Beta given in other consultant reports is 1, which we

16 Lally, Martin, *"An Examination of Blume and Vasicek Betas"*. Financial Review, August 1998.

apply here. For the prior expectation of the standard error we use the standard error on the overall market.[17] Table II-2 illustrates the effect of the Vasicek adjustments.

Table II-2: Effect of the Vasicek adjustment

	Simple OLS		Market average		Weighting		Vasicek
	Beta	Standard error	Beta	Standard error	Company beta	Market beta	Beta
	[A]	[B]	[C]	[D]	[E]	[F]	[G]
2 year beta	0.79	0.09	1.00	0.36	94.5%	5.5%	0.80

Notes and sources:
[A], [B]: Stata analysis.
[C], [D]: Assumed.
[E]: [D]^2/([D]^2+[B]^2).
[F]: 1-[E].
[G]: [A]x[E]+[C]x[F].

II.D.4. Un-levering and Re-levering Beta

The two-year equity beta after the Vasicek adjustments is 0.80. This equity beta measures the risk of KPN's equity, which will reflect its financing decisions. As debt is added to the company, the equity will become riskier as, each year, more cash from profits goes towards paying debt instead of distributing dividends to equity. With more debt, increases or decreases in firm profit will have a larger effect on the value of equity. Hence, if two firms engage in exactly the same activity but one firm has a higher gearing, that firm will also have a higher beta than the firm with lower gearing. In Table II-3 we un-lever KPN's beta imagining that the firm is funded entirely by equity. The average gearing for the two-year period is 51%. The resulting beta is referred to as an asset beta or an unlevered beta. To accomplish the un-levering, the methodology specifies the use of the Modigliani and Miller formula.[18] This results in an asset beta for KPN of 0.45. We note that this asset beta is slightly higher than our previous estimate of 0.42, but lower than the average for the peer group identified in the work for Ofcom.

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[17] The standard error on the FTSE 100 index is used as a proxy for the standard error of the European market, and is reported by the LBS. Valueline reports the standard deviation of all stocks in the US market.

As we are using the market average beta for our prior expectation, it is consistent to use the standard deviation of the distribution of the betas underlying the market population as the prior expectation of the standard error.

[18] The specific construction of this equation was suggested by Hamada (1972) and has three underlying assumptions: A constant value of debt; a debt beta of zero; that the tax shield has the same risk as the debt.

We then re-lever the asset beta, using the expected future gearing of KPN of 42%. Table II-3 illustrates that this results in an equity beta for KPN of 0.69.

Table II-3: Re-levering KPN's beta

Equity beta	[1]	Section II.D.3	0.80
Gearing (D/A)	[2]	See note	51%
Gearing (D/E)	[3]	[2]/(1-[2])	104%
Tax rate	[4]	KPMG	25%
Asset beta	[5]	[1]/(1+(1-[4])x[3])	0.45
Forecast gearing (D/A)	[6]	Setion II.B	42%
Forecast gearing (D/E)	[7]	[6]/(1-[6])	72%
Forecast equity beta	[8]	[5]x(1+(1-[4])x[7])	0.69

Notes and sources:
[2]: This is based on KPN's market value, which is calculated using Bloomberg data. Average gearing ratio over the period of Q2 2013 to Q1 2015.

II.E. The Equity Risk Premium

The methodology specifies a 'European' ERP. That is, it uses an ERP based on the excess return of stocks over bonds for the major economies of Europe, rather than the ERP based on only the excess return of shares in the Netherlands. More specifically, the methodology uses the simple average of the long-term arithmetic and geometric ERP as the anchor for the ERP estimate. We also present evidence on the long-term ERP in Europe using both the arithmetic and geometric realised ERP.

Table II-4 illustrates the realised ERP derived from the Dimson, Marsh and Staunton (DMS) study for individual European countries.[19] This report contains ERP estimates using data up to and including 2014. Table II-4 also shows the simple and weighted average ERP for the Eurozone. All the ERPs are calculated relative to long-term bonds and the weighting is based on current market-capitalisation of each country's stock market. Hence, the ERPs of larger markets are given more weight, assuming that a typical investor would have a larger share of their portfolio in countries with more investment opportunities.

[19] E. Dimson, P. Marsh, and M. Staunton, *Credit Suisse Global Investment Returns Sourcebook 2015* (DMS), Table 10.

Table II-4: Historic Equity Risk Premium Relative to Bonds: 1900 – 2014

		Risk premiums relative to bonds, 1900 - 2014				
		Geometric mean % [A]	Arithmetic mean % [B]	Average % [C]	Standard Error % [D]	2014 market cap $million [E]
Austria	[1]	2.50	21.50	12.00	14.40	100,169
Belgium	[2]	2.30	4.40	3.35	2.00	374,059
Denmark	[3]	2.00	3.60	2.80	1.70	336,052
Finland	[4]	5.10	8.70	6.90	2.80	198,544
France	[5]	3.00	5.30	4.15	2.10	1,935,091
Germany	[6]	5.00	8.40	6.70	2.70	1,837,847
Ireland	[7]	2.60	4.50	3.55	1.80	140,411
Italy	[8]	3.10	6.50	4.80	2.70	561,295
The Netherlands	[9]	3.20	5.60	4.40	2.10	398,313
Norway	[10]	2.30	5.30	3.80	2.60	241,172
Portugal	[11]	2.60	7.40	5.00	3.10	61,381
Spain	[12]	1.90	3.90	2.90	1.90	724,418
Sweden	[13]	3.00	5.30	4.15	2.00	664,775
Switzerland	[14]	2.10	3.60	2.85	1.60	1,572,441
United Kingdom	[15]	3.70	5.00	4.35	1.60	3,670,080
Europe	[16]	3.10	4.40	3.75	1.50	
World	[17]	3.20	4.50	3.85	1.40	
Average Eurozone	[18]	3.13	7.62	4.78		
Value-weighted average Eurozone	[19]	3.48	6.48	4.98		

Notes and sources:
[A], [B], [D]: Credit Suisse Global Investmentmet Returns Sourcebook 2015, Table 10.
[C]: ([A]+[B])/2.
[18]: Average [1], [2], [4], [5], [6], [7], [8], [9], [11], [12].
[19]: Weighted average [1], [2], [4], [5], [6], [7], [8], [9], [11], [12] by [E].

Looking at Table II-4 the simple average of the arithmetic and geometric ERP for the period 1900 to 2015 was 3.8% if all of Europe is included, and 4.8% if only Eurozone countries are included. The very low ERP in Denmark and Switzerland in particular lower the simple average ERP for all of Europe. Using the market size to weight the averages for all of Europe, the ERP for the Eurozone is 4.98%, which we round up to 5.0%. These figures reflect the very long run and notably exclude countries in former Eastern Europe. As discussed in the previous section, we use the ERP for the Eurozone, since a Dutch investor is more likely to be diversified over the same currency zone, rather than to incur additional currency risks by diversifying within Europe but outside of the Euro zone.

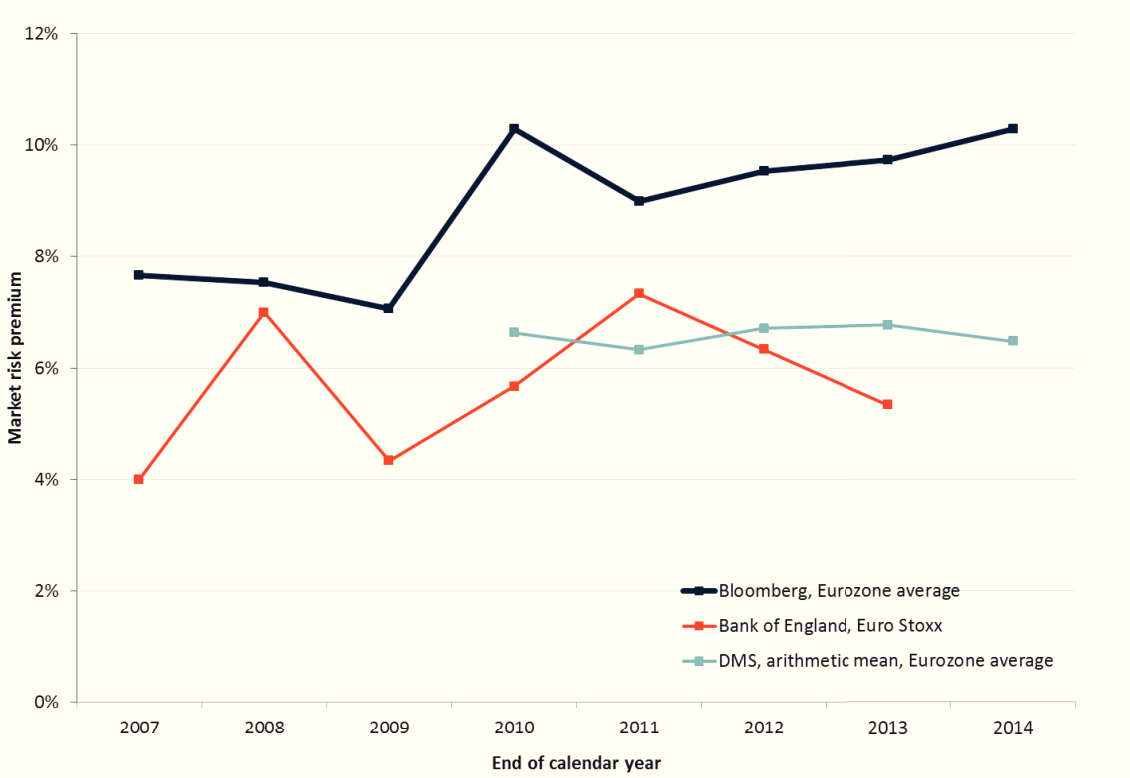
The methodology asks us to also take into account ERP data derived from Dividend Growth Models. We have obtained and constructed two ERP estimates based on Dividend Growth Models.[20,21] The Bloomberg estimate shows that the ERPs have been increasing for the past four years. The ERP forecast by Bloomberg is currently above the historically realised ERP at

[20] Bloomberg provides market premium by country relative to the ten year government bonds. We weight the premium by the market capitalization at the end of each calendar year.

[21] Bank of England, "Financial Stability Report," November 2013, Chart 1.6.

a little over 10%. The Bank of England (BoE) estimates, on the other hand, have been decreasing. The final estimate available was below the historically realized ERP.

Figure 5: Eurozone Equity Risk Premiums by Year



Source: Bloomberg, Bank of England Nov-13 FSR, various DMS reports and Brattle calculations.

Hence, the trend and magnitude of the ERP based on DGM evidence seems to be contradictory. However, given the state of the Eurozone economies, we find it unlikely that the ERP has decreased materially since our June 2013 report. Therefore, it still seems reasonable not to make any of the downward adjustments that DMS recommend applying to the historical average ERP, to convert the historical data into an expected, forward-looking ERP. DMS in essence argue that several factors mean that the historic outturn realised ERP is likely to overestimate the future ERP, because several events occurred to increase the outturn ERP which will not happen again. These events include the favourable resolution of many risks that were present in the last century, which led to unusually high real dividend growth rates, the reduced risk of holding shares due to advances in technology which made diversification easier, real exchange rate gains which would not be expected to be repeated. Correcting for these factors, DMS estimate that the expected arithmetic average ERP over bills would be 4.5-5%, rather than the observed world ERP of 5.7% over bills, a reduction of

between 70 and 120 basis points.[22] If we instead take the 'raw' historical ERP estimates over long-term bonds, we obtain a Eurozone average ERP of 5.0%.

II.F. INFLATION

The methodology requires the estimation of a real WACC, by converting the nominal WACC to a real WACC using an estimate of inflation. The methodology requires that inflation consider both historic and forecast rates of inflation in the Netherlands and Germany.

Historical inflation over the prior three years amounts to 0.9% for Germany and 1.0% for the Netherlands.[23] This period matches the time horizon used for averaging the risk free rate, which may be useful as the bond yields will have inherent assumptions on the inflation expectations of the market.

Euro-area inflation predictions are provided by the ECB, which are based on a survey of professional forecasters. The short term prediction is 1% for one year head, 1.4% for two years ahead, and 1.8% for five years ahead.[24]

The Dutch Central Planning Bureau also provides forecasts of inflation rates for the Netherlands: the predicted inflation for is -0.1% and 0.9% for 2015 and 2016 respectively.[25] The Bundesbank provides a forecast for Germany of 1.1% and 1.8% for 2015 and 2016 respectively.[26]

Based on the considerations above, we use an inflation rate of 1.5%. This is the mid-point between the historical inflation and the longer term forecast.

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22 See Credit Suisse Global Investment Returns Sourcebook 2015 section 2.6 p.33.

23 Eurostat, annual rate of change for HICP.

24 ECB, inflation forecasts for 2015 Q2.

25 CPB, "Main economic indicators: most recent forecasts 2013-2016", 5 March 2015.

26 Bundesbank, "New Bundesbank projection: German economy remains in good shape", 05 December 2014.

II.G. Summary Of KPN WACC

Table 10 illustrates the overall calculation of KPN's WACC obtained by combining the parameters in the previous sections. We apply the marginal corporate tax rate for the Netherlands, which in 2014 is 25%, to arrive at a real pre-tax WACC of 4.49%.

Table II-5: Current WACC for KPN

2014 tax rate	[1]	25.00%	KPMG corporate tax table
Debt/Asset	[2]	42.00%	Section II.B
Debt/Equity	[3]	72.41%	[2]/(1-[2])
Asset beta	[4]	0.45	Section II.D
Equity beta	[5]	0.69	[4]x(1+(1-[1])x[3])
Risk free rate	[6]	1.49%	Section II.C
ERP	[7]	5.00%	Section II.E
After-tax cost of equity	[8]	4.96%	[6]+[5]x[7]
Pre-tax cost of debt	[9]	5.30%	Section II.A
Nominal after-tax WACC	[10]	4.54%	(1-[2])x[8]+[2]x(1-[1])x[9]
Nominal pre-tax WACC	[11]	6.06%	[10]/(1-[1])
Inflation	[12]	1.50%	Assumed
Real pre-tax WACC	[13]	4.49%	(1+[11])/(1+[12])-1

III. WACC For The Fibre-To-The-Home

Fibre-to-the-Home (FttH) access allows telecom operators to rent the KPN fibre network at a wholesale level to provide broadband services to residential customers. The main difference between FttH and standard broadband is that FttH allows the retail service provider to sell a much faster 'ultra-broadband' service with download speeds of up to 1 GB/s.

In our May 2013 report we noted that the WACC for FttO is likely to be higher than the WACC for wholesale broadband (KPN's WACC), because of the higher ratio of fixed to variable costs (so called operating leverage) in a newer fibre network relative to a mature copper network.

The higher proportion of fixed costs is because the fibre networks require high levels of investment relative to a mature copper network. Hence, as the level of fixed investments increase, the sensitivity of equity cash flows to revenue increases, and this in turn increases beta and hence the cost of equity. The issue of high operating leverage will also apply to FttH networks, which also require large fixed investments.

However, there are reasons to think that FttH may have even higher systematic risk than FttO, because of the type of area where the network is deployed or rolled out. In a residential area the network is largely rolled-out on the basis of 'demand bundling' and it is referred to as FttH. For FttO, the network is in many cases built following a specific request received directly from the business customer willing to receive the ultra-broadband services.

Because the roll-out of FttH networks anticipates the demand for services from residential customers, whereas FttO is often built following proven demand, FttH could be a more risky and speculative investment than FttO. In essence, operators invest 'pre-emptively' in FttH based on anticipated demand, but an economic downturn could mean that the demand is not realized, or materializes more slowly than anticipated. To the extent that the economic downturn affects all assets in the market, and is therefore systematic, this would raise the beta of FttH activities relative to FttO.

Hence, the FttH activity may have a higher systematic risk than both wholesale broadband services provided over a copper network *and* FttO activity. Because of this potential difference ACM have asked us to estimate a separate WACC for the FttH activity.

III.A. The Search for an FttH Peer Group

To calculate a specific WACC for FttH services, we have first investigated if it is possible to find one or more listed firms that earn the majority of their revenue from FttH activities – that is a 'pure play' FttH operator. If such firms exist, we could then estimate a beta for the FttH activity directly from their share prices. To find a 'pure play' FttH operator – or an approximation thereof – we have reviewed the annual reports and quarterly presentations of 27 listed telecommunications companies worldwide to find the percentage of revenues and EBITDA from FttH activities.[27] We find that only some companies report the detail of their FttH revenues, and of these none were a significant percentage of the total. Most companies did not break out earnings from FttH activity at all. Hence we are not able to identify a pure-play FttH operator.

This also means that techniques such as 'beta decomposition' will not work. Beta decomposition tries to estimate the beta of a pure-play FttH operator by plotting betas against the percentage of earnings from FttH. By extrapolating the line, who could in theory estimate

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[27] We reviewed the 24 companies analysed in our May 2013 report (see Appendix II) and have expanded our sample to Verizon in USA, Etisalat in United Arab Emirates and NTT in Japan.

the beta of an operator which obtains 100% of their earnings from FttH. However, in reality there is insufficient data on FttH earnings available. Moreover, given the changing percentage of FttH earnings over time, and the need to estimate betas over a three-year period, the betas will not be sufficiently stable to perform this kind of exercise even if earnings data was available.

The absence of significant revenues from FttH can likely be attributed to the early stage of deployment of fibre networks, especially in Europe, where a 50% broadband penetration rate (including both copper and fibre) is envisaged in 2020 accordingly to the European Digital Agenda.[28] This means that even while some companies are investing in fibre networks, their fibre revenues and profits are very small compared to copper business and mobile activity. More common ways of identifying revenues in company reports are as fixed-line and mobile, or by the type of service provided, such as voice, broadband and TV.

As an alternative to finding a peer group from which we can estimate a beta, we have investigated reasonable ways to modify the KPN's WACC to make it suitable for the FttH activity. We discuss possible adjustments below.

III.B. Precedent from Regulatory Decisions

According to the European Commission Recommendation on regulated access to Next Generation Access Networks,[29] when setting access prices to the unbundled fibre loop, National Regulatory Authorities (NRAs) should include a higher risk premium to reflect any additional and quantifiable investment risk incurred by the incumbent operator.

The European Commission also set out the principles that NRAs should follow in defining the adequate risk premium. Investment risk should be rewarded by means of a risk premium incorporated in the cost of capital:[30]

"*NRAs should estimate investment risk inter alia by taking into account the following factors of uncertainty:*

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28 Source: Digital Agenda for Europe, Pillar n. IV, "Fast and ultra-fast internet access", May 2010.

29 Commission Recommendation of 20/09/2010, SEC 1037, par. 4.

30 Commission Recommendation of 20/09/2010, SEC 1037, par. 6.

(i) uncertainty relating to retail and wholesale demand; (ii) uncertainty relating to the costs of deployment, civil engineering works and managerial execution; (iii) uncertainty relating to technological progress; (iv) uncertainty relating to market dynamics and the evolving competitive situation, such as the degree of infrastructure-based and/or cable competition; and (v) ***macro-economic uncertainty****…*

…Criteria such as the existence of economies of scale (especially if the investment is undertaken in urban areas only), high retail market shares, control of essential infrastructures, OPEX savings, proceeds from the sale of real estate as well as privileged access to equity and debt markets are likely to mitigate the risk of NGA investment for the SMP operator".

As of today, only France, Spain, Italy and Lithuania have implemented the European Commission Recommendation on the definition of a WACC premium for FttH services and defined a premium for fibre services on top of the standard 'copper WACC'.[31] Risk premiums for FttH are 5.0% in France, 4.81% in Spain and 4.4% in Italy.[32] Lithuania does not disclose the size of the fibre WACC premium it applies.

Values in France and Lithuania seem to have been defined as a pure incentive for fibre without detailed calculations on the magnitude of systematic risk. However, in Spain and Italy the NRAs have calculated the risk premium by taking into account the specific risks identified by the European Commission. Both analyses use a financial model of an FttH business to estimate the effect of investment risks on FttH profitability.

Specifically, Spain estimates the risk premium as the difference between the Internal Rate of Return (IRR) of an FttH project and the IRR of less risky ADSL broadband services. The IRR calculation follows a Montecarlo simulation where the NRA has varied 50,000 times the main inputs of the project such as: i) cumulative demand of fibre and ADSL services; ii) capital and

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[31] Note that we have seen reported in some sources that OPTA (now ACM) applies a 3.5% premium for fibre services. This is not correct – rather, there is a 3.5% 'headroom' allowance on the IRR, in case actual revenues exceed the planned revenues. If the excess return is over 3.5%, then prices must be reduced.

[32] All premiums are expressed in nominal pre-tax terms with the exception of the Italy that considers real pre-tax values. Risk premium for Italy at 4.4% is calculated by adding the expected inflation reported by Agcom (1.2%) to the real pre-tax premium of 3.2% (using the Fisher Formula). Source: Agcom's consultation 42/15/CONS, table 29 at pag. 129

operating expenditures, iii) market share of incumbent operator, iv) retail prices for fibre and ADSL services.[33]

Italy estimates the risk premium by using an approach consistent with the theoretical framework of the real option. The Italian Regulator built a stylized profitability model for an investment in FttH and use a Montecarlo simulation to vary three key variables: i) fibre demand; ii) average revenue per users (ARPU), iii) capital and operating expenditures.

The risk premium rewards two options:

- "Wait and see": an investor in FttH can decide to postpone the investment in order to have more information (and less risk) on the expected demand, hence obtaining a higher IRR of the project (according to the assumptions in the model). The increase in the IRR which results from waiting to invest is the risk premium for FttH;
- "Flexibility": the incumbent is regulated at wholesale level and after the investment is exposed to the opportunistic behaviours of alternative operators (OLOs). If the real demand for FttH is lower than expected, OLOs can rely on copper and the incumbent bears all the risk of the sunk investment. The risk premium also considers that the incumbent and OLO can share the investment risk, by signing long term contracts. Hence, the Italian Regulator simulates a trend in the risk premium linked to the length of the hypothetical long term contract for fibre services, and the percentage of the costs the OLO pays upfront.

As we noted above the Spain and Italy decisions seem to have considered also some kind of systematic risk in their calculations. The macroeconomic risks (i.e. GDP, income) in their analysis can be considered as a proxy of the systematic risk and embedded in the demand uncertainty of fibre service and the level of the retail price of the service.

However, the Commission's guidelines is that the risks that the premium is compensating for include non-systematic risks. That is, it is for risks that an investor could diversify by investing in many different projects. For example, the risk that a fibre project could experience cost overruns could be diversified, by investing in a portfolio of projects. The cost

[33] Source: CMT Resolución sobre el procedimiento de cálculo de la prima de riesgo en la tasa de retorno nominal para servicios mayoristas de redes de acceso de nueva generación (MTZ 2012/2155).

of equity should only reflect systematic risk – that is, risks that cannot be diversified – and that other risks should be accounted for by giving an uplift to the allowed cash flows.[34]

The ACM allows a 3.5% margin or headroom for KPN, meaning that the realised return can exceed the expected return by 3.5% without KPN having to reduce its prices. The 3.5% margin therefore partly compensates KPN for the risk that the return could be less than expected due to non-systematic risk factors by allowing KPN to keep some of the excess return when it is higher than expected. Applying the 3.5% margin as well as giving an uplift to the WACC would result in a 'double counting' of the non-systematic risks for KPN.

In this report we are aiming to estimate a WACC for FttH that is directly comparable to KPN's WACC, and which covers only systematic risk. In the next section we consider what effect investment in fibre will have on the systematic risk of a firm.

III.C. FttH WACC In the DCF Model

To test whether the FttH WACC premia applied by other NRAs seem reasonable for the Netherlands, we have used KPN's DCF model (the DCF model). This is a financial model of an FttH investment in the Netherlands, and simulates capital investments, the rate of fibre network build out and take-up, operating costs and revenues for the period 2008 to 2032. By varying the parameters in the model, we can investigate the effect on the IRR of an FttH investment, and hence the increase in the WACC that might be required to compensate.

As a starting point we have reviewed the annual reports and quarterly presentations of incumbent telecoms operators in Spain, Portugal, Italy and France in order to verify if there is a clear relationship between the macroeconomic conditions – for example GDP and income – and the demand for FttH post 2008 economic downturn. We could then simulate the effect of an economic downturn on an FttH investment in the Netherlands, and calculate the effect on the project's IRR.

However, we were unable to find evidence of the relationship between the economic crisis and the take-up of FttH services in annual reports. This is because the operators do not seem to report their results at this level of detail. The geographic diversification of the operators, where a significant portion of their earnings comes outside Europe and especially in emerging

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[34] See for example R.A. Brealey & S.C. Myers, *Principles of Corporate Finance*, Fifth International Edition, p. 972. Professor Myers is a Principal of *The Brattle Group*.

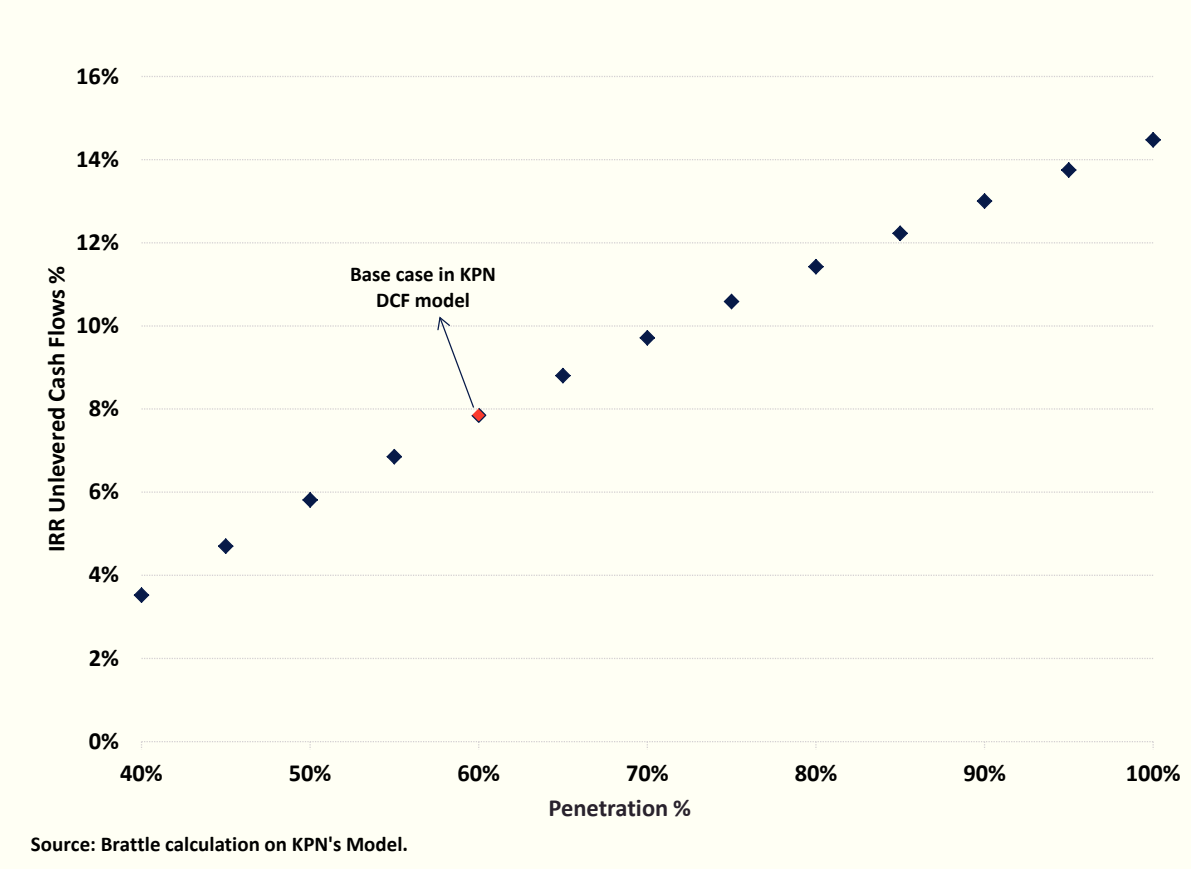
countries in Latin America, as well as the relatively small revenue contribution from FttH may explain why the operators do not report the outcome of their FttH investments in detail.

Notwithstanding this, as noted above NRAs in Spain and Italy do consider that FttH has a higher systematic risk than copper broadband or FttC, because systematic changes in macroeconomic conditions (i.e. GDP, income) will affect the demand for and profitability of FttH services. Hence, we have used the DCF model to investigate what would need to change in the model to reduce the IRR by around 4.5 percentage points, this being in the middle of the range of the FttH premia granted by other NRAs.

We have developed scenarios in the DCF model which reduce the IRR of the FttH investment by about 4.5 percentage points. The key variable in our simulations is the demand for FttH services expressed by the 'adoption rate' of active customers – that is, the percentage of customers connected to fibre who actually subscribe to the FttH service. Based on discussions with the ACM, we consider that the fibre investment program, so both capital and fixed operating costs – are fixed and would not vary with the adoption rate. Hence, lower adoption rates reduce the project IRR because costs are fixed while revenues and free cash-flows from operations are lower than expected.

Figure 6 below illustrates the relationship between the adoption rates and the project IRR in the DCF model. The trend in the demand of FttH services is the same in all simulations and the maximum penetration rates are reached in 2027.

Figure 6: Adoption rates and IRR



Source: Brattle calculation on KPN's Model.

The base case in the DCF model envisages an adoption rate of 60% from 2027 onwards with a notional project IRR of 7.85%.[35] As illustrated in Figure 6 we find a linear trend, where for every 5% increase (decrease) in penetration rates the IRR increases (decreases) by around 1%. Hence to reduce IRR of the FttH investment by around 4.5 percentage points the penetration rate from 2027 onwards must be 40%, this being 20 percentage points below the base case in the DCF model. Hence, a reduction in the adoption rate of 20 percentage points decreases the project IRR from 7.85% (base case) to 3.5%.

A reduction of 20 percentage points of adoption rate may be possible, but it is less clear to what extent this is a systematic risk – that is, it is a risk associated with the wider market. It seems intuitive that in an economic downturn consumers may save money by switching to a

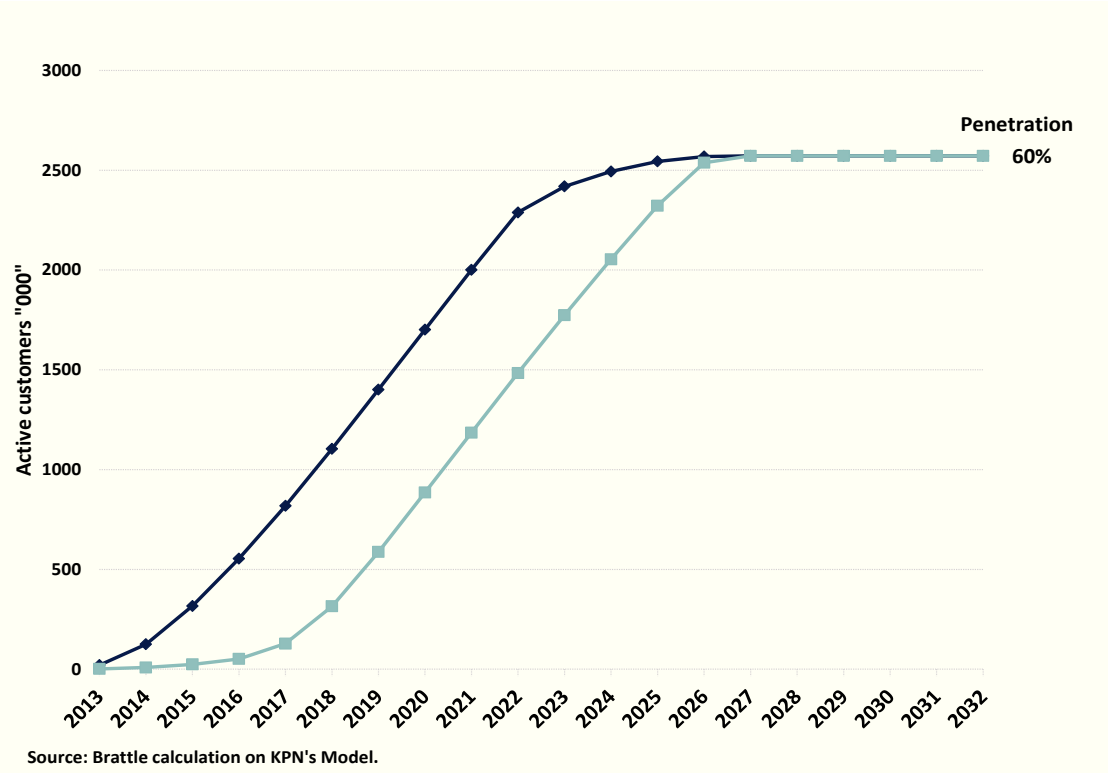
[35] We understand that 7.85% is not the actual IRR that KPN is expected to earn on its FttH investments. However, the relationship between the change in the IRR and the change in the penetration rate – which is what we are interested in measuring in this context – is not sensitive to the initial IRR. Therefore we are confident that our results would not change significantly if we started from KPN's actual expected IRR.

slower internet service, or not taking up the faster FttH service. If economic activity and incomes are higher consumers may have a higher willingness to spend on FttH services. Hence the adoption rate will depend in part of wider systematic economic conditions. But a lower than expected adoption rate could also mean that FttH operators overestimated consumers' willingness to pay for a faster FttH service, relative to other slower internet services. This mis-estimation of demand could occur regardless of economic conditions.

Moreover, we imagine that if adoption rates are consistently lower than expected, the FttH operator may be able to mitigate the reduction in IRR by reducing or postponing the capital expenditures after the end of the crisis, or at least focusing on geographic areas with higher adoption rates.

An alternative scenario is to suppose that the demand of FttH is postponed by about three years due to the economic downturn, but the maximum penetration rate from 2027 is always 60% as in the base case. Figure 7 reports the comparison between the demand in the base case and in the alternative scenario.

Figure 7: Active customers (Base case vs postponed take-up)



Source: Brattle calculation on KPN's Model.

The scenario of a three year delay due to a crisis seems more clearly consistent with systematic risk, since the final adoption rate – which depends on inherent consumer preferences – remains unchanged. Table III-1 shows that a delay in demand reduces the IRR by 1.87%, or around two percentage points, compared to the base case.

Table III-1: Change in IRR in case of delayed demand

			Penetration rate	
	Notes	%	Scenario 60% (Base Case) [A]	Take-up of 60% postponed [B]
IRR Unlevered Cash Flows	[1]		7.85%	5.98%
Change in IRR	[2]	-1.87%		

Notes and Sources:
Brattle calculation on KPN's Model.

However, we note that this reduction in the IRR only occurs if there is an economic downturn within the regulatory period. The expected IRR value is actually the weighted average of the IRR in the case of a delay in demand and the IRR without a delay. For example, if we assess a reduction in demand scenario as occurring with a 50% probability, then the expected reduction in the IRR is 50% of 2%, or 1%.

On the other hand, as discussed above we recognise that FttH has higher systematic risks than FttO. In our May 2013 report we recommended a premium of one percentage point over copper broadband for FttO. The risks we investigate in this report are over and above the risk of FttO. This is because FttH shares the same additional risks we identified for FttO, such as increased operating leverage because of the large investments required, but it has additional risks over and above the FttO risks. Hence, the 1 percentage point premium that results from the risk of delayed take up due to an economic crisis should be added onto the 1 percentage point FttO premium.

Given the analysis above, an FttH premium of two percentage points above the KPN WACC seems reasonable, and if anything is likely to overestimate the actual systematic risk premia required if the chance of an economic crisis in the next regulatory period is less than 50%. However, in our view the consequences of underestimating the risk premium are worse than the consequences of overestimating it. This is because an underestimation could delay investment in FttH, thereby delaying the realisation of the EU's Digital Agenda with the associated benefits, whereas we understand that KPN does face some pricing constraints – not last from its own copper broadband service – and may not charge the maximum price possible in any case.

We observe that our estimation is lower than FttH premia recommended by the other NRAs. However, this is because their premia include both systematic and non-systematic risk while our exercise is to quantify only the systematic risk related to the FttH activity.

APPENDIX I – Details On KPN's Leverage

Table appendix I-1: Calculation of Operating Lease Leverage

Operational lease as of 31-Dec-2011												**Notes and sources:**
Due period	[1]		< 1 yr	1-5 yrs	> 5 yrs							
Operational lease €million	[2]		457	831	934							p 131, 2011 Annual report of KPN
Years to payment due	[3]		1	2	3	4	5	6	7	8	9	10	[2]. year 1 takes lease amount for less than 1 year; year 2 to 5 takes lease amount for 1 to 5 years, divided by 4; year 6 to 10 takes lease amount for more than 5 years, divided by 5.
Projected payments €million	[4]		457	207.75	207.75	207.75	207.75	186.8	186.8	186.8	186.8	186.8	
Averaging period: start	[5]		01/12/2011										
Averaging period: end	[6]		31/12/2011										
Cost of debt	[7]		2.12%	2.66%	3.21%	3.69%	4.15%	4.36%	4.57%	4.45%	4.54%	4.59%	Average yields for BBB rated industrial bonds, denominated in euros for the period between 01-12-2011 and 31-12-2011.
Discount factor	[8]		97.92%	94.88%	90.95%	86.52%	81.62%	77.41%	73.13%	70.58%	67.08%	63.84%	1/(1+[7])^[3]
Discounted Cash Flows €million	[9]		447	197	189	180	170	145	137	132	125	119	[4]x[8]
Present Value of Commitment €million	[10]	1,840											Sum [9]
Operational lease as of 31-Dec-2012												**Notes and sources:**
Due period	[11]		< 1 yr	1-5 yrs	> 5 yrs							
Operational lease €million	[12]		527	1029	928							p.142, 2012 Annual report of KPN
Years to payment due	[13]		1	2	3	4	5	6	7	8	9	10	[12]. year 1 takes lease amount for less than 1 year; year 2 to 5 takes lease amount for 1 to 5 years, divided by 4; year 6 to 10 takes lease amount for more than 5 years, divided by 5.
Projected payments €million	[14]		527	257.25	257.25	257.25	257.25	185.6	185.6	185.6	185.6	185.6	
Averaging period: start	[15]		01/12/2012										
Averaging period: end	[16]		31/12/2012										
Cost of debt	[17]		0.62%	1.05%	1.28%	1.65%	2.05%	2.24%	2.42%	2.60%	2.88%	3.13%	Average yields for BBB rated industrial bonds, denominated in euros for the period between 01-12-2012 and 31-12-2012.
Discount factor	[18]		99.39%	97.94%	96.25%	93.66%	90.35%	87.58%	84.59%	81.44%	77.47%	73.49%	1/(1+[17])^[13]
Discounted Cash Flows €million	[19]		524	252	248	241	232	163	157	151	144	136	[14]x[18]
Present Value of Commitment €million	[20]	2,248											Sum [19]
Operational lease as of 31-Dec-2013												**Notes and sources:**
Due period	[21]		< 1 yr	1-5 yrs	> 5 yrs							
Operational lease €million	[22]		203	462	272							p.165, 2013 Annual report of KPN
Years to payment due	[23]		1	2	3	4	5	6	7	8	9	10	[22]. year 1 takes lease amount for less than 1 year; year 2 to 5 takes lease amount for 1 to 5 years, divided by 4; year 6 to 10 takes lease amount for more than 5 years, divided by 5.
Projected payments €million	[24]		203	115.5	115.5	115.5	115.5	54.4	54.4	54.4	54.4	54.4	
Averaging period: start	[25]		01/12/2013										
Averaging period: end	[26]		31/12/2013										
Cost of debt	[27]		0.74%	0.97%	1.31%	1.71%	2.06%	2.35%	2.63%	2.89%	3.16%	3.47%	Average yields for BBB rated industrial bonds, denominated in euros for the period between 01-12-2013 and 31-12-2013.
Discount factor	[28]		99.27%	98.09%	96.17%	93.44%	90.29%	87.00%	83.38%	79.61%	75.58%	71.12%	1/(1+[27])^[23]
Discounted Cash Flows €million	[29]		202	113	111	108	104	47	45	43	41	39	[24]x[28]
Present Value of Commitment €million	[30]	854											Sum [29]
Operational lease as of 31-Dec-2014												**Notes and sources:**
Due period	[31]		< 1 yr	1-5 yrs	> 5 yrs							
Operational lease €million	[32]		171	397	263							page 167, 2014 Annual report of KPN
Years to payment due	[33]		1	2	3	4	5	6	7	8	9	10	[32]. year 1 takes lease amount for less than 1 year; year 2 to 5 takes lease amount for 1 to 5 years, divided by 4; year 6 to 10 takes lease amount for more than 5 years, divided by 5.
Projected payments €million	[34]		171	99.25	99.25	99.25	99.25	52.6	52.6	52.6	52.6	52.6	
Averaging period: start	[35]		01/12/2014										
Averaging period: end	[36]		31/12/2014										
Cost of debt	[37]		0.36%	0.49%	0.62%	0.74%	0.89%	1.04%	1.19%	1.33%	1.47%	1.63%	Average yields for BBB rated industrial bonds, denominated in euros for the period between 01-12-2014 and 31-12-2014.
Discount factor	[38]		99.02%	99.02%	98.17%	97.08%	95.68%	93.99%	92.06%	89.99%	87.73%	85.05%	1/(1+[37])^[33]
Discounted Cash Flows €million	[39]		169	98	97	96	95	49	48	47	46	45	[34]x[38]
Present Value of Commitment €million	[40]	792											Sum [39]

Table appendix I-2: KPN's Debt and Gearing

			Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Average 2- year	Average 3-year
Share price	€/share	[1] Bloomberg	7.49	6.79	4.83	3.41	1.90	2.06	2.36	2.63	2.62	2.47	2.53	2.89		
Shares outstanding	million	[2] Bloomberg	1,431.52	1,431.52	1,431.52	1,431.52	4,270.25	4,270.25	4,270.25	4,270.30	4,270.25	4,270.30	4,270.25	4,270.25		
Market capitalization	€million	[3] [1]x[2]	10,718.22	9,722.37	6,918.32	4,888.07	8,122.57	8,817.95	10,064.52	11,248.11	11,168.85	10,536.71	10,810.82	12,358.86		
Net debt	€million	[4] Bloomberg	12,961.00	13,016.00	12,610.00	12,277.00	9,803.00	9,638.00	9,718.00	10,275.00	10,584.00	10,419.00	8,165.00	8,165.00		
PV of oprating lease	€million	[5] See note	2,044.01	2,145.78	2,247.55	1,899.14	1,550.72	1,202.31	853.90	838.53	823.16	807.79	792.42	792.42		
Net debt adj. for lease	€million	[6] [4]+[5]	15,005.01	15,161.78	14,857.55	14,176.14	11,353.72	10,840.31	10,571.90	11,113.53	11,407.16	11,226.79	8,957.42	8,957.42		
Enterprise value	€million	[7] [3]+[6]	25,723.24	24,884.15	21,775.88	19,064.21	19,476.29	19,658.26	20,636.42	22,361.63	22,576.01	21,763.50	19,768.24	21,316.29		
Gearing (Debt/Equity)		[8] [6]/[3]	140.0%	155.9%	214.8%	290.0%	139.8%	122.9%	105.0%	98.8%	102.1%	106.5%	82.9%	72.5%	103.8%	135.9%
Gearing (Debt/Asset)		[9] [8]/(1+[8])	58.3%	60.9%	68.2%	74.4%	58.3%	55.1%	51.2%	49.7%	50.5%	51.6%	45.3%	42.0%	50.9%	57.6%

Notes and sources:

[5]: Calculated from operating lease reported in various ARs. Split the yearly change equally to derive quarterly values.

APPENDIX II – FttH Peer Group Analysis

Table II-1: Revenues breakdown by activities for selected peers

Firm		Listed	NGA Technology	Total Revenue	Openreach	BT Global Services	Broadband	Fiber	Video	Fixed Telephony	Telephony	Fixed Network	TV	Internet and Phone business	Telecoms	Mobile	Other	Fixed Telephony, Internet and TV	Pay TV	Audiovisuals	Pay TV, Broadband and Voice	Satellite and TV distribution	Cable TV	Wholesale	Retail	Solution Services	Total
BT, £ million	[1]	√	FTTH GPON/FTTC+VDSL2	19,307	8%	40%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15%	36%	-	100%
KPN, € million	[2]	√	FTTH P2P/FTTC+VDSL2	8,796	-		-	-	-	16%	-	-	-	11%	-	32%	11%	-	-	-	-	-	29%	-	-	100%
Belgacom, € million	[3]	√	FTTC+VDSL2	6,417	-		-	-	-	43%	-	-	-	-	-	28%	29%	-	-	-	-	-	-	-	-	100%
Verizon, $ million	[4]	√		110,875	-		-	-	-	37%	-	-	-	-	-	63%	0%	-	-	-	-	-	-	-	-	100%
Deutsche Telecom, € million	[5]	√	FTTC+VDSL2/FTTH GPON	58,653	-		-	-	-	-	-	-	-	-	88%	-	12%	-	-	-	-	-	-	-	-	-	100%
Telefonica, € million	[6]	√	FTTH GPON/FTTC+VDSL2	18,378	-		-	-	-	58%	-	-	-	-	-	42%	-	-	-	-	-	-	-	-	-	100%
Iliad, € million	[7]	√	FTTH P2P	4,168	-		-	-	-	-	-	-	-	-	-	39%	0%	-	-	-	62%	-	-	-	-	-	100%
Liberty Global, $ million	[8]	√	HFC(FTTN+Coax)/DOCSIS 3.0	9,511	-		23%	-	46%	-	14%	-	-	-	-	-	17%	-	-	-	-	-	-	-	-	-	100%
Telenet, € million	[9]	√		1,376	-		32%	-	-	-	20%	-	-	-	-	-	11%	-	-	-	-	-	37%	-	-	-	100%
TDC, DKK million	[10]	√	FTTC+VDSL2/FTTH/B(P2P)/HFCDOCSIS 3.0	26,116	-		20%	-	-	14%	-	-	15%	-	-	25%	11%	-	-	-	-	15%	-	-	-	-	100%
Telenia Sonera, SEK million	[11]	√	FTTH/B/FTTC+VDSL/HFCDOCSIS 3.0	104,354	-		35%	-	-	-	-	-	-	-	-	49%	16%	-	-	-	-	-	-	-	-	-	100%
Elisa, € million	[12]	√	FTTH/B (P2P)/HFCDOCSIS 3.0	1,530	-		-	-	-	-	-	39%	-	-	-	61%	-	-	-	-	-	-	-	-	-	-	100%
Kabel Deutschland, € million	[13]	√	HFC(FTTN+Coax)/DOCSIS 3.0	1,599	-		-	-	-	-	-	-	71%	29%	-	-	-	-	-	-	-	-	-	-	-	-	100%
Eircom, € million	[14]		FTTC/VDSL/some FTTH GPON	1,828	-		-	-	-	-	-	78%	-	-	-	25%	-3%	-	-	-	-	-	-	-	-	-	100%
Telecom Italia, € million	[15]	√	FTTC+VDSL2/FTTH PON	19,538	-		-	-	-	64%	-	-	-	-	-	36%	-	-	-	-	-	-	-	-	-	-	100%
Telenor, NOK million	[16]	√	FTTH GPON/FTTC+VDSL2	98,516	-		-	-	-	-	-	-	-	-	-	69%	9%	14%	-	-	-	7%	-	-	-	-	100%
Sonaecom/Optimus	[17]	√	FTTH GPON	863	-		-	-	-	26%	-	-	-	-	-	66%	8%	-	-	-	-	-	-	-	-	-	100%
Vodafone, £ million	[18]	√	FTTH GPON	46,417	-		-	-	-	-	-	8%	-	-	-	92%	-	-	-	-	-	-	-	-	-	-	100%
Ziggo, € million	[19]	√	HFC (FTTN+Coax)/DOCSIS 3.0	1,478	-		-	-	43%	-	47%	-	-	-	-	-	10%	-	-	-	-	-	-	-	-	-	100%
Zon	[20]	√	HFC (FTTN+Coax)/DOCSIS 3.1/FTTH GPON	855	-		-	-	-	-	-	-	-	-	-	-	-	-	-	11%	89%	-	-	-	-	-	100%
ONO	[21]		HFC (FTTN+Coax)/DOCSIS 3.0	1,485	-		3%	76%	-	-	-	-	-	-	-	-	21%	-	-	-	-	-	-	-	-	-	100%
Tele 2, SEK million	[22]	√	FTTH P2P	43,726	-		13%	-	-	7%	-	-	-	-	-	78%	3%	-	-	-	-	-	-	-	-	-	100%
Comhem, SEK million	[23]		HFC (FTTN+Coax)/DOCSIS 3.0	4,520	-		-	27%	-	12%	-	-	-	-	-	-	23%	-	37%	-	-	-	-	-	-	-	100%
Virgin media, £ million	[24]	√	HFC (FTTN+Coax)/DOCSIS 3.1	670	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28%	72%	-	100%
NTT Com, Yen million	[25]			910	-		-	-	-	-	30%	-	-	48%	-	-	6%	-	-	-	-	-	-	-	-	16%	100%
Etisalat, AED million	[26]	√		2,003	-		25%	-	-	6%	-	-	-	-	-	53%	15%	-	-	-	-	-	-	-	-	-	100%

Notes and Sources:
[1]:BT, Annual Relation 2012, pp. 51, 113.
[2]:KPN, Annual Relation 2012, pp. 25, 27, 29, 80.The total revenues are the revenues generated in Holland which are the 67% of the total consolidated revenues of the group.Same approach for the EBITDA, which is the 68% of the Total consolidated EBITDA of the group.
[3]:Belgacom, Annual Relation 2011, pp. 98, 113.
[4]:Verizon, Annual Relation 2011, pp. 29-31.
[5]:Deutch Telekom, Annual Relation 2011, pp. 2, 221.
[6]:Telefonica, Annual Relation 2012, p. 56.The total revenues are the revenues generated in Spain which are the 29% of the total consolidated revenues of the group.
[7]:Iliad, Annual Financial Report 2014, pp.11.
[8]:Liberty Global, Annual Relation 2011, p. 96 and 132.
[9]:Telenet, Annual Relation 2011, p. 17 and 20.
[10]:TDC, Annual Relation 2012, p. 18,23,26,29,32.
[11]:Telia sonera, Annual Relation 2011, p. 37,55.
[12]:Elisa, Annual Relation 2011, pp. 20, 31.
[13]:Kabel Deutschland, Annual Report 2011, p. 19 and 77.
[14]:EIRcom, Financial Statement 2010, p. 9 and 36.
[15]:Telecom, Annual Report 2011, pp. 20,36. The total revenues are the revenues generated in Italy which are the 64% of the total consolidated revenues of the group.Same approach for the EBITDA, which is the 75% of the Total consolidated EBITDA of the group.
[16]:Telenor, Annual Report 2011, p. 20 and 39.
[17]:Sonaecom, Annual Report 2011, p. 10.
[18]:Vodafone, Annual Report 2011, Excel spreadsheet.
[19]:Ziggo, Annual Report 2011, p. 34 and 54.
[20]:Zon, Annual Report 2011, p. 172 and 215.
[21]:ONO, Annual Report 2011, p. 176 and 212.
[22]:Tele 2, FY 2012, p. 16 and 18.
[23]:Comhem, FY 2012, p. 31, 33 and 35.
[24]:Virgin Media, Annual Report 2012, p. 47.
[25]:NTT ComFinancial Results, Fiscal Year ended March 31, 2015, p.10.
[26]:Etisalat, Q1 2015 Results Presentation, p.11. Data refer to UAE region in Q1.

FTTH GPON= Fiber to the home
FTTH P2P= Fiber to the home point to point
FTTB= Fiber to the business
FTTC= Fiber to the cabinet
FTTN= Fiber to the node or neighborhood
VDSL2= Very High-speed Digital Subscriber Line
DOCSIS 3.0=Data Over Cable Service Interface Specification
HFC(FTTN+Coax)= Hybrid fiber-coaxial

Table II-2: EBITDA breakdown by activities for selected peers

Firm		Listed	NGA Technology	Total EBITDA	Broadband	Fixed Telephony	Wireline	Pay TV, Broadband and Voice	Audovisuals	Mobility service	Openreach	Wholesale	Retail	Telephony	Other	Total
BT, £ million	[1]	√	FTTH GPON FTTC+VDSL2	6,064	-	-	-	-	-	-	38%	20%	30%	-	12%	100%
KPN, € million	[2]	√	FTTH P2P FTTC+VDSL2	5,138	-	-	-	-	-	-	-	-	-	-	-	0%
Belgacom, € million	[3]	√	FTTC+VDSL2	1,897	-	-	-	-	-	-	-	-	-	-	-	0%
Verizon, $ million	[4]	√		12,880	-	-	-	-	-	-	-	-	-	-	-	0%
Deutsche Telecom, € million	[5]	√	FTTC+VDSL2 FTTH GPON	20	-	-	-	-	-	-	-	-	-	-	-	0%
Telefonica, € million	[6]	√	FTTH GPON FTTC+VDSL2	-												
Iliad, € million	[7]	√	FTTH P2P	1,284	-	-	-	-	-	-	-	-	-	-	-	0%
Liberty Global, $ million	[8]	√	HFC(FTTN+Coax) DOCSIS 3.0	-												0%
Telenet, € million	[9]	√		-												0%
TDC, DKK million	[10]	√	FTTC+VDSL2 FTTH/B(P2P) HFC DOCSIS 3.0	10,441	-	-	-	-	-	-	-	-	-	-	-	0%
Telenia Sonera, SEK million	[11]	√	FTTH/B FTTC+VDSL HFC DOCSIS 3.0	-												0%
Elisa, € million	[12]	√	FTTH/B (P2P) HFC DOCSIS 3.0	506	-	-	-	-	-	-	-	-	-	-	-	0%
Kabel Deutschland, € million	[13]	√	HFC(FTTN+Coax) DOCSIS 3.0	-16,568	-	-	-	-	-	-	-	-	-	-	-	0%
Eircom, € million	[14]		FTTC VDSL some FTTH GPON	648	-	-	-	-	-	-	-	-	-	-	-	0%
Telecom Italia, € million	[15]	√	FTTC+VDSL2 FTTH PON	9,243	-	-	-	-	-	-	-	-	-	-	-	0%
Telenor, NOK million	[16]	√	FTTH GPON FTTC+VDSL2	25,702	-	-	-	-	-	-	-	-	-	-	-	0%
Sonaecom/Optimus	[17]	√	FTTH GPON	213	-	-	4%	-	-	94%	-	-	-	-	2%	100%
Vodafone, £ million	[18]	√	FTTH GPON	14,475	-	-	-	-	-	-	-	-	-	-	-	0%
Ziggo, € million	[19]	√	HFC (FTTN+Coax) DOCSIS 3.0	835	-	-	-	-	-	-	-	-	-	-	-	0%
Zon	[20]	√	HFC (FTTN+Coax) DOCSIS 3.1 FTTH GPON	93	-	-	-	84%	-	-	-	-	-	-	16%	100%
ONO	[21]		HFC (FTTN+Coax) DOCSIS 3.0	367	-	-	-	-	-	-	-	-	-	-	-	0%
Tele 2, SEK million	[22]	√	FTTH P2P	10,960	12%	9%	-	-	-	77%	-	-	-	-	2%	100%
Comhem, SEK million	[23]		HFC (FTTN+Coax) DOCSIS 3.0	1,770	-	-	-	-	-	-	-	-	-	-	-	0%
Virgin media, £ million	[24]	√	HFC (FTTN+Coax) DOCSIS 3.1	-												0%

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