



# **Estimating the WACCs for FTR-MTR**

A Report for ACM

July 2016

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## 1. Introduction and Summary

The Netherlands Authority for Consumers and Markets (ACM) has commissioned NERA Economic Consulting for research on the cost of capital used for the calculation of fixed termination rates (FTRs) and mobile terminations rates (MTRs). ACM sets price caps for FTRs and MTRs using a Bottom-up Long-run Incremental Cost model, which calculates the efficiently incurred costs for a hypothetical fixed and mobile operator. This includes an allowance for the efficient operator's Weighted Average Cost of Capital (WACC).

This report sets out NERA's calculation of the WACC for the following activities:

- A copper-based fixed-line incumbent moving to/on Next Generation Networks (NGN)/Next Generation Assets (NGA);
- An Hybrid Fibre-Coaxial (HFC)-based cable company, moving to/on Data Over Cable Service Interface Specification 3 (DOCSIS3);
- A mobile operator (2G/3G and/or 4G), in a competitive market, which for the purposes of this exercise ACM has defined as a market with three or more mobile operators.

The ACM has instructed that NERA should use the Capital Asset Pricing Model to estimate the cost of equity and apply the methodology described in Annex 7 of the Request for Proposal.

We apply the Capital Asset Pricing Model (CAPM) to calculate the cost of equity of each activity:

$$\text{Cost of Equity} = \text{Risk free Rate} + \text{Beta} * \text{Equity Risk Premium}$$

Where:

- The risk-free rate measures the return an investor required for investing in an asset whose returns exhibit no co-movement with the market;
- The equity risk premium (ERP) measures the return above the risk-free rate an investor demands for investing in the market portfolio; and
- The beta measures the co-movement of the return of the asset in question against the market.

The risk-free rate and equity risk premium are general market parameters, whereas the beta estimate is specific to the activity concerned.

### 1.1. Summary of WACC Estimate

This section provides an overview of our estimates of each parameter used to estimate the WACC.

#### **Risk-free Rate**

We estimate the nominal risk-free rate as the average of the Dutch and German 10-year nominal government bond yields over the last three years, consistent with the ACM's

methodology. This provides a risk-free rate estimate of 1.15%, reflecting the average of the Dutch government bond yield (1.26%) and the German government bond yield (1.04%).

### **Equity Risk Premium**

The ACM specifies that the equity risk premium (ERP) should be calculated as the average of the long term arithmetic and geometric average ERP based on the Dimson, Marsh and Staunton database for Eurozone countries, weighted by the current market capitalisation of each country's stock market.

Following this approach, we adopt an ERP estimate of 4.9%, reflecting the average of the geometric mean (3.4%) and arithmetic mean (6.4%).

### **Beta**

Under the CAPM, the beta parameter reflects the systematic risk of a particular activity or project. The ACM specifies that the beta for each activity should be calculated using European comparator data with reference to three years of daily historical data.

- For the fixed line comparators, we identify TDC in Denmark and Iliad in France as comparators. Both of these comparators have extensive fixed line networks and have invested heavily in NGN technology. We have placed equal weights on TDC and Iliad to calculate a fixed line asset beta of 0.57.
- For the HFC comparators, we have identified Liberty Global listed in the US, Telenet in Belgium and Nos in Portugal as potential comparators, all of which have upgraded the majority of their HFC networks to DOCSIS 3.0. Liberty Global, Telenet and Nos represent reliable HFC comparators, since they operate brands that rely on their HFC networks.<sup>1</sup> Liberty Global owns Virgin Media in the UK, Unitymedia in Germany and Ziggo in the Netherlands, as well as other leading cable operators in Europe. Placing equal weight on Liberty Global, Telenet and Nos, we estimate an asset beta of 0.55 for HFC activity.
- Finally, for mobile operators, our comparators include Telenor in Norway, Vodafone in the UK, Tele2 in Sweden, Telefonica Deutschland in Germany, Freenet in Germany and Orange Belgium in Belgium. All of these operators compete in a market with three or more operators, in line with the ACM's methodology of including comparators from competitive markets. We estimate an asset beta of 0.63 using these comparators for mobile activity.

### **Gearing**

Under the ACM's methodology, the gearing should be estimated using comparators with a healthy financial position. We have defined this as including comparators with an investment-grade credit rating of at least BBB-, who operate in countries with a similar sovereign credit rating to the Netherlands of AAA.

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<sup>1</sup> Note that Liberty Global owns 56.6% of Telenet's shares.

Applying these criteria shows that the fixed line and mobile comparators identified in the beta analysis remain valid for the purpose of estimating the gearing. Using the same comparators, we estimate a gearing of 27% for fixed line activity and 23% for mobile activity. For the HFC comparators, we find that both Liberty Global and Telenet have credit ratings below investment-grade status, suggesting they may be at risk of not maintaining a healthy financial position. Liberty Global and Telenet's high leverage (and corresponding low gearing) likely reflects a business strategy of financing acquisitions through debt financing. We have therefore disregarded their gearing and taken the average of the gearing estimate for fixed line and mobile activity, ensuring that the gearing for HFC activity relates to healthy financial position. Our estimate of the gearing for HFC activity is 25%.

### **Cost of Debt**

The cost of debt estimate ensures that investors can recover efficient debt financing costs. The ACM requires that the cost of debt is estimated based on debt spreads for an appropriate debt index, with an additional allowance of 15 basis points for debt issuance costs.

In selecting an appropriate index, one of the main considerations is the appropriate credit rating, to reflect the underlying default risk of the companies in the index. Since the gearing estimate reflects a healthy financial position with investment-grade credit rating, we have maintained this approach to select the debt index by considering an index with a credit rating of BBB.

We have selected the iBoxx Europe corporate non-financials debt index to estimate the debt spread, using three years of daily data in line with estimation window for the risk-free rate. The debt spread is calculated over the average of Dutch and German corporate bond yields. We have taken the average of the 7-10 year maturity and 10+-year maturity indices to reflect the varying maturities of bonds that telecoms operators issue, which results in a debt spread of 1.61%. Adding 0.15% for debt issuance costs, our cost of debt estimate is 2.91% in pre-tax, nominal terms.

### **Inflation**

The ACM specifies that the inflation estimate for calculating the nominal WACC should be the historical and forecast rates of inflation in the Netherlands and Germany, in line with the markets used to calculate the nominal risk-free rate.

Based on the historical Dutch and German inflation of 0.75% during the same three years over which the risk-free rate is estimated and forecast inflation of around 1.5% in the medium-term, we adopt an inflation estimate of 1.125%, the average of the historical and forecast approaches.

### **Taxes**

We adopt the Dutch corporate tax rate of 25% to calculate the real pre-tax WACC, the derivation of which is provided below.

**Table 1.1**  
**NERA WACC Estimates**

	<b>Fixed Line</b>	<b>HFC</b>	<b>Mobile</b>	<b>Methodology</b>
Tax		25%		Dutch corporate tax rate
Risk-free Rate		1.15%		3Y Avg of 10Y Dutch & German govt bond yields
ERP		4.88%		Long-run historic mean of Eurozone markets
Total Market Return		6.03%		<i>Calculation</i>
Asset Beta	0.57	0.55	0.63	3Y daily beta of comparator group for each activity
Gearing	27%	25%	23%	
Equity Beta	0.73	0.69	0.77	<i>Calculation</i>
Cost of Equity (Nominal)	4.70%	4.51%	4.91%	<i>Calculation</i>
Cost of Debt (Pre-tax, Nominal)		2.91%		Corporate Non-financial Debt Index with BBB rating
WACC (Post-tax, Nominal)	4.02%	3.92%	4.29%	<i>Calculation</i>
Inflation		1.125%		Avg of Historical and Forecast Dutch and German inflation
WACC (Pre-tax, Nominal)	5.36%	5.23%	5.71%	<i>Calculation</i>
<b>WACC (Pre-tax, Real)</b>	<b>4.19%</b>	<b>4.06%</b>	<b>4.54%</b>	<b><i>Calculation</i></b>

*Source: NERA analysis*

We estimate a WACC (pre-tax, real) of 4.19% for fixed line activity, 4.06% for HFC activity and 4.54% for mobile activities. The difference in WACC for each activity reflects differences in systematic risk across the different activities through the asset beta estimate.

## 1.2. Report Structure

This report is structured as follows:

- Section 2 provides our estimates of the risk-free rate and ERP;
- Section 3 sets out our estimates of the beta for each activity;
- Section 4 describes our approach to estimating the gearing for each activity;
- Section 5 provides our cost of debt estimates;
- Section 6 sets out our assumptions for inflation and taxes; and
- Section 7 presents our WACC estimates for each activity.

The appendices provide supporting information.

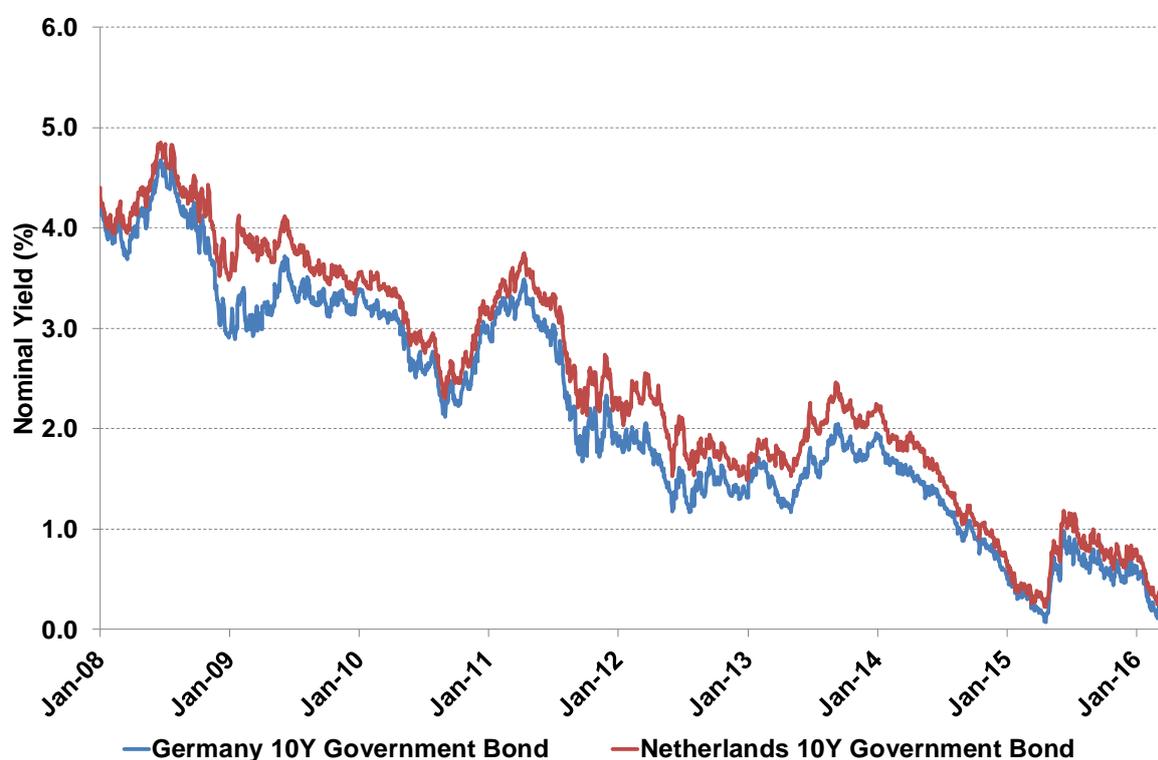
## 2. Total Market Return

This section provides our estimate of the risk-free rate and the equity risk premium, which together make up the total market return.

### 2.1. Risk-free Rate

The ACM's methodology specifies the risk-free rate is measured using the average of 10-year Dutch and German government bond yields over the last three years. Figure 2.1 shows these government bond yields from January 2008 onwards. The decline since the onset of the global financial crisis reflects the European Central Bank (ECB) setting lower interest rates and purchasing government bonds under the quantitative easing programme. More recently over the past three years, the decline in government bonds yields has again continued as a result of ECB policy. In particular, the ECB has lowered the interest rate on deposit facilities to -0.3% in December 2015 and -0.4% in March 2016.<sup>2</sup>

**Figure 2.1**  
**Dutch and German 10Y Government Bond Yields**



Source: Bloomberg data up to 29/03/2016.

The average of the Dutch and German 10-year nominal government bond yields over the last three years up to 29<sup>th</sup> March 2016 is 1.15%, and we use this as our estimate of the nominal

<sup>2</sup> ECB (10 March 2016): "Monetary policy decisions", Press Release. Source: <https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310.en.html>.

risk-free rate. This reflects the average of the Dutch government bond yield (1.26%) and the German government bond yield (1.04%).

## 2.2. Equity Risk Premium

The ACM specifies that the equity risk premium should be calculated using the following methodology:

- Average of the long term arithmetic and geometric average ERP based on Dimson, Marsh and Staunton;
- The ERPs are weighted based on current market-capitalisation of each country's stock market;
- Downward adjustment for the historical average ERPs; and
- Sanity check and possible adjustment with forward looking models (Dividend Growth Model)

The ACM's methodology requires that the ERP is calculated as the excess return of stock over bonds for the major economies of Europe, based on the average of arithmetic and geometric means reported in Dimson, Marsh and Staunton (DMS).

Table 2.1 reports the arithmetic and geometric mean for the ERP using data from 1900 to 2015 for the Eurozone economies reported by DMS. Each country's estimate is weighted by the current market capitalisation of the main stock market in that country, in line with a typical European investor's behaviour of placing more weight in a portfolio on stocks in countries with larger stock markets.

**Table 2.1**  
**Long-run Historical ERP in Major European Countries**

	Geometric Mean	Arithmetic Mean	Average	Current Market Cap (€m)	1M Avg Market Cap (€m)
Austria	2.60%	21.50%	12.05%	57,186	58,907
Belgium	2.40%	4.50%	3.45%	370,025	338,692
Finland	5.20%	8.80%	7.00%	232,741	236,722
France	3.00%	5.40%	4.20%	1,207,717	1,213,784
Germany	5.10%	8.50%	6.80%	974,926	966,928
Ireland	2.80%	4.80%	3.80%	125,688	124,621
Italy	3.10%	6.50%	4.80%	394,484	399,651
The Netherlands	3.30%	5.60%	4.45%	509,979	496,317
Portugal	2.70%	7.50%	5.10%	53,151	51,687
Spain	1.80%	3.80%	2.80%	526,421	527,364
Europe	3.20%	4.50%	3.85%		
Average Eurozone	3.20%	7.69%	5.45%		
Weighted Average Europe (Current)	3.41%	6.33%	4.87%		
Weighted Average Europe (1M Avg)	3.42%	6.35%	4.88%		

*Source: Dimson, Marsh, Staunton (February 2016): "Credit Suisse Global Investment Returns Sourcebook 2016", p28. Note: (1) For Austria and Germany, statistics are based on 114 years, excluding 1921-22 for Austria and 1922-23 for Germany. Source: Elroy Dimson, Paul Marsh, and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research. (2) Estimates are as of 29/03/2016.*

Table 2.1 shows the weighted average ERP for major Eurozone countries using weights based on either the current market capitalisation of the main stock market index in the country or the 1-month average market capitalisation. We believe the 1-month average market capitalisation is a preferable weight measure because it is less vulnerable to daily market volatility. A 1-month average provides greater reliability over the appropriate weight to be placed on each country's ERP. In this particular case, the choice of weight measure has no visible impact on the final weighted average ERP.

Based on the full sample of Eurozone countries reported by DMS, we estimate an ERP of 4.88%. This reflects the average the geometric mean of 3.42% and arithmetic mean of 6.35%. The sample of Eurozone countries includes Austria, which appears to be an outlier in having an arithmetic mean of 21.5%, potentially reflecting the hyperinflationary period in the early 1920s.<sup>3</sup> If Austria is excluded from the sample, the weighted average ERP falls to 4.78%, implying the inclusion of Austria makes little difference to the final ERP estimate.

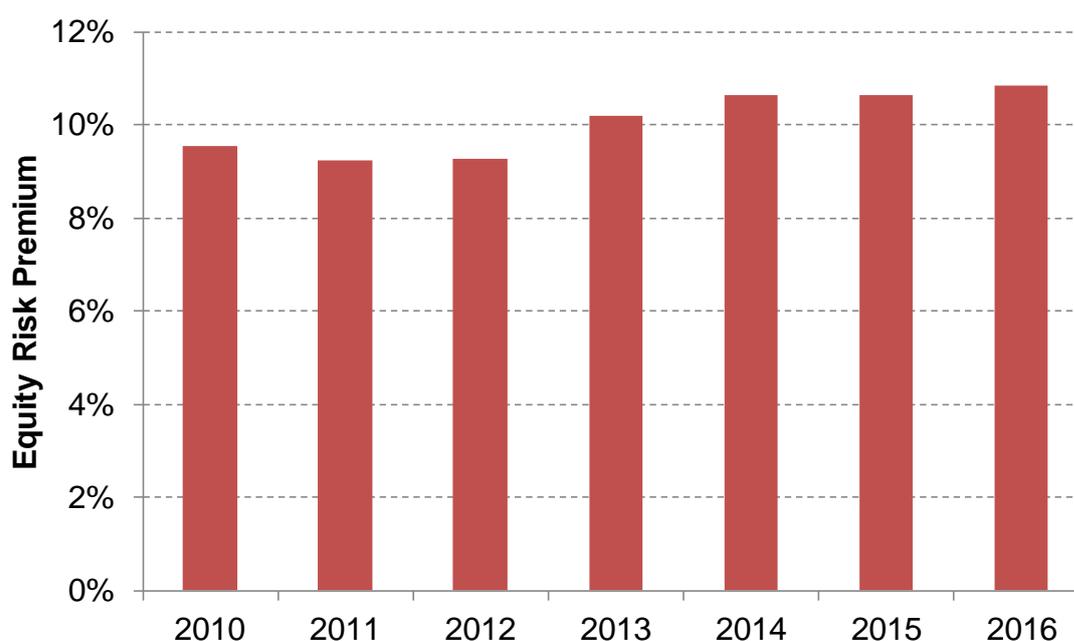
We therefore estimate an ERP of 4.88% based on the long-run historical ERP from DMS.

<sup>3</sup> See Dimson, E, Marsh, P, Staunton, M (February 2016): "Credit Suisse Global Investment Returns Sourcebook 2016", p29.

In addition to the historical approach, we have cross-checked our estimate using forward-looking evidence from a dividend growth model (DGM). A DGM calculates the total market return based on projections of dividend growth and the current market price of the asset in question. It therefore provides an estimate of the total market return, based on the market's current expectations.

Figure 2.2 shows the ERP based on Bloomberg's DGM, where it calculates the total market return using analyst forecasts of dividend growth and a long-run dividend growth assumption. The ERP is then calculated by subtracting the government bond yield for each country from the total market return of the stock market index. The figure below shows the average ERP across the Eurozone countries reported by Bloomberg.

**Figure 2.2**  
**ERP based on Bloomberg Dividend Growth Model**



*Source: Bloomberg; Note: The average ERP above is based on the following countries – Austria, Belgium, Finland, France, Germany, Ireland, Italy, The Netherlands, Portugal and Spain.*

Figure 2.2 shows that the average ERP in Europe based on Bloomberg's DGM has been relatively stable over the past 6-7 years. The average ERP in 2016 is 10.8%, significantly higher than the estimate of 4.88% based on the historical DMS data. The higher ERP estimate using the forward-looking DGM approach may be due to analyst optimism about future dividend growth.

We have also considered whether the ERP estimate based on the historical DMS approach requires a downward adjustment. The academic literature has documented an increase in price-dividend ratios in some developed markets in the last few decades.<sup>4</sup> This implies that

<sup>4</sup> See for example Asness, C (2000): "Stocks vs Bonds: Explaining the Equity Risk Premium".

the long-term historical ERP calculated using over 100 years of data may not be a suitable forward-looking estimate, and a downward adjustment to the historical ERP may be required. However, given the ERP estimate using the DGM cross-check is higher than the estimate based on the historical DMS approach, we do not make any downward adjustment to the historical ERP estimate of 4.88%.

### 3. Beta

Under the CAPM, the beta parameter is used to measure the risk of the activity in question to calculate the return required by an investor bearing that risk. The beta is measured as the co-movement between the specific asset's returns and the returns of the market portfolio. This co-movement is known as the systematic risk associated with the asset, equating to the risk that an investor cannot diversify away by holding the market portfolio. Since expected returns are not observable, the beta is usually measured using historical returns of the asset and the market.

In this case, we require beta estimates for each of the three activities (copper/NGA fixed-line, hybrid fibre-coaxial and mobile) to measure the systematic risk associated with each. The comparator companies identified for each activity are used to estimate the beta, the gearing and also the cost of debt.

#### 3.1. Estimation Methodology

The ACM's specified methodology requires us to identify a peer group of listed European comparators for each activity. This peer group should reflect the systematic risk profile of the activity in question.

With regards to the methodology for estimating the beta using market data, the ACM sets the following directions:

##### **Reference Market**

The beta is measured against the returns of a Eurozone index representing the European market.

The use of a local market index as the reference market for estimating betas reflects the tendency of investors to exhibit a degree of home bias. Investors often tend to favour investing in their home country, and by implication, the market portfolio they use to diversify idiosyncratic risk is the market in their own home country.

For European investors, this is likely to be a Eurozone index, since the common currency has integrated financial markets within the Eurozone by reducing foreign-exchange related transaction costs. We have used a Eurozone index for the European comparators. For comparators from other countries, we have used the stock index for that country to reflect the home bias of the investors in those stocks.

##### **Data Frequency and Estimation Window**

We use a three year daily sampling period.

When estimating the beta using historical data, one has to make a choice about the frequency of data to be used and the historical estimation window.

For the data frequency, one can adopt daily, weekly or monthly data. The use of daily data provides the most data points when conducting the beta regression, and therefore leads to more statistically robust estimates. However, if the stock market return data for the

companies is illiquid, then daily data may not capture the fair market price of the stock, and may result in inaccurate beta estimates. We therefore check that all the comparator companies are liquid, and then use daily data to estimate the beta. The results of the liquidity checks are shown in section 3.2.

For the estimation window, the choice of window reflects a compromise between using more data points and selecting a window that is most likely to reflect the risks facing a regulated company over a future regulatory period. On the one hand, ex ante regulation of telecoms operators requires that the beta estimate is forward-looking, and therefore the systematic risk over short historical estimation window is more likely to align with the systematic risk over a future regulatory period. However, the use of a short historical estimation window provides fewer data points with which to estimate the beta, resulting in less statistically robust estimates. We consider that a three year estimation window provides a reasonable balance between the two considerations, and use it as the window for estimating the beta.

### **Unlevering the Equity Beta**

When estimating the beta for each activity using comparator companies, we estimate equity betas, which measure the systematic risk of each company given its actual capital structure. Since the capital structure can vary across companies, and may not reflect the optimal capital structure for each of the three activities we are considering, we unlever the equity beta estimates using the capital structure of the comparator company. The equity beta can be unlevered using two alternative formulas:

- Modigliani-Miller

$$\beta_A = \beta_E * (1 - (1 - tax\ rate) * \frac{D}{D + E})$$

This formula assumes the debt beta is equal to zero and the tax shield has the same risk as debt.

- Miller

$$\beta_A = \beta_E * (1 - \frac{D}{D + E})$$

The Miller formula also assumes the debt beta is equal to zero.

We unlever the equity beta using the Modigliani-Miller formula, in line with the ACM's recommendation.

## **3.2. Comparator Selection and Beta Estimates**

In order to identify the beta for each activity, we must determine suitable listed comparator companies for each activity. In general, there are unlikely to be any companies that derive 100% of their profits from the one particular activity. Therefore, we relax this constraint to include companies that include a significant proportion of their profits or revenues from an

activity. This approach has been adopted by numerous European telecoms regulators, for example Ofcom in its recent mobile call termination market review.<sup>5</sup> Ofcom included Deutsche Telekom in its comparator set to estimate the beta for mobile activities, even though Deutsche Telekom derives a significant proportion of its total revenues from fixed line activities.

### 3.2.1. Fixed Line Operator (Copper to NGA) Comparators

The first activity for which we identify comparators is a copper-based fixed-line incumbent moving to/on Next Generation Networks (NGN)/Next Generation Assets (NGA). In order to filter the European universe of telecommunications companies, we applied the following criteria:

- Revenues from Europe: We are interested in estimating the beta for a European operator, and therefore we have filtered to only include companies that derive more than 50% of their revenue from Europe. European regulatory regimes tend to exhibit similar features in terms of ex-ante price regulation of network access, so filtering to only include European companies is more likely to result in companies facing similar systematic risk.
- Revenue greater than €1bn: This filter to only include companies of over a certain size prevents inclusion of small companies, for which share price data may be illiquid. In the UK, Ofcom recently adopted a similar criterion for comparators in its Business Connectivity Market Review.<sup>6</sup>
- Limited state ownership: We remove any comparators with significant state ownership. State ownership can result in beta estimates that do not reflect the fair market's pricing of systematic risk because the state may have other objectives to smooth profits over the economic cycle. This criterion results in the exclusion of Proximus, which has more than 50% of its shares owned by the Belgian government.<sup>7</sup>
- Greater than 50% of total revenue derived from fixed line activities: This filter is applied to ensure we only include companies that have significant systematic risk exposure to fixed line activities. We discuss below whether the filtered companies' network deployment consists of copper moving to NGN.

Under the fourth criteria above to filter for fixed line comparators, we use revenue instead of profits. Although profits are more likely to capture the returns of the company (which determines the beta), profits for an individual company tends to exhibit significant volatility over time. Therefore, applying the criteria based on profits may result in the exclusion of some comparators that have particularly low profits in a given year because of company-specific factors that do not affect beta. By contrast, revenues tend to be a more stable measure for determining how exposed a company is to systematic risk associated with fixed line activities, and therefore we have chosen to use revenues as the criteria.

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<sup>5</sup> Ofcom (17 March 2015): "Mobile call termination market review 2015-18", Annexes 7-13, p107.

<sup>6</sup> Ofcom (12 June 2015): "Business Connectivity Market Review – Annexes: Leased lines charge controls and dark fibre pricing", p175.

<sup>7</sup> Source: Telegeography.

After the applying the criteria above, we have identified the following three comparators for fixed line activities.

**Table 3.1**  
**Fixed Line Activity Comparators**

Company	Country	% of FY14 Revenues from Fixed	Total Revenue in FY14	3Y Bid-Ask Spread	% of Shares Traded Daily in Last 3Y
BT	UK	67.1%	£18,287m	0.04%	0.18%
TDC	Denmark	56.6%	€23,344m	0.15%	0.32%
Iliad	France	61.4%	€4,168m	0.16%	0.49%

*Source: Telegeography, Bloomberg. Note: Bid-ask spread and % of shares traded daily are calculated using data up 31 March 2016.*

The three comparators appear to represent suitable comparators for fixed line activities. However, in order to determine whether these comparators provide services over a copper network moving to NGN, we consider each of them in more detail below.

## **BT**

BT operates the copper DSL network in the entire United Kingdom under its universal service obligation. In recent years, it has invested heavily in the fibre network from 2010 onwards, primarily using Fibre-to-the-Cabinet technology (FttC). BT covered 80% of the population with FttC in September 2015,<sup>8</sup> highlighting the transition it has made to NGN infrastructure. This suggests BT should represent a good comparator for copper-based fixed line activity moving to NGN.

However, BT also operates a division known as BT Global Services, which provides IT services to a range of business customers in the UK and internationally, including cloud computing services, data centres and professional services. This business activity typically results in greater systematic risk than fixed line telecommunications because demand for IT services tends to co-vary more with the economic cycle than demand for calls and broadband. Ofcom reached this conclusion when estimating the beta for BT's fixed line business, where it set a higher beta of 1.08 for BT Global Services than it did for the regulated fixed line entity (0.55) when disaggregating the overall BT group observed beta (0.72).<sup>9</sup>

Therefore, the BT group observed beta, when used as a comparator for fixed line activity, may be an overestimate since it incorporates the more risky BT Global Services business. This provides support for selecting a beta below that of the BT group observed beta.

<sup>8</sup> Source: Telegeography

<sup>9</sup> Ofcom (22 March 2016): "Business Connectivity Market Review – Draft Statement", Table A30.1, p56.

## **TDC**

TDC passes 99% of Danish households with copper ADSL technology, but also passes 42% of households with Hybrid Fibre-Coaxial technology. The HFC network is used to provide broadband and TV services, and therefore does not represent copper-based fixed line activity moving to NGN. TDC does not provide the breakdown of its total revenue derived from each type of network, and we cannot determine whether its observed beta estimate is suitable for estimating the beta for copper to NGN fixed line activity. We therefore treat the TDC beta estimate with caution.

## **Iliad**

Iliad is one of the leading French companies providing broadband and telephony services. Iliad launched copper-based ADSL services in 2001, but has more recently invested heavily in NGN infrastructure. It commenced its Fibre-to-the-Home (FttH) deployment in 2006 and as of March 2016, has close to 2.5m connectible FttH sockets.<sup>10</sup> This transition to NGN infrastructure from a copper-based network suggests that Iliad is likely to be a good comparator.

We note however that Iliad also derives some of its revenues from mobile services under the brand 'Free' and therefore its beta will in part depend on the systematic risk it faces from supplying mobile services.

The descriptions of each company's networks clearly show that not all of them are perfect comparators for copper to NGN fixed activity. TDC operates a large HFC network and BT derives a significant portion of its revenues from IT services, which likely results in a different systematic risk profile to an operators than only provides fixed line telecoms services. Iliad appears to be the most suitable comparator given its focus on NGN infrastructure, although it still faces some systematic risk exposure from mobile activities.

Table 3.2 shows the three year daily beta estimates for the three comparators above using the methodology described in section 3.1.

**Table 3.2**  
**Beta Estimates for Fixed Line Comparators**

	<b>BT</b>	<b>TDC</b>	<b>Iliad</b>
Asset Beta Estimate	0.77	0.39	0.74
Standard Error	0.04	0.05	0.06

*Source: Bloomberg, NERA analysis*

Table 3.2 shows that the beta estimates for the comparators lie in the range 0.39 to 0.77, with TDC's beta much lower than the other two comparators. Our review of the comparators above shows that BT's beta may be affected by its IT services subsidiary, which likely faces

<sup>10</sup> Iliad Press Release 2015 Results, 10 March 2016.

significantly more risk than the remaining fixed line subsidiaries. Since, Ofcom concluded that the beta of the fixed line wholesale activities for BT is 0.55, much lower than our calculated beta for BT Group of 0.77, we do not include BT Group's beta of 0.77 to calculate our final beta estimate. Instead, we use Ofcom's beta estimate for BT's fixed line activities as a cross-check. We estimate a beta of 0.57 for fixed line activity, based on the average of the betas for TDC and Iliad.

Given the limited number of comparators in the fixed line sample, we also calculated betas for a sample of "Tier-2 fixed-line comparators" as a cross-check. We selected Tier-2 comparators by following the same criteria based on which we selected BT, TDC and Iliad, but relaxed the threshold on the percentage of revenue derived from fixed line business to 40%. Based on the relaxed criteria, we identified four Tier-2 fixed-line comparators and calculated their asset betas in the table below. The average asset beta for Tier-2 comparators is 0.60, consistent with our central estimate for fixed-line comparators of 0.57.

**Table 3.3**  
**Beta Estimates for Tier-2 Fixed Line Comparators**

Company	Country	% Revenues from Fixed	Asset Beta Estimate
Telefonica	Spain	40%	0.63
Orange	France	40% <sup>1</sup>	0.65
Swisscom	Switzerland	44% <sup>1</sup>	0.52
Hellenic Telecom	Greece	54% <sup>1</sup>	0.61
<b>Average</b>			<b>0.60</b>

Source: NERA analysis of Bloomberg data

Notes:

1. For Orange, Swisscom and Hellenic Telecom, the latest data available for % revenue from fixed-line business is from 2013. We assume company revenue structure has been stable from 2013 to 2015 but note this assumption should be treated with caution. Therefore, although Hellenic Telecom derived more than 50% revenue from fixed-line business in 2013, we only include it in the Tier-2 sample.

We estimate a beta of 0.57 for fixed line activity, based on the average of the betas for TDC and Iliad. This is in line with Ofcom's beta estimate of 0.55 for BT's fixed line activities as well as the average beta of 0.60 for the Tier-2 fixed-line comparators.

### 3.2.2. Hybrid Fibre-Coaxial Comparators

The second activity for which we identify comparators is a Hybrid Fibre-Coaxial (HFC)-based cable company, moving to/on Data Over Cable Service Interface Specification 3 (DOCSIS3). In order to filter the European universe of telecommunications companies, we applied the following criteria:

- Revenues from Europe: We are interested in estimating the beta for a European operator, and therefore we have filtered to only include companies that derive more than 50% of their revenue from Europe. European regulatory regimes tend to exhibit similar features in terms of market structure and regulation, so filtering to only include European companies is more likely to control for systematic risk.
- Limited state ownership: We remove any comparators with significant state ownership.

- Bloomberg filter for cable companies: We apply Bloomberg's filter for cable companies, which excludes any telecoms companies which derive their revenues mainly from copper/fibre or mobile networks.
- Historic returns data available for three years: Under the ACM's methodology, we are required to estimate betas using 3 years of daily historical data. This results in the exclusion of

After applying the above criteria, we identify the following four HFC activity comparators.

**Table 3.4**  
**HFC Activity Comparators**

Company	Country	Total Revenue in FY15	3Y Bid-Ask Spread	% of Shares Traded Daily in Last 3Y
Liberty Global	Multinational	\$10,738.8m	0.03%	1.21%
Kabel Deutschland	Germany	€360m	0.39%	0.24%
Telenet	Belgium	€312m	0.18%	0.23%
Nos	Portugal	€1,444.3m	0.26%	0.43%

*Source: Telegeography, Bloomberg. Note: Bid-ask spread and % of shares traded daily are calculated using data up 31 March 2016.*

We note that Liberty Global is a multinational telecoms company, which owns brands across the world in Europe and Latin America. It owns the brands Virgin Media and Ziggo, which were previously listed as separate companies before they were taken over by Liberty Global. It also owns 56.6% of the shares of Telenet, which is identified as a separate comparator above.

We investigate the four comparators in more detail below.

### **Liberty Global**

Liberty Global provides telecoms services in over 14 countries through a number of different brands. These include Virgin Media in the UK, Unitymedia in Germany, 56.6% of Telenet in Belgium, and Ziggo and UPC Nederland in the Netherlands. Table 3.5 shows the extent to which these brands operate an HFC network moving to DOCSIS 3.0. For the purpose of this assessment, we have included the main brands that operate under Liberty Global, with subscribers in excess of 500,000.

**Table 3.5**  
**Network Description of Brands under Liberty Global**

<b>Operator</b>	<b>Country</b>	<b>Subscribers (Dec 2015)</b>	<b>HFC Network</b>	<b>Upgrade to DOCSIS 3.0</b>	<b>Other Networks</b>
Virgin Media	United Kingdom	4,694,900	HFC network covering 12.6m homes, with plans of further expansion	DOCSIS 3.0 launched in 2010, with plans of further expansion	Provides mobile services as an MVNO, without its own network
Unitymedia	Germany	3,106,200	HFC network in 12.7m homes	DOCSIS 3.0 covering over 97% of footprint	Provides mobile services as an MVNO, using O2 network
Ziggo	Netherlands	3,106,200	HFC network nationwide	DOCSIS 3.0 covering 7m homes	Provides mobile services as an MVNO, using Vodafone network
UPC (Austria)	Austria	537,800	HFC network in 1.3m homes	DOCSIS 3.0 covering full footprint	Provides ADSL broadband to ~15% of total retail subs; Small MVNO operation of 13k subs
UPC (Cablecom)	Switzerland	759,900	HFC network in 2.2m homes	DOCSIS 3.0 covering full footprint	Provides mobile services as an MVNO, using Salt network
UPC Poland	Poland	1,052,400	HFC network in 2.7m homes	DOCSIS 3.0 covering full footprint	Small MVNO operation of 7.2k subs
UPC Hungary	Hungary	588,200	HFC network in 1.6m homes	DOCSIS 3.0 covering full footprint	Small MVNO operation
Telenet	Belgium	1,570,500	HFC network in 2.9m homes	DOCSIS 3.0 covering full footprint	Provides mobile services as an MVNO, using Orange Belgium network. But recent acquisition of BASE provides own network.
VTR	Chile	1,003,100	HFC network in 3m homes	Plans to upgrade to DOCSIS 3.0	Became a full MVNO in 2013 with 137K subs

*Source: Telegeography*

Table 3.5 shows that the majority of Liberty Global's brands operate extensive HFC networks that have been upgraded to DOCSIS 3.0, often across the whole footprint of the company. This demonstrates that Liberty Global is likely to be a good comparator to estimate the beta for an HFC operator moving to DOCSIS 3.0.

The brands under Liberty Global also operate as MVNOs, accessing the mobile networks of mobile operators to provide bundled quad-play services. Since these mobile services are effectively an add-on to existing broadband and telephony services, we consider the systematic risk facing these brands is rooted in the demand for the services provided over the HFC network. Therefore, we maintain Liberty Global as a comparator for this activity.

## **Telenet**

56.6% of Telenet's shares are owned by Liberty Global, and so the beta estimate for Liberty Global in part reflects the beta for Telenet. Around 35% of Telenet's shares are in free float on the Euronext Brussels exchange, and to make use of this observable market information we include it in our comparator set for HFC moving to DOCSIS 3.0 activity, given its profile in Table 3.5.

## **Nos**

Nos is a telecoms operator in Portugal providing broadband, telephony and mobile services to retail customers. Its HFC network upgraded to DOCSIS 3.0 passes 3.4m homes, with over a one third of the market share as of December 2015.<sup>11</sup> Nos was established after the merger of two telecoms operators ZON and Optimus in 2014.

## **Kabel Deutschland**

Kabel Deutschland is one of the largest cable operators in Germany, with close to 20% of retail subscriber market share in December 2015.<sup>12</sup> It has been controlled by Vodafone Germany since April 2014, and its shares were fully delisted from the Frankfurt Stock Exchange from 1 April 2016.<sup>13</sup> Therefore, we cannot calculate a beta estimate for Kabel Deutschland using data from 1 April 2016 onwards. Moreover, the beta estimate for Kabel Deutschland may reflect the market's expectation of the systematic risk facing Vodafone Germany, after the announcement of the takeover in June 2013. We have adopted a prudent approach and excluded Kabel Deutschland from the sample of HFC comparators, although we have reported its beta estimate for informational purposes below.

We note that Kabel Deutschland's HFC network extends to 6m homes in Germany, with extensive upgrade to DOCSIS 3.0. Kabel Deutschland does not operate its own mobile network, but does provide a quad-play product through its parent company Vodafone Germany.

The beta estimates for all the comparators for the HFC activity are shown below. However we propose not to place weight on Kabel Deutschland given its beta estimate is likely to reflect the systematic risk facing its parent company following the announcement of the takeover by Vodafone Germany in June 2013.

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<sup>11</sup> Source: Telegeography.

<sup>12</sup> Source: Telegeography.

<sup>13</sup> Source: <https://www.kabeldeutschland.com/en/investor-relations/nachrichten/160331.html>.

**Table 3.6**  
**Beta Estimates for HFC Comparators**

	Liberty Global	Telenet	Kabel Deutschland	Nos
Asset Beta Estimate	0.59	0.45	0.22	0.62
Standard Error	0.06	0.04	0.04	0.05

*Source: Bloomberg. Note: Betas are estimated using data up to 8 April 2016. For Liberty Global, we use the S&P500 as the reference index, since Liberty Global's shares are listed in the US.*

Table 3.6 shows that the average asset beta for Liberty Global, Telenet and Nos is 0.55, using 3 years of daily data. The asset beta for Kabel Deutschland appears inconsistent with the other three companies, consistent with our prior view that its risk is affected by Vodafone Germany's takeover. We therefore exclude Kabel Deutschland from our comparator set for HFC activity, and rely on the beta estimates for Liberty Global, Telenet and Nos.

We estimate an asset beta of 0.55 for HFC activity, using Liberty Global, Telenet and Nos as our comparators.

### 3.2.3. Mobile Comparators

Finally, we identify comparators for a mobile operator (2G/3G and/or 4G), in a competitive market. The ACM has identified a competitive market to include three or more mobile operators. In order to filter the European universe of telecommunications companies, we applied the following criteria:

- Revenues from Europe: We are interested in estimating the beta for a European operator, and therefore we have filtered to only include companies that derive more than 50% of their revenue from Europe.
- Revenue greater than €1bn: This filter to only include companies of over a certain size prevents inclusion of small companies, for which share price data may be illiquid.
- Limited state ownership: We remove any comparators with significant state ownership.
- Greater than 50% of total revenue derived from mobile activities: This filter is applied to ensure we only include companies that have significant systematic risk exposure to mobile activities.
- Three or mobile operators: In line with the ACM's methodology, we have only included operators in markets where there are three or more competitors.

After applying the criteria above, we identify the following comparators for mobile activities.

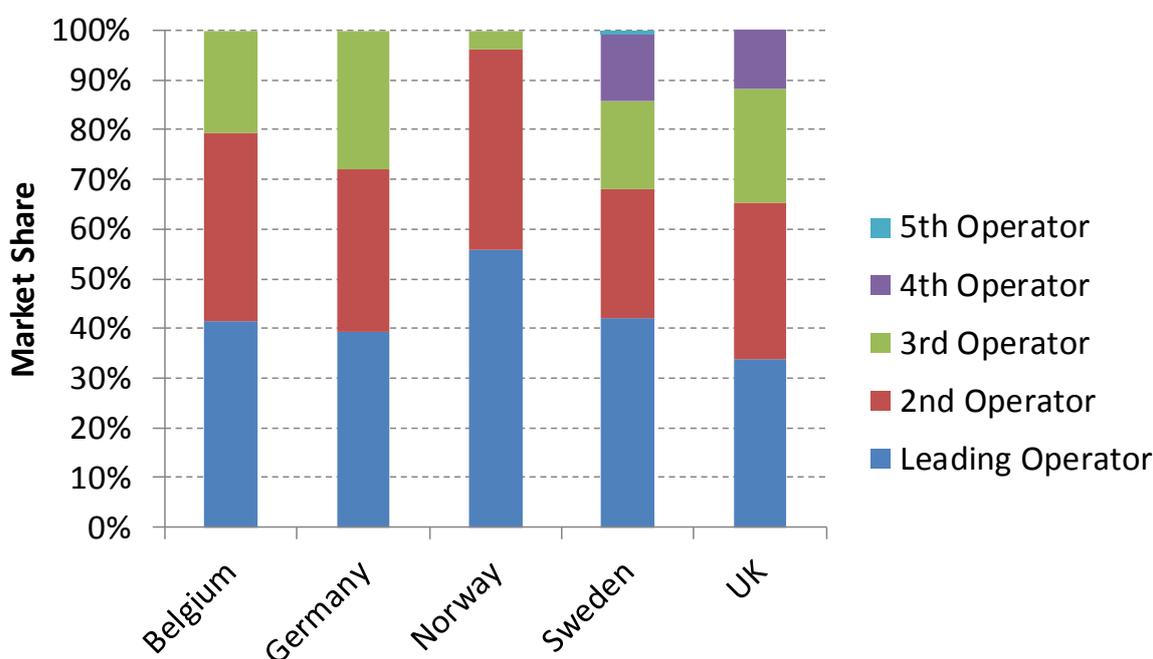
**Table 3.7**  
**Comparators for Mobile Activities**

Operator	Country	Total Revenue in FY15	% of Revenue from Mobile	Bid-Ask Spread	Number of Operators in Market
Telenor	Norway	NOK 128,175m	76.9%	0.12%	0.30%
Vodafone	United Kingdom	£42,227m	69.5%	0.03%	0.21%
Tele2	Sweden	SEK 26,856m	76.1%	0.10%	0.49%
Telefonica Deutschland	Germany	€7,888.0	86.8%	0.80%	0.45%
Freenet	Germany	€2,981.1	98.0%	0.46%	0.46%
Orange Belgium	Belgium	€1,249.2m	78.1%	0.24%	0.48%

Source: Telegeography

Figure 3.1 shows the market shares of the comparators against the other main competitors in their main country of operation.

**Figure 3.1**  
**Market Shares in Comparator Countries**



Source: Telegeography

Figure 3.1 highlights that all of the comparators operate in markets with three or more comparators. However, in the Norwegian market, where Telenor operates, the operator with the third greatest market share (ice.net) only has 3.7% market share. This suggests that the Norwegian market may have limited mobile competition and the beta for Telenor may not be fully reflective of a beta for a competitive mobile operator. This may warrant placing less weight on Telenor when calculating the final beta estimate for mobile activities.

The beta estimates for the mobile operators are provided below.

**Table 3.8**  
**Beta Estimates for Mobile Activity**

	<b>Telenor</b>	<b>Vodafone</b>	<b>Tele2</b>	<b>Telefonica Deutschland</b>	<b>Freenet</b>	<b>Orange Belgium</b>
Asset Beta Estimate	0.54	0.75	0.63	0.63	0.78	0.40
Standard Error	0.04	0.04	0.05	0.05	0.05	0.07

*Source: Bloomberg*

Table 3.8 shows that the betas for mobile operator lie in the range of 0.40 to 0.78. Of the sample of comparators, only Telenor may be operating in a market with limited competition, but its beta is not significantly out of line with the other comparators. Moreover, we find no other reason to exclude any of the other comparators since they all derive a significant proportion of their revenues from mobile activities, they operate in competitive markets and their stock market price data shows no signs of illiquidity. We have therefore placed equal weight on all the comparators in Table 3.8 and estimate an asset beta of 0.63 for mobile activities.

## 4. Gearing

This section sets our estimate of the gearing for each activity, which is used to lever the asset beta to calculate the equity beta and also to determine the weights on the cost of equity and cost of debt for the final WACC calculation.

ACM's methodology specifies that the gearing should be based on a comparator group with a healthy financial position.

We start by considering the comparators identified for the beta estimates in section 3.2 to determine whether these comparators currently have a healthy financial position. A healthy position is typically defined by the credit rating assigned to a company's debt issuances by credit rating agencies. The credit rating for a company reflects two broad factors:

- **Sovereign risk:** The likelihood of a company defaulting on its debt obligations may be affected by the credit rating of the government of that country. For example, if the Dutch government were to default in its public debt, there is increased likelihood of Dutch companies defaulting as some financial markets may express concern about the Dutch economy and the ability of the government to provide stimulus.

We are estimating the WACC for operators in the Netherlands, and therefore to control for sovereign risk, we include comparators located in countries with a similar credit rating to the Dutch government's credit rating of AAA, the highest possible rating.

- **Company-specific risk:** A company's likelihood of default also depends on company-specific factors and the financial risk facing the company. One of the main factors that drive financial risk is the gearing of the company, since a higher gearing means that for a given volatility of cash flows to the firm, there is increased chance of the firm not being able to meet its interest payments. The company's financial risk is captured by the credit rating assigned to the company's debt. We therefore only include companies with an investment credit rating of BBB- or above to calculate the WACC for operators with a healthy financial position.

Table 4.1 shows the sovereign credit rating and company credit rating for each of the comparators used for the beta calculation.

**Table 4.1**  
**Comparator Gearing and Credit Ratings**

Activity	Operator	Country	Sovereign Credit Rating	Company Credit Rating	Gearing (3Y Average)
Fixed Line	TDC	Denmark	AAA	BBB-	42%
	Iliad	France	AA	N/A	11%
HFC	Liberty Global	US	AA+	BB-	56%
	Telenet	Belgium	AA	B+	43%
	Nos	Portugal	BB+	N/A	31%
	Telenor	Norway	AAA	A	22%
	Vodafone	UK	AAA	BBB+	34%
Mobile	Tele2	Sweden	AAA	N/A	19%
	Telefonica Deutschland	Germany	AAA	BBB	16%
	Freenet	Germany	AAA	N/A	15%
	Orange Belgium	Belgium	AA	N/A	35%

Source: Bloomberg, Trading Economics (<http://www.tradingeconomics.com/country-list/rating>).

Note: Credit ratings are from S&P as of 14 April 2016. The reported company credit rating is the long-term issuer default rating. The exception is Telefonica Deutschland for which we provide the Fitch credit rating, since the S&P rating is not available. Several of the companies in the comparator group are not rated by any credit rating agency.

When calculating the gearing of the companies, we do not make any adjustment for operating leases. By doing that, we effectively assume that the operating leases for each activity for which we estimate a WACC is equal to the average of the leases of the comparators. In other words, our methodology ensures that the lease structure underpinning the operator for each telecoms activity is the same as the average of the comparators.

Table 4.1 shows that the sovereign credit rating of the country where the comparators operate are similar to that of the Netherlands, with some having a slightly lower credit rating of AA. The company credit ratings of the fixed line and mobile comparators (where data is available) are all of investment-grade level. For these two activities, we adopt the average gearing of the comparators, resulting in a gearing for fixed line activity of 27% and a gearing for mobile activity of 23%.

For the cable operators, Liberty Global and Telenet, the credit rating is below investment-grade status and does not reflect a healthy financial position. Since Liberty Global owns a large portion of Telenet's shares, these two comparators can be considered together. Liberty Global's high gearing is a function of its business strategy where it finances acquisitions through debt financing.<sup>14</sup> This preference for debt financing has resulted in a credit rating below investment-grade status. Given this choice of business strategy, which results in a capital structure below investment-grade status, we do not consider Liberty Global and Telenet's gearing as relevant for determining the appropriate gearing for HFC activity.

<sup>14</sup> Source: Financial Times (11 August 2014): "Liberty Global's deals appetite not constrained by debt".

Instead, we adopt the average gearing for the fixed line and mobile operators, which reflects the capital structure of a telecoms firm maintaining investment-grade credit rating. Our estimate of the gearing for HFC activity is 25%.

We take the average gearing for fixed line and mobile operators because we do not consider a company's business (fixed-line vs. mobile) is the only determinant of its financial structure. The gearing is also a function of company strategy, internal cash generation and dividend policy, all of which are company-specific and do not systematically depend on whether the company is a fixed line or mobile operator. This is demonstrated by the fact that the gearings for fixed and mobile operators are not materially different (27% for fixed vs 23% for mobile). Table 4.1 in our report highlights that a higher level of gearing generally results in a lower credit rating (for example, Liberty Global has the highest credit rating of 56% and lowest credit rating of BB-). Since Table 4.1 does not show any obvious difference in the credit ratings of the fixed and mobile operators, we consider it appropriate to calculate the average gearing across these two groups. This implies that our gearing estimate for cable operators is in line with the gearing of a company with the average credit rating of fixed line and mobile operators.

We note that the final WACC estimate is not very sensitive to the gearing assumption, an insight originally provided by Modigliani and Miller (1958).<sup>15</sup> Any increase in gearing has two effects on a firm's cost of capital, which combine to offset each other:

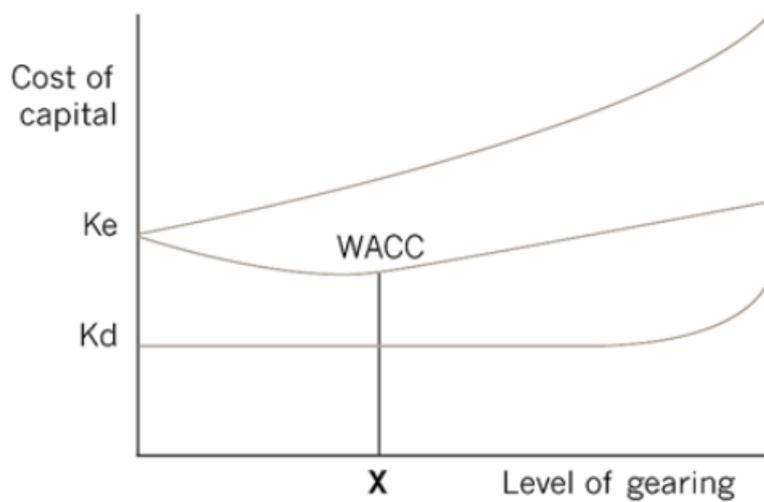
- Higher cost of equity resulting in higher WACC: A higher gearing means that the firm's equity capital is more risky. This is because debt holders have the prior claim on a firm's cash flows and hence an increase in the gearing reduces the likelihood that equity holders will receive a return on their investment. The consequence of this is the firm's cost of equity increases, through a higher equity beta.
- Greater weight placed on cost of debt resulting in lower WACC: A higher gearing also means that more weight is placed on the cost of debt when calculating the WACC. Since the cost of debt is lower than the cost of equity (because debt holders have the prior claim on cash flows), by placing more weight on the cost of debt, the WACC falls.

In a world with no taxes, these two effects perfectly offset with each other. With taxes on income to equity holders, there is some effect on the WACC of changing the gearing, but it remains relatively insensitive, as shown by the illustrative example below.

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<sup>15</sup> Modigliani, F, Miller, M (June 1958): "The Cost of Capital, Corporation Finance and the Theory of Investment", American Economic Review, Vol. 48, No 3.

**Figure 4.1**  
**Effect of Gearing on WACC**



*Source: NERA analysis*

## 5. Cost of Debt

This section provides our estimate of the cost of debt for each telecoms activity. The cost of debt estimate is intended to remunerate an investor in each activity for the risk associated with financing efficient debt costs.

The ACM specifies that the cost of debt should be based on the three year average spread on an index of bonds of comparator companies with a comparable creditworthiness. Section 4 shows that the credit rating of the fixed line and mobile operators is approximately BBB, which is equivalent to an investment-grade credit rating. Although the HFC comparators have a lower credit rating, we assumed that an investment-grade rating is required to maintain a healthy financial position, corresponding to a BBB credit rating.

To ensure consistency with our gearing estimates for each activity, we have selected a cost of index with a BBB rating. This implies that an investor is remunerated for investing in the debt of a company that maintains an investment-grade credit rating. We have selected the iBoxx Europe Corporate Non-Financial Index with BBB rating, which captures the cost of debt of non-financial corporations in Europe. This data is available for indices with different maturities for debt. The iBoxx indices are used extensively in UK utility regulation to set the cost of debt for price controls, including Ofgem when it adopted a debt indexation approach to recover efficient debt costs.<sup>16</sup>

The iBoxx debt index we are considering is available for 7-10-year maturity and 10+ year maturity:

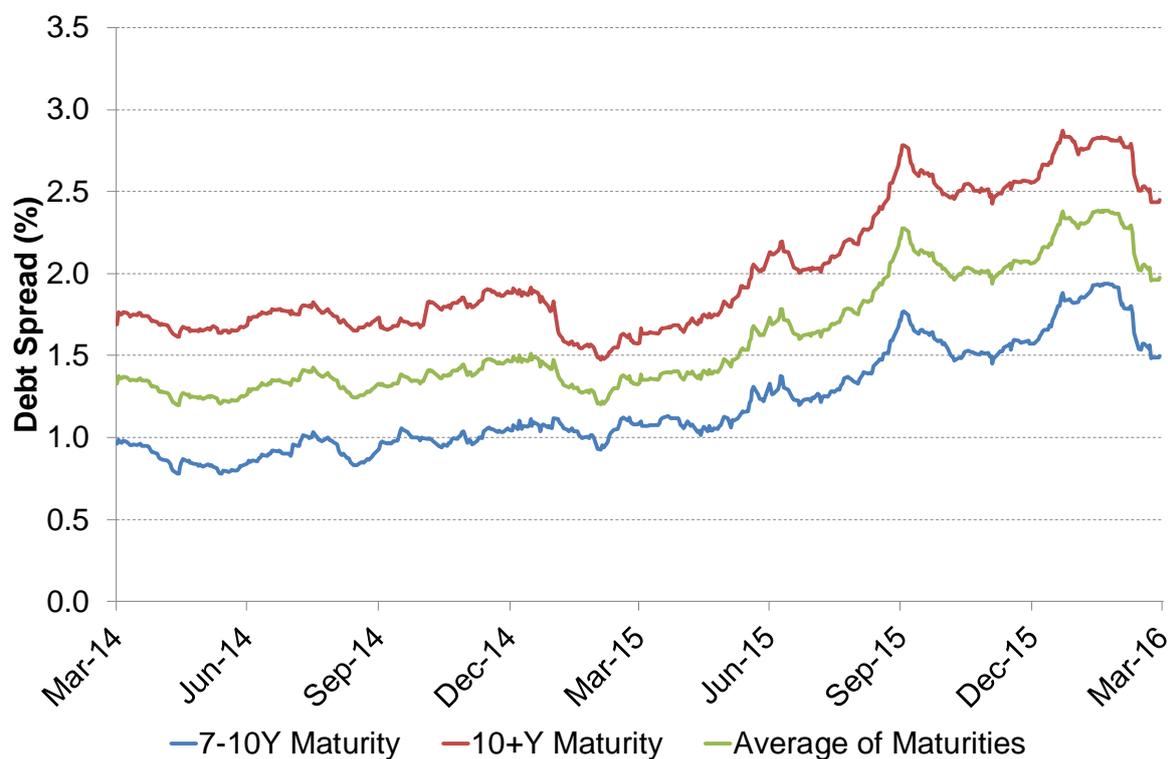
- 7-10 year: This index has an average remaining life of 8.4 years for the 3-year historical period over which we calculate the debt spread.
- 10+ year: This index has an average remaining life of 13.0 years for the 3-year historical period over which we calculate the debt spread.

Both of these indices provide relevant evidence for estimating the cost of debt since telecoms operators issue debt for a range of maturities, covering both of the indices. Figure 5.1 shows the debt spreads for the indices for both maturities over the 3-year period consistent with the risk-free rate calculation.

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<sup>16</sup> Ofgem (25 November 2014): “Cost of debt indexation model 31 October 2014”.

**Figure 5.1**  
**Debt Spreads for BBB-rated Corporate Debt Indices**



Source: Datastream iBoxx

We estimate an average debt spread of 1.61% based on the evidence in Figure 5.1.

Our final cost of debt estimate is presented below, which includes 15bps to cover the costs of issuing debt, in line with the ACM's methodology. We estimate a total nominal cost of debt of 2.91% based on the iBoxx BBB-rate corporate non-financial debt index and the allowance for debt issuance costs.

**Table 5.1**  
**Cost of Debt Estimate**

	<b>Estimate</b>	<b>Source</b>
Risk-free Rate	1.15%	Section 2.1
Debt Spread	1.61%	iBoxx Europe Corporate Non-financial BBB-rated index; Average of 7-10Y and 10+Y maturities.
Debt Issuance Fees	0.15%	ACM methodology
<b>Cost of Debt</b>	<b>2.91%</b>	<b>Calculation</b>

Source: NERA analysis

## 6. Inflation and Taxes

This section briefly provides our estimates of the information and tax rates to be applied when calculating the real WACC in pre-tax terms.

### 6.1. Inflation

The ACM specifies that the inflation estimate for calculating the nominal WACC should be the historical and forecast rates of inflation in the Netherlands and Germany, in line with the markets used to calculate the nominal risk-free rate.

Since the risk-free rate is calculated over three years of historical data, we have considered the historical inflation over the same period. We have used the HICP measure of inflation, which is the measure used by the European Central Bank for inflation targeting.

**Table 6.1**  
**Netherlands and Germany Historical Inflation**

	<b>March 13 to March 14</b>	<b>March 14 to March 15</b>	<b>March 15 to March 16</b>	<b>3Y Avg</b>
Netherlands	1.90	0.10	0.40	0.80
Germany	1.40	0.50	0.20	0.70
Average	1.65	0.30	0.30	0.75

*Source: Eurostat*

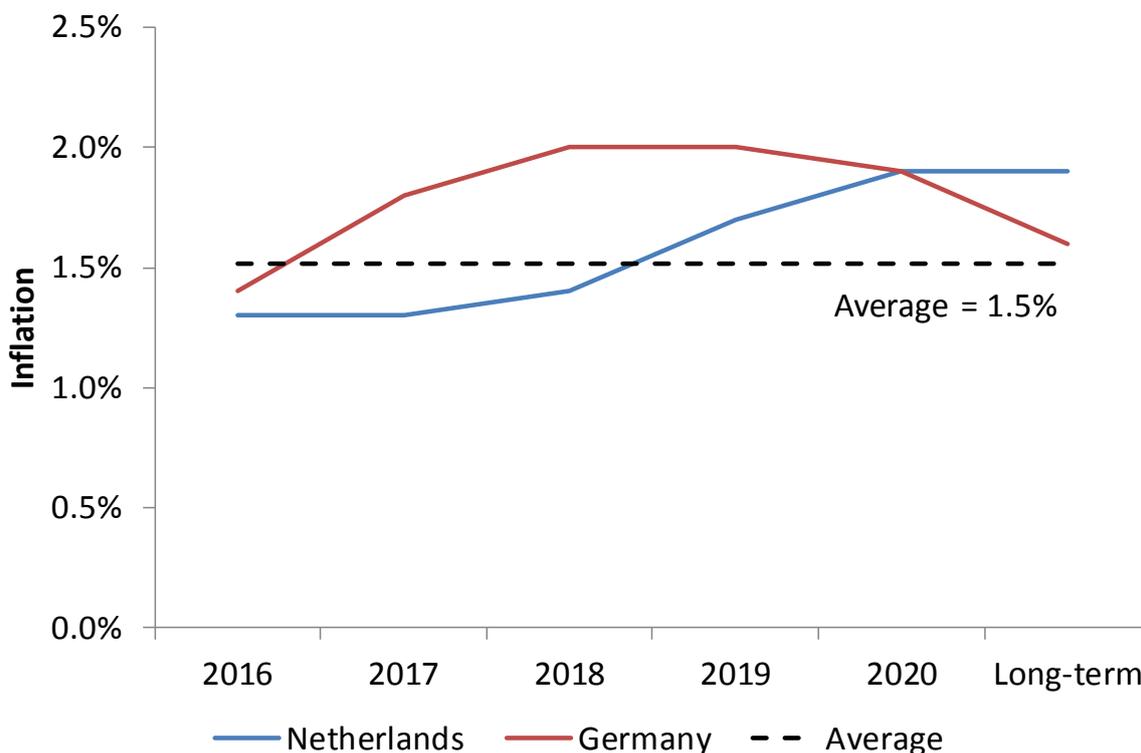
Table 6.1 shows that the average historical inflation for the Netherlands and Germany has been 0.75% over the same 3-year historical period over which the nominal risk-free rate is calculated. This is significantly below the ECB's inflation target of below 2.0%.

By contrast, market inflation expectations suggest that inflation is expected to increase in both the Netherlands and Germany towards the ECB's target. Figure 6.1 shows that the consensus forecast for Dutch and German inflation is on average 1.5% from 2016 onwards. As a cross-check, the ECB survey of professional forecasters forecast average inflation of 0.7% for 2016, 1.4% for 2017 and 1.6% for 2018, with an average of 1.25%.<sup>17</sup> The same survey provides a long-term inflation forecast of 1.8% for 2020.

Based on the historical Dutch and German inflation of 0.75%, and forecast inflation of around 1.5%, we adopt an inflation estimate of 1.125%, the average of the historical and forecast approaches.

<sup>17</sup> Source: ECB Survey of professional forecasts.  
[http://www.ecb.europa.eu/stats/prices/indic/forecast/html/table\\_3\\_2016q1.en.html#inflation](http://www.ecb.europa.eu/stats/prices/indic/forecast/html/table_3_2016q1.en.html#inflation)

**Figure 6.1**  
**Netherlands and Germany Inflation Forecast**



Source: Consensus Economics (October 2015): "Consensus Forecasts Global Outlook: 2015-2025".

## 6.2. Taxes

We adopt the Dutch corporate tax rate of 25% to estimate the post-tax WACC as follows:

$$\begin{aligned}
 & \text{Post tax WACC (Nominal)} \\
 &= \frac{E}{D + E} * \text{Cost of Equity (Nominal)} + (1 - \text{tax rate}) * \frac{D}{D + E} \\
 & \quad * \text{Pre tax Cost of Debt (Nominal)}
 \end{aligned}$$

The post-tax WACC (Nominal) calculated above can then be converted to pre-tax nominal terms by dividing by (1-Dutch corporate tax rate). Finally, to calculate the WACC in pre-tax real terms, we apply the following Fisher formula:

$$\text{Pre tax WACC (Real)} = \frac{1 + \text{Pre tax WACC (Real)}}{1 + \text{Inflation}} - 1$$

## 7. Weighted Average Cost of Capital

Our estimates of the WACC (pre-tax, real) are presented in Table 7.1.

**Table 7.1**  
**NERA WACC Estimates**

	Fixed Line	HFC	Mobile	Methodology
Tax		25%		Dutch corporate tax rate
Risk-free Rate		1.15%		3Y Avg of 10Y Dutch & German govt bond yields
ERP		4.88%		Long-run historic mean of Eurozone markets
Total Market Return		6.03%		<i>Calculation</i>
Asset Beta	0.57	0.55	0.63	3Y daily beta of comparator group for each activity
Gearing	27%	25%	23%	
Equity Beta	0.73	0.69	0.77	<i>Calculation</i>
Cost of Equity (Nominal)	4.70%	4.51%	4.91%	<i>Calculation</i>
Cost of Debt (Pre-tax, Nominal)		2.91%		Corporate Non-financial Debt Index with BBB rating
WACC (Post-tax, Nominal)	4.02%	3.92%	4.29%	<i>Calculation</i>
Inflation		1.125%		Avg of Historical and Forecast Dutch and German inflation
WACC (Pre-tax, Nominal)	5.36%	5.23%	5.71%	<i>Calculation</i>
<b>WACC (Pre-tax, Real)</b>	<b>4.19%</b>	<b>4.06%</b>	<b>4.54%</b>	<b><i>Calculation</i></b>

*Source: NERA analysis*

We estimate a WACC (pre-tax, real) of 4.19% for fixed line activity, 4.06% for HFC activity and 4.54% for mobile activities. The difference in WACC for each activity reflects differences in systematic risk across the different activities through the asset beta estimate.

The WACC for mobile activities is the highest across the three activities, potentially because the demand for mobile subscriptions (particularly business demand) is more income elastic than other telecommunications services. The WACC for fixed line activities exceeds that of HFC activity potentially because of the substantial fibre investment currently being undertaken by European fixed line operators, where demand for fibre-based services is relatively uncertain. By contrast, DOCSIS 3.0 technology is relatively well established across Europe, resulting in lower beta estimates for cable operators.

## Appendix A. Beta Statistical Robustness Checks

This appendix sets out results for the statistical robustness checks we have undertaken for the comparators across the three sample groups. We conclude from this analysis that OLS-based beta estimates set out in Section 3 are robust.

Specifically we have undertaken two statistical tests:

- **White test for heteroscedasticity.** The presence of heteroscedasticity does not bias the OLS beta estimates, but affects the statistical inferences around those estimates. When heteroscedasticity is detected<sup>18</sup>, we run GLS (Generalized Least Squares) regression which corrects for heteroscedasticity. As shown in Table A.1, GLS estimates are very similar to OLS estimates. We therefore consider OLS-based beta estimates are robust.
- **Dimson test for asynchronous trading.** Beta estimates based on daily data can be subject to estimation bias. A common problem cited in the academic literature is that when stocks are traded more thinly or thickly than the market average, price signals are not assimilated simultaneously. Consequently, the firm's share price may react more slowly/quickly than the market price, and as a result a lead or a lag term of the market return can have a significant correlation with the stock return. Dimson tests for the significance of the correlation between the lead/lag term of the market return and the stock return. When joint significance is detected<sup>19</sup>, we calculate Dimson-adjusted beta, defined as the sum of the betas on the contemporaneous, lead and lag terms of the market return. As shown in Table A.1, Dimson-adjusted betas are not materially different from OLS betas (within the range of +/- 2 standard deviations around the OLS estimates). Therefore, we consider OLS-based beta estimates are robust.

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<sup>18</sup> We define significance at 99% confidence level for the test.

<sup>19</sup> We define significance at 99% confidence level for the test.

**Table A.1**  
**Beta Statistical Robustness Checks**

Comparator	OLS beta	OLS Standard Error	Heteroscedasticity?	GLS beta	Asynchronous trading?	Dimson-adjusted beta
TDC A/S	0.60	0.05	No	N/A	No	N/A
BT GROUP PLC	0.95	0.04	No	N/A	No	N/A
ILIAD	0.80	0.06	No	N/A	No	N/A
TELENOR ASA	0.66	0.04	No	N/A	No	N/A
VODAFONE GROUP	1.05	0.04	No	N/A	No	N/A
TELE2 AB-B SHS	0.79	0.04	No	N/A	No	N/A
TELEFONICA DEUTS	0.72	0.05	Yes	0.73	No	N/A
FREENET AG	0.88	0.05	Yes	0.89	No	N/A
ORANGE BELGIUM	0.54	0.07	No	N/A	Yes	0.62
LIBERTY GLOBAL-A	1.04	0.06	Yes	1.04	Yes	1.13
KABEL DEUTSCHLAN	0.27	0.04	No	N/A	No	N/A
TELENET GRP HLDG	0.67	0.04	No	N/A	No	N/A
NOS SGPS	0.83	0.05	No	N/A	No	N/A

Source: NERA analysis

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