NERA
ECONOMIC CONSULTING

The Cost of Capital for KPN's Wholesale Activities

A Report for OPTA

March 2012

Project Team

Dr. Richard Hern
Dominik Huebler
Tomas Hozik

NERA Economic Consulting
15 Stratford Place
London W1C 1BE
United Kingdom
Tel: +44 20 7659 8500
Fax: +44 20 7659 8501
www.nera.com

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Executive Summary

This report sets out our best estimates of the cost of capital for KPN's wholesale fixed line telecommunications services, for the purposes of determining a cost of capital for three different forecasting periods: i) the year 2010, ii) the year 2011, iii) the three-year period 2012-2014.

In deriving these estimates we draw on the WACC methodology developed in previous reports for OPTA, which has previously been consulted on with the industry working group, although we have made some changes to this methodology to deal with the high volatility in the financial markets in recent years.

Our estimates are based on the following key principles:

- Estimates of each component of the WACC should be internally consistent, based on objective and consistent data sources, and must be empirically verifiable.
- Estimates of a "forward-looking" WACC to be applied at different cut-off dates use data up to the start of the respective forecasting period.
- Estimates of a "forward-looking" WACC should be based on the use of averages of time-series data, given that there is significant uncertainty about whether current conditions will prevail over the near future. This is in line with the approach, previously consulted on with the Industry Group, set out in NERA (2005) and NERA (2009).[1]

Table 1 below shows that the real pre-tax cost of capital for KPN's wholesale telecom services has fallen over time. This is the result of a reduction in KPN's asset beta and risk-free rates only partly offset by an increase in the equity risk premium. Overall, we calculate the following pre-tax WACC rates:

- A real, pre-tax WACC of 6.72% for 2010;
- A real, pre-tax WACC of 5.76% for 2011; and
- A real, pre-tax WACC of 5.10% for 2012-2014.

[1] NERA (2005) "*The Cost of Capital for KPN's Wholesale Activities"*, NERA (2009)*: The Cost of Capital for KPN's Wholesale Activities.*

Table 1:
Cost of Capital for KPN's Wholesale Fixed Line Telecom Services

	1Y (2010)	1Y (2011)	3Y (2012 – 2014)
Cost of Equity			
Nominal risk-free rate	3.24%	2.26%	1.53%
Inflation	1.20%	1.50%	1.80%
Real risk-free rate	2.02%	0.75%	-0.27%
ERP	5.67%	6.60%	6.87%
Asset beta	0.45	0.41	0.39
Gearing (D/(D+E))	40.9%	42.2%	49.00%
Equity beta	0.76	0.71	0.76
Real post-tax return on equity	6.33%	5.43%	4.99%
Cost of Debt			
Nominal cost of debt	5.27%	5.17%	5.23%
Real cost of debt	4.15%	3.74%	3.49%
WACC			
Corporate tax rate	25.50%	25.00%	25.00%
Nominal post-tax WACC	*6.27%*	*5.89%*	*5.70%*
Nominal pre-tax WACC	*8.00%*	*7.35%*	*7.00%*
Real post-tax WACC	5.01%	4.32%	3.83%
Real pre-tax WACC	**6.72%**	**5.76%**	**5.10%**

Source: NERA analysis.

1. Introduction

NERA Economic Consulting was commissioned by OPTA to estimate the cost of capital for KPN's wholesale fixed line telecommunications. In this report we present estimates over different time frames. We provide estimates of the cost of capital for 2010, 2011 and an average estimate for the period 2012-2014.

In deriving these estimates we draw on the WACC methodology developed in previous reports for OPTA, which has been consulted on with the industry working group. We cross-check whether the methodology remains appropriate, taking into account the continued turmoil in financial markets since 2008.

The structure of the report is as follows:

- Section 2 discusses choice of appropriate datasets in estimating CAPM parameters;
- Section 3 presents risk free rate estimates;
- Section 4 presents equity risk premium estimates;
- Section 5 presents beta estimates;
- Section 6 sets out cost of debt and gearing assumption;
- Section 7 concludes by presenting the WACC estimates; and

2. Choice of Appropriate Datasets in Estimating CAPM Parameters

This section discusses two key practical issues in estimating the cost of capital, and particularly with respect to the application of the CAPM: the choice of reference market and the choice of current or historic evidence as a basis for the parameter estimates.

2.1. Choice of Reference Market

From an investor's standpoint, the cost of capital should be estimated with reference to the financial market that best represents their investment opportunity set, as the cost of capital for any single investment is defined by the whole portfolio of investment opportunities to which an investor has access. This "set" is commonly referred to as the "market portfolio".

In theory the "market portfolio" should include both traded and non-traded assets. However, in practice WACC parameters are calculated with respect to readily available stock market indices, and therefore the "market portfolio" only captures assets listed on a stock exchange, to the exclusion of unlisted assets.

The next key question is whether to use a domestic, regional or worldwide index. Recent Dutch regulatory precedent has tended to use the Euro market as the reference capital market. The highly integrated nature of the financial markets suggests that the opportunity set facing investors is significantly wider than the Dutch domestic market.

Transaction costs and taxation barriers to investment in securities across countries have declined significantly over time. It is now a simple matter to purchase and sell shares traded on exchanges in other countries. It is also true that by spreading risks among different domestic equity markets, investors can achieve lower risks and/or improve investment returns. Not only have global portfolios outperformed individual domestic markets over the 1969-2006 period but investors have also achieved reductions in risk through diversification across different countries, which reduces exposure to shocks in the domestic market.

However, we continue to see significant incidence of "home bias", i.e. the overweighting of domestic shares in the portfolios of professional investors around the world. The explanations for this seemingly sub-optimal behaviour are manifold with an important focus on "hidden costs" of transacting overseas that make it less easy to trade in other countries than it would appear from theory. See e.g. Stulz (2005) and Ahearne et al. (2004) who describe that there are information asymmetries and political risks arising from cross-border trading, which will always inhibit full market integration.[2]

Consequently, the issue of the reference market becomes an empirical matter. Figure 2.1 shows the share of Dutch stocks in the average portfolio of professional fund managers in different countries based on a survey of more than 20,000 portfolio managers.

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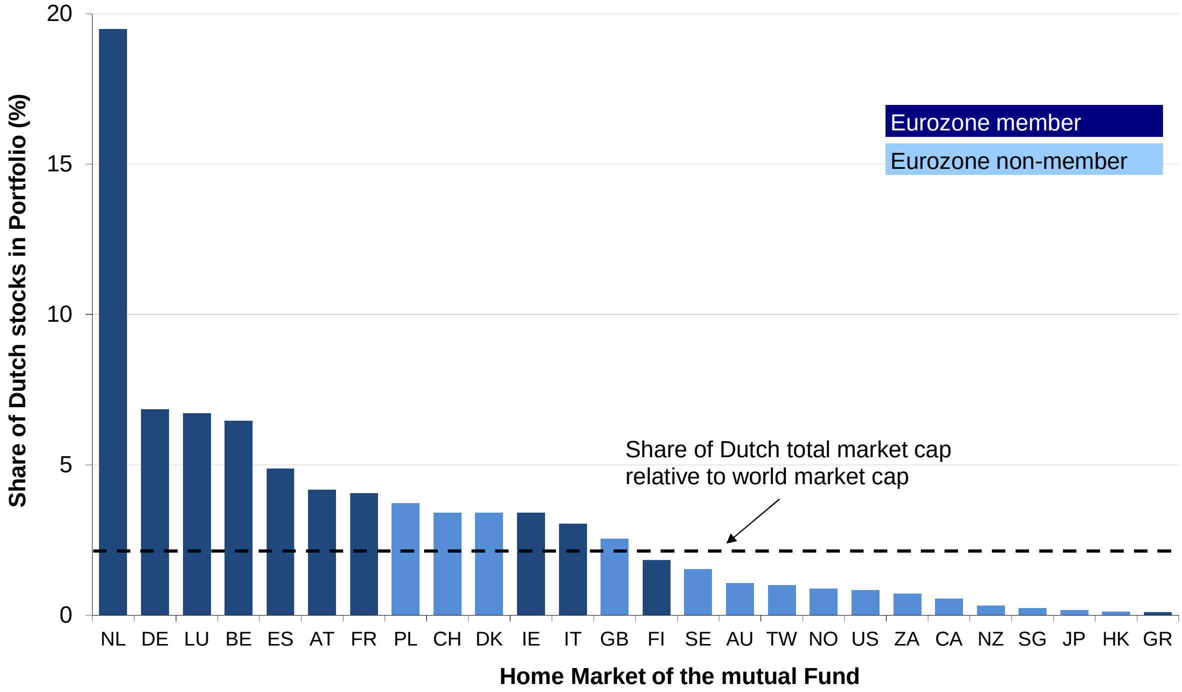
[2] René M. Stulz: The Limits of Financial Globalization, The Journal of Finance, August 2005 or Alan G. Ahearne, William L. Griever and Francis E. Warnock: Information costs and home bias: an analysis of US holdings of foreign equities, Journal of International Economics, March 2004.

Figure 2.1
Share of Dutch stocks in international fund managers' portfolios



Source: NERA analysis of data in Chan et al. (2005): What Determines the Domestic Bias and Foreign Bias? Evidence from Mutual Fund Equity Allocations Worldwide, Journal of Finance

Figure 2.1 shows that Dutch stocks are overrepresented relative to their share of total market capitalisation (marked by the dotted line) in the portfolios of fund managers in almost all European countries but underrepresented in all other countries including significant underrepresentation in major markets such as the US, Japan (JP) and Australia (AU). Assuming a world market would therefore overstate the degree of market integration.

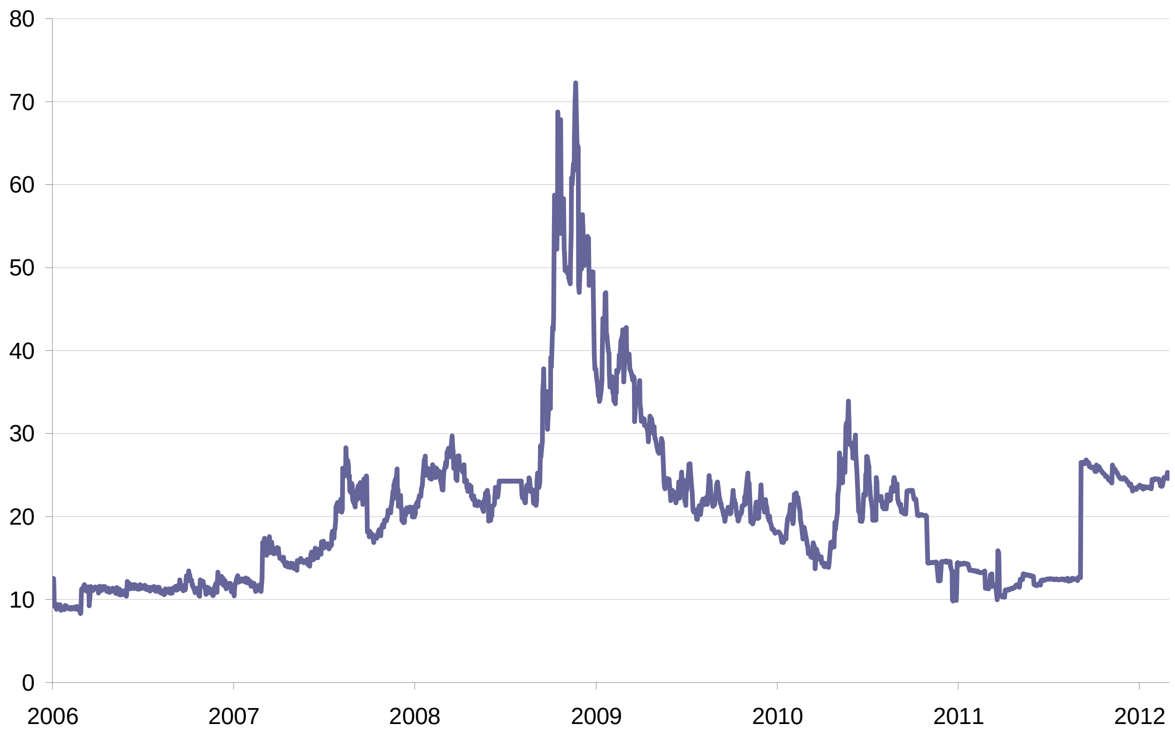
Drawing on the empirical results above our approach in estimating the cost of capital for KPN is to draw on market evidence from Europe in setting WACC parameter values, where relevant.

2.2. Current or Historic Evidence

In principle it is possible to estimate the WACC using either long-run or short-run data as long as all parameters are consistently estimated either over the short-run or consistently over the long-run. The choice of estimation horizon depends on the view taken on market conditions over the next regulatory period. If one believes in a return to "normal" conditions the use of long-run estimates is preferable while the use of short-run estimates implicitly assumes the current conditions will prevail throughout the period.

Figure 2.2 shows the expected volatility of the Euro Stoxx 600 index 6 months ahead. The expected volatility is backed out from the prices of options with different strike prices that give an indication of how likely the market views different outcomes to be.

Figure 2.2
Forecast Market Volatility (backed out from option prices)



Source: NERA analysis of Bloomberg data. We also considered volatility measures for longer-dated options but found these to be illiquid.

Figure 2.2 shows that current expected volatility is at more than twice the level observed before the outbreak of the subprime crisis in 2007. Not only is expected volatility currently significantly higher than it was before the financial crisis (in what might be considered "normal" conditions) but also has volatility itself become more volatile. This set of findings has significant consequences for determining the WACC:

Up to the outbreak of the great financial crisis in 2007/08 there was an increasingly widespread view amongst practitioners that robust and stable estimates of both the equity risk premium and beta should be obtained using historic time series data. International regulators were increasingly using historic time series data as the main basis for deriving estimates of beta and the equity risk premium.

However, as the financial crisis has led to a situation of extended high volatility in the financial markets it is questionable as to whether forecasts based on a return to a notion of pre-crisis "normal" within the time frame of a three-year regulatory period are likely to be an accurate reflection of capital market conditions.

In estimating the parameters to be used in estimating the cost of capital we must choose the measure that best proxies forward looking expectations of capital costs prevailing over the forecasting period 2012-2014.[3] This inevitably involves a degree of judgement about what the expected conditions over the period will be.

In general there is no way an estimate of future conditions will ever be fully reflective of the (currently unknown) conditions over the future regulatory period. However, care should be taken in deriving an estimate that is internally consistent (with regard to the view underlying all parameters) and most likely to be reflective of *average* conditions over the forecasting period.

As noted above current ongoing volatility in financial markets means that forecasts based on an expectation of a return to long-run "normal" conditions for the whole of the regulatory period may not be a good estimate of the currently expected cost of capital. However, purely current or "spot" market data might not provide the best estimate of the forward looking parameters either because of:

- Excess market volatility; and
- Biases/distortions to yields arising from institutional factors and quantitative easing.

These issues are discussed in further detail below.

2.2.1. Excess Market Volatility

There is widespread evidence that financial markets have exhibited periods of "excess volatility" that cannot be explained by standard economic paradigms such as the Efficient Markets Hypothesis (EMH). The implication of "excess volatility" and "stock market bubbles" is that current "spot" prices do not provide complete information regarding expected future values. Since "excess" volatility is by its nature only a temporary phenomenon, the use of historic time-series evidence on WACC parameters may be a better guide to fundamentals.

A paper by Smithers and Wright[4] (2002) argued that there is powerful evidence of mis-valuation in world stocks markets and also predictability ('mean reversion') in stock price returns over long investment horizons.[5] They conclude by saying *"There are strong reasons, both in principle and in practice, to doubt the applicability of the EMH to the valuation of the stock market as a whole."* A number of other empirical studies have shown that stock prices regularly display evidence of "excess" stock market volatility.[6]

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[3] In determining the WACC for 2010 and 2011 respectively we must choose the best estimate of the expected cost of capital over the forecasting period *at the start* of that period.

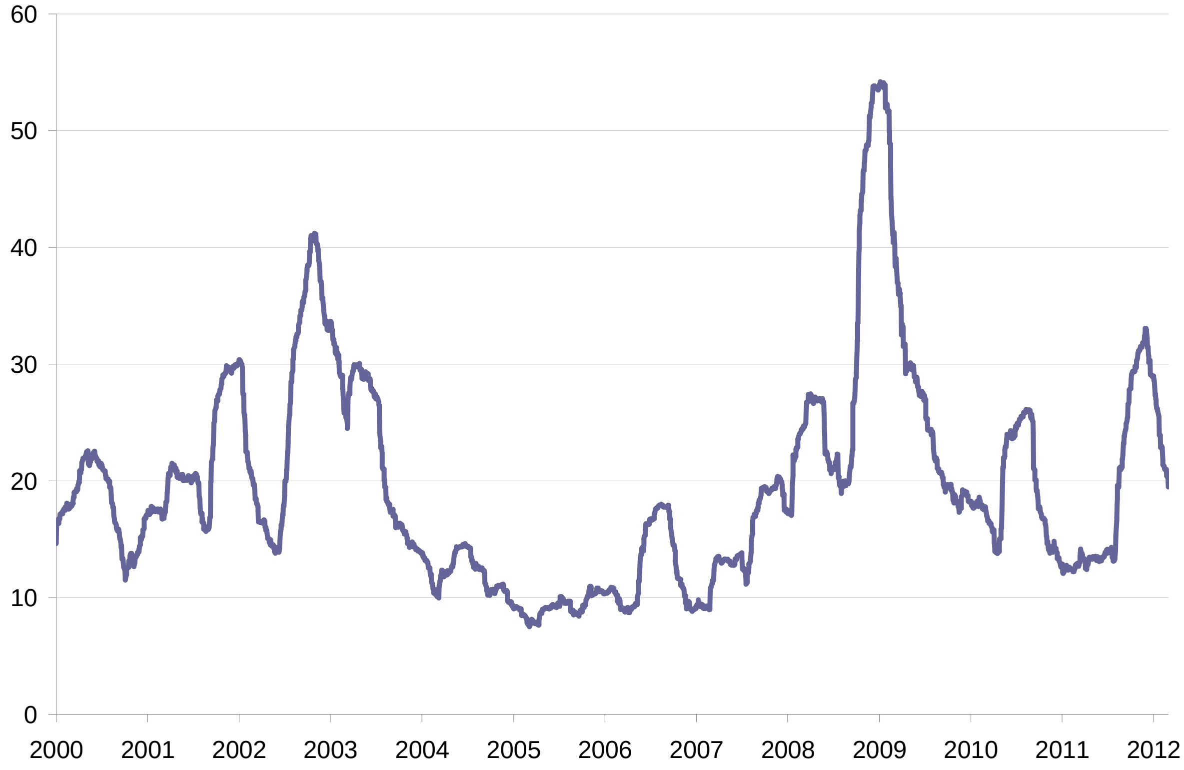
[4] Smithers A. and Wright S. (2002), Stock Markets and Central Bankers: The Economic Consequences of Alan Greenspan, available at www.smithers.co.uk.

[5] Smithers and Wright were also authors of a study on the cost of capital commissioned by the UK Joint Regulators Price Control Group, (See Smithers (2003)).

[6] As examples of the literature, McConnell and Perez Quiros (1999) find evidence that the volatility of aggregate output has actually fallen since the early 1980s. Cochrane (1991), amongst others, has confirmed that increased market volatility is not matched by the fundamentals and has therefore found evidence of "excess" market volatility. Shiller (1981) attributed this excess volatility to changes in sentiment, and not to fundamentals such as ex post dividend volatility.

The chart below presents evidence that shows significant changes in levels of market volatility over relatively short periods of time. Figure 2.1 shows the *outturn* volatility of the Dow Jones European 600 Index since 2000.

Figure 2.3
3-Month Volatility of Dow Jones European 600 Index
(January 2000 – March 2012)



Source: NERA analysis of Bloomberg data.

Figure 2.3 shows the changing and unstable pattern of volatility in European stock markets that broadly confirms volatility expectations shown in Figure 2.2. Both the early 2000s with the terrorist attacks of September 11, 2001 as the trigger and the period after the collapse of Lehman Brothers have seen significant spikes in volatility followed by swift reductions. On the other hand the period from 2004 to 2007 saw low and mostly stable volatility. Recently volatility has come down from its sovereign debt crisis peak in November 2011 although it is unclear whether it will spike up again in the near future.

Evidence of periods of exceptional volatility in recent years place the Efficient Markets Hypothesis assumption underpinning the use of "spot" data in doubt, implying that caution should be exercised in interpreting "spot" or short term estimates of market parameters. Since by definition periods of excess volatility are short lived, longer term historical evidence may provide a better reflection of true fundamentals in order to smooth out such periods taking into account that these periods will not be a feature of all of the next regulatory period.

2.2.2. Distortions to yields arising from institutional factors

Higher than average levels of volatility (and the associated "flight to quality", i.e. into "AAA" rated securities) have been one reason why global government bond interest rates in the Netherlands have fallen to historically lower levels in recent years. Moreover, a number of commentators have suggested that current historical lows for "AAA" rated countries are partially caused by expansive monetary policy (quantitative easing) and part-caused by a number of further "artificial" distortions to yields which do not reflect changes in the true underlying rate demanded by investors for holding a risk-free asset.

These distortions include the influence of pension and insurance fund regulations which inflate demand for government yields, supply side distortions and mass purchase of US Treasuries by Asian Central Banks. E.g. there is concern that pension fund regulations distort the yields on index-linked bonds as outlined by the Bank of England:

> *"… strong pension fund demand for inflation-protected bonds has pushed down their yields …this demand may reflect several regulatory and accounting changes over the the past few years that have encouraged pension funds to seek to match their liabilities more closely with inflation-linked assets"* (Bank of England (2008) Quarterly Bulletin, May)

The OECD has noted that this is a global phenomenon:

> *"Very long-dated and [index-linked] bonds seem to be currently undersupplied relative to perceived or expected demand"*[7]

Moreover, in addition to these institutional factors the impact of expansionary monetary policy (quantitative easing) on government bond rates is quantified as having depressed government bond yields by as much as 100 basis points.[8]

In deriving an estimate of WACC parameters over the next regulatory period we will need to take a view on whether these factors are likely to impact on the WACC throughout the whole of the regulatory period. Using evidence from forward curves it is not clear that these levels will continue to persist in the future (see section 3.3 below) and instead we may see some reversion to conditions more resembling the long-run average towards the end of the period.

We therefore do not believe spot rates provide the best available evidence on average future WACC parameters throughout the regulatory period. Instead we consider that the use of relatively short historical time-series evidence will prevent estimates from being unduly influenced by both i) anomalous current market conditions or ii) a misplaced belief in a quick return to "normal."

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7 As reported in Dow Jones International News (30 January 2006) *"Euro Yield Curve is Unlikely to Invert"*.

8 See e.g. Joyce et al. (2010): The financial market impact of quantitative easing, Bank of England working paper no. 393, available at: http://www.bankofengland.co.uk/publications/Documents/workingpapers/wp393.pdf
Meier, A. (2009): Panacea, Curse or Non-event? Unconventional Monetary Policy in the United Kingdom, IMF Working Paper
D'Amico, St, and King, T. (2010). "Flow and Stock Effects of Large-Scale Treasury Purchases." Federal Reserve Board Finance and Economics Discussion Series No. 2010-52.

2.2.3. Conclusion on current vs. time series evidence

In summary, our recommendation is that, while accepting the general principle that estimates of the cost of capital should be forward-looking, current evidence of exceptional volatility means the risk of serious error is heightened when spot estimates are used. The use of relatively short-term historical data will ensure that estimates of WACC parameters are less likely to be seriously biased by one-off events that cannot be reasonably expected to continue to prevail, such as shocks to capital markets that cause excess volatility and factors driving the volatility in interest rates currently observed.

We consider that a three year historical period, consistent with the length of the regulatory period is an appropriate measurement period which minimises biases to forward-looking estimates of the cost of capital arising from temporary or abnormal distortions, whilst is short enough to reflect any fundamental medium term changes in underlying market conditions. This approach is consistent with that taken at the last review.

3. The Risk Free Rate

3.1. Methodology

The expected return on a risk-free asset, ($E[r_f]$), or the "risk-free rate", is the return on an asset which bears no systematic risk at all – i.e. the risk-free asset has zero correlation with the market portfolio. Alternatively, the real risk-free interest rate can be thought of as the price that investors charge to exchange certain current consumption for certain future consumption. In part, it is determined by investors' subjective preferences and in part by the nature and availability of investment opportunities in the economy.

There has been some recent debate about the best methodology for estimating the real risk-free rate. The dominant methodology used by practitioners and regulators in the past is to use government bond yield evidence. There are two types of bonds that can be used – index-linked and nominal bonds. An alternative approach uses swap rates as a basis for a risk-free rate.

In principle the yields of index-linked government bonds provide the most immediate estimate of the real risk-free rate. However, only a limited number of European countries issue index-linked government bonds thus creating market that is less liquid and less deep than the market for nominal government bonds. It is therefore not always possible to find a bond that combines the desired maturity with the absence of default risk (especially now that the number of AAA rated issuers has been reduced because of recent downgrades). Moreover, there is concern that pension fund regulations distort the yields on index-linked bonds. Commentary by the Bank of England outlines the issue:

> *"… strong pension fund demand for inflation-protected bonds has pushed down their yields …this demand may reflect several regulatory and accounting changes over the the past few years that have encouraged pension funds to seek to match their liabilities more closely with inflation-linked assets"* (Bank of England (2008) Quarterly Bulletin, May)

The OECD has noted that this is a global phenomenon:

> *"Very long-dated and [index-linked] bonds seem to be currently undersupplied relative to perceived or expected demand"*[9]

In principle the swap-based approach provides a good alternative to the index-linked government bond approach that overcomes the issue of inelastic demand for index-linked government debt. However, the swap-based approach depends on the availability of robust data on banking credit risk (e.g. through CDS spreads) which is currently not available.

In 2009 we concluded on using Dutch and German nominal government bonds for estimating the risk-free rate because of the lack of robust evidence from index-linked government bond markets or swap-based estimates.[10] The limitations on the use of index-linked bonds and

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9 As reported in Dow Jones International News (30 January 2006) *"Euro Yield Curve is Unlikely to Invert"*.

10 NERA (Jan 2009): The Cost of Capital for KPN's Wholesale Activities: A 1-year Estimate for 2007

swap-based estimates continue to apply. We therefore continue to use nominal government bonds, the yields of which are then deflated using expected inflation. However, we note that there are two German government bonds indexed to inflation maturing in 2013 and 2016 respectively that we consider as a cross-check on our estimate of the risk-free rate for 2012-2014. (see section 3.4)

3.2. Length of Maturity

The CAPM model is a so-called 'one-period' model which does not explicitly define the length of the underlying time horizon for the risk-free rate. Since the risk-free rate is typically estimated using government bonds, the choice of the redemption period can have an important impact on the estimate of this key parameter.[11]

An appropriately designed regulatory regime needs to ensure that investors are compensated for risk over the lifetime of the investments. This means before the investment decision, in order for investors to commit capital, they need to expect to break even on average and earn a risk-reflective rate of return on the investment over their investment horizon. There are two main approaches when considering the appropriate length of the maturity period used to determine a risk-free rate:

- Setting the underlying maturity equal to the end of the regulatory review period; or
- Setting the underlying maturity equal to the life of the asset.

The right approach depends on the investment horizon of a typical investor. For instance, an investment in a greenfield project (with yet unknown demand and technological uncertainties) would need to ensure its investors an appropriate compensation for the risks over the entire project live. In this case, the investment horizon would be the asset life of the new investment. Therefore, the risk free rate would need to be estimated with respect to the lifetime of the project.

By contrast, the likely investment horizon of an investor investing in an already existing regulated utility business - where new investments mainly reflect replacement capex – may be the regulatory period. This is because the uncertainty surrounding the allowed regulatory rate of return is revised at the beginning of each new regulatory period. In this case, the risk-free rate should be based on the length of the regulatory review period. The use of a maturity profile equal to the regulatory review period has also been proposed in Lally (2002):

> *"To summarise, the use of an interest rate of longer term than the regulatory period for setting output prices leads to two problems in a presence of a non-flat term structure. If the non-flat term structure is due to a liquidity premium, and therefore unpredictability in future spot rates, the use of the long-term spot rate for setting prices will lead to the revenues being too large ex ante, i.e., their present value will exceed the initial investment. In addition, if the non-flat term structure is due to predictable change over time in the short term spot rate, then the use of the longer*

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[11] We note economic theory (e.g. the Liquidity Theory) predicts that the government bond yield curve is upward sloping (meaning long-dated bonds trade at higher yields).

> *term interest rate for setting prices will lead to revenues that are sometimes too large and sometimes too small, ex ante."*

We note that OPTA has used a maturity equal to the regulatory period since 1997, and this approach has been consulted on with the Industry Working Group. Therefore while noting that there are arguments on both sides it appears that Dutch investors have been willing to accept risk-free rates derived on the basis of the length of the regulatory period. Therefore, on balance we prefer the use of a maturity equal to the length of the regulatory period for the WACC determination for KPN, as this is consistent with OPTA's approach used in previous price reviews, which has been consulted on with the Industry Working Group.

3.3. Evidence from nominal government bond rates

One way to estimate the risk-free rate is to use nominal bond yields, and derive the real risk-free rate by deflating nominal yields by inflation expectations. There is a deep and liquid market from which to draw the data and the approach is used by numerous European regulators The use of nominal bonds as the basis for a real risk free rate is advantageous *if* the nominal government bond market is more liquid / less distorted than the inflation-protected government bond market.

In deriving the estimates for different time periods based on nominal government bonds we use an averaging period of three years each in order to reflect that in the current volatile environment spot rates can be influenced by one-off events and can thus be misleading with regard to the likely average rate over the regulatory period. Nevertheless, given the relatively short regulatory period in the Netherlands we consider it appropriate to give significant weight to recent data. We therefore use an averaging period of three years to strike a balance between using the most recent data and not giving excessive weight to one-off events bearing in mind that any deviations between outturn rates and forecasts can be rectified relatively quickly given the shortness of the regulatory period.

In 2009 we discussed at length the relative merits of using a risk-free rate that approximates the maturity of the asset life against using the maturity of a risk-free rate that approximates the regulatory period. Some of the arguments are repeated in section 3.2. Moreover, OPTA has continually used the regulatory period as the benchmark, an approach that has consulted on with the Industry Working Group.

Table 3.1 presents our estimates of the nominal risk-free rate for three-year maturity German and Dutch government bonds. The use of German Government bonds is in line with standard regulatory and practitioner precedent in estimating the nominal risk-free rate for the Eurozone area. As a further consistency check, we also consider evidence on nominal Dutch Government bond yields. We draw on Bloomberg estimates of the fair market value of (hypothetical) German and Dutch government bonds with constant three-year maturity; as derived from the yields on bonds with a similar maturity. This approach represents a refinement of our 2009 methodology where we directly used the individual bonds with a similar maturity.

Table 3.1
Nominal Risk-free Rate Estimates (%)

	German Government Bond rate (3Y maturity)	Dutch Government Bond rate (3Y maturity)	NERA Estimate of the Nominal risk-free rate
2010 (Up to Dec 2009)	3.17	3.30	3.24
2011 (Up to Dec 2010)	2.17	2.34	2.26
2012-2014 (Up to Dec 2011)	1.43	1.64	1.53

Source: NERA analysis of Bloomberg data. Bloomberg fair market estimates of government bond rates with a maturity of three years, averaged over three years.

Table 3.1 shows that the risk-free rate has fallen substantially since 2009, by around 100 basis points (1.0%) between December 2009 and December 2010 and a further c.70 bps between December 2010 and 2011. This represents the impacts of unconventional monetary policy in the Eurozone aimed at lowering the cost of debt financing as well as significant "flight to quality", i.e. investors reorganising their portfolios towards low risk assets.

In order to arrive at the real risk-free rate, which is the relevant parameter in the Dutch context we subtract the expected rate of inflation for the forecasting period. We use the latest available information for the respective forecasting period drawing on evidence from the ECB Survey of Professional Forecasters, published in Q4 of the year preceding the forecasting period.

Table 3.2 shows our estimates of the real risk-free rate for 2010, 2011 and 2012-2014.

Table 3.2
Real Risk-free Rate Estimates (%)

	Nominal risk-free rate estimate (3Y maturity)	Expected inflation	NERA Estimate of the Real risk-free rate
2010 (Up to Dec 2009)	3.24	1.20	2.02
2011 (Up to Dec 2010)	2.26	1.50	0.75
2012-2014 (Up to Dec 2011)	1.53	1.80	-0.27

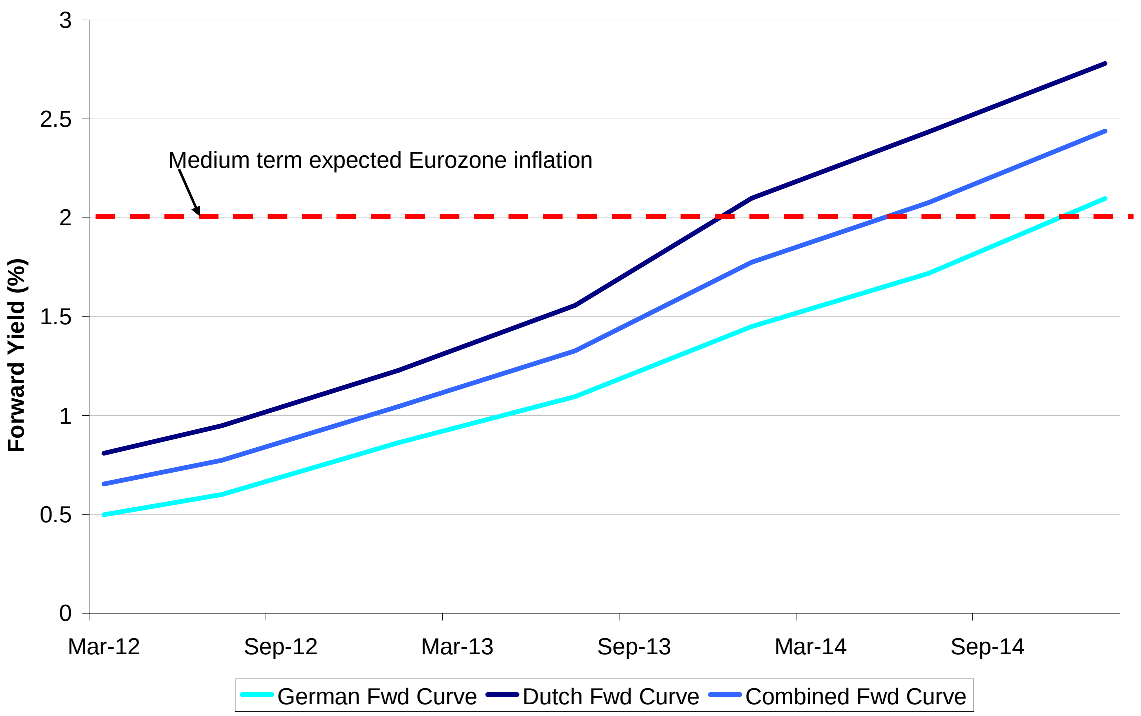
Source: NERA analysis and ECB survey of professional forecasters. Real rate derived user the Fisher equation.

We note that the values for the real risk-free rate that we obtain for 2011 and 2012-2014 are significantly lower than any recent regulatory precedent. While they reflect current yields observed in the market, they appear to be heavily influenced by unconventional monetary policy (quantitative easing and expansion of the ECB tendering facility) as well as significant "flight to quality" to some of the few remaining "AAA" nations in Europe.

Had we relied on spot rates alone the estimated negative risk-free rate would have been even more significant. With spot rates for three-year maturity Dutch and German government bonds at 0.66% and 0.31% respectively the spot real risk-free is equal to -1.31% after accounting for expected inflation of 1.8%.

We check whether negative real risk-free rates are expected to continue throughout the regulatory period by investigating evidence from forward curves[12] on Dutch and German government bond rates with 3Y maturity. Figure 3.1 shows that real yields on Dutch and German government bond yields are forecast to stay negative throughout the majority of the 2012 to 2014 regulatory period when accounting for the fact that according to the EC survey of professional forecasters inflation is expected to reach 2.0% again over the next five years.

Figure 3.1
Expected future government bond yields based on forward curves



Source: NERA analysis of Bloomberg data

Based on the above the average expected yield on a three-year government bond (averaging Dutch and German bonds) is below 1.5%. Thus, the implied real-risk free rate of -0.27% calculated in Table 3.2 is comparatively generous for any expected inflation level above 1.8%.

12 Forward curves derive the expected yield on a say three-year maturity bond at a date in the future (say 1 Jan 2014) by comparing the current yield on a bond that is maturing on the 1 Jan 2014 to one that will have exactly three years of maturity left on the 1 Jan 2014.

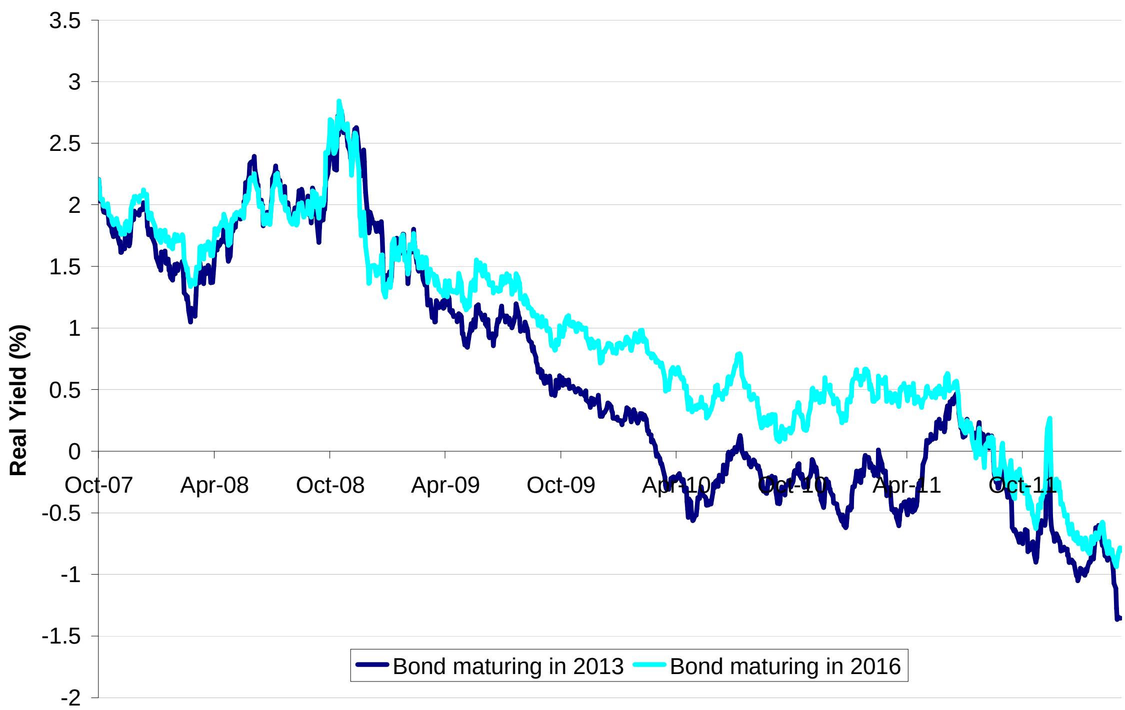
Current ECB evidence on the expected level of inflation five years from now suggests inflation rates are expected to rise towards 2.0% with current levels already at 1.8%.

3.4. Cross-Check using German index-linked government bonds

We note that the observation of negative real risk-free rates over the next three years is also borne out by evidence from the index-linked government bond market. In this section we consider evidence from German index-linked bonds.[13]

There are two German index-linked bonds maturing close to the forecasting horizon for the 2012-2014 period, one maturing in 2013 and one maturing in 2016. Figure 3.2 shows that these issues display negative yields at the moment, in line with our finding derived from nominal government bond yields.

Figure 3.2
Yields on German index-linked issuance



Source: NERA analysis of Bloomberg data

On the whole the yields shown in Figure 3.1 confirm our results in Table 3.2. We do not consider these two bonds as primary evidence because of the structural features potentially distorting the index-linked government bond market (see section 3.1) and because it is not possible to derive a robust fair market curve with exactly three years maturity given the limited issuance.

[13] We are not aware of any outstanding Dutch index-linked issuance.

3.5. Conclusion on Real Risk-free Rate

We primarily derive the real risk-free rate from nominal German and Dutch government bond rates from which we subtract expected Eurozone inflation over the forecasting horizon as predicted by the ECB survey of professional forecasters. The results from this approach are shown in Table 3.3.

Table 3.3
Real Risk-free Rate Estimates (%)

	NERA Estimate of the Real risk-free rate
2010 (Up to Dec 2009)	2.02
2011 (Up to Dec 2010)	0.75
2012-2014 (Up to Dec 2011)	-0.27

Source: NERA analysis of Bloomberg and ECB survey of professional forecasters. Real rate derived using the Fisher equation.

The real risk-free rate for 2010 exceeds regulatory precedent while we see a significant reduction in the real risk-free rate afterwards with the rate falling to 0.75% for 2011 and even turning negative for the period 2012-2014. This negative outlook is brought about by historically low nominal risk-free rates. Based on the most recent (March 2012) spot rates the negative real risk-free rate would have been even more pronounced.

We cross-check our estimates against German index-linked government bonds and forward curves for German and Dutch nominal government bonds. These data sources confirm the fall in risk-free rates since 2008 and also confirm that real risk-free rates are expected to stay negative for much of the regulatory period. We therefore see no reason to adjust our results derived from nominal government bonds.

4. The Equity Risk Premium

The equity risk premium (ERP) is the difference between the expected return on the market portfolio and the expected return on a risk-free asset (formally stated as $E[r_m] - E[r_f]$ i.e. it is the reward investors demand for bearing the risk they expose themselves to by investing in equity markets.

In Section 4.1 we summarise recent Dutch and international regulatory precedent on estimates of the ERP. Section 4.2 discusses how to estimate the equity risk premium at times of heightened volatility. In Section 4.3 we summarise the findings from analyses of long-run historical returns. Section 4.4 discusses alternative estimates of the ERP that better account for market expectations and section 4.5 concludes.

4.1. Regulatory Precedent on the Equity Risk Premium

Table 4.1 presents recent Dutch regulatory precedent on the equity risk premium.

Table 4.1
Dutch Regulatory Precedent on the Equity Risk Premium

Regulator	Case (date)	ERP
OPTA	EDC WACC	6.0%
NMa	TenneT (2010) and regional networks (2010)	4.0 – 6.0%
NMa	GTS (2011)	4.0 – 6.6%

Source: NERA analysis of regulatory decisions

Recent Dutch precedent on the ERP shows estimates of the ERP lying between 4% and 6%. We note that the NMa considers a range from 4.0-6.0% for the determination of GTS' tariffs for the period 2010-2013 while using a range from 4.3-6.6% for the re-determination of the tariffs for the period 2006-2009 to account for the impact of the financial crisis.

We also consider recent regulatory precedent on the ERP in telecoms decisions in other European countries, summarised in Table 4.2.

Table 4.2
Recent UK and European Regulatory Decisions on the Equity Risk Premium

Institution	Case	ERP
ARCEP (FRA)	Fixed and mobile WACC for 2010/11	5.00%
BIPT (BEL)	Fixed and mobile WACC Belgium (2010)	5.25%
BNetzA (GER)	Fixed line charges (2011)	4.73%
Ofcom (GBR)	Draft decision for BT Openreach (2012)	5.00%

Source: NERA analysis of regulatory decisions

UK and European regulatory precedent shows slightly lower ERPs than those allowed by the Dutch regulators, in the range of 4.73-5.25%. In most cases, most weight has been given to evidence on historic average returns with limited explicit account being taken of current market conditions.

Outside the UK, in countries including the US, and Australia the ERP has generally been set at a higher level. In the US, although the CAPM is not widely used to estimate the cost of equity, it is often used as a check on the DCF results. The most widely quoted source used in US hearings to assess the level of the ERP is the Ibbotson data.[14] The method recommended by Ibbotson is to compute the arithmetic average of stock market returns against long-term Treasury bond yields.

4.2. Estimating the Equity Risk Premium at times of heightened volatility

In 2009 we used the arithmetic mean of long-term historic data as our preferred measure of the equity risk premium (ERP), consistent with the academic literature on long-run asset returns. Our estimate was taken from the annual DMS Yearbook, which contains the best historic data on market returns and the ERP. This source is widely used in regulatory settings for estimating the ERP. Because DMS did not report an explicit estimate of the European ERP we estimated the European ERP as the average of the individual country ERPs.

Since 2009 DMS have published an explicit European ERP, which is ca. 100 basis points below the average of the individual ERPs. We also note that the sole use of long-run average *realised* returns may not be an appropriate reflection of the *short-run expected* returns by investors, especially in a period of financial turmoil where market volatility is significantly above its long-run average. (cf. Figure 2.2 in section 2.2)

Relying solely on historical averages of realised returns produces a counterintuitive result in that large falls in the stock market lead to reductions in the *expected* market return. An approach that results in a conclusion that the financial crisis of 2008/09 led to lower required returns for investors to hold the equity market portfolio is simply not consistent with observed data on buy-sell patterns.

An alternative approach that accounts for such volatility is to estimate the ERP based on current market data. One widely used variant of this approach applies the Dividend Growth Model (DGM) to estimate expected returns for a stock market portfolio; subtracting current yields on risk-free assets gives the ERP. This is the "forward-looking" approach to estimating the ERP.

There is no consensus on which approach is superior. E.g Damodaran (2011)[15] states: *"Most investors and managers, when asked to estimate risk premiums, look at historical data."* However the NYSSA[16] favours the forward-looking ERP: *"It is always better to use a forward-looking value that reflects the current market conditions. But the standard methods*

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[14] Ibbotson Associates publish data on the ERP every year in a handbook, "Stocks, Bonds, Bills & Inflation".

[15] Damodaran (2011): Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2011 Edition

[16] New York Society of Security Analysts: http://post.nyssa.org/nyssa-news/2010/04/deriving-a-forwardlooking-equity-market-risk-premium.html

for calculating equity risk premiums rely on historical estimates—and therefore are backward looking."

These views suggest that the forward-looking approach may have a more solid (theoretical) grounding, but that the historic approach represents more closely how investors actually behave.

We therefore cross-check our estimate of the ERP based on long-run realised returns with the estimated ERP using a dividend growth model. This model uses data on current stock prices and analyst forecasts of dividends in order to back out the implied discount rate (cost of equity) that justifies the current stock market valuation, thereby giving an up-to-date estimate of the forward-looking cost of equity. The DGM is the main model used in regulatory determinations in the US.

The need for including an ex ante estimate of the market risk premium has also been recognised by the NMa recently. In its determination the NMa notes that the use of ex ante data in determining the market risk premium is relevant for two reasons. The first reason is that the WACC should be "forward-looking" and thereby anticipate future developments not reflected in the historic averages and secondly the NMa views the ex ante approach as a way of cross-checking whether recent market developments have made it necessary to adjust the historic-based figure.[17]

4.3. Historical Evidence on the Equity Risk Premium

The Global Investment Returns Yearbook compiled annually by finance professors Dimson, Marsh and Staunton in co-operation with Credit Suisse provides long-run historic averages for returns on equity markets for 17 countries around the world over the period from 1900 - 2011, and compares them against the returns on treasury bills and bonds. Since 2009 the authors have also started reporting an equity risk premium for the Eurozone as a whole accounting for diversification gains that such a portfolio achieves compared to simply averaging the individual country ERPs to get a Eurozone estimate as was the common approach before.

The results are summarised in Table 4.3 for selected Eurozone markets reported by Dimson, Marsh and Staunton, US, UK and the world and Eurozone averages.

[17] NMa (2011): Decision on GTS WACC, http://www.nma.nl/images/Bijlage%202%20WACC%20bij%20Methodebesluit%20Transport%20GTS%202010-2013%20%282%2922-193277.pdf

Table 4.3
Dimson, Marsh and Staunton Estimates of the Equity Risk Premium, Relative to Bonds, Arithmetic Averages (1900 – 2011)

	Average up to		
Country	**2009**	**2010**	**2011**
Belgium	4.9%	4.9%	4.7%
Netherlands	5.9%	5.8%	5.6%
Germany[1]	8.8%	8.8%	8.5%
Eurozone (DMS, combined)	**5.2%**	**5.2%**	**5.0%**
USA	6.3%	6.4%	6.2%
UK	5.2%	5.2%	5.0%
World (DMS weighted index)	4.9%	5.0%	4.8%

Source: Credit Suisse (2010, 2011, 2012) "Global Investment Returns Yearbook. The German estimates are based on returns over108- 110 years of data, with 1922/3 excluded where hyperinflation had a major impact on the risk premia and bills returned –100%.

In line with our approach set out in Section 2.1 our primary estimates of the cost of capital components for KPN's wholesale activities are based on Eurozone data. The Table shows that the Eurozone arithmetic ERP relative to bonds measured over the period 1900-2009 was 5.2% (5.2% and 5.0% for 2010 and 2011 respectively). This estimate is lower than the average for the Netherlands and higher than the average for the world index. This is consistent with standard arguments about reduced risk achieved by diversification that goes along with lower returns. Most notably however the historic averages for the Eurozone as a whole throughout 2009 to 2011 are 80-100 bps lower than the previously used measure of the ERP, which averaged individual country ERPs.

Using this lower estimate of the ERP (compared to 2009 precedent) is not consistent with observed evidence on heightened market volatility (see Figure 2.2 above). We therefore complement the historic approach with ERP estimates derived from the dividend growth model.

4.4. Estimating the Equity Risk Premium using the DGM

The simplest model for determining the forward-looking MRP is the 'one-step' DGM. The 'one-step' DGM is derived as follows:

$$\mathbf{R_m = D_1/P_0 + g}$$

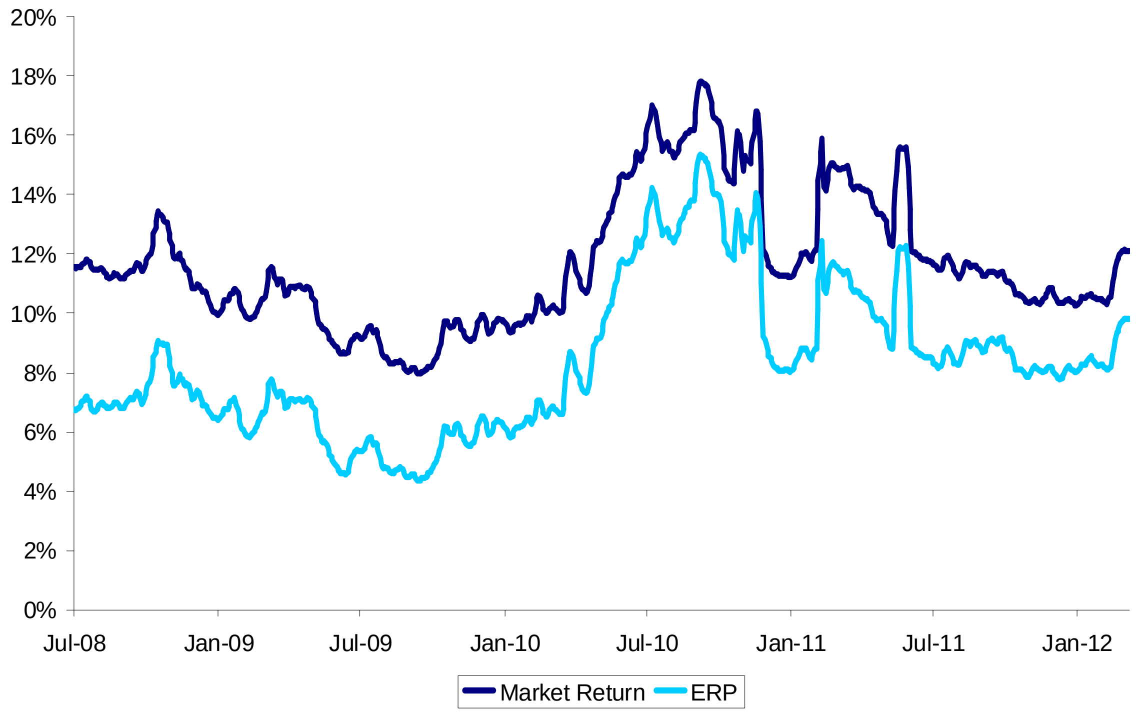
Where:

- $\mathbf{R_m}$ is the expected market return on the leading stock exchange in the country;
- $\mathbf{D_1/P_0}$ is the prospective dividend yield for the leading stock exchange; and
- **g** is the long term dividend growth rate based on analyst forecasts of future earnings growth.

The use of the long-term earnings growth rate as a proxy for dividend growth relies on the assumption that dividend payout ratios (dividends to earnings) remain constant. This is an assumption commonly made in deriving estimates of the MRP. There are more complex dividend growth models that account for changes in payout policy. Such estimates are produced by Bloomberg as shown in Figure 4.1.

By using up-to-date data on analyst forecasts of earnings and current stock prices the DGM is able to estimate a current equity risk premium based on the latest expectations by stock market actors. Figure 4.1 shows that these current earnings expectations are significantly above long-run averages, which we calculated at 5.0-5.2% in section 4.3. This is consistent with heightened risk investor risk aversion during the financial crisis of 2008/09 and particularly the sovereign debt crisis in Europe.

Figure 4.1
Bloomberg ERP estimate for the Netherlands



Source: NERA analysis of Bloomberg data

4.5. Summary and Conclusions on the Equity Risk Premium

We summarise evidence presented in this section:

- Dutch and international regulatory precedent on the equity risk premium broadly falls into a range from 4.0 to 6.6%. The upper end of the range is consistent with the Dutch energy regulator allowing an uplift to the ERP to account for increased risk brought about by heightened market volatility following the financial crisis.
- Long-run arithmetic historical averages of the ERP for the Eurozone, presented by Dimson, Marsh and Staunton suggest an ERP lying in the range of 5.0 to 5.2%. However, these do not account for the currently heightened volatility in financial markets.
- In order to account for the increased current volatility of financial markets (that has on the other hand led to extremely low returns on risk-free assets, cf. section 3) we also consider

DGM estimates of the ERP that provide a forward-looking estimate of expected market returns as expressed through current stock market valuations.

Table 4.4 shows the estimated ERPs based on both methods. Taking into account that conditions are likely to normalise over the medium term we propose to use an average of the forward-looking and historic estimate of the ERP. Based on this approach we calculate ERP estimates of 6.87% for 2012-2014 (6.6% for 2011 and 5.67% for 2010 respectively)

Table 4.4
ERP Estimates (%)

	Realised Historic Returns(1)	Current expected Returns (2) (Netherlands)	ERP (50%DMS, 50%DGM)
Up to end 2009	5.00	6.33	5.67
Up to end 2010	5.20	8.00	6.60
Up to end 2011	5.20	8.53	6.87

Source: NERA analysis of Dimson, Marsh and Staunton: Global Investment Returns Sourcebook and Bloomberg data. (1) DMS estimate of long-run realised returns for Eurozone published in 2009, 2010 and 2011 respectively. (2) Bloomberg DGM estimate of the Dutch ERP using 3Y average (or longest available, where less than 3Y available) for all periods.

The increase in the ERP compared to regulatory precedent is consistent with the observed reduction in the risk-free rate. (cf. section 3). Not incorporating the effect of the financial crisis on the ERP in any way (by relying purely on historic returns) risks distorting the estimate of the cost of equity, especially where the other parameters are estimated over relatively short time frames.

5. Beta

The Beta factor is a measure of co-variance of an asset's returns with the returns of the market as a whole, which are driven by macroeconomic factors such as interest rate movements and the general business cycle. Beta reflects systematic, non diversifiable risk and according to CAPM theory, only this type of risk should matter to investors and therefore be reflected in the cost of equity.

In estimating beta for KPN's wholesale activities there are three key issues that need to be resolved. These are:

- The appropriate time-frame over which to estimate the betas;
- The method of de-leveraging our observed equity betas to derive comparable asset betas; and
- The appropriate comparators

We discuss these issues below.

5.1. The Time Frame

Beta estimates are generally obtained by means of regression analysis using historical evidence of the relationship between the returns to a company and the returns to the market as a whole. However, using historical evidence raises the question of the appropriate time period over which to estimate beta.

It is standard practice to estimate betas over a range of time periods between 6 months and 10 years and for data periodicities ranging from daily to monthly. Since the beta estimate is to be used as a forward looking measure of risk, under the assumption of market efficiency, the most economically relevant estimation time frame is the most recent period. However, there are three reasons why consideration should be given to betas derived from longer time periods.

- Beta estimates require a sufficiently long time period to smooth out the effects of business cycles
- Short term excess volatility can distort beta estimates
- A longer time period provides more statistically robust regression results.

For these reasons, we consider betas based on returns data over periods ranging from one year to five years. In 2009 we used five years of data to ensure the effects of business cycles and short-term market volatility did not distort the estimates. We follow the same approach here but present sensitivities in the appendix.

5.2. Estimating Asset Betas from Observed Equity Betas

There are two adjustments we have to make to our observed equity (or regression) betas to derive asset betas.

The Blume Adjustment process

First, the raw betas (or historical betas, i.e. those betas obtained from the regression of the company's stocks against the market index) have been adjusted according to a simple deterministic formula:

$$\beta_{Equity\text{-}adjusted} = (0.67)*\beta_{Equity\text{-}raw} + (0.33)*1.0.$$

This is referred to as the Blume technique.

Blume tested to see if forecasting errors on based on historical estimates were biased. Blume demonstrated that a tendency for estimated betas to regress towards their mean value of one. The adjustment formula above captures this tendency. There is also an alternative adjustment process, referred to as the Vasicek process. Vasicek developed a method for adjusting betas that took into account differences in the degree of sampling error for individual firm betas rather than applying the same adjustment process to all stocks.

There has not been extensive research into their comparative accuracy. Klemkosky and Martin (1975) discovered that the Vasicek technique had a slight tendency to outperform the Blume technique[18]. However, a slightly later study by Eubank and Zumwalt (1979) concluded that the Blume model generally outperforms the Vasicek model over shorter timeframes, with little difference between the over long time periods[19].

Allowing for financial risk

The value of the equity beta (ie the beta obtained from regression analysis) will not only reflect business riskiness, but also financial riskiness.[20] Equity betas have been adjusted for financial risk ("de-levered") to derive asset (or "unlevered") betas according to the following formula:[21]

(5.1) Miller formula: $\beta_{equity} = \beta_{asset}\,(1+(D/E))$

where D represents a company's debt, and E represents a company's equity. [22]

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[18] Klemkosky and Martin, The Adjustment of Beta Forecasts", Journal of Finance, X, No. 4 (1975); cited in Elton and Gruber, Modern Portfolio Theory and Investment Analysis, Fifth Edition, page 145.

[19] Eubank and Zumwalt, "An analysis of the Forecast Error Impact of Alternative Beta Adjustment Techniques and Risk Classes", Journal of Finance, 33 (5), 1979; cited in The Cost of Capital, Theory and Estimation, C S Patterson, page 127.

[20] As a company's gearing increases, the greater the variability of equity returns, since debt represents a fixed prior claim on a company's operating cashflows. For this reason, increased gearing leads to a higher cost of equity.

[21] This formula is attributed to Miller (1977).

[22] This formula does not include the debt beta. The debt beta is immaterial for the cost of equity in this situation because KPN's actual gearing is very similar to the assumed notional level (since we base the notional level on actual gearing). The observed equity beta is both de-levered and re-levered using the Miller formula, and if the gearing level is the same for each of these then the final equity beta is independent of the debt beta value. Therefore, since the debt beta is immaterial, we have ignored it for ease of exposition.

An alternative formula for unlevering betas is the following, attributable to Modigliani and Miller:

(5.2) Modigliani-Miller formula: $\beta_{equity} = \beta_{asset}\ (1+(1-t_e)\ (D/E))$

where tc is the effective tax rate.

The basic difference between the Modigliani-Miller theory and the Miller theory is as follows: Modigliani-Miller assume that debt is treated more favourably than equity, which in practice occurs through the effect of corporate tax shields on debt. Miller, subsequently, raised the possibility that debt could be treated more favourably than equity when there are different personal tax rates on debt that offset the effect of the corporate tax shields.

Some recent empirical evidence suggests that the more appropriate formula for levering and un-levering betas is the Miller formula.[23] We also prefer to use this formula for its simplicity since it does not require estimation of forward-looking effective tax rates for telecommunications companies.

The impact of using the Miller formula rather than the Modigliani-Miller formula is the derived asset beta is lower. However, when the beta is levered back up to an assumed gearing the overall impact on the WACC is very small (provided the assumed gearing is broadly similar to the actual gearing used for de-levering).

5.3. Empirical Evidence on comparators

In 2009 our primary evidence was derived from beta analysis using KPN's share price data, crosschecked with beta estimates of comparator companies. KPN's stock continues to be listed on the Amsterdam stock exchange. Consequently evidence on KPN's beta serves as our primary evidence on beta.

We note that some commentators have argued that beta estimates for KPN as a whole do not reflect the risk of KPN's wholesale activities. We have not seen any conclusive empirical evidence to support the claim that KPN's wholesale activities are less risky than KPN's business risk as a whole. There is no statistical method for determining the extent to which the estimated beta for KPN as a whole differs from the beta for its wholesale activities. Making adjustments which are not based on sound economic principles would introduce an unnecessary degree of regulatory uncertainty and risk, which is detrimental to the company to attract capital at the lowest cost.

Furthermore, in order to obtain a robust estimate of the beta of KPN's wholesale activities we also cross-check the beta estimate derived for KPN with the beta estimates for a group of European telecommunications companies.

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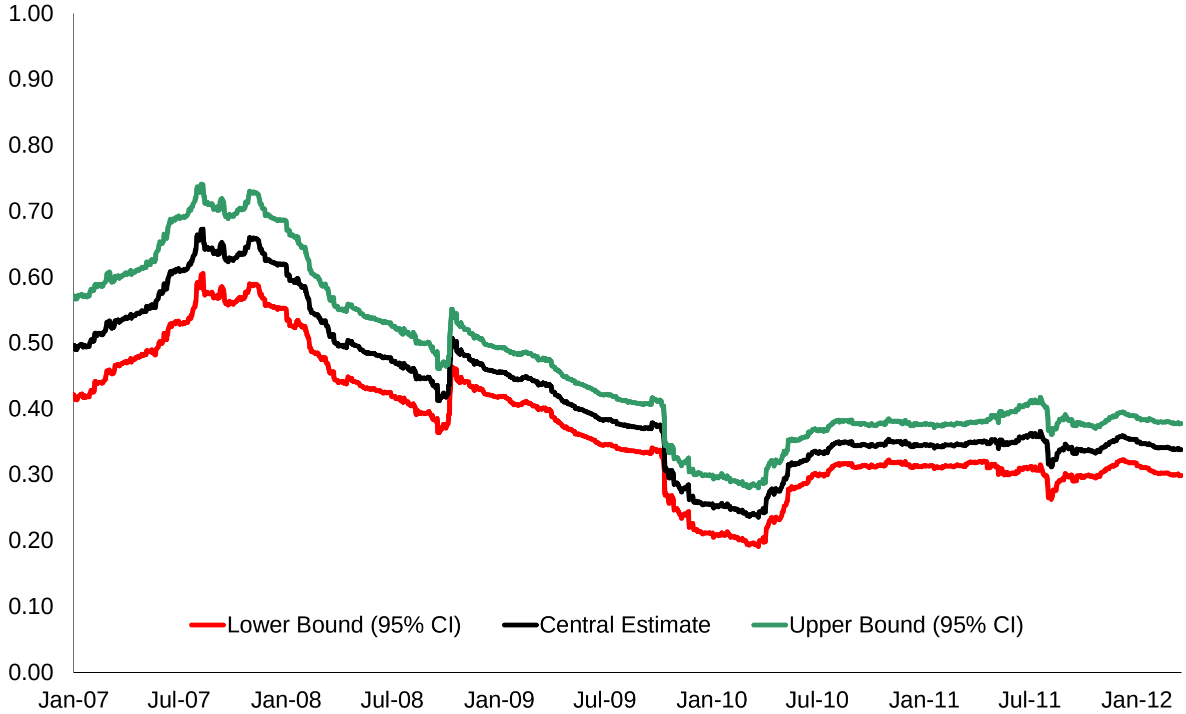
23 A recent study by Graham (2002) in the Journal of Finance suggests that personal taxes in the US can offset 50% of the debt interest tax shield. Other recent theories originating with Miles and Ezzell (1980) have noted that the expected value of the corporate debt tax shield declines with increasing debt since as a firm increases its debt it becomes less likely that the firm will pay tax in any given state of nature. These theories are particularly relevant for the current volatile circumstances of the telecom industry where the value of the interest tax shield is lower.

Figure 5.1 shows a time series of KPN's Blume-adjusted asset beta estimates from January 2007 to March 2012 (represented by the black / middle line). This time series consists of 1-year rolling asset betas, i.e. the first historic rolling asset beta in January 2007 has been estimated using daily returns data throughout 2006. Beta estimates have been estimated against the DJ Stoxx European 600 Index. We also calculated the 95%-confidence interval for our KPN (mean) beta estimate, i.e. we can be reasonably sure that the "true" beta estimate is within the range of the upper- and lower (green and red) lines.

Figure 5.1
KPN 1-Year Rolling Asset Beta, Blume-adjusted
(Mean Estimate, 95%-Confidence Interval)



Source: NERA analysis of Bloomberg data

Figure 5.1 shows that KPN's historic one-year asset betas have been first rising then falling since 2007 having stabilised at a level lower than in 2007 since mid-2010. This observation is consistent with the stock market view of KPN as a defensive stock. As stock market volatility increased (see Figure 2.2) the relative volatility of KPN compared to the stock market fell, leading to a lower beta. This effect operates in the opposite direction to the observed increase in the ERP (see section 4)

In keeping with our methodology from 2009 Table 5.1 presents estimates of KPN's beta values using daily frequencies over five years up to the respective cut-off points and compares them to the industry average for major Eurozone telecoms operators. The appendix contains more detailed documentation of individual company beta estimates calculated over different time frames.

Table 5.1
Asset Beta Estimates (5Y Estimates)

	KPN Beta (Mid Point)	Industry Average	KPN Beta (95% CI)
2010 (Up to Dec 2009)	0.43	0.42	0.41 - 0.45
2011 (Up to Dec 2010)	0.40	0.39	0.37 - 0.41
2012-2014 (Up to Dec 2011)	0.37	0.39	0.35 - 0.39

Source: NERA analysis of Bloomberg data. Daily data, Blume and Miller adjusted, estimated against the DJ Euro Stoxx 600. Comparator group consists of five largest European telecoms companies with significant fixed-line operations (i.e. excluding Vodafone): Deutsche Telekom, BT, France Telecom, Telecom Italia, Telefonica

The estimates in Table 5.1 reflect the observed reduction in KPN's beta since 2007 with the five-year average beta falling from 0.43 for data up to end-2009 to 0.37 for data up to end-2011. Our analysis of returns data for KPN further reveals that in the periods up to end 2009 and up to end 2010 KPN's asset beta was marginally above the industry average while it was slightly below when data up to December 2011 is considered.

We note that the beta estimate is based on a regression analysis and will therefore contain a statistical error. In Table 5.1 we present the 95%-confidence interval for KPN's asset betas – that is, KPN's "true" asset beta is very unlikely to be larger or lower than these values. In 2009 our chosen point-estimate was based at the top end of the 95% confidence interval of KPN's asset beta. At the time the top end of KPN's asset beta was consistent with the average beta value for the industry comparator group. At this stage we are following the same approach as the industry average is consistent with the top end of KPN's asset beta range for the most recent period.

Our preferred beta estimate is the 95%-confidence upper bound of KPN's 5 year beta estimate of 0.39 (for 2012-2014).[24] The choice to use the upper bound rather than the point-estimate is based on the industry average being in line with the upper bound for KPN. The 95%-confidence upper bound gives us confidence that KPN's true asset beta is very unlikely to be larger than 0.39 (for 2012-2014). Given the asymmetric economic costs of pricing infrastructure assets too high and too low we use an approach that reduces the risk of setting the cost of capital too low.[25]

24 We use 0.41 for 2011 and 0.45 for 2010 respectively.

25 On the asymmetric costs of pricing infrastructure too high and too low see e.g. the UK Competition Commission (2008): Competition Commission report: Stansted Airport Ltd - Q5 price control review, appendix L, page L27 & L28.

Table 5.2
Asset Beta for KPN's Wholesale Activities (Preferred Estimates)

	KPN Beta – Preferred Estimate
2010 (Up to Dec 2009)	0.45
2011 (Up to Dec 2010)	0.41
2012-2014 (Up to Dec 2011)	0.39

Source: NERA analysis of Bloomberg data. Daily data, Blume and Miller adjusted, estimated against the DJ Euro Stoxx 600.

Since 2007, there is evidence in the market to suggest that betas for telecommunications services have fallen. This development has to be seen in conjunction with the increase in overall market volatility described in section 4. These two effects largely counterbalance each other. Moreover, it is not clear whether the current market conditions with very high market volatility because of the European sovereign debt crisis will continue throughout the next three year regulatory period. In order to account for the fact that current conditions may not prevail throughout the entire regulatory period we do not only put weight on spot estimates but also on longer-term data in deriving our parameter estimates.

6. The Cost of Debt and Gearing

6.1. Cost of Debt

In 2009 our estimate of KPN's cost of debt was based on the actual coupon cost of KPN's outstanding EUR-denominated bonds at the relevant cut-off date. This method provides an accurate picture of the actual cost of KPN's debt and has been accepted by both OPTA and the IG at numerous previous reviews.

Consequently, our estimate of the nominal cost of debt for KPN is calculated as the weighted average coupon cost of all EUR-denominated bonds issued by KPN and outstanding as of the relevant cut-off date (i.e. 31 Dec 2009, 31 Dec 2010 and 31 Dec 2011 respectively).[26]

An estimate based on *actual* market evidence of historic debt issues by KPN most closely reflects both KPN's likely cost of debt finance prevailing over the near future and historical actual debt costs. Table 6.1 presents information on the average coupon costs of debt issued by KPN for the three different cut-off dates. The appendix provides more detail on the individual bonds outstanding at each cut-off date.

Table 6.1
NERA Coupon Cost of Debt Estimate for KPN
(based on KPN EURO Debt Issues)

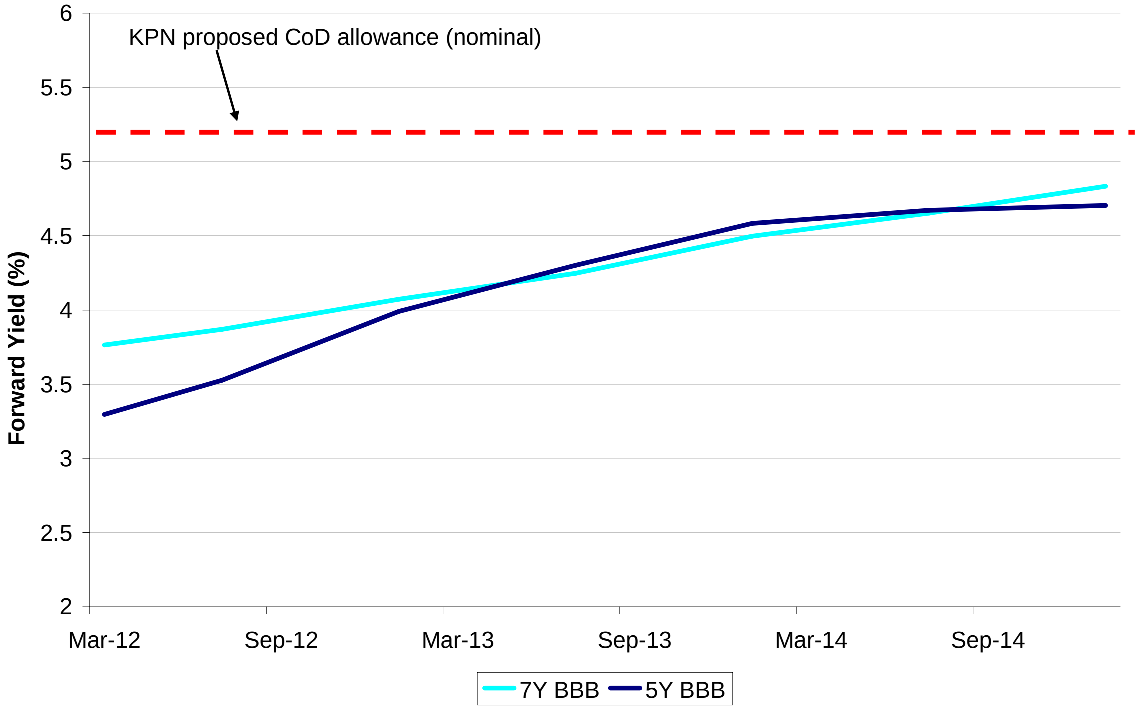
	Nominal Coupon Cost of Debt	Expected inflation	NERA Estimate of the Real Coupon Cost of Debt
2010 (Up to Dec 2009)	5.27	1.20	4.02
2011 (Up to Dec 2010)	5.17	1.50	3.62
2012-2014 (Up to Dec 2011)	5.23	1.80	3.37

Source: NERA analysis of Bloomberg data and ECB survey of professional forecasters. Real rate derived user the Fisher equation. Averages have been weighted by total amount issued.

Only limited amounts of the outstanding debt mature in 2010 and 2011 respectively (1% and 13%). Thus the average weighted coupon at the respective cut-off dates represents KPN's actual debt costs over 2010 and 2011 relatively well. However, 43% of the EUR-denominated debt outstanding as of December 2011 is set to mature between 2012 and 2014. Consequently, KPN will have to refinance a significant portion of its current debt and thus may face different debt costs over the period if new debt can only be obtained at less favourable terms. We investigate this issue in Figure 6.1 where we review predicted nominal debt costs for industrial issue with a "BBB" rating (the same as KPN).

[26] It is up to KPN to choose the currency of its financing instruments. It is therefore not the responsibility of OPTA to compensate KPN for potentially higher coupon payments on debt instruments denominated in other currencies.

Figure 6.1
Forward Curves for EUR "BBB" Industrials nominal debt cost



Source: NERA analysis of Bloomberg data. No data available on longer maturities

Figure 6.1 shows that financing costs for "BBB" rated issuers are expected to rise throughout the regulatory period. However, KPN's cost of debt allowance as per Table 6.1 is above the forward rates for reference bonds with 5 to 7 years (in line with the asset lives of KPN's assets) throughout the entire regulatory period. We therefore do not see any evidence that the allowance as per Table 6.1 would not allow KPN to raise new debt.

It is important to emphasise that the costs of debt finance associated with the coupon in the table exclude the costs of issue, Bank, Legal, Trustee and Paying Agent fees. In addition, corporate issues are usually made at a discount to par to meet investors preferred tax positions (discount part of returns is treated as capital gain) and to round the coupon payment to the nearest 1/8% (market practice). We understand that typically, an extra 10-15 bps[27] to bond coupons for fees and discounting arrangements must be added in order to adequately reflect KPN's cost of debt finance.

Our preferred estimates of the nominal cost of debt for KPN for the different cut-off dates are reported in Table 6.2. This reflects both, future coupon payments as well as any additional costs associated with the issuance of bonds born by KPN.

[27] Bps stands for 'basis points' and 1 bps is equal to 0.01%.

Table 6.2
NERA Final Cost of Debt Estimate for KPN
(based on KPN EURO Debt Issues)

	NERA Estimate of the Real Coupon Cost of Debt	Transaction Cost Allowance	NERA Estimate of the Final Real Cost of Debt
2010 (Up to Dec 2009)	4.02	+10-15 bps	4.15
2011 (Up to Dec 2010)	3.62	+10-15 bps	3.74
2012-2014 (Up to Dec 2011)	3.37	+10-15 bps	3.49

Source: NERA analysis of Bloomberg data and ECB survey of professional forecasters. Real rate derived user the Fisher equation. Averages have been weighted by total amount issued.

In the past some observers have argued that using the current cost of debt instead of the embedded cost of debt would encourage KPN to finance itself efficiently. We note that this is one approach that is taken by a number of regulators. However, Figure 6.1 suggests that at this point in time such an approach would put significant pressure on KPN in having to obtain new debt finance throughout the regulatory period at terms significantly better than the industry "BBB" average simply to be able to match the regulatory cost allowance. As movements in the cost of debt are largely beyond the company's control we do not believe that there should be an incentive mechanism for a cost item the company has limited control over. We therefore do not think that it would be appropriate for OPTA to shift its cost of debt methodology to a "current" cost of debt methodology.

6.2. Gearing

In 2009 we used the average actual gearing of KPN over the most recent year (2006 and 2008 for the two respective estimates) to derive the WACC. The respective estimates for the current cut-off dates are reported below, alongside more long-run averages.

Table 6.3 presents the capital structure for KPN. We calculated KPN's debt-to-equity ratio as total debt outstanding divided by the market value of equity. Based on this we also calculated the market gearing, which is total debt over enterprise value (D/(D + E)), as reported in the table.

Table 6.3
KPN's level of Gearing

	1Y	3Y	5Y
Up to end 2009	40.9%	38.6%	35.9%
Up to end 2010	42.2%	41.2%	37.7%
Up to end 2011	49.0%	44.3%	41.7%

Source: NERA analysis of Bloomberg data.

Table 6.3 shows that continued financial turmoil since 2008 has led to a gradual increase in gearing. There may be an argument for looking at more long-run estimates of gearing, consistent with an expected return to lower gearing levels over the regulatory period and the longer averaging period used for risk-free rate and beta.

However, we would not expect the gearing assumption to matter significantly to the cost of capital estimate as the benefits of increased debt finance above 40% are largely offset through a higher cost of equity (if the equity beta is adjusted for correctly). Consequently we follow the approach taken at the last review and take the latest 1Y values before the start of each observation period.

7. WACC Estimates

Table 7.1 presents our overall estimate of the cost of capital for KPN's wholesale fixed line telecommunications services for 2010, 2011 and 2012-2014 respectively.

Table 7.1
Cost of Capital for KPN's Wholesale Fixed Line Telecom Services

	1Y (2010)	1Y (2011)	3Y (2012 – 2014)
Cost of Equity			
Nominal risk-free rate	3.24%	2.26%	1.53%
Inflation	1.20%	1.50%	1.80%
Real risk-free rate	2.02%	0.75%	-0.27%
ERP	5.67%	6.60%	6.87%
Asset beta	0.45	0.41	0.39
Gearing (D/(D+E))	40.9%	42.2%	49.00%
Equity beta	0.76	0.71	0.76
Real post-tax return on equity	6.33%	5.43%	4.99%
Cost of Debt			
Nominal cost of debt	5.27%	5.17%	5.23%
Real cost of debt	4.15%	3.74%	3.49%
WACC			
Corporate tax rate	25.50%	25.00%	25.00%
Nominal post-tax WACC	*6.27%*	*5.89%*	*5.70%*
Nominal pre-tax WACC	*8.00%*	*7.35%*	*7.00%*
Real post-tax WACC	5.01%	4.32%	3.83%
Real pre-tax WACC	**6.72%**	**5.76%**	**5.10%**

Source: NERA analysis.

Appendix A. Averaging Method for the Historic ERP estimate

Substantial debate has taken place over whether average realised historical equity returns should be calculated using either geometric or arithmetic averages.

A large number of academic papers have stated a preference for the use of arithmetic means of historical data to estimate a prospective equity risk premium. Two examples of the arguments presented are as follows:

- Dimson, Marsh and Staunton (2000) argue (p.9) that "When decisions are being taken on a forward-looking basis, however, the arithmetic mean is the appropriate measure since it represents the mean of all the returns that may possibly occur over the investment holding period".[28]
- In his book "Regulatory Finance", Morin (1994) argues, "One major issue relating to the use of realized returns is whether to use the ordinary average (arithmetic mean) or the geometric mean return. Only arithmetic means are correct for forecasting purposes and for estimating the cost of capital."

Consistent with recent mainstream academic wisdom, NERA favour the use of the arithmetic rather than the geometric mean in deriving an average measure to calculate the ERP using historical data.

In their Millennium Book, Dimson, Marsh and Staunton (2001) note that historical evidence on the equity risk premium may overestimate the prospective risk premium. In particular, they argue (p.134) that periods of extreme volatility observed during the 20th century may mean that arithmetic averages of historical data may overestimate the prospective risk premium. They present recalculated arithmetic averages of the risk premia based on projections of early 21st century levels of volatility. Based on this evidence they show that arithmetic averages are around 0.6% lower when re-based for assumed lower levels of market volatility.[29] However, we note that this adjustment is contested (see for example Wright, Mason and Miles (2003).[30] Caution over adjustments for differences in forward looking volatility relative to long run historical levels may be particularly relevant with respect to recent market behaviour since 2001 (occurring after DMS (2002)) which has demonstrated periods of volatility significantly higher than previous average levels. Other arguments are

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28 Dimson, Marsh and Staunton (2000) "*Risk and Return in the 20th and 21st Centuries*", Business Strategy Review 2000, Volume 11 Issue 2, pp1-18.

29 In Table 28 of their report, Dimson, Marsh and Staunton show that the predicted arithmetic mean equity risk premia versus bills for the UK is 5.9%. This compares to historical evidence presented in Table 25 that shows the UK equity risk premia relative to bills of 6.5%.

30 Wright, Mason, Miles (2003), "A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK", Smithers and Co Ltd.

presented by Dimson, Marsh and Staunton that also suggest that future ERPs may differ from historical estimates. These arguments can be summarised as:[31]

- Systematic underestimation of inflation by investors;
- High levels of technological, productivity and efficiency growth over the 20th Century that they (DMS) consider are unlikely to be repeated; and
- Observed rising stock prices (and therefore returns) are also suggested to be a sign of lowered long term investment risk which would result in a reduction in *required* rates of return.

Dimson, Marsh and Staunton's conclusion that the prospective equity risk premium is lower than the historical equity risk premium is not without controversy. There are a number of criticisms of DMS' approach to and justification for deriving downward adjustments to historical returns evidence, made both by other academic commentators and by DMS themselves.

We do not incorporate this contested analysis in our estimate, particularly given that recent long run estimates of the ERP are downwardly influenced by recent consecutive and significant losses in global equity markets associated with the bear market of the late 2000s. This decrease in the measure of the ERP is counterintuitive; the bear market is widely reported to have been associated with an increase in the ERP. Further, DMS themselves recognise the exceptional nature of recent falls. We therefore conclude that 2011 evidence may be on the low side as an estimate of the forward looking ERP.

31 The authors show, by decomposing the historical ERP and subtracting the estimated impact of unanticipated cash flows and reductions in investors' required rates of return, that predicted ERPs are likely to be greater than historical estimates. Overall, the authors conclude that factors such as these would have likely led to a reduction in investors required rates of return and a reduction in the equity risk premium. They conclude that this evidence suggests (p.149) that the net effect of these factors means an expected equity risk premium on an annualised basis is around 3-4 percent; and on an arithmetic mean basis is around 4-5 percent. This is around 1.5% lower than the ERP implied by the historical averages.

Appendix B. Details of Beta Estimation

This appendix undertakes a sensitivity analysis of the beta for KPN and its comparators to using different time frames for estimating beta for each of the cut-off dates. (Dec 2009, Dec 2010, Dec 2011). The comparator group is made up of Europe's five largest fixed-line operators.[32]

B.1. Beta estimates up to end-2009

Table B.1
Beta Estimates for European Telecommunications Companies (Dec 2009)

Company	1Y	2Y	5Y
KPN	0.26	0.39	0.43
KPN – upper bound of 95% CI	0.30	0.41	0.45
Telecom Italia	0.28	0.30	0.33
BT Group	0.32	0.39	0.44
France Telecom	0.31	0.39	0.42
Deutsche Telekom	0.28	0.38	0.39
Telefonica	0.40	0.50	0.51
Average (ex KPN)	**0.32**	**0.39**	**0.42**

Source: NERA analysis of Bloomberg data. Betas have been estimated against the DJ Stoxx European 600 Index (SXXP), over time periods which end on 31/12/2009 (1) The gearing rates used for unlevering are the averages over the time period in question. (2) Raw equity betas have been adjusted using the following formula: $\beta_{equity\_adjusted} = (0.67)*\beta_{equity\_raw} + (0.33)*1.0$. *(3) Adjusted equity betas have been unlevered using equation the following formula:* $\beta_{equity\_adjusted} = \beta_{asset}$ *(1+(Debt/Equity).*

32 We note that in 2009 we also used Telia Sonera (Sweden) and Portugal Telecom as comparators. According to our research these two companies currently do not constitute good comparators. Telia Sonera is strongly involved in mobile telephony activities in Central Asia, which has increased its risk profile compared to European fixed-line operations while Portugal Telecom's beta has been biased downwards by the financial crisis in the country, which has decoupled Portuguese stock prices from the European market to a degree that is not representative of telecommunications services in the Netherlands.

B.2. Beta estimates up to end-2010

Table B.2
Beta Estimates for European Telecommunications Companies (Dec 2010)

Company	1Y	2Y	5Y
KPN	0.35	0.29	0.40
KPN – upper bound of 95% CI	0.38	0.32	0.41
Telecom Italia	0.32	0.30	0.30
BT Group	0.42	0.36	0.39
France Telecom	0.45	0.36	0.41
Deutsche Telekom	0.31	0.29	0.36
Telefonica	0.61	0.48	0.52
Average (ex KPN)	**0.42**	**0.36**	**0.39**

Source: NERA analysis of Bloomberg data. Betas have been estimated against the DJ Stoxx European 600 Index (SXXP), over time periods which end on 31/12/2010 (1) The gearing rates used for unlevering are the averages over the time period in question. (2) Raw equity betas have been adjusted using the following formula: $\beta_{equity\_adjusted} = (0.67)*\beta_{equity\_raw} + (0.33)*1.0$. *(3) Adjusted equity betas have been unlevered using equation the following formula:* $\beta_{equity\_adjusted} = \beta_{asset}$ *(1+(Debt/Equity).*

B.3. Beta estimates up to end-2011

Table B.3
Beta Estimates for European Telecommunications Companies (Dec 2011)

Company	1Y	2Y	5Y
KPN	0.36	0.35	0.37
KPN – upper bound of 95% CI	0.39	0.38	0.39
Telecom Italia	0.31	0.32	0.29
BT Group	0.57	0.49	0.41
France Telecom	0.48	0.47	0.40
Deutsche Telekom	0.39	0.36	0.35
Telefonica	0.55	0.58	0.51
Average (ex KPN)	**0.46**	**0.44**	**0.39**

Source: NERA analysis of Bloomberg data. Betas have been estimated against the DJ Stoxx European 600 Index (SXXP), over time periods which end on 31/12/2011 (1) The gearing rates used for unlevering are the averages over the time period in question. (2) Raw equity betas have been adjusted using the following formula: $\beta_{equity\_adjusted} = (0.67)*\beta_{equity\_raw} + (0.33)*1.0$. *(3) Adjusted equity betas have been unlevered using equation the following formula:* $\beta_{equity\_adjusted} = \beta_{asset}$ *(1+(Debt/Equity).*

The above results show that our approach of taking the 5-year average of the upper bound of the confidence interval for KPN's estimated beta generally provides KPN with an allowed beta in line with or above the industry average. There are some indications that industry betas have been increasing again over the most recent one-year period. This is in line with observed lower market volatility throughout most of 2011 (cf. Figure 2.3), which tends to increase the beta of defensive stocks such as fixed-line telecommunications operators.

However, we do not consider there to be sufficient evidence that using the 5-year beta is unsuitable for OPTA to change methodology for the following reasons:

- Figure 2.2 shows that expected volatility has increased again in late 2011, a priori leading to the expectation of reduced betas in the near future;
- The evidence for a recent increase in beta for KPN is much less pronounced than for the industry average;
- In 2009 OPTA did not opt for a one-year approach despite evidence that KPN's five-year asset beta up to December 2008 (mean estimate: 0.49, upper bound of 0.54) was overstating the current beta compared to a one-year estimate (mean estimate: 0.46, upper bound of 0.50).

In fact one of the reasons for using a medium term averaging period of five years is that such differences balance out over the longer term. We therefore do not see any necessity to adjust the averaging period.

Appendix C. Actual Cost of Debt for KPN

This appendix lists KPN's outstanding EUR-denominated bonds at each of the cut-off dates. Note that the rating agency Standard & Poor's downgraded the rating of KPN's debt from BBB+ to BBB on 21 February 2012. Consequently the rating grades shown for the cut-off dates 31 December 2009, 31 December 2010 and 31 December 2011 differ from the forward-looking rating used in section 6.1.

Table C.1
KPN's outstanding EUR Debt Issues at 31 Dec 2009

Maturity	Issue Date	Coupon (%)	Size (M €)	S&P Rating
28/10/2010	28/10/2005	2.75	150	BBB+
21/07/2011	21/07/2004	4.5	1,425	BBB+
13/11/2012	13/11/2007	5.0	1,250	BBB+
18/03/2013	16/03/2006	4.5	850	BBB+
16/09/2013	16/09/2008	6.25	850	BBB+
04/02/2014	04/02/2009	6.25	750	BBB+
29/05/2014	29/05/2007	4.75	650	BBB+
22/06/2015	22/06/2005	4.0	1,000	BBB+
15/01/2016	02/04/2008	6.5	925	BBB+
17/01/2017	13/11/2006	4.75	1,000	BBB+
04/02/2019	04/02/2009	7.5	750	BBB+
30/09/2024	30/09/2009	5.625	700	BBB+
Weighted Average Coupon Cost		**5.27%**		

Source: NERA analysis of Bloomberg data. Averages have been weighted by total amount issued.

Table C.2
KPN's outstanding EUR Debt Issues at 31 Dec 2010

Maturity	Issue Date	Coupon (%)	Size (M €)	S&P Rating
21/07/2011	21/07/2004	4.5	1,425	BBB+
13/11/2012	13/11/2007	5.0	1,250	BBB+
18/03/2013	16/03/2006	4.5	850	BBB+
16/09/2013	16/09/2008	6.25	850	BBB+
04/02/2014	04/02/2009	6.25	750	BBB+
29/05/2014	29/05/2007	4.75	650	BBB+
22/06/2015	22/06/2005	4.0	1,000	BBB+
15/01/2016	02/04/2008	6.5	925	BBB+
17/01/2017	13/11/2006	4.75	1,000	BBB+
04/02/2019	04/02/2009	7.5	750	BBB+
21/09/2020	21/09/2010	3.75	1,000	BBB+
30/09/2024	30/09/2009	5.625	700	BBB+
Weighted Average Coupon Cost		**5.17%**		

Source: NERA analysis of Bloomberg data. Averages have been weighted by total amount issued.

Table C.3
KPN's outstanding EUR Debt Issues at 31 Dec 2009

Maturity	Issue Date	Coupon (%)	Size (M €)	S&P Rating
13/11/2012	13/11/2007	5.0	1,250	BBB+
18/03/2013	16/03/2006	4.5	850	BBB+
16/09/2013	16/09/2008	6.25	850	BBB+
04/02/2014	04/02/2009	6.25	750	BBB+
29/05/2014	29/05/2007	4.75	650	BBB+
22/06/2015	22/06/2005	4.0	1,000	BBB+
15/01/2016	02/04/2008	6.5	925	BBB+
17/01/2017	13/11/2006	4.75	1,000	BBB+
04/02/2019	04/02/2009	7.5	750	BBB+
21/09/2020	21/09/2010	3.75	1,000	BBB+
04/10/2021	15/09/2011	4.5	500	BBB+
30/09/2024	30/09/2009	5.625	700	BBB+
Weighted Average Coupon Cost		**5.23%**		

Source: NERA analysis of Bloomberg data. Averages have been weighted by total amount issued.

NERA

ECONOMIC CONSULTING

NERA Economic Consulting
15 Stratford Place
London W1C 1BE
United Kingdom
Tel: +44 20 7659 8500
Fax: +44 20 7659 8501
www.nera.com