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The Cost of Capital for KPN's Wholesale Activities

A Final Report for OPTA

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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 as an input to the calculation of the price cap applying over the period 1st January 2006 to 31st December 2008.[1] 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 over a three year price control period to December 2008 are based on the use of a risk-free rate maturing in 2008. Our estimate of the WACC is therefore implicitly based on market expectations over the period to 2008 and therefore this single WACC estimate is appropriate for the price control period from 2006 to 2008.

§ Estimates of a "forward-looking" WACC should be based on the use of averages of time-series data, given recent evidence of exceptionally low yields on government bonds. We also note that international regulators are increasingly using historical time series data as the main basis for deriving estimates of risk free rates and beta estimates in the CAPM. This is in line with the approach, previously accepted by the IG, set out in NERA (2003).[2]

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1 In addition to the estimate of the WACC to used in setting the price cap, this report sets out an estimate of the WACC to be used as an input to the CEA analysis. This WACC is based on a risk-free rate estimated using longer term historical data, consistent with the historical cost data measured from 1996 onwards underlying the CEA analysis. The WACC applicable to the CEA analysis is presented in Appendix A.

2 NERA (2003) "*Re-estimating the Cost of Capital of Telecommunications Interconnection Services in Holland: A Final Report for OPTA*".

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

Cost of Equity	
Inflation	1.9%
Real risk-free rate	1.4%
ERP	6.0%
Asset beta	0.6
Financial gearing (D/(D+E)	38.0%
Equity beta	1.0
Real post-tax return on equity	7.2%
Cost of Debt	
Nominal cost of debt	5.2%
Real cost of debt	3.2%
WACC	
Corporate tax rate[1]	30.2%
Real post-tax WACC (Net of Debt Tax Shield)	5.3%
Real pre-tax WACC	7.6%

Source: NERA analysis.
*(1) The corporate tax rate in the Netherlands is 30.5% from 1st January 2006 and 30.0% from 1st January 2007. We calculated a weighted average tax rate for the regulatory period from 1st January 2006 to 31st December 2008 of 30.2% (=30.5%*1/3 + 30.0%*2/3).*

Our best estimate of the real pre-tax cost of capital for KPN's wholesale activities in estimating the regulatory price cap over the period 2006 to 2008 is 7.6%.

1. Introduction

In this report we have estimated the cost of capital for KPN's wholesale fixed line telecommunications services. In addition to the estimate of the WACC to be used in setting the price cap, this report sets out an estimate of the WACC to be used as an input to the CEA analysis. This WACC is based on a risk-free rate estimated using longer term historical data, consistent with the historical cost data measured from 1996 onwards underlying the CEA analysis. The WACC applicable to the CEA analysis is presented in Appendix A.

1.1. Structure of the Report

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;
- Appendix A presents our best estimate of the cost of capital to be applied in CEA analysis;
- Appendix B presents supporting information relating to the risk-free rate; and
- Appendices C and D present NERA's responses to Industry Group comments.

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 domestic 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. For example, the purchase of ADRs and ADSs provides a simple means for accessing equity in foreign companies, as do a wide range of mutual funds in Europe that hold an international portfolio of equity investments.[3]

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 1969-2001 period, but investors have also achieved reductions in risk through diversification across different countries, which reduces exposure to shocks in the domestic market.

Our approach in estimating the cost of capital for Dutch regulated companies is to draw on market evidence from the Eurozone and world markets in setting WACC parameter values, where relevant.

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[3] To illustrate, low-cost foreign index funds called "WEBS", an acronym for World Equity Benchmark Shares, eliminate some of the guesswork and costs involved in investing internationally. Each WEBS Index Series seeks to match the performance of a specific Morgan Stanley Capital International (MSCI) index.

2.2. Current or Historic Evidence

From a practical viewpoint, it is widely recognised that robust estimates of both the equity risk premium and beta can only be obtained using historic time series data. International regulators are increasingly use historic time series data as the main basis for deriving estimates of beta and the equity risk premium.[4] With regard to the risk-free rate, estimates can be based on either very short term (or spot) data or longer term yield evidence. A choice must therefore be made regarding the appropriate measurement time frame on which to base the risk-free rate estimate.

In estimating the risk-free rate to be used in estimating the cost of capital applied in the calculation of the price cap applying over the period 1st January 2006 to 31st December 2008 we must choose the measure that best proxies forward looking expectations of the interest rate prevailing over the period of the price cap. There are two key reasons why current or "spot" market data might not provide the best estimate of the forward looking risk-free rate:

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

These issues are discussed in further detail below.

2.2.1. Volatility

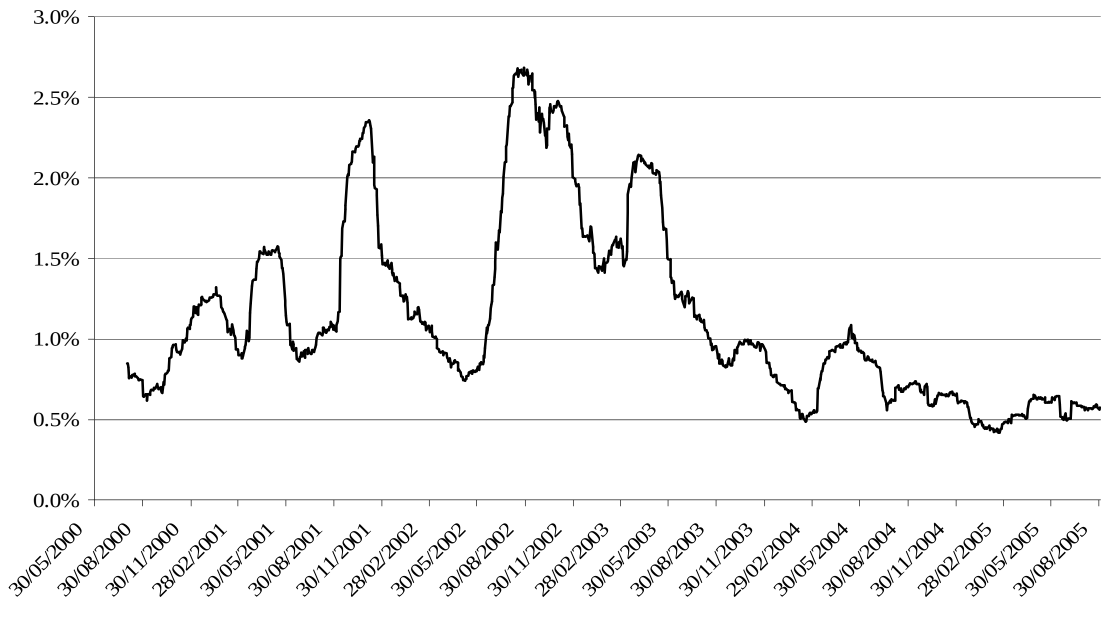
There is widespread evidence that financial markets have recently exhibited periods of "excess volatility" that cannot be explained by standard economic paradigms such as the Efficient Markets Hypothesis (EMH). The implication of "excess volatility" and "stock market bubbles" is that current "spot" prices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

4 In its recent (December 2004) Final Determinations, Ofwat used the top end of a 2.5% to 3.0% range for the real risk-free rate, "*based on a period average level of yields on medium-term index-linked gilts rather than recent yields which appear historically low*". Ofgem (2004) also used a risk free rate of around 3.0% in setting the cost of capital for the DNOs. The Competition Commission eg BAA plc (2002) has also noted that current yields should be used with caution when estimating the risk free rate because of market volatility.

A recent paper by Smithers and Wright[5] (2002) argued that there is powerful recent evidence of mis-valuation in world stocks markets and also predictability ('mean reversion') in stock price returns over long investment horizons.[6] 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.[7]

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 volatility of the Dow Jones European 600 Index over the past five years. In this chart, volatility is measured on an historic basis using the square root of the variance of daily returns over the three months prior to the date on the chart. The variance is the average squared deviation from the mean daily return over the 3-month period; the standard deviation is defined as the square root of the variance and is measured in the same percentage units as the returns of the stock price index.

Figure 2.1
3-Month Rolling Standard Deviation of Daily Returns on Dow Jones European 600 Index



Source: Bloomberg

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

6 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)).

7 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 first period of high volatility shown in Figure 2.1 occurred in the aftermath of the terrorist attacks of September 11, 2001. The standard deviation of daily returns reached just over 1.8% at its peak. A second period of high volatility began around June 2002 and peaked in August 2002 at over 2.6%. Uncertainty over the military position regarding Iraq was probably the main driving factor for this period of market turbulence. Volatility declined between October and March of the same year although remaining at a higher than average level until March 2003 when the war in Iraq finally began. Volatility increased during this period until the war ended in April 2003. Since mid-2003, the European equity market has become significantly less volatile. The average level of volatility has been higher in 2002-2003 than in 2004 as well as in 2005.

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.

2.2.2. Distortions to yields arising from institutional factors

Higher than average levels of volatility have been one reason why global interest rates have fallen to lower levels in recent years. However, even though volatility has returned to more normal levels in 2004 and 2005, global interest rates remain at very low levels.

A number of commentators have suggested that current historical lows may be partially caused by a number of "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.

Without being able to fully explain current historical lows in interest rates, it is not clear that these levels will continue to persist in the future. This is exemplified by commentary suggesting that current lows are unsustainable. For example, Morgan Stanley states that "*We estimate that long-term real rates are close to 1 percentage point below sustainable levels.*" and "*we assess where sustainable – or equilibrium - real rates might be and conclude that they are likely to be significantly in excess of current levels.*"[8]

We therefore consider that the use of historical time-series evidence will prevent estimates being unduly influenced by anomalous current market conditions, which represent distortions to yields from the true risk-free rate demanded by investors.

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8 Morgan Stanley (09/03/05) "*Where Should Long-Term Interest Rates be Today? A 300-Year View*".

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, there is current evidence of exceptionally low interest rates that cannot be reasonably expected to prevail over the future. The use of longer term historical data will ensure that estimates of WACC parameters are not affected by temporary factors that cannot be reasonably expected to continue to prevail, such as shocks to capital markets that cause excess volatility and factors driving the abnormally low 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. The use of a measurement period equal in length to the regulatory period is consistent with our approach adopted in NERA (2003)[9] where the risk-free rate used in calculating the cost of capital applying over a one year price cap period (of 31st July 2003 to 30th June 2004) was estimated using one year's historical yield evidence.

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[9] NERA (2003) *"Re-estimating the Cost of Capital of Telecommunications Interconnection Services in Holland: A Final Report for OPTA"*.

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.

In line with the dominant methodology employed by practitioners and regulators we estimate the risk-free rate using government bond yield evidence. Our estimate is based on the following key principles:

§ ***Preference for the use of index-linked evidence where possible.*** In practice it is generally difficult to identify an asset that fulfils the criteria of zero correlation with the market since inflation, as do other factors, has been shown to lead to covariance between theoretically risk-free government debt and equity returns. By being insulated from both inflation (and therefore inflation risk), yields on index-linked government bonds (ILGs) are less correlated with the market than the yields on Treasury bills and other government bonds, and are therefore closer to satisfying the theoretical requirement of having a zero beta.[10] For this reason various regulatory precedent, including the UK, relies on index-linked-gilts (ILGs) yields to provide the closest proxy to the risk-free asset.

§ ***Supplementation of ILG evidence with nominal Government bond evidence.*** In order to provide a cross-check on the risk-free rate estimates obtained using ILG evidence, we further consider nominal Dutch and German Government bond yield evidence, deflated by inflation expected at the time of yield measurement.

§ ***Use of three years of historical averages.*** As discussed in Section 2, it is widely acknowledged that interest rates are currently at an all-time low. Coupled with evidence of recent periods of excess market volatility, "spot" evidence may not be a robust proxy for the expected risk-free rate over a future time frame. We consider that the use of historical evidence will prevent undue bias to forward-looking estimates arising from such temporary influences on observed yields. Our preferred estimate of the risk-free rate is based on three year averages of yield evidence, consistent with the with the length of the regulatory period.

§ ***Use of Eurozone Government bond yields as our primary source of evidence.*** Our preferred reference market to be used in estimating the risk-free rate for KPN's cost of capital is the Eurozone market. However, as set out in Section 1, wider European and global evidence is also relevant, and we cross-check our primary risk-free rate estimates against this evidence accordingly.

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[10] This point was made by Stephanie Holmans in Ofwat RP5 (1996), Section 2.5.

- ***Use of 2008 maturity in estimating the risk-free rate to be used in estimating the cost of capital applied in the calculation of the price cap applying over the period 1st January 2006 to 31st December 2008***. In previous reports for OPTA – where the cost of capital is used as a binding constraint to set regulated prices - we have advised on the use of a maturity equal to the regulatory period. In line with this methodology as accepted by the IG (see NERA (2003)) we estimate the risk-free rate for use in calculating the price cap using 2008 maturity (or as close as feasible) government bonds, as the WACC is being used to set cash flows for the prospective three year price control period and that period only. Since the regulated rate of return will be re-set in at the end of the price control period, in December 2008, the use of a risk free rate maturing at the end of the regulatory price control period to estimate the cost of capital at each regulatory price review means that the investor's expected rate of return over the whole of the asset life will be equal to the average prospective level of risk free rates with a maturity equal to the price control period length over the period of the asset life.

3.2. Index-Linked Government Bonds

In this Section we present evidence on international index-linked government bond (ILG) yields. This Section summarises Appendix B which presents full details of the ILG evidence assessed.

Eurozone ILGs

As stated above, we consider that the appropriate primary reference market to be used in estimating WACC parameters for KPN cost of capital is the Eurozone market. We therefore consider Eurozone ILG yields as our first-tier of evidence in evaluating the appropriate risk-free rate for KPN. We present evidence on Eurozone ILGs in Appendix B.1. We summarise key points regarding this evidence below:

- Four governments in the Eurozone currently have ILGs outstanding; France, Italy, Austria and Greece. France is the dominant issuer as shown in Appendix B.1.
- With the exception of the Austrian bond, we consider that the liquidity of all Eurozone bonds presented is comparable to the liquidity of nominal German government bonds.[11]
- Our preferred methodology as set out above uses the three year historical average of yield evidence and a maturity of 2008. Only France has a bond with a close maturity (2009) issued before 2002, therefore ensuring three years of historical data.
- We therefore consider the French bond maturing in 2009 as our primary first-tier source of evidence on the real risk-free rate for the price cap. This evidence is presented in Table 3.1.

[11] Such that yields can be robustly used to estimate the real risk-free rate without requiring consideration of the presence of liquidity premia in observed yields.

Table 3.1
Conclusion on First-Tier Evidence on the Real Risk-Free Rate

	Issue Date	Maturity	3Y Average Yield to Maturity[1]
France	29/09/1998	25/07/2009	1.4%

Source: NERA analysis of Bloomberg data. (1) Weekly data from 01/11/2002 – 04/11/2005 (inclusive).

The Table shows that the average yield to maturity for the first-tier wider Eurozone ILGs meeting our methodological criteria is 1.4% on a three year historical basis for application to the price cap calculation. Given the small size of this sample, we consider other European evidence, in addition to cross-checking against nominal German and Dutch government bond evidence, in order to further ensure robustness of our estimate. This additional evidence is presented in the following sections.

3.3. Other European and Developed Country ILGs

We also consider ILG evidence based on wider European (non-Eurozone) markets. Whilst we consider that the Eurozone represents the best proxy of the reference market for the typical investor in Dutch equity markets, the significant erosion of barriers to capital movement, particularly between developed country markets, in recent years has resulted in the widening of investment opportunities to investors. In particular, the increase in diversification options and currency hedging instruments has significantly reduced the cost to and uncertainty associated with investing in different currency areas. Evidence of substantial cross-border equity holdings, particularly in government securities demonstrates the increasing openness of international capital markets. We therefore consider that wider European and developed market evidence is relevant in assessing the rate demanded by the typical Eurozone investor for holding risk-free assets.

We present evidence on wider European (non-Eurozone) ILGs in Appendix B.2. We summarise key points regarding this evidence below:

§ Two wider European (non-Eurozone) governments currently have ILGs outstanding; the UK and Sweden. Of these two issuers, the UK is the larger issuer as shown in Appendix B.2.

§ With the exception of the Swedish 2028 bond, we consider that the liquidity of all wider European bonds presented is comparable to the liquidity of nominal German government bonds, such that yields can be robustly used to estimate the real risk-free rate without requiring consideration of the presence of liquidity premia in observed yields.

§ The wider European market shows greater maturity than the Eurozone ILG market, with the majority of bonds issued before March 2000.

§ A single Swedish bond is issued with maturity of 2008 and sufficient historical evidence to estimate a three year historical average yield in line with our methodological approach in estimating the risk-free rate for the price cap.

§ Significant and widely acknowledged distortions to yields arising from institutional factors mean that UK ILG evidence cannot be robustly used in estimating the forward-looking risk-free rate. Yields have been widely acknowledged to be downwardly biased by factors since 1997 which have artificially inflated demand for UK ILGs, primarily the MFR and later the FRS17. [12] [13] [14]

- Our concluding set of wider European evidence on the real risk-free rate for the price cap is therefore based on the Swedish ILG with a maturity of 2008 measured over a three year period.

Table 3.2
Other European Evidence on the Real Risk-Free Rate

	Issue Date	Maturity	3Y Average Yield to Maturity[1]
Sweden	01/12/1995	01/12/2008	1.8%

Source: NERA analysis of Bloomberg data. (1) Weekly data from 01/11/2002 – 04/11/2005 (inclusive).

The Table shows that the average yield to maturity for the second-tier wider European ILGs meeting our methodological criteria is 1.8%. We further consider wider market evidence on ILGs below.

We present evidence on wider developed market (non European) ILGs in Appendix B.3. We summarise key points regarding this evidence below:

- Three significantly sized wider market governments currently have ILGs outstanding; Australia, Canada and the US. Of these three issuers, the US is the largest issuer as shown in Appendix B.3.
- With the exception of the Australian ILGs, we consider that the liquidity of all wider market bonds presented is comparable to the liquidity of nominal German government bonds, such that yields can be robustly used to estimate the real risk-free rate without requiring consideration of the presence of liquidity premia in observed yields.
- We note that reduced supply may have downwardly impacted on long maturity US ILG yields, however we consider that these influences are not significant enough to warrant the exclusion of US evidence from our assessment of wider market evidence
- With regard to the criteria of a 2008 maturity and at least three years of historical yield evidence available, a single US bond maturing in 2008 is available. This bond is presented in Table 3.3.

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12 See for example the Bank of England: "*The Minimum Funding Requirement led to strong institutional demand for ILGs. The combination of strong and rather price-insensitive demand (largely from pension funds) with limited supply has pushed real yields down, perhaps more than in the conventional gilt market. Consequently, real yields in the ILG market may not be a good guide to the real yields prevailing in the economy at large*"[12] (Bank of England (1999) *Quarterly Bulletin*, May).

13 FRS17 refers to Financial Reporting Standard 17. This sets out the requirements for accounting for retirement benefits in company accounts and will replace SSAP24 'Accounting for Pension Costs' when it is fully implemented. The Debt Management Office (DMO) recently argued that the introduction of FRS17 may lead to an increase in demand for government gilts and strong corporate bonds as companies reallocate their pension portfolios from equities into gilts. The DMO cites the extreme example of Boots PLC which moved all its pension fund assets, around £2.3bn, predominantly from equities into long-dated gilts in 2001(DMO (2002) "Annual Review 2001-02", p11).

14 Regulators in the UK have widely acknowledged the downward bias in UK ILG yields – see for example, Competition Commission (2003) "Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks", para 7.208.

Table 3.3
Other Wider Market Evidence on the Real Risk-Free Rate

	Issue Date	Maturity	3Y Average Yield to Maturity[1]
US	15/01/1998	15/01/2008	1.0%

Source: NERA analysis of Bloomberg data. (1) Weekly data from 01/11/2002 – 04/11/2005 (inclusive).

The Table shows that the average yield to maturity for the second-tier wider ILGs meeting our methodological criteria is 1.0%.

3.4. Conclusions on ILG evidence

Table 3.4 summarises first-tier ILG evidence for the Eurozone.

Table 3.4
Conclusion on First-Tier (Eurozone) Evidence on ILGs

Eurozone	**1.4%**

Source: NERA analysis of Bloomberg data.

Table 3.5 summarises second-tier ILG evidence for the wider European and North American markets.

Table 3.5
Conclusion on Second-Tier Evidence on ILGs

Europe (non Eurozone)	1.8%
North America	1.0%
Average	**1.4%**

Source: NERA analysis of Bloomberg data.

3.5. Nominal German and Dutch Government Bond Evidence

As stated in Section 2.1, our preferred reference market for estimating the risk-free rate in assessing the cost of capital for KPN is the Eurozone market. In the sections above we have assessed relevant ILG evidence in accordance with our preference for the use of index-linked instruments in estimating the real risk-free rate. Given the relatively limited availability of direct Eurozone ILG evidence and in order to ensure comprehensiveness in deriving a robust estimate of the risk-free rate, we further consider nominal German and Dutch Government bond evidence. 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. In line with our methodology set out in Section 3.1, we consider evidence on bonds fulfilling the following criteria:

§ Issuance in or prior to 2002, in order to enable estimation of three year historical average yields in line with our methodology set out earlier;

- Sufficient liquidity as indicated by the bid-ask spread (proxied by a bid-ask spread no higher than 0.2%); and
- Maturity as close to December 2008 as possible.

Table 3.6 presents evidence on nominal yields on German and Dutch Government bonds fulfilling the criteria set out above.

Table 3.6
Three-Year Average Yields on German and Dutch Government Bonds (Risk-Free Rate for Price Cap)

Issue Date	Maturity	3Y average nominal yield to maturity	Average (to 2008) Eurozone inflation forecast over 3Y(1)	3Y implied average real yield to maturity
Germany				
30/10/1998	04/07/2008	3.1%	1.8%	1.2%
10/07/1998	04/07/2008	3.1%	1.8%	1.2%
Average		**3.1%**		1.2%
Netherlands				
26/01/1998	**15/07/2008**	**3.1%**	**1.8%**	**1.2%**
Average all				**1.2%**

Source except where noted: NERA analysis of Bloomberg data
(1) Source for Eurozone inflation forecasts: Consensus Economics (2002-2005). Average inflation calculated for all bonds as average of average inflation expected in 2002, 2003, 2004 and 2005 for the maturity of the bond (to 2008).

3.6. Conclusion on Real Risk-free Rate

Table 3.7 presents summary evidence on the real-risk-free rate.

Table 3.7
Conclusion on Real Risk-Free Rate

1st-Tier ILG Evidence	
Eurozone	**1.4%**
2nd-Tier ILG Evidence	
Europe (non Eurozone)	1.8%
North America	1.0%
2nd-Tier ILG Average	**1.4%**
Nominal Evidence	
Germany	1.2%
Netherlands	1.2%
Nominal Evidence Average	**1.2%**

Source: NERA analysis of Bloomberg data

Our primary estimate of the real risk-free rate is 1.4% based on Eurozone ILG evidence. As a consistency check on our primary ILG evidence we consider a number of further sources of supporting evidence, summarised as:

- Second-tier (North American and wider European) evidence indicates an average yield of 1.4%; and
- Nominal German and Dutch government bond evidence indicates an average implied real yield of 1.2%.

Supporting international ILG evidence therefore indicates a risk-free rate consistent with our primary Eurozone ILG based estimate of 1.4%, measured over three years. Nominal German and Netherlands evidence is consistent with this indicating a slightly lower real implied risk-free rate of 1.2%. However, we believe evidence on nominal gilt yields is less robust than evidence on ILG yields (given that expected inflation cannot be directly observed).

Our concluding estimates of the real risk-free rate is therefore 1.4%.

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 summarises academic evidence on the ERP. In Section 4.3 we summarise the findings from analyses of long-run historical returns. Section 4.4 concludes.

4.1. Regulatory Precedents on the Equity Risk Premium

OPTA (2003) previously use an equity risk premium of 6% in setting the terminating interconnection price control for KPN in 2003.

Table 4.1 presents other recent Dutch (DTe) regulatory precedent on the equity risk premium.

Table 4.1
Dutch Regulatory Precedent on the Equity Risk Premium

Regulator	Case (date)	ERP
DTe	TenneT (2004) (based on Tabors Caramanis & Associates)	6.4%
DTe	TenneT (2004) (based on Brattle Group)	5.7%-7.9%
DTe	Regional Electricity Networks (2000)	4%-7%
DTe	GTS (2005)	5%

Source: *Tabors Caramanis & Associates (May 2004) "Cost and Risk Analysis for a Norway-Netherlands HVDC Interconnector, Brattle Group (June 2004) "The Cost of Capital for the Nor-Ned Cable" and DTe (2000) "Guidelines for price cap regulation of the Dutch electricity sector in the period from 2000 to 2003", February 2000.*

Recent DTe precedent shows estimates of the ERP lying between 4% and 8%, with the weight of evidenced balanced towards the upper end of this range.

We also consider recent regulatory precedent on the ERP in Ireland and the UK, summarised in Table 4.2.

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

Institution	Case	ERP
Ofgem	Final Proposals for DNOs (2004)	2.5%-4.5%
Ofwat	Final Determinations (2004)	~5.0%
Ofcom	Various (2004) e.g. Partial Private Circuits charge control, TV licence renewal, mobile termination charges	5.0%
CAR	Dublin Airport Authority (2005)	6.0%

UK regulatory precedent shows lower ERPs than those allowed by the DTe and the CER, ranging between 2.5% and 5.0%. Most recent decisions have tended to the upper end of this range. In most cases, some consideration has been given to evidence on historic average returns, however UK authorities have generally judged that the historic ERP overstates the current risk premium. Estimates of the ERP have generally relied heavily on small sample survey evidence on the expectations of investors. Surveys that have been considered by the authorities include CLSE (1999), Price Waterhouse (1998), NERA (1998) and other evidence from investment bank analysts. The reliance on survey evidence has prevailed despite the CC itself recognising that ***"this evidence may be subject to biases that are difficult to quantify and assess"*** (Competition Commission, 2000a, paragraph 8.28).

However, more recently, justification for the ERP allowed by regulators has focused more on a range of evidence including long run historical evidence of equity returns, ex-ante evidence (price-earnings) in addition to survey evidence. This move away from the reliance on survey evidence, which has been subject to a number of criticisms, has paralleled recent increases in the ERP allowed by UK regulators.

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.[15] The method recommended by Ibbotson is to compute the arithmetic average of stock market returns against long-term Treasury bond yields.

4.2. Academic Evidence on the Equity Risk Premium

A large amount of academic literature exists discussing the ERP. In particular, the ERP has attracted significant recent academic debate, partly in response to the bullish equity markets observed in the US economy in the 1990s. Table 4.3 below presents selected academic estimates of the ERP, illustrating the large wide range of estimates of the ERP that have been derived in the literature.

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

Table 4.3
Recent Academic Evidence on the Equity Risk Premium

Source	ERP estimate	Details
Brealey and Myers (1996)	8.5%	Long-run historical data
Bowman (2001)	7.5%	Summary of various US based literature including historical and ex-ante evidence
Franks (2001)	5%	N.A
Dimson, Marsh and Staunton (2001)	5%-10% (Eurozone)	Ex post estimates based on 101 years of data. Based on arithmetic averages
Welch (2001)	5.5% (average)	Mean long-term expected risk premium of respondents to survey of financial economist professors
Fama and French (2001)	2.6%-4.3%	Estimates derived from dividend and earnings growth models over 2nd half of 20th century. Compares with estimate from average returns of 7.43%.
Ibbotson and Chen (2001)	5.9-6.2%	Historical and supply side models.
Oxera (undated)(1)	4.7%-8.5%	Ex post estimates of one year and five years returns averaged using various periods over the last 100 years. Using the whole period the ERP was around 5%
Ibbotson (2002)	6.7%	US real returns over 1926-2001
Ibbotson and Chen (2003)	5.9%	Arithmetic basis, decomposing equity returns into inflation, earnings, dividends, P/E, dividend payout ratio, book value, return on equity and GDP per capita.
Lally and Marsden (2004)	5.5%	New Zealand historical returns 1931-2000
Siegel (2004)	3.0%	DGM model, assuming that only a portion of dividend yield contributes to earnings growth
Dimson, Marsh and Staunton (2005)	5.9%	Average arithmetic returns on equity relative to bonds over period 1900 – 2004 for seven Eurozone countries

(1) Cited in Franks and Mayer (2001).

Of these studies, the Ibbotson and Chen (2001) study is widely quoted in international regulatory contexts.[16] The authors used historical evidence for the US market and supply side models (egg. dividend growth models) to predict future equity risk premia. The authors conclude:

> *"Contrary to several recent studies that declare the forward-looking equity risk premium to be close to zero or negative, we find the long term supply of equity risk premium is only slightly lower than the pure historical return estimate. The long-term equity risk premium is estimated to be about 6%*

16 See IPART (2002) and related submissions.

arithmetically and 4% geometrically. Our estimate is in line with both the historical supply measures of public corporations (i.e. earnings) and the overall economic productivity (GDP per capita)".

4.3. Historical Evidence on the Equity Risk Premium

LBS/ABN AMRO Studies

Dimson, Marsh and Staunton (2005) reports the returns on equity markets for 17 countries around the world over the last 103 years, and compares them against the returns on treasury bills and bonds. The results are summarised in Table 4.4 for the Eurozone markets reported by Dimson, Marsh and Staunton, US, UK and the world average.

Table 4.4
LBS / ABN AMRO (2005) Estimates of the Equity Risk Premium, Relative to Bonds, Arithmetic Averages (1900 – 2004)

Ireland	5.1%
Belgium	4.2%
Netherlands	5.8%
Spain	4.1%
France	5.8%
Italy	7.7%
Germany[1]	8.3%
Eurozone average	**5.9%**
USA	6.6%
UK	5.2%
World average (unweighted)[2]	**5.9%**
World (DMS weighted index)	**5.1%**

Source: LBS / ABN AMRO (2005) "Global Investment Returns Yearbook. The estimates are based on returns over 103 years of data, with 1922/3 excluded where hyperinflation had a major impact on the risk premia and bills returned –100%. .(2) This is a NERA-calculated unweighted average of: Australia, Belgium, Canada, Denmark (from 1915), France, Germany, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Spain, Sweden, Switzerland (from 1911), UK and USA.

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 unweighted Eurozone average arithmetic ERP relative to bonds measured over the period 1900-2004 ranging from 4.2% to 8.3%, with an average of 5.9%.

This estimate is consistent with the unweighted world average (average of 17 countries reported by DMS) of 5.9%. DMS report a slightly lower figure of 5.1% for their constructed market cap weighted World Index, however, we note that this index is dominated by the US (in 2004 DMS (2005) report that the US comprised 51% of world market capitalisation and the UK 10%. These proportions are likely to be even higher historically). This average may therefore not be as relevant as a secondary source of supporting evidence as the unweighted world average. Both the Eurozone and unweighted world averages are broadly consistent with the Netherlands average of 5.8%.

In conclusion, the updated Dimson, Marsh and Staunton data shows an equity risk premium for the Eurozone ranging broadly from 4% to 8% and averaging about 6%. This is consistent with World and Netherlands evidence.

Choice of averaging process

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 recent 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".[17]
- 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.[18] However, we note that this adjustment is contested (see for example Wright, Mason and Miles (2003).[19] 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

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

[18] 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%.

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

periods of volatility significantly higher than previous average levels. Other arguments are presented by Dimson, Marsh and Staunton that also suggest that future ERPs may differ from historical estimates. These arguments can be summarised as:[20]

- 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. As set out in Appendix Section C.2, 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 (2005) 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 early 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 2005 evidence may be on the low side as an estimate of the forward looking ERP.

In summary, Dimson, Marsh and Staunton (2005) present long-run ex-post evidence that suggests an ERP for Netherlands and the major Eurozone markets ranging from 4.1% to 8.3%, averaging 5.9% and a world average of 5.9%, based on arithmetic historic averages. We object to any adjustment of historic averages without a formal proof that historic ERP estimates are biased. In the absence of such a reliable proof (and with it a robust and transparent methodology to adjust historic data) any adjustment of historic data is highly arbitrary. We therefore, rely on Dimson, Marsh and Staunton's analysis of long-run historical evidence of the ERP, which shows an equity risk premium of around 6% for the Netherlands.

4.4. Summary and Conclusions on the Equity Risk Premium

We summarise evidence presented in this section:

- OPTA and DTe regulatory precedent shows estimates of the ERP in the range of 4.0% to 8.0%.

[20] 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.

- Recent UK and Ireland regulatory precedent shows central estimates of the ERP in the range of 3.5% to 6.0%.
- International regulatory precedent shows central estimates of the ERP in the range of 5.0% to 7.0%.
- Recent academic papers generally conclude that the equity risk premium lies in a range of 4% to 8%. The widely quoted Ibbotsen and Chen (2001) study estimates an equity risk premium in the range of 4% to 6%.
- Long-run arithmetic historical averages of the ERP for Eurozone and World countries, presented by ABN AMRO and LBS (Dimson, Marsh and Staunton (2005) suggest an ERP lying in the centre of the range of 4% to 8%.

Overall, we conclude that Dimson, Marsh and Staunton's analysis shows that the equity risk premium is most likely lie around 6%. This is consistent with the midpoint of the range and average arithmetic ERP for Eurozone countries, and is consistent with the average ERP for the World and Netherlands measured over the period 1900-2004.

Of all the evidence presented we consider the LBS/ABN AMRO data on the historical equity risk premia over 1900-2005 to be the most compelling. This data source is widely recognised as the most comprehensive and consistent dataset of historical returns. It also produces estimates of the ERP that are remarkably consistent across countries over a long period of time.

We conclude that 6%, the central point indicated by the Dimson, Marsh and Staunton analysis is the appropriate ERP for our Eurozone reference market, taking into account regulatory precedent and other academic evidence. We note further that our estimate is highly consistent with other recent regulatory precedent (eg. DTe) in Holland.

5. Beta

There are two key issues involved in the estimation of a beta coefficient for KPN. These are:

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

We discuss these two 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 6 months to five years.

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[21]. 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[22].

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.[23] Equity betas have been adjusted for financial risk ("de-levered") to derive asset (or "unlevered") betas according to the following formula:[24]

(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.

One IG respondents queried NERA's use of formula 3.4, stating that the following formula attributable to Modigliani and Miller is preferable for unlevering Betas:

(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.

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21 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.

22 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.

23 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.

24 This formula is attributed to Miller (1977).

Some recent empirical evidence suggests that the more appropriate formula for levering and un-levering betas is the Miller formula.[25] 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.

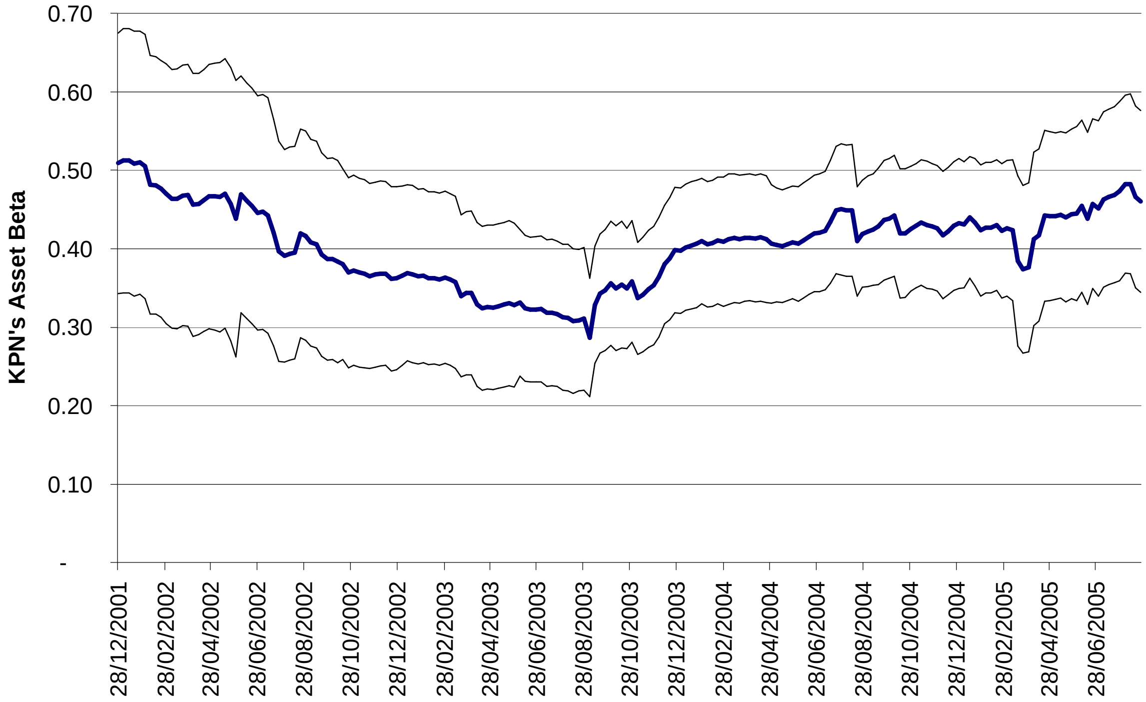
The impact of using the Miller formula rather than the Modigliani-Miller formula is the derived asset beta is lower. However, when the beta is levered back up to an assumed gearing of 25% or 50% the overall impact on the WACC is very small.

5.3. Empirical Evidence

Figure 5.1 shows a time series of KPN's asset beta estimates from December 2001 to August 2005 (represented by the big blue line). This time series consists of 2-year rolling asset betas, i.e. the first historic rolling asset beta in 28/12/2001 has been estimated using two years of weekly returns data from 07/01/2000 – 28/12/2001. Beta estimates have been estimated against the DJ Stoxx European 600 Index. We also calculated the 95%-confidence interval for our KPN's (mean) beta estimate (represented by the upper and lower black lines), i.e. we can be reasonably sure that the "true" beta estimate is within range of the upper- and lower black lines.

25 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 theries 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
KPN 2-Year Rolling Asset Beta
(Mean Estimate, 95%-Confidence Interval)



Source: NERA analysis of Bloomberg data

Figure 5.1 shows that KPN's historic two-year asset betas have been reasonably stable over the last year ranging from around 0.40 to 0.50, with the most recent two-year asset beta of 0.47. The 95%-confidence upper bound of our (mean) asset beta estimate ranges from 0.50 to 0.60.

Table 5.1 presents estimates of KPN's beta values using daily and weekly time intervals.

Table 5.2 presents estimates of other European telecommunications companies' beta values using daily and weekly time intervals.

Table 5.1
Beta Estimates for KPN

Company	Market Gearing D/E	Market leverage D/(D+E)	Beta, 6M (daily) Equity	Beta, 6M (daily) Asset	Beta, 1Y (daily) Equity	Beta, 1Y (daily) Asset	Beta, 2Y (weekly) Equity	Beta, 2Y (weekly) Asset	Beta, 5Y (weekly) Equity	Beta, 5Y (weekly) Asset
KPN	0.58	0.37	0.81	0.51	0.83	0.53	0.76	0.47	1.09	0.50
95%-Confidence Interval			*0.40-1.04*	*0.38–0.65*	*0.53-0.97*	*0.43-0.62*	*0.36-0.96*	*0.35-0.58*	*0.83-1.45*	*0.41-0.60*

Table 5.2
Beta Estimates for European Telecommunications Companies

Company	Market Gearing[1] D/E	Market leverage D/(D+E)	Beta, 6M (daily) Equity[2]	Beta, 6M (daily) Asset[3]	Beta, 1Y (daily) Equity[2]	Beta, 1Y (daily) Asset[3]	Beta, 2Y (weekly) Equity[2]	Beta, 2Y (weekly) Asset[3]	Beta, 5Y (weekly) Equity[2]	Beta, 5Y (weekly) Asset[3]
TDC A/S	0.66	0.40	0.82	0.49	0.86	0.52	0.81	0.47	1.10	0.68
Teliasonera	0.13	0.11	0.97	0.85	1.05	0.93	0.87	0.76	0.94	0.78
BT Group	0.90	0.47	1.05	0.56	1.06	0.56	0.90	0.44	1.03	0.56
France Telecom	0.79	0.44	1.08	0.61	1.20	0.67	1.12	0.60	1.41	0.56
Deutsche Telekom	0.61	0.38	0.88	0.55	0.93	0.58	1.03	0.58	1.10	0.60
Telefonica SA	0.37	0.27	0.97	0.71	1.08	0.79	1.14	0.82	1.08	0.74
Portugal Telecom SGPS	0.48	0.32	0.98	0.64	0.86	0.55	0.81	0.53	0.84	0.54
Average (ex KPN)	0.58	0.34	0.96	0.63	1.01	0.66	0.95	0.60	1.07	0.64

Source: Bloomberg/NERA analysis of Bloomberg data. Betas have been estimated against the DJ Stoxx European 600 Index (SXXP), over time periods which end on 16/5/2003 (1) The gearing rates used for unlevering are the averages over the time period in question. Market gearing value quoted is most recent available: usually 12/04; for longer term betas, the value used for gearing is matching the term. (2) Raw equity betas have been adjusted using the following formula: $b_{equity\_adjusted} = (0.67)*b_{equity\_raw} + (0.33)*1.0$*. The equity betas reported in the table are the adjusted betas. (3) Adjusted equity betas have been unlevered using equation the following formula:* $b_{equity\_adjusted} = b_{asset}\,(1+(Debt/Equity)$*.*

The evidence on asset beta estimates presented in Table 5.1 and Table 5.2 is summarised in Table 5.3.

Table 5.4
Asset Beta Estimates for KPN and Eurozone Telecom Companies

	6 month daily asset beta	1 year daily asset beta	2 year weekly asset beta	5 year weekly asset beta
KPN	0.51	0.53	0.47	0.50
KPN 95% confidence upper bound	0.65	0.62	0.58	0.60
Industry Average	0.63	0.66	0.60	0.64

Source: NERA analysis of Bloomberg data

Our analysis of returns data for KPN reveals that in 2008 the range of asset beta estimates lies between 0.47 and 0.53 depending on the considered time window. Our asset beta estimates for the European comparator telecommunications companies are consistently higher than KPN's asset betas. The average asset beta of our proxy comparators ranges from 0.60 to 0.66. However we note, the beta estimate is based on a regression analysis and will therefore contain a statistical error. In Table 5.4 we present therefore the upper bound of the 95%-confidence interval for KPN's asset betas – that is, KPN's "true" asset beta is very unlikely to be larger than these values. The 95%-confidence upper bound is in fact close to the average of our proxy comparators.

Our preferred beta estimate is the 95%-confidence upper bound of KPN's 5 year beta estimate of 0.60. The 95%-confidence upper bound gives us confidence that KPN's true asset beta is not larger than 0.60. Moreover, our preferred estimate of 0.60 is lower than the industry's average of 5 year asset betas.

5.4. Beta – Conclusions

NERA's 2003 report *"Re-estimating the Cost of Capital of Telecommunications Inter-connection Services in Holland"* (June 2003) estimated an asset beta for telecommunications interconnection in Holland in 2003 of 0.7.

In reaching our conclusions regarding the appropriate current beta for telecommunications services in Holland we note that the central beta estimates for Telecommunications Interconnection in Holland and its comparators, shown in Table 5.1, Table 5.2 and Table 5.5 lie in the range of around 0.5 to around 0.9. In 2003, the central asset beta estimates for KPN and its comparators lay between 0.4 and 0.7.

Since 2003, there is evidence in the market to suggest that betas for telecommunications services have fallen slightly. Given that the current low level of low volatility can lead to estimates of beta that are lower than they would be under normal market conditions, we consider that most weight should be attached to the 5-year beta estimates, taking into account both KPN's empirical beta and the beta of comparators. On the basis of the 5-year weekly estimates for KPN and average telecoms stocks, we consider that the appropriate level of the "true" asset beta for KPN is 0.60, which is equal to KPN's 95%-confidence upper bound for the empirical numbers, but around 7% lower than the industry's average 5-year empirical asset beta.

6. The Cost of Debt and Gearing

6.1. Cost of Debt

NERA's approach to estimating a cost of debt is based on *actual* market evidence of historic debt issues by KPN. This reflects most closely both KPN's likely cost of debt finance prevailing over the near future (such as the regulatory price cap period 2006 to 2008) and historical actual debt costs. This cost of debt estimate can therefore be used in both estimation of the cost of capital applicable to the price cap and in historical CEA analysis.

Table 6.1 below presents information on the average spreads over government bonds of debt issued by KPN and comparator companies.

Table 6.1
KPN's EURO Debt Issues
(Excluding Callable/Convertible Bonds)

Issue date	Maturity	Coupon	YTM[1]	S&P Rating
13/02/2001	04/10/2005	6.25%	2.56%	A-
04/10/2000	04/10/2005	6.25%	N/A	A-
04/10/2000	04/10/2005	6.25%	8.29%	A-
12/04/2001	12/04/2006	7.25%	2.76%	A-
05/11/1998	05/11/2008	4.75%	3.51%	A-
21/07/2004	21/07/2009	2.52%	2.42%	A-
21/07/2004	21/07/2011	4.50%	3.82%	A-
22/06/2005	22/06/2015	4.00%	3.93%	A-
Weighted Average[2]		**4.99%**		

Source: NERA analysis of Bloomberg data. (1) YTM stands for yield to maturity (2) Averages have been weighted by total amount outstanding.

According to the data presented above, the average weighted[26] coupon of all of KPN's normal (non callable/convertible) bonds outstanding (denominated in euros) is 4.99%.

All bonds with a coupon larger than 5.0% will be matured by 12/04/2006. However, we cannot assume that from 12/04/2006, KPN can raise debt finance at current low coupon costs. A cost of debt which is based on recent coupon rates will likely underestimate KPN's actual cost of debt during its business cycle since there is evidence that yields on bonds are at exceptionally low levels (see Section 3). Moreover, until then, KPN has to meet its debt obligation and pay out relatively high coupons of 6.25% and 7.25%, which will have a direct impact on KPN's cash flows. We therefore believe that the average weighted coupon of KPN's actual debt cost of 5.0% is a reasonable estimate of KPN's cost of debt over the regulatory period.

[26] We used the total amount outstanding of each bond issue to weigh the different coupons.

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.

To conclude, our preferred estimate of the nominal cost of debt for KPN is 5.15%. This reflects both, future coupon payments as well as any additional costs associated with the issuance of bonds born by KPN.

6.2. Gearing

Table 6.2 presents the capital structure for KPN. We calculated KPN's market gearing level as total debt outstanding divided by the market value of equity. We used quarterly figures and averaged the market gearing for every year from 2000 to 2005. We note, gearing data for 2005 for KPN is only available for the first two quarters 31/03/2005 and 30/06/2005. Based on market gearing we also calculated the financial gearing, which is total debt over enterprise value (D/(D + E)).

Table 6.2
KPN's level of Gearing
(Average Quarterly Gearing from 2000- 2001)

Financial Year	Market Gearing D/E	Financial Gearing D/(D+E)
2000	185%	65%
2001	290%	74%
2002	132%	57%
2003	69%	41%
2004	64%	39%
2005	61%	38%

Source: NERA analysis of Bloomberg data.

Table 6.2 shows that KPN's average financial gearing decreased substantially from its peak of 74% in 2001 to 38% in 2005. For our purpose of calculating the average weighted cost of capital for KPN, we rely on KPN's most recent 2005 market gearing of 38%.

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.

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

7. WACC Estimates

Table 7.1 presents our overall estimate of the cost of capital for KPN's wholesale fixed line telecommunications services as an input to the calculation of the price cap applying over the period 1st January 2006 to 31st December 2008.

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

Cost of Equity	
Inflation	1.9%
Real risk-free rate	1.4%
ERP	6.0%
Asset beta	0.6
Financial gearing (D/(D+E)	38.0%
Market gearing (D/E)	61.3%
Equity beta	1.0
Real post-tax return on equity	7.2%
Cost of Debt	
Nominal cost of debt	5.2%
Real cost of debt	3.2%
WACC	
Corporate tax rate	30.2%
Real post-tax WACC (Net of Debt Tax Shield)	5.3%
Real pre-tax WACC	7.6%

Source: NERA analysis.

*(1) The corporate tax rate in the Netherlands is 30.5% from 1st January 2006 and 30.0% from 1st January 2007. We calculated a weighted average tax rate for the regulatory period from 1st January 2006 to 31st December 2008 of 30.2% (=30.5%*1/3 + 30.0%*2/3).*

Our best estimate of the real pre-tax cost of capital for KPN's wholesale activities is 7.6%

Appendix A. WACC Applicable to CEA Analysis

The main body of this report sets out our best estimate of the WACC applicable to the calculation of the price cap applying to KPN's wholesale fixed line telecommunications services over the period 1st January 2006 to 31st December 2008.

This Appendix sets out a further estimate of the WACC to be applied in CEA analysis. Consistent with its application in cost analysis based on historical cost data over the period from 1996, we estimate the cost of capital based on a risk-free rate estimated using longer term historical data. The risk-free rate is the only cost of capital parameter within the IG methodology that can be measured using either very short term or longer term historical data; the ERP and beta parameters must by definition be estimated using historical data and the cost of debt is based on actual debt costs of all currently outstanding debt.

The following Sections therefore set out the following:

- The risk-free rate estimate for input to the cost of capital for CEA analysis; and
- Our best estimate of the cost of capital for KPN's fixed wholesale fixed line telecommunications services to be applied in undertaking CEA analysis.

A.1. Risk-Free Rate for CEA Analysis

As set out in Section 3, our methodology for estimating the risk-free rate is based on the following:

- Preference for ILG evidence;
- Primary reliance on Eurozone ILG evidence, cross-checked with wider European and global evidence; and
- Cross checking of ILG evidence with German and Dutch nominal government bond evidence.

In estimating the risk-free rate to be used in determining the cost of capital as an input to the price cap calculation we used a maturity of 2008 and measured yields over a three year historical period.

In estimating the risk-free rate to be applied to CEA analysis we must adapt these criteria to the purpose and context of the analysis.

The risk-free rate is the only cost of capital parameter within the prescribed methodology as set out in this report that can be measured using either very short term or longer term historical data; the ERP and beta parameters must by definition be estimated using historical data and the cost of debt is based on actual debt costs of all currently outstanding debt. The risk-free rate is also the only parameter with this report's methodology on which our choice of maturity can vary. In estimating the risk-free rate applicable to the CEA analysis cost of capital we must therefore determine:

- The appropriate maturity; and
- The appropriate length of historical time series measurement period.

Maturity

In this case the cost of capital is being used as a basis of assessing the efficiency of KPN against other telecommunications operators including US Telco's rather than as a binding constraint in the KPN price cap. As a number of US Telco operators do not have a fixed length of price cap and in many cases the length of regulatory price control period varies. We therefore use a longer maturity than that assumed in estimating the cost of capital as an input to KPN's three year price control period.

Length of time-series measurement period

Consistent with its application in cost analysis based on historical cost data over the period from 1996, we estimate the cost of capital based on a risk-free rate estimated using longer term historical data.

However, market commentary and evidence on liquidity both indicate that the international index-linked government debt market only attained sufficient liquidity and depth to ensure that i) yields were not biased by significant liquidity premia and ii) a sufficient variety and number of instruments had been issued to enable consistent data availability. Given our preference for the use of index-linked data as set out above we therefore consider five years of historical yield evidence in estimating the risk-free rate to be used in calculating the cost of capital to be applied in historical CEA analysis.

Estimates of the real risk-free rate

On the basis of the criteria set out above and the liquidity criteria used in selecting ILG bonds set out in Section 3 and selecting from the bonds set out in detail Appendix B, we estimate the risk-free rate on the basis of:

- First tier evidence on Eurozone ILG yields for bonds with maturities over ten years and issued before or in 2000;
- Second tier evidence on wider European and global ILG yields for bonds with maturities over ten years and issued before or in 2000; and
- Third tier evidence on implied real yields on nominal German and Dutch government bonds with maturities over ten years and issued before or in 2000.

These estimates are presented in Table 3.7.

Table A.1
Conclusion on Real Risk-Free Rate

	5Y Average Yield to Maturity RFR for CEA Analysis
1st-Tier ILG Evidence	
Eurozone	**3.0%**
2nd-Tier ILG Evidence	
Europe (non Eurozone)	3.2%
North America	3.0%
2nd-Tier ILG Average	**3.1%**
Nominal Evidence	
Germany	3.0%
Netherlands	3.1%
Nominal Evidence Average	**3.1%**

Source: NERA analysis of Bloomberg data

Our primary estimate of the real risk-free rate is 3.0% based on five year historical average Eurozone ILG yield evidence. As a consistency check on our ILG evidence we consider a number of further sources of supporting evidence, summarised as:

- Europe (non-Eurozone) ILG evidence indicates an average yield of 3.2%;
- Second-tier (North American and wider European) evidence indicates an average yield of 3.1%; and
- Nominal German and Dutch government bond evidence indicates an average yield of 3.1%.

Supporting international and Eurozone nominal evidence therefore indicates a slightly higher, but broadly consistent, real risk-free rate than our primary comparator, showing a range of 3.1% to 3.3%. Consistent with our preferred approach to the estimation of WACC parameters for KPN, our primary reference market is the Eurozone market. We therefore conclude on a real risk-free rate of 3.0%.

Our concluding estimate of the historical real risk-free rate for the CEA analysis is therefore 3.0%.

A.2. Conclusion on Cost of Capital for CEA Analysis

As set out above, the only difference between our estimate of the cost of capital to be applied to the CEA analysis and that used as an input to the price cap relates to the risk-free rate estimate. Table A.2 sets out our best estimate of the cost of capital for KPN’s fixed wholesale fixed line telecommunications services to be applied in undertaking CEA analysis.

Table A.2
Cost of Capital for KPN's Wholesale Fixed Line telecommunications Services for CEA Analysis

Cost of Equity	
Inflation	1.9%
Real risk-free rate	3.0%
ERP	6.0%
Asset beta	0.6
Financial gearing (D/(D+E)	38.0%
Market gearing (D/E)	61.3%
Equity beta	1.0
Real post-tax return on equity	8.8%
Cost of Debt	
Nominal cost of debt	5.2%
Real cost of debt	3.2%
WACC	
Corporate tax rate	31.5%
Real post-tax WACC (Net of Debt Tax Shield)	6.3%
Real pre-tax WACC	9.2%

Our best estimate of the cost of capital for CEA analysis is 9.2% on a real, pre-tax basis.

Appendix B. Evidence on the Risk-Free Rate

As stated in Section 3, our preferred methodology for estimating the risk-free rate to be used in calculating KPN's cost of capital is to use evidence on international index-linked government bond (ILG) yields. Table B.1 sets out the key characteristics of the main issuers in the global ILG market.

Table B.1
Global ILG Market

	Market value ($US bn)	Number of Indexed Bonds	Longest Maturity	2Y Average bid-ask spread(1)
Eurozone				
France	109	8	2032	0.08%
Italy	46	4	2035	0.07%
Austria	-	3	2023	N/A
Greece	-	3	2025	0.12%
Other Europe				
UK	181	9	2035	0.05%
Sweden	32	5	2028	0.11%(2)
Other				
US	300	16	2032	0.12%
Canada	24	4	2036	0.08%
Australia	-	12	2020	1.02%

Except where noted, source: UK Debt Management Office (www.dmo.gov.uk).

(1) Average bid-ask spread is calculated as [bid price-ask price]/average(bid price, ask price), where square brackets [ ] denote absolute value. Average 2Y bid-ask spread is assessed for all bonds quoted for more than 2/3 of the 2 year period to date. It should be noted that bid-ask spreads are not adjusted for differences in average maturity of debt issued by each country. N/A denotes insufficient quoted evidence to assess bid-ask spread. Source for bid-ask spreads: NERA analysis of Bloomberg data.
(2) Sweden average bid-ask spread excludes the bid-ask spread on the 2028 bond, which is a significant outlier.

The international index-linked government debt market, led by the earlier development of the UK market, has grown very rapidly. As shown in the Table, the three largest ILG markets are the US, the UK and France, however, rapid growth in other markets, notably Italy, has seen the size and diversity of issues in the global ILG market increase significantly in recent years.

We consider the characteristics of the ILG markets set out in the Table further in assessing the use of these bonds evaluating the real risk-free rate in the following sections.

B.1. Eurozone ILGs

Table B.2 presents yield and liquidity evidence on quoted Eurozone ILGs.

Table B.2
Eurozone ILGs

Issuer	Issue Date	Maturity	Currency	5Y bid-ask spread
France	10/31/2002	7/25/2032	EUR	0.11%
France	10/1/1999	7/25/2029	EUR	0.12%
France	1/22/2004	7/25/2020	EUR	0.12%
France	11/23/2004	7/25/2015	EUR	0.12%
France	2/11/2003	7/25/2013	EUR	0.07%
France	10/31/2001	7/25/2012	EUR	0.07%
France	6/22/2004	7/25/2011	EUR	0.06%
France	9/29/1998	7/25/2009	EUR	0.06%
Italy	9/17/2003	9/15/2008	EUR	0.07%
Italy	1/31/2005	9/15/2010	EUR	0.08%
Italy	2/18/2004	9/15/2014	EUR	0.11%
Italy	10/27/2004	9/15/2035	EUR	0.12%
Austria	2/28/2003	2/28/2013	EUR	1.72%
Greece	3/27/2003	7/25/2025	EUR	0.12%

Source: NERA analysis of Bloomberg data

The Table shows the following:

§ ***Majority of issues after 2003.*** Of the 14 bonds shown, only four were issued prior to 2003. This is indicative of the rapid growth in the Eurozone ILG market in recent years. All four of the bonds issued before 2003 were issued by France, consistent with the French ILG market's position as the largest and most developed in the Eurozone.

§ ***High liquidity for the majority of bonds.*** A concern voiced in the UK by the Competition Commission regarding the use of international ILGs in estimating the real risk-free rate is that lower liquidity in international markets may mean that liquidity premia exist in yields relative to the more mature UK market. This concern should also be addressed in the context of the use of international ILG yields in estimating the risk-free rate for Eurozone countries. The Table shows that, with the exception of the Austrian bond, all bonds have a five year average bid-ask spread of less than 0.12%. This is not significantly different from the five year average bid-ask spread of 0.06% observed on German nominal Government bonds, measured on the same basis. These bid-ask spreads are significantly lower than those seen in highly liquid commercial debt markets, confirming the qualitative evidence of strong liquidity in index-linked government bond markets relative to nominal markets. As an example recent bid-ask spreads on quoted bonds issued by quoted UK WaSC water and sewerage companies bonds range from 0.43% -to 1.24%.[28] The exception to this is the Austrian bond; a bid-ask spread of 1.72% is high, relative to

[28] See NERA (2003).

commercial and nominal Government debt. This reflects the relatively immature status and small size of the Austrian ILG market.[29]

B.2. Wider European ILG evidence

Table B.3
Other European ILGs

Issuer	Issue Date	Maturity	Currency	5Y bid-ask spread
UK	7/8/1981	7/19/2006	GBP	0.03%
UK	10/19/1982	5/20/2009	GBP	0.03%
UK	1/28/1982	8/23/2011	GBP	0.03%
UK	2/21/1985	8/16/2013	GBP	0.05%
UK	1/19/1983	7/26/2016	GBP	0.06%
UK	10/12/1983	4/16/2020	GBP	0.06%
UK	12/30/1986	7/17/2024	GBP	0.06%
UK	6/16/1992	7/22/2030	GBP	0.07%
UK	7/11/2002	1/26/2035	GBP	0.12%
Sweden	4/22/1999	12/1/2028	SEK	2.09%
Sweden	12/1/1995	12/1/2020	SEK	0.10%
Sweden	5/3/1999	12/1/2015	SEK	0.11%
Sweden	4/1/1994	4/1/2014	SEK	0.16%
Sweden	12/1/1995	12/1/2008	SEK	0.11%

Source: NERA analysis of Bloomberg data

The Table shows the following:

§ ***Greater market maturity versus the Eurozone market.*** All bonds shown in the Table were issued prior to 2003, with the majority of issues occurring at least five years ago, prior to 2000. This contrasts with the relatively short period since issue (less than two years) of the majority of the Eurozone ILGs presented in Table B.2, and reflects the greater maturity of the Swedish and UK ILG markets.

§ ***High liquidity for the majority of bonds.*** As with the Eurozone bonds, we consider the liquidity of wider European ILG bonds in assessing the appropriateness of their use in estimating the real risk-free rate. The Table shows that, with the exception of the Swedish 2028 bond, all bonds have a five year bid-ask spread average of less than 0.16%, with the majority of spreads lying in the 0.03% - 0.12% range. As discussed above, this range is consistent with bid-ask spreads observed on nominal German Government bonds. As expected, the bid-ask spreads on the UK ILGs are generally significantly lower than those observed for Eurozone and other ILG evidence (and nominal German Government bonds), reflecting the higher liquidity of the UK ILG market arising from its greater size and maturity relative to other ILG markets.

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[29] The bid-ask spread on the Austrian bond compares with the 0.12% observed on the Greek bond. Whilst the bonds shown in the Table indicate similar times of issuance, it should be noted that both Greece and Austria have two other bonds issued. These are not shown due to lack of quoted yields. The Greek bonds were issued in 1997, whilst the Austrian bonds were issued in 2003. This difference in market maturity may explain the differential in liquidity observed between the two quoted bonds.

§ ***Downward sloping yield curve for UK ILGs.*** Current UK ILG yields are generally negatively correlated with maturity,[30] in contrast to other ILGs evidence which generally exhibits an upward sloping yield curve. An upward sloping yield curve is consistent with theory which predicts that investors will demand a term premium for holding longer maturity instruments, due to the higher risk associated with less certain cashflows.[31] The downward slope of the UK ILG yield curve is associated with the widely recognised downward bias to yields by institutional factors which have artificially inflated demand for UK ILGs, primarily the MFR and later the FRS17. [32] [33] [34]

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30 For example, the current yield on the 50Y UK bond is 1.024%, comparing to a yield of 1.509% on the 2020 bond and 1.695% on the 2009 bond.

31 Whilst it should be noted that spot curves can be downward sloping when future interest rates are expected to fall relative to current rates, due to the outweighing of the term premium effect by the expectation of lower future returns, longer period historical averages will contain yield evidence over the period of a business cycle, such that changing interest rate expectations, which are pro-cyclical, will generally have less influence on yields. Yields will therefore be more likely to demonstrate the upward sloping nature of the yield curve with respect to the term premium.

32 See for example the Bank of England: "*The Minimum Funding Requirement led to strong institutional demand for ILGs. The combination of strong and rather price-insensitive demand (largely from pension funds) with limited supply has pushed real yields down, perhaps more than in the conventional gilt market. Consequently, real yields in the ILG market may not be a good guide to the real yields prevailing in the economy at large"*[32] (Bank of England (1999) *Quarterly Bulletin*, May).

33 FRS17 refers to Financial Reporting Standard 17. This sets out the requirements for accounting for retirement benefits in company accounts and will replace SSAP24 'Accounting for Pension Costs' when it is fully implemented. The Debt Management Office (DMO) recently argued that the introduction of FRS17 may lead to an increase in demand for government gilts and strong corporate bonds as companies reallocate their pension portfolios from equities into gilts. The DMO cites the extreme example of Boots PLC which moved all its pension fund assets, around £2.3bn, predominantly from equities into long-dated gilts in 2001(DMO (2002) "Annual Review 2001-02", p11).

34 Regulators in the UK have widely acknowledged the downward bias in UK ILG yields – see for example, Competition Commission (2003) "Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks", para 7.208.

B.3. Wider Market ILG Evidence

Table B.4
Wider Market ILGs

Issuer	Issue Date	Maturity	Currency	5Y bid-ask spread
Australia	10/14/1996	8/20/2020	AUD	0.90%
Australia	5/18/1994	8/20/2015	AUD	0.91%
Australia	2/22/1993	8/20/2010	AUD	0.94%
Australia	8/20/1985	8/20/2005	AUD	1.05%
Canada	6/9/2003	12/1/2036	CAD	0.07%
Canada	3/8/1999	12/1/2031	CAD	0.12%
Canada	12/7/1995	12/1/2026	CAD	0.12%
Canada	12/10/1991	12/1/2021	CAD	0.15%
US	10/29/2004	4/15/2010	USD	0.05%
US	1/18/2005	1/15/2015	USD	0.01%
US	7/15/2003	7/15/2013	USD	0.10%
US	1/15/2004	1/15/2014	USD	0.09%
US	7/15/2004	7/15/2014	USD	0.09%
US	7/30/2004	1/15/2025	USD	0.16%
US	7/15/2002	7/15/2012	USD	0.10%
US	2/6/1997	1/15/2007	USD	0.06%
US	1/15/2002	1/15/2012	USD	0.09%
US	10/15/2001	4/15/2032	USD	0.19%
US	1/16/2001	1/15/2011	USD	0.08%
US	1/15/1998	1/15/2008	USD	0.07%
US	4/15/1998	4/15/2028	USD	0.15%
US	1/15/1999	1/15/2009	USD	0.07%
US	4/15/1999	4/15/2029	USD	0.14%
US	1/18/2000	1/15/2010	USD	0.07%

Source: NERA analysis of Bloomberg data.

The Table shows the following:

§ ***Greater market maturity versus the Eurozone market but lower maturity versus the wider European market (UK and Sweden).*** The Table shows that the Australian and Canadian ILG markets are significantly more mature than the Eurozone markets and the US markets, with issuance in these markets as early as 1991 (Canada) and 1993 (Australia). The US market is a slightly younger, with the first issue in 1997 consistent with the first French issue in 1998.

§ ***Liquidity is low for Australian ILGs.*** The five year average bid-ask spreads observed for the Australian bonds are significantly higher, at over 0.9%, than the range of 0.03% - 0.15% generally observed for Eurozone, wider European, Canadian and US ILGs. This is likely to reflect significantly lower liquidity in the Australian market, and may partially explain the higher yields observed for the Australian ILGs vis-à-vis comparable maturity US and Canadian bonds. Due to the low liquidity of Australian ILGs indicated by the high bid-ask spreads, we consider that the yields on these bonds may include significant liquidity premia and we therefore exclude them from wider market evidence used in assessing the risk-free rate.

- ***Low yields on US ILGs vs other markets.*** US ILG yields vis-à-vis comparable maturity and liquidity bonds in other markets are currently relatively low. This has been attributed by some commentators to the restriction in supply of ILGs (known as TIPS in the US) at longer maturities – the Treasury announced its intention to cease the issuance of 30 year TIPs in October 2001.[35] Whilst we recognise that supply pressures may downwardly impact on long term US TIP yields, we do not believe it appropriate to exclude US evidence on the basis that i) the influence of reduced supply is likely to have only been felt over the recent couple of years and therefore not the whole of the five year historical period of our preferred five year average and ii) the extent of the impact of reduced supply vis-à-vis other "natural" influences that reflect underlying movements in the risk-free rate (such as increased demand from pension funds arising from demographic factors) cannot be robustly ascertained.

[35] The first TIP with a maturity greater than ten years issued since 2001was issued in July 2004.

Appendix C. NERA Response to Industry Group's Comments

C.1. Risk Free Rate

> Comment from ACT members and Tele2: "*NERA argues that yields should be based on a 5 year historical period rather than based on current spot rates or short period averages of recent bond price yields. This is a somewhat surprising view given: (i) NERA's previous prognostications on this issue; (ii) NERA's belief in the efficiency of markets, which is expressed in other parts of the report. The impact of NERA's approach is to increase the estimated cost of capital significantly.*"

This comment is addressed by our change in the context of our estimate of the cost of capital. The main body of our updated report estimates the cost of capital for the price cap and includes an estimate of the cost of capital as an input to CEA analysis in Appendix A.

In estimating the cost of capital as an input to the price cap calculation we base the risk-free rate on a three year historical average of yields, which is consistent with the length of the regulatory period; an approach undertaken in NERA (2003) and accepted by the IG. We use time-series data in reflection of recent evidence that indicates that market inefficiency may arise from excess volatility and, of particular relevance in estimating the risk-free rate, institutional distortions may mean that current yields are biased as an indicator of investors' true underlying risk-free rate.

With regard to the estimation of the risk-free rate as an input to CEA analysis, as we state in Appendix A, the most appropriate methodology involves the use of long term historical data consistent with the CEA analysis which considers historical data from 1996. The cost of capital that is estimated for this purpose should therefore based on time series data, regardless of any issues with respect to market efficiency and previous approaches. As stated in Appendix A, evidence on yields for our preferred type of evidence on the risk-free rate, Eurozone Index Linked Government bonds, is only available at sufficient levels of liquidity from 2000 onwards. We therefore use five year averages in estimating the risk-free rate in this context.

> Comment from KPN: *"KPN is of the opinion that it is not appropriate to use the real risk-free rate instead of the nominal risk-free rate in the WACC calculation, as the WACC will be applied to calculate future cost prices in which the price development is already included. As the outcomes of the cost price model are nominal, application of inflation correction would be incorrect and the cost of capital should be calculated with a nominal WACC instead."*

Our estimates of the risk-free rate are made in real terms as we estimate a real WACC. This is consistent with its application to CCA asset values. To use a nominal WACC would result in double counting of inflation in returns.

C.2. Equity Risk Premium

> Comment from KPN: *"NERA states that it favours the use of the arithmetic rather than the geometric mean in deriving an average measure to calculate the ERP using historical data. As KPN is a member of the Eurozone, the premia for EU (6.9%) and Netherlands (6.7%) would be better indicators, possibly completed with Germany (9.9%) and the UK (5.6%). This would justify an ERP in the upper end of the range 6% to 7%."*

We have updated our source of data for the ERP to DMS (2005). This shows a Eurozone average that is 5.9%, consistent with a world average of 5.9% and a Netherlands ERP of 5.8%. We do not agree that Germany and the UK alone are relevant sources of evidence for comparison with the Eurozone.

To conclude, we see no reason to adjust our estimate of the ERP of 6.0% upwards, as suggested by KPN.

> Comment from ACT members and Tele2: *"The proposed Equity Risk Premium is out of line with that used by telecoms regulators in other countries and is not supported by a large number of academic economists; at least in a European context the ERP of 6% appears to be on the high side."*

First we stress that our estimate of the ERP of 6% is in line with regulatory precedent in the Netherlands. Table C.1 presents other recent Dutch (DTe) regulatory precedent on the equity risk premium.

Table C.1
Dutch Regulatory Precedent on the Equity Risk Premium

Regulator	Case (date)	ERP
DTe	TenneT (2004) (based on Tabors Caramanis & Associates)	6.4%
DTe	TenneT (2004) (based on Brattle Group)	5.7%-7.9%
DTe	Regional Electricity Networks (2000)	4%-7%
DTe	GTS (2005)	5%

Source: Tabors Caramanis & Associates (May 2004) "Cost and Risk Analysis for a Norway-Netherlands HVDC Interconnector, Brattle Group (June 2004) "The Cost of Capital for the Nor-Ned Cable" and DTe (2000) "Guidelines for price cap regulation of the Dutch electricity sector in the period from 2000 to 2003", February 2000.

Recent DTe precedent shows estimates of the ERP lying between 4% and 8%, with the weight of evidenced balanced towards the upper end of this range.

Second, we note that 6% is broadly consistent with other regulatory precedent in the EU (see Table C.2 below).

Table C.2
EU Regulatory Precedents on ERP

Precedent	Regulatory assumption
Ofgem (2004) Final Proposals for DNOs	2.5%-4.5%
Ofwat (2004), Water Companies (UK)	5%
Ofcom (2004), several decisions including Partial Private Circuits charge, TV licence renewal, mobile termination charges (UK)	5%
CER (2005), Dublin Airport (Ireland)	6%

Very recent UK regulatory precedent shows lower ERPs than those allowed by OPTA and CER in Ireland. In most cases, some consideration has been given to evidence on historic average returns; however UK authorities have generally judged that the historic ERP overstates the current risk premium. Estimates of the ERP have generally relied heavily on small sample survey evidence on the expectations of investors. The reliance on survey evidence has prevailed despite the CC itself recognising that *"this evidence may be subject to biases that are difficult to quantify and assess"* (Competition Commission, 2000a, paragraph 8.28).

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.[36] The method recommended by Ibbotson is to compute the arithmetic average of stock market returns against long-term Treasury bond yields.

To conclude, recent European and Netherlands ERP precedent indicates that an ERP of 6% is well justifiable.

<u>Comment from ACT members and Tele2:</u> *"The information on the ERP provided by NERA on academic evidence is somewhat limited. For example, it provides a very old figure from Brealey and Myers from 1996, since which time information on the historical record has significantly improved and presents figures from Dimson, Marsh and Staunton (2001) showing figures from 5-10%[37]. It can be noted that these figures have now been updated to reflect returns since 2000."*

We have taken this comment into account and updated our Dimson, Marsh and Staunton evidence to 2005. This updated evidence strongly supports an ERP of 6%, as set out in Section 4. To conclude, we have chosen an ERP measure for this study of 6%.

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

37 Dimson, Marsh and Staunton, *Triumph of the Optimists – 101 Years of Global Investment Returns,* Princeton University Press.

Comment from ACT members and Tele2: *"DMS are very careful to note the limitations of historical evidence arguing that extrapolation of the future from the past would be inappropriate because of both a fall in the risk premium and because of unanticipated cash flows. In the UK it is argued that these factors could result in the expected future (geometric) risk premium being 2.4% lower than the historic (geometric) risk premium."*

DMS (2002) state that "*a crude estimate of the expected equity risk premium is the arithmetic mean of the one-year historical premia"* (p.183). Further, DMS (2002) recognize that "*historical arithmetic means […] are clearly influenced by past levels of stock market volatility (among other factors)"* (p.184). They therefore suggest that estimates of expected future arithmetic risk premia must be calculated based on current predictions of market volatility (p.184).

We note that DMS's adjustments to historical averages are highly contested. First, with regard to declining volatility, Wright, Mason and Miles (2003)[38] note that

> *"There is indeed a reasonable amount of evidence that macroeconomic aggregates like GDP became more stable in the second half of the twentieth century. But, at least in mature markets, the evidence that stock markets, as opposed to the rest of the economy, have got much safer, is distinctly weaker. In economies that escaped major disruption, such as the UK or the US, there is little or no evidence of a decline in stock return volatility." (p. 39)*

Moreover, DMS (2002a) are themselves cautious about their volatility adjustments:

> *"For our estimates of arithmetic premia, we illustrate the approach using the same volatility for all national markets. That cannot be correct since markets inevitably expose investors to differing levels of risk. Nevertheless, for simplicity we assume a current volatility level for all sixteen national markets of 16%, and for the world index of 14%....Clearly, the volatility of one stock market is not in reality the same as another. Different stock markets have had differing risk levels in the past, and projections for the future should not be uniform […] We therefore stress that assuming the same projected volatility for all premia is an expositional device, no more." (p. 184)*

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

The second issue of systematic underestimation of inflation by investors has been discussed in a range of academic papers. A recently published book by Cornell (1999) on "The Equity Risk Premium" does not agree that investors have systematically underestimated inflation over the 20th century.[39] Cooper and Currie (1999) in their analysis of the cost of capital for the UK water sector also concluded that it was implausible that investors had systematically underestimated inflation over a long period of time. A number of other recent academic papers have reached similar conclusions.[40]

Third, Wright, Mason and Miles (2003)[41] question DMS' (2001) argument that the trading costs of forming diversified portfolios have decreased. They note that the portion of the population investing indirectly in the stockmarket (e.g. via pension funds) has risen substantially in recent years, which may have increased principal-agent cost for the average investor.

Fourth, DMS (2002b) themselves write on their adjustment for unanticipated growth:

> *"This is clearly a rather ad hoc measure of unanticipated real dividend growth, but it suffices to illustrate the general idea." (p. 15)*

And when discussing the increase in the price/dividend ratios over the century to justify their adjustment for the required risk premium, they state:

> "*Undoubtedly, the change is in part a reflection of expected future growth in real dividends, so we could in principle decompose the impact of this valuation change into both an element that reflects changes in required rates of return, and an element that reflects enhanced growth expectations. To keep things simple, we assume that the increase in the price/dividend ratio is attributable solely to a long-term fall in the required risk premium for equity investment." (p. 15)*

In conclusion, DMS (2001) state that

> *"We acknowledge that our dividend projections are simplistic, and the reader should not put too much weight on cross-country differences" (p. 192)*

and, in addition to four other caveats on the "scope to finesse our estimates of the expected risk premium",

> *"Fifthly, and very importantly, we use a naïve model of investors' dividend expectations, an issue that merits further research." (p. 193).*

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[39] "Although the United States did experience a prolonged period of unexpected high inflation between 1973 and 1980, the rate then dropped unexpectedly over the period between 1982 and 1990…(T)his means that although bondholders have experienced both good and bad intervals because of inflation, inflation has had almost no impact over the full period on their average returns. Consequently, inflation cannot explain the large average difference between the historical returns on equity and the historical returns on long term treasury bonds"

[40] See Cooper and Currie (1999) and Draper and Paudyal (1995).

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

We concur with the authors that the methodology used in deriving unanticipated growth is "simplistic". The authors use previous long term-dividend growth as a proxy for investors' forecasts over a single year. The difference between long-term dividend growth and outturn dividend growth is then taken as unanticipated growth. This application may lead to systematic biases in the estimation of forecast error. For example, during periods of increasing (decreasing) dividend growth rates, the use of historical long-term dividend growth will systematically underestimate (overestimate) future dividend growth.

The assumption that changes in the price/dividend ratio can be wholly attributed to changes in required risk premium is also questionable, as noted by the authors themselves. In addition to this, the ex-post price/dividend ratio may systematically under- or over-estimate the required risk premium, particularly where dividend growth is unstable, as equities are priced on the basis of *projected* dividends.

In line with the criticism applied to DMS' adjustments, and DMS' own comments on the simplicity and expositional nature of their approach, we do not incorporate these contested adjustments in our estimate of the ERP. This is particularly relevant given that recent (2005) 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 early 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 2005 evidence may be on the low side as an estimate of the forward looking ERP and further contested downward adjustments may result in a bias.

> Comment from ACT members and Tele2: *"NERA states that the arithmetic mean rather than the geometric mean should be used to calculate the ERP from historic data. There is some merit in this view however it misses a number of subtleties which have led authors to place at least some weight on the lower geometric mean. For example, the use of the arithmetic mean will result in upward bias where returns are correlated over time (there is evidence of negative autocorrelation). In addition, where the models are used to get returns for a multi-year period, as is the case here, some form of geometric averaging is likely to be appropriate. Finally, it can be noted that NERA quotes with approval a statement from DMS regarding the use of arithmetic means. However, this statement is subsequently qualified and, in fact, DMS do recognise some merit in geometric means, albeit with modifications."*

DMS (2002) state: "*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*".[42,43] However, in a contested

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

[43] Frontier cite DMS' argument for downward adjustment to arithmetic averages on the basis of differential forward looking volatility from historical volatility, but a range of geometric to arithmetic averages is a completely arbitrary way to take this into account. As set out in NERA (2005b), we further note that DMS' argument with respect to the volatility adjustment is contested, and DMS (2002) themselves outline the weaknesses underlying the adjustment.

adjustment, DMS (2002) recalculate the arithmetic mean premium for each country in order to adjust for the relatively high level of historic market volatility, which might be no longer relevant for the derivation of a current ERP. In recalculating an adjusted arithmetic mean, DMS (2002) revert to the geometric mean in that they replace the historical difference between the arithmetic and geometric means with a difference based on risk estimates that are more contemporary (see page 184). However, they still use arithmetic means to derive a forward looking equity risk premium.

C.3. Asset Beta

Comment from KPN: *"KPN's main objective to NERA's beta calculation is the sequence of executing the Blume-adjustment and the adjustment for financial risk (de-leveraging). Equity beta's should be unlevered to asset beta's first, before carrying out the Blume-adjustment. As NERA is carrying out those adjustments in reverse order the outcome of this exercise is too low in our opinion. If the calculations would be carried out in the correct sequence, this would result in a beta of 0.68 for KPN and 0.77 for the benchmark group."*

We observe that the academic literature and mainstream practice is not consistent on whether the Blume-adjustment should be made to equity betas or asset betas to take account of the empirical tendency of betas to tend towards unity over time.

To our understanding, Bloomberg, as well as the London Business School adjust raw equity betas first and then de-leverage them for their financial gearing.

We also note that the Blume-adjustment itself is only a rough estimate for the fact that companies' beta estimates converge towards one in the long run. Our approach of adjusting and de-leveraging beta estimates for KPN (and comparator companies) yields smaller estimates than reversing the adjustment and de-leveraging exercise. We are therefore more conservative in our assumption that companies' systematic risks converge towards one in the long run.

Comment from KPN: *"NERA explains its preferred estimated of 0.6, based on the 95% upper bound of KPN's 5 year beta estimate. As Spronk & Hallerbach explained in their report of November 2003 in reaction to NERA's report of June 2003, an industry-average is a better indicator than a company specific parameter. As the industry average (0.64) is higher than NERA's estimate, KPN is opinion that that the used beta is too low."*

The choice between an industry average beta and a company specific beta rests on a trade-off between increased statistical robustness (from the availability of more data when using an industry average) and a more direct measure of the riskiness that comes from using a company specific beta.

In our report we consider both: industry average and direct market evidence on KPN. We acknowledge that a value of 0.6 is consistent with 95% confidence interval for KPN – meaning we can say with 95% confidence that the beta for KPN is lower than this value over five years of historic data. However we choose this 95% confidence interval because we acknowledge that the industry's average beta is actually slightly higher than 0.6 meaning that a more conservative assumption on KPN's beta is more appropriate.

> Comment from ACT members and Tele2: *"NERA's analysis is somewhat limited in that it makes no attempt to exclude mobile operations; that it does not look at the Beta's of different activities."*

The cost of capital and beta used in this analysis is similar to the cost of capital used by international regulators to set fixed line LRIC interconnection prices and is based on objectively verifiable market data.

We do not have any objective basis to adjust the observed cost of capital for KPN's activities for the inclusion of its mobile operations. There are reasons why mobile activities are now more or less risky than fixed line activities, and the data does not provide a basis for a robust adjustment.

C.4. Cost of Debt

> Comment from ACT members and Tele2: *"NERA has based its estimated cost of debt on actual market evidence rather than on the risk free rate adjusted for a KPN debt premium. It is questionable whether this approach is appropriate."*

The approach taken in our report, by looking at actual market evidence is clearly superior to the 'building block' approach: First, the risk free rate cannot be measured with exact precision (especially in the current situation of clear market distortions) and second there is a degree of uncertainty regarding the appropriate debt premium for KPN. Both factors contribute to the risk that KPN's cost of debt as calculated in the 'building block' approach is higher or lower than KPN's required cost of debt. We therefore suggest considering direct market evidence on KPN's cost of debt, because it better reflects KPN's specific risk for which bondholders have to be compensated in the market.

C.5. WACC Differentiation

> Comment from ACT members and Tele2: *"OPTA intends to apply a non-differentiated WACC for KPN's infrastructure. This appears to be at odds with the differentiated WACC as was applied in 2002 and 2003 for originating and terminating access on KPN's network. ACT and Tele2 are of the opinion that the WACC should be differentiated on retail and wholesale level to related infrastructure investments in order to properly reflect the various levels of investment risks."*

With regard to our estimate of the WACC as an input to the regulatory price review the previous approach used in estimating the WACC in 2002 is not relevant. In the past, different systems were used in regulating originating (top-down, EDC) and terminating (bottom-up, BULRIC). The use of differentiated WACCs is therefore no longer a logical choice on the basis of differences in regulatory framework applied.

With regard to our estimate of the WACC as an input to the CEA analysis, our approach to estimating KPN's WACC is not intended to be used as an input into a regulatory price review. Our WACC estimate is derived as an input into KPN's efficiency assessment and corresponds to the WACC of teleco assets in general.

Appendix D. NERA Response to Industry Group's Comments – 2nd Consultation

D.1. Risk Free Rate

D.1.1. Spot Rates Vs. Time Trend Evidence

> KPN Comment: "NERA's preferred estimate of the risk free rate is not based on spot rates for the risk free rate since generally accepted wisdom that these levels are historically extremely low. KPN approves that instead a historical period is used."

> ACT/Tele2 Comment: "NERA states that global interest rates are low by historic standards and that one reason for this may be higher than average levels of volatility. However, as it itself notes volatility levels have returned to more normal levels in 2004 and 2005. The European Central Bank has noted a sharp decline in volatility recently and in its September 2005 bulletin comments notes that bond market volatility in European bond markets is relatively low. It is unclear therefore why the fact that global interest rates are low by historic standards should be attributed to yield volatility, particularly as there are other more obvious factors at work. These include:
>
> - an inflation rate which is low by historic standards. Further, inflation has been low for a number of years a fact which may have resulted in a change in long run inflationary expectations and hence interest rates;
> - a slow down in the world economy;
> - European specific factors, such as generally weak economic growth. These result in interest rates which are low in comparison with non-Euro countries such as the UK."

We acknowledge the fact that levels of volatility have declined recently and have returned to more normal levels. We present evidence of this in Figure 2.3 in our report. We stress that excess volatility is only one possible reason which can lead to unsustainable yields on government gilts and that it was a cause of low yields in 2002/03.

There is, however, ample evidence of other factors, other than excess volatility, that can explain why interest rates are currently depressed. These factors relate to transitory demand and supply side effects discussed in our report. For instance, there is evidence that pension fund regulations, such the adoption of accountancy standards FRS17 in the UK have depressed UK yields below their long-run equilibrium level. UK regulators and the UK Competition Commission have also recognised the downward bias in determining the real risk-free rate:

> *"There appears to be widespread recognition that gilt yields have been affected by special factors, including an increased demand from pension funds as a result of the introduction of the minimum funding requirements (MFR) in 1997, just before the decline in gilt yields started"*[44].

There is evidence that these effects continue to be important. Industry practitioners have very recently stated that current lows in interest rates are unsustainable. For example, Morgan Stanley states that *"We estimate that long-term real rates are close to 1 percentage point below sustainable levels."* and *"we assess where sustainable – or equilibrium - real rates might be and conclude that they are likely to be significantly in excess of current levels."*[45]

Similarly to the UK, recent falls in international ILG yields are in line with recognition that current global yields are at historically low levels, with the FT currently stating that "*Yields have recently been hovering near levels not seen since the latter part of the 19th century*"[46]. Numerous possible reasons for global lows in interest rates have been suggested by commentators. In their Spring 2005 Quarterly Bulletin the Bank of England discuss the role of investment growth, growth in savings rates (actual and expected), growth in money supply and the growth of index linked bond markets as possible factors in explaining the lows. This is in line with other commentators, indicating that lows currently exhibited cannot be fully understood.[47][48] The majority of commentators however do appear to concur that a number of possible influences on recent interest rates are likely to be temporary.

In summary, in using current measured real risk-free rates, regulators should be certain that risks around current rates are symmetric on a forward-looking basis. Evidence strongly suggests that this is currently not the case. Thus, it is not justified to freeze the risk free rate for the entire upcoming regulatory period at the current level of low government yields. We therefore considered a more conservative approach and calculated an average over historic yields. In our view, this estimate will reflect better the actual risk free rate over the next three years given the current supply and demand side distortions in global fixed income markets.

ACT/Tele2 believe that the Risk Free Rate (RfR) is, contrary to our view, not unduly biased downward, but is low because of a structural shift in fundamental macro-economic factors, e.g. caused by a change in long-run inflationary expectations; a slow down in the world economy, etc. In our view, there is not conclusive evidence to support the assumption of a fundamental shift of global interest rates. We consider our approach more conservative in the current situation of evidence of transitory supply and demand side distortions.

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44 Competition Commission (2003), p188.

45 Morgan Stanley (09/03/05) "*Where Should Long-Term Interest Rates be Today? A 300-Year View*".

46 Financial Times (05/05/05) "*Eurozone yields touch record lows*".

47 AFX International Focus (16/02/05) "*Low interest rates a conundrum, Greenspan says*".

48 Also see for example Morgan Stanley (09/03/05) "*Where Should Long-Term Interest Rates be Today? A 300-Year View*".

D.1.2. Historical Period

ACT/Tele2Comment: "It is indeed the case, as NERA recognises, that the risk free rate should be based on bonds which have a remaining term which matches the regulatory period but this most certainly does not justify the use of historical averages which also match the regulatory period."

KPN Comment: "KPN is of the opinion that the historical period is not at all related to the regulatory period. As NERA itself already motivated in its (first) Draft Final Report for OPTA an approximate business cycle is approximately 5 years, which justifies a risk free rate based on five-year averages of yield evidence in order to minimise the impacts of transient and cyclical influences on forward-looking estimates. KPN wonders why NERA changed the length of the historical period. (…) There is no reason whatsoever to link the length of the historical period to the length of the regulatory period. Moreover, in the past NERA never linked the length of the historical period to the length of the regulatory period."

In calculating the risk free rate we decided to use historic averages over three years, which coincides with the length of the upcoming regulatory period. KPN recognizes the need to use a historical period. The historical period that is used should represent the best estimate for the next three-year period for the RfR. Clearly, there is a degree of freedom in choosing a historical period. We use a period of three years on the assumption that the average over this period represents the best forecast of the next three-year period.[49]

[49] Note, our first WACC report for OPTA was not meant to be an input into the price review, but was to asses KPN's efficiency over (mostly) a historic period. In that case it seems plausible to base the risk free rate over the historic period over which KPN's efficiency was assessed. The calculation of the risk free rates reflects our best estimate in both reports given their purposes.

D.1.3. Length of Maturity Period

ACT/Tele2 Comment: "It is indeed the case, as NERA recognises, that the risk free rate should be based on bonds which have a remaining term, which matches the regulatory period (…)"

KPN Comment: "KPN requests NERA to align the maturity period [of the risk free rate] to the average life cycle of its assets or the refinancing need of KPN. When for whatever reason not doing so would at least require to take on board the extra costs of going to the market more often (higher transaction costs) and the additional financing costs associated with the upfront knowledge that the average the financing needs cannot be redeemed with the period of 3 years, and therefore will have to be refinanced again for another period."

Hallerbach/Spronk Comments: "The length of the regulatory period should not be relevant in any way in considering the tenor of the minimum required rates of return (…)."

In dealing with a real world, we must acknowledge that a truly risk free asset (with a standard deviation of zero) is non-existent. European Government bonds have a certain degree of sovereign risk, which can not entirely be ignored; thus any observed yields on Government bonds are inclusive of a term premium. In this case, the question of the appropriate maturity period becomes, indeed, relevant.

In our view, the best estimate of the risk free rate is based on a maturity equal to the regulatory period. After the end of each regulatory period, the WACC is reset and with it the risk free-rate.

In our previous response to the industry group's comments in respect to our 2003 WACC-study, we cited a paper published by Professor Martin Lally (2002), which focused specifically on the issue of the appropriate timeframe for the derivation of an estimate of the risk free rate.[50] Lally's paper concludes that the risk free rate should match the regulatory period.[51] We re-state Lally's argument:

> *"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 term interest rate for setting prices will lead to revenues that are sometimes too large and sometimes too small, ex ante. The only policy that leads to future cash flows whose present value matches the initial investment is the setting of prices using an interest rate whose term matches the regulatory period. This is a basic test that any formula for setting output prices of regulated firms should satisfy"* (underlines added).

We also stress that we use the risk free rate in order to derive the cost of equity. KPN's concern of higher refinancing costs relate to KPN's cost of debt. We note that we did not use the risk free rate as an input in the calculation of KPN's cost of debt. We agree with KPN that the cost of refinancing and transaction cost (incurring in going to the market) are all relevant factors in determine the cost of debt. We therefore based the cost of debt in our report on KPN's actual cost of debt, considering its refinancing costs and embedded debt costs, as well as its transaction costs in going to the market.

D.2. Real Vs Nominal WACC

KPN Comment: "KPN is still of the opinion that it is not appropriate to use the real risk-free rate instead of the nominal risk-free rate in the WACC calculation, as the WACC will be applied to calculate future cost prices in which the price development is already included. As the outcomes of the cost price model are nominal, application of an inflation correction would be incorrect and the cost of capital should be calculated with a nominal WACC instead. KPN shares this point of view with Prof. Dr. J. Spronk and Dr. W.G. Hallerbach of the Erasmus University in Rotterdam, who also made a similar statement in earlier discussions with NERA. Quote:

'The nominal risk-free rate is the return on capital with no risk whatsoever on the periodical interest payments and repayment of the principal amount. This nominal risk-free rate consists of a real risk-free rate, compensation for the expected inflation, and a rate for the risk of inflation (the risk that the actual future inflation for the maturity is different from the expected inflation). Each of the aforementioned three elements are linked to the de facto required risk-free rate of return.'

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[50] "Determining the risk free rate for Regulated Companies", prepared for the Australian Competition and Consumer Commission by Martin Lally Associate Professor School of Economics and Finance Victoria University of Wellington August 2002. http://www.accc.gov.au/content/index.phtml/itemId/332450.

[51] We note Professor Lally's recommendations have been used as the basis for subsequent regulatory decision by the ACCC.

We agree with KPN that investors' return should allow for inflation, and that what matters are real returns received by investors.

- There are, however, two ways in which this can be achieved. Inflation is compensated for through annual indexation and applied to the assets on which a real return is allowed (our approach).
- The second approach is to wrap expectations of inflation into the nominal WACC calculation (KPN's suggestion). Here, however, the regulatory asset base (RAB) is not adjusted to allow for inflation because the necessary compensation is provided by the WACC calculation itself.

The typical UK approach (with the sole exception of Ofcom as mentioned by KPN) is for the RAB to be indexed by inflation and a real WACC to be used. This has one important advantage: under straight line depreciation the regulatory depreciation allowance is constant in real terms in each year that the asset remains within the asset base, i.e. today's customers and tomorrow's customers pay an equal amount for the asset.

Wrapping inflation into the WACC, has, on the other hand, the advantage that the company's cash flows to remunerate its investors matches more closely consumers' cash flows to remunerate the company (assuming interest paid is based on a nominal basis with no indexation of the principal).

<u>We stress both approaches yield exactly the same present value of cash flows.</u>

> <u>KPN Comment:</u> "Furthermore the use of a real risk-free rate would lead to arbitrary discussions on inflation adjustments and further discussion on inconsistencies, as you could argue that different cash flow components should be deflated with different price indices instead of generic price level adjustment."

Our approach in setting a real WACC and indexing the RAB, does not involve any adjustments of cash flows. Moreover, the RAB should be indexed by a pre-determined index, which tracks actual inflation.

D.3. Equity Risk Premium

ACT/Tele2 reconsider the discussion on the Equity Risk Premium, by criticizing our rebuttal of their comments in the first round of consultation. In this section we comment on ACT/Tele2's comments, on which we have not already referred to in the first round of consultation (see Appendix C.2).

> <u>ACT/Tele2 comment</u>: "As a general comment it can be noted that while the studies by DMS, WMM and Fama and French come to somewhat different views on how the ERP should be calculated they all argue that there is a bias in using the historical ERP (as do other studies). The fact that there may be no precise consensus on how a bias should be calculated should not be considered as a justification for using the uncorrected historical ERP."

DMS/WMM suggest reasons why historical data may over-estimate the current ERP; however, as we noted in our previous comments, their adjustments are more likely to be a thought experiment than a sound and non-contestable methodology.

DMS/WMM do not proof the hypothesis that historic ERP estimates are biased, nor do they reject the hypothesis that historic averages are not a biased estimate. Therefore, the authors cannot propose a unanimous and robust methodology to adjust historic estimates. In the absence of such a reliable proof (and with it a robust and transparent methodology to adjust historic data) any adjustment is highly arbitrary. However, arbitrariness must be avoided in any WACC estimation. Using long-run unadjusted historic averages avoids the arbitrariness of an unproven adjustment.

We note that other academics do support the use of historical numbers as a basis for ERP. See for instance Morin R.A (1994) "Regulatory Finance – Utilities' Cost of Capital", p.272.

The best example of using unadjusted historic data is the use of Ibbotson Associates compilation of historical risk premiums from 1926 to the present. Annual updates of the return results are published by Ibbotson Associates. The estimation of ERP proceeds directly from the historical results. We note that the Ibbotson Associates are the primary source of information in most rate cases and litigious settings in the US, where arbitrariness must be avoided.

D.4. Cost of Debt

ACT/Tele2 comment: "NERA uses the coupon rate rather than the yield to maturity to provide its estimate of the cost of debt. It provides no justification for doing so which is unfortunate since the relevant measure is yield to maturity;"

The yield-to –maturity reflects KPN's current cost of debt. However, KPN must be compensated for not only the current cost of debt, but also for its outstanding debt, which was issued in the past where interest rates were substantially higher.

The best measure to approximate KPN's actual cost of debt is the weighted average of its coupons on its outstanding debt.

ACT/Tele2 comment: "A nominal cost of debt (before fees) of 5% does not reflect KPN's current credit rating."

We based our estimate of the cost of debt on the average weighted coupon cost of KPN, which is 4.99%.

ACT/Tele2 reject our estimate of KPN's overall cost of debt of 4.99% on the grounds that this estimate is in stark contrast to KPN's credit rating. It is however unclear to us what the underlying rational for this rejection is.

KPN's cost of debt is influenced by past issuance of outstanding debt and the level of interest rates prevailing in these periods in time. In this regard, the average weighted coupon cost of all outstanding debt reflects well KPN's overall cost of debt.

D.5. Beta

> ACT/Tele2 Comment: "It is noted that NERA does not provide any of the evidence [that mobile activities are now more or less risky than fixed line activities]. Secondly, whereas it is rather difficult to disentangle the betas of particular lines of business within fixed telecommunications it is somewhat easier to calculate a beta for mobile communications since companies which just provide mobile communications do exist. Further, contrary to the inference drawn from NERA's assertion, the asset Beta for mobile companies almost certainly is different (and higher) than that for fixed companies."
>
> "The recent Competition Commission report on the mobile companies in the UK quotes a number of estimates of mobile Betas including those from the economies themselves, Oftel (now Ofcom) and the Brattle Group. It can be noted that all the figures provided, including that from Oftel, indicated an average (asset) Beta of over 1 [Footnote: The Betas are equity betas with gearing at 10% (in some cases an equity beta at 30% is also shown)]. This compares with the asset beta of 0.6 used by NERA for KPN. We therefore re-iterate our view that it is important to estimate an asset Beta for KPN fixed as opposed to a combined asset Beta for KPN fixed and mobile and that the impact of doing so on the cost of capital is likely to be material."

Ofcom estimate beta of 1.0 for the BT Group as a whole. Ofcom does neither estimate a pure play fixed line asset beta, nor a mobile asset beta.

Our beta estimates are based on telecom companies with predominately fixed line activities. We acknowledge that telecomm companies do other activities of which some may be more risky than others. There is no satisfactory method of adjusting KPN's quoted beta estimate since one cannot observe KPN's mobile risk separately.

Undoubtedly, over the past mobile activities became less and less risky. Betas for mobile activities show a downward trend. We also note that fixed line activities became more risky with increased competition from mobile providers.

We cannot observe the riskiness of KPN's mobile activities. Other mobile telecommunications companies are not exact comparators and face different risk exposures to KPN and also offer also offer services other than mobile services in related areas such as internet access, content, retailing, etc.

Overall we are content that our estimate of the beta of 0.6 for KPN's fixed line activities – which is based on KPN's beta overall and cross checked against comparators of companies offering predominantly fixed line services - is a robust estimate.

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