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A Consistent Methodology for Estimating the WACC for Dutch Energy Networks

A report for Netbeheer Nederland

27 November 2012

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Netbeheer Nederland has asked NERA to examine the methodology NMa commonly uses for determining the WACC.

We understand that Netbeheer Nederland is concerned that the NMa's methodology fails to adequately capture recent changes in market conditions and will therefore lead to an estimate that is not representative of the true cost of capital for the next regulatory period. [1] In this report we assess whether the NMa's methodology adequately captures recent developments in financial markets and how the methodology could be improved to reduce the risk of bias for the next regulatory period.

Current NMa methodology risks delivering a downward-biased estimate

We have argued for many years that the NMa's approach to estimating the WACC as applied in the past (which can be traced back to a report by Frontier Economics in 2005) is not rigorous, and will likely cause a downward bias in the cost of capital of Dutch energy networks. Two of the previous arguments we have made against the NMa's methodology are:[2]

1. "Taking input data from inconsistent datasets; and

2. "Using short term data on stock markets that is biased by temporary events"

Specifically, the NMa derives the nominal risk-free rate from yields on Dutch government bonds averaged over two and five years. Given that yields on government bonds have dropped to record historic lows over the last two years (and market evidence shows that they are predicted to rise significantly over the next regulatory period), the NMa's methodology will lead to the selection of an extremely low estimate of the risk-free rate that is unlikely to be representative of conditions over the coming regulatory period (cf. Section 2.3).

That approach might be justifiable if the NMa also calculated the other elements of the CAPM formula from market data for a similar time period. However, the NMa has not in the past estimated its WACC in an internally consistent way. Unlike the risk-free rate, the NMa has in past decisions estimated the Equity Risk Premium by placing significant weight on long run time series data.[3] At the current time this is likely to cause a bias in the NMa's overall estimate of the WACC, since the Global Financial Crisis (GFC) and high stock market volatility have led to an increase in the ERP in recent years which broadly offsets the concurrent reduction in the risk-free rate, as investors reallocate assets in favour of lower risk securities (the so-called "flight to quality"). The NMa's use of inconsistent datasets – a short

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1 Similarly there is an argument that the NMa's use of comparator companies with lower regulatory risk (with fewer occasions of regulatory decisions being altered ex post) leads to a risk of underestimating the true cost of capital of Dutch network operators.

2 See pages 4-9 of "How to Set a Reasonable Rate of Return: Objective Measures of Risk and Reward A Report for Gas Transport Services" , 22 December 2010

3 We note that for GTS the NMa has used a different range for the ERP for one year (2009) in light of then current conditions by placing some weight on current estimates of the ERP although the exact methodology and approach to determining the revised ERP estimate have never been fully explained.

timeframe for the risk-free rate and a long historical timeframe for the ERP – does not capture the relationships between these parameters in full and is likely to cause a downward bias in the overall WACC.

Short and Long Run WACCs

If the NMa wants to use a risk-free rate based on very recent data which takes account of the sovereign debt crisis then, for the sake of consistency and to produce an accurate estimate of the WACC, it is technically correct and important to calculate an ERP that is also based on recent stock market data. The only objective way to do this is to calculate the ERP using a forward-looking DGM approach, which the NMa and other European regulators have been reluctant to endorse.[4] Similarly the estimation period for the beta has to be aligned with the chosen estimation period for the other parameters.

However, even the consistent use of solely short term data on parameters for determining the cost of capital is problematic in the context of the Dutch energy networks' next three-to-five year regulatory period, that doesn't start until 2014, because macro-economic conditions then might be very different from recent history.

An alternative to using short run or current data is to estimate all WACC inputs on a longer-term basis under the assumptions that the GFC and its aftermath will be resolved by the start of the regulatory period and that economic conditions will return to long-run equilibrium values.

In general we favour the use of long run historical averages as the "standard approach" for calculating WACC parameters for regulatory purposes since the purpose of setting a regulatory WACC is to allow a company to recover its financing costs over a regulatory period, which is likely to reflect a range of economic conditions. Averages of historical data will typically smooth out for business cycle volatilities. In addition, on the cost of debt side the use of long-run averages is consistent with the reality that debt will generally have been raised over a period of time and cannot generally be refinanced at current rates, without significant refinancing costs. In this context it makes little sense to estimate the cost of debt based on short periods of data.

The use of longer term averages to calculate the WACC will also lead to greater stability in WACC parameters from one price review to the next price review, than if the WACC were always calculated using short run data, which will be more volatile.

We note the use of longer term averages has become the main approach used by other regulators in Europe for calculating WACC parameters (e.g. Ofgem uses long run averages of the risk free rate, ERP and cost of debt and the German regulator, the Bundesnetzagentur explicitly uses 10-year averages for the risk-free rate and long run averages for the ERP).

However, there are circumstances where the use of longer term averages is potentially problematic if there is little evidence that the economy will return to its longer run

[4] Strictly speaking a forward-looking ERP would have to be combined with forward-looking (rather than spot market) evidence on the other parameters. As such the spot rate should be checked against forward rates and adjusted if necessary, in case such an approach is chosen.

equilibrium any time soon, which would mean that an estimate of the cost of equity based on long-run averages would not be representative of the true cost of equity during the period.

Dealing with Unusual Financial Market Conditions

The financial crisis has had a significant and ongoing effect on financial markets. It has led to the risk-free rate being substantially and persistently lower than its long-run average. Since there is strong empirical and theoretical support for an inverse relationship between the risk-free rate and the ERP, reductions in the risk-free rate have been at least partly offset by increases in the equity risk premium.

We have to consider whether the use of longer run averages for the WACC is appropriate in the current macro-economic environment of persistently low interest rates. One way to do this is to examine market evidence on expected future risk free rates and expected corporate bond yields from forward curves, sourced from Bloomberg.

At the current time, our analysis shows that forward rates (expected yields to maturity) over the period 2014-2018 for Dutch government bonds with a 10-year maturity are expected to increase slowly from their current low levels but are forecast to reach their long-run averages by 2017/2018. Other macro-economic data shows a similar pattern, with market data suggesting that the next regulatory period will mark a transition phase with the current crisis gradually subsiding to a return to more "normal" conditions.

Should conditions remain in line with current forecasts it could be argued that the use of long run historical averages for WACC and cost of equity parameters in particular might not be representative of the expected financial conditions for the regulatory period.

In this context, an alternative approach, for example, is to calculate the WACC as a weighted average of short and long run WACC estimates based on a balanced view of the relative likelihood of "long-run normal" and continued exceptional conditions prevailing during the next regulatory period.

NERA experts have recently recommended this approach to the UK Competition Commission for the determination of the cost of debt, in the case of UK Water (2010), NERL (2010) and BAA airports (2010), and it was accepted in all of these cases.

The practical difficulties with applying this "weighted average" approach are twofold:

- First we need to define the circumstances where a departure from long run averages is justified;
- Second, we need to define how the weights to be applied to short run and longer run data are determined.

In this paper we suggest that the regulatory methodology should use projections of the forward curve for the risk free rate to define the circumstances where a departure from long run averages is justified. In applying this methodology, there needs to be a clear and transparent threshold agreed regarding what constitutes a "material difference" e.g. a threshold of 0.5 percentage points between the average forward rate and the long run historical rate.

If the forward curve shows an average risk free rate over the regulatory period that is above or below the threshold, the WACC should then be calculated as a weighted average of short run and long run data where the weights are based on the projected yield curve.

It might be argued that this "weighted average" approach to determining the WACC should be applied in all circumstances but it is clearly a more complicated methodology that requires more input parameters and affords the regulator greater discretion. In most economic conditions, we believe that the additional complexity of this approach would make it unsuitable for regulatory purposes. However, the persistence of the recession and unusual bond market conditions that have followed the Global Financial Crisis make it necessary to put forward this alternative approach for use in exceptional macro economic conditions. It is too early to say whether it will be necessary to apply this approach to estimate the WACC for Dutch energy networks for the next regulatory period; this will depend on the expected time path for future interest rates, and the market's expectations for a return to more normal macro economic conditions.

Summary

This paper sets out a number of key principles for WACC estimation in a regulatory context:

- First, a key condition for a robust and unbiased WACC estimate is the use of data from consistent periods for estimating each parameter. This condition is due to the (inverse) correlation between individual WACC parameters, in particular the risk-free rate and the Equity Risk Premium (ERP);
- Second, we propose that the "standard approach" for regulatory WACC estimation is to calculate internally consistent estimates of WACC based on long run historical data (e.g. using a ten–year period that can be expected to cover at least a full business cycle);
- Third, we define the conditions where a regulator would be justified in departing from this "standard approach", where forecasts of future risk free rates over the regulatory period are significantly different from long run averages and / or the regulatory period is very short. In these circumstances the WACC should be estimated as a weighted average of short and long run data consistent with the profile of the government bond yield curve.

The NMa's current WACC methodology does not satisfy these principles since it does not use consistent datasets for calculating the WACC, it affords greater weight to short run data than longer term averages, and there are no transparent principles for establishing when a departure from a standard approach would be justified.

1 Introduction

Netbeheer Nederland has asked NERA to examine the methodology NMa commonly uses for determining the WACC.

We understand that Netbeheer Nederland is concerned that the NMa's methodology fails adequately to capture recent changes in market conditions and will therefore lead to an estimate that is not representative of the true cost of capital for the next regulatory period. In this report we assess whether, and if so how, the NMa's methodology adequately captures recent developments in financial markets and how the methodology could be improved to reduce the risk of bias for the next regulatory period.

To this end we review different methodologies for estimating the WACC during a crisis period and during more "normal" times before assessing the available evidence about expected economic conditions during the next regulatory period. Drawing on theoretical and empirical evidence, as well as regulatory precedent, we derive a range of possible solutions for the challenge of estimating the WACC when the macroeconomic outlook is as uncertain as it is today.

The remainder of this report is structured as follows:

- Section 2 describes different methodologies for estimating the WACC;
- Section 3 reviews the macroeconomic outlook for the next regulatory period;
- Section 4 summarises how regulators in other AAA-rated countries have reacted to potential biases in the standard WACC methodology; and
- Section 5 summarises our findings providing recommendations.

2 WACC Methodologies

2.1 Short or Long Run Data?

The purpose of the determination of WACC is to provide a return that will allow the company to attract capital. The aim of the regulator is to estimate the expected cost of capital of the regulated company/ies over the relevant regulatory period.

In this case the NMa will need to forecast the expected cost of capital for an energy network in the Netherlands over the regulatory period, which will extend from a start date on 1 January 2014 to an end date that must fall between 31 December 2016 and 31 December 2018. As the NMa can re-set the cost of capital at three-to-five-yearly intervals, the NMa can focus on the need to define a WACC for those years alone and does not need to consider the outlook beyond that period.

In estimating the WACC one key condition for a robust and unbiased estimate of the WACC is the use of an appropriate and consistent period for the estimation of each parameter in the calculation. The current NMa approach does not use consistent time periods and therefore risks delivering biased results. (See also section 2.3)

In principle, there are two "standard" ways of calculating the expected cost of capital in a consistent way. The first approach is to rely on spot (or very short-term) estimates for all parameters. This approach assumes that today's spot market data provide an unbiased estimate of the market conditions prevailing (on average) over the forthcoming regulatory period. The DGM is an example of a standard approach to the cost of capital that uses short run data. However, European regulators have been reluctant to use the DGM, and its application for setting allowed rates of return has largely been limited to US rate of return proceedings.

An alternative to using short run or current data is to estimate all WACC inputs using long run historical data under the assumption that the average financing conditions over the prospective regulatory period will resemble long-run equilibrium values.

In general we favour the use of long run historical averages as the "standard approach" for calculating WACC parameters for regulatory purposes since the purpose of setting a regulatory WACC is to allow a company to recover its financing costs over a regulatory period, which is likely to reflect a range of economic conditions. Averages of historical data will typically smooth out for business cycle volatilities. In addition, on the cost of debt side the use of long-run averages is consistent with the reality that debt will generally have been raised over a period of time and cannot generally be refinanced at current rates, without significant refinancing costs. In this context it makes little sense to estimate the cost of debt based on short periods of data.

The use of longer term averages to calculate the WACC will also lead to greater stability in WACC parameters from one price review to the next price review, than if the WACC were calculated using short run data, which will be more volatile.

We note the use of longer term averages has become the main approach used by other regulators in Europe for calculating WACC parameters (e.g. Ofgem uses long run averages of the risk free rate, ERP and cost of debt).

However, there are circumstances where the use of longer term averages is potentially problematic if there is little evidence that the economy will return to its longer run equilibrium any time soon.

In this report, we examine the conditions where a regulator would be justified in departing from a long-run approach. As set out in more detail in section 2.3 the current NMa approach is neither consistently long-run nor consistently short-run and therefore risks significant bias. The NMa should move to a consistent approach in any case. This report is mostly concerned with the conditions under which this approach should be based on short-run or long-run data.

We do this by examining a range of evidence on investors' forecasts about the macro-economic outlook from 2014 onwards. If this evidence shows that the economic outlook is significantly different from long run average conditions, then this would justify a departure from the standard approach.

2.2 Consistency of Datasets

Independently of whether a short-run or a long-run approach to estimating the WACC is used, a key condition for a robust and unbiased WACC estimate is the use of data from consistent periods for estimating each parameter. This condition is due to the (inverse) correlation between individual WACC parameters, in particular the risk-free rate and the Equity Risk Premium (ERP). While the risk-free rate falls during times of high market volatility because of the well-known "flight to quality" effect, the ERP increases during times of high volatility.

The need to take account of these inverse movements in the risk-free rate and ERP in applying the CAPM has never been stronger than it is today. Short-run and long-run averages come to similar WACC estimates when all parameters are close to their long-run averages; however, unprecedentedly low yields on government bonds around the world since the start of the Global Financial Crisis (GFC) in 2008 have led to a reduction in measures of the risk-free rate in the CAPM formulation. This reduction has been offset by higher Equity Risk Premiums, as investors have demanded higher returns to compensate for increased risk.

Central banks have been among the commentators to notice this effect: e.g. the Europen Central Bank stated in 2010 that:

> *"short term risk premia have increased significantly during the financial crisis"*[5]

Scruggs (1998) and Bliss & Panigirtzoglu (2004) show the theoretical and empirical foundation for a link between ERP and volatility.[6] Similarly Cochrane explains in a chapter

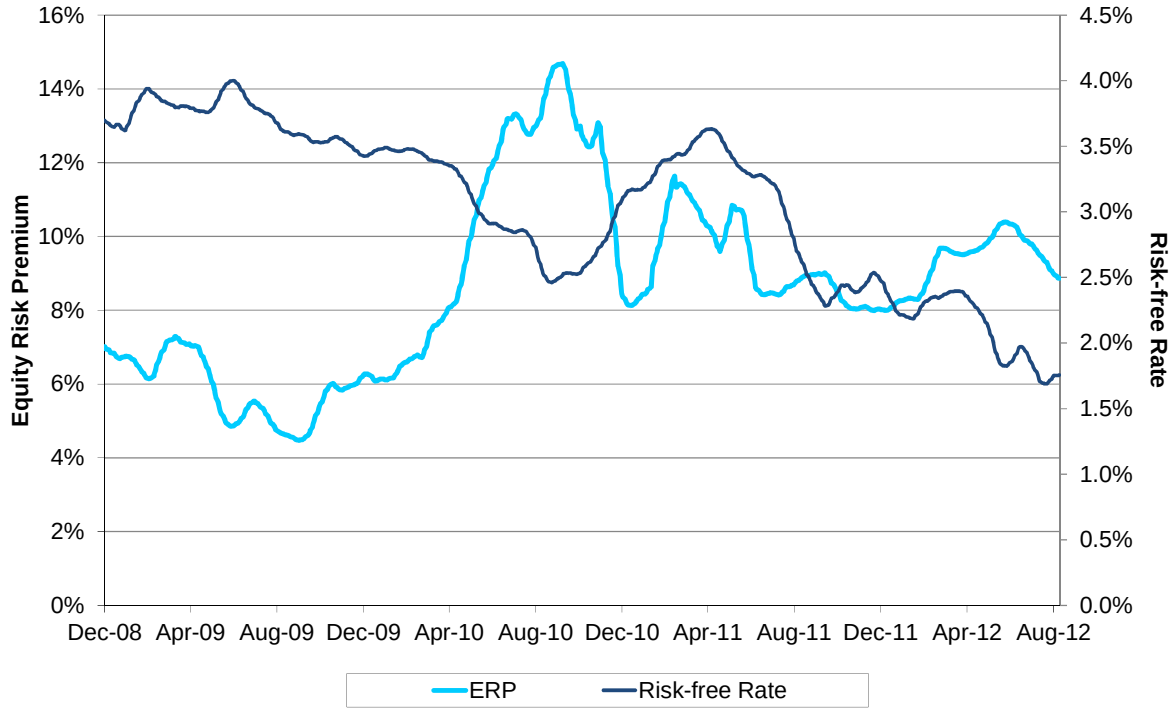
[5] ECB (2010): The term structure of risk premia new evidence from the financial crisis; Working paper series March 2010

of the "Handbook of the Equity Risk Premium" that variables that determine expected market returns *"[…] typically have a suggestive business cycle correlation. Expected returns are high in "bad times", when we might well suppose people are less willing to hold risks."*[7]

Similarly Cochrane and Piazzesi (2009) argue that changes to the ERP during a crisis can be significant and take a long time to return to normal levels. Based on a review of data over a number of previous recessionary periods going back to 1970, they conclude that the ERP increases by almost 20 per cent in periods of crisis, coming back to its previous "normal level" three years after the end of the recession, on average.[8]

The theoretical link between the two can also be shown empirically when comparing risk-free rates and the Bloomberg's ERP estimates for the Dutch stock market (See Figure 2.1).

Figure 2.1
Empirical Co-Movement between Dutch ERP and risk-free rate



Source: NERA analysis of Bloomberg data. Bloomberg's ERP estimate based on multi-stage DGM, rolling monthly averages

The correlation between the two series, i.e. the extent to which they move together, is -0.513. A figure of -1 describes perfect inverse correlation, 0 describes the absence of correlation and a figure of +1 describes perfect positive correlation. The two series are therefore inversely

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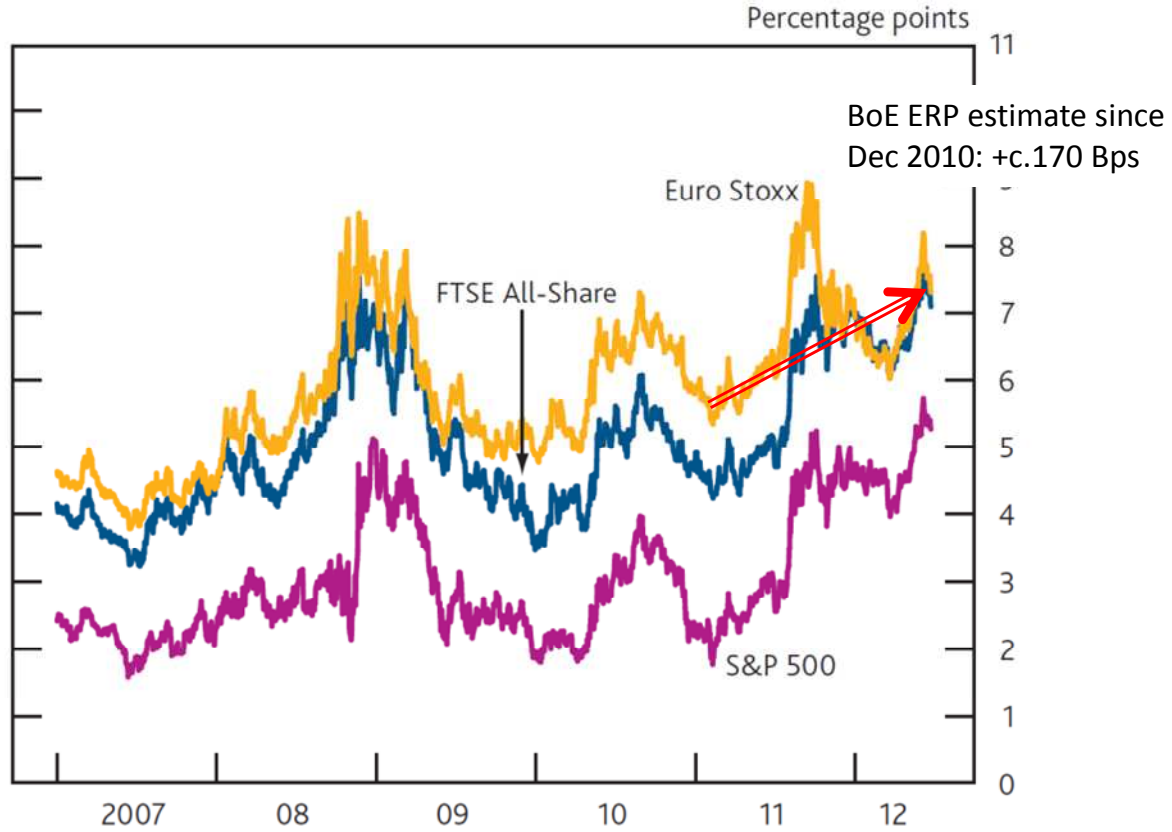
6 Scruggs, J.T. (1998): Resolving the Puzzling Intertemporal Relation Between the Market Risk Premium and the Conditional Market Variance: A two factor approach, *Journal of Finance*
Bliss, R. & Panigirtzoglu, N. (2004): Option-implied Risk Aversion Estimates, *Journal of Finance*

7 "Handbook of the Equity Risk Premium" by Rajnish Mehra, 2008, p. 244

8 Cochrane, J. and Piazzesi, M. (2009): Decomposing the yield curve, AFA 2010 Atlanta Meetings Paper

correlated to a substantial degree.[9] The same trade-off is in evidence when other data providers are used for estimating the ERP. For example, the Bank of England also reports a strong increase in the ERP in Europe, the UK and the US (shown in Figure 2.2) over the period since the NMa's data cut-off for its most recent WACC decision; during this period, the risk-free rate has fallen significantly as illustrated in Figure 2.1, which confirms the inverse correlation with the sharply increasing ERPs shown here.

Figure 2.2
Evolution of ERP estimates by the Bank of England



Source: Bank of England Financial Stability Report, June 2012 (referring to Bloomberg, Thomson Reuters, Bank calculations). Note that the Bank of England uses GDP growth as the long-run growth rate assumption for dividends. This approach is not shared by major financial data providers such as Bloomberg and tends to bias downward absolute numbers.

Table 2.1 shows yields on Dutch government bond rates with 10-year (10Y) maturity and different estimates of the ERP in Europe over a range of periods.

[9] Correlation is not a binary relationship, i.e. there can be inverse correlation between two parameters even if the coefficient does not equal to 1. In that case the relationship is not one of perfect correlation. However, perfect correlation is not required to make it necessary to use consistent time frames as any form of correlation will only be picked up by consistent estimation periods with other choices leading to biased estimates.

Table 2.1
Estimates* of ERP and Risk-Free Rate over Different Time Frames (%)**

Risk-free Rate (%)	**1Y**	**2Y**	**3Y**	**5Y**
Dutch 10Y Govt Bond	2.3	2.7	2.9	3.4
ERP (%)				
Bloomberg	9.1	9.7	9.3	8.5***
Bank of England****	c.7.0	c.6.0	c. 5.5	c.5.5
Total Market Returns (Nominal, "post-tax", Range, %)[10]				
Range	9.3-11.4	8.7-12.4	8.4-12.2	8.9 -11.9

*Source: Bloomberg and Bank of England (BoE) Financial Stability Report, June 2012. Notes: * These estimates are shown for illustrative purposes at this stage. We do not necessarily endorse the range or any point within this range as the "best estimate" of the ERP. ** No 10Y average reported because ERP data from Bank of England and Bloomberg is not available. *** Bloomberg "5Y" ERP estimate based on 4Y 2months, the longest available time frame. **** Underlying data for BoE report not publicly available (Averages estimated). Differences between Bloomberg and Bank of England methods arise from differences in approach to estimating the long-run growth rate [Bloomberg uses glide path based on current pay-out ratio; Bank of England uses "drop" from current analyst forecast to GDP growth rate after 5 years]. Bloomberg estimates will have a tendency to overestimate while Bank of England estimates will have a tendency to underestimate.*

The empirical findings provide strong support for the theoretical postulate of an inverse relationship between the ERP and the risk-free rate with variation in the total market returns being significantly smaller than variation in each of its constituent parts. Academic opinion differs on the strength of the inverse correlation. Smithers & Co, advisers to the UK regulators for a large-scale review of the cost of capital methodology, came to the conclusion that the best estimate of changes in the ERP associated with changes in the risk-free rate would be to assume that changes in the risk-free rate would be completely offset by changes in the equity risk premium.

> *"Given our preferred strategy of fixing on an estimate of the equity return, any higher (or lower) desired figure for the safe rate would be precisely offset by a lower (or higher) equity premium, thus leaving the central estimate of the cost of equity capital unaffected".*[11]

On the other hand Guo and Whitelaw (2006) show that the increase in the ERP caused by increased market volatility outweighs the reduction in the risk-free rate,[12] i.e. that total returns on the equity market do react to changes in volatility, albeit less strongly than the individual components, ERP and risk-free rate, which partly counterbalance each other. This view is also shared by UK regulatory authorities who have not fully adopted the Smithers & Co

[10] These numbers are total market returns estimates, i.e. equivalent to the nominal, post-tax return on equity for the market as a whole or a company with an equity beta of 1.0.

[11] Smithers and Co (2003): A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K., A report commissioned by the U.K. economic regulators and the Office of Fair Trading, p. 49. Emphasis added

[12] Guo, H. and Whitelaw, R. (2006): Uncovering the Risk-Return Relationship in the Stock Market, *Journal of Finance*

recommendation of an unchanged market return under all circumstances. For example, the UK Competition Commission has written:

> *"the evidence tends to suggest that on this basis market returns are more stable than the ERP […but…]We did not mean to suggest that the market return is invariant"*[13]

Alongside the inverse correlation between the risk-free rate and the ERP, we have also observed an inverse correlation between the beta of network companies and the ERP.

This reduction in relative risk, i.e. the network company betas, during the financial crisis is in line with observed beta estimates for other classes of infrastructure assets. It represents the fact that while the market as a whole has become more volatile in absolute terms, the cash flow profile of infrastructure assets has been broadly unaffected by the financial crisis in absolute terms, leading to lower *relative risk* while absolute risk remains unchanged. There is also a degree of inverse correlation between the debt premium and the risk-free rate

Based on the above we conclude that it is not possible or reliable to estimate individual WACC parameters in isolation from each other. Anyone estimating the cost of capital in current conditions would have to weigh the evidence on the macroeconomic outlook / expected market volatility throughout the next regulatory period and to decide what is the most appropriate historical period for the joint estimation of the various parameters.

Given how far removed from long-run values the current estimates of both the ERP and the risk-free rate are, it is more important than ever that a consistent estimation period is used to reflect both these trends. By the same token, the estimate of the beta will only be consistent with the other parameters if the currently low betas are combined with currently higher returns on the equity market as a whole. There are significant grounds for concern that the current NMa method (described in the next section) will not deliver such consistent estimates.

2.3 Current NMa methodology risks delivering a downward-biased estimate

NERA experts have argued for many years that the NMa's approach to estimating the WACC as applied in the past (which can be traced back to a report by Frontier Economics in 2005) is not rigorous, and is likely to cause a downward bias in the cost of capital of Dutch energy networks. Two of the previous arguments made against the NMa's methodology are:[14]

1. "Taking input data from inconsistent datasets; and

2. "Using short term data on stock markets that is biased by temporary events"

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[13] UK Competition Commission (2010): Bristol Water Plc: Price Determination – Appendices and Glossary, p. N26 & N27. The CC refers to real returns. However, as inflation expectations for the Netherlands have not varied significantly with medium term forecasts according to Consensus Economics always in the range from 1.7% to 2.0% the same argument will apply to nominal returns in the Netherlands.

[14] See pages 4-9 of "How to Set a Reasonable Rate of Return: Objective Measures of Risk and Reward A Report for Gas Transport Services", 22 December 2010

The NMa derives the nominal risk-free rate from yields on Dutch government bonds, specifically from the average yields observed over periods of two years and five years. These points are taken as the bounds of the NMa's range, with the mid-point usually being chosen by the NMa as the final value. Given that yields on government bonds had dropped to record historic lows around mid-2011, our concern of downward bias is even more pronounced now than it was previously, as the two years from mid-2011 to mid-2013 would be given a weight of 70% under the standard NMa methodology for determining the risk-free rate.[15] This implies that if the NMa were to determine the risk-free rate using its existing method it would give 70% weight to years significantly affected by the sovereign debt crisis, which is unlikely to be representative of conditions over the actual regulatory period, as discussed in section 3.

It is far from clear that the NMa's method for determining the ERP would afford the same weight to the (higher) ERP observed during the crisis. In the past the NMa reached a view on the ERP after discussing a range of evidence including historical evidence (long-run estimates by Dimson, Marsh and Staunton for the Netherlands and the world) and forward looking evidence (based on the dividend growth model, using earnings yields in the Netherlands, the UK and the USA). While neither the NMa nor its advisers have been explicit about the weight given to historic and forward-looking evidence, the NMa's decision to set a range for the ERP of 4% to 6% for all years except 2009 suggests that it based its estimate of ERP mostly on historic data, which gives such a range for Dutch markets.

In summary, the NMa has previously used an ERP largely consistent with very long run data and a risk-free rate that was 70% based on data from the last two years. Since the yields on government bonds are likely to have been unprecedentedly low over the two years up to when it sets the risk-free rate allowance in late 2013 (cf. Figure 2.1), this will lead to a risk-free rate that is very low. However, there is no guarantee that the NMa's methodology will include a compensating adjustment for the effect of the Global Financial Crisis on the ERP.

In addition, the NMa's estimates of beta are based on short run data averaged over two and five years. As explained above, the beta for infrastructure companies tends to decline in periods of high market volatility as such assets are generally regarded as relatively safe. The effect of using a low risk-free rate, a low beta and a long run normal ERP is an unrepresentatively low WACC. [16]

If the NMa wants to use a risk-free rate based on (mostly) very recent data which takes account of the sovereign debt crisis, then a consistent and accurate estimate of the WACC would have to include an ERP that is also based on recent stock market data. The best way to do this is to calculate the ERP using a forward-looking DGM approach. European regulators have been reluctant to place much weight on the DGM, on the grounds that results are sensitive to assumptions. As the discussions above show, the CAPM approach is subject to precisely the same criticism in current conditions. However, an alternative to using short-run

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[15] The 2Y average is given 50% weight. The last two years make up 40% of the 5Y average, which is also given 50% weight, giving those two years a total weight of 20%. The total weight placed on the last two years is therefore 70%.

[16] Similarly there is an argument that the NMa's use of comparator companies with lower regulatory risk (with fewer occasions of regulatory decisions being altered ex post) leads to a risk of underestimating the true cost of capital of Dutch network operators.

data in the CAPM formula is to rely consistently on long-run data for all parameters as other utility regulators have done e.g. in the UK.

> *"We considered it appropriate to focus on longer-term estimates (…) Our experience from previous price controls shows that looking beyond short-term volatility is a prudent approach to take when setting the cost of equity assumption for network companies."*[17]

Such an approach is particularly suited to times where forward-looking estimates suggest an eventual "return to normal" during the regulatory period. In the next section we assess the available macroeconomic evidence as to whether conditions in financial markets during the next regulatory period are likely to more closely resemble current trends or long-run averages.

[17] Ofgem (2012): RIIO-GD1: Initial Proposals Supporting Document – Finance and uncertainty, p.18. Ofgem discusses this in the context of an eight-year price control. However, the previous price controls it refers to have been five-year price controls, i.e. similar in length to the Dutch experience.

3 Assessing the Economic Outlook for the Next Regulatory Period

3.1 Projecting the Economic Outlook

Below we provide evidence on investor expectations for 2014 (when the next regulatory period starts) and beyond where sufficient data is available, in order to assess whether investors expect a "return to normal" or continued extraordinary conditions with low risk-free rates and high volatility.[18] If the former proves correct this would justify placing more weight on longer run historical time series data on WACC and cost of equity in particular while if the latter is true more weight should be given to short-run estimates of the risk-free rate and DGM-based estimates of the ERP.

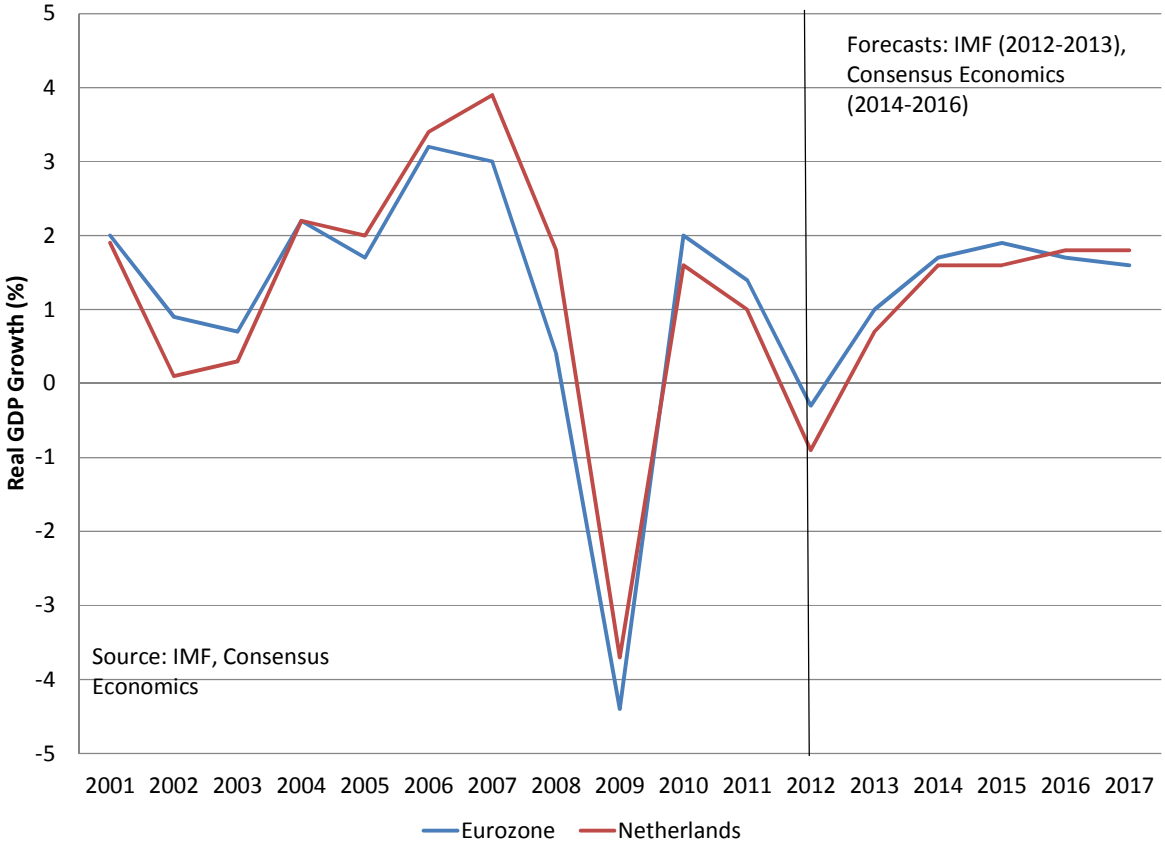
3.1.1 GDP growth

GDP growth is not directly linked to the WACC for energy networks, but it is strongly correlated with interest rates, and therefore expected GDP growth gives an indication of the likely profile of future government bond yields.

The current consensus is that GDP growth in the Netherlands and the broader Eurozone will recover from its current low levels (which would be the predominant factors in a 2Y average) but will still be below the levels seen in the 2005-2008 period and closer to the levels observed before the start of the boom that preceded the global financial crisis.

[18] In this context we refer to market-based measures of expected parameters as implied by forward curves and options. These liquid capital market instruments represent the consensus view that balances supply and demand in financial markets; as created by all participants in these markets and not necessarily limited to individual investor groups.

Figure 3.1
Forecasts of Real GDP Growth

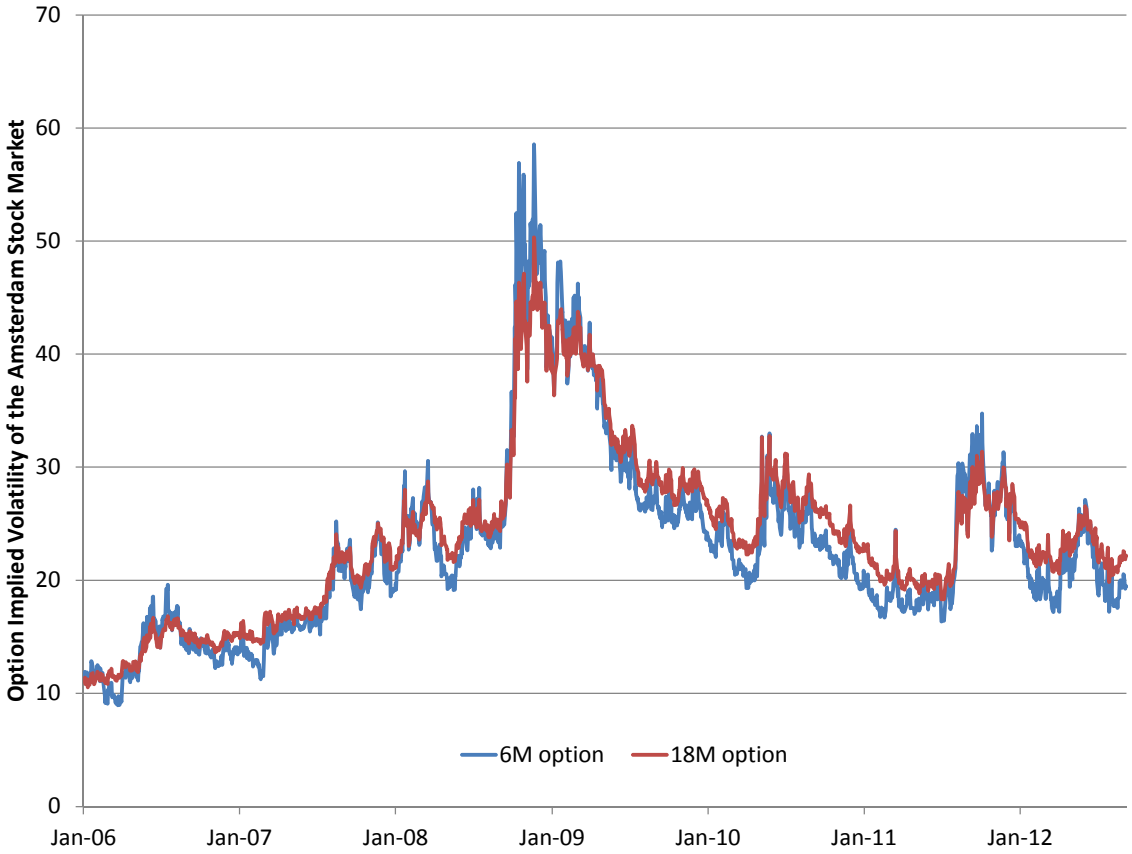


Source: NERA, IMF, Consensus Economics

3.1.2 Volatility & ERP

Figure 3.2 shows that despite a recent drop in volatility, expected volatility in the Dutch stock market is still almost 100% higher than before the start of the financial crisis (albeit far below its peak). In particular the 18M option-implied volatility is of interest as it helps forecast expected volatility at the start of the coming regulatory period. Current estimates suggest that while expected volatility is below its peak we cannot assume that markets will have fully "returned to normal" by the beginning of the next regulatory period. There are no available forecasts for the later parts of the regulatory period as trading in options with a maturity of more than 18 months is not sufficiently liquid to provide reliable data.

Figure 3.2
Forecast Volatility (6M ahead & 18M ahead) of the AEX Index



Source: NERA analysis of Bloomberg data

As set out above, stock market volatility is a driver of the equity risk premium. We do not have explicit forecasts of the ERP one and a half years ahead. However, the volatility figures described in Figure 3.2 suggest that the ERP is likely to have fallen back from its peak but will still be significantly above its long-run value. This assessment appears to be supported by a number of academic papers. E.g. Berg (2010) writes:

> *"These findings suggest that (marginal) investors have demanded higher short-term risk premia during the crisis. Investors were, however, well aware that risk premia will revert back to normal levels in the long run."* [19]

Similarly, Cochrane and Piazzesi (2009) argue that changes to the ERP during a crisis can be significant and take a long time to return to normal levels:

> *"[…] the ERP increases by almost 20 per cent in periods of crisis, coming back to its previous "normal level" three years after the end of the recession, on average."*[20]

[19] Berg, T (2010): The Term Structure of Risk Premia: during the Financial Crisis Evidence from a New Calibration Approach based on CDS Spreads; SSRN Working Paper Series; November 2010. In this case short-term refers to the observation period not the maturity of the asset.

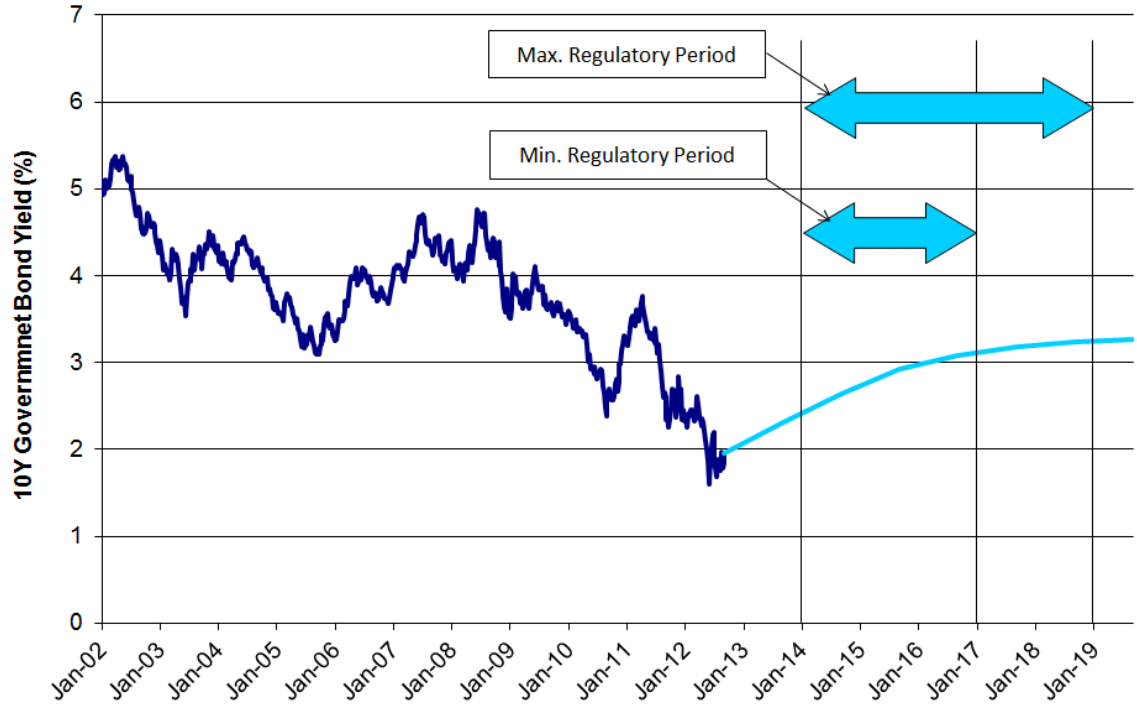
Thus, even if we assume that the recession ends in 2013 (cf. section 3.1.1 and Figure 3.1) and current negative growth does not spill over into next year, Cochrane and Piazzesi's findings suggest that the ERP will be elevated, relative to its long-run trend, until 2016, i.e. for at least half the next regulatory period.

3.1.3 Risk-free Rate

Forecasts of future risk-free rates can be derived from the analysis of "forward rates on government bonds." This technique extracts the expected rate on a 10Y government bond in, say, five years' time by evaluating the current yield differential between a 5Y and a 15Y maturity government bond. The difference between the yield on the 5Y bond (which will have matured in 5Y time) and the 15Y bond, which will be a 10Y bond at that point in time, can be used to derive the expected yield of a 10Y bond in 5 years' time.

Figure 3.3 shows rates for Dutch government bonds with a 10Y maturity. The blue line also shows the 10Y rates implicit in yields for bonds with differing maturities, as at the middle of 2012. These rates are expected to increase by around 150 basis points between now and the end of the next regulatory period. As such any approach that would draw mainly on data from 2012 and 2013 would likely lead to a significantly downward-biased estimate of the average risk-free rate over the 2014-2016/18 regulatory period.

Figure 3.3
Forward Rates for Dutch Government Bond Rates



Source: NERA analysis of Bloomberg data

[20] Cochrane, J. and Piazzesi, M. (2009): Decomposing the yield curve

Other jurisdictions have altered their approach in response to concerns about the averaging period being unrepresentative. For example, in Australia, the regulator's proposal to use an unrepresentative averaging period for setting the WACC for regulated energy companies was overturned by the Australian Competition Tribunal.

> *"The Tribunal considers that an averaging period during which interest rates were at historically low levels is unlikely to produce a rate of return appropriate for the regulatory period."*[21]

3.1.4 Beta

There is no forward-looking data source for estimating beta values. As noted above there is some evidence that beta estimates for infrastructure companies tend to move inversely with market volatility. As such it is plausible that betas will be below their very long-run averages inasmuch as market volatility will be above its long-run values, as suggested by Figure 3.2. In practice, we are not aware of any objective basis for adjusting betas to offset this bias, but note that it increases the importance of avoiding downward biases in other parameters.

3.1.5 Cost of Debt

Forecasts of future corporate bond rates can be derived from the analysis of "forward rates on corporate bonds." using the methodology as described for the derivation of future risk-free rates in section 3.1.3 above.

Figure 3.4 shows current forward rates for A-rated Eurozone industrial corporate bonds with a 10Y maturity. These are expected to increase by around 200 basis points between now and the end of the minimum next regulatory period (2017).[22] As such any approach that would draw mainly on data from 2012 and 2013 is likely to lead to a significantly downward-biased estimate of the average corporate bond rate over the 2014-2016/18 regulatory period.

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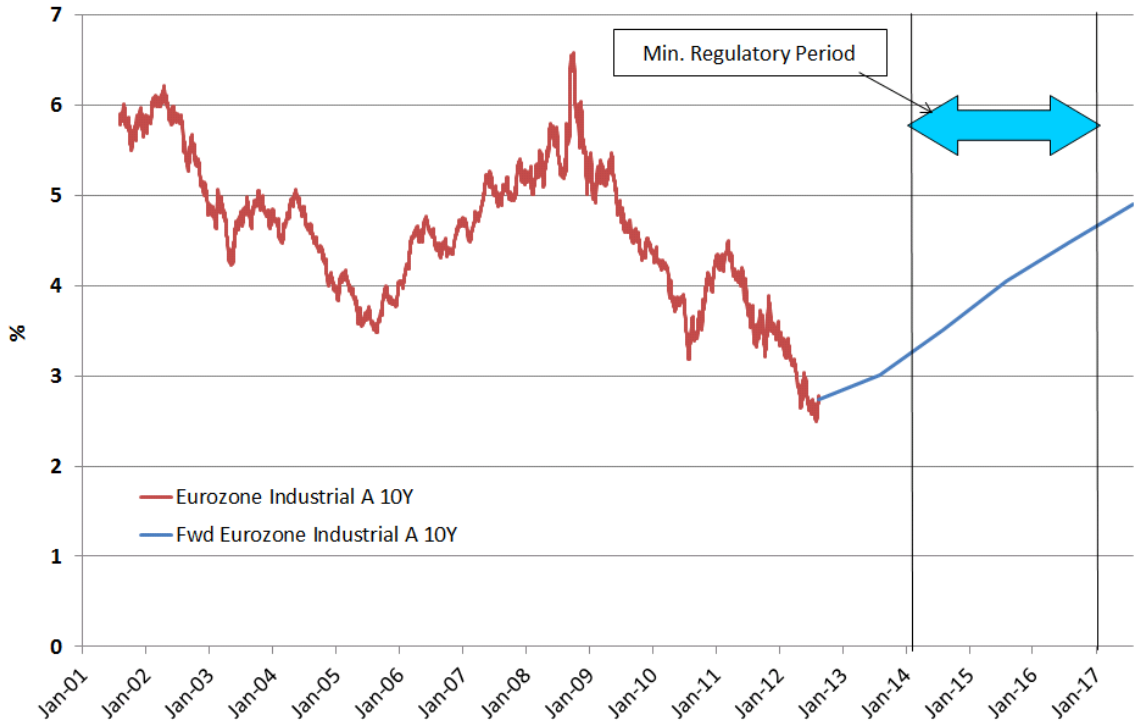
[21] Australian Competition Tribunal (2009): Application by EnergyAustralia and Others [2009] ACompT 8

[22] Bloomberg provides insufficient data to enable us to calculate the forward corporate bond rates up to 2019.

Figure 3.4
Forward Rates for Eurozone Industrial Corporate Bond Rates



Source: NERA analysis of Bloomberg data. NB: Bloomberg does not currently report reliable yields on long-maturity BBB-rated bonds or on A-rated bonds with a maturity in excess of 15 years, which means robust forward curves can only be calculated up to 2017.

3.2 Summary

The evidence above suggests that economic growth is forecast to return to positive levels from 2013 onwards, although will remain pre-crisis levels even up to 2018.

Risk-free rates and corporate bond rates are currently expected to be starting at levels below their long-run values but are forecast to reach (risk-free rate) or exceed their long-run averages (A rated corporate debt) by the middle/ end of the period.

We not have good evidence on the expected ERP over the whole regulatory period up to 2018 as market data from options prices only shows expected volatility (which is only an indirect proxy for the ERP) up to 2014.

Consequently, based on currently available data, indications are that the next regulatory period will mark a transition phase with the current crisis gradually subsiding for a return to more "normal" conditions.

Should conditions remain in line with current forecasts it could be argued that the use of long run historical averages for WACC parameters might not be representative of the expected financial conditions for the regulatory period.

In this context, an alternative approach, for example, is to calculate the WACC as a weighted average of short and long run WACC estimates based on a balanced view of the relative likelihood of "long-run normal" and continued exceptional conditions prevailing during the next regulatory period.

The practical difficulties with applying this "weighted average" approach are twofold:

- First we need to define the circumstances where a departure from long run averages is justified;
- Second, we need to define how the weights to be applied to short run and longer run data are determined.

In terms of defining the circumstances where a departure from long run averages is justified, it is sensible to focus on only one financial metric. This will reduce the possibility of regulatory discretion and confusion about how to deal with (possibly) conflicting information.

The most direct evidence on the WACC comes from market expectations on the risk free rate. This affects both the cost of equity (in the CAPM) and the cost of debt and, we have shown in Section 2, that there is a strong correlation between the risk free rate and the ERP. Therefore the regulatory methodology should use projections of the forward curve for the risk free rate to define the circumstances where a departure from long run averages is justified. In applying this methodology, there needs to be a clear and transparent threshold agreed regarding what constitutes a "material difference". A suggestion is that this threshold be set around 0.5%, i.e. a threshold of 0.5% between the average forward rate and the long run historical rate.

If the forward curve shows an average risk free rate over the regulatory period that is above or below the threshold, the WACC should then be calculated as a weighted average of short run and long run data where the weights are based on the projected yield curve.

To give an example, the Eurozone nominal risk free rate is currently projected to rise from its current level of 1.8% to around 3.5% over the period 2014-208. The average forecast risk free rate over the period is 2.7%. This compares to a ten year average historical risk free rate of 3.5%. Hence the projected risk free rate lies approximately 50% of the difference between its short run and long run levels.

In these circumstances, the regulator would be justified in departing from using a WACC based on long run averages, and to use a risk free rate of 2.7%. The ERP and other WACC parameters should then be calculated as a 50:50 weighted average of short and long run data to be consistent with this estimate.

These weights will need to be adjusted for shorter regulatory periods, with more weight placed on the current WACC estimate, unless economic conditions alter substantially.

4 Regulatory Precedent from other AAA countries

The phenomenon of the flight to quality, which has led to a significant reduction in risk-free rates has not only affected the Netherlands but also AAA-rated countries around the world. A number of regulators have recently changed their methodology in ways that accommodate the potential inconsistency that arises when (relatively) current averages of the risk-free rate (which are significantly below their long-run equilibrium values) are combined with long-run averages of the MRP as calculated by DMS. Below we draw on evidence from a sample of different AAA-rated countries and how they have reacted to the aforementioned issue.

In the **UK.** Ofgem has moved away from using current averages of gilt (government bond) yields and has instead relied on what it describes as very long-run averages for both the risk-free rate and the ERP that are broadly consistent with regulatory precedent, although the exact derivation of its numbers is unclear. Ofgem writes:

> *"We considered it appropriate to focus on longer-term estimates (…) Our experience from previous price controls shows that looking beyond short-term volatility is a prudent approach to take when setting the cost of equity assumption for network companies."*[23]

The eventual estimates of the risk-free rate chosen by Ofgem in its latest price review (RIIO-GD1, 2012) are around 60 basis points above the ten-year average yield on the relevant government bonds, while Ofgem's estimate of the ERP is in line with long-run arithmetic average estimates of the UK ERP.[24]

Other UK regulators have also increased their estimates of the ERP while using estimates of the risk-free rate significantly above current government bond yields. Ofwat, for example, the regulator for the water sector, chose an estimate at the top of the range recommended by its advisers, while using long-run estimates of the risk-free rate. Ofwat concluded:

> *"It reflects our view that we should assume a high equity risk premium given the economic conditions within which the cost of capital is set and is at the top of the historical range."*[25]

Similarly the UK aviation regulator, the CAA also adopted an approach that included an uplift to total market returns (i.e. the sum of the risk-free rate and the ERP) relative to long-run normal conditions.

> *"the market return included a small uplift on the longer-run market return for the current macroeconomic conditions"*[26]

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[23] Ofgem (2012): RIIO-GD1: Initial Proposals Supporting Document – Finance and uncertainty, p.18. Ofgem discusses this in the context of an eight-year price control. However, the previous price controls it refers to have been five-year price controls, i.e. similar in length to the Dutch experience.

[24] See Ofgem (2012): RIIO-GD1: Initial Proposals Overview, p. 37 (which states Ofgem uses a real risk-free rate of 2%) and FTI Consulting (2012): Cost of capital study for the RIIO-T1 and GD1 price controls, p.28 (which states the 10Y average for index-linked gilts with 10Y maturity is 1.4%).

[25] Ofwat (2009): Future water and sewerage charges 2010-15: Final determinations, p.128-129.

In **Germany** the regulator uses the 10Y average for calculating the risk-free rate. In addition, although the Bundesnetzagentur (BNetzA) used the latest DMS data and up-to-date estimates of beta to calculate a risk premium (as the product of beta and ERP) for a draft decision, its final decision adopted a risk premium c. 70 basis points higher.[27] It listed the impact of the financial crisis as one driver for this decision alongside the specific considerations associated with the German "energy turnaround".

> *"The review of the consultation responses has led us to question the results of the application of the CAPM in light of past and ongoing developments on international capital markets. (…) After the review of the consultation responses the Decision Chamber considers it justified to deviate from the CAPM approach. Alongside the operators numerous institutional investors have pointed out the exceptional situation on the financial markets that cannot be ignored."*[28]

The BNetzA's implicitly acknowledged that mechanical application of the CAPM (using long-run historic estimates of the ERP) was not suited to estimating the cost of capital in the midst of a financial crisis. as it did not pick up short-to-medium term changes in one central parameter, namely the ERP.

In **Finland** the energy sector regulator (EMVI) uses short-run averages of the risk-free rate (similar to the NMa) and a fixed estimate of the ERP based on a consultant's estimate. EMVI noted in 2011 that the real risk-free rate implied by its current methodology had turned negative. In order to avoid including such an effect in the cost of capital, the EMVI adopted an estimate of the rate of inflation capped at 1% (which was significantly lower than actual inflation at the time), which essentially amounted to an uplift on the cost of equity. While there is no theoretical basis for capping inflation in this manner, the EMVI's approach gives a result that is similar to Ofgem's approach of looking at long-run numbers, as the EMVI considered a long-run ERP together with an estimate of the risk-free rate that mitigates the current downward trend.[29]

Outside Europe, the **Australian** competition authorities have also addressed the issue of potential bias in the risk-free rate estimate brought about by the reliance on periods of

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[26] CAA (2010): NATS (En Route) plc price control: CAA formal proposals for control period 3 (2011-2014): under Section 11 of Transport Act 2000, p. 144.

[27] For the draft decision the BNetzA calculated a risk premium of 2.9% based on an equity beta of 0.66 and an ERP of 4.4%. The BNetzA eventually uses the risk premium it applied for the previous regulatory period, which was 3.59% based on an ERP of 4.55% and an equity beta of 0.79.

[28] Bundesnetzagentur (Nov 2011): Beschluss BK4-11/304, p.7. (Determination of the Return on Equity) – German original, translation by NERA. Original in German:
"Vorliegend hat die Auswertung der Stellungnahmen jedoch dazu geführt, eine Überprüfung des aktuellen Ergebnisses aus dem CAPM-Ansatzes (sic) vor dem Hintergrund der zurückliegenden und anhaltenden Entwicklungen an den internationalen Kapitalmärkten zu hinterfragen. (...) sieht die Beschlusskammer nach Auswertung der eingegangenen Stellungnahmen es als sachgerecht an, vom CAPM-Ansatz abzuweichen. Neben den Netzbetreibern haben zahlreiche institutionelle Investoren auf die außergewöhnliche Situation an den Finanzmärkten hingewiesen, die nicht außer Acht gelassen werden kann."

[29] EMVI (2011): Regulation methods for the assessment of reasonableness in pricing of electricity distribution network operations and high-voltage distribution network operations in the third regulatory period starting on 1 January 2012 and ending on 31 December 2015, chapter 2.1

atypically low interest rates. In general, the Australian Energy Regulator (AER) has used a short-run average of the risk-free rate together with a fixed ERP estimate. In 2009, however, Australian government bond rates had already fallen to historically low levels before rising and falling again. In this context the Competition Appeals Tribunal, an appellate body, overturned a decision by the AER on the grounds that the chosen averaging period for the risk-free rate was unlikely to be representative of future conditions.

> *"The Tribunal considers that an averaging period during which interest rates were at historically low levels is unlikely to produce a rate of return appropriate for the regulatory period."*[30]

Instead the Tribunal ruled that an alternative (earlier) period that had been used as the basis for estimation by the network operators should be used in calculating the risk-free rate, resulting in a higher estimate of total market returns for a given ERP.

In addition the regional regulator for New South Wales has picked up on the inconsistency between using a short-run risk-free rate and long-run MRP and has moved from using a short-run period for the risk-free rate to using a ten-year average:

> *For this review, we consider that the value of the risk free rate is currently well below long term averages and that there is a high level of market uncertainty. We consider the risks in setting a 5-year determination in the current conditions are more significant than under normal market conditions.*
>
> *We acknowledge the argument that there may be greater stability in the sum of the market risk premium and the risk free rate (ie, the expected market return) than in the individual components. (…)*
>
> *Therefore, to guide our decision-making on the point estimate for the WACC, we estimated the long term averages of the risk free rate, inflation rate and the market risk premium. (Emphasis added).*[31]

IPART's change in approach is aligned with our suggested approach set out here, which follows the recognition that IPART's and NMa's past approach, which combined short-run and long-run averages for individual parameters, can lead to significant bias in the final WACC estimate.

Figure 3.3 suggests that the NMa is likely to encounter the same issues for the next regulatory period if it continues to place most weight on the 2Y time period before its final decision (i.e. likely to be mid-2011 to mid-2013) and does not adjust the ERP accordingly. Both the Bank of England and Bloomberg currently estimate the ERP for the Eurozone to be significantly

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30 Australia Competition Tribunal (2009): Application by EnergyAustralia and Others [2009] ACompT 8

31 Independent Pricing and Arbitration Tribunal (2011): WACC for Sydney Desalination Plant, available at: http://www.ipart.nsw.gov.au/Home/Industries/Water/Reviews/Metro_Pricing/Review_of_Sydney_Desalination_Plant_Pty_Ltds_prices/09_Dec_2011_-_Final_Report/Final_Report_-_Review_of_water_prices_for_Sydney_Desalination_Plant_Pty_Limited_-_From_1_July_2012_-_December_2011

above the NMa's historic estimate of 5%[32] reflecting an increased perception of risk in the market (as expressed by asset valuations relative to dividend yields and growth forecasts).[33]

Our review of regulatory precedent has shown that a number of regulators in other countries have adopted new approaches in reaction to the inconsistent WACC estimates created by a mechanical application of the CAPM with "traditional" input parameters including (relatively) short-term estimates of risk-free rate and beta and long-run historic averages based on DMS data. A number of these approaches have been relatively arbitrary (e.g. limiting the rate of inflation used to calculate the risk-free rate in Finland, using a floor on the risk-free rate consistent with past regulatory precedent by Ofgem in the UK) but they have recognised the empirical finding that total market returns (i.e. the sum of the risk-free rate and the ERP) are comparatively more stable than its component parts.

[32] The NMa has commonly used the mid-point of its range from 4% to 6%.

[33] Bloomberg also publishes an estimate of the equity risk premium for the Netherlands that is comparable to the estimate for the Eurozone as a whole that is c. 50-100 bps below the Eurozone estimate throughout most of 2012.

5 Conclusions

The financial crisis has had a significant and ongoing effect on financial markets. It has removed both the risk-free rate and the equity risk premium (ERP) from its long-run averages. There is strong empirical and theoretical support for an inverse relationship between these two parameters. As such reductions in the risk-free rate have been at least partly offset by increases in the equity risk premium.

However, the NMa's past approach of combining a relatively short-run average of risk-free rate estimates with mostly long-run average estimates of the ERP risks underestimating the current WACC unless the NMa places more weight on correctly estimated measures of the current ERP.[34] Similarly the estimation period for the beta has to be aligned with the chosen estimation period for the other parameters, i.e. in that case would also have to use short-run estimates.

This paper sets out a number of key principles for WACC estimation in a regulatory context:

- First, a key condition for a robust and unbiased WACC estimate is the use of data from consistent periods for estimating each parameter. This condition is due to the (inverse) correlation between individual WACC parameters, in particular the risk-free rate and the Equity Risk Premium (ERP);
- Second, we propose that the "standard approach" for regulatory WACC estimation is to calculate internally consistent estimates of WACC based on long run historical data (e.g. a minimum of five years)[35];
- Third, we define the conditions where a regulator would be justified in departing from this "standard approach", where forecasts of future risk free rates over the regulatory period are significantly different from long run averages. In these circumstances the WACC should be estimated as a weighted average of short and long run data consistent with the profile of the government bond yield curve.

The NMa's current WACC methodology does not satisfy these principles since it does not use consistent datasets for calculating the WACC, it affords greater weight to short run data than longer term averages for some parameters, and there are no transparent principles for establishing when a departure from a standard approach would be justified.

Our review of regulatory precedent has shown that other regulators have also realised that their traditional approach to WACC estimation is unsuitable in current market conditions. Other regulators have typically dealt with the problems by applying arbitrary adjustments to certain WACC parameters (like the risk free rate) instead of determining a more rigorous methodology.

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[34] We note that for GTS the NMa has used a different range for the ERP for one year (2009) in light of then current conditions by placing some weight on current estimates of the ERP although the exact methodology and approach to determining the revised ERP estimate have never been fully explained.

[35] See above for reasons related to stability and predictability that support the use of long-run data over short-run data. Similarly, on the cost of debt side the use of long-run averages is consistent with the recognition of embedded debt, which will have been raised over a period longer than one period and will not be fully refinanced within one period.

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