24 October 2006

Review of Smithers & Co's 2006 Report on the Cost of Capital

A Report for Macquarie Bank

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1. Overview

This report briefly reviews Smithers & Co Ltd (2006) "Report on the Cost of Capital provided to Ofgem", (hereafter "Smithers"). In that report Smithers set out their estimates of the cost of capital for UK electricity and gas companies.

In parts of this report we also discuss Ofgem's use of the Smithers analysis in the cost of capital proposals for the Transmission Price Control Review 2006 (TPCR6).

Table 1 below sets out Smithers' recommended cost of capital parameters, alongside those proposed by Ofgem for TPCR6. We also present a re-calculation of the Smithers WACC estimate based on a re-gearing of the Smithers equity beta estimate for Ofgem's assumed gearing of 60%.[1]

Table 1
Comparison of Smithers and Ofgem Estimates of WACC Parameters for TPCR6

	Smithers	**Smithers (at 60% gearing)**	**Ofgem TPCR6**
Risk Free Rate	2.5%	2.5%	2.3%
Cost of Equity			
Real market return: compound average	5.5%	5.5%	-
Adjustment to arithmetic average	1% - 2%	1% - 2%	-
Real market return: arithmetic average	6.5% - 7.5%	6.5% - 7.5%	-
Implied equity premium	4% - 5%	4% - 5%	5.2%
Estimated "value effect"	0% - 1.25%	0% - 1.25%	-
Equity beta	0.5	0.85 – 0.95	0.9
Cost of equity	**4.5% - 6.5%**	**5.9% - 8.5%**	**7.0%**
Cost of debt			
Term premium	0% - 0.75%	0% - 0.75%	-
Real long term risk-free yield	2.5% -3.25%	2.5% -3.25%	2.3%
Debt premium (default premium as defined by Smithers)	1% - 1.5%	1% - 1.5%	1.1%
Cost of debt (real yield on long-term A-rated debt as defined by Smithers)	**3.5% - 4.75%**	**3.5% - 4.75%**	**3.4%**
Implied WACC (post tax net of debt tax shield) range at 60% gearing	**3.3% - 4.5%**	**3.8% - 5.4%**	**4.2%**
Mid-point of Implied WACC range	**3.9%**	**4.6%**	**4.2%**

We note several points in relation to WACC ranges in Table 1 above:

- Although Smithers do not present a cost of capital estimate, the cost of debt and cost of equity estimates presented in their report imply a real post tax WACC in the range of 3.3% to 4.5%. The central value of this range of 3.9% is significantly below all UK regulatory cost of capital decisions since privatisation.

[1] In making this adjustment, we also exclude the Viridian beta estimate from the comparator set for reasons that we explain in Section 2 of this report.

- A reason why the implied Smithers WACC estimate is so low is because Smithers appear not to "adjust" the cost of equity estimate to be consistent with the same gearing assumption as the cost of debt. Instead, Smithers' estimate of the equity beta appears consistent with actual gearing (which NERA calculate to be around 37% over the period) whereas Smithers' cost of debt assumption is consistent with a gearing of around 60% (consistent with an A- debt rating).

- NERA's re-calculation of the Smithers' equity beta at 60% gearing results in an equity beta of 0.85 to 0.95, implying a cost of equity of 5.7% to 8.1% and a real post tax WACC of 3.8% to 5.4% with a mid-point of 4.6%. This is higher than Ofgem's assumed WACC of 4.2% for TPCR6.

In the rest of this report, we comment on aspects of Smithers' analysis in more detail. Our overall conclusion is that Smithers have listed a great deal of relevant evidence, but they would have to adjust their method of estimating the equity beta to ensure that the final estimate of the WACC is internally consistent.

The adoption of wide ranges for most parameters is also unnecessary or unjustified and the use of a more internally consistent approach will result in parameter estimates with a (narrower) range.

2. Beta Estimates

Smithers do not set out how they derive an equity beta estimate of 0.5. Smithers' analysis sets out a range of evidence which shows equity betas varying between 0.09 and 0.90, depending on the methodology and reference market used.

The results of Smithers' analysis are re-produced in Appendix A of this report. Table A.1 shows that an equity beta estimate of 0.5 is broadly consistent with the average beta estimate of the set of comparator stocks chosen, using UK FTAS data over a rolling 5-year period.

The average beta estimate of the sample is broadly the same using an OLS regression technique as applying the Kalman Filter to enable time-varying beta estimates, although a number of the individual beta estimates change significantly depending on the technique that is used.

Our comments on Smithers' approach to estimating the equity beta are grouped as follows:

- Choice of comparators;
- Liquidity and use of daily data;
- Relationship between beta and gearing;
- Standard errors and confidence intervals.

2.1. Choice of Comparators

Smithers' estimates of beta are based on the following quoted stocks: Scottish Power, Scottish and Southern, Viridian, Centrica, IPR, National Grid, United Utilities, Kelda, Severn Trent.

Of the comparators selected by Smithers, only SSE, National Grid and Scottish Power undertake a substantial proportion of regulated transmission activities. The other energy comparators cited by Smithers are predominantly engaged in generation and retail activities, which means that their beta estimates may be overestimated relative to transmission. The remainder of Smithers' comparators are water companies. The risks associated with the operation and regulation of water companies are likely to differ from those faced by transmission companies. At this stage we cannot conclude on the magnitude or exact nature of differences.

In using the Smithers analysis to estimate a cost of capital at TPCR6, further analysis should be undertaken to "unbundle" the transmission activity component of beta from the beta of the parent company and to assess the validity of including regulated utilities undertaking activities different from transmission in order to estimate a beta for TPCR.

2.2. Liquidity and Use of Daily Data

Smithers' calculations of beta are based on the use of daily data. However, Smithers (2003) have previously noted that beta estimates based on daily data may be downwardly biased if the stocks are not as liquid as the market portfolio:[2]

> *"For less frequently traded stocks where it may take more than a few hours for new information to be reflected in measured process a daily beta estimate is likely to be downward biased."*

Other academic papers also discuss the bias to betas arising from illiquidity (for example Dimson and Marsh (1983) and Lo and Mackinlay (1990)). Ibbotson (1997) argues that the slower reaction of less liquid stocks is due to higher transactions costs. These higher transactions costs mean that traders will not act on information until the value of the information exceeds the costs of acting on it.

In Appendix B we show that Viridian has a significantly higher average bid-ask spread than the other stocks used to estimate beta and we believe that this illiquidity explains its low beta estimate in the range of 0.15 and 0.28, compared to ranges of 0.32 – 0.90 and 0.35 - 0.84 for the other comparators respectively. Our initial analysis indicates Viridian should be excluded on this basis.

Other stocks such as Kelda (which has low beta estimates under all of the approaches used by Smithers) also have lower liquidity relative to the larger stocks. This is consistent with Kelda's very recent re-admission to the FTSE 100 (it was removed in September 2003 before being readmitted in July 2005).

Further analysis is required to assess whether biases to beta estimates are evident in Smithers' use of daily data for stocks other than Viridian. It is unlikely that this will be the case for the majority of the stocks which have historically been large and therefore can be reasonably assumed to be liquid. However, for some stocks that are less liquid than the market index, the use of lower frequency (such as weekly) data should be considered.

2.3. Betas and Gearing

Smithers' beta estimate of 0.5 appears to be consistent with actual gearing of the comparators over this period, which we calculate has been significantly lower (37%) than Ofgem's assumed gearing of 60% at TPCR6.[3] Smithers' cost of debt assumption is also consistent with a gearing of around 60% (consistent with an A- debt rating).

Smithers do not fully justify their reasons for not re-levering equity betas. However (p.57), they present evidence showing that equity betas have declined for eight of the comparators over the period even though gearing has increased, stating that this is contrary to Modigliani-Miller's theory which predicts a positive relationship between gearing and equity betas.

Smithers cite two papers (Marston and Perry (1996)) and Faff et al. (2002)) which they state show systematic departures from Modigliani-Miller's predictions on equity betas and gearing.

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[2] Smithers (2003): Wright, Mason and Miles on behalf of Smithers & Co. "A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K." 13 February 2003, p.81.

[3] See Appendix A for details.

Smithers note that both papers fail to fully control for firm- and year- specific effects. This caveat is key – without controlling for other factors no meaningful conclusions can be drawn.

In addition to the caveats on the limited supporting research noted by Smithers above, there is a substantial body of academic work showing that the main prediction of Modigliani-Miller theory – that higher gearing increases the cost of equity - continues to hold. Copeland and Weston (1993) and Morin (1994) provide a summary of the empirical evidence on the effects of changes in capital structure on beta estimates. Morin concludes that:

> *"the evidence strongly favors a positive relationship between leverage and the cost of equity which is consistent with the Modigliani-Miller proposition. However, there is still some controversy over the acceptance of the linear formulation…(S)ome investigators believe the relationship is curvilinear, others believe it is linear but has a slope of less than R-i.".*

Further studies finding evidence supporting the positive relationship between gearing and the cost of equity include Mehta, Moses, Deschamps and Walker (1980), Gapenski (1986), Brigham, Gapenski and Aberwald (1987), Copeland and Weston (1995) and Graham (2002). In summary, the bulk of empirical work done in this area supports the predicted positive relationship between gearing and the cost of equity.

In order to analyse Smithers' finding that gearing appears to be negatively related to equity betas, we must look at other reasons why equity betas may decline which are unrelated to (and may outweigh the effect of) changing gearing levels. Smithers themselves (Section 2) already provide one important reason for why measured UK betas have declined over the period, namely an increase in the UK market beta against the world index. Smithers do not appear to control for this effect in their tests of the relationship between the equity beta and gearing, since these tests are undertaken using UK (FTAS) betas. It is noticeable in Appendix A of the Smithers report that the time trends of the world betas are rather different to the time trend of the UK betas suggesting that the relationship between the world beta and gearing may be very different than the relationship between the UK betas and gearing.

Smithers (2004) have also previously discussed other reasons that explain why measured betas have fallen over time which are unrelated to gearing effects, but not discussed in their most recent report. Importantly, Smithers suggest that electricity companies might be viewed as relatively safe investments during the bear market of the early 2000 period:

> "*Early 2000 was of course the peak in global stock markets, and was followed by a significant bear market. It is possible that a number of these companies were viewed as having a particular advantage as relatively safe investments in the bear market, and that this brought down their betas…*"[4]

Smithers conclude that this effect may explain why observed betas fell over the early 2000 period (although they noted that this is unlikely to be the sole explanation).

NERA's own analysis is consistent with Smithers' observations that the bear market of the early part of this century does, at least partially, explain why betas fell over this period. We

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[4] Smithers (2004): Smithers & Co. "Beta Estimates for: Scottish Power, Scottish & Southern Energy, Viridian Group, Centrica, International Power, National Grid Transco, United Utilities, Kelda Group, Severn Trent, provided to Ofgem" 15 March 2004. p.5

have also shown that regulatory price reviews and other regulatory initiatives have caused electricity beta estimates to fall significantly at certain points in time over the last five or so years.[5,6] This has happened because the price reviews have led to a fall in electricity and energy stocks at times when the market was rising, leading to a fall in beta estimates.[7]

To correct beta estimates for the impact of regulatory events and abnormal market volatility, we have previously advocated employing a dummy variable approach, adopted by Francis, Grout and Zalewska (2000) and Buckland and Fraser (2001). This approach seeks to capture the impact of specific events by introducing "dummy variables" into the beta regression equation. At the very least these types of control variables should be introduced in tests of the relationship between beta and gearing, to correct for other influences on beta over the period.

In conclusion, Smithers have presented little evidence to support the proposition that Modigliani-Miller's predictions of a positive relationship between equity betas and gearing levels do not hold. We therefore see no reason to depart from the standard approach of re-levering observed equity betas for consistency with the gearing assumption.

2.4. Standard Errors and Confidence Intervals

Smithers' estimates of betas are generally falling over time but are unstable with wide confidence intervals.[8]

Previous analysis by Smithers (2004) on the beta estimates for electricity and gas companies also showed evidence of unexplained parameter instability. Faced with this evidence, Smithers concluded that upward adjustments should be made to certain beta estimates such as Viridian and Centrica. In other cases (National Grid, International Power, Kelda, Severn Trent), Smithers concluded that the best beta estimate is the one based on the full-sample from the early 1990s onwards.

At the 2004 Distribution Price Control Review (DPCR2004), Ofgem estimated a beta of 1.0 based on the beta evidence and the adjustments recommended by Smithers at that time. It is unclear why Smithers have reached different conclusions in their 2006 analysis with respect

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5 See "UK Electricity Distribution: A Report for EDF Energy", prepared by NERA, March 2004.

6 The perception of harsh regulatory reviews in both the electricity and water sectors was reflected in newspaper reports at the time: "Spare the rod and spoil the utility. That seems the current message from water and electricity price watchdogs. Whatever their past laxity, this year they are making up for lost time", Daily Mail, 21 November 1998. "These are worrying times for investors in utilities… The pressure from regulators and competition regimes fixed against the incumbents have taken a sickening toll on share prices", The Times, 27 November 1999.

7 The extent to which these beta estimates are good approximations for the true expected beta depends on whether such events are deemed to be exceptional. We would argue that price reviews are exceptional if the outcomes are different than the markets' prior expectations. From this point of view, the price reviews of Viridian, United Utilities, and the other DNOs in the early 2000 period, which were all perceived as being unexpectedly harsh, can be considered one-off events. The changes in the wholesale market rules under NETA and the various other moves to introduce more competition, or harsher regulation, are also likely to be one-off (or at least infrequent) structural changes. We therefore conclude that the decoupling witnessed over the last review period is likely to be an exceptional rather than a periodic event. In the finance literature, the situation whereby a company's stock price primarily reacts to industry or company specific events (over a sustained period of time) rather than to movements in the market as a whole is known as "decoupling". Kolbe (2000), in particular, has argued that decoupling can cause significant biases in estimates of the true beta of a stock.

8 The confidence intervals (CIs) associated with Smithers Kalman Filter beta estimates are wide – the 95% upper CI is typically over 1 and the 95% lower CI is typically around or below 0. The ranges are tighter for the OLS rolling betas but still sizeable.

to the adjustments that should be made to beta and the time period (Smithers' 2006 paper uses rolling 5-year betas whereas the 2003 paper prefers full sample betas) over which beta is estimated.

Smithers' 2006 analysis shows that beta instability for electricity companies continues to persist – if not increase in some cases. Confidence intervals graphed by Smithers for standard rolling OLS beta estimates have remained fairly constant since the mid 1990s, whilst Kalman Filter confidence intervals generally appear to have increased.

It appears to us that persistent instability in rolling estimates may be related to a number of factors. First, periods of extreme market volatility in the early 2000 period are likely to have distorted betas. Second, distortions arising from regulatory events such as price reviews (such as DPCR in 2004, Water in 1999 and 2004) have been shown to cause distortions to utility stock beta estimates.

Further analysis would be required to assess the causes of comparator beta instability in recent years and therefore the need or scope for adjustments to measured betas in order to form conclusions on an appropriate transmission beta.

2.5. NERA Analysis of Betas

NERA's preliminary analysis of daily beta estimates for National Grid, SSE and Scottish Power show ranges from 0.8 to 1.3 at a 60% gearing level. This analysis is consistent with recent UK regulatory precedent which has typically set equity betas equal to one.

However, our estimates do not take into account specific adjustments for distorting factors such as periods of excess volatility or the impact of regulatory price reviews. We also note that our estimates are consistent with the risks faced by the listed (parent company) as a whole. Further work is required to "unbundle" the transmission-specific component of the overall betas in order to estimate a beta at TPCR6. This is particularly important in the case of SSE and Scottish Power, which both undertake a range of unregulated activities such as generation.

Our preliminary estimates of equity betas are also consistent with recent European (non UK) regulatory precedent on gas and electricity transmission betas (assuming 60% gearing) Recent regulatory precedent set out in Appendix C for Austria, Ireland, Denmark and Italy shows asset betas ranging from 0.33 to 0.40. At Ofgem's 60% gearing assumption this range corresponds to an equity beta range of 0.8 to 1.0, averaging 0.95.

3. Equity Risk Premium

Smithers' 2006 report estimates the equity risk premium (ERP) in a range of 4% to 5%. This is based on an estimate of the overall cost of equity for the market of between 6.5% and 7.5% (based on the arithmetic average of total long run market returns) minus their estimate of the risk free rate of 2.5%. This estimate of the ERP is consistent with previous analysis of the equity risk premium presented in Mason, Miles and Wright (2003). Smithers do not update their estimate of the ERP in their 2006 report.

Our main comment on Smithers' approach to estimating the ERP is that it assumes that total equity returns are constant over time. In other words, it assumes that a 1% reduction/increase in the risk free rate tended is associated with a 1% increase/reduction in the ERP.

We agree with Smithers that there is strong evidence that the ERP and risk free rate are inversely correlated. However, the nature of the relationship between the risk free rate and equity risk premium is complex and is the subject of ongoing research. It is far from clear in the academic literature that changes in the risk free rate are directly offset by changes in the equity risk premium.

There is evidence that a range of factors such as interest rate expectations, expected market volatility, increases in risk aversion of investors, pension fund activity and/or business cycle factors can all impact on the relationship between the risk free rate and equity risk premium. We believe that many of these factors are reasons why the ERP has recently (over the past five year period) been higher than its long run average and the risk free rate been lower than its long run average.

Our main point however is that if the Smithers assumption that the ERP and risk free rate are perfectly inversely correlated is accepted, it follows that any change in the risk free rate assumption must also be reflected in a corresponding equal adjustment to the ERP assumption. Ofgem must take account of this relationship if it accepts Smithers' analysis of the ERP.

Our preliminary analysis indicates that Ofgem's own estimate of the equity risk premium 5.2% at TPCR6 is supported by recent evidence on the equity risk premium for the UK, based on our preferred approach of using very long-run returns evidence on the equity market. Dimson, Marsh and Staunton (2005) report the average arithmetic return on equity in the UK over bonds for 1900-2004 to be 5.2%, the same as Ofgem's estimate.[9]

[9] Dimson, Marsh and Staunton/ABN AMRO/LBS (2005) "Global Investment Returns Yearbook 2005".

4. Risk-Free Rate

Smithers' estimate of the real risk free rate is 2.5%. In justifying this conclusion, Smithers refer to the following evidence:

- Mason, Wright and Miles (2003) estimate of the risk free rate of 2.5% based on the benchmark "Taylor Rule", justified as follows:

  "*realistically, most available long-term forecasts of real short rates are likely to be driven by assumptions about equilibrium real rates drawn from relatively short samples. Thus, for example, the common assumption in discussions of monetary policy along "Taylor Rule" lines, that the mean real interest rate should be of the order of 2.5%, is largely driven by experience since the 1980s*" (p43).

- Nominal yields on UK medium dated bonds less the Bank of England inflation target of 2% which gives an estimate of the real risk free rate of around 2 to 2.5%.

Smithers further assume a "term premium" of 0 to 0.75% to reflect higher returns on longer term bonds issued by utilities. This range is based on:

- Recent evidence on term premia which are close to zero;
- Time series evidence on average term premia over the twentieth century of 0.75%.

Smithers' analysis merits several observations:

- With respect to the evidence presented by Mason, Wright and Miles (2003) based on the "Taylor Rule". We do not think any weight should be attached to this evidence. The key component of the formulation of the Taylor Rule - the relationship between output and inflation - is subject to many underlying economic influences. It is not reasonable to expect that the nature of these influences will remain as they have since the 1980s in generating an average policy determined rate of 2.5%.[10]

- The use of current nominal yield evidence is inconsistent with the methodology used to estimate other parameters, where Smithers uses longer term evidence (such as in estimating the default premium). Since cost of capital parameters are interrelated, mixing "spot" and time series data can lead to biases in the cost of capital estimate. More generally, the use of spot data can result in parameters being biased by temporary factors or abnormal market conditions.

- It is also widely acknowledged that UK gilt yields are currently downwardly distorted by pension fund regulations such as FRS17 which encourage holdings of government securities. This is consistent with Smithers' observations (p39) that: "*a very similar figure* [to Smithers' risk-free rate estimate] *is also implicit in the current term structure of*

[10] A recent Federal Reserve Staff paper by Sack (2002) suggests that the Federal Reserve has moved away from the use of the Taylor rule in deriving a methodology for setting interest rates. It is instead suggested that monetary policy decisions made in the US since 1999 correspond to a simple rule determined by differences between the forward rates implied by the prevailing yields of nominal and inflation-indexed US Treasury bonds.

nominal yields." and *"a striking feature of the recent past is that differences between yields at different maturities (ie term premia) have all but disappeared."*

§ With respect to the term premium, the disappearance of the recent term premium is widely associated with the impact of pension fund regulations which have encouraged holdings of longer maturity government bonds, reducing the yield premium of long bonds over shorter maturity instruments. For this reason, we regard recent evidence from the UK gilt market on the term premium to be unreliable as a basis for estimating the forward looking term premium on utilities cost of capital.[11]

In summary, Smithers' estimate of the risk-free rate is based on outdated policy-based evidence which is not relevant to recent investor experience. Additional evidence presented by Smithers in this latest report is likely to be biased downwards by influences on government bond yields (although particularly focused on index linked yields) from pension fund regulations.

Our recommendation on the risk-free rate is that it should be estimated on a consistent basis with other parameters; i.e. using averages of time series data. In this sense we agree with Ofgem's measurement of the risk free rate using ten year averages. However we disagree with Ofgem's measurement of the risk free rate using UK ILGs, as these yields have been distorted by institutional factors, such as the Minimum Funding Requirement and the Pension Protection Fund, for the vast majority of the ten year measurement period (since mid 1996).[12]

The effect of these distortions is to set returns on the affected range of bonds below the risk-free rate by the amount that pension funds are willing to pay to meet their legal obligations. UK ILGs therefore no longer serve as a measure of the risk-free rate for use in estimating the cost of equity.

NERA's preliminary analysis of the most recent historical evidence on yields on Eurozone index-linked government bonds gives a risk-free rate in the region of 2.5%, indicating that an estimate of the risk-free rate unbiased by UK pension law would be higher than Ofgem's estimate at TPCR6.

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[11] Smithers (p39) notes that nominal yields have fallen in line with index-linked yields *"The two charts show that the general tendency for nominal yields to fall in recent years has been due to both to falls in the implicit forecasts of inflation (particularly in earlier years) and to falls in indexed yields. The latter have been at unprecedented lows in the recent past, notably at long maturities."*

[12] Evidence indicates that UK ILG yields were significantly downwardly biased between 1997 and 2002 to 2003 by the introduction of the MFR in 1997, and additionally depressed by supply side restrictions and increases in average market volatility since then. The impact of the full implementation of the FRS17 (and the Pension Protection Fund levies) appears to have fuelled the most substantial declines in real yields yet, to a 300 year low earlier this year. Easing of yields since then do not signal the removal of the downward bias to yields, as pension fund demand continues to outstrip supply.

5. Problems with the CAPM and Other Models

We note the following three key problems with the CAPM that are relevant to estimates of the cost of equity for transmission companies at the relevant time. All three problems are likely to lead to underestimates of the cost of equity for regulated utilities at the current time:

- ***Instability of beta estimates***: as noted by Smithers in Sections 2 and 10 of its report, observed equity betas for UK utilities have been unstable in recent years. This weakens the robustness of cost of equity estimates based solely on the CAPM.[13]

- ***Interest rate sensitivities***: Since the CAPM includes the interest rate as a direct parameter, CAPM-based estimates of the cost of equity will tend to track changes in interest rates.[14] It does not however track movements in the ERP – as robust measures of this parameter are typically based on very long term evidence. A number of studies have shown that the ERP and risk-free rate are negatively correlated.[15] Unless a forward looking measure of the ERP exists to take account of this negative correlation, application of the CAPM can cause a potential bias in the estimate of the cost of equity, low interest rates causing a downward bias and vice versa. Given current low levels of the risk-free rate globally (ignoring UK-specific factors), the CAPM as currently applied may underestimate the cost of equity.

- ***Asymmetric risk***: the CAPM assumes normally distributed expected returns and cannot take account of skewed risks such as downside asymmetric risk. It is often argued that regulated companies face greater asymmetry in their returns compared with unregulated businesses and therefore the CAPM underestimates the cost of equity for regulated companies by comparison to unregulated companies.

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[13] The Kalman Filter method can be used to mitigate some effects arising from one-off distortions to prices which bias standard OLS beta estimates. The Kalman Filter derives a more forward-looking beta estimate than OLS techniques: the OLS beta estimate is based on historical data with equal weight attached to each historical data point. By contrast, although the Kalman Filter also uses historical data, it allows the beta estimate to change over time and updates the beta estimate on a daily basis as recent news comes to the market.

[14] In a very recent testimony on behalf of PPL Wallingford Energy in the State of Connecticut, NERA expert Dr Jeff Makholm explained why application of the CAPM during periods when interest rates are so low is likely to underestimate the cost of equity for utilities: *"My experience in regulated cost of capital cases during mid- to late-2002 signal that CAPM estimates, given the unusually low risk-free rates experienced during the last 12 years, likely understate the cost of capital in reference to the more widely-used DCF method because of the lack of an objective forward-looking risk premium that takes into account unusually low interest rates."*

[15] A number of academic studies showing that the true risk free rate and true ERP are negatively correlated – i.e. when risk-free rates fall, the ERP rises, and vice versa. The reason for this negative correlation is that in market conditions when equity risks are high, investors switch into risk free assets ("flight to quality") causing a decrease in the yield on such assets. Morin (1995 p. 291) in "US Regulatory Finance" explains the reasoning why the ERP and the risk free rate are negatively related as follows: "*The reason for this relationship is that when interest rates rise, bondholders suffer a capital loss. This is referred to as interest rate risk. Stockholders, on the other hand are more concerned with the firm's earning power. So, if bondholders' fear of interest rate risk exceeds shareholders' fear of loss of earning power, the risk differential will narrow and hence the risk premium will shrink. This is particularly true in high inflation environments….(C)onversely in low interest rate environments, where bond holders' interest rate fears subside and shareholders' loss of earning power dominate, the risk differential will widen and hence the risk premium will increase.* . A negative relationship between the ERP and interest rates is documented by numerous academic studies eg. Fama and Schwert (1997), Ferson (1989), Chen (1991) and most recently Wadhwani (1999). Cooper and Currie (May 1999) also stress the importance of consistency: *"It is difficult to interpret the risk premium estimate as anything other than part of an overall package, from which one is not free to select any individual item and mix it with other assumptions"*.

In light of the problems associated the CAPM with estimating the cost of equity for UK utilities at the present time, further evidence from other models can be (at least) a useful supplement or cross check on CAPM based estimates.

Ofgem asked Smithers to investigate the use of the Fama-French three factor model in assessing the cost of capital. The Fama-French three-factor model essentially adds a size and a value-related risk-factor in the ordinary CAPM. We broadly agree with Smithers' conclusion that there is at best weak statistical evidence for a significant role for the additional two factors. The theoretical foundations of the Fama-French model are also weak. The size and value factors are difficult to interpret in economic terms and as long as a natural link between the risk factors and state variables (which affect the average investor) is missing, the model will fail to convince regulators and stakeholders.

The DGM may address some of the difficulties associated with CAPM. US analysts praise the DGM for its great stability, particularly with regard to interest rate fluctuations. It may therefore be (at the very least) a good cross-check on CAPM.

Appendix A. Re-gearing Smithers Beta Estimates

Smithers do not set out how they derive a concluding equity beta of 0.5. Their analysis sets out a range of evidence which shows equity betas varying between 0.09 and 0.90, depending on methodology and reference market used, as set out in Table A.1.

Table A.1
Smithers Estimates of Equity Betas (p8)

	SP	SSE	VRD	CNA	IPR	NG	UU	KEL	SVT	Av.
FTAS full sample	0.69	0.48	0.20	0.66	0.74	0.63	0.61	0.32	0.46	**0.53**
FTAS latest rolling sample	**0.66**	**0.46**	**0.15**	**0.90**	**0.76**	**0.58**	**0.51**	**0.32**	**0.44**	**0.53**
MSCI full sample	0.33	0.21	0.10	0.34	0.43	0.36	0.30	0.15	0.24	**0.27**
MSCI latest rolling sample	0.34	0.22	0.09	0.51	0.32	0.32	0.30	0.18	0.29	**0.29**
FTAS Kalman Filter	0.45	0.86	0.31	0.71	0.89	0.62	0.66	0.90	0.67	**0.67**
FTAS, Rolling Kalman Filter, Latest Sample	**0.52**	**0.42**	**0.28**	**0.70**	**0.84**	**0.55**	**0.44**	**0.35**	**0.39**	**0.50**

Smithers (p13) appear to conclude that FTSE (UK) based estimates should be used:

> *"If this is the case, UK regulated companies may end up selling the greater part of their equities to UK investors, in which case "UK" betas, despite being less well-measured, and possibly unstable, may nonetheless imply more realistic estimates of the true cost of equity capital."*

Smithers (p11) also appear to imply that the rolling standard beta and the rolling Kalman Filter together imply a reasonable estimate of beta:

> *"Table 2.1 and Charts 2.1 to 2.3 show that, as far as central estimates of beta go, the rolling regression approach and the rolling Kalman Filter approach typically produce fairly similar (thought by no means identical) answers. However, the two methods give a quite different picture of the degree of uncertainty surrounding these estimates";* and
>
> *"Since the two approaches appear to be biased in different directions, we can therefore have some degree of confidence that the width of the confidence interval for beta lies somewhere between the two estimates."*

Table A.1 above shows that the average of Smithers' beta estimates based on

i) "FTAS, Rolling Kalman Filter, Latest Sample" is 0.5; and

ii) "FTAS latest rolling sample" is 0.53

Taken together, these estimates correspond to Smithers' concluding estimate on the equity beta of 0.5. We assume, in the absence of further details, that this analysis is the basis for Smithers' conclusion on an equity beta of 0.5.

Smithers do not set out the time period used in deriving its rolling FTAS based estimates of beta. Charts 2.1 and 2.2 in their report show rolling beta estimates from 1996 onwards,

whilst Chart 2.3 shows "spot" beta estimates from 1990/1991. We therefore assume that rolling estimates are based on five years or so historical data. On this basis, Smithers' most recent rolling estimates of beta (both Kalman Filter and standard OLS) are based on data since 2001.

On this basis, we present average gearing for Smithers nine comparators since 2001. This is shown in Table A.2.

Table A.2
Gearing for Smithers' Comparators, Average 2001-2006

	Net Debt/Equity	Net Debt/(Equity + Net Debt)
Scottish Power	53%	35%
Scottish and Southern	23%	19%
Viridian	51%	34%
Centrica	8%	7%
IPR	63%	39%
National Grid	111%	53%
United Utilities	89%	47%
Kelda	93%	48%
Severn Trent	95%	49%
Average	**65%**	**37%**

Source: NERA analysis of Bloomberg data

The Table shows that the average gearing (net debt/(equity +net debt)) over the five year period since 2001 for Smithers' comparators is 37%. This is significantly lower than Ofgem's assumption of 60%. Smithers' equity beta estimate is based on actual gearing. Smithers' estimate must therefore be re-levered for Ofgem's gearing assumptions.

Table A.2 re-levers Smithers' equity beta estimates based on "FTAS, rolling Kalman Filter, latest sample" and "FTAS latest rolling sample" for Ofgem's gearing assumption of 60%, using the actual five year gearing for the comparators shown in Table A.2.

Table A.3
Rolling Kalman and OLS Beta Estimates, Re-Levered for 60% Gearing

	FTAS latest rolling sample	FTAS rolling Kalman Filter, latest sample
Scottish Power	1.08	0.85
Scottish and Southern	0.93	0.85
Viridian	0.25	0.46
Centrica	2.08	1.62
IPR	1.17	1.29
National Grid	0.69	0.65
United Utilities	0.67	0.58
Kelda	0.41	0.45
Severn Trent	0.56	0.50
Average	**0.87**	**0.81**

Source: NERA analysis of Bloomberg and Smithers data. Smithers' equity betas presented are de-levered and re-levered using the Miller formula: $B_{asset} = B_{equity}/(1+D/E)$.

The Table shows that the beta estimates re-levered for Ofgem's gearing assumption of 60% are 0.9 for the latest OLS rolling beta and 0.8 for the latest rolling Kalman Filter beta.

If Viridian is excluded from the sample of comparators, which we believe it should be on the basis of its low liquidity (see Appendix B), then the average beta estimates are 0.95 and 0.85 respectively. This range is consistent with Ofgem's equity beta estimate of 0.9.

Appendix B. Bid-Ask Spread Analysis for Smithers' Comparators

The bid-ask spread is a commonly used indicator of liquidity in equity stocks.[16] Higher bid-ask spreads are associated with lower liquidity. In order to gauge an idea of the relative liquidity of Smithers' comparators, we estimated five year average weekly bid-ask spreads. This is set out in Table B.1.

Table B.1
Rolling Kalman and OLS Beta Estimates, Re-Levered for 60% Gearing

	5Y Average Bid-Ask Spread
Scottish Power	0.2%
Scottish and Southern	0.2%
Viridian	**0.8%**
Centrica	0.3%
IPR	0.3%
National Grid	0.1%
United Utilities	0.2%
Kelda	0.4%
Severn Trent	0.3%

Source: NERA analysis of Bloomberg data. We note that a full analysis of liquidity would involve comparison of individual company equity liquidity to the market index as a whole. Given the size of some of the comparators (e.g. NG, United Utilities), relative liquidity is a sufficient proxy for initial analysis of comparator liquidity at this stage. We note however that this analysis should not be interpreted as definitive.

[16] See for example Competition Commission (2000).

Appendix C. Regulatory Precedent on Transmission Betas

Table C.1
Recent European Regulatory Precedent on Transmission Betas

Regulator	Country	Year	Gas/Electricity	Asset Beta	Equity Beta at 60% Gearing
E-Control	Austria	2003	Gas	0.33	0.83
CER	Ireland	2003	Gas	0.40	1.00
DERA	Denmark	2005	Gas	0.38	0.95
AEEG	Italy	2005	Gas	0.38	0.95
CER	Ireland	2005	Electricity	0.40	1.00
				0.38	**0.95**

Betas re-levered using equity betas presented are de-levered and re-levered using the Miller formula: $B_{asset} = B_{equity}/(1+D/E)$.

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