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Beta Estimates and Bond Spread Analysis for:

Scottish Power
Scottish & Southern Energy
Viridian Group
Centrica
International Power
National Grid Transco
United Utilities
Kelda Group
Severn Trent

provided to Ofgem

by

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Birkbeck College
and
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Beta Estimates and Bond Spread Analysis for Ofgem

1. Summary

This note reports estimation results of the CAPM beta, and provides analysis of spreads on corporate debt (where available) for the following nine companies: [1]

Scottish Power
Scottish & Southern Energy
Viridian Group
Centrica
International Power
National Grid Transco
United Utilities
Kelda Group
Severn Trent

Beta Estimation

We have taken a virtually identical approach to that set out in our previous report.[2] Estimation was carried out using monthly, weekly and daily data from the early 1990s onwards. The results over the full sample are summarised in Table 1 overleaf and are very similar to those from our last report, with all companies having betas well below unity. We again also report results of rolling regressions to allow for the possibility of parameter instability. For some (but not all) companies, lengthening the sample to include the most recent data seems to provide evidence that betas are "settling down", as the market becomes more familiar with the features of these companies. But parameter instability remains a problem that regulators should take very seriously.

In Section 2 we provide more discussion of the general features of the beta estimation results; in Section 4 we provide detailed company analysis.

Analysis of Bond Spreads

We have collected yield data on sterling denominated bonds for seven out of the nine companies. All show a very similar declining pattern in the recent past, but this common pattern appears in turn to be dominated by a market-wide decline in credit spreads. In Section 3 we discuss features of spreads that are common to all companies, and provide some historical background on credit spreads in the UK and US. In Section 5 we provide company-specific spread comparisons.

[1] No analysis of spreads provided for Viridian and International Power, due to lack of relevant data.
[2] "Beta Estimates for Ofgem", 15 March 2004

Table 1: Beta Estimates for All Available Data Using FT All Share as Market Index

	Beta	OLS standard Errors	White s.e.	Newey West s.e.	Sample
Scottish Power					
Monthly	0.7073	0.1593	0.2277	0.2426	1991:08 2005:08
Weekly	0.6759	0.0762	0.0901	0.1109	8/02/1991 8/12/2005
Daily	0.7051	0.0320	0.0388	0.0462	7/29/1991 08/23/2005
Scottish & Southern					
Monthly	0.6073	0.1607	0.2442	0.2694	1991:10 2005:08
Weekly	0.4569	0.0715	0.0842	0.1055	9/27/1991 8/12/2005
Daily	0.5034	0.0309	0.0451	0.0521	9/23/1991 08/23/2005
Viridian					
Monthly	0.3217	0.1547	0.1689	0.1790	1993:07 2005:08
Weekly	0.1893	0.0729	0.0997	0.1040	7/02/1993 8/12/2005
Daily	0.1966	0.0281	0.0347	0.0361	6/22/1993 08/23/2005
Centrica					
Monthly	0.7308	0.1630	0.1674	0.1639	1997:03 2005:08
Weekly	0.6942	0.0853	0.0934	0.1004	2/21/1997 8/12/2005
Daily	0.6762	0.0384	0.0477	0.0575	2/11/1997 08/23/2005
International Power					
Monthly	2.1274	0.2403	0.3361	0.3493	2000:11 2005:08
Weekly	1.1866	0.1280	0.1722	0.1551	10/13/2000 8/12/2005
Daily	0.7247	0.0550	0.0734	0.0692	10/3/2000 08/23/2005
National Grid					
Monthly	0.4584	0.1265	0.1375	0.1343	1995:12 2005:08
Weekly	0.5470	0.0635	0.0886	0.0969	12/01/1995 8/12/2005
Daily	0.6281	0.0277	0.0341	0.0400	11/23/1995 08/23/2005
United Utilities					
Monthly	0.5241	0.1008	0.1086	0.1360	1990:08 2005:08
Weekly	0.5464	0.0604	0.0805	0.0931	7/27/1990 8/12/2005
Daily	0.6146	0.0264	0.0412	0.0445	7/20/1990 08/23/2005
Kelda Group					
Monthly	0.5251	0.1284	0.1633	0.1657	1991:08 2005:08
Weekly	0.3670	0.0720	0.1062	0.1216	7/19/1991 8/12/2005
Daily	0.3152	0.0304	0.0481	0.0494	7/12/1991 08/23/2005
Seven Trent					
Monthly	0.4047	0.1207	0.1337	0.1693	1991:08 2005:08
Weekly	0.3642	0.0648	0.0930	0.1097	7/19/1991 8/12/2005
Daily	0.4571	0.0264	0.0414	0.0451	7/12/1991 08/23/2005

2. Beta Estimation Results: General Observations

Table 1 provides beta estimates over all available data (the estimation sample for each equation is given in the last column of the table). The market proxy used is the FT All Share Index. The table also provides three alternative measures of the "standard error" of the beta estimate: the larger the standard error, the more imprecisely the parameter is estimated. Standard errors can be used to construct "confidence intervals" for beta estimates, as shown on a rolling basis in the charts in Section 4 for individual companies. The standard errors using the standard Ordinary Least Squares (OLS) formula are known to understate the true degree of uncertainty, particularly in high frequency data; the alternative measures take this into account, and are typically significantly larger, implying in turn wider confidence intervals.

Returns on both individual companies and the market are measured as log excess returns over the safe rate, converted appropriately for the relevant frequency (see Appendix for details of data and estimation results). The Appendix provides details of data transformations, full estimation results for the estimation using daily data, and diagnostic tests of parameter instability.

Table 2. Alternative Beta Estimates (Daily Data, Full Sample)

	OLS Estimate using FTAS	**Bayesian-Adjusted**	**OLS Estimate using Broader Market Index**
Scottish Power	0.7051	0.7099	0.6919
Scottish & Southern	0.5034	0.5136	0.4796
Viridian	0.1966	0.2046	0.1936
Centrica	0.6762	0.6842	0.6614
International Power	0.7247	0.7345	0.7360
National Grid	0.6281	0.6326	0.6311
United Utilities	0.6146	0.6204	0.6096
Kelda Group	0.3152	0.3278	0.3063
Severn Trent	0.4571	0.4655	0.4568

Table 2 compares three alternative beta estimates, again derived from all available daily data. The first is as given in Table 1. The second includes a "Bayesian Adjustment". This takes into account the fact that the beta of the average firm must be one. Thus if we had no data at all our best guess would be that all firms would have a beta of one. Our statistical estimates will typically lead us to move significantly away from this first guess, but, since our beta estimates are not known precisely, the Bayesian adjustment pushes beta towards one, to a greater extent, the less precisely beta is estimated. Since, using daily data, beta is quite precisely estimated, the adjustment has only a very minor effect.

The final column of Table 2 shows the impact of using the return on a broader market index, defined as a weighted average of the return on the FT All Share (with a 70% weight) and on the MSCI global index, expressed in sterling (with a 30% weight). This also has a minimal impact on beta estimates.

A much more significant issue, that we raised in our last report, is the evidence of time variation in company betas. We have again run rolling regressions at all frequencies, and have carried out parameter stability tests. In Section 4, we provide charts of rolling beta estimates (at all three

frequencies) and associated 95% confidence intervals.[3] Note that the confidence intervals in these charts now use Newey-West robust standard errors, as in Table 1, and are as a result wider than those in our previous report, where we used OLS standard errors.

In each case, the beta estimate shown in these charts is for a sample of a fixed number of years (usually five where samples are long enough) ending in the period shown: thus the first point shown in the plot of the daily beta estimate is at the end of the earliest available fixed sample; the last point comes at the end of the most recent sample of the same length. The bottom panel of each chart also shows (on a log scale) the relevant share price and the FT All Share Index, to put the beta estimates in historical context. (In a slight presentational change from our previous report all panels of any individual chart show the same sample to enable more direct comparison with beta estimates.)

In almost all the companies examined these charts, and parameter stability tests provided in the appendix, point to parameter instability. Given this result beta estimates cannot generally be viewed as being as well-determined as might appear from simply looking at whole-sample estimates, which may also be biased in a forward-looking sense.

As we noted in our last report, the issue of parameter instability is potentially a very crucial one. The standard errors of beta estimates shown in Table 1 are predicated on the assumption that the true beta is constant. Their validity is seriously undermined if there is evidence (as there appears to be for virtually all the companies) that beta has drifted over time.

If beta for any company was expected to continue to drift indefinitely, the associated true standard errors must increase the further we look into the future. Over the relatively long time horizons over which regulatory decisions are made, this would imply that the true required Bayesian adjustments could become much larger than those in Table 2, since the further ahead we look, the less the history of beta tells us about its future value, and the more we would need to rely upon the unconditional expectation that the average firm must have a beta of unity.

However, for most of the companies showing signs of parameter instability, this appears to have been a much more significant problem relatively early in their histories. A pattern common to a number of companies has been that rolling beta estimates appear to fall in the early years of the sample, and then stabilise roughly in those samples that terminate from early 2000 onwards (and thus are based on data running from roughly 1995 onwards). We noted previously that one explanation of this pattern might be that in these early years the properties of these companies were therefore relatively unknown; whereas by the later sample periods, they had become more familiar to the markets, and therefore their betas began to settle down. For some (though not all) companies, the inclusion of more recent data appears to lend support to this explanation.

Table 3 summarises the evidence and (tentative) implications of the evidence of parameter instability (more detailed analysis of individual companies is provided in Section 4).

[3] The confidence interval is a range above and below the point estimate that we can be 95% certain contains the true (but unobservable) value of beta. It is constructed by adding or subtracting 1.96 times the coefficient standard error from the point estimate.

Table 3. Impact of Parameter Instability in Beta Estimates (Daily Data)

	Full Sample	Last 5 Years	Stable in Full Sample?	Stable in Last 5 Years?	Implied Adjustment to Full Sample Beta?
Scottish Power	0.7051	0.6182	No	Yes	Down
Scottish & Southern	0.5034	0.4046	No	Yes	Down
Viridian	0.1966	0.1355	No	No	None or Up
Centrica	0.6762	0.8350	No	Yes	Up
International Power	0.7247	0.7049	Yes	Yes	None
National Grid	0.6281	0.5511	No	No	None
United Utilities	0.6146	0.4696	No	Yes	Down
Kelda Group	0.3152	0.2522	No	No	None or Up
Severn Trent	0.4571	0.3463	No	Yes	Down

The evidence summarised in Table 3 suggests that the nine companies fit into a number of categories and sub-categories:

- The smallest category contains just one company, **International Power**, for which there appears to be little or no evidence of parameter instability in beta.[4] Thus for this company the best estimate of beta appears to be the full sample estimate.
- The remaining eight companies all show evidence of parameter instability, but for five of them estimates of beta seem to have stabilised in recent years.
- Within this group, beta for one company, **Centrica**, appears to have stabilised at a value **above** its full sample estimate. This points to an upward adjustment, probably using the estimate based on data from the last five years.
- The remaining four companies in this group, **Scottish Power, Scottish and Southern, United Utilities** and **Severn Trent** all have betas which appear to have stabilised at levels **below** their full sample estimates. If Ofgem is prepared to make the judgement that this stabilisation reflects a learning process on the part of the market, which is now complete, there is a case for a downward adjustment to the full sample estimate. Estimates based on the last five years represent an obvious alternative.[5]
- The remaining three companies all share the feature that beta estimates do not yet appear to have fully stabilised (although in all cases the degree of drift in recent years has been markedly less than in earlier years). For these companies, parameter instability has an ambiguous impact, noted in our last report. Beta estimates from the past five years would point to a downward adjustment. But because parameter instability makes beta estimates more uncertain as we look further into the future, leading us to set relatively more weight on the unconditional expectation of unity, this would point to an upward adjustment to beta estimates. Given the offsetting impact of these two effects, it is not easy to come to a clear-cut conclusion for these three companies, however, our results suggest a further sub-division:
- In the case of **National Grid** the degree of drift in beta is quite modest (though sustained). Since its full sample beta estimate is also in a similar range to several of the companies whose betas appear to have stabilised, it may be reasonable to assume that the two effects of parameter instability precisely offset, and use the full sample estimate.
- For the remaining two companies, **Viridian** and **Kelda** there are two further factors. First, beta estimates for these companies both from the full sample, and *a fortiori* from recent

[4] Even in this case the appendix shows some instability (on the CUSUMSQ test); but this appears to relate to shifts in the goodness-of-fit of the beta equation, rather than shifts in beta itself.

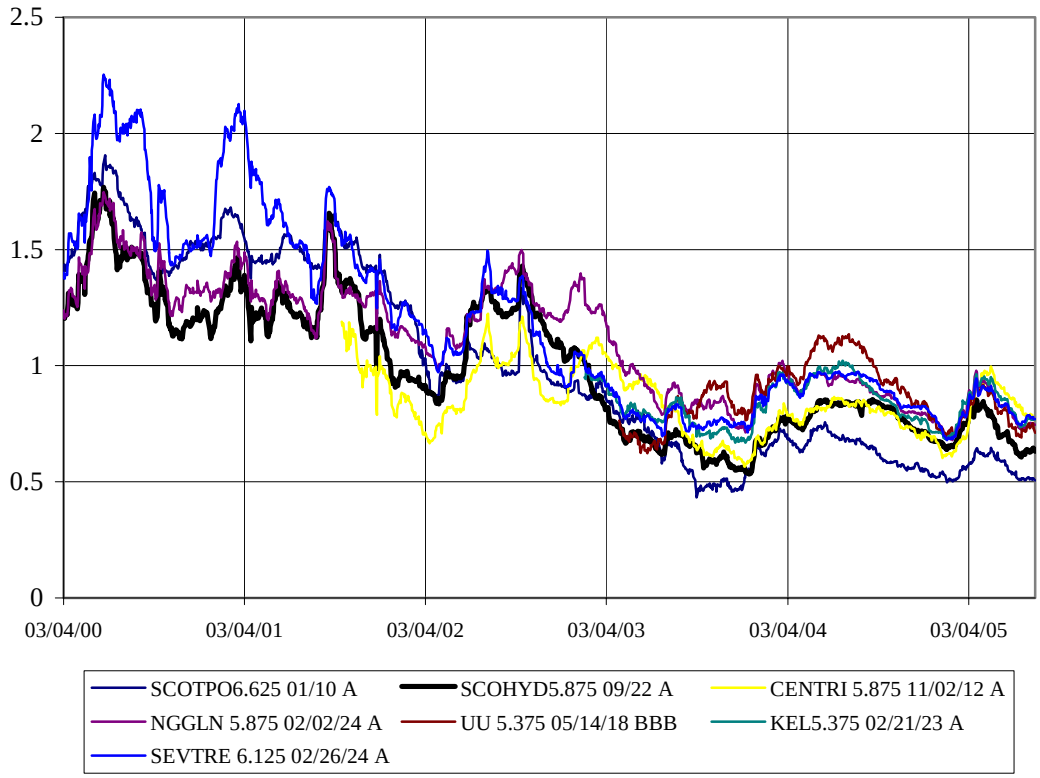
[5] As discussed in Section 4, for most companies in this category beta appears to have been stable on samples of anything up to 10 years.

years are very low indeed. Second, in both cases there has been a reversal of the downward drift in more recent samples. These additional factors suggest that recent estimates should be discounted, and may even suggest an upward adjustment to their full sample beta estimates.

3. Bond Spreads: General Observations

We have collected data on bond yields for representative traded bonds for seven out of the nine companies. We have focussed on sterling-denominated bonds with no special features (eg, callable components) that would result in yield distortions. Chart A below shows the yield spreads for the seven companies that can be directly compared on this basis.[6] Since each bond has a fixed maturity date each yield spread is calculated relative to a single UK gilt with a similar maturity date, rather than the more commonly used average gilt yield with constant maturity.

Chart A. Yield Spreads of UK Elecricity Companies



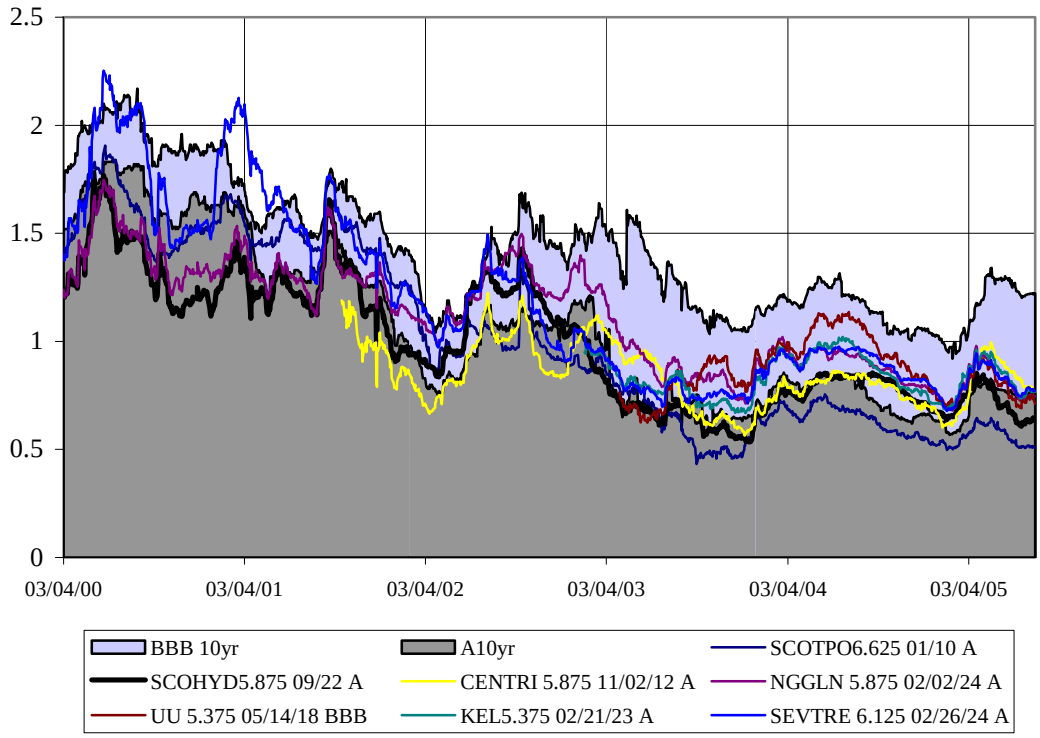
The most notable feature of the chart is the common pattern in all seven yields. All yield spreads have declined on trend since the start of the chart in 2000; notably also the distribution of spreads across the companies has become increasingly compressed.

The differences that do appear are only to a very limited extent due to maturity differences (most of the bonds shown are of comparably long maturity) or other firm-specific factors. Instead they appear to much more clearly related to market credit spreads on bonds of a comparable credit rating. To bring this out, Chart B supplements the data shown in Chart A with two representative benchmark credit spreads on bonds that are reasonably comparable: the spreads between A-rated and B-rated corporate bonds and gilts at a constant ten year maturity.[7]

[6] We exclude Viridian, whose sole bond no longer trades, and International Power, which only has dollar-denominated debt with callable components that distort yields.

[7] The benchmark corporate yield and gilt series are provided by Bloombergs data service. The maximum maturity available is ten years.

Chart B. Yield Spreads of UK Elecricity Companies vs Market Benchmarks



The chart shows that most of the recent pattern of credit spreads of the electricity companies reflects general market movements, with the two market spreads bracketing most of the distribution, especially in recent years. All of the companies shown are currently rated "A". We do not have a record of their credit ratings in earlier years, but the wider distribution of spreads in the earlier years may reflect either past shifts in ratings, or (probably more likely) greater uncertainty as to future ratings.

Strictly speaking there is a failure of comparability between the benchmark spreads (which are at constant maturity in years) and the individual company yields (which have a constant maturity date, and thus have a declining maturity as time progresses. For the bonds with long maturity (most mature around 2020) this is a minor problem; but for the two shorter maturity bonds shown (the maturity of which moves from around 10 to around 5 years over the course of the chart) it may cause more of a failure of comparability. In the analysis of individual companies in Section 5 we attempt a more precise comparison.

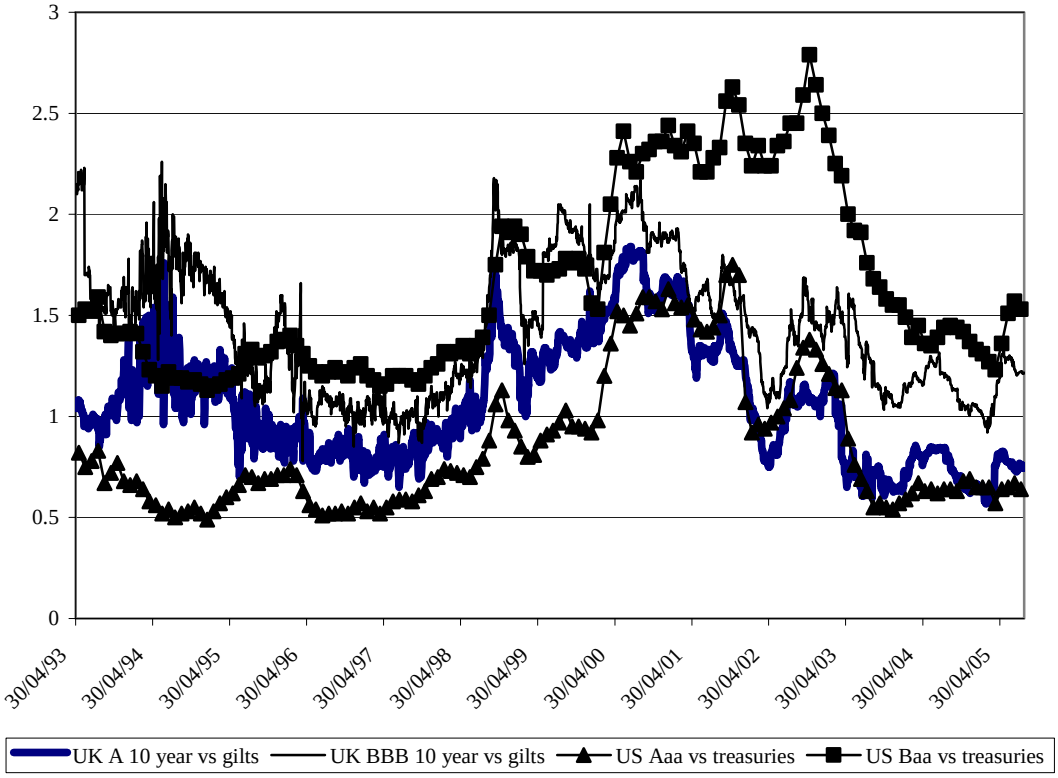
An obvious question to be addressed is whether the relatively short period of calendar time covered by the data in Chart B provides sufficient history to assess the likely average spread for these companies in future. Charts C and D provide some longer historical background.

Since Chart B shows that most of the history of the companies' yields is explicable in terms or spreads on benchmark corporate bonds, we can look for information from their longer history. Unfortunately, in comparison with the long swings in asset prices that have been observed over the past couple of centuries, even these spreads have a relatively short history, if we restrict ourselves to data from the UK. However, data from the US are available for a much longer period.

Chart C shows data on spreads since 1993 for both the UK and the US (using Moody's Aaa and Baa data published by the Federal Reserve). The chart brings out the common features in spreads in both economies. Strikingly, also, the correlations appear to have increased in more recent years as markets have become more integrated. While the credit rating systems will also clearly have

differences (the US Baa-Aaa spread appears typically to be wider than the UK BBB-A spread), it is striking that over the sample as a whole the average spreads in the two economies are fairly similar: for the UK the average spreads for A and BBB-rated bonds were 106 and 144 basis points respectively, while in the US the equivalent figures for Aaa and Baa were 86 and 165 basis points.

Chart C. UK vs US Corporate Bond Spreads

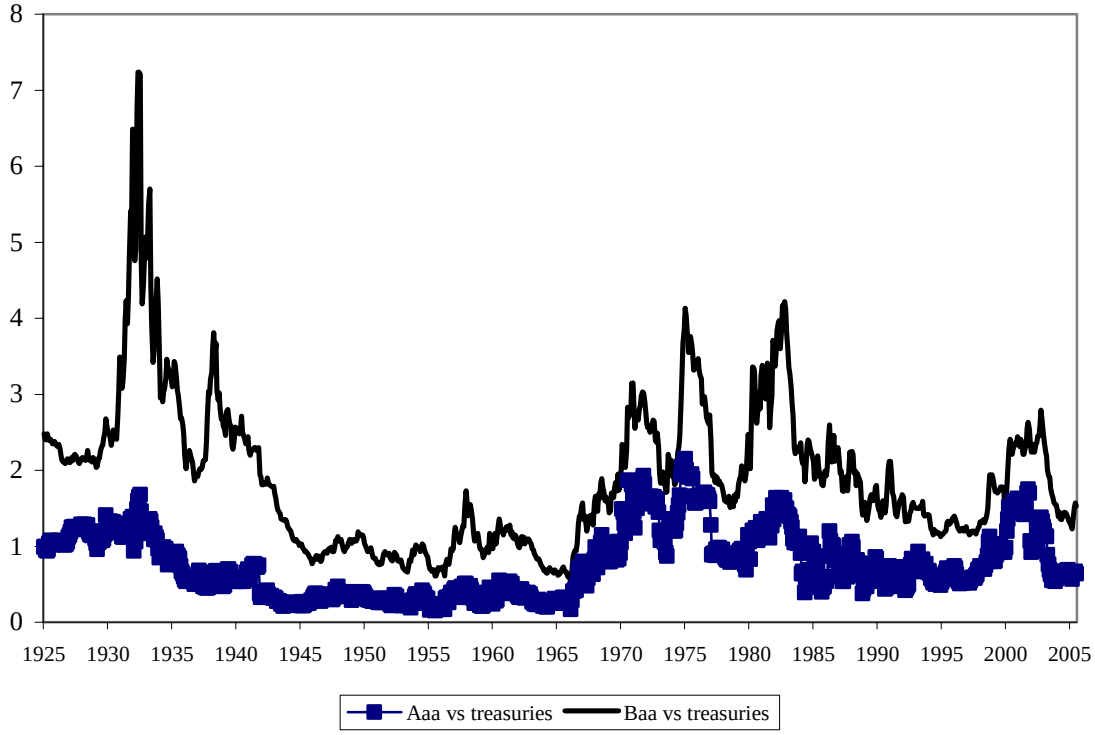


The chart brings out the feature that, in terms of the sample shown, current credit spreads are at historically quite low levels in the US, but are roughly comparable to those in the early 1990s. The same comparison suggests that UK spreads (especially A-rated) are distinctly lower in comparison with previous lows in the mid 1990s. It is unclear whether this reflects country-specific factors, or an increasing degree of market integration. It is certainly striking that the UK A spread has become increasingly similar to the US Aaa spread, although it does remain somewhat above.

Since Chart C suggests that US and UK credit spreads have become increasingly similar, Chart D provides a much longer historical comparison using only US data, using spread data from 1925 onwards. A number of key features come out of this longer dataset:

- The degree of historical variation in spreads has been quite wide. Current credit spreads in the USA are at fairly low levels historically, but certainly not at all-time lows. They are comparable to values in the 1980s and 1990s, but still above the lows seen in the early postwar period.
- The chart suggests a greater stability in the higher rated Aaa spread.
- This is reflected in average spreads over all available data: the average for the Aaa spread has been 77 basis points, compared to 190 basis points for the Baa spread. The similarity between the long historical average for the Aaa spread and its average of 86 basis points in the much shorter sample since 1993 shown in Chart C is quite striking.
- An obvious statistical caveat is that historical movements in both spreads have been highly persistent. Thus it would be overly simplistic to assume that current rather low spreads must inevitably revert towards the historic average over the sort of time horizons relevant to regulators.

Chart D. An Historical Perspective:
Moody's Aaa and Baa vs US Treasuries



To summarise the overall message from the above analysis of spreads:

1. Recent movements in credit spreads for UK electricity companies have been dominated by movements in relevant market benchmark credit spreads. Section 5 provides company-specific analysis of the most appropriate benchmark spread.
2. These benchmark spreads themselves are at historically quite low levels on available UK data.
3. Credit spreads on UK A-rated bonds appear increasingly similar to those on US Aaa-rated bonds, for which we have much more data.
4. A longer historical analysis of US spreads suggests that current spreads in the UK, while low, are not so markedly low as might appear from looking at only UK data.
5. The historic average US Aaa credit spread of 77 basis points appears increasingly relevant. The spread on UK A-rated bonds of 10 year maturity is currently only 10 basis points above that on Aaa. On available data in 1993 the average difference has been only somewhat larger, at around 20 basis points.

4. Beta Estimates for Individual Companies

4.1 Beta Estimates for Scottish Power

Whole-sample beta estimates shown in Table 1 are very little changed from our previous report, with little disagreement between estimates at different frequencies. All suggest a point estimate of around 0.7. However, as noted in the previous report rolling estimates of beta, shown in Panels a, b and c of Chart 1, suggest strongly that beta has not been constant over time. The Appendix shows that the evidence in Chart 1 is supported by the CUSUM and CUSUMSQ statistics that are used to diagnose parameter instability: the second of these breaches 95% bounds by a significant margin in the earlier samples. However if the two tests are carried out only on the last five years' worth of daily data, the rejection on the CUSUMSQ test is distinctly more marginal.[8]

The point estimate for beta over the last five years is 0.62, with a 95% confidence interval of 0.50 to 0.74, (using conservative Newey-West standard errors). Chart 1 reinforces the tentative conclusion drawn in our previous report that the beta of Scottish Power may have stabilised in recent years: it shows that the beta estimate has been very stable at around this value in five-year samples ending from around 2000 onwards. Thus beta appears stable on data for the past ten years or so. As we noted in our past report the history of Scottish Power's share price, shown alongside the FT All Share in the bottom panel of Chart 1, suggests that at the start of the sample, it was affected strongly by idiosyncratic factors linked to its initial formation; it was during this period that most of the out-performance of the market occurred, leading to a higher beta estimate. As these earlier observations drop out of the moving sample, the beta estimate on both daily and weekly data converges fairly steadily on a figure of around 0.6. The monthly figure remains lower but is very poorly determined due to the small number of observations in each sample.

[8] This can be seen from the feature shown in the chart in the appendix that the CUSUMSQ statistic moves roughly in line with critical values.

Chart 1a. Scottish Power Monthly Rolling Beta Coefficient (5 yr window)

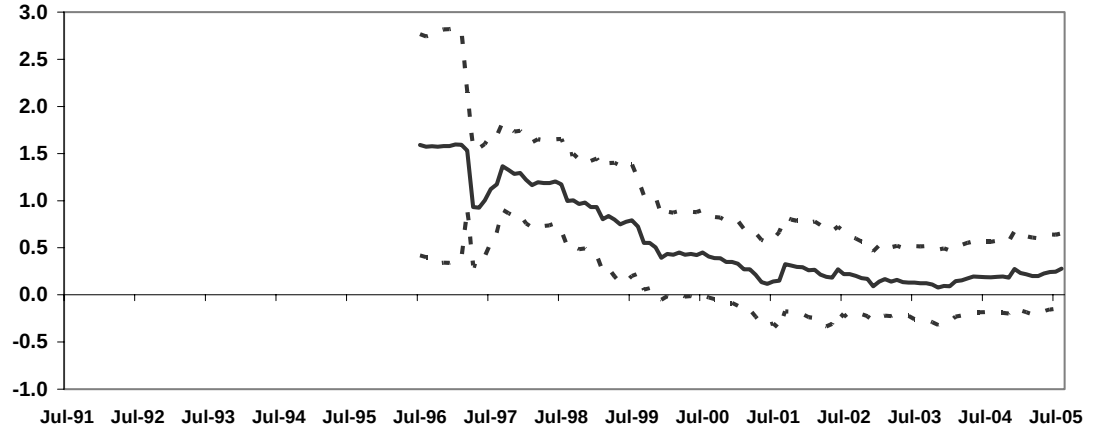


Chart 1b. Scottish Power Weekly Rolling Beta Coefficient (5 yr window)

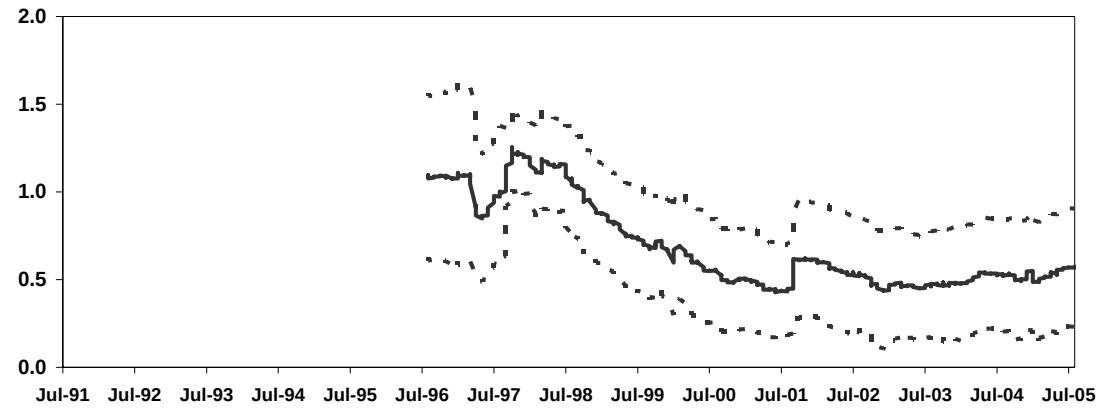


Chart 1c. Scottish Power Daily Rolling Beta Coefficient (5 yr window)

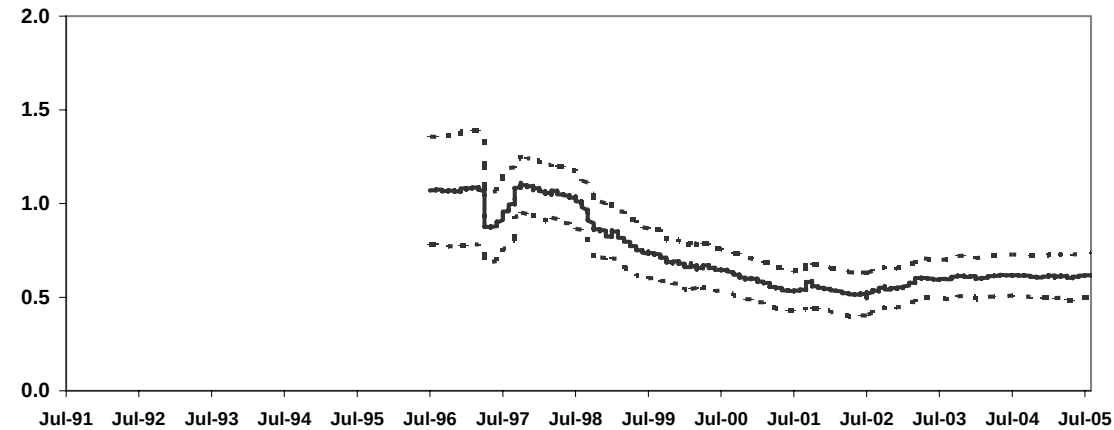
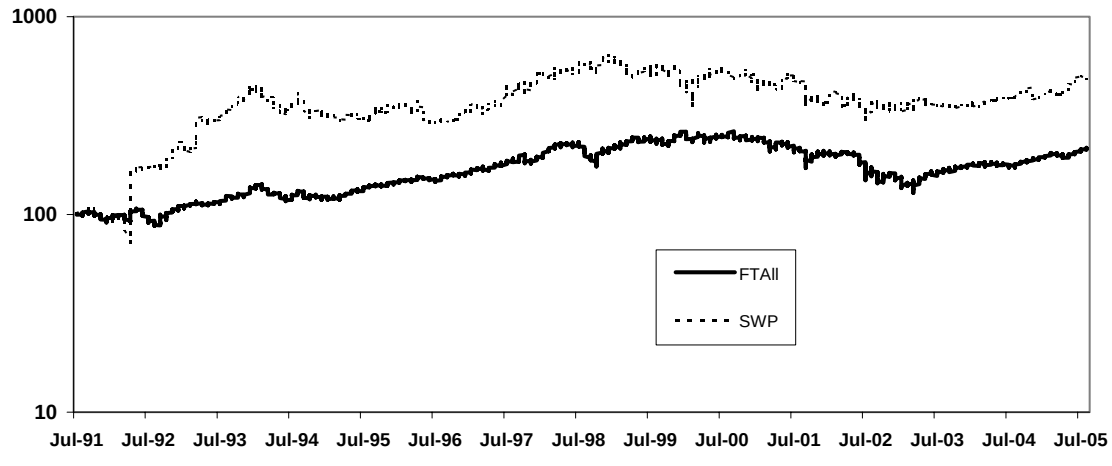


Chart 1d. Scottish Power and FTAll Share Price Indices (July 1991=100)



3.2. Beta Estimates for Scottish and Southern Energy

A fairly similar pattern can be seen in the results for Scottish and Southern to those described for Scottish Power, albeit that the evidence points to a somewhat lower beta value.

Whole-sample beta estimates shown in Table 1 suggest a point estimate of around 0.5. There is however again evidence of parameter instability, of a very similar pattern, with Chart 2 showing the beta estimate declining in earlier samples, but apparently stabilising in samples that terminate roughly from 2000 onwards (thus including data from roughly the last ten years). This is again reflected in the CUSUM and CUSUMSQ statistics shown in the Appendix. The inclusion of the most recent data reinforces this conclusion.

Again, the bottom panel of Chart 2 points to early out-performance of the market in the earlier years, but a much more stable relationship thereafter. If it is assumed that the stock has now "settled down", then its beta estimate from more recent samples is likely to be a better estimate than that derived from the whole sample. Using daily data for the past five years the beta estimate is 0.404 with 95% confidence interval of 0.301 to 0.502. Note that this range does not include the full sample beta estimate of 0.503, shown in Table 1, showing that the downward shift in the beta estimate is statistically significant.

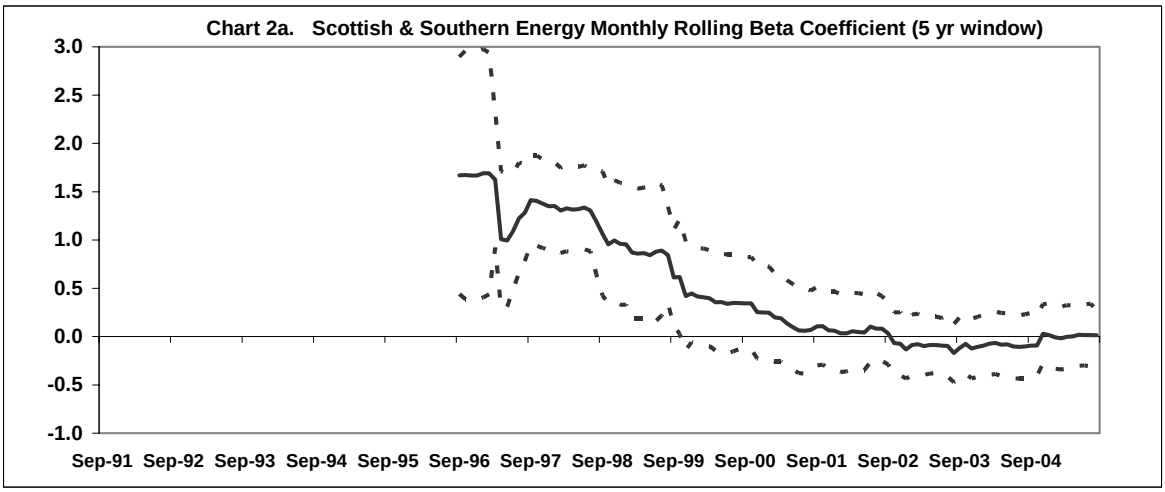


Chart 2a. Scottish & Southern Energy Monthly Rolling Beta Coefficient (5 yr window)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Sep-91 Sep-92 Sep-93 Sep-94 Sep-95 Sep-96 Sep-97 Sep-98 Sep-99 Sep-00 Sep-01 Sep-02 Sep-03 Sep-04

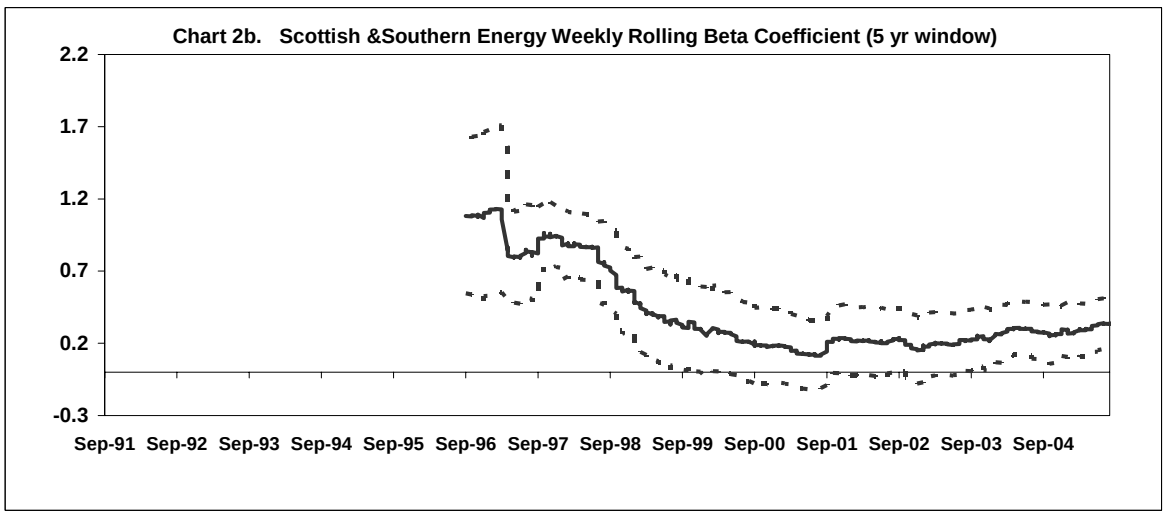


Chart 2b. Scottish &Southern Energy Weekly Rolling Beta Coefficient (5 yr window)
2.2
1.7
1.2
0.7
0.2
-0.3
Sep-91 Sep-92 Sep-93 Sep-94 Sep-95 Sep-96 Sep-97 Sep-98 Sep-99 Sep-00 Sep-01 Sep-02 Sep-03 Sep-04

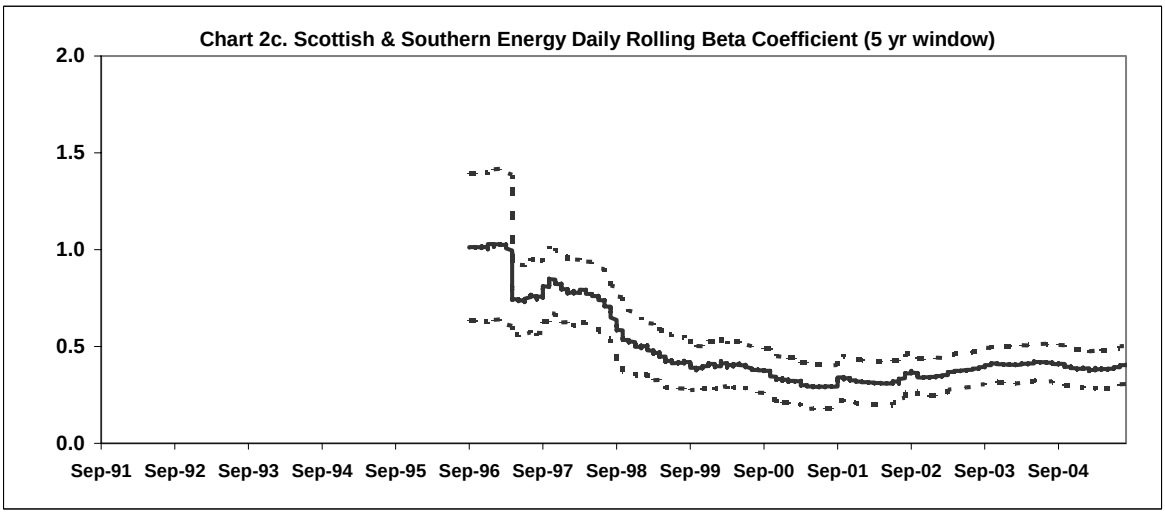


Chart 2c. Scottish & Southern Energy Daily Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
Sep-91 Sep-92 Sep-93 Sep-94 Sep-95 Sep-96 Sep-97 Sep-98 Sep-99 Sep-00 Sep-01 Sep-02 Sep-03 Sep-04

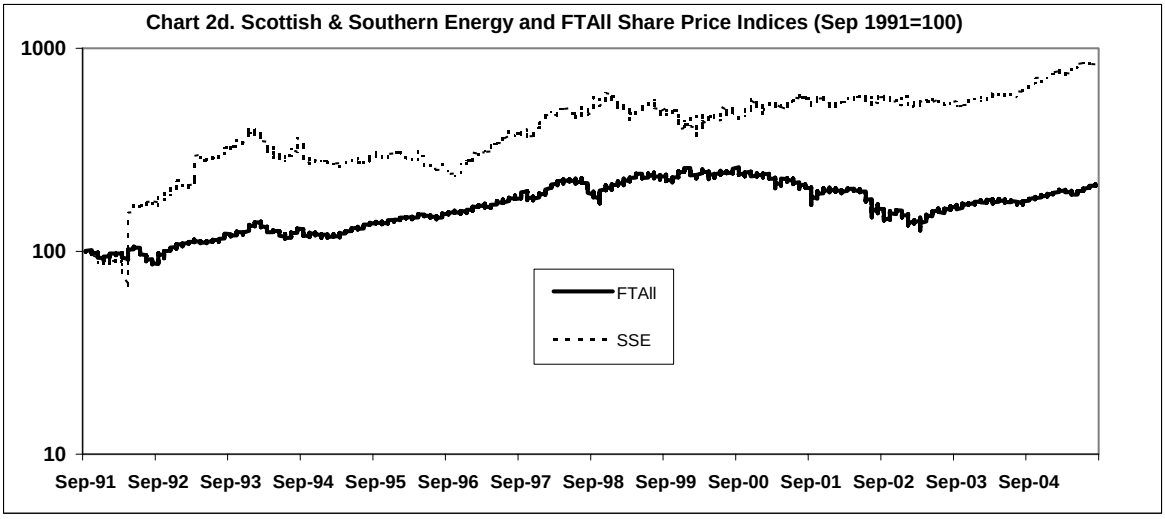


Chart 2d. Scottish & Southern Energy and FTAll Share Price Indices (Sep 1991=100)
1000
100
10
FTAll
SSE
Sep-91 Sep-92 Sep-93 Sep-94 Sep-95 Sep-96 Sep-97 Sep-98 Sep-99 Sep-00 Sep-01 Sep-02 Sep-03 Sep-04

4.3. Beta Estimates for Viridian

This company has the lowest whole sample beta estimate of all the companies examined: the point estimate on daily data is only 0.20.

It also again displays a very similar pattern of a declining beta estimate; though even more markedly so than in the last two cases. There are strong rejections of parameter stability on both CUSUM and CUSUMSQ tests. However this pattern is again dominated by the early part of the data sample.

The inclusion of the most recent data provides some evidence of Viridian's beta settling down, albeit at a still very low level. In our last report we noted that on the then most recent samples of daily data, Viridian's beta had fallen steadily, reaching a value below 0.1, suggesting that it should be priced as an almost risk-free asset. Including the latest data implies a slight rise. This is reassuring in the sense that it reverses the previous steady downward drift, but of course it does not do much if anything to reverse the continued impression of parameter instability. The beta estimate on the latest five year sample is 0.135, with a 95% confidence interval of 0.008 to 0.187. This is still a very low figure, and the true confidence interval is almost certainly wider given the evidence of parameter stability.

Thus recent data for Viridian reinforce the conclusion from our last report that the balance of evidence is tilted fairly strongly in favour of erring in an upward direction in estimating beta, given a) the extremely low value of beta estimates; b) that future values of Viridian's beta remain very uncertain; and c) the limited evidence from more recent samples that it has been rising. Thus a conservative approach would be to set beta to its full sample estimate, or possibly even higher.

Chart 3a. Viridian Group Monthly Rolling Beta Coefficient (5 yr window)

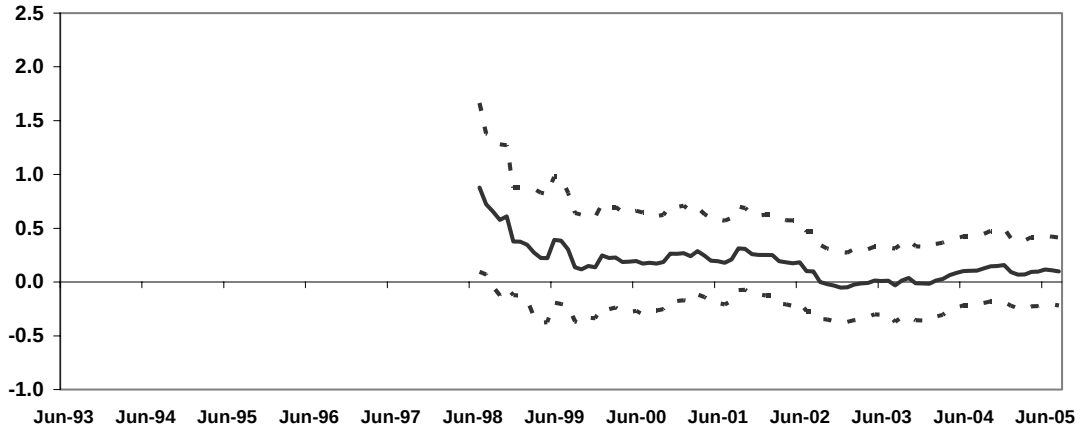


Chart 3b. Viridian Group Weekly Rolling Beta Coefficient (5 yr window)

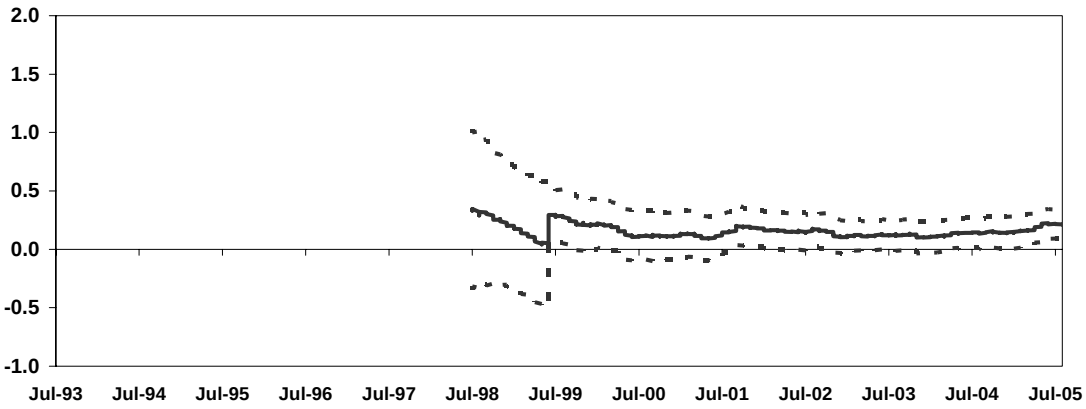


Chart 3c. Viridian Group Daily Rolling Beta Coefficient (5 yr window)

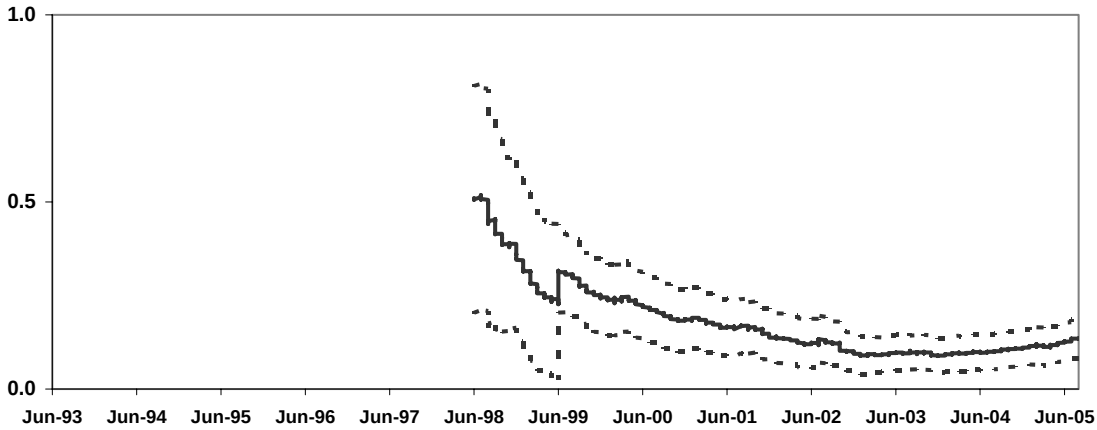
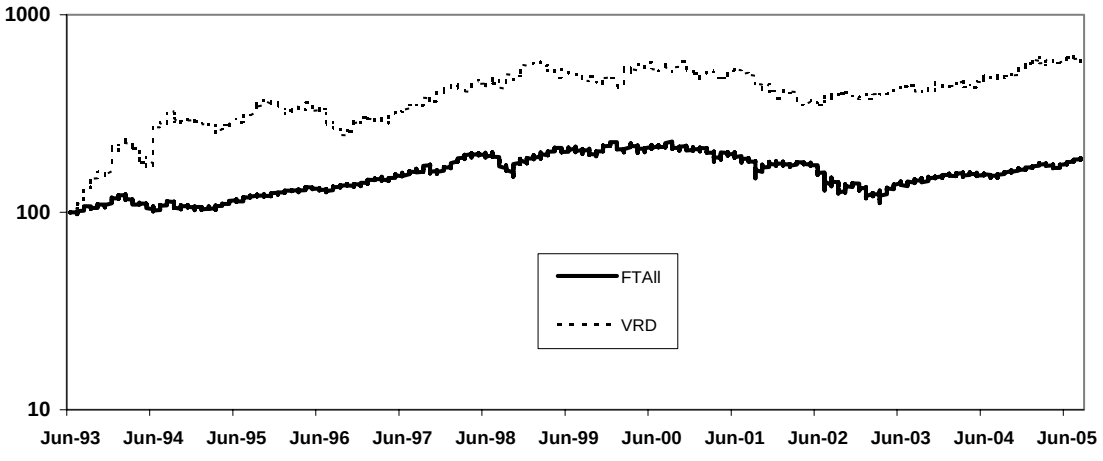


Chart 3d. Viridian Group and FTAll Share Price Indices (Jun 1993=100)



4.4. Beta Estimates for Centrica

This company has a point estimate of beta over all available data of just under 0.68. This is almost identical to our last estimate. However, we noted in our last report that the path of the rolling beta estimates in Chart 4 (here derived from rolling four year samples, given the somewhat shorter sample) shows a very distinct step pattern that is clearly visible in estimates at all three frequencies. The beta estimate is stable until samples terminating on or after mid-2002; then there is a step up, with stability thereafter. We noted previously that the most likely explanation would appear to be the impact of the very rapid rise in Centrica's share price in September 1998, which, being unrelated to general market movements, would have lowered the beta estimate in samples containing this highly exceptional period.

Inclusion of the most recent data reinforces the evidence for this pattern, with rolling beta estimates being very stable in recent samples. Using daily data for the last five years the beta estimate is 0.835, with a 95% confidence interval of 0.72 to 0.95.

We conclude, as in our last report, that in the case of Centrica the pattern of parameter instability points fairly unambiguously to erring towards an upward adjustment to the whole-sample beta estimate, whatever the explanation of the instability. If Ofgem is content to assume that there has been a structural shift that can explain an upward movement in beta in more recent samples, this would point towards using the value of around 0.83 from the most recent five year sample. But even if no such explanation can be found, the evidence of unexplained parameter instability would still point in the same direction, since over longer forecast horizons, the statistical best guess of beta would in any case tend towards unity.

Chart 4a. Centrica Monthly Rolling Beta Coefficient (4 yr window)

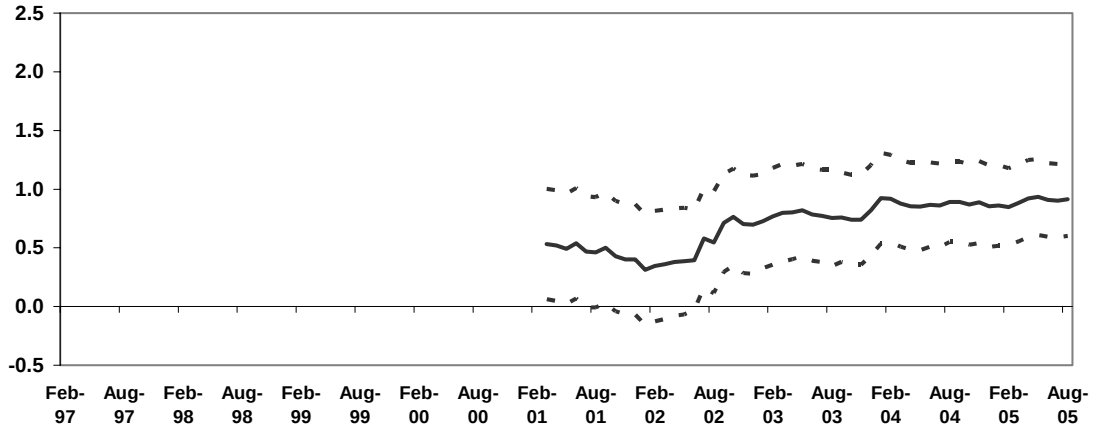


Chart 4b. Centrica Weekly Rolling Beta Coefficient (4 yr window)

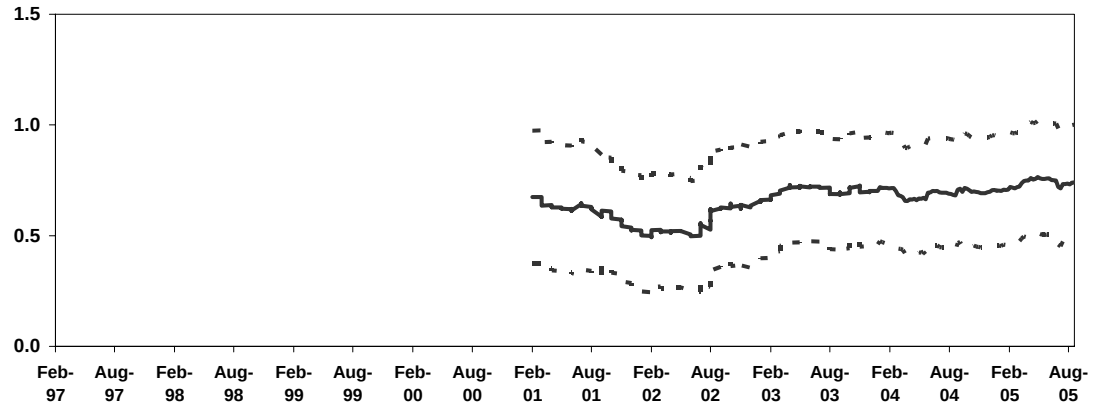


Chart 4c. Centrica Daily Rolling Beta Coefficient (4 yr window)

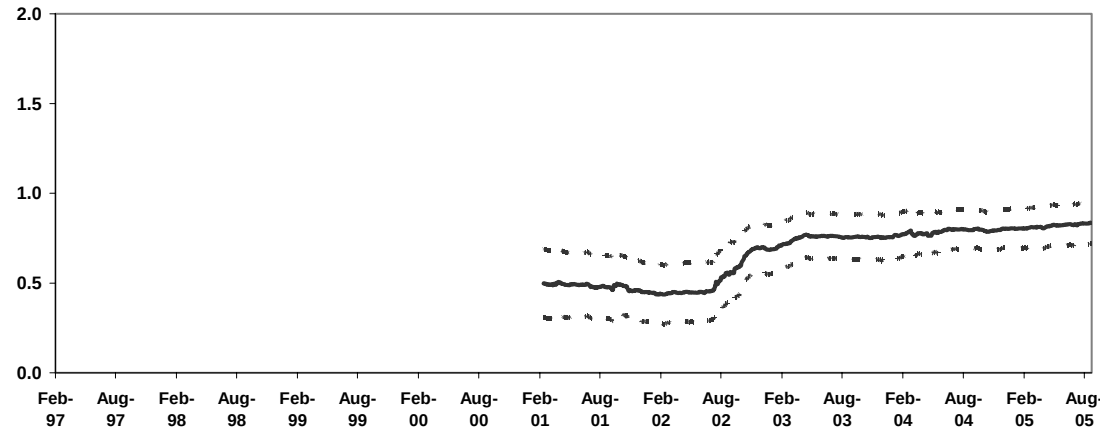
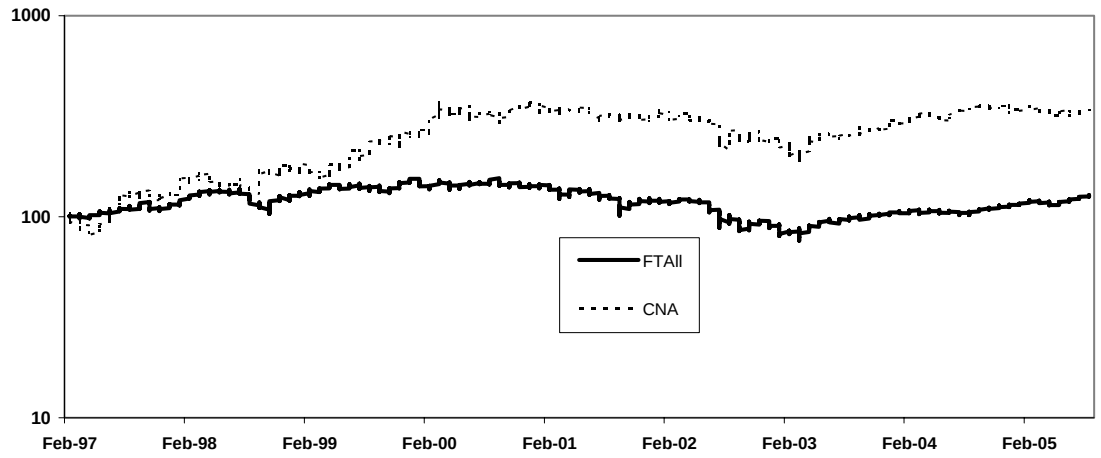


Chart 4c. Centrica and FTAll Share Price Indices (Feb 1997=100)



4.5. Beta Estimates for International Power

We noted in our last report the distinct contrast between results for International Power, depending on the frequency of the data used in estimation. This contrast remains in the beta estimates for the whole sample shown in Table 1, with values of 0.72, 1.19 and 2.13 from estimation on daily, weekly, and monthly data respectively. However, we concluded in our last report that this was likely to be due to the rather short sample (which starts in October 2000), particularly since this was a rather unusual period in which the market was mainly falling.

The addition of something over a year's extra data lends support to our conclusion that results based on daily data are distinctly more reliable, on two grounds. First, the rolling beta estimate from daily data (using a moving sample of only two years due to the relative paucity of data for this company) remains very stable.[9] Second, rolling estimates from both weekly and monthly data show a distinct pattern of convergence towards the estimate based on daily data in more recent samples. This pattern only emerges to a significant extent once the most recent data are included.

On the most recent rolling year two year sample of daily data the estimate of beta is 0.705. This is very close to the estimate of 0.72 from the whole sample, which has a confidence interval of 0.59 to 0.86. This range is distinctly wider than for the other companies examined due to the relatively shorter data sample. However, given that there is little or no evidence of parameter instability there is more reason to feel confident that this confidence interval is being correctly measured, and there is no obvious reason to depart from the estimated beta derived from all available data.

[9] The rejection of parameter stability on the CUSUMSQ test appears to reflect an increase in the standard error (ie, the overall "fit" of the equation) rather than a shift in the beta estimate (the CUSUM statistic remains well within its critical bounds). This worsening in fit is also shown in the widening of the confidence interval in more recent samples.

Chart 5a. International Power Monthly Rolling Beta Coefficient (2 yr window)

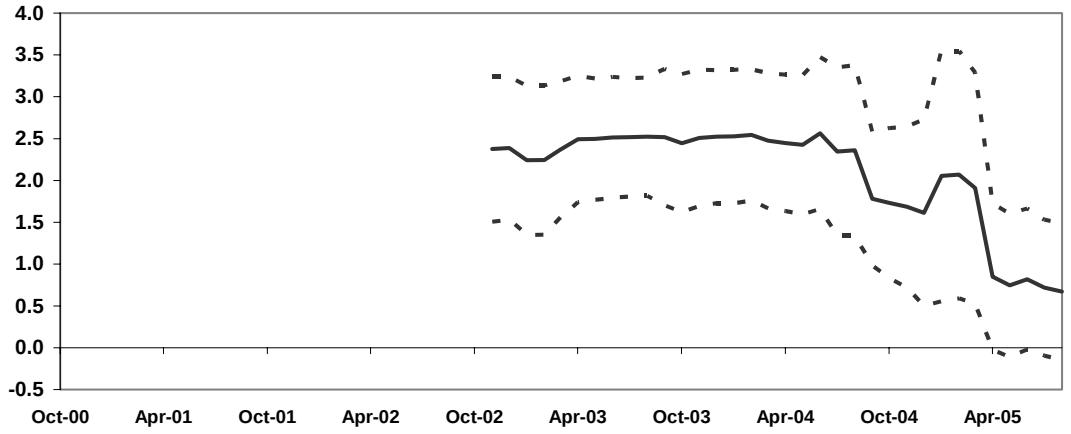


Chart 5b. International Power Weekly Rolling Beta Coefficient (2 yr window)

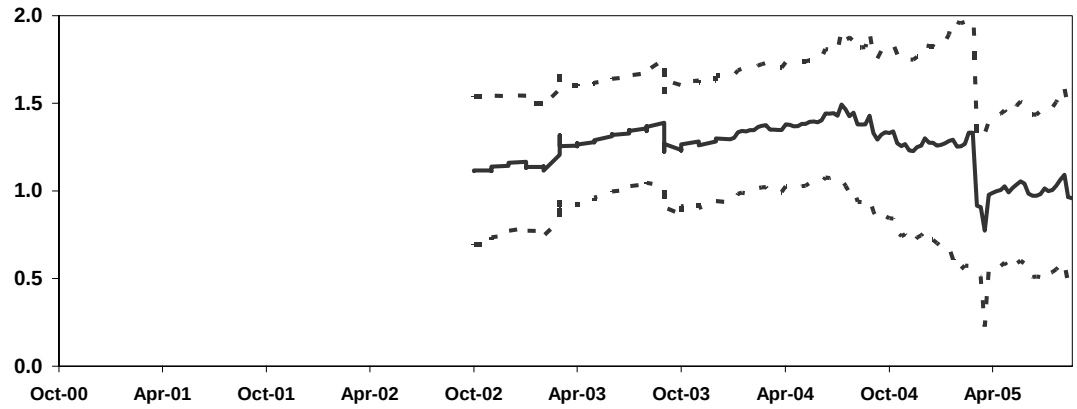


Chart 5c. International Power Daily Rolling Beta Coefficient (2 yr window)

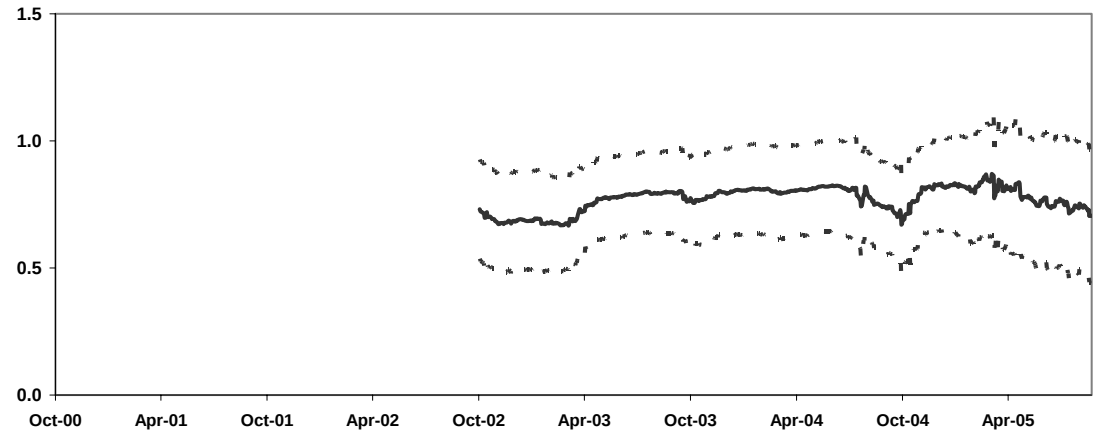
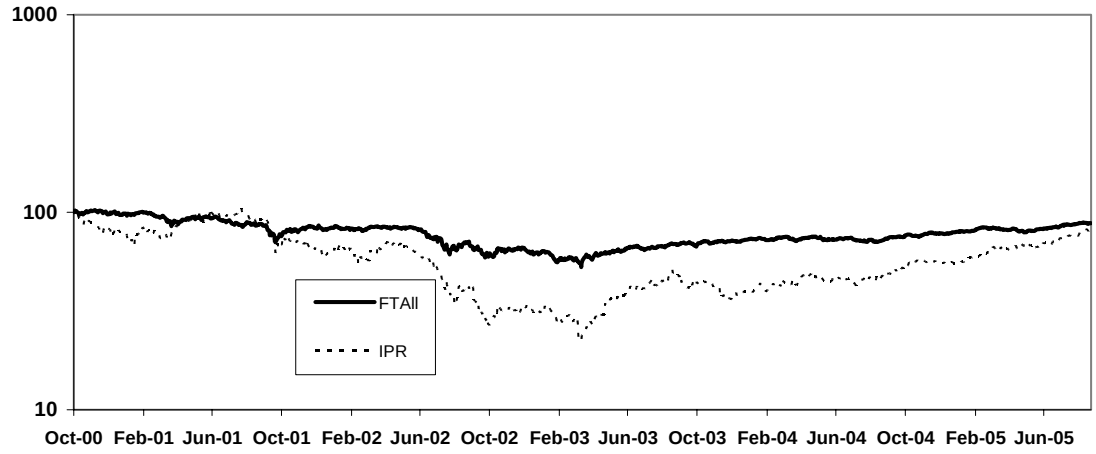


Chart 5d. International Power and FTAll Share Price Indices (Oct 2000=100)



4.6. Beta Estimates for National Grid Transco

Table 1 shows that using all available daily data, the beta estimate for National Grid Transco is very little changed from our last report, at 0.615. The addition of new data does however reinforce the evidence we noted previously, of a downward drift in beta for this company. The evidence of parameter instability is significant on both CUSUM and CUSUMSQ tests, and, in contrast to a number of the other companies examined, it remains in more recent data. While the drift in NGT's beta is quite slow, it continues even on the most recent data. This is again in contrast to some other companies where beta appears to have stabilised in more recent years.

One possible explanation for this downward drift may be the extent of NGT's operations overseas: US operations made up nearly half of its turnover in 2003/4. This may repay further investigation.

On the most recent four year sample of daily data NGT's estimated beta is 0.55. This is just within the notional 95% confidence interval based on daily data; however the evidence of parameter instability casts doubt on the reliability of this confidence interval. NGT therefore falls into the awkward group of companies where evidence of parameter instability points in two opposite directions: the downward drift in beta points to a downward adjustment to the estimate from the full sample; but the very presence of continuing parameter instability points to an upward adjustment because it increases the degree of uncertainty about the true value of beta. On balance, in NGT's case a simple assumption it may be simplest to treat the two effects as precisely offsetting, and use the full sample estimate.

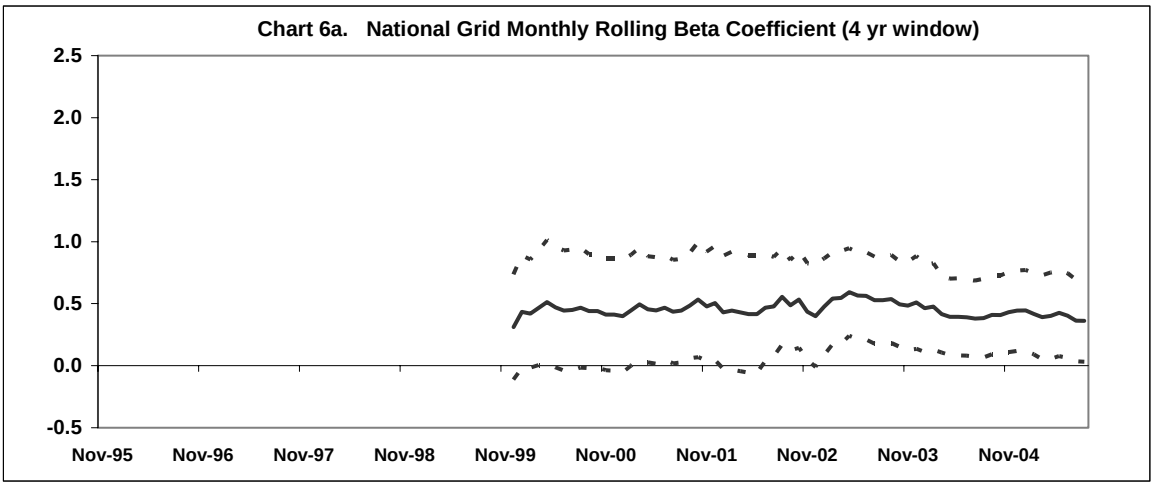


Chart 6a. National Grid Monthly Rolling Beta Coefficient (4 yr window)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
Nov-95
Nov-96
Nov-97
Nov-98
Nov-99
Nov-00
Nov-01
Nov-02
Nov-03
Nov-04

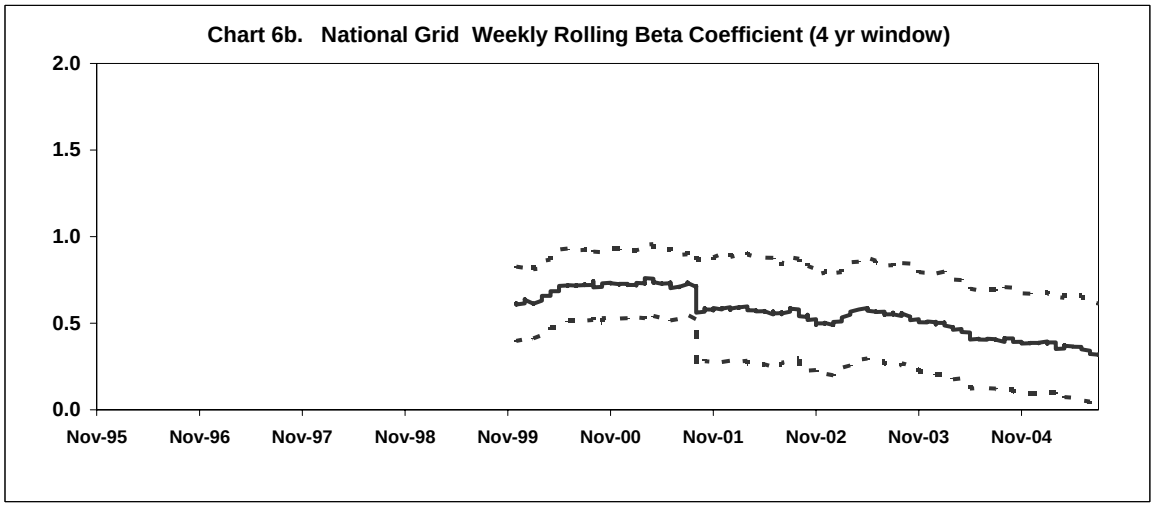


Chart 6b. National Grid Weekly Rolling Beta Coefficient (4 yr window)
2.0
1.5
1.0
0.5
0.0
Nov-95
Nov-96
Nov-97
Nov-98
Nov-99
Nov-00
Nov-01
Nov-02
Nov-03
Nov-04

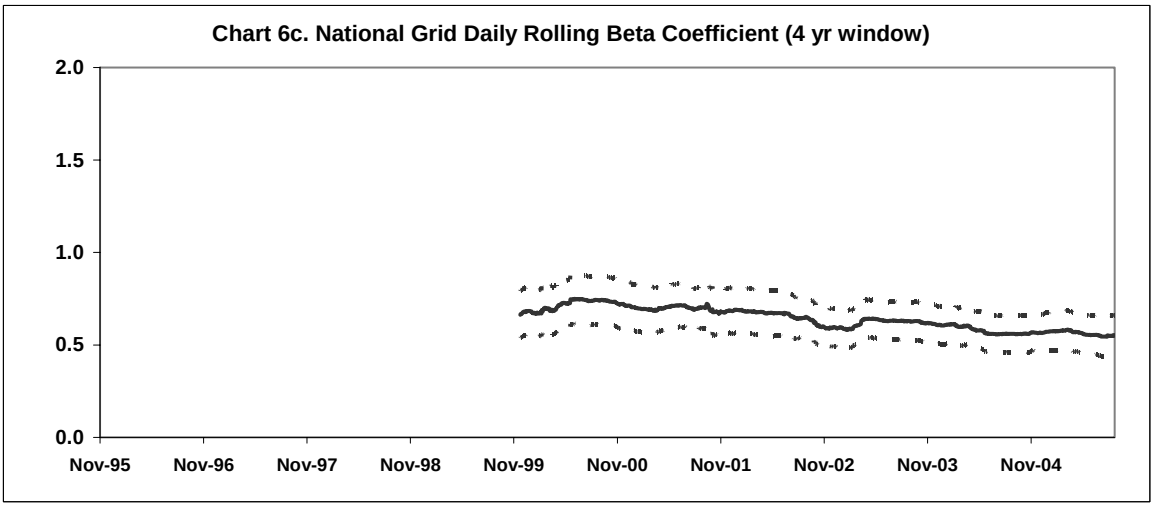


Chart 6c. National Grid Daily Rolling Beta Coefficient (4 yr window)
2.0
1.5
1.0
0.5
0.0
Nov-95
Nov-96
Nov-97
Nov-98
Nov-99
Nov-00
Nov-01
Nov-02
Nov-03
Nov-04

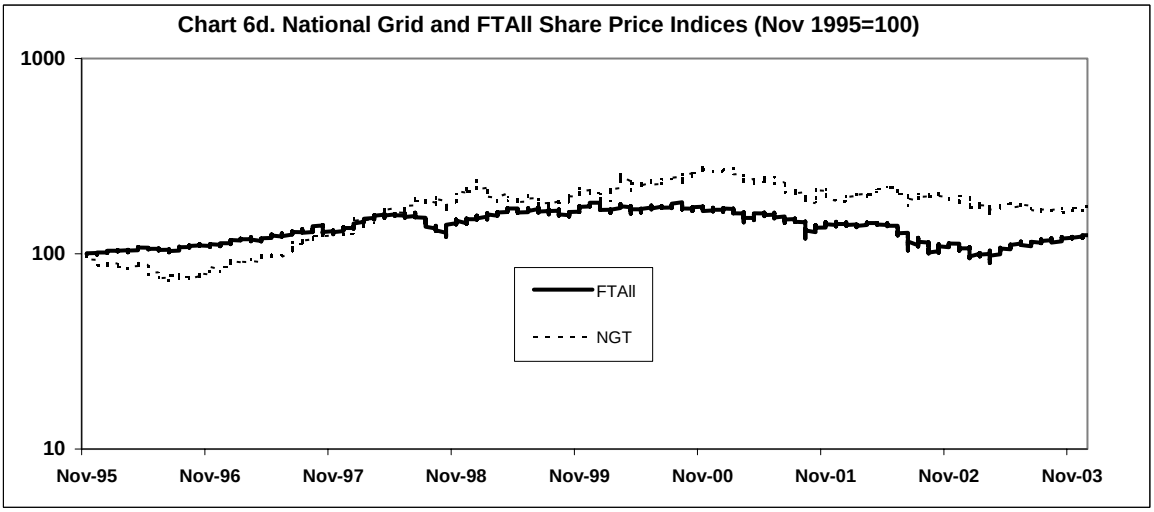


Chart 6d. National Grid and FTAll Share Price Indices (Nov 1995=100)
1000
100
10
FTAll
NGT
Nov-95
Nov-96
Nov-97
Nov-98
Nov-99
Nov-00
Nov-01
Nov-02
Nov-03

4.7. Beta Estimates for United Utilities

The whole-sample estimate of beta for this company is just over 0.6 based on daily data.

In terms of the pattern of beta estimates over time, this company again accords with the common pattern of a declining tendency in beta in early samples followed by stabilisation in those samples terminating roughly from 2001 onwards. There has also been a very distinct narrowing of the rolling confidence interval around this estimate.

While the drift in beta is evident from the chart, it is barely statistically significant on the CUSUM and CUSUMSQ tests shown in the appendix. In our last report we therefore concluded that there were no grounds to move away from the full sample estimate. While this remains the conservative approach, it is noteworthy that the evidence of "settling down" of UU's beta in the recent samples is reinforced by the inclusion of more recent data. On the latest rolling five year sample the estimate of beta is 0.470, with a confidence interval of 0.388 to 0.551. Since this apparently stable range is evident in samples covering up to the last ten years or so, and does not contain the estimate derived from the full sample, there are now somewhat stronger grounds for shifting to a lower estimate.

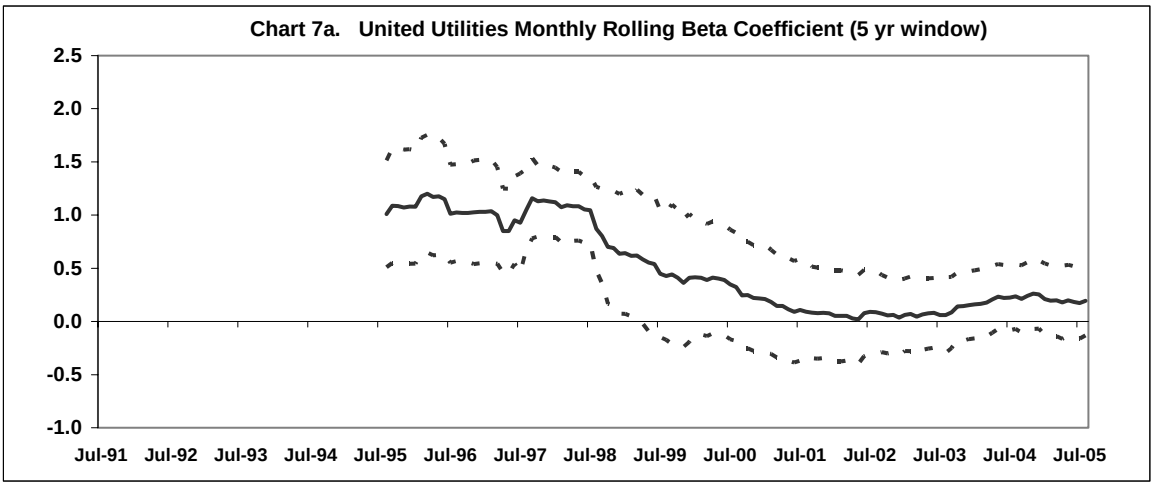


Chart 7a. United Utilities Monthly Rolling Beta Coefficient (5 yr window)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

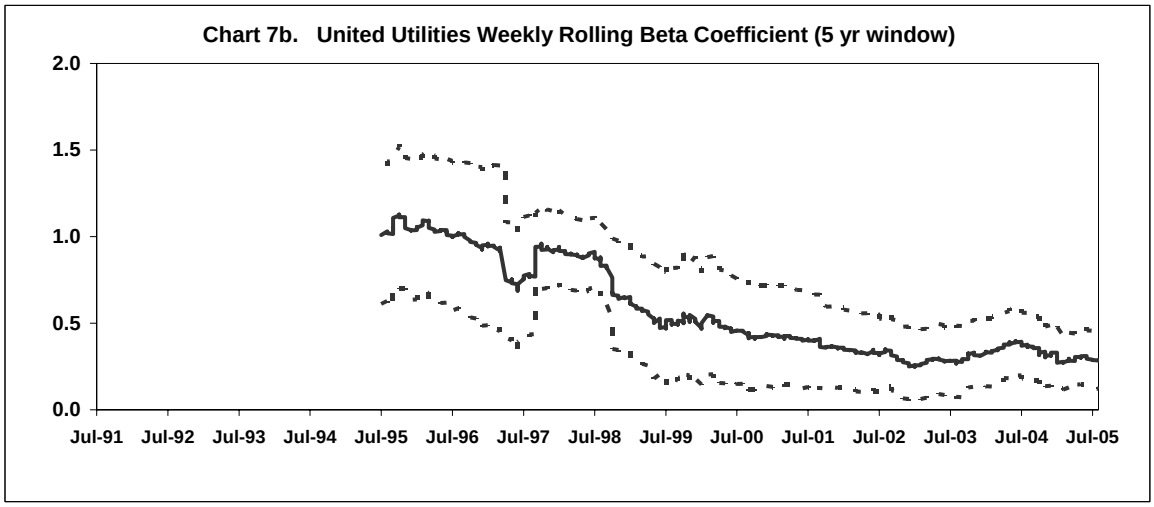


Chart 7b. United Utilities Weekly Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

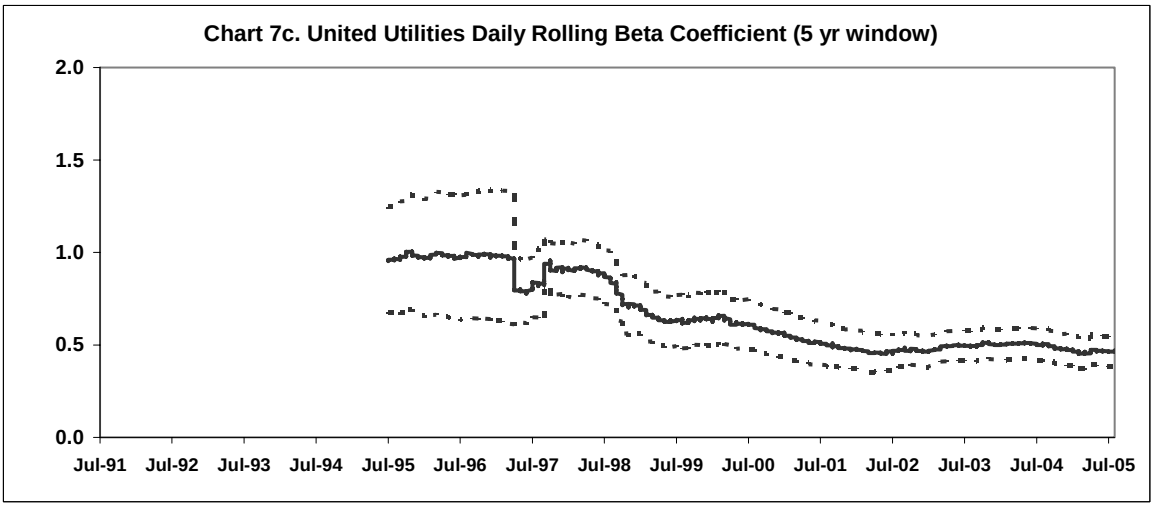


Chart 7c. United Utilities Daily Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

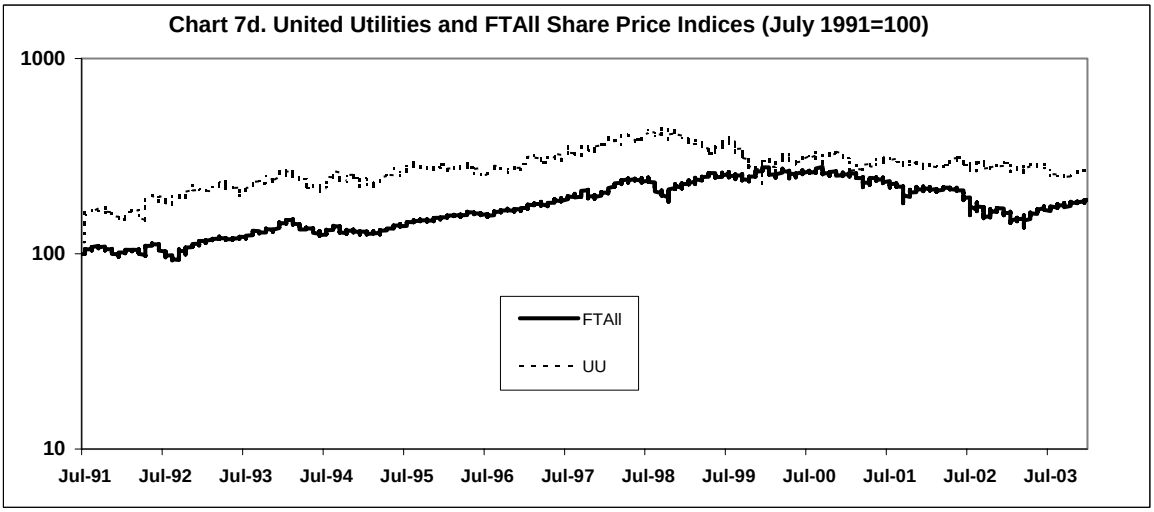


Chart 7d. United Utilities and FTAll Share Price Indices (July 1991=100)
1000
100
10
FTAll
UU
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03

4.8. Beta Estimates for Kelda Group

The estimate of Kelda's beta derived from daily data over all available data is the second lowest of the 9 companies, at 0.315, with similar results from weekly and monthly data.

In contrast to most of the other companies the evidence of parameter instability in Kelda's beta estimate is not restricted to earlier observations. There is a strong rejection on the CUSUMSQ test, and, while there is no rejection on the CUSUM test over the full sample there is a very distinct downward shift in beta in the earlier five year samples. Movements thereafter are however much more modest, with a slight upward drift in the most recent samples to some extent offsetting the downward drift we noted in our last report.

This pattern in beta appears to reflect the impact of a very distinct phase in the history of Kelda's share price, shown in the bottom panel of Chart 8, roughly between 1998 and 2001, when idiosyncratic factors in the share price appear to have dominated its behaviour, thus bringing down the beta estimate. More recently Kelda has risen more in line with the market, and the estimate has as a result drifted up again somewhat in samples including the most recent data. The estimate of beta based on the last five years is 0.252. Given the continuing evidence of drift in beta we also examined results from a shorter rolling sample of only 2 years to see if this drift is likely to continue: the resulting figure on the most recent sample is somewhat higher, at 0.28 – a figure not significantly different from the full sample estimate.

Overall the pattern of beta in more recent data does not suggest any reason to depart from the estimate of 0.315 based on all available data; indeed if anything, as noted in Section 2, a case might be made for an upward adjustment.

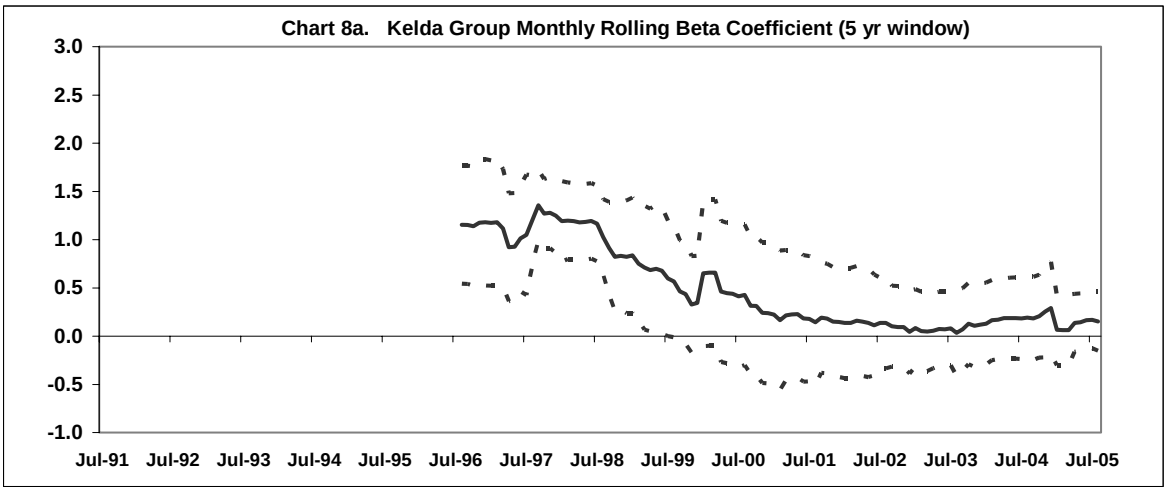


Chart 8a. Kelda Group Monthly Rolling Beta Coefficient (5 yr window)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

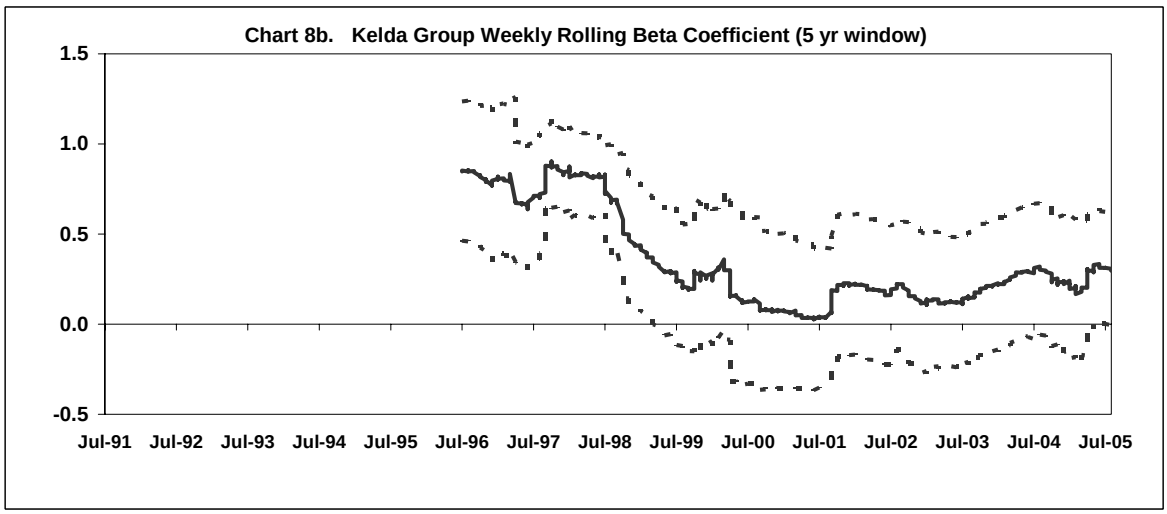


Chart 8b. Kelda Group Weekly Rolling Beta Coefficient (5 yr window)
1.5
1.0
0.5
0.0
-0.5
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

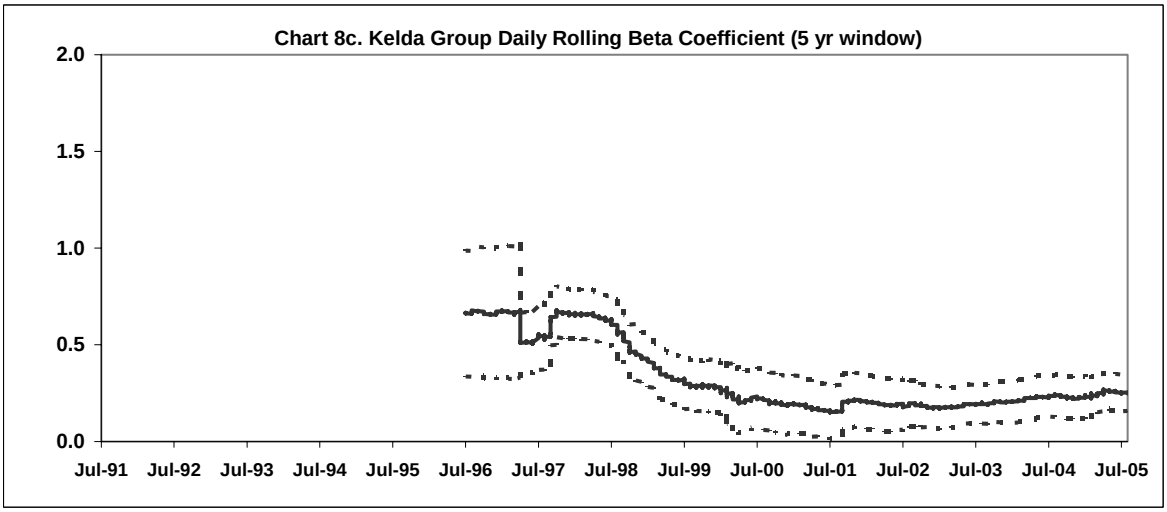


Chart 8c. Kelda Group Daily Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

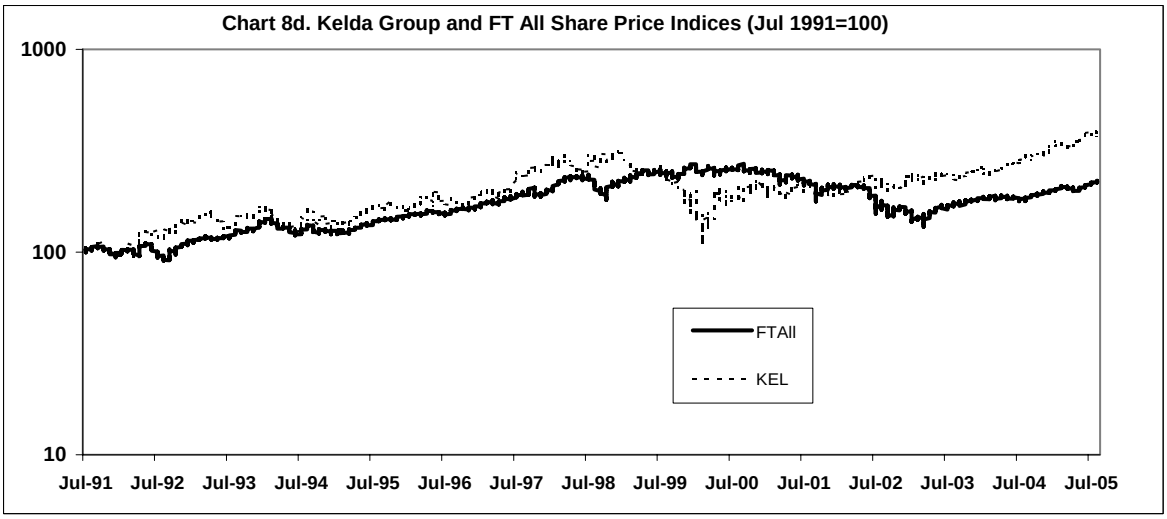


Chart 8d. Kelda Group and FT All Share Price Indices (Jul 1991=100)
1000
100
10
FTAll
KEL
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

4.9. Beta Estimates for Severn Trent

As we noted in our last report the diagnosis for the last company examined, Severn Trent, appears closer to that applied earlier to Scottish Power and Scottish & Southern Energy. The point estimate of beta from the full sample of daily data is 0.46. But there is again a distinct pattern of downward drift in beta similar to that for the other two companies. In the estimate derived from daily data there appears to be reasonably strong evidence of Severn Trent's beta stabilising in more recent samples.

Similar arguments apply in this case to those used earlier in relation to Scottish Power and Scottish and Southern. The inclusion of recent data does appear to provide some further evidence that Severn Trent's share price may have "settled down" in terms of its relationship to the market. The estimate of beta based on the most recent five year sample is 0.346, with a confidence interval of 0.257 to 0.435. If Ofgem are content to assume that it will remain stable in future, then it may be appropriate to use a lower figure for beta than that derived from the full sample.

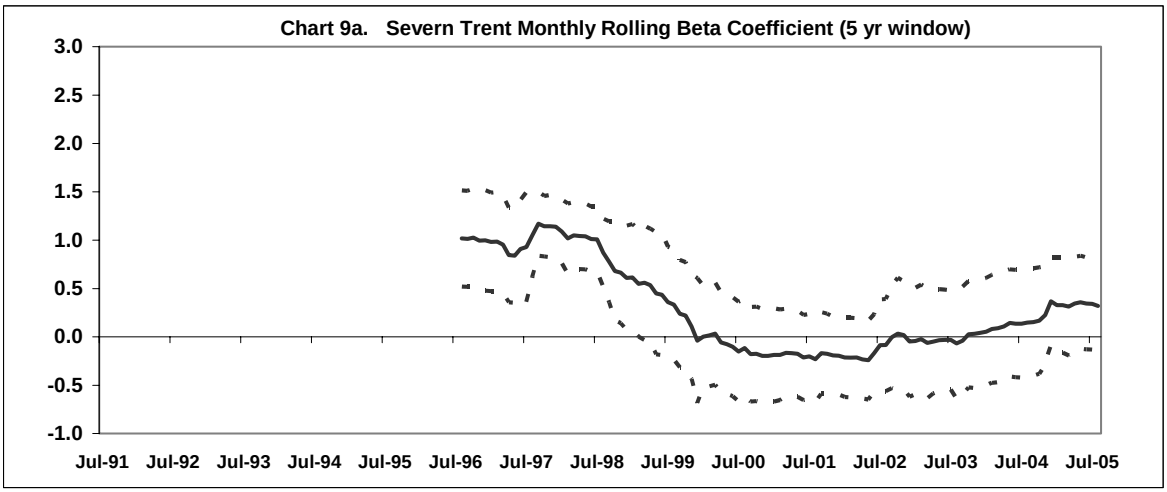


Chart 9a. Severn Trent Monthly Rolling Beta Coefficient (5 yr window)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

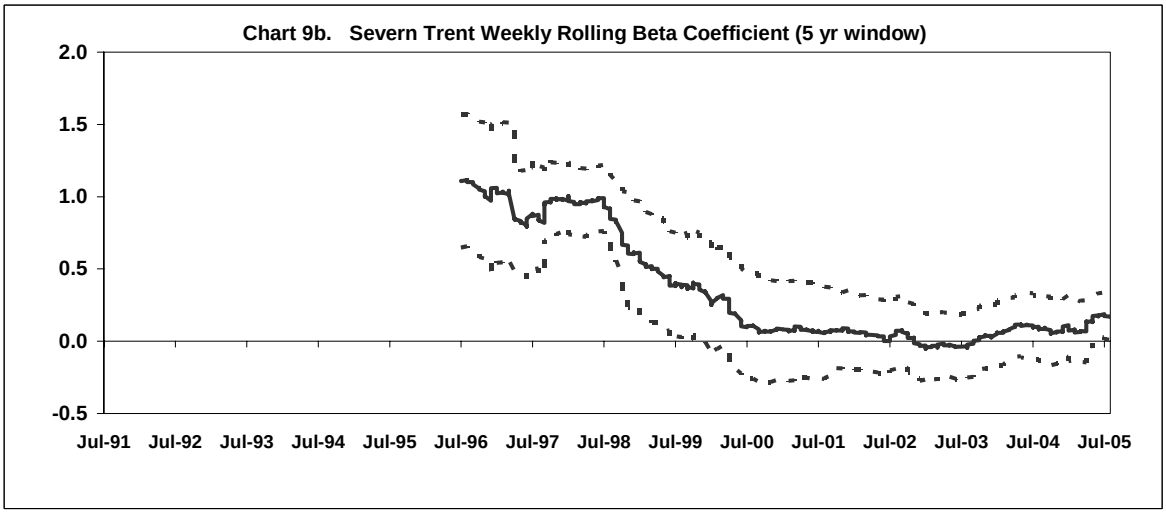


Chart 9b. Severn Trent Weekly Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
-0.5
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

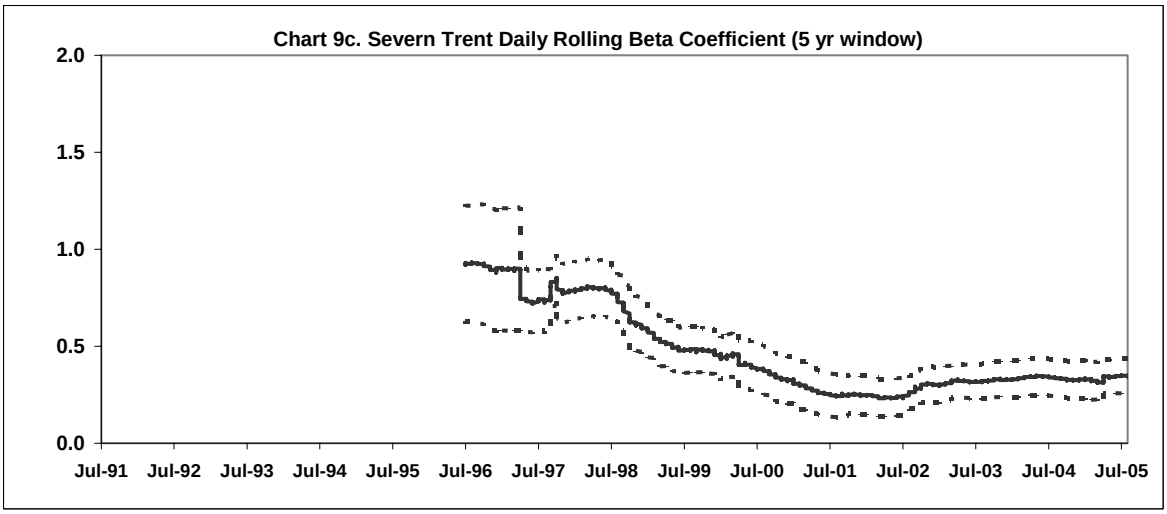


Chart 9c. Severn Trent Daily Rolling Beta Coefficient (5 yr window)
2.0
1.5
1.0
0.5
0.0
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

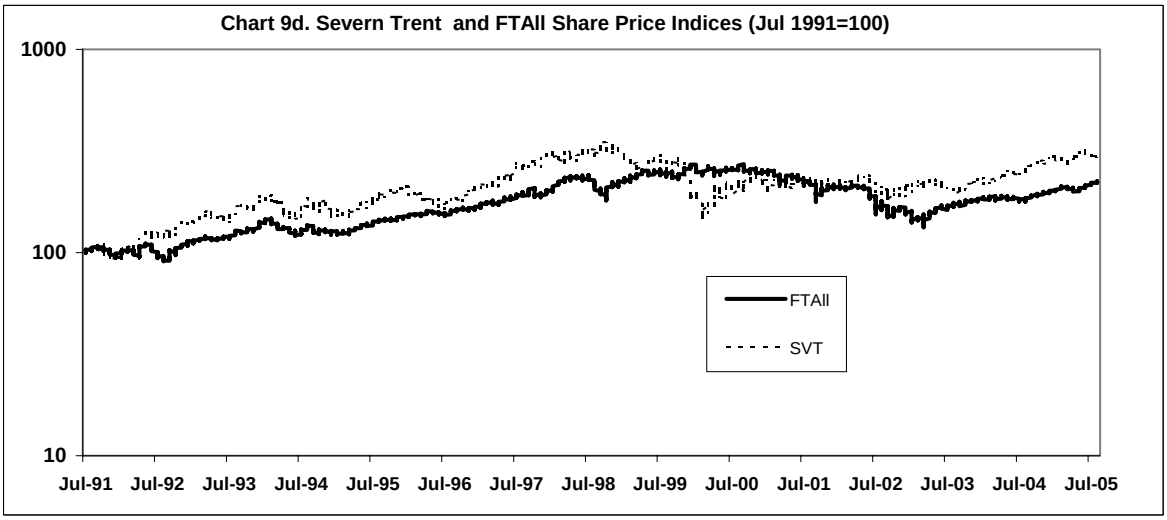


Chart 9d. Severn Trent and FTAll Share Price Indices (Jul 1991=100)
1000
100
10
FTAll
SVT
Jul-91 Jul-92 Jul-93 Jul-94 Jul-95 Jul-96 Jul-97 Jul-98 Jul-99 Jul-00 Jul-01 Jul-02 Jul-03 Jul-04 Jul-05

5. Bond Spread Analysis for Individual Companies

As noted in Section 3, spreads for individual bonds are calculated with reference to a single UK government bond of a similar maturity. The specific gilts used in calculating the spreads discussed below are as follows:

Scottish Power	UKT 6.25 11/25/10 Govt
Scottish and Southern	UKT 5 03/07/25 Govt
Centrica	UKT 6.25 11/25/10 Govt
National Grid Transco	UKT 5 03/07/25 Govt
United Utilities	UKT 5 03/07/25 Govt
Kelda	UKT 5 03/07/25 Govt
Severn Trent	UKT 5 03/07/25 Govt

5.1 Scottish Power

Chart 1e. Spread on Bonds vs Market Benchmark: Scottish Power

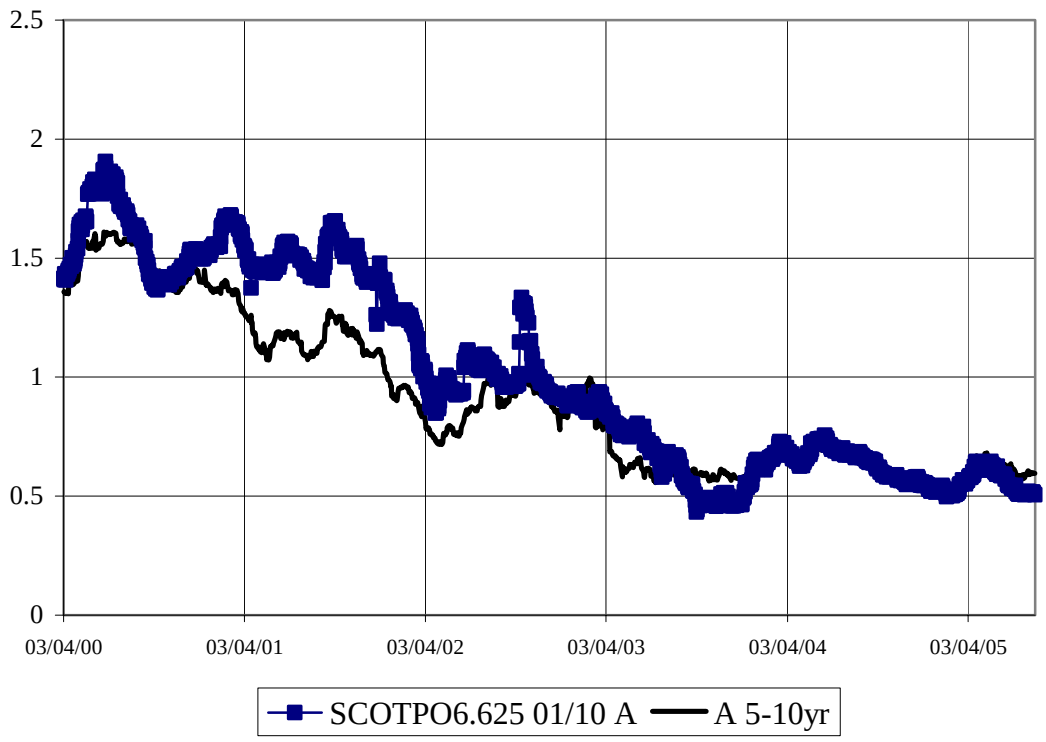


Chart 1e compares the yield spread on a representative traded bond for Scottish power that had a maturity over the sample shown varying from roughly ten to five years. For this reason it is shown relative to the average spread on a A-rated bonds of 5, 7 and 10 year fixed maturity. As the chart shows, the two yields have become virtually indistinguishable in the last two to three years. Thus there seems no reason to factor any company-specific elements into Scottish Power's credit spread.

5.2 Scottish and Southern

Chart 2e. Spread on Bonds vs Market Benchmark: Scottish & Southern

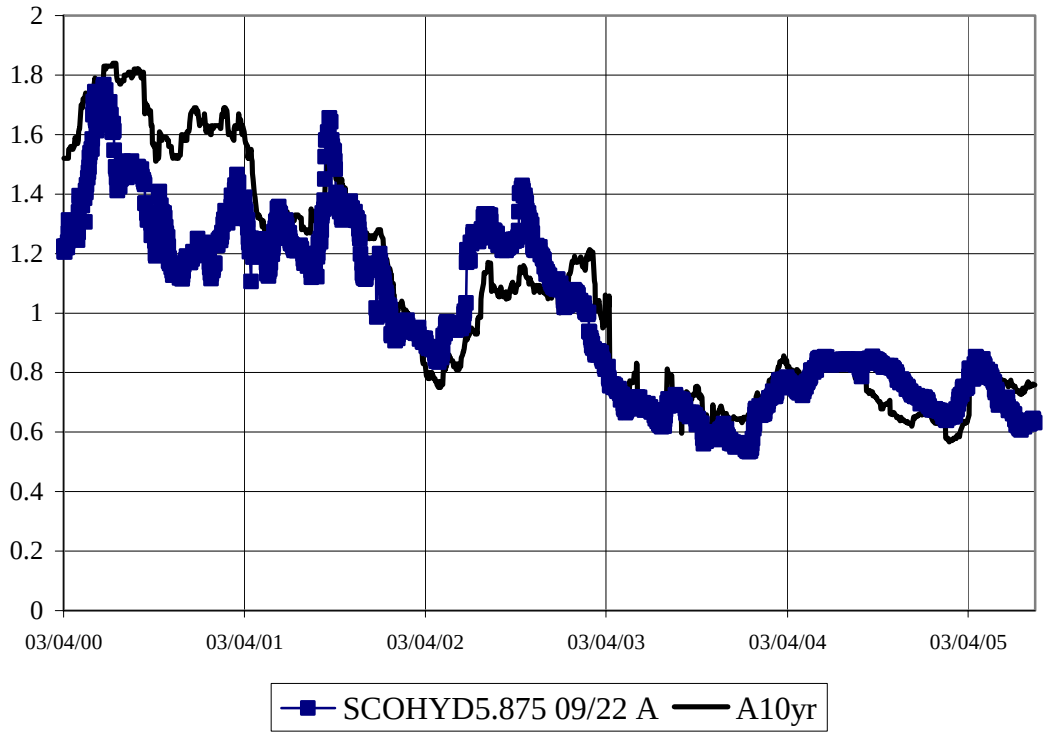


Chart 2e shows the yield on a representative Scottish and Southern bond with quite long maturity (ranging from 22 down to 17 years over the sample shown). There are no available market benchmark spreads at such a long maturity; the chart therefore shows the longest available (fixed) maturity of ten years. However, given that the yield curve is typically fairly flat at maturities above ten years maturity differences are probably of minor significance. Certainly the correspondence between the two yields is again very strong, and increasingly so in recent years. While Scottish & Southern's yield has fallen somewhat below the benchmark in the most recent data the difference is quite small, and well within the bounds of historic variation.

5.3 Viridian

As noted in the introduction Viridian does not currently have any traded bonds.

5.4 Centrica

Chart 4e. Spread on Bonds vs Market Benchmark: Centrica

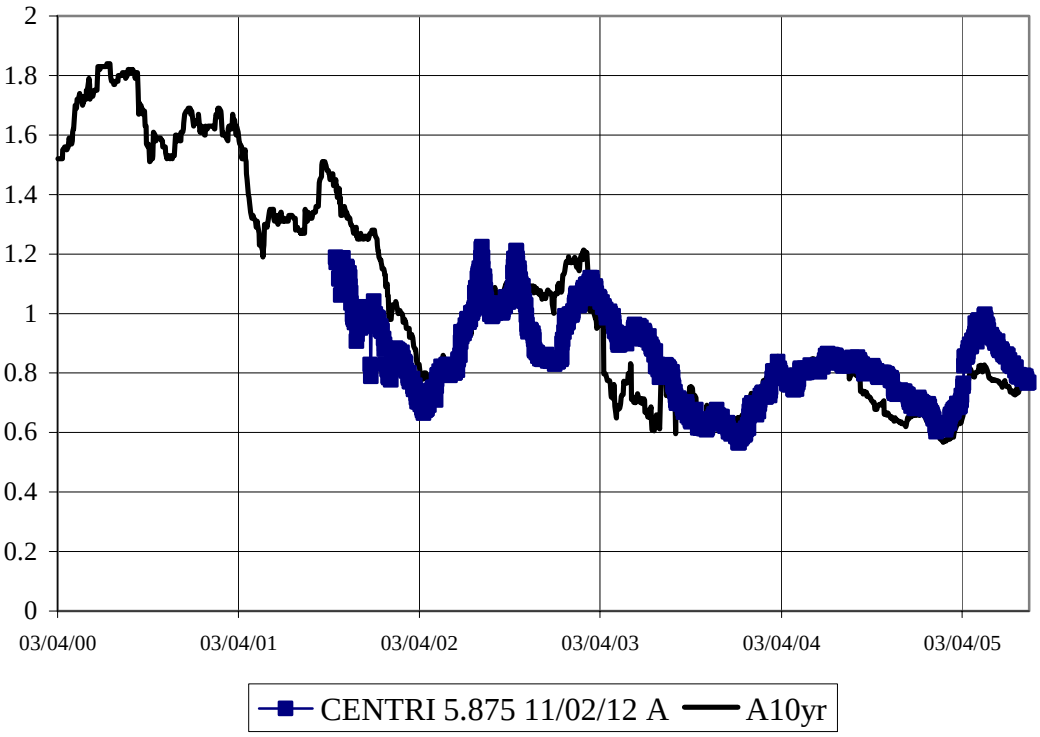


Chart 4e compares the yield on a Centrica bond with maturity that ranged from twelve years down to 7 years with the benchmark credit spread on ten year A-rated bonds. The correspondence in recent years is not quite as good as in the last two companies but is fairly consistent; and currently the two spreads are virtually identical.

5.5 International Power

International Power's only traded bonds are dollar-denominated convertible bonds with both put and call features. A put feature basically enables the owner of the bond to sell them back to the issuer at a certain price on a certain date. Conversely, a call option enables the issuer to the buy them back at a certain price on a certain date. These option features can induce significant distortions to prices and hence yields, making comparisons with benchmark yields on conventional bonds meaningless. (For example, a 2023 dated International Power US dollar bond with 3.75% coupon is currently trading at a yield of only 0.33%). These features of International Power's bonds should also be borne in mind in assessing its gearing.

5.6 National Grid Transco

Chart 6e. Spread on Bonds vs Market Benchmark: National Grid

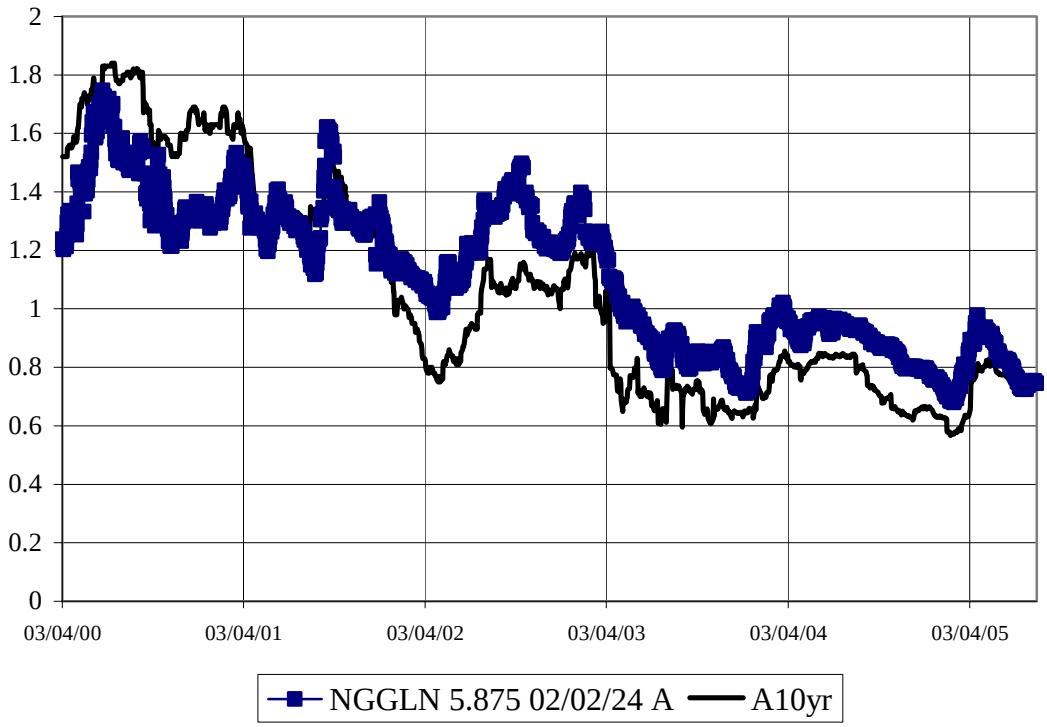
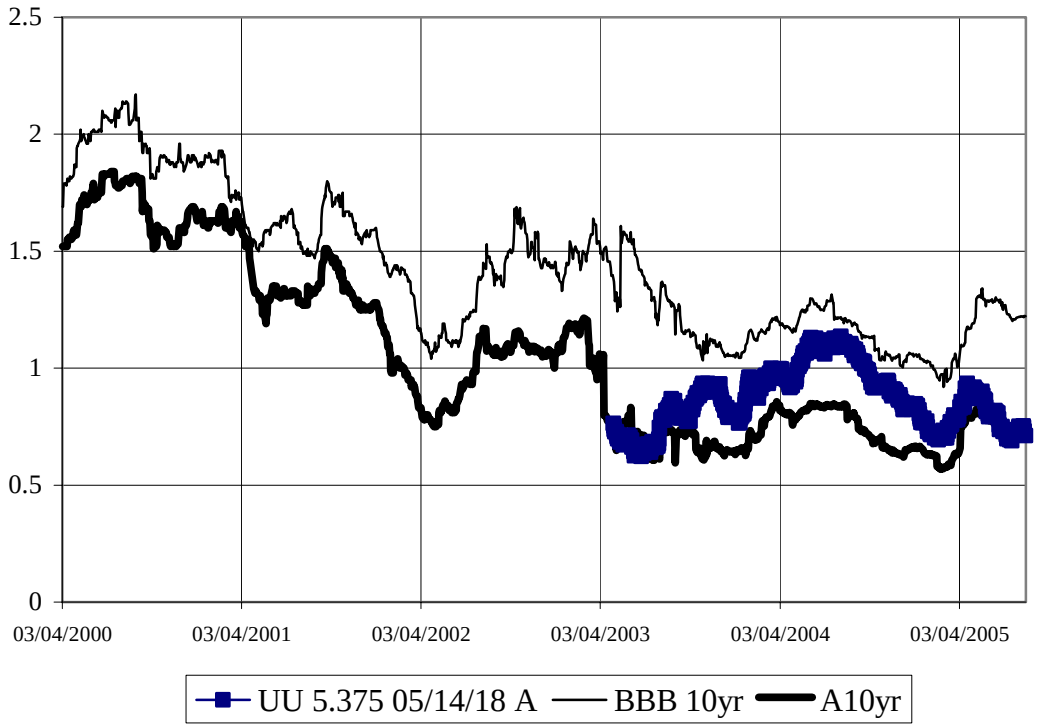


Chart 6e shows the yield on a representative National Grid Transco bond with quite long maturity (ranging from 24 down to 19 years over the sample shown). As noted above in relation to Scottish and Southern, there are no available benchmark spreads at such a long maturity; the chart therefore shows the longest available (fixed) maturity of ten years. The correlation is somewhat weaker than for the other companies examined thus far, but this seems unlikely to be due to maturity effects, since the maturity differences are comparable to those the case of Scottish and Southern. The spreads have however become virtually identical in the most recent past.

5.7 United Utilities

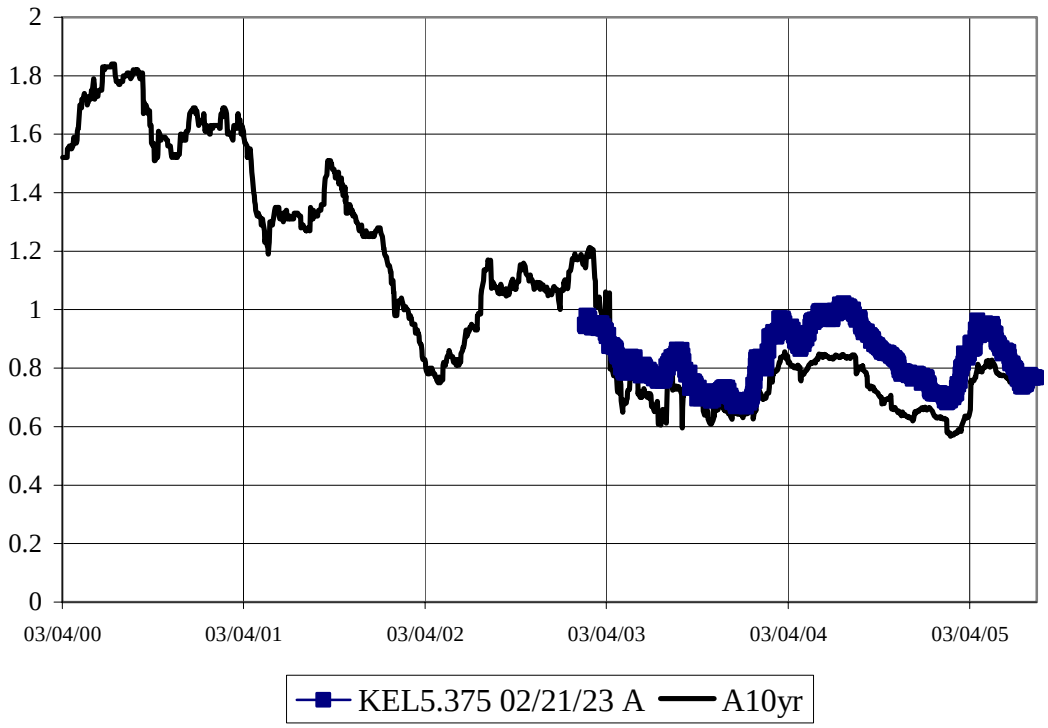
Chart 7e. Spread on Bonds vs Market Benchmarks: United Utilities



We have a relatively short run of data for the United Utilities bond shown above (with maturity ranging from 15 down to 13 years). While some of this company's US dollar debt is rated BBB, the debt related to the regulated UK entity is A-rated. For purposes of comparison the chart shows both benchmark A and BBB yields. Over its relatively short history the yield on this bond seems to have tracked the benchmark A- rated bond more closely: particularly so in the recent past.

5.8 Kelda

Chart 8e. Spread on Bonds vs Market Benchmark: Kelda



For this company we again have a relatively short history. The spread on the bond shown, with maturity varying from 20 to 18 years, does however appear to correspond quite closely with that on the benchmark A-rated bond.

5.9 Severn Trent

Chart 9e. Spread on Bonds vs Market Benchmark: Severn Trent

The spread on this bond, with maturity varying between 24 and 19 years over the sample shown, has been quite strongly correlated with the best available benchmark spread, on A-rated bonds with ten year maturity. On average Severn Trent's spread has been somewhat higher; but as in the case of several other companies, the two yields appear to have converged in more recent years, suggesting that it is being priced much more closely to the market benchmark.

Appendix

A. Data Transformations for Beta Estimation

Excess Returns for all companies, and for the market are given by

$\ln (P_t / P_{t-1}) - r$

where P is the relevant price, and

$r = \ln ((1+R_t/k/100)$

where R_t is the safe rate , and k is the annualisation factor, set equal to 261 for daily data, 52 for weekly data, and 12 for monthly data

All price data are ex-dividend, and were downloaded from Bloomberg's Data Service

B. Detailed Estimation Results on Daily Data

Results are shown for all available data, using the FT All Share Index to derive the market return, RM.

Scottish Power

```
============================================================
Dependent Variable: RSPW
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 7/29/1991 08/23/2005
Included observations: 3672 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000216   0.000306   0.704736   0.4810
        RM           0.705131   0.046198   15.26330   0.0000
============================================================
R-squared            0.117065    Mean dependent var 0.000199
Adjusted R-squared   0.116824    S.D. dependent var 0.019024
S.E. of regression   0.017878    Akaike info criter-5.209957
Sum squared resid    1.173004    Schwarz criterion -5.206576
Log likelihood       9567.481    F-statistic        486.5917
Durbin-Watson stat   1.889911    Prob(F-statistic)  0.000000
============================================================
```

Scottish and Southern

```
============================================================
Dependent Variable: RSSE
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 9/23/1991 08/23/2005
Included observations: 3632 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000374   0.000293   1.273954   0.2028
        RM           0.503437   0.052111   9.660943   0.0000
============================================================
R-squared            0.068200    Mean dependent var 0.000361
Adjusted R-squared   0.067944    S.D. dependent var 0.017828
S.E. of regression   0.017212    Akaike info criter-5.285877
Sum squared resid    1.075389    Schwarz criterion -5.282465
Log likelihood       9601.153    F-statistic        265.6866
Durbin-Watson stat   1.909466    Prob(F-statistic)  0.000000
============================================================
```

Viridian

```
============================================================
Dependent Variable: RVRD
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 6/22/1993 08/23/2005
Included observations: 3176 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000345   0.000288   1.196128   0.2317
        RM           0.196633   0.036076   5.450488   0.0000
============================================================
R-squared            0.015141    Mean dependent var 0.000342
Adjusted R-squared   0.014831    S.D. dependent var 0.015037
S.E. of regression   0.014925    Akaike info criter-5.570937
Sum squared resid    0.707020    Schwarz criterion -5.567119
Log likelihood       8848.648    F-statistic        48.79782
Durbin-Watson stat   1.764011    Prob(F-statistic)  0.000000
============================================================
```

Centrica

```
============================================================
Dependent Variable: RCEN
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 2/11/1997 08/23/2005
Included observations: 2226 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=7)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000425   0.000351   1.211707   0.2258
        RM           0.676252   0.057521   11.75665   0.0000
============================================================
R-squared            0.122335    Mean dependent var 0.000357
Adjusted R-squared   0.121941    S.D. dependent var 0.020484
S.E. of regression   0.019194    Akaike info criter-5.067536
Sum squared resid    0.819346    Schwarz criterion -5.062408
Log likelihood       5642.168    F-statistic        309.9977
Durbin-Watson stat   2.081044    Prob(F-statistic)  0.000000
============================================================
```

International Power

```
============================================================
Dependent Variable: RIPR
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 10/3/2000 08/23/2005
Included observations: 1276 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=7)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C          -0.000134   0.000550  -0.244541   0.8069
        RM           0.724688   0.069227   10.46826   0.0000
============================================================
R-squared            0.119833    Mean dependent var-0.000334
Adjusted R-squared   0.119142    S.D. dependent var 0.023044
S.E. of regression   0.021628    Akaike info criter-4.828079
Sum squared resid    0.595946    Schwarz criterion -4.820005
Log likelihood       3082.315    F-statistic        173.4524
Durbin-Watson stat   2.147713    Prob(F-statistic)  0.000000
============================================================
```

National Grid Transco

```
============================================================
Dependent Variable: RNGT
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 11/23/1995 08/23/2005
Included observations: 2544 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000139   0.000259   0.537979   0.5906
        RM           0.628064   0.039793   15.78322   0.0000
============================================================
R-squared            0.168511    Mean dependent var 0.000106
Adjusted R-squared   0.168184    S.D. dependent var 0.015403
S.E. of regression   0.014048    Akaike info criter-5.691874
Sum squared resid    0.501661    Schwarz criterion -5.687282
Log likelihood       7242.064    F-statistic        515.1659
Durbin-Watson stat   2.032083    Prob(F-statistic)  0.000000
============================================================
```

United Utilities

```
============================================================
Dependent Variable: RUU
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 7/20/1990 08/23/2005
Included observations: 3938 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=9)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           8.53E-05   0.000230   0.371649   0.7102
        RM           0.614603   0.044448   13.82743   0.0000
============================================================
R-squared            0.121252    Mean dependent var 5.76E-05
Adjusted R-squared   0.121029    S.D. dependent var 0.016211
S.E. of regression   0.015198    Akaike info criter-5.534734
Sum squared resid    0.909192    Schwarz criterion -5.531546
Log likelihood       10899.89    F-statistic        543.1004
Durbin-Watson stat   1.948467    Prob(F-statistic)  0.000000
============================================================
```

Kelda

```
============================================================
Dependent Variable: RKEL
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 7/12/1991 08/23/2005
Included observations: 3683 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           0.000128   0.000270   0.474289   0.6353
        RM           0.315242   0.049404   6.380952   0.0000
============================================================
R-squared            0.028390    Mean dependent var 0.000123
Adjusted R-squared   0.028127    S.D. dependent var 0.017255
S.E. of regression   0.017010    Akaike info criter-5.309452
Sum squared resid    1.065099    Schwarz criterion -5.306079
Log likelihood       9779.356    F-statistic        107.5590
Durbin-Watson stat   1.976887    Prob(F-statistic)  0.000000
============================================================
```

Severn Trent

```
============================================================
Dependent Variable: RSVT
Method: Least Squares
Date: 08/31/05   Time: 20:11
Sample(adjusted): 7/12/1991 08/23/2005
Included observations: 3683 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=8)
============================================================
     Variable      CoefficientStd. Errort-Statistic  Prob.
============================================================
         C           6.71E-05   0.000252   0.266262   0.7901
        RM           0.457074   0.045140   10.12566   0.0000
============================================================
R-squared            0.075070    Mean dependent var 5.95E-05
Adjusted R-squared   0.074819    S.D. dependent var 0.015385
S.E. of regression   0.014798    Akaike info criter-5.588053
Sum squared resid    0.806111    Schwarz criterion -5.584680
Log likelihood       10292.40    F-statistic        298.7624
Durbin-Watson stat   1.865268    Prob(F-statistic)  0.000000
============================================================
```

C. Stability Tests

CUSUM Test

The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals.[10] The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. If there is no parameter instability the test statistic would be expected to stay around zero. Movement outside the critical lines is suggestive of coefficient instability.

CUSUM of Squares Test

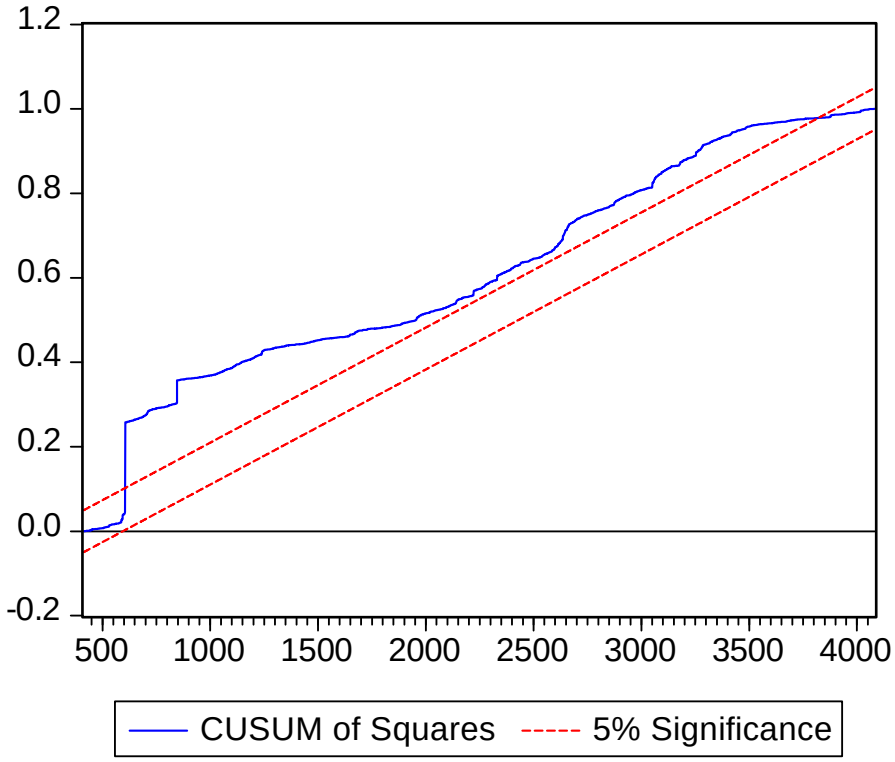
The CUSUM of squares test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of squared residuals.[11] If there is no parameter instability this statistic should rise steadily from zero to unity at the end of the sample. The significance of the departure of from its expected value is assessed by reference to a pair of parallel straight lines around the expected value.

[10] Strictly = sum of recursive residuals/sample standard error of equation

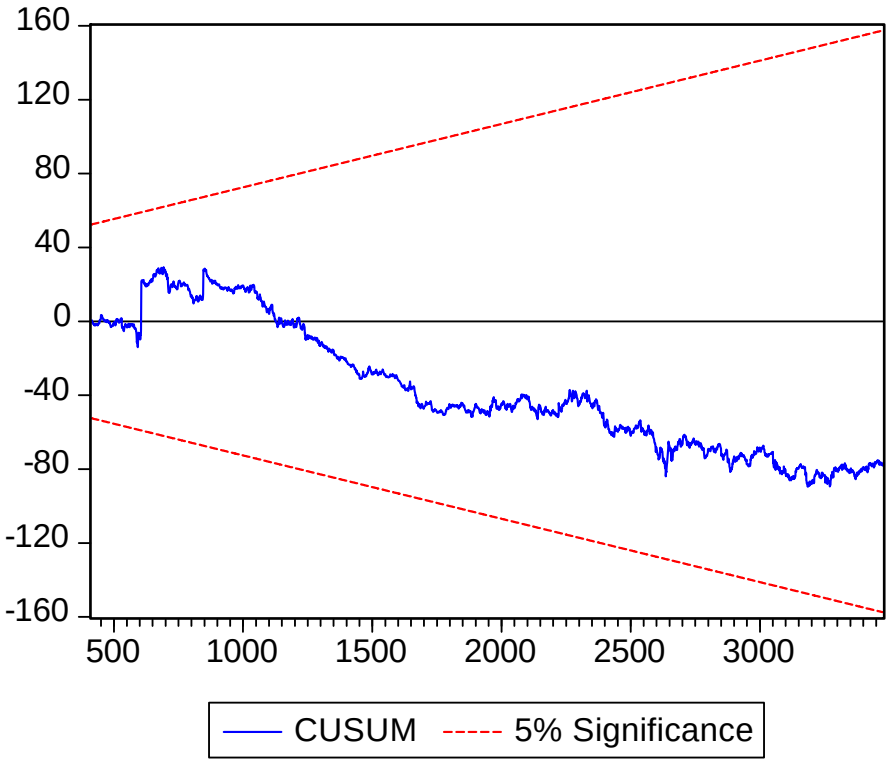
[11] Strictly = sum of squared recursive residuals to point *t*, divided by total sum of squared residuals over entire sample

1. Scottish Power

Cumulative Sum of Squares of Recursive Residuals

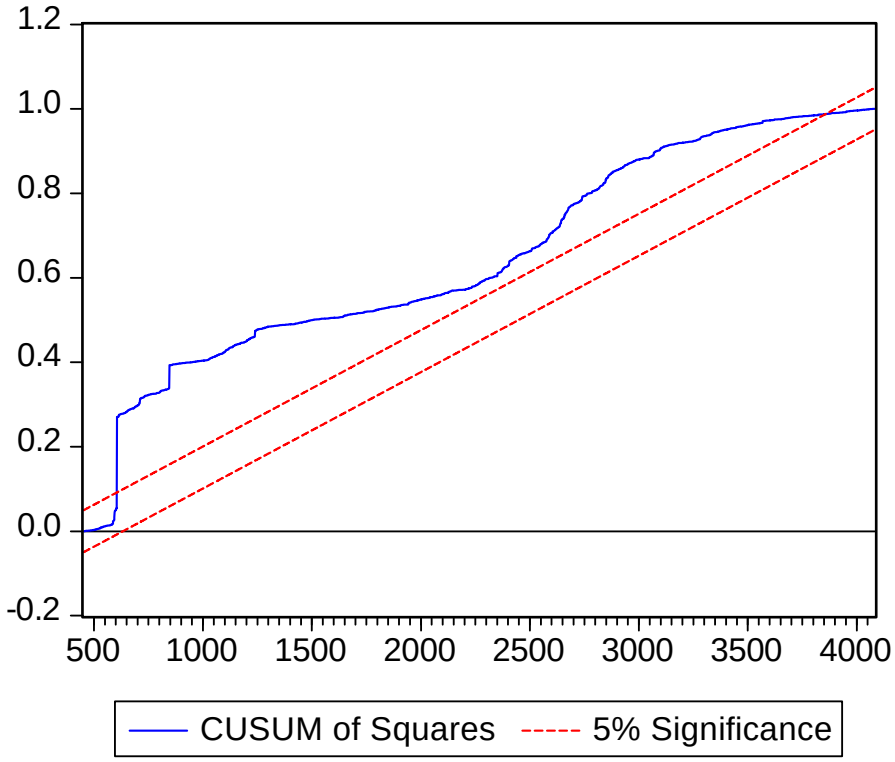


Cumulative Sum of Recursive Residuals

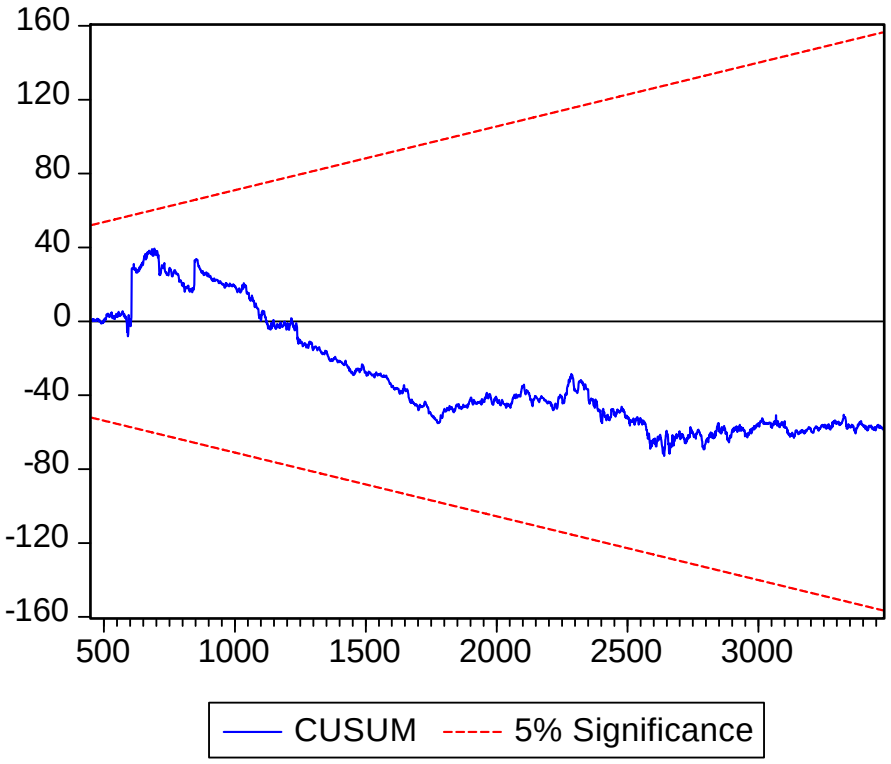


2. Scottish and Southern Energy

Cumulative Sum of Squares of Recursive Residuals

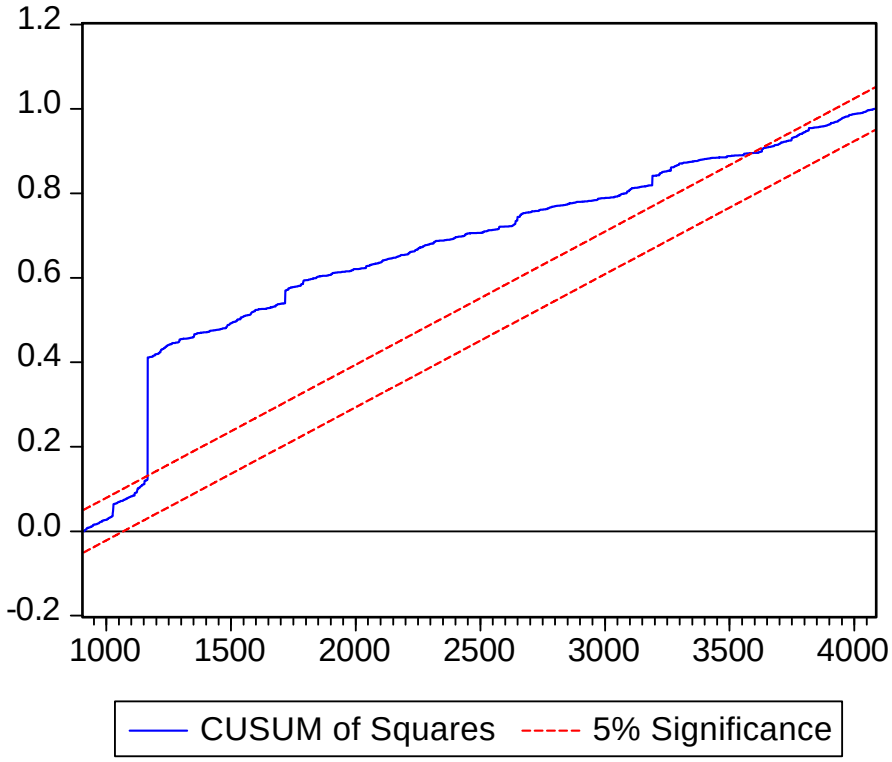


Cumulative Sum of Recursive Residuals

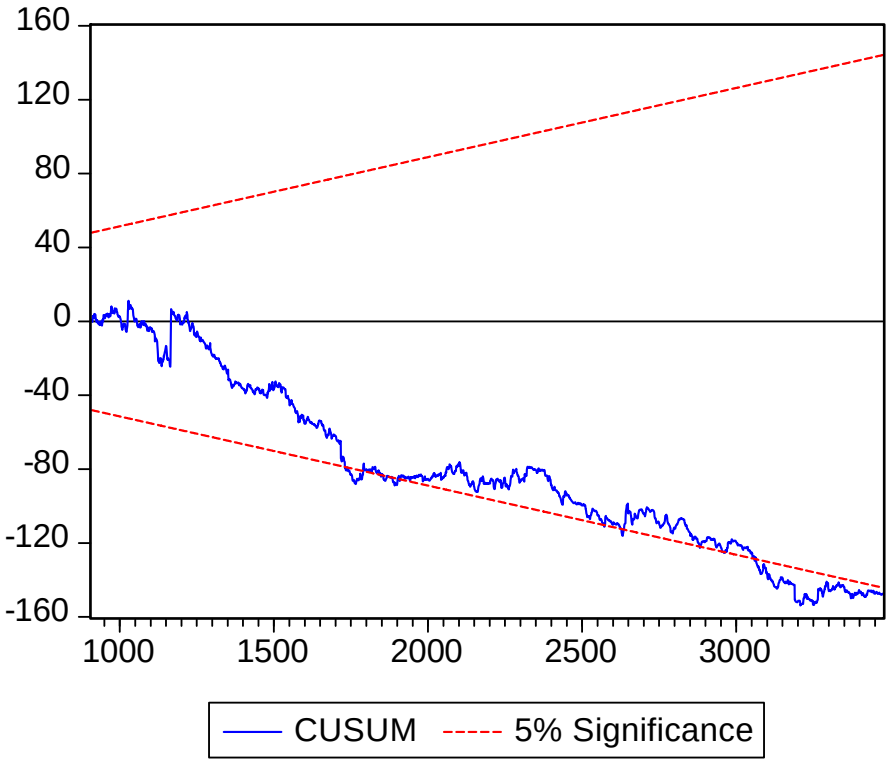


3. Viridian Group

Cumulative Sum of Squares of Recursive Residuals

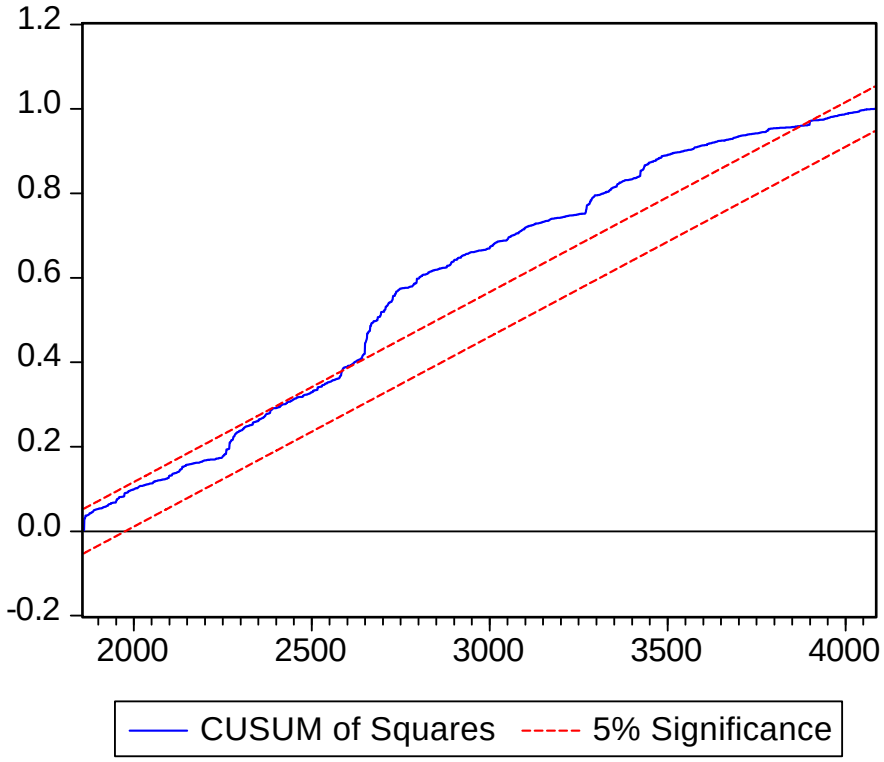


Cumulative Sum of Recursive Residuals

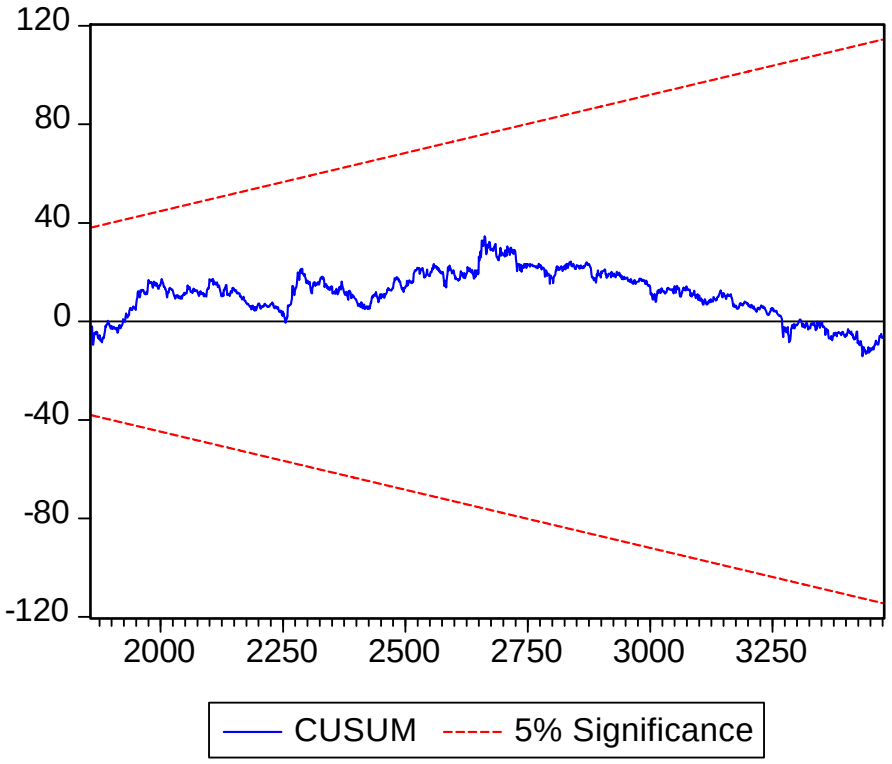


4. Centrica

Cumulative Sum of Squares of Recursive Residuals

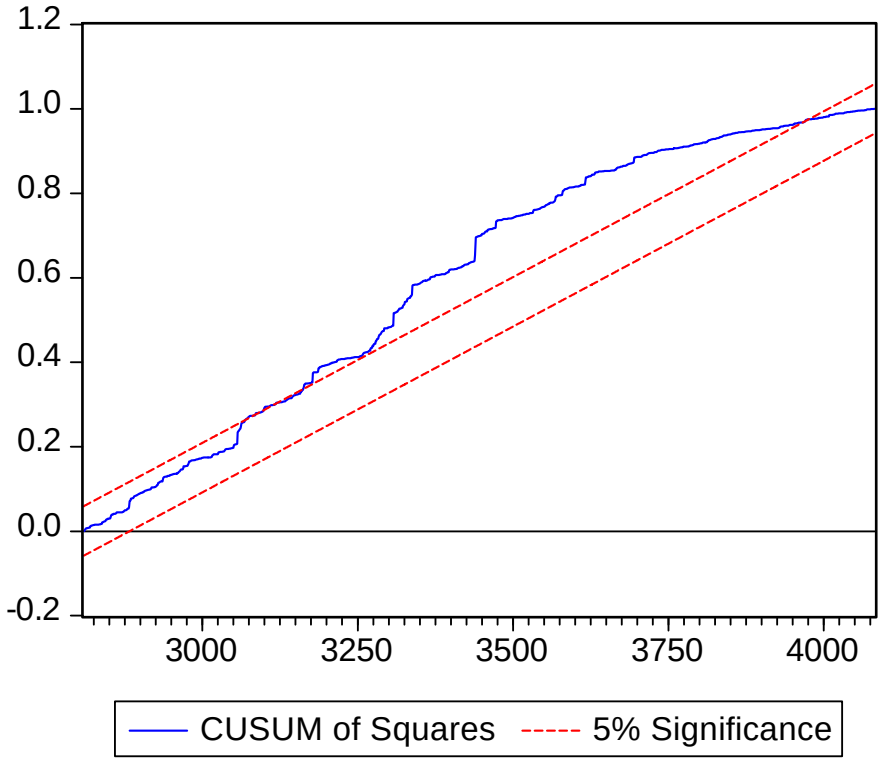


Cumulative Sum of Recursive Residuals

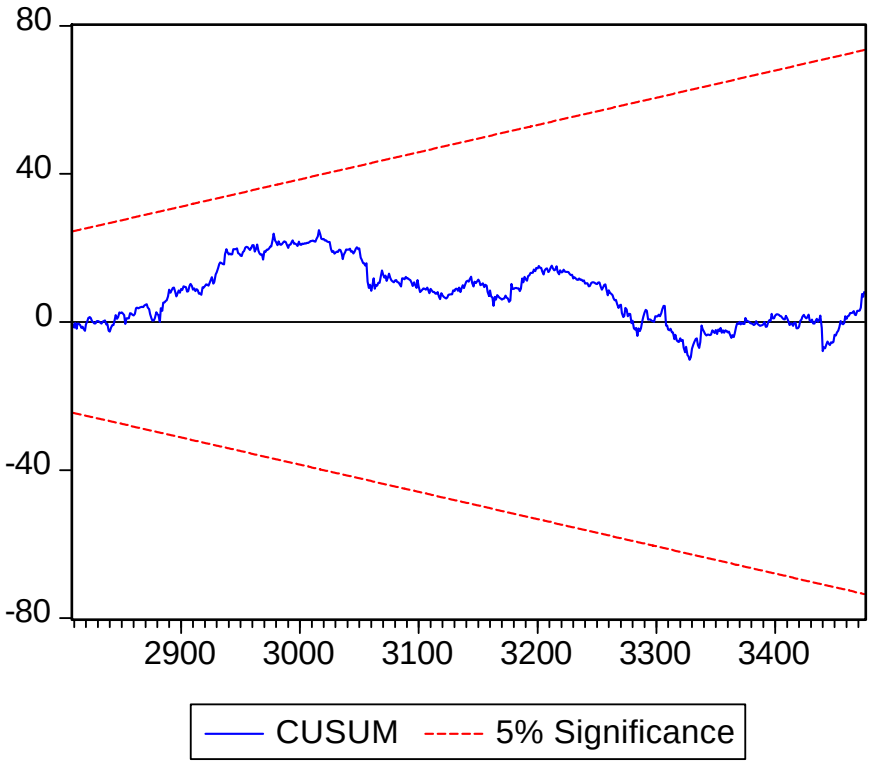


5. International Power

Cumulative Sum of Squares of Recursive Residuals

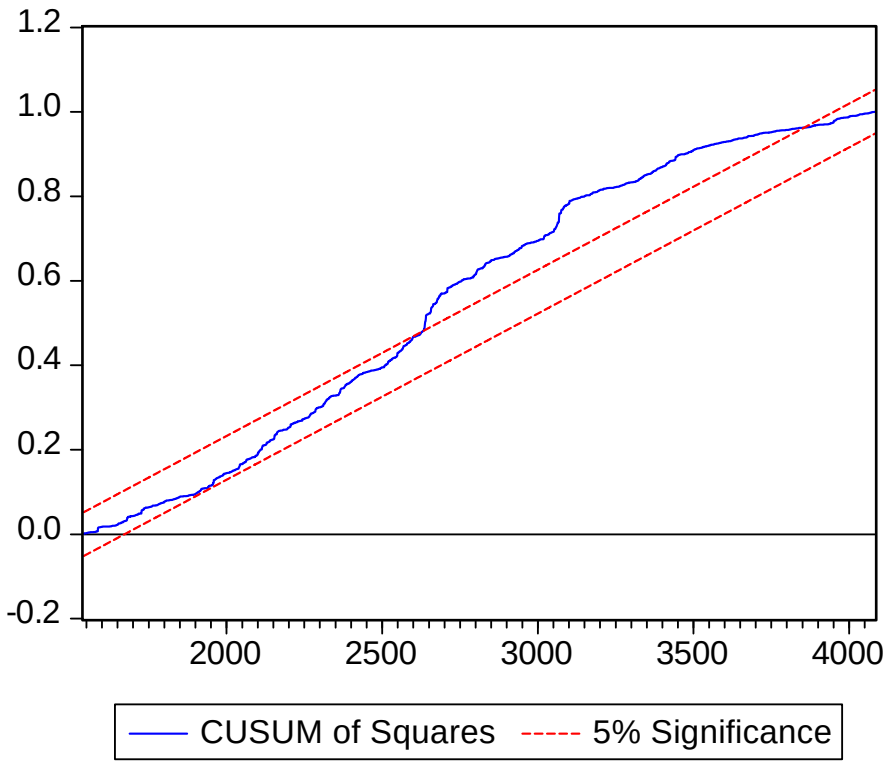


Cumulative Sum of Recursive Residuals

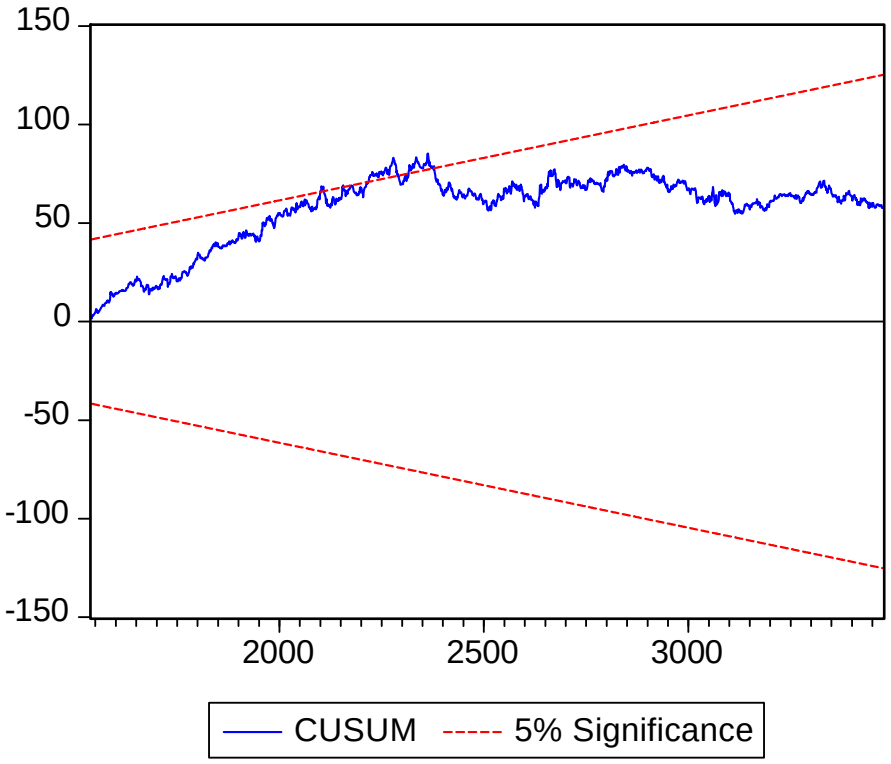


6. National Grid Transco

Cumulative Sum of Squares of Recursive Residuals

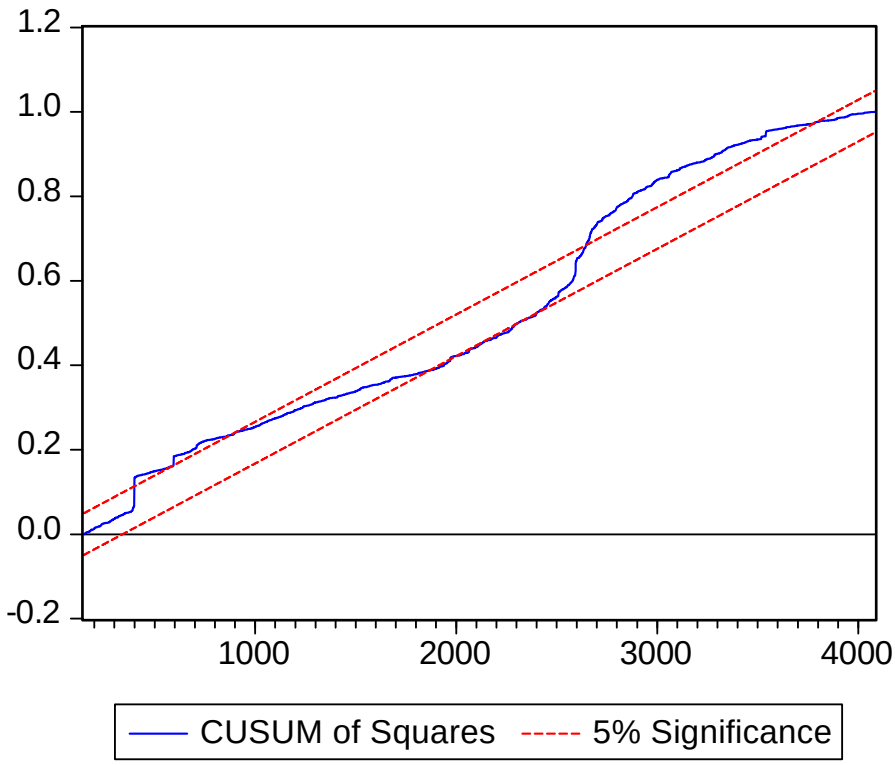


Cumulative Sum of Recursive Residuals

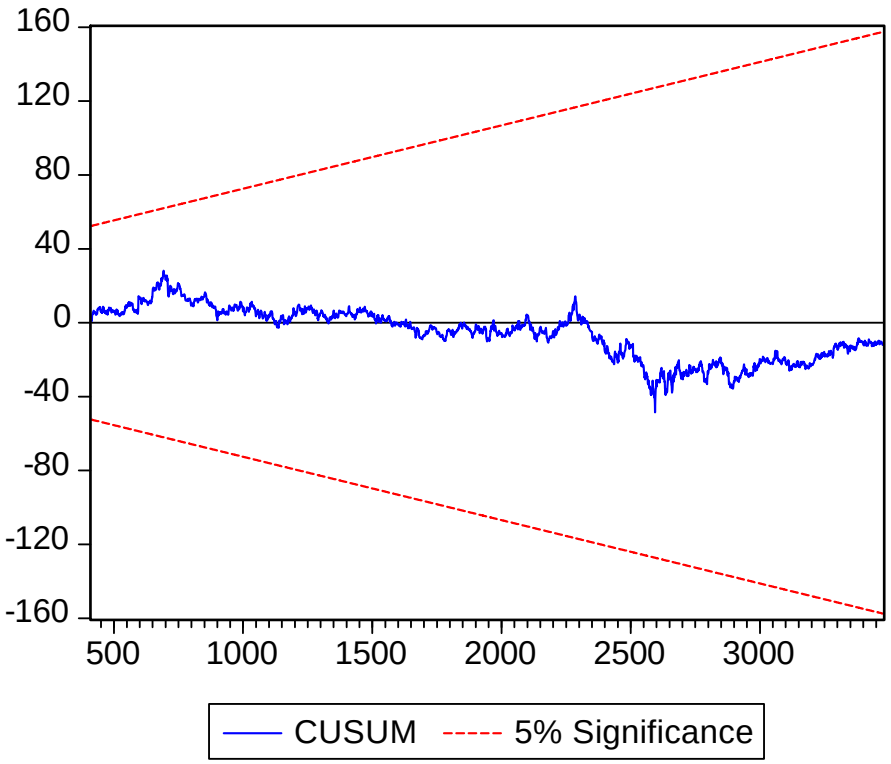


7. United Utilities

Cumulative Sum of Squares of Recursive Residuals

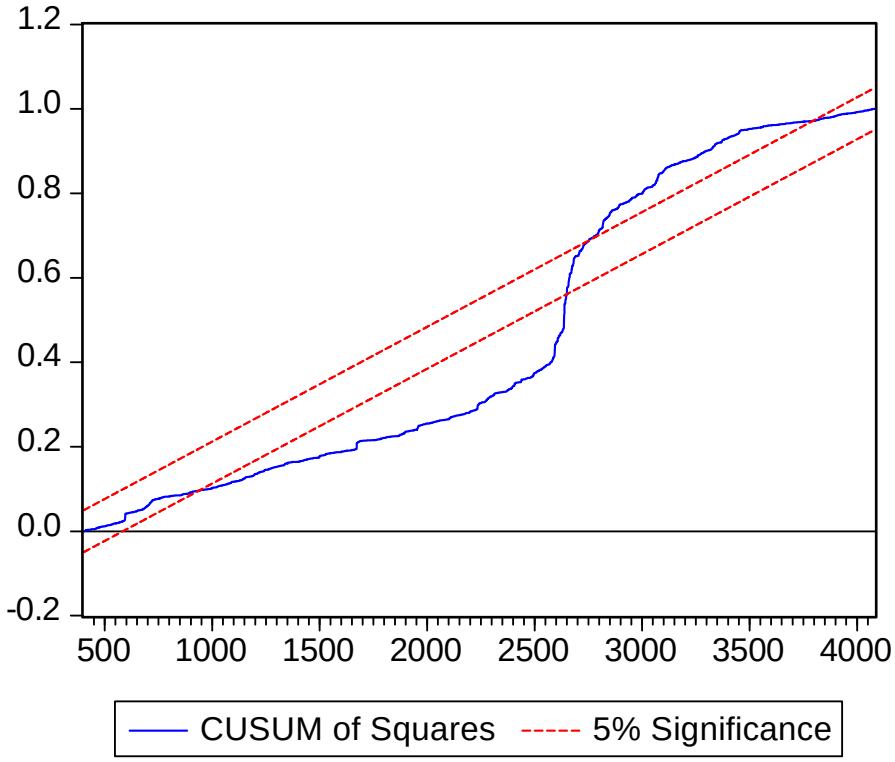


Cumulative Sum of Recursive Residuals

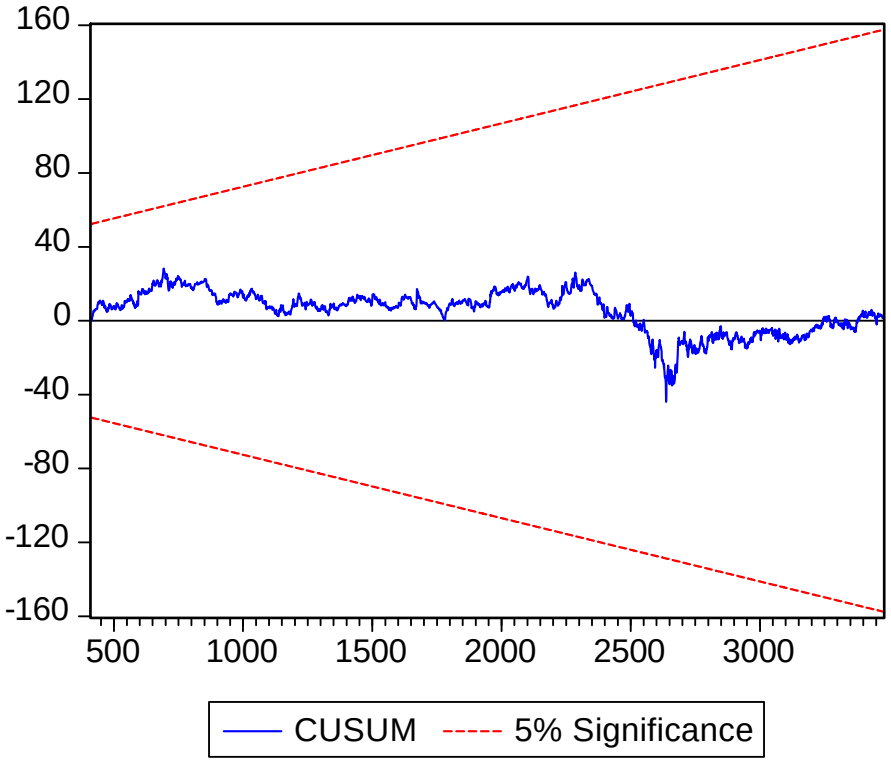


8. Kelda Group

Cumulative Sum of Squares of Recursive Residuals

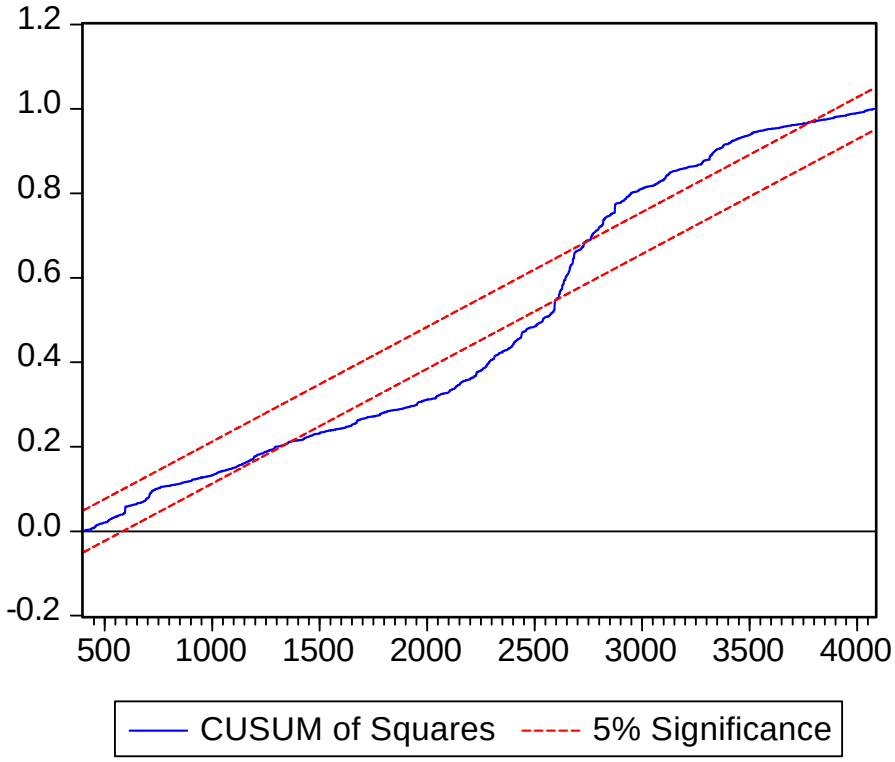


Cumulative Sum of Recursive Residuals



9. Severn Trent

Cumulative Sum of Squares of Recursive Residuals



Cumulative Sum of Recursive Residuals