

Comments on the document:

Beta analysis of British Telecommunications: Update
Brattle, June 2005

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July 18 2005



**Ofcom's approach to risk in the
assessment of the cost of capital**
Second consultation in relation to BT's equity beta

BT's response to the
Ofcom consultation document
published 23rd June 2005

Submitted to Ofcom 22nd July 2005

Annexes to main response

This document includes the following annexes referred to in BT's main response, written on behalf of BT by Professor Ian Cooper, London Business School:

Annex 1:
Comments on the Brattle Group document "Beta analysis of British Telecommunications: Update"

Annex 2:
Comments on the PwC document "Disaggregating BT's Beta"

This document is available electronically at <http://www.btplc.com/responses>

SUMMARY

This note is a review of the evidence and arguments given in the document *Beta analysis of British Telecommunications: Update* (June 2005, Brattle), which is an update of the earlier document *Financial Analysis of British Telecommunications* (February 2004, Brattle).

In 2004 Brattle's conclusion was that the best estimate of BT's equity beta was 1.29, based on one year of daily data. Both Ofcom and BT accepted this estimate. Estimates made using the Dimson adjustment and a world index were discounted. Brattle now recommends an estimate of 1.0 based on two years of daily data, and gives some weight to estimates made using the Dimson adjustment and a world index.

Brattle's new preference for a two-year window is partly based on statistical tests that are, in my opinion, biased. Brattle itself largely discounts them. It is also based on an intuitive examination of a chart of the development of estimates of BT's beta. This shows that the two-year estimate was stable until very recently at a level of 1.2-1.3. Brattle's preference for the two-year estimate comes from this period of stability. The justification for the change in Brattle's beta estimate comes entirely from a very recent period of very high instability in this estimate. I cannot see how a change based on a period of high instability can be justified by a period of stability that implies an entirely different value.

In my opinion, the very recent very rapid change in Brattle's estimate does not reflect a change in the fundamental risk of BT. There is strong evidence that it is a statistical artefact caused by outlier observations and heteroscedasticity. These econometric problems make beta estimates unreliable. They can explain why the two-year, one-year and six month estimates have all changed rapidly recently and give conflicting signals. They also invalidate the test on which Brattle bases its justification of the Dimson adjustment.

A summary of evidence on BT's beta in a form used by Ofcom is given in the Table below, whose details are given in section 7. It shows the prior belief of 1.3, which was the beta estimate used by Brattle, Ofcom and BT as recently as last year. Unless there have been significant identifiable changes in the fundamental risk of BT in the last year, this estimate should, in my opinion, still carry significant weight. In my opinion, there have been no such changes.

The table also shows current beta estimates based on one-year, two-year and six-month windows using daily data, the estimators examined by Brattle. It shows an estimate based on five years of monthly data. It also shows a range of estimates relative to a world index that have been estimated in a way that is, in my opinion, preferable to the procedure used by Brattle.

Summary of the evidence on BT's beta

<i>Estimated by</i>	<i>Data frequency</i>	<i>Index</i>	<i>Period</i>	<i>Estimate</i>
Prior belief				1.3
Updating evidence				
Cooper	Daily (One year)	UK	2004-05	1.1
Cooper	Daily (Two years)	UK	2003-05	0.9
Brattle	Daily (Six months)	UK	2004-05	1.4
LBS	Monthly	UK	2000-05	1.4
Cooper	Daily	World	2004-05	0.9-1.2

In my opinion, combined with the evidence of the unreliability of the recent estimates based on daily data, Table 2 shows what closer inspection of the evidence also shows: there is no strong evidence on which to base a significant revision of the earlier beta estimate of 1.3.

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1. Introduction

This note is a review of the evidence and arguments given in the document *Beta analysis of British Telecommunications: Update* (June 2005, Brattle), which is an update of the earlier document *Financial Analysis of British Telecommunications* (February 2004, Brattle).

The discussion in this note is limited to issues raised in these Brattle documents, and their use by Ofcom. It does not examine estimates of beta produced by other services, such as London Business School, Datastream, or Bloomberg.

2. Summary of Brattle's conclusions

In Brattle (2004), the conclusions were:

1. The best estimate of BT's equity beta in February 2004 was 1.29, based on daily data from the calendar year 2003, measured against the FTSE All Share index.
2. Betas measured against a World index had statistical problems that invalidated their use.
3. No Dimson adjustment for thin trading or the bid-ask spread was necessary.

Both Ofcom and BT accepted the estimate.

In Brattle (2005), the conclusions are:

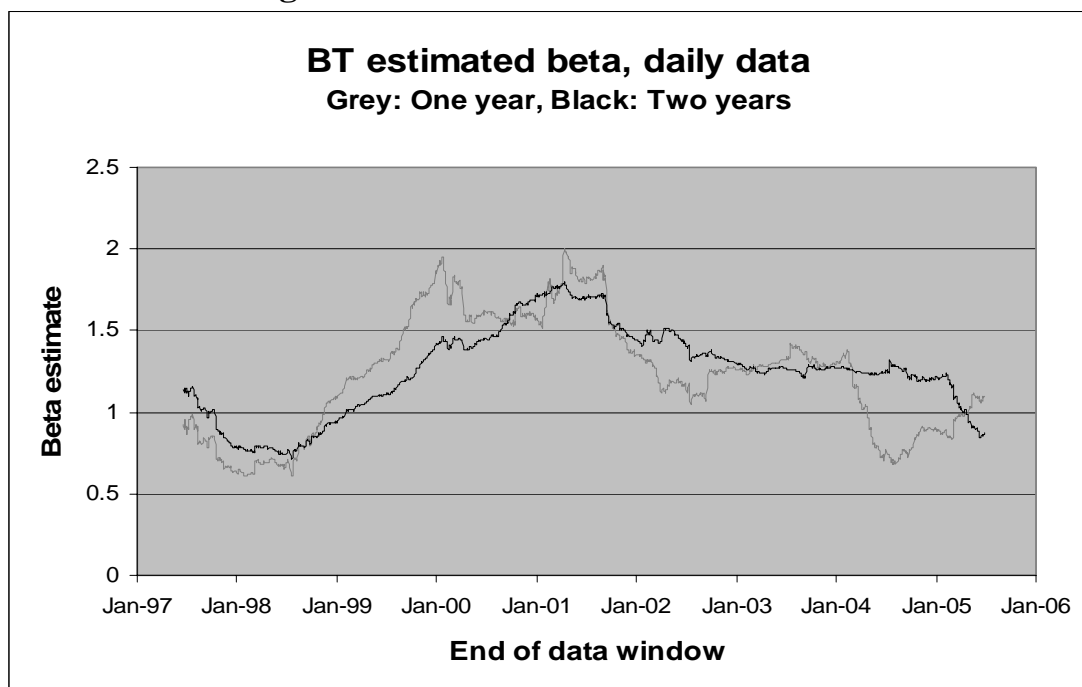
1. Betas measured against a World index have some, though limited, value.
2. The Dimson adjustment for thin trading and the bid-ask spread is significant and has some value.
3. The best data window for beta measured against the FTSE All Share Index is two years.
4. The range of possible beta estimates in June 2005 is 0.49-1.01.
5. No single estimate is given, although Brattle 'recommend(s) adopting an estimate at the top of the range'. This seems to imply a value of about 1.0.

Brattle's new conclusions are mainly based on betas measured relative to the FTSE All Share Index using daily data to 11/04/2005. First, I analyse these. Then I discuss the analysis of betas measured relative to a world index.

3. Updated estimates

Before examining Brattle's estimates, I update the evidence of how the beta estimates have evolved beyond the point where the data used by Brattle ends. Figure 1 below reproduces information in Figure 1 of Brattle (2005). It shows beta estimates for BT using one year and two-year windows of daily data. The data used by Brattle end at the point where the lines cross in April 2005.

Figure 1: BT beta estimates from 1997



In my opinion, the following features of this chart are important:

1. From 2002 until early 2004, both estimates indicated a beta of around 1.3.
2. In the recent past both estimates have behaved erratically. The one-year beta estimate has fallen and then risen rapidly while the two-year beta estimate has fallen rapidly in the very recent past.
3. The two-year beta estimate has tended to follow the one-year beta estimate with a lag.
4. Both estimates have been roughly equally volatile over the period.
5. The Brattle data ends coincidentally at the point when the two estimates are equal.

6. At the moment (using data to 4/7/2005) the one-year estimate is 1.10 and the two-year estimate is 0.88. Therefore, they are no longer equal, as at the end of the Brattle data.

Brattle also reports a beta estimate based on a six-month window, which is 1.38 at the end of its data period.

4. Brattle's choice of estimate

4.1 Introduction

In Brattle (2005), Brattle prefers a two-year window. This is a change from its preference in Brattle (2004) for a one-year window. The choice is based on three tests:

1. Tests of statistical difference in beta estimates for different periods.
2. Chow tests of structural stability in different periods.
3. Beta development graphs.

The first two are statistical tests. The third is an informal test.

4.2 Statistical tests

The test of statistical difference in betas appears to indicate that the latest six months of data has a higher beta than the prior six months. No other tests of differences in beta show any significance. In my opinion, if this test is taken at face value, it indicates that the most recent six-month beta estimate of 1.38 should be given higher weight in any estimate, because it appears to have increased significantly over earlier periods.¹ In contrast, Brattle interprets the test as indicating that the two-year beta should be used. It is not clear to me how it draws this inference from this test. If the latest six months is statistically different from the prior six months, the two periods should not be pooled together, whether it is within a two-year window or any other.

Brattle discounts the second of the tests, the Chow test, on the grounds that it can be misleading unless there are *a priori* grounds for the choice of the break point between periods. According to the econometric

¹ Brattle discounts this change on the grounds that it simply represents 'statistical noise'. However, the point of tests of structural stability is to distinguish changes in parameters from changes caused by noise. The fact that an estimate based on a six-month window is noisier than one based on a longer window is taken into account in such a test. Although Brattle discounts the results of this test in Brattle (2005), Brattle (2004) uses the result of a similar test to justify the choice of a one-year window.

authority cited by Brattle, this also applies to the test of statistical difference in betas used by Brattle, which is a special case of the Chow test. The conclusion of this authority is stronger than that given by Brattle:

‘..in some applications the timing of the break may be unknown. The Chow and Wald tests become useless at this point.’²

The estimation of BT’s beta is a case where the timing of the structural break is unknown.

My interpretation of both of these tests is different to Brattle’s. I agree with Brattle that the lack of any *a priori* grounds for the choice of break points gives a chance of the Chow test finding spurious results. In my opinion, this also applies to the test of statistical difference in betas. There is another problem that can bias both tests. The tests assume that the regression residuals satisfy standard assumptions. In particular they require that the residuals are normally distributed. A test of the data used by Brattle indicates that they are not.³ The problem with non-normality of daily stock returns is well known (Campbell et al (1997)). Even apart from the problem with identifying the break point, this deviation from normality invalidates the tests of stability performed by Brattle.

In conclusion, in my opinion there is no reason, based on the statistical tests performed by Brattle, to prefer a particular length of data window to any other. The lack of any *a priori* reason for the choice of periods is acknowledged by Brattle to cause a problem with the Chow test. It causes the same problem with the test of beta stability. In addition, the regression residuals are not normally distributed, which invalidates the tests performed by Brattle. I cannot see any reason, based on the statistical tests presented by Brattle, to change from a one-year window to a two-year window.

If one does take the tests at face value, they appear to indicate that the most recent six months of data should be given greater weight than previous periods, because the tests indicate a structural break six months ago. This would mean that the beta estimate of 1.38 during that period

² Greene (2003) page 139.

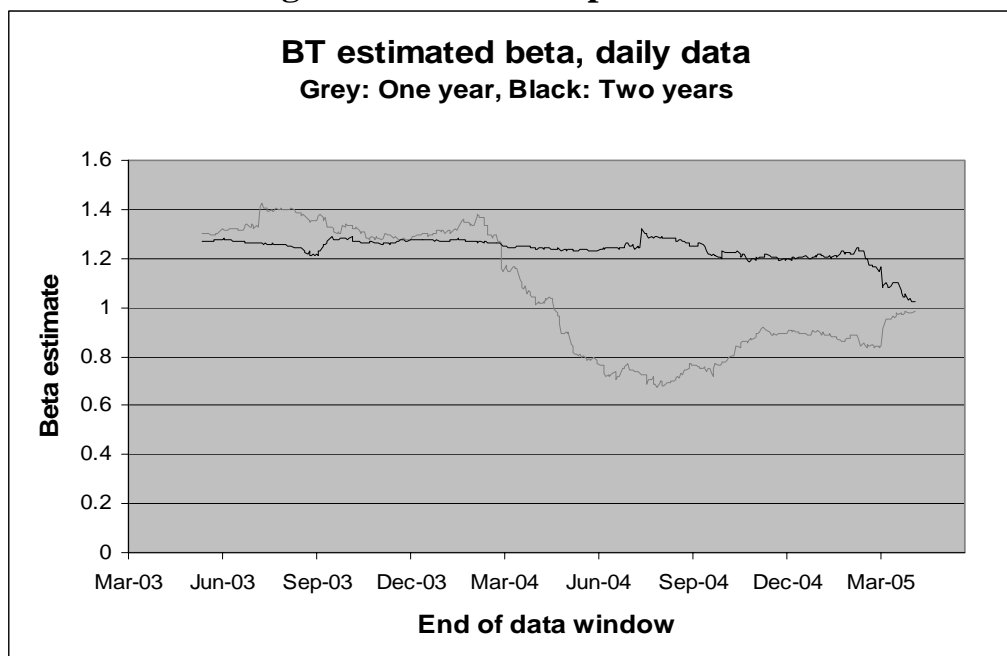
³ In particular, the two-year regression to 11/04/2005 favoured by Brattle has three observations with standardised residuals greater than 4, and five more greater than 3. Each of these has a very small chance of being generated by a normal distribution. Collectively, there is zero chance that they come from such a distribution. More formal tests based on the kurtosis of the residuals and the Bera-Jarque statistic confirm this.

should be given higher weight. However, my own interpretation of both tests is that the deviation from normality and lack of exogenous dating of the structural break invalidates the results of the tests, so that nothing can be concluded from them regarding the best choice of the window with which to estimate the BT beta.

4.3 Beta development chart

Brattle's preference for a two-year window is also based on graphical evidence that the two-year is 'the most stable of the estimates'. The evidence given by Brattle is reproduced in Figure 2, which is a subset of Figure 1.

Figure 2: Beta development chart



According to Brattle, Figure 2 'confirms that the two-year estimate is the most stable of the estimates'⁴. In my opinion, this is not true in any sense that is relevant to the estimation of the beta of BT going forward, for the following reasons:

1. The stability does not apply in the most recent period. In particular, the estimate has fallen from 1.2 to 1.0 over the space of two months. This is a huge change in beta in such a short time that is unlikely to be related to any fundamental change in BT over that period. The most recent estimate, which Brattle advocates, comes from a period of highly unstable estimates.

⁴ Brattle (2005) page 10.

2. In the very recent past, the two-year estimate has been changing faster than the one-year estimate, and so is less stable in that sense.
3. The two-year estimate is falling, whereas the one-year estimate is rising. In the past, the one-year estimate has been the better indicator of trends. The six-month estimate is also rising and, according to Brattle's analysis, is statistically significantly higher in the last six months.
4. Figure 2 starts, coincidentally, at the beginning of a period of abnormal stability of the two-year estimate. The more complete picture in Figure 1 does not indicate similar stability.
5. Points (1)-(4) above were known at the time of the Brattle analysis. In addition, changes that have occurred beyond the data period used by Brattle confirm both the instability of the two-year estimate and the continued divergence in trend from the one-year estimate.

I cannot understand the logic of the Brattle position. It seems to be that the use of a two-year estimate is justified by the fact that it was stable between April 2003 and late February 2005. In this stable period, until late February 2005, the procedure now favoured by Brattle would have given an estimate in the range 1.2-1.3.

This stability has clearly ended. The large revision that Brattle wants to make to its estimate, from 1.3 to 1.0, cannot be justified by that period of stability. If the period of stability is used, the estimate should be somewhere between 1.2 and 1.3. The lowering of the estimate can be justified only by the recent period of instability. It is difficult to see how a change in beta arising entirely from a short period of high instability is justified on the basis of a period of stability that has ended.

To put the current instability of the beta estimate in perspective, between 11 February and 11 April 2005 the two-year beta estimate has fallen by 0.2. These two estimation periods share 22 months of data. Only two months differ between them. Changing less than ten percent of the data on which the estimate is based changes the estimate by twenty percent. This level of instability indicates severe estimation problems.

In my opinion, Figure 2 indicates a conclusion that is entirely different to that reached by Brattle. It is that no judgement can be made about the relative merits of the different beta estimates until the reasons for their recent rapid change and conflicting signals are understood. Brattle does not present such an explanation. It does, however, mention issues that, for reasons given below, I believe to be central to the problem.

5. The recent change in estimates of BT's beta: Change in fundamental risk or statistical artefact?

5.1 Is it a change in fundamental risk?

Brattle has changed its estimate of BT's beta on the basis of the recent large change in the two-year estimate. This assumes that that a change of more than 0.2 has been generated by a change in the fundamental risk of BT in the last two months. In my opinion, this is highly implausible. Brattle does not present any analysis of what might have caused such a large change, and there is nothing about BT of which I am aware that could have generated such an effect. BT has not changed its business mix significantly in this period, and any change in capital structure is much too small to have generated such a large change in beta in such a short period of time.

5.2 Could it be a statistical artefact?

An alternative explanation is that the changes in the beta estimates are an artefact of the data used to estimate beta in the recent period. Possible statistical causes are non-normality of the residuals, discussed above, and heteroscedasticity (changing volatility).

Non-normality in beta residuals is usually caused by the presence of large 'outliers' in the data. Such outliers mean that standard beta estimates suffer from the following problems:⁵

1. Estimates produced using standard beta estimation techniques are unreliable, and can change rapidly over very short periods of time when there is no change in fundamental risk.
2. The accuracy of beta estimates, as measured by standard errors, is exaggerated.
3. Standard tests of statistical significance, such as the test of differences in betas, Chow test, and test of significance of the Dimson estimators, are invalid. They may find significance when none is actually present.

⁵ See Judge et al (1988) section 22.1. The estimates do still have some useful properties, such as being the best linear unbiased estimators, but the accuracy of the estimates and their distribution are difficult to assess, especially some data may come from a distribution that has an infinite variance. Judge et al (1988, section 22.1.2) suggest that this is a particular problem for financial market data. In addition, when the independent variable in the regression is random, as in a beta regression, there can be other related problems.

In my opinion, the beta regressions used by Brattle suffer from these problems caused by non-normal data with outliers. As I discuss below, I believe that this problem is greatest with the recent data.

A related problem is heteroscedasticity. This was extensively analysed in Brattle (2004) as part of its selection of the estimation procedure. No such analysis is presented in Brattle (2005), although heteroscedasticity is mentioned to justify the choice of estimation procedure for the world beta, which is discussed below. Heteroscedasticity can cause similar problems to non-normality. With heteroscedasticity, the standard regression method is not the best way to estimate beta, and measures of accuracy, such as standard errors, are unreliable.⁶ I show below that the period used by Brattle to draw inferences about BT's beta suffers from severe heteroscedasticity.

In my opinion, problems with outliers and heteroscedasticity fully explain the recent instability in beta estimates and the conflicting signals from the estimates based on different length windows. I now discuss the evidence for this, and the implications for the estimation of BT's true beta.

5.3 The reason for recent instability in estimates of BT's beta

It is relatively simple to understand some aspects of the recent behaviour of estimates of BT's beta. This is made easier by presenting the estimates in a different way. Figure 3 shows the same data as in Figure 1, but with the estimates dated by the date that the estimation period begins, rather than when it ends. Now there is a clear pattern that shows:

1. If the data period starts after early 2003, both estimates behave erratically.
2. Both estimates 'drop off a cliff' starting in early 2003.
3. Both estimates behave almost identically from the start of 2001 onwards, the period that Brattle says justifies using the two-year rather than the one-year estimate.

Presented in this way, there is no reason to prefer one estimate to the other. Both are highly unstable in the recent past. The only difference is that the one-year estimate appears to pick up a recent rise that reverses the fall in the estimates that occurred starting in early 2003. This is consistent with the evidence that the one-year beta appears to pick up trends in the

⁶ See Judge et al (1988) Chapter 9. In addition, since the independent variable in a beta regression is stochastic, there may be other problems related to the problems with outliers and heteroscedasticity that are related to this.

estimates quicker than the two-year beta, and with the fact that the six-month beta shows a recent increase.

Figure 3: Beta estimates relative to the start of the estimation period

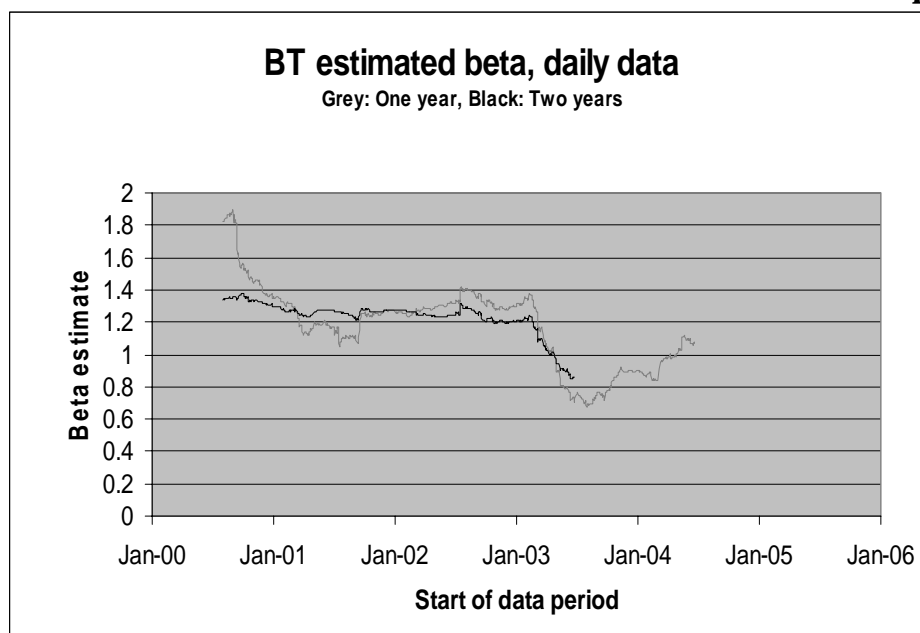


Figure 4: The volatility of the UK stock market

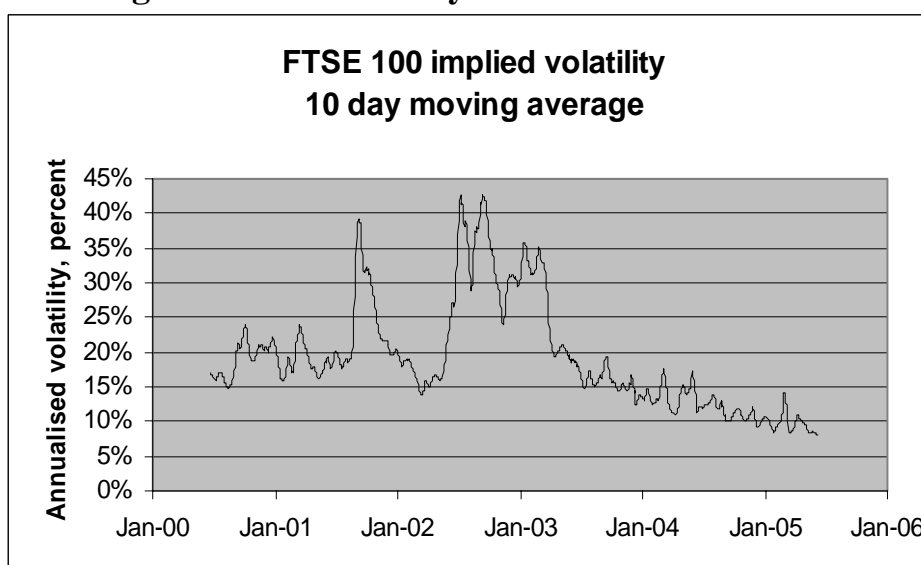


Figure 4 shows that the changes in the estimates are related to heteroscedasticity. One test for heteroscedasticity in Brattle (2004) is an examination of the volatility of the market index. Figure 4 presents a measure of this volatility. It shows the implied volatility of FTSE 100 index options. There are three periods of different volatility behaviour:

1. A period of volatility of about 20% up to mid-2001.
2. A period of high and erratic volatility up to early 2003.

3. A period of low and declining volatility after early 2003.

As a benchmark against which to judge these volatility levels, the average volatility of the UK market index over the last hundred years has been twenty percent, and this is generally considered a typical level of volatility for an equity market index.⁷

The juxtaposition of Figures 3 and 4 shows that the instability in beta estimates has occurred during the period of abnormally low market volatility after early 2003. The estimates become highly unstable if the data period used starts beyond early 2003, just as market volatility falls to levels well below its historical average. This is true for both the one-year and two-year estimates.

The relationship between the volatility of the stock market and the instability of beta estimates can be seen in Figure 5. This shows, on the right, the beta regression on which Brattle bases its estimate of 1.0 using two years of data to 11 April 2005. On the left is a beta estimate from two months earlier that includes only a little of the period of higher volatility before April 2003. Both graphs have the same scales on their axes and are presented so that a 45-degree line represents a beta of one. The data in the two graphs have considerable overlap, since they share twenty-two months of data.

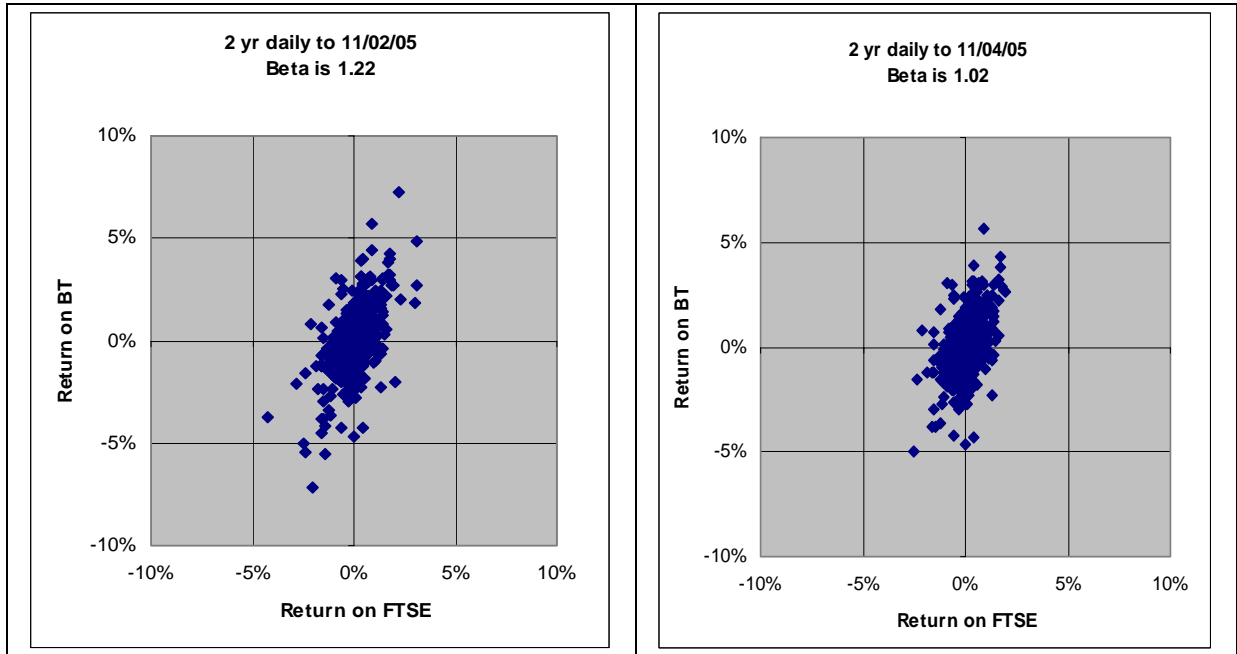
From examination of these graphs, the following points are apparent:

1. The left-hand graph has a wider range for the market return and, therefore, potentially carries more information about beta.
2. The dense clustering of the points in the right-hand side graph makes it difficult to estimate the beta. In particular, the lack of any degree of variation in the market return makes the regression uninformative about the beta.
3. Both graphs have outliers, so neither regression satisfies the standard regression assumptions.

In my opinion, both graphs look intuitively as though the beta is above one. However, the statistical estimate of beta for the period ending in April is only 1.02. The reason for this beta that is lower than the data visually suggest is the influence of the outliers. Standard regression analysis gives outliers a heavy weighting.

⁷ Dimson et al (2005) Table 5.

Figure 5: Two-year beta regressions ending in January and April 2005



The influence of outliers is unpredictable. Sometimes they increase beta estimates, sometimes decrease them. The main effect they have is to make estimates volatile and unreliable. When this is combined with a period of low market volatility, which makes beta estimates relatively uninformative anyway, it can create exactly the type of behaviour seen in the recent estimates of the BT beta. This behaviour can occur even when the true beta is constant, because it is not related to changes in the actual beta. It is simply an artefact of data that is uninformative about the true beta, combined with the presence of outliers.⁸

There is no standard way around this problem.⁹ One practical solution that is sometimes used is to base the estimate on monthly data, which generally suffers less from the outlier problem. Ofcom reports an estimate of 1.4 using this approach. The other way is to form a judgement about which estimates based on daily data are the most informative about the true beta of BT and weight the evidence accordingly. I now discuss this approach.¹⁰

⁸ The uninformativeness of the beta regression is difficult to measure formally, because the presence of outliers invalidates standard estimates such as standard errors. However, the problem should be intuitively clear from Figure 5.

⁹ See, for instance, Judge et al (1988) chapter 22.

¹⁰ More sophisticated methods of dealing with heteroscedasticity and outliers are given in Schwert and Seguin (1990) Campbell et al (1997) and Berglund and Knif (1999). However, these techniques are

6. Which estimates should receive more weight?

6.1 Introduction

Until recently there seemed to be little controversy about using an equity beta of 1.3 for BT. The issue of whether this should be lowered to 1.0, as Brattle advocates, or to 1.1, as Ofcom suggests, depends on how much weight one gives evidence from the recent period of unstable and conflicting beta estimates.¹¹

Brattle bases its conclusion primarily on the estimate of 1.01 for the two-year window ending in April 2005. This, effectively, gives a hundred percent weight to that estimate and a weight of zero to the previous estimate of 1.3 that was used as recently as September 2004.¹² The Brattle position essentially amounts to saying that the right-hand panel of Figure 5 represents convincing evidence that the beta has fallen by more than 0.2 from its earlier estimate of 1.29.

This fall has, apparently, happened entirely within the space of two months represented by the difference between the left-hand and right-hand panels of Figure 5. Until 11 February 2005, the two-year beta estimate, which Brattle now favours, was still above 1.2 and would not represent evidence for a reduction of the earlier estimate.

In my opinion, the reduction of the beta estimate proposed by Brattle is justified only if:

1. These recent estimates are indicative of a change in the fundamental beta of BT, rather than econometric problems.
2. It is the two-year estimate that should be given most weight, rather than the one-year or six-month estimate.
3. Beta estimates produced during a period of abnormally low market volatility that suffer from problems with heteroscedasticity and outliers are highly informative.
4. The period of low market volatility that has produced the estimates will persist.

I now give my opinion on each of these issues.

typically aimed at dealing with the estimation for a large number of shares. For an individual share, such as BT, close examination of the data is probably as good.

¹¹ Adjusting beta estimates by giving lower weights to periods of abnormal behaviour is a practical solution to a complex problem. See, for instance, Franks (1995).

¹² Ofcom (2004).

6.2 Is there a change in fundamental risk?

In my opinion, these recent estimates should not be taken as indicative of a change in the fundamental beta of BT because:

1. There is no indication that they are related to fundamental factors such as changes in BT's operations or gearing.
2. They can be easily explained by econometric problems arising from outliers and heteroscedasticity.

6.3 Should the two-year estimate be given the highest weight?

In my opinion, even if they are given weight, it is not the two-year estimate that should be given the highest weight because:

1. The estimates are volatile, indicating unreliability. The period of stability of the two-year estimate is over.
2. The signals they give are conflicting. The one-year estimate is now 1.1 and increasing rapidly. The six-month estimate is, according to Brattle, 1.4 and statistically significantly higher than earlier estimates. The two-year estimate is 0.9 and falling rapidly.
3. In the past the one-year and six month estimates have been better indicators of trends than the two-year estimates.
4. The reasons given by Brattle for preferring the two-year estimate are not valid.

6.4 Are recent beta estimates highly informative?

In my opinion, the econometric problems produced by the combination of factors that affect recent beta estimates based on daily data for BT make them unreliable because:

1. The lack of market volatility reduces the informativeness of the beta estimate.
2. Heteroscedasticity raises complex problems of estimation.
3. Outliers make the estimates unreliable.

6.5 Will the period of low volatility persist?

In my opinion, even if these estimates are given weight and the two-year estimate is preferred, the weight should be low because periods of low volatility tend not to persist.

The current market volatility of below ten percent is remarkably low by historical standards. The behaviour of equity market volatility has been extensively studied. All studies of market volatility of which I am aware show that periods of abnormally low volatility do not persist very long. Volatility reverts to its long-run mean quite quickly, on average. An estimate of the speed of this mean-reversion is given in Dimson and Marsh (1990). They suggest that the best future forecast of market volatility is obtained by assuming that the current level moves back half the way to its long-run average over a quarter of a year. This would take the expected future volatility almost back to its long-run average over the space of a year. Franks and Schwartz (1991) find even faster reversion to the mean. Thus a beta estimate that is low because of low market volatility would not be a valid forecast of the future beta over any horizon longer than a year.

6.6 My weighting of the evidence

For the reasons given above, I would give the very recent estimates low weight and maintain an estimate close to its previous value of 1.3.

7. Other estimates

7.1 Introduction

Brattle also presents other estimates, based on the Dimson adjustment and a world index. Both of these are lower than its final estimate of 1.01. On this basis it says that its estimate is ‘at the top of the suggested range’. This raises the question of whether the Dimson and world betas should be taken as evidence of a lower true beta.

7.2 Dimson estimates

The Dimson method is used primarily to adjust for thin trading biases, biases induced by trading costs or, when international data are used, for differences in the opening times of markets. Brattle estimates Dimson adjustments for one day and two day leads and lags and finds that the one-day adjustment is insignificant, the two-year lead is insignificant, the two-year lag is insignificant for one year of data, but the two-year lag is significant for two years of data.

In my opinion, this is almost certainly an artefact of the data and should be ignored because:

1. There is no *a priori* reason for using the Dimson adjustment for a highly traded share such as BT.
2. If there were some thin trading or bid-ask spread problem it should show up at one-day lag rather than two days lag.
3. The problems with outliers in the data can easily cause spurious results of the type found by Brattle. Brattle says that the Dimson adjustment becomes significant only in the last two months of data, which is when these problems are greatest.
4. The problems with outliers in the data invalidate the test used by Brattle to justify the inclusion of the Dimson adjustment.
5. The Dimson adjustment estimated by Brattle is much larger than can be justified by thin trading problems for a share like BT.

Therefore, in my opinion, the analysis of the Dimson-adjusted betas should receive no weight.

7.3 World beta estimates

Brattle also presents an estimate based on one year of daily data using a world index. This is 0.49. It is based on year of daily data for the FTSE All World index denominated in dollars, converted into sterling using the dollar/sterling exchange rate. It does not include the Dimson adjustment.

In my opinion, the method used by Brattle to estimate the world beta is potentially misleading. Standard international capital asset pricing theory says that the world beta should be estimated in a way that excludes some effects of currency variation.¹³ One way to do this is to include the change in currency rates in the regression. Another is to use a global index that represents the return to a portfolio hedged against currency risk, such as the MSCI index. If one does the former by including the dollar pound exchange rate return in the Brattle estimation of the BT world beta, it rises to 0.95. If one uses the MSCI global index as the world index and includes the Dimson adjustment, the estimate is 1.18.¹⁴ In my opinion, this is the best estimate based on simple analysis.

In my opinion, the Brattle estimate of 0.49 for the world beta is based on a misspecified regression. In my opinion, the world beta, if estimated

¹³ See, for instance, Adler and Dumas (1983). The intuitive reason is that the global capital asset pricing model assumes that all investors must view beta as being the same. Therefore, the measurement of beta cannot differ according to the currency perspective of the investor. Thus, although one can measure beta from any currency perspective, the inclusion of currency returns in the beta estimation means that one will get the same estimate regardless of this.

¹⁴ Brattle (2002) advocates the use of the Dimson adjustment when dealing with international data.

correctly, is much higher. A simple estimation technique gives an estimate of 1.18. This is similar to the domestic beta before the recent period of estimate instability. If this estimate of the world beta were used in an international capital asset pricing model, the equity market risk premium would also have to be re-estimated.

7.4 Other estimates: Conclusions

Brattle also presents other estimates, based on the Dimson adjustment and a world index. Both of these are lower than its final estimate of 1.0. In my opinion, there are no theoretical or empirical grounds for including the Dimson adjustment for BT. In my opinion, the Brattle estimation of the world beta is misspecified. A more correct specification gives an estimate of 1.2.

8. The use of the estimate by Ofcom

Brattle concludes strongly that daily data should be used. In contrast, PwC (2005) uses weekly data as its preferred choice for the analysis of BT's beta. Brattle prefers a two-year window and PwC a one-year window. PwC also appears to estimate its world betas differently to Brattle. These are further illustrations that the choice of weighting to give different beta estimates is not clear. It is difficult to see how one choice can be optimal for one calculation and the other for another, when both are in the context of trying to estimate the true beta of all or part of the BT business. When the two estimates are combined, the property of the resulting estimate is unclear. In addition, the fall in the recent estimate of BT's beta is used by Brattle to adjust its own estimate downward. However, PwC attributes changes in beta estimates to changes in the business mix of BT. It estimates an adjustment to take account of this. Care must be taken that the adjustments proposed by Brattle and PwC are not, at least partially, adjustments for the same thing.

Ofcom summarises the evidence on beta in a table that is reproduced as Table 1 below. There are several noteworthy features of this table:

1. It mixes a high beta that has been adjusted downwards towards one to make it an optimal forecast (the LBS beta), with low betas that have had no similar upward adjustment.
2. It reports the Brattle estimates as though they are based on one year of data for 2004-2005 and are, therefore, simply updates of earlier estimates based on one year of data. In fact, they are based on two

years of data for 2003-2005 and represent a change in estimation method as well as updating.

3. It contains no reference to Ofcom's prior estimate of 1.3.
4. It gives equal prominence to four estimates, two of which (the Dimson adjusted beta and the world beta) Brattle itself discounts.

Table 1: Ofcom's summary of the evidence on BT's beta

<i>Estimated by</i>	<i>Data frequency</i>	<i>Index</i>	<i>Period</i>	<i>Estimate</i>
Brattle	Daily	UK	2004-05	1.0
Brattle	Daily (+Dimson)	UK	2004-05	0.6
LBS	Monthly	UK	2000-05	1.4
Brattle	Daily	World	2004-05	c. 0.5

Table 2 gives an alternative representation of the evidence in the form used by Ofcom. It includes the prior estimate, which apparently represented Brattle and Ofcom's view of BT's beta until quite recently. Unless there have been significant identifiable changes in the fundamental risk of BT in the last year, this estimate should, in my opinion, still carry significant weight. In my opinion, there have been no such changes.

Table 2: Alternative summary of the evidence on BT's beta

<i>Estimated by</i>	<i>Data frequency</i>	<i>Index</i>	<i>Period</i>	<i>Estimate</i>
Prior belief				1.3
Updating evidence				
Cooper	Daily (One year)*	UK	2004-05	1.1
Cooper	Daily (Two years)*	UK	2003-05	0.9
Brattle	Daily (Six months)	UK	2004-05	1.4
LBS**	Monthly	UK	2000-05	1.4
Cooper	Daily	World	2004-05	0.9-1.2

*Data to 4/7/2005. **After Bayesian adjustment.

Table 2 does not include the Dimson adjustment in the domestic beta because this adjustment is, in my opinion, unjustifiable. The world beta is estimated including what is, in my opinion, a more correct treatment of currency. The one-year and two-year daily estimates use the most recent data available to me, and so are slightly different from Brattle's. I have

not been able to replicate Brattle's six-month estimate, so that is included rather than a six-month estimate by me.

In my opinion, combined with the evidence of the unreliability of the recent estimates based on daily data, Table 2 shows what inspection of Figures (3)-(5) also shows, that there is no strong evidence on which to base a significant revision of the earlier beta estimate of 1.3.

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