Three's response to Ofcom's Annual Licence Fees for 900MHz and 1800MHz spectrum consultation: Correction.

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Correction to statistical comparison of accuracy of different estimation methods.

In Annex E of Three's response to Ofcom's Annual Licence Fees consultation, Three presented a statistical comparison of Ofcom's (and Three's) various methods for estimating the lump sum value of 1800MHz spectrum.

Following submission of our response, Three would like to correct our calculation of the absolute error of the Ofcom relative method approach.

We previously underestimated the average absolute error for Ofcom's relative method.

As noted in our consultation response, Ofcom's relative method produces up to two estimates of the 1800MHz value for each of the benchmark countries, namely applying the two average relative ratios (1800:800 and 1800:2600) across the group of benchmark countries to either the benchmark country 800MHz or 2600MHz value as appropriate.[1]

In order to evaluate the predictive power of the Ofcom relative method, for our consultation response, we calculated a single estimate of 1800MHz value by taking the simple average of the two individual 1800MHz value estimates described above[2].

Upon reflection, Three considers that this second step (of calculating a single estimate of 1800MHz value in each of the benchmark countries) was unnecessary and inconsistent with the approach Ofcom has taken to the use of relative ratios. This is because Ofcom did not take an average of values implied by the two relative ratios, but rather used the implied values in isolation.

Therefore, a correct test of the predictive power of the Ofcom relative method requires the calculation of two 1800MHz values in the benchmark countries using the two respective ratios, and calculating the absolute error of each of these estimates. The average absolute error is then calculated by taking the average of all these absolute errors.

The table below presents the relevant 1800MHz estimates presented in Table 12 of our Consultation Response, and the corrected average absolute error of the Ofcom relative method:

[1] In Greece and Ireland there have not been 2600MHz auctions so the Ofcom relative method produces a single estimate of 1800MHz value in these countries (i.e. using the benchmark country 800MHz value) rather than two estimates.
[2] Or single 1800MHz value estimate in the case of Greece and Ireland.

Table 1: Ofcom relative estimates of benchmark country 1800MHz values (UK-normalized, in £m/MHz).

Country	B_{OR1i}	B_{OR2i}
Austria	20.9	7.8
Czech Republic	14.0	12.1
Germany	16.5	6.5
Greece	10.3	-
Ireland	19.3	-
Italy	15.9	15.1
Portugal	11.9	10.4
Romania	7.2	10.8
Sweden	4.7	41.8
Switzerland	3.1	14.7
Average absolute error of Ofcom relative method	**8.9**	

Source: Three.

The adjustment to this calculation results in an increase in the absolute error of the Ofcom relative method from 7.9 to 8.9. Our updated summary table (Tables 6 and 20 in our main response) is presented below:

Table 2: Observed spectrum values (UK-normalized, in £m/MHz)

Method	Standard deviation of UK estimates	Average absolute error of sample estimates
Ofcom absolute method	10.8	8.5
Ofcom combination of UK values method	NA	10.6
Ofcom relative method	22.7	**8.9**
Corrected relative method	16.0	6.7
Distance method	5.1	7.0

Source: Three.

Conclusion: Ofcom should use an estimation method with a low standard deviation and low estimation error.

Our corrected analysis of the predictive power of the Ofcom relative method results in an increase in its average absolute error. The implication of this is that the method has a lower level of accuracy than our initial consultation response indicated. As a result of this, the difference in accuracy of the Ofcom relative method to both the corrected relative method and the distance estimation methods becomes more material.

In combination, the two statistics presented above highlight that the distance method performs much better than any of the alternative methods.

Indeed, the average absolute error is a direct test of the accuracy of the respective methods. Clearly, the more accurate the estimation method the better (everything else being equal), hence the lower absolute errors of the distance and corrected relative methods indicate that these are preferable to Ofcom's absolute, relative and combinations of values methods.

In addition, a method that generates a lower standard deviation is preferable to one that yields a wider spread of values, even if their predictive power is the same.

The standard deviation of the UK estimates for each method indicates how far the estimates are from the average of those estimates. A higher standard deviation indicates that the individual estimates tend to be further away from the mean. A higher standard deviation can be interpreted as indicating that there is a lower level of certainty that the mean of the group of estimates is the true mean of distribution.

Accordingly, the lower standard deviation of the distance method and corrected relative methods is an indication that there is a greater level of certainty around the mean UK estimates that those two methods give.

This can be seen when considering how, in general, the wider the spread of values generated by a method, the more sensitive the final 1800MHz value will be to:

- the classification of individual UK 1800MHz estimates as more or less important;
- the weights attached to the more and less important evidence; and
- the inclusion or exclusion of individual countries or benchmark values from the overall sample – for instance, removing estimates from a sample with a wide range of values (as Ofcom has effectively done by only using a limited number of the relative ratio implied UK values) can significantly affect the resulting overall estimate of 1800MHz value.