Three's Response to Ofcom's Consultation on Annual Licence Fees for 900MHz and 1800MHz spectrum.

Non-confidential

17 August 2018

Three.co.uk

Executive Summary.

Three welcomes the opportunity to respond to Ofcom's consultation on 900MHz and 1800MHz Annual Licence Fees ("ALFs").

We consider that Ofcom has overestimated ALFs at full market value following Steps 1 to 3 of its assessment by:

- Failing to take due account of the impact of recent market developments on the value of 800MHz and 2.6GHz spectrum;
- Incorrectly interpreting evidence on international benchmarks of market value; and
- Erring in its annualization of the lump-sum market value of 900MHz and 1800MHz spectrum.

These errors demonstrate that Ofcom's ALFs must be sufficiently above what could reasonably be regarded as market value and/or that Ofcom has failed to objectively justify the basis on which it exercises its regulatory judgment to reach its proposed valuations.

In Step 4 of its methodology Ofcom then concludes that setting ALFs at full market value will promote its statutory duties, and that there is no harm to consumers or investment which needs to be weighed against the benefits of more efficient use of spectrum.[1] Therefore, Ofcom proposes to make no modification to the ALFs set at full market value in its previous steps.

However, Ofcom's conclusion only follows from its presumption that MNOs may be less responsive to the opportunity cost of holding spectrum than to ALFs set at market value.

In effect, Ofcom has taken the view that, unless it intervenes by setting ALFs at full market value, there is a risk that mobile prices, investment decisions by MNOs and their use of 900MHz and 1800MHz spectrum may be inefficient and may not reflect the true cost of that spectrum to society.

Ofcom's presumption is based on unreliable evidence. 900MHz and 1800MHz licences have been tradable since 2011. The generally accepted view of economists is that MNOs will be fully responsive to the opportunity cost of holding tradable spectrum. If MNOs do take full account of opportunity cost, ALFs will be at best redundant (i.e. if set at

[1] Para 5.17 and 5.61

or below full market value) and at worst they can have a detrimental impact on Ofcom's statutory duties (i.e. if set inadvertently above market value).

In the absence of reliable evidence to support its presumption, Ofcom has failed to explain how its provisional conclusion that no modification under Step 4 is required fulfils its statutory duties. Therefore, Ofcom has simply failed to show that its provisional conclusion fulfils its statutory duties. The only option available to Ofcom to remedy this fundamental flaw in its consultation process is to re-consult.

Moreover, Ofcom has a statutory duty to ensure the widespread availability of mobile services throughout the UK. Ofcom has made improving mobile reception a national priority and aims to work closely with DCMS to "*explore every available solution*". Ofcom believes that near ubiquitous mobile coverage would cost up to £6bn, and that the best approach is to contract a single operator to build and operate masts for other MNOs to use.

From Three's perspective, there in an obvious available solution but it requires Ofcom to be more flexible in its approach to ALFs. It seems to us entirely possible to use ALFs to fund the required improvements in mobile coverage in a way that does not distort economic incentives or discriminate.

Contents.

1. Ofcom has not carried out a proper assessment of the level of ALFs in light of its statutory duties.

This section sets out our analysis of the impact of ALFs set at full market value on optimal use of 900MHz and 1800MHz licences, consumer prices, investment and competition. This is Step 4 of Ofcom's analysis. We conclude that:

- Ofcom has failed to show how setting ALFs at full market value promotes optimal use of 900MHz and 1800MHz spectrum;
- Ofcom's assessment of the impact of ALFs at full market value on consumer prices ignores material considerations;
- Ofcom should consider the role of ALFs in promoting investment in mobile coverage and competition in harder to reach areas.

Ofcom has failed to show how setting ALFs at full market value promotes optimal use of 900MHz and 1800MHz spectrum

Ofcom concludes that setting ALFs at full market value will promote optimal use of spectrum. However, this conclusion only follows from Ofcom's view that MNOs may be less responsive to the opportunity cost of holding tradable spectrum than to ALFs set at full market value.

However, the (scant) evidence Ofcom has presented in support of this view is unreliable. In summary, Ofcom has not appropriately considered the impact of ALFs at full market value on optimal use, so its provisional conclusion cannot stand:

- ALFs can promote optimal use of spectrum only if MNOs are not responsive to the opportunity cost of holding tradable spectrum;
- If MNOs are fully responsive to the opportunity cost of holding tradable spectrum, ALFs are at best redundant and at worst can be detrimental to the optimal use of spectrum;
- Ofcom has relied upon seriously flawed evidence to conclude that MNOs are not fully responsive to opportunity cost;
- Conclusion: Ofcom needs to evidence its view that MNOs are more responsive to ALFs set at full market value than to opportunity cost.

i. ALFs can promote optimal use of spectrum only if MNOs are not responsive to the opportunity cost of holding tradable spectrum

The consultation refers to Ofcom's 2010 Strategic Review of Spectrum Pricing ("the 2010 Review") as the source of its spectrum pricing policy. In that review, Ofcom interpreted its duty to secure the optimal use of spectrum. Ofcom considered that optimal use is more likely to be secured if spectrum is allocated and assigned to those uses and users that will provide the greatest benefits to society. [2]

Ofcom explained that, "*in the commercial sector, the users and uses that can generate the greatest benefit to society are normally those who value spectrum more highly. The fact that they are prepared to pay the highest price for spectrum normally indicates their ability to use it more productively in order to satisfy commercial demand for downstream services*".

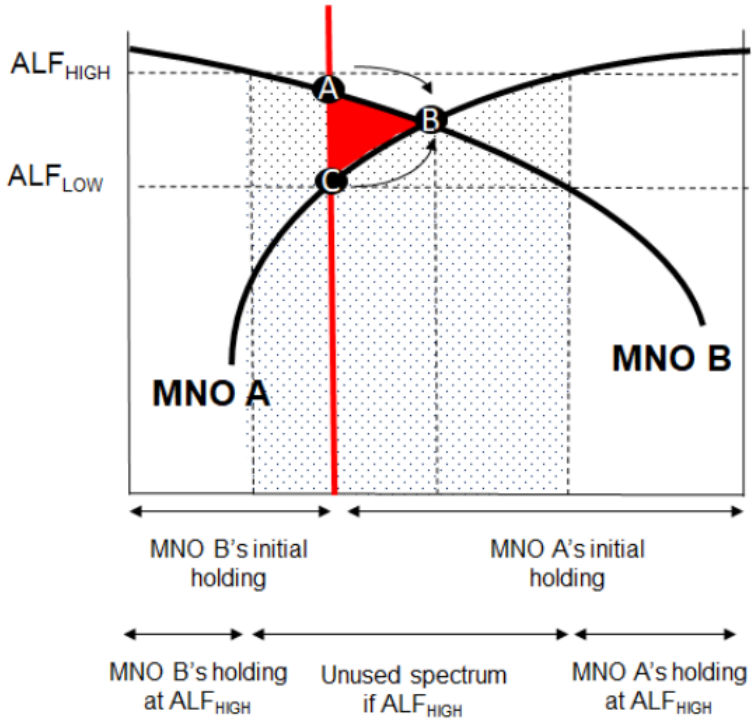
Ofcom considered in that context the role of spectrum fees in securing optimal use of spectrum that has been assigned administratively (such as 900MHz and 1800MHz). Ofcom found that fees can promote optimal use by acting as a proxy for opportunity cost, or the price that would emerge in a well-functioning market, which reflects the value of the spectrum to the next best user.

Three agrees that ALFs can promote optimal use when licences are not tradable, or at least if MNOs are not responsive to the opportunity cost of holding tradable spectrum. It is well-established that, if a user does not face opportunity cost in the price it pays for spectrum, it will have less of an incentive to use spectrum efficiently and relinquish it to higher value users.

The role of ALFs in promoting optimal use when licences are not tradable is illustrated in Figure 1. The horizontal axis measures the total amount of spectrum available to MNOs A and B. Moving to the right of the diagram means that MNO B has more spectrum and MNO A has less. The solid curves represent MNO A's and B's (diminishing) willingness to pay for extra spectrum (from right to left in the case of MNO A and from left to right for MNO B). The area under each curve reflects the value that the MNO's customers place on the extra capacity contributed by that spectrum.

[2] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/42909/srsp-statement.pdf

Figure 1: Asymmetric risk in setting ALFs too high or too low



Source: Three

Suppose licences are not tradable and the distribution of spectrum between MNOs A and B is as shown by the red line. Consumers are not getting maximum value from the spectrum. There is an efficiency loss (the red triangle) as some spectrum is being used by a lower value user (MNO A, which values extra spectrum at C). If set correctly at full market value (B) ALFs can help optimal use, by giving MNO A an incentive to relinquish some spectrum, which Ofcom can then re-assign to MNO B. At that point both MNOs attach the same value to an extra block (B) and spectrum is efficiently allocated.

As Ofcom recognises, however, ALFs create an asymmetric risk if they diverge from market value. If inadvertently set below market value (ALF_{LOW}), some spectrum may be used by a lower value user (here, MNO A) and there is an efficiency loss (ABC, in red). If set above market value (ALF_{HIGH}), both MNOs reduce their demand and spectrum is left unused. The efficiency loss from setting ALFs too high (shown by the dotted area) is far greater than the efficiency loss of setting ALFs too low (the red triangle).

ii. If MNOs are fully responsive to the opportunity cost of holding tradable spectrum, ALFs are at best redundant and at worst can be detrimental to the optimal use of spectrum

Consistent with the above, in the consultation Ofcom takes the view that ALFs set at full market value can help promote optimal use of tradable ALF licences "*by helping to ensure that licence holders have an appropriate incentive to return spectrum licences for which they are not the highest value potential user*".[3]

Ofcom has not satisfactorily explained, however, why ALFs at full market value are needed for 900MHz or 1800MHz licences to find their way to the highest value users, given that the licences are tradable and can be freely exchanged since 2011.

This is critical because, if MNOs are fully responsive to the opportunity cost of holding tradable spectrum, there is no need for ALFs and no efficiency loss (red triangle) for ALFs to remedy.

Standard economics holds that, if the rights to use an asset such as spectrum can be bought and sold, they will tend to be acquired by those for whom they are most valuable (as long as transaction costs, such as those of finding a trading partner, agreeing terms and monitoring performance of the contract, are small).[4]

This means that the potential for trading between MNOs can be expected to lead to an efficient use of 900MHz and 1800MHz licences without the need for ALFs, regardless of which party initially has, or is ultimately awarded, those rights.

Simply put, the licences will be used in the way which is most valued. If transaction costs are significant – which, with only four MNOs in the UK, is unlikely to be the case – trading will still occur provided the cost of the transaction is less than the increase in value which results from the trade.

Further, introducing ALFs in that case creates downside risks only: ALFs would be redundant at best and, at worst, can have a negative impact on the optimal use of spectrum:

- ALFs set at or below full market value would have no impact on the optimal use of 900MHz and 1800MHz licences. Trading

[3] Para 5.28
[4] Coase, Ronald. The Problem of Social Cost. The Journal of Law and Economics (October 1960)

would direct spectrum to the highest value users anyway. ALFs would simply reduce the value of the licences to all users (by an amount equal to the net present value of the ALFs) and serve no other purpose than extracting revenue from MNOs;

- If however ALFs are inadvertently set above market value, they risk having a negative impact on optimal use, as licensees may relinquish spectrum which is then left fallow (as shown by the large dotted area in Figure 1). ALFs could also reduce incentives to invest, as they could then be expropriating an MNO's return on its sunk investments.

Ofcom accepted that ALFs may not be needed in certain circumstances its 2007 review of fees applicable to spectrum used for terrestrial broadcasting. Ofcom said that there would be no need for annual fees at all if:[5]

- *"spectrum were a freely and efficiently traded good, with sufficient liquidity and transparency that there was good information in the market about prices, and those prices were a good reflection of market value; and*

- *all users of spectrum had to acquire the spectrum that they wanted through the market".*

In that case, Ofcom explained, spectrum users would forgo revenue by continuing to hold their rights to spectrum. There would be an implicit cost associated with holding spectrum on an ongoing basis, which would reflect the value of that spectrum to other users (i.e. the opportunity cost). This creates incentives for efficient use without the need for a licence fee.

Ofcom revisited this analysis in the 2010 Review, the conclusions of which are not accurately presented in the consultation. Ofcom found that, in principle, there are two main circumstances where trading alone may not provide sufficient incentives to use spectrum efficiently in individual markets:[6]

- *"if trading is limited by barriers like transaction costs, coordination problems and/or lack of price information; and*

[5] Future Pricing of Spectrum Used For Terrestrial Broadcasting. A Statement (2007), paragraph 3.23. http://www.ofcom.org.uk/consult/condocs/futurepricing/statement/statement.pdf
[6] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/42909/srsp-statement.pdf , para 4.199

- *if licensees are more responsive to AIP than to trading".*

Ofcom found that "*there is currently no single spectrum market ... This points to the need for a separate analysis of each market in future fee rate reviews, and means that the role of AIP as a complement of other market mechanisms may well differ in each individual market"*.[7]

Ofcom recognised that spectrum fees may need to perform a more important role in some markets than others, even if in its view fees "*will likely continue to be needed to play a role complementary to spectrum trading for most licence sectors*" (emphasis added). Ofcom set out its intention "*to assess the roles of trading and AIP in each sector-specific fee review on a case-by-case basis… in order to reach a decision appropriate to the circumstances of the individual markets".*[8]

iii. Ofcom has relied upon seriously flawed evidence to conclude that MNOs are not fully responsive to trading;

In summary, the fundamental question is whether trading can be relied upon to promote optimal use of 900MHz and 1800MHz spectrum and, if so, whether ALFs can add anything or just risk being detrimental to the optimal use of spectrum.

In 2010 Ofcom promised a case by case assessment of the role of ALFs on tradable licences in the context of individual, sector-specific fee reviews. This was meant to include a review of the efficiency of trading in each specific market, and of the extent to which licensees may be more responsive to ALFs than to trading.

Ofcom ducked this question in its 2015 ALF Decision because it took the view that it did not have any discretion about whether or not to set ALFs at full market value. The Court of Appeals' quashing of that decision now requires Ofcom to consider it. But Ofcom's analysis of this critical question is tentative at best and is confined to three and a half pages of the consultation.[9]

On the efficiency of mobile trading, Ofcom simply notes that no voluntary trade has taken place between MNOs since mobile licences were made tradable in 2011.[10]

[7] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/42909/srsp-statement.pdf
[8] Para 4.211
[9] Paras 5.47 to 5.61 of the consultation
[10] Para 5.49

On MNO's responsiveness to trading, Ofcom surmises that *"there is a risk that operators may be less responsive to the opportunity cost of holding spectrum (through forgoing the revenue from trading it) than to fees at market value"* (emphasis added).[11]

Ofcom cites as evidence the confidential submission of an MNO warning of price increases and delayed investment if ALFs increase above current levels.[12] Ofcom also argues that one possible explanation for the lack of mobile trades, amongst many other explanations, is that MNOs are not taking full account of opportunity cost.[13]

In our view, it is unreasonable and unjustifiable for Ofcom to reach this speculative view based on unreliable evidence, in particular where the consequence is the imposition of an ALF bill of £210m on the mobile industry, for the following reasons:

- Ofcom cannot rely on an inference from an unsubstantiated stakeholder submission to conclude that MNOs may be more responsive to ALFs than to opportunity cost;
- Few conclusions can be drawn about the effectiveness of trading on the basis of trading volumes;
- The Qualcomm trades are perfectly good examples of a firm being responsive to the opportunity cost of holding spectrum.

Ofcom cannot rely on an inference from an unsubstantiated stakeholder submission to conclude that MNOs may be more responsive to ALFs than to opportunity cost.

To the best of our knowledge, there is no support for Ofcom's view about the (limited) responsiveness of firms to opportunity cost in the literature of economics. Since Ofcom is effectively rejecting generally accepted economic principles, Three expects it to provide evidence for its view.

The 2010 Review did discuss two hypothetical examples where spectrum users could, in principle, be less responsive to trading than to spectrum fees.[14] First was the case of a civil servant who could not retain proceeds from the sale of spectrum within her Government department. The second example was that of a hypothetical business

[11] Para 5.48. This is the second reason it considered back in 2010 about why trading alone may not provide sufficient incentives to use spectrum efficiently
[12] Para 5.48, 5.59
[13] Para 5.49
[14] Para 4.203

manager who was under pressure to reduce operating budgets, but not to realise untapped revenue sources (such as might arise from selling spectrum).

The consultation makes no attempt to determine whether mobile managers face such pressures in practice. The only reason given by Ofcom in support of its view is the (confidential) submission of an MNO warning of price rises and delayed investment in the event of increases in ALFs beyond current levels. As Ofcom suggests, such responses would not be expected if the MNO's pricing and investment decisions already fully reflected opportunity cost.[15]

Ofcom is usually much more circumspect in taking MNO submissions at face value. For instance, in the recent PSSR auction appeal Ofcom discounted the position advanced by Three and BT as aligned with the party's own commercial interests. Ofcom should put together a compelling body of evidence instead of relying on an inference from an unsubstantiated submission which superficially appears to be consistent with its view.

At the very least Ofcom should adopt a similarly low threshold to accept evidence that appears to contradict its view. The fact that no MNO has ever relinquished spectrum in response to ALFs suggests that MNOs may not be very responsive to ALFs either. Ofcom is quick to dismiss this as uninformative, on the basis that its 2015 decision was subject to appeal throughout the period where ALFs reflected full market value.[16]

Few conclusions can be drawn about the effectiveness of trading based on trading volumes

It is true that no MNO has voluntarily traded spectrum since trading was introduced in 2011. However, as Ofcom noted itself in its 2010 Strategic Review, "*few conclusions can … be drawn about the effectiveness of trading on the basis of trading volumes alone*".[17]

Ofcom suggests that one possible explanation for the lack of trades is that MNOs do not take full account of opportunity cost.[18] But, as Ofcom suggests, lack of trading is also consistent with the opposite view – i.e. that ALF licences are already owned by the highest value users, so

[15] Para 5.48, 5.59
[16] Para. 5.31
[17] SRSP Consultation, para A6.9
[18] Para 5.49

there are no gains from trade even when MNOs take full account of opportunity cost.

As Ofcom recognised in its 2010 Review,[19] spectrum is used in combination with long-lasting equipment, as well as sites and other assets. Once deployed it is very costly and time-consuming to release spectrum for use by others. Doing so requires migrating users served by the spectrum to alternative frequencies, or deploying extra sites or more efficient technology to serve that traffic (which is typically a multi-year undertaking).

For instance, in the context of 900MHz and 1800MHz 3G liberalization Ofcom estimated that releasing one 2x5MHz 900MHz block between Vodafone and O2 would cost those MNOs around £60m to £210m.[20] This may be compared with Ofcom's assessment of the market value of 900MHz in the current consultation, which is £190m per 2x5MHz block.[21] Ofcom also found that the release of a single block would require 2 years to be achieved and could disrupt operation of the network in the interim.[22]

Similarly, following Ofcom's advice in the Orange/T-mobile merger, in March 2010 the European Commission gave the parties three-and-a-half years and five-and-a half-years respectively (until Sep 2013 and Sep 2015) to release a 2x10MHz and a further 2x5MHz 1800MHz block as part of the divestment commitments.

These has two implications. First, due to the existence of sunk equipment and network costs and the significant cost of migrating users to other frequencies, a licence holder will tend to value its ALF licence more than other users (who are yet to incur those costs and need to deduct them from their spectrum valuation).

Secondly, investment decisions can commit firms during the economic lifetime of the equipment. As Ofcom recognised in the 2010 Review, trading decisions may be inevitably tied up with investment decisions. Users may only respond to opportunity cost when it is efficient to do so - i.e. when the equipment, which operates on specific frequencies which cannot easily and quickly be retuned, falls to be replaced. Both factors will tend to limit the number of trades in the market at any one time.[23]

[19] Consultation, para A6.18
[20] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/55068/government-advice.pdf
[21] Para. 4.42
[22] https://www.ofcom.org.uk/__data/assets/pdf_file/0021/46218/spectrumlib.pdf
[23] SRSP Consultation, para A6.18

Lack of trading is also consistent with the view that MNOs have a strategic incentive to deny spectrum to rivals and will not trade or relinquish it, even when faced with ALFs at full market value. This strategic (or foreclosure) value of spectrum may be very high and may prevent trades that would promote spectrum efficiency.

The Body of European Regulators for Electronic Communications (BEREC) has cited the incentive to deny spectrum to rivals as the key reason for the apparent dearth of trades in the EU:[24]

> *"Spectrum trades which have taken place across Member States have mostly been as a consequence of mergers among operators... Spectrum markets are extremely "thin" markets with only a few potential buyers and sellers who are also already competitors in their own right on the downstream markets. For example, a licence-holder who plans to remain in the market is unlikely to trade harmonised spectrum to its potential competitors: indeed, the incentives are the exact opposite, particularly in a highly concentrated market with a finite supply of the essential resource: radio spectrum*".

As Ofcom acknowledges, strategic behaviour is not however a reason to set ALFs at full market value, because it is unlikely that doing so would help provide an incentive to return spectrum or trade it with a higher value user.[25]

The Qualcomm trades are perfectly good examples of a firm being responsive to the opportunity cost of holding spectrum

Ofcom rejects Qualcomm's 2015 sale of its 1400MHz spectrum to Three and Vodafone as an example of trading promoting spectrum efficiency.[26] On the contrary, both trades are perfectly good examples of a firm (Qualcomm) being responsive to the opportunity cost of holding spectrum.

Qualcomm originally purchased 1400MHz spectrum at auction in 2008. Qualcomm intended to use the spectrum for media broadcasting, but it subsequently found that deployment of a media broadcasting network in the UK was not commercially viable.

When an ECC decision harmonised the band for supplemental downlink in mobile, a greater value use appeared for the spectrum. Qualcomm

[24] BEREC's views on duration, on renewal of rights and on coordinated timing of assignments
[25] Footnote 116. In 2004, Ofcom similarly recognised that spectrum fees are unlikely to prevent hoarding which has anti-competitive intent or effect, because the potential rewards of such behaviour are likely to be greater than the fee. Ensuring effective competition following the introduction of spectrum trading, June 2004
[26] Para 5.51

responded to rational commercial incentives (i.e. the opportunity cost of holding on to the spectrum) by putting its 1400MHz on the market and selling it to the highest bidders in 2015.

Ofcom's reason to dismiss those trades is that Qualcomm was not an MNO for whom spectrum is a "*strategic resource*". If Ofcom is suggesting that equipment manufacturers are more responsive to trading than MNOs, it should provide evidence for that view. If the suggestion is instead that an MNO may have little incentive to trade spectrum to rivals for strategic reasons, this does not justify setting ALFs at full market value as we discuss above.

Ofcom's reason to dismiss those trades is that Qualcomm was not an MNO for whom spectrum is a "*strategic resource*". If Ofcom is suggesting that equipment manufacturers are more responsive to trading than MNOs, it should provide evidence for that view. If the suggestion is instead that an MNO may have little incentive to trade spectrum to rivals for strategic reasons, this does not provide support for the view that no modification should be made under Step 4 of Ofcom's assessment and therefore cannot be relied upon to justify setting ALFs at full market value, as we discuss above.

iv. Conclusion: Ofcom needs to evidence its view that MNOs are more responsive to ALFs set at full market value than to opportunity cost

In summary, Ofcom's conclusion that setting ALFs at full market value promotes optimal use of spectrum is critically dependent on its view that MNOs may be less responsive to opportunity cost than to ALFs set at that level. But this has not been demonstrated. Ofcom cannot simply rely on a priori reasoning, particularly when its conclusions are contrary to generally accepted economic principles.

Whether MNOs take account of opportunity cost is a matter of fact that Ofcom can determine through its vast information gathering powers. For instance, internal documents may be used to test the hypothesis that mobile managers face stronger pressure to reduce operating budgets than to realise untapped revenues.

Similarly, the reasons for the apparent dearth of mobile trades in the UK can be ascertained by gathering evidence. Three has approached other MNOs in the past to explore potential trades. Ofcom can request internal documents to understand the considerations taken into account to reject Three's proposals, to determine MNOs' responsiveness to opportunity cost or the potential existence of strategic considerations.

Whether existing users have the highest value for ALF spectrum they already own can also be assessed empirically. For instance, Ofcom can analyse the results of recent European awards of expired 900MHz and 1800MHz spectrum to determine whether existing licence-holders were able to retain their licences at the auction.

It is critically important that Ofcom collects evidence because the consequences of getting this wrong could be severe. If MNOs do take full account of the opportunity cost ALFs will be at best redundant (i.e. if set at or below full market value) and, at worst (i.e. if set inadvertently above market value) they can have a detrimental impact on the optimal use of spectrum.

It is no answer to say that Ofcom has addressed this asymmetric risk by setting ALFs "conservatively", or that the risk of ALFs above market value is mitigated because MNOs' values for infra-marginal spectrum could greatly exceed market value (as Ofcom alleges was the outcome of the 4G auction).[27]

First, despite all its caution, there is an obvious risk that Ofcom may have overestimated the market value of ALF licences. At the end of the day, Ofcom has had to estimate the unknown and unobservable UK market price for 900MHz and 1800MHz licences. It has done so based on prices for other bands (800MHz and 2.6GHz) and benchmarks from other countries.

Second, MNOs' values for infra-marginal spectrum in the 4G auction did not greatly exceed auction prices. On the contrary, there was a narrow margin between the incremental values bid by some MNOs for the last blocks won and the auction price determined by the highest losing bidder. If, hypothetically, Ofcom had to set ALFs on 800MHz and 2.6GHz spectrum without the information provided by the auction, it would have to be very accurate to avoid the risk of fallow spectrum.

In particular, Ofcom has estimated an auction price of £300m for a 2x5MHz block at 800MHz (determined by the highest losing bidders, in 2013 prices). This compares with EE's incremental bid value for the only 800MHz block it won of £353m (i.e. only 18% higher). Three bid £225m for the block reserved to it, but this reflected the reserve price and not the highest losing bid.

[27] Paras 5.62-5.65

Similarly, Ofcom has estimated an auction price of £55m for 2x5MHz in the 2.6GHz band, although it says it should probably be £64m reflecting the highest losing bid from O2.[28] This compares with BT's incremental bid value of £55m for the last 2x5MHz 2.6GHz block it won.

Ofcom's assessment of the impact of ALFs at full market value on consumer prices ignores material considerations

Ofcom concludes that ALFs should be set at full market value, even if doing so may lead to higher consumer prices than if a discount was granted. In Ofcom's view subsidising the cost of ALF spectrum to artificially supress consumer prices would not be appropriate.[29]

Ofcom considers that retail prices should reflect the input cost of spectrum and, to the extent that consumer demand reflects those prices, it will appropriately reflect the cost of supply.[30] Ofcom suggests that unless ALFs are set at full market value "*operators may tend to set consumer prices which do not reflect the full resource cost of providing their services*".[31]

Again, this conclusion is based on Ofcom's view that MNOs are not fully responsive to the opportunity cost of spectrum. This view ignores generally accepted economic principles, including the need to reflect opportunity costs in retail pricing and the fact that cost-based pricing in mobile is not necessarily optimal if not uniformly followed in the pricing of related services.

i. The consultation ignores that MNOs must cover opportunity costs in their retail pricing

The costs which concern economists are those which influence the relative prices of goods and services, and the allocation of factors of production (such as spectrum) amongst firms and industries.

It is well-established that a firm must cover not only its money expenses (i.e. the payments for the productive services it hires such as staff salaries or rent on an acre of land) but also the opportunity costs of the factors of production it owns (i.e. the revenues foregone by using those assets instead of renting, selling or lending them to others).

[28] https://www.ofcom.org.uk/__data/assets/pdf_file/0033/79764/statement.pdf, para 2.226
[29] Paras 5.68, 5.72
[30] Para 5.69, 5.72
[31] Para 5.69. See also 5.48 d), 5.58-5.59

For example, if a firm owns a building and pays no rent for office space, the rent the firm could have earned by leasing the space is a cost of doing business. If a new project involves the tying-up of office space which can be used elsewhere (e.g. by sub-letting it to another firm), the rent foregone by doing so is clearly a cost that the firm must reflect in its pricing.

The reason is that, unless receipts from the project cover that cost, the project will not be profitable and should not be undertaken. More generally, all assets which have alternative uses have an opportunity cost which must be fully covered by an MNO's prices.

In the consultation, Ofcom rejects this basic tenet of economics in a single page.[32] It is suggested that MNOs do not fully reflect the opportunity cost of spectrum in their pricing, so that mobile prices "*do not reflect the full resource cost of providing their services"*.

No reference or authority is given for this view. Again, the only evidence provided is the submission of an MNO warning of price rises and delayed investment in the event of increases in ALFs beyond current levels.

This position raises more questions than it answers. The opportunity cost of spectrum is only one of many such costs faced by an MNO. The opportunity cost of capital, or the return MNOs expect from alternative investments of similar risk, is another one. Three would welcome Ofcom's clarification of the following questions:

- Does Ofcom also believe that MNOs are less responsive to the opportunity cost of capital? If MNOs do not fully reflect that cost in their retail prices why do telecoms regulators "*take the regulated firm's cost of capital as an appropriate estimate of its opportunity cost of finance*"?[33] What is the point in Ofcom including that cost in its charges for regulated inputs, such as mobile call termination or leased lines, if MNOs will not respond to them or fully reflect them in their retail prices?

- If, alternatively, Ofcom believes that MNOs are fully responsive to the opportunity cost of capital, why is it that MNOs' retail prices include the opportunity cost of some inputs only (i.e. capital, but not that of spectrum)?

[32] Paras 5.66 to 5.72
[33] Para 5.87

Ofcom's position is also inconsistent with its approach to annualising ALFs. Ofcom spreads 900MHz and 1800MHz lump-sum values over a 20-year period, using a discount rate that aims to leave an MNO indifferent between paying an ALF and paying a lump-sum value.[34] But this approach implicitly assumes that an MNO is equally responsive to both types of payment.

If MNOs are more responsive to the direct cost of ALFs than to the opportunity cost (or lump-sum value) of the spectrum licence, at the discount rate chosen by Ofcom the MNO would prefer to pay the lump-sum value than the ALF. The ALF would be more visible in shareholder accounts and would be fully reflected as a cost, whereas the lump sum value would not be. It follows that Ofcom needs to use a lower discount rate to annualise its lump-sum values and make MNOs truly indifferent between both types of payment.

ii. The consultation ignores that cost-based pricing in mobile does not necessarily generate optimal results for society

Moreover, it is not necessarily the case that retail prices should fully reflect the cost of inputs, including spectrum. Modern economics recognises that cost-based pricing does not necessarily provide a correct guide for individual prices if it is not uniformly followed throughout the economy.[35]

This well-known result (theorem of second-best) shows that the optimal price for mobile services depends on the price-to-cost relationships of all other services related to mobile in production or consumption. If those other retail prices depart from cost, it may be socially optimal to deviate from cost-based pricing in mobile as well.[36]

For this reason, the generally accepted view of economists is that regulators should *"shun piecemeal ameliorative measures [i.e. trying to align prices to cost in individual markets] that have not been sanctioned by careful analysis and the liberal use of common sense".*[37]

Again, Ofcom has not taken account of relevant considerations in its proposals. Cost-based pricing is presented as an axiom to be blindly

[34] Para. 4.68
[35] Kahn, A. The Economics of Regulation. Principles and Institutions. MIT Press
[36] For instance, if the price of a mobile substitute is below cost (e.g. due to an externality), cost-based mobile prices may produce a worse (instead of a better) allocation of resources. The right approach may be to keep mobile prices below cost to avoid distorting consumer choices between both services.

[37] Baumol, W. Welfare Economics and the Theory of the State. The London School of Economics, 1965

followed. The consultation does not even mention second-best considerations, let alone examine the implications for setting ALFs at full market value. A proper assessment requires Ofcom to assess the optimality of cost-based pricing in its discussion of the potential impact of ALFs on consumer prices.

iii. Conclusion – Ofcom has ignored generally accepted economic principles in its conclusion about the impact of ALFs at full market value on consumer prices

In summary, Ofcom does not appear to have considered generally accepted economic principles in its proposals. This omission has a material impact on Ofcom's conclusions.

If MNOs do price the opportunity cost of holding spectrum, consumers will take full account of the opportunity cost of the spectrum input in their decisions. If so, ALFs are at best redundant and can have no impact on consumer prices and, at worst (i.e. if set above market value), they risk inflating consumer prices above resource costs.

Ofcom should consider the role of ALFs in promoting investment in mobile coverage and competition in harder to reach areas

Ofcom concludes that setting ALFs at full market value can be expected to promote efficient investment decisions, because those decisions should reflect the true cost of inputs.[38]

Ofcom rejects the idea of discounting ALFs to correct market failures, promote investment and competition between MNOs, on the basis that doing so would grant an unconditional subsidy which would not be targeted at the potential market failure, could distort economic incentives and may be discriminatory if the size of the subsidy is determined by each operator's ALF licence holdings.[39]

In addition, Ofcom refuses to compensate MNOs through a reduction in ALFs for the costs of meeting the 90% coverage obligation. In its view, the commitment was a voluntary one, no direct compensation was offered and neither Ofcom nor Government behaved so as to create a substantial new cost on operators.

[38] Para 5.77
[39] Para 5.86

i. Ofcom assumes that MNOs do not fully consider opportunity costs

Ofcom's view that setting ALFs at full market value can be expected to promote efficient investment decisions only follows if MNOs are not fully responsive to opportunity costs, which has not been demonstrated.

MNOs can increase capacity in an area by deploying more spectrum, a more efficient technology or adding more sites. Faced with a choice between investing in sites and spectrum, MNOs will choose the option with lower costs (relative to the capacity provided).

If the cost of spectrum reflects its true opportunity cost (because MNOs are fully responsive to that cost), and the cost of sites also reflects its true value, an MNO will decide between both inputs in a way that maximises benefits generated from their use. Similarly, for ALFs to distort economic incentives or have an impact on competition they must affect MNOs' pricing and investment decisions.

The question, therefore, is whether MNOs fully consider the opportunity cost of holding spectrum. If they do, investment decisions will be taken in full view of the relative costs of the inputs in question and will be fully efficient without the need for ALFs. Moreover, in that case ALFs will have no impact on pricing and investment decisions (provided they are below market value) and so cannot distort economic incentives or have an impact on competition.

As above, in that case, ALFs are at best redundant and can have no impact on investment provided they are set at or below market value. At worst (i.e. if ALFs are set above market value), spectrum will appear more expensive than its true opportunity cost and MNOs will be incentivised to over-economise and make use of more costly alternatives. Inefficient investment might then translate into higher costs for consumers.

ii. Ofcom should consider the role of ALFs in promoting investment in mobile coverage and competition in harder to reach areas

The Government and Ofcom-led 90% coverage initiative imposed a substantial cost on Three. Three only agreed to it on the assurance that Government would get Ofcom to review those fees in light of the coverage obligation. Ofcom's decision not to adjust ALFs imposed a disproportionate burden on Three as the MNO with the smallest geographic coverage.

From our perspective, what really matters is what happens next. The 2017 Conservative Party manifesto includes a pledge to reach 95% geographic coverage by 2022, and to have most of the population covered by a 5G signal by 2027.

For its part, Ofcom has a statutory duty to ensure the widespread availability of mobile services throughout the UK, and to have regard to the different interests of people including those living in rural areas. Ofcom has recognised that market failures (such as positive externalities or uniform pricing) may prevent MNOs from achieving the optimal level of coverage from a societal perspective.[40]

Ofcom has made improving mobile reception a national priority, stating that it will work closely with DCMS to "*explore every available solution*". Ofcom has estimated that near universal coverage of the UK landmass would cost up to about £6bn.[41] Ofcom believes that a cross-subsidy will be needed to extend mobile coverage, and that there is a strong case for contracting a single operator to build and operate masts for other MNOs to use.

MNOs have delivered current levels of coverage at no cost to the taxpayer, including the uneconomic 90% coverage commitment. There is no scope to absorb further costs, as the cost per site and the number of sites needed to extend coverage to rural and remote areas rise steeply (as site access, power, maintenance and backhaul becomes more costly owing to the larger distances involved), while there are fewer customers generating revenue in those locations to justify deployment.

There is one obvious available solution but it requires Ofcom to be more flexible in its approach to ALFs. In our view, ALFs can be used to promote network deployment, investment and competition in harder to reach areas. It seems entirely possible to institute an ALF scheme that will subsidise mobile coverage extensions, targeted at the market failures above, and where the absolute size of the subsidy is the same for all MNOs so there is no distortion of economic incentives or discrimination between MNOs.

[40] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/46158/not-spots.pdf
[41] https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/solid-progress-further-to-go-for-connected-britain

2. Ofcom has erred in its calculation of ALFs at full market value.

Notwithstanding that Ofcom has failed to properly justify why ALFs at full market value are consistent with securing its statutory duties, Ofcom has also erred in its calculation of ALFs at full market value under Steps 2 and 3 of its assessment by:

- Failing to take due account of the impact of recent market developments on the value of the 800MHz and 2.6GHz spectrum;
- Incorrectly interpreting evidence on international benchmarks of market value; and
- Erring in its annualization of lump-sum market value

Ofcom has not analysed all relevant factors in its estimate of the UK market value of the 800MHz and 2.6GHz spectrum bands.

Neither of the ALF spectrum bands have been auctioned in the UK, so Ofcom's starting point for the estimation of lump-sum market values is the UK value of the 800MHz and 2.6GHz spectrum (based on an analysis of bids in the 2013 4G auction).

Ofcom then uses auction prices from 800MHz, 900MHz, 1800MHz and 2.6GHz awards across Europe to estimate the relative values of these bands. Ofcom then applies these relative values to its estimates of the UK value of 800MHz and 2.6GHz spectrum to derive its estimates of the UK lump-sum market value of the ALF bands.

In assessing whether the value of these bands has changed since its September 2015 ALF Statement Ofcom provisionally concludes that:

- Market developments "*do not provide clear evidence that the value of either the 800MHz or 2.6GHz band have changed since 2013*";
- The auction prices from the recent PSSR auction (2.3GHz and 3.4GHz) "*do not provide evidence that would lead us to change our assessment of the forward-looking market values for ALF spectrum".*

Ofcom has failed to properly evidence these provisional conclusions and has omitted relevant factors from its assessment. A proper consideration of the evidence shows, on balance, that the value of 2.6GHz is in fact likely to be lower (and certainly no higher) than at the time of the 2013 4G auction.

i. Ofcom makes no attempt to quantify the impact of market developments since 2013 on the market value of 800MHz or 2.6GHz

Ofcom identifies three market developments since the 4G auction in 2013 which may have affected the value of these bands:

- Mobile data usage has increased significantly and is expected to continue increasing. Ofcom implies that, other things equal, this would increase the forward-looking value of ALF spectrum;

- The forthcoming award of 3.6GHz – 3.8GHz spectrum in 2019 which will "*provide additional capacity to that which was expected to be made available for mobile use at the time of our 2015 Statement*". Ofcom implies that, other things equal, this would reduce the forward-looking value of ALF spectrum;

- Technological developments such as MIMO (multiple input multiple output) which allow for increased capacity from the same amount of spectrum. Ofcom implies that, other things equal, this would reduce the forward-looking value of ALF spectrum.

In only three paragraphs (4.39 to 4.41 of the Consultation), Ofcom lists these developments and provisionally concludes that "*on balance, we do not consider that recent technological or commercial developments provide clear evidence as to whether the forward-looking value of 900MHz or 1800MHz spectrum is higher or lower than in our 2015 assessment*".

Ofcom makes no attempt to quantify the impact of any of these developments and instead contradicts its own conclusion by uplifting its 2015 estimate of lump-sum market value of the ALF bands by CPI. In doing so Ofcom implicitly assumes that the value of the spectrum has in fact increased over the period yet provides no reasoning or evidence to support this assumption.

ii. Ofcom wrongly asserts that growing data usage has increased (and will continue to increase) the forward-looking value of ALF spectrum

Ofcom has only identified one market development which could put upward pressure on the forward-looking value of ALF spectrum. Ofcom notes that data usage has increased and is expected to continue to do so, and that data usage has grown more quickly than it had forecast in its 2014 Mobile Data Strategy Statement.

However, Ofcom fails to take account of is the crucial importance of how data usage has evolved compared to MNOs' expectations at the time of the 2013 4G auction. The mobile industry as a whole was forecasting much higher growth in data usage than Ofcom had predicted in 2014. In a 2013 report by GSMA, it forecast that data usage would grow by an annual rate of 54% across Europe from 2012 to 2017.[42] This is consistent with the actual growth rate that Ofcom refers to – 50% compound annual growth.[43]

It is therefore the case that data usage has grown at the same rate as MNOs expected. Ofcom is therefore wrong to conclude that increasing data usage has put upward pressure on the forward-looking value of ALF spectrum.

Given that Ofcom has failed to identify any other market developments which point to an increase in the value of ALF spectrum, there is no basis for its decision to assume that the market value of the ALF bands has increased in line with inflation. Ofcom's failure to objectively justify the basis on which it exercises its regulatory judgment to reach its conclusion renders that conclusion flawed.

iii. Ofcom is correct that developments such as MIMO have reduced the value of the ALF spectrum

Ofcom correctly argues that technological developments such as MIMO will serve to reduce the forward-looking value of ALF spectrum, and that the prospects for deploying such technologies may now be clearer than was the case in 2013. Through our use of MIMO, we can deliver 70% more capacity, but with massive MIMO we expect to deliver 3-5 times as much capacity.

All else the same, this significantly reduces the amount of spectrum MNOs need to meet forecast demand, and as Ofcom suggests, will reduce MNOs' intrinsic valuations of future spectrum to be auctioned, as well their valuations of the 1800MHz spectrum.

iv. Ofcom has understated the amount of additional spectrum that will be available compared to what was known previously

[42] Figure 8, GSMA, *The Mobile Economy 2013*, https://www.gsma.com/mobileeconomy/archive/GSMA_ME_2013.pdf
[43] Para 4.39, Ofcom, *Annual Licence Fees for 900MHz and 1800MHz frequency bands*, published 8 June 2018, https://www.ofcom.org.uk/__data/assets/pdf_file/0022/114736/consultation-alf.pdf

Ofcom identifies the upcoming 3.6GHz-3.8GHz and 700MHz spectrum auction and states that this provides "*additional capacity compared to what was expected to be made available for mobile use at the time of the 2015 Statement*".

As Ofcom implies, this will reduce the forward-looking value of ALF spectrum. The value each MNO places on additional spectrum will tend to reduce as it obtains more frequencies.[44] However, Ofcom has understated the amount of extra spectrum that has become (or will become) available, compared to what was known at the time of the 2013 4G auction, and therefore underestimated the downward pressure that this has put on the value of ALF spectrum.

In 2010, the UK government committed to making 500MHz of sub-5GHz public sector spectrum available for civil use by 2020. This expectation of a future increase in spectrum capacity will have been understood and priced into MNOs' private valuations in the 2013 4G auction. However, since the 2013 auction, the government increased its target by setting out plans to release a further 250MHz below 10GHz by 2022, recognising that this spectrum could be useful for 5G, fixed links, backhaul for small cells or macro base stations and satellite use.[45]

In 2015, Ofcom granted consent for Qualcomm to sell 40MHz of 1400MHz spectrum, with Hutchison 3G UK Ltd and Vodafone each buying 20MHz.[46] As Ofcom acknowledges, MNOs' intrinsic valuation for additional spectrum is reduced if they already hold more spectrum. As a result of this spectrum transfer, all else the same, two of the main four UK MNOs will have had lower valuations for ALF spectrum.

Ofcom is currently consulting on a proposal that would increase the amount of spectrum to be auctioned in the 3.6GHz-3.8GHz band in 2019.[47] Ofcom's view is that this proposal will deliver benefit for consumers, and is minded to grant UK Broadband's request. If this variation is implemented, it will increase the amount of useful spectrum in the band by 9% (from 110MHz to 120MHz).

---

[44] https://www.ofcom.org.uk/__data/assets/pdf_file/0013/104305/Statement-annexes-Award-of-the-2.3-and-3.4-GHz-spectrum-bands.pdf para A11.82

[45] Para 4.28, Ofcom, *Review of Public Sector Spectrum Release (PSSR): Recommendations to Government on the setting of a revised PSSR target*, published 2 March 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/518307/Advice_to_Government_-_CLEAN_-_PSSR_Target_Mar2.pdf.

[46] Ofcom, *Trade of frequencies in the 1452-1492MHz band from Qualcomm UK Spectrum Ltd to Vodafone Limited and Hutchison 3G UK Limited,* https://www.ofcom.org.uk/__data/assets/pdf_file/0022/81670/trade-of-frequencies-statement.pdf.

[47] Ofcom, *Variation of UK Broadbands Spectrum Access Licence for 3.6GHz spectrum: Ofcom's consideration of a request to vary the permitted lower frequency block,* https://www.ofcom.org.uk/__data/assets/pdf_file/0017/115343/Variation-UK-Broadband-Licence-3.6-GHz-spectrum.pdf

In consequence, Ofcom has failed to consider all of the additional spectrum that has (or will) become available since the time of the 2013 4G auction. Given the amount of additional spectrum that is now committed for release, compared to what was known back in 2013, it is likely that the 800MHz and 2.6GHz are worth considerably less today than after the 2013 auction.

In light of the above, it is clear Ofcom simply has not done the necessary work to conduct a proper estimation of the downward pressure on the value of ALF spectrum arising from the extra spectrum that has become (or will become) available, compared to what was known at the time of the 2013 4G auction. This amounts to another failure to objectively justify the basis on which it exercises its regulatory judgment to reach its conclusion, and so renders that conclusion flawed.

v. Ofcom has failed to take account of falling industry revenues and the impact this has on spectrum valuation

Ofcom has recognised that the incremental revenue per unit of capacity will affect MNOs' spectrum valuations.[48] MNOs derive their demand for additional spectrum from the expected incremental revenue they can earn from it, whether from increasing their number of customers or driving higher revenues from their existing customers i.e. by delivering improved performance.

Ofcom data shows that mobile industry revenues were lower in each year from 2014 to 2017 than they were in 2013 (in real terms).[49] Despite MNOs growing their spectrum holdings and customers using more data, falling data prices have reduced MNOs' ability to monetise their spectrum. On a per-user basis, average revenues fell by 5% from 2013 to 2017.[50]

The falling revenues of MNOs, due to a weaker ability to drive revenue from their spectrum holdings, is an additional factor which would cause MNOs to place lower valuations on the 800MHz and 2.6GHz spectrum (if it were to be auctioned today).

We consider that the evidence reviewed above points to a reduction, rather than increase, in the market value of 2.6GHz spectrum (and

[48] https://www.ofcom.org.uk/__data/assets/pdf_file/0013/104305/Statement-annexes-Award-of-the-2.3-and-3.4-GHz-spectrum-bands.pdf, para A11.98
[49] Figure 4.1, Ofcom, *2018 Communications Market Report*, https://www.ofcom.org.uk/__data/assets/pdf_file/0022/117256/CMR-2018-narrative-report.pdf..
[50] Figure 4.18, Ofcom, *2017 Communications Market Report*, shows that mobile ARPUs fell by 4% in real terms from 2013 to 2016: https://www.ofcom.org.uk/__data/assets/pdf_file/0017/105074/cmr-2017-uk.pdf. Page 52, Ofcom, *2018 Communications Market Report*, explains that mobile ARPUs fell by 1% in real terms in 2017: https://www.ofcom.org.uk/__data/assets/pdf_file/0022/117256/CMR-2018-narrative-report.pdf.

therefore the 1800MHz band). As such the price from the 2013 4G auction (£5.5m/MHz) not uplifted by CPI is likely to provide an upper bound on forward-looking market value.

Ofcom must therefore undertake a proper assessment of these factors rather than simply assuming that the value of the spectrum has increased in line with inflation. Ofcom's failure to do so means again that it cannot objectively justify the basis on which it exercises its regulatory judgment to reach its conclusion, and so renders that conclusion flawed.

Ofcom has incorrectly interpreted evidence on recent international benchmarks of market value

In arriving at its estimate of lump-sum market value, Ofcom complements information from the UK 800MHz and 2.6GHz auctions with evidence from relevant European spectrum auctions, to derive international benchmarks of UK market value.

In doing so Ofcom incorporates evidence from the 2016 Danish 1800MHz auction into the set of benchmarks used in its September 2015 Final Statement. As a direct consequence of incorporating the Danish 2016 auction benchmark, Ofcom revises its view of the UK market value of 1800MHz upwards from to £14m[51] to £15m per MHz.

However, Ofcom's interpretation of the Danish benchmark is fundamentally flawed. In failing to properly account for the coverage obligation in the 800MHz Danish auction (which in turn feeds into the calculation of the new Denmark relative value benchmarks), Ofcom places too much weight on a benchmark which is not sufficiently robust or comparable. Ofcom must attach substantially lower weight (or altogether disregard) the Danish relative value benchmark.

i. Ofcom's approach to interpreting international benchmarks of market value

The starting point for Ofcom's analysis is the set of absolute and relative value benchmarks from its September 2015 ALFs Statement (updated for CPI and PPP). Ofcom then considers whether there is any new evidence from relevant European auctions which have taken place since the 2015 statement.

[51] The lump-sum market value as set out in Ofcom's September 2015 Statement expressed in April 2018 prices

As summarised in Table 1, Ofcom identifies the Danish award of 1800MHz (in 2016) and the Norwegian awards of 1800MHz and 900MHz (in 2016 and 2017, respectively) as providing potentially relevant information on which to derive benchmarks.

Table 1: Ofcom assessment of relevant spectrum awards since 2015

Country	Frequency	Date of award	Absolute value benchmark	Relative value benchmark
Denmark	1800MHz	2016	£16.4m	£24.8m
Norway	1800MHz	2016	£38.3m	No awards of 800MHz & 2.6GHz over relevant period
Norway	900MHz	2017	£28.3m	No awards of 800MHz & 2.6GHz over relevant period
Poland	800MHz & 2.6GHz	2015	n/a	No awards of ALF bands over relevant period
Cyprus	800MHz & 2.6GHz	2016	n/a	No awards of ALF bands over relevant period

Source: Ofcom

In the case of Norway only absolute value benchmarks are calculated (as there were no corresponding auctions of 800MHz and 2.6GHz on which to calculate a relative value benchmark over the relevant period). In the case of Denmark, a relative value benchmark of 1800MHz is generated in addition to absolute benchmarks using information from a 2010 award of 2.6GHz and a 2012 award of 800MHz.

In incorporating these additional benchmarks into its estimate of 1800MHz lump-sum market value Ofcom assigns the Danish benchmark Tier 1 status (i.e. the group of benchmarks to which it attaches the greatest weight), with a risk of either understatement of overstatement.

In common with the approach adopted in its 2015 ALF Statement, Ofcom then selects as its estimate of UK market value a point between

the midpoint and minimum of the Tier 1 benchmarks. Given that the Danish Benchmark is higher than all the existing Tier 1 benchmarks, this raises the midpoint of the Tier 1 estimates resulting in an increase in Ofcom's estimate of market value.

While Ofcom also considers the new absolute value benchmarks as part of its cross-checks, in common with its 2015 Statement, it ultimately concludes that these do not provide a basis in which to depart from the Tier 1 relative value benchmarks-based estimate. As such only the new Denmark relative value benchmark is determinative in Ofcom's reaching a revised view of the UK market value of the 1800MHz band.

ii. Ofcom attaches too much weight to the Denmark relative value benchmark

As per the established distance method approach, the Denmark relative value benchmark is calculated using auction prices from the 2012 award of 800MHz and 2010 award of 2.6GHz (as well as the 2016 1800MHz award).

In its review of the 800MHz auction price as an absolute benchmark, Ofcom cites the follow factors which "on balance" led Ofcom to conclude that it carries a risk of understatement:

- the inclusion of an obligation to provide outdoor coverage with minimum download speeds of >10Mbit/s across 207 postcode areas.

- the participation of two MNOs in the auction via a joint venture (which may have reduced the intensity of competition in the auction).

Ofcom addresses the former point by using a UK value of 800MHz including a coverage obligation when applying the distance method ratio in its calculation of the relative value 1800MHz benchmark. In doing so Ofcom implicitly assumes that the Danish 800MHz coverage obligation was no more challenging (and therefore had an equivalent impact on auction prices) than the UK 800MHz coverage obligation.

Ofcom has not provided any evidence or reasoning in support of this assumption and there is good reason to question it. Firstly, we note that while the geographic scope of the UK 800MHz obligation was broader, the Danish obligation required licensees to deliver minimum download speeds of 10Mbps, whereas the UK obligation auction required only 2Mbps.

Secondly, the format of the auction is likely to have had a material impact on final prices. This is because the coverage obligation was attached to all lots with participants being allowed to incorporate regional exemptions from the obligations into their bids for a preferred package. A participant could therefore only receive unencumbered spectrum by bidding for (and winning) exemptions across all regions.

To guarantee an auction outcome in which the coverage obligation was met in its totality across all regions, participants were also required to place a bid at reserve prices for a spectrum package without exemptions as a condition for bidding on an equivalent package with exemptions.

In its 2012 assessment of the Danish auction outcome DotEcon noted that the award produced some of the lowest prices in Europe and that this could be directly attributed to the auction format which required all bids to fulfil the coverage obligation as a pre-condition for participating in the auction.[52]

Ofcom fails to consider, or even identify, the implications of the risk of understatement of the Danish 800MHz value in its assessment of the Denmark relative value benchmark for 1800MHz.[53] Instead it reaches the erroneous conclusion that the benchmark carries a risk of either understatement or overstatement. This assessment is inconsistent with Ofcom's conclusions that:

- the 800MHz value carries a risk of understatement
- the 1800MHz value carries a risk of overstatement; and
- the 2.6GHz value carries no identifiable risk or either under or overstatement.

As is apparent from the distance method formula, if the 800MHz value is understated, the 1800MHz is overstated and there is no countervailing overstatement of 2.6GHz value, then the resulting benchmark of UK market value of 1800MHz will be overstated.

Ofcom has failed to take account of these points in its designation of Denmark as a Tier 1 benchmark. Ofcom's (cumulative) criteria for assigning Tier 1 status to a benchmark are that:

---

[52] Digital Dividend, the Danish Way. DotEcon Report, September 2012.

[53] While Ofcom did consider the potential impact of its treatment of the Danish 800MHz coverage obligation in its September 2015 ALFs Statement, this was with respect to the 1800MHz relative value benchmark derived from the 2010 Danish 1800 MHz award and Ofcom ultimately concluded that as it was a tier 3 benchmark "this issue is does not have a large impact on our provisional decision." Such a response is clearly no longer applicable to the tier 1 designated relative value benchmark that Ofcom is now proposing to derive from the 2016 Danish 1800MHz award.

- the auction prices appear likely to have been primarily determined by a market-driven process of bidding in the auctions;

- based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

- the outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

For the reasons discussed above the Danish benchmark fails to meet the first and last of these criteria and should be relegated to a lower tier.

Ofcom has therefore erred both in process (in failing to properly assess the risk arising from the 800MHz coverage obligation) and in its conclusions that (i) Denmark is a Tier 1 benchmark and (ii) there is either a risk of overstatement and understatement. Therefore, Ofcom errs in its interpretation of the Danish auction, assigning undue weight to it.

Given that this 2016 Danish benchmark plays a determinative role in Ofcom's decision to increase its estimate of UK lump-sum market value of 1800MHz, Ofcom must re-visit its analysis and re-interpret the impact of the Danish benchmark in light of a proper the aforementioned risks.

Ofcom has erred in its annualization of lump-sum market value

Ofcom errs in its conversion of lump sum estimates into an ALF by:

- failing to conduct an up-to-date calculation of the WACC;
- ignoring recent evidence on the risk-free rate; and
- applying an overly backward-looking and internally inconsistent approach to deriving the cost of debt.

In doing so Ofcom fails to meet its stated objective of setting a ALF that reflects the forward-looking market value of the ALF spectrum. We consider this has a material effect on Ofcom's estimate of ALFs if set at market value. Ofcom must therefore conduct a fully updated analysis of the discount rate to ensure it is robustly underpinned by the latest market evidence.

To convert the lump-sum market value of ALF spectrum into an annual license fee, Ofcom aims to ensure MNOs are indifferent between incurring a one-off lump-sum payment and a stream of annually recurring payments.

Ofcom achieves this by applying a discount rate to uplift the annual ALFs such that the present value of the stream of payments equals the lump-sum market value if paid today.

In considering the appropriate discount rate to use Ofcom takes a weighted average (75:25) of:

- MNOs' cost of debt - to approximate the "lower bound" case where ALFs are set once and never revised (such that MNOs bear all risk associated with a change in the market value of the spectrum); and

- MNOs' WACC - to approximate the "upper bound" case where ALFs are hypothetically set via a spectrum revenue sharing mechanism between the MNO and Government (such that Government bears all risk associated with changes in market value).

i. Ofcom has failed to undertake an updated analysis of the WACC

Ofcom's approach (as summarised in Table 2) is not to conduct an updated analysis of the underlying parameters, but to borrow an estimate of the WACC from the 2018 Mobile Call Termination Market (MCT) Market Review.

This is problematic because in the 2018 MCT Market Review Ofcom did not undertake a full re-analysis of the WACC (it merely cross-checked some of the parameters) and relied on the WACC estimate from its 2015 MCT Market Review.

The result is that Ofcom is proposing to use exactly the same WACC (in pre-tax nominal terms) as it used in its 2015 Statement on ALFs (with only changes for inflation and tax). This is despite material changes in the market since 2015.

It is incumbent on Ofcom to undertake a proper review of MNOs' forward-looking cost of capital as consistent with its wider statutory duties.

Table 2: Summary of Ofcom's WACC decisions

	Pre-tax nominal	Post-tax real
2015 MCT Market Review	9.1%	5.2%
2015 ALF Final Statement	9.1%	5.2%
2018 MCT Market Review	9.1%	5.5%
2018 ALFs consultation	**9.1%**	**5.5%**

Sources: Ofcom 2018, 2015 MCT Market Review Final Statements, Ofcom 2015 ALF Final Statement.

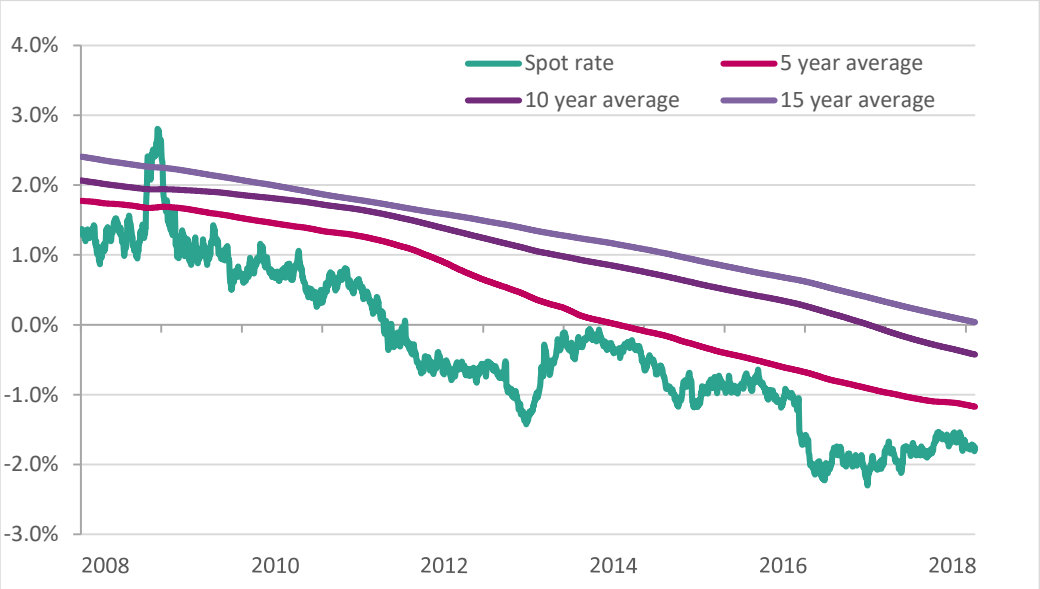
ii. Ofcom's estimate of the risk-free rate is based on outdated evidence

The risk-free rate (RFR) is a key parameter, feeding into both the cost of debt and cost of equity components of the WACC. Ofcom's approach to estimating the RFR is based on an analysis of yields on index-linked British Government securities.

Ofcom's estimate of the real RFR of 0.0% (i.e. that used in the 2018 MCT Market Review which is in turn taken from the 2018 Wholesale Local Access Market Review), is based on an analysis of gilt yields up to the 29 December 2017.

An additional three quarters of data is available since this cut-off date, which Ofcom has not attempted to make use of. As can be seen from Figure 2 below, this additional data shows that yields on 10-year gilts have remained negative throughout this period. A similar trend is visible on 5 and 15 year gilts.

Figure 2: Yields on 10 year maturity index-linked gilts



Source: Bank of England and Three calculations

Furthermore, the spot rate, 5-year, 10-year and 15-year average yields on 10 year gilts are all either negative or zero. In fact, yields are only positive for averaging periods of 20 years (see Table 3 below). We consider this is supportive of a negative risk-free-rate.

Table 3 Comparison of yields on 10-year gilts

Averaging Period	2016 WLAMR Consultation	2018 WLAMR Statement	ALF Consultation Response
Spot Rate	-1.9%	-1.9%	-1.8%
1 Month	-1.8%	-1.8%	-1.8%
3 Months	-1.9%	-1.8%	-1.7%
1 Year	-1.4%	-1.9%	-1.8%
2 Years	-1.2%	-1.7%	-1.9%
5 Years	-0.8%	-1.1%	-1.2%
10 Years	**0.1%**	**-0.3%**	**-0.4%**
15 years	**0.7%**	**0.4%**	**0.0%**
20 years	1.2%	0.9%	0.8%
Estimate of RFR	**0.5%**	**0.0%**	**-**

Source: Ofcom 2018 WLAMR Statement, Bank of England.

In its 2017 WLAMR Consultation and 2018 WLAMR Statement, Ofcom set a real RFR which sat between the 10 and 15 year averages of yields in 10 year gilts. Applying this approach to the latest data on gilt yields would imply a negative RFR.

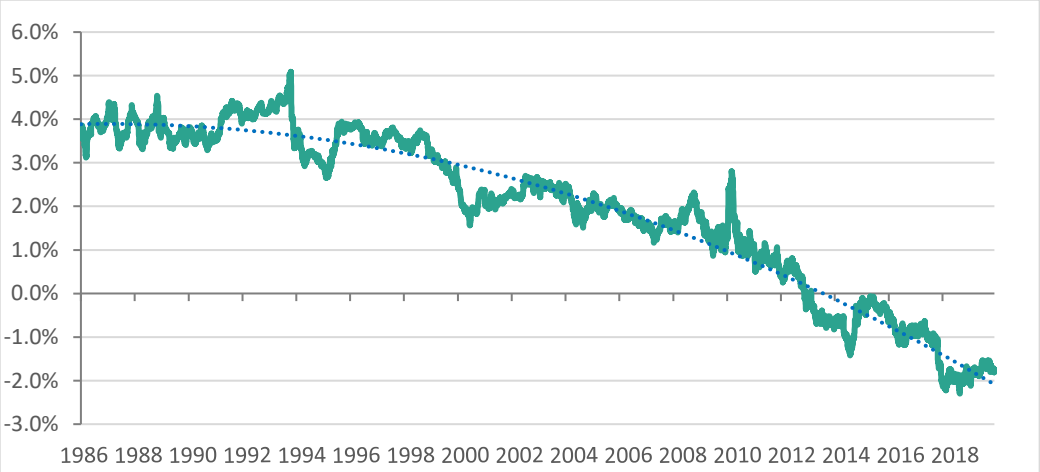
iii. Ofcom's estimate of the risk-free rate is not sufficiently forward looking

Setting aside the additional evidence on gilt yields that Ofcom has failed to take into account, Ofcom's approach to interpreting the data on which it has based its estimate is, in any case, flawed.

Ofcom's stated intention in setting ALFs is to represent the forward-looking market value of the ALF spectrum bands. However, this intention is not borne out by Ofcom's approach to setting the risk-free rate, which is overly reliant on long-term historic averages of gilt yields.

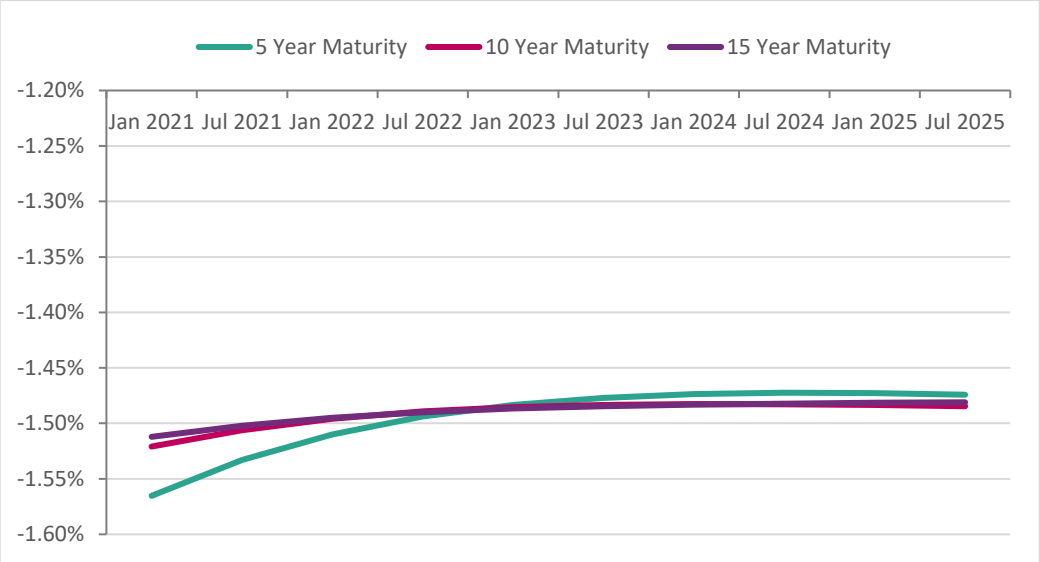
Figure 3, there has been a clear and enduring downward trend in gilt yields over the past 25 years, with little evidence of mean reversion. Furthermore, spot rates have been negative since 2011 and yield rates are expected to remain at around -1.5% over the next seven years across 5, 10 and 15 year maturities (see Figure 4).

Figure 3: Long-term trend in 10 year index-linked gilts



Source: Bank of England

Figure 4: Implied forward yields from July 2018 spot rate



Source: Bank of England and Three Calculations

Ofcom appears to not only disregard forward-looking evidence on implied future yields but also implicitly over-weights 15 year (rather than shorter) averages in its analysis of historic yields. In doing so Ofcom overstates the forward-looking cost of capital which it purports to be estimating.

In the 2018 WLAMR Statement (from which Ofcom's estimate of the RFR for the ALF discount rate is borrowed), Ofcom appears to offer the following justifications for this backward-looking approach, which we address in turn.

The relatively long-lived nature of telecoms investments

Ofcom argues that telecoms investments are relatively long-lived and that the risk-free rate should be determined on a long (backward-looking) horizon consistent with an efficient network operator being able to finance investments steadily through time. Ofcom cites the following evidence to support this point:

- BT's network infrastructure assets have asset lives of between two and 40 years, with the main WLA assets of duct, copper and fibre having asset lives towards the mid-point and top of this range.

- The average maturity on BT's debt is currently around 6-10 years (see sub-section on the cost of debt below).

In relation to the first point, this evidence is clearly specific to the Wholesale Local Access market and BT's below-ground duct and copper infrastructure. Ofcom has not demonstrated the extent to which it is relevant to the assets used in the operation of a mobile network. In this regard, we note that [✂].

In relation to the second point, we note that this is broadly consistent with the maturity on sterling debt of UK mobile operators and in fact supports the use of 10 (rather than 15) year average gilt yields. These would imply a negative risk free rate of -0.3% (on the basis of the data Ofcom analysed in setting the WLAMR WACC or -0.4% taking into account more recent data) rather than the 0.0% RFR that Ofcom is proposing to use.

Impact of the EU referendum result

Ofcom argues that the EU referendum result is expected to have impacted gilt yields in two opposing ways. On the one hand the downgrade in the credit rating of UK Government debt following the referendum is expected to be associated with higher gilt yields. On the other hand, investors in the wake of the referendum result, and associated uncertainty around Brexit, may seek to transfer money to less risky assets which may increase gilt yields via a "flight to safety" effect.

While we accept that these are both possible consequences of the EU Referendum, the extent to which they have (or will continue to materialise) should now be fully reflected in expectations of future rates as implied by spot and forward yields. Analysis of such evidence points to expectations of persistently negative yields over the 10-year horizon.

Impact of the Bank of England's Quantitative Easing (QE) policy

Ofcom states that the programme of largescale asset purchasing by the Bank of England may have reduced yields on government debt. While Ofcom is not explicit about the implications of this for its analysis it appears to be suggesting that the QE programme may have distorted the gilt market such that evidence on recent yields does not provide a suitable proxy for the return investors expect to receive on a risk-free asset.
In response to this we note PwC's recent analysis of the cost of capital for Ofwat's forthcoming PR19 Price Review which concludes that:

> *"Asset purchases of gilts between 2012 and 2016 have been relatively minimal, yet real risk-free rates have structurally declined. This implies that market forces other than externally-influenced policies such as QE have been the more significant driver of real risk-free rates into the negative territory."*[54]

This is consistent with the Bank of England's own analysis of the impact of successive rounds of QE on gilt yields, which shows that the market reaction (measured by the change in gilt yields) to the later rounds of QE was minimal and in some cases actually resulted in an increase in yields.[55]

The prevailing negative risk-free rates can therefore not be dismissed as a short-term distortion arising from the Bank of England's QE interventions in the UK bond market.

Finally, we note that a negative RFR is supported by recent views on the cost of capital published by other regulators (see Table 4). The CAA, Ofwat and Ofgem, in setting out their initial view on the cost of capital for upcoming price reviews, have found a negative RFR ranging from between -1.8% to -0.4%. This is fundamentally at odds with Ofcom's estimate of 0.0%.

Table 4: Recent regulatory publications on the RFR

	Real RFR
Ofcom 2018 WLAMR (March 2018)	0.0%
Ofwat PR19 Final Methodology (December 2017)	-1.3% to -0.4%
CAA H7 Consultation (November 2017)	-1.4% to -1.0%
Ofgem RIIO-2 Framework Consultation (March 2018)	-1.8% to -0.6%

Sources: Ofcom, Ofwat, CAA and Ofgem.

iv. Ofcom's approach to estimating the cost of debt is internally inconsistent

Regardless of which specific horizon Ofcom determines for its analysis of each component of the cost of capita, it is important that a coherent approach is used across each of the inputs.

[54] PwC, Updated analysis on cost of Equity for PR19, December 2010
[55] See Figure 10, "QE: the Story so Far", Staff Working Paper No. 624, Bank of England, October 2016.

As recommended in a recent review of approaches to estimating the cost of capital undertaken by a group of independent experts on behalf of UKRN, the application of a backward-looking approach to the estimation of the risk-free rate (for example justified on the basis of providing regulatory stability)

"*should be applied to the Regulatory Expected Return (RER) as a whole rather than component by component, since if this approach is not applied consistently across components, not only might this reduce the impact of any smoothing, but may also induce distorted choices.*"[56]

However, Ofcom's approach of using market-aligned evidence to inform its estimate of the debt premium on the one hand but long-term historic averages for the risk-free rate on the other results in a fundamental inconsistency in the parameters of the cost of debt.

To illustrate this point, the spot rate on an index of 10-year maturity BBB rated bonds[57] is currently 2.8% (or on average 2.6% over the past 12 months), which together with a current/forecast RPI of around 3.3% suggests an MNO cost of debt in RPI terms of -0.5%. This is clearly inconsistent with the existence of a debt premium.

Ofcom's estimate of the RFR in the WACC is also inconsistent with the cost of debt estimate which forms its "lower bound" discount rate. To see how this is the case, Ofcom's estimate of a real RFR of 0.0% in conjunction with an RPI of 3.3% and debt premium range of 1.0% - 1.5% implies a pre-tax nominal cost of debt in the WACC of between 4.3% - 4.8%.

However, Ofcom's analysis of MNOs' sterling dominated debt over the past 12 months to May 2018 shows that spot rates have not exceeded 4.0% since April 2016. Consistent with this market aligned view, Ofcom sets a nominal cost of debt of 2.7% (before adjustment for inflation risk premium and tax) as its lower bound estimate of the discount rate. Ofcom therefore uses fundamentally incoherent estimates of the cost of debt in its lower and upper bound estimates of the discount rate.

[56] Estimating the cost of capital for implementation of price controls by UK Regulators, UKRN, March 2018.
[57] Bloomberg's BVCSGU10 index as used by Ofcom as a proxy for MNOs' lower bound cost of debt in its calculation of the ALF discount rate.