Brian Williamson

Keeping an eye on the prize – investment in mobile networks to deliver coverage, capacity & the 5G strategy: A reappraisal of recurring spectrum fees

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About the Author

Brian Williamson is a Partner at Communication Chambers and has extensive policy and strategy experience in relation to applications, networks and radio spectrum. In relation to spectrum, Brian has provided policy advice and expert testimony in relation to pricing, trading, spectrum caps, mobile data and spectrum demand, Wi-Fi demand for spectrum and policy in relation to spectrum licence renewal.

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Contents

1. Executive summary

Mobile applications, and mobile network ubiquity, capacity and quality, have grown in importance as applications use and development has pivoted to mobile.

Mobile offers unique attributes not feasible via a PC and wired connection; including the ability to use services (almost) wherever you are; to use location-based services including maps and platform-based transport services; and to capitalise on sensor-based inputs including sound, vision and orientation – augmented by online information and artificial intelligence.

Yet one of the key inputs to the mobile sector, radio spectrum, is encumbered by uncertainty at licence renewal and by the prospect of recurring fees (distinct from the initial price paid at auction). Spectrum rights are not assured and unencumbered, for example, in the way that land rights are.

It has been argued that recurring fees are necessary to ensure that mobile operators make efficient use of their spectrum holdings and do not demand excess spectrum; yet they face the implicit price – or own use 'opportunity cost' – of spectrum irrespective of any administratively imposed price.

The reason for this is that mobile network operators face a constant trade-off - in meeting growing demand for coverage, data capacity and higher quality service (including 5G) – between the efficiency of use of existing spectrum and investment in new sites and acquisition of new spectrum. A pipeline of spectrum availability via the market further helps ensure that spectrum is allocated efficiently between operators.

Whilst in principle there remains the possibility that some alternative use is of higher value at the margin than mobile use, in practice it is accepted by Ofcom and Government that spectrum should be reallocated from other uses including government use and terrestrial broadcasting to mobile use. The 'own use' opportunity cost which operators face is therefore the market opportunity cost.

An administratively imposed recurring fee on mobile use is not therefore required to promote the optimal use of spectrum – it is not a proportionate measure.

Moving away from administrative incentive pricing for mobile use would be consistent with prior shift from administrative 'beauty contests' to auctions' namely it would reduce the scope of administrative decisions in relation to spectrum allocation in favour of the market - where possible and consistent with public policy goals.

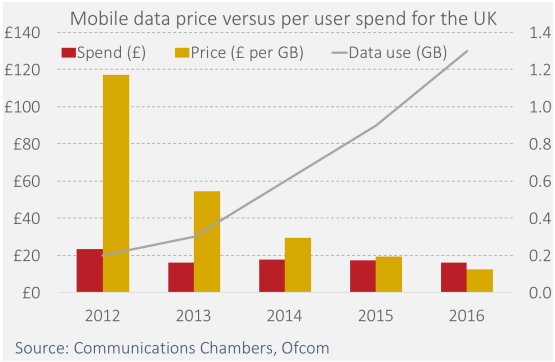
Administratively imposed recurring fees may also be counterproductive in relation to delivery against duties under the Communications Act including:

> *"(d) the desirability of encouraging investment and innovation in relevant markets;*
>
> *(e) the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom;"*

Administrative spectrum fees reduce free cash flow, and reduced cash flow is likely to reduce investment given information asymmetries in capital markets. Economy wide evidence supports this conclusion, as does the observation that firms put weight on maintaining dividends alongside investment.

Further, the government has broader policy goals, including its 5G strategy and a broader goal of promoting productivity and income growth. Policy supportive of investment to enhance mobile connectivity would help deliver these goals.

Investment in new - more efficient - mobile network technology is also the primary means by which unit costs, and prices, are reduced over time (the following illustrates past unit price reductions – alongside almost constant bills and rapid data growth - which flowed from investment in new technology, including 4G).



Investment is the primary means by which innovation is embodied in mobile networks, driving productivity growth, consumer benefit via lower per gigabyte prices and wider economic benefits from enhanced connectivity.

Further, a 2010 Ministerial direction included inter alia the requirement on Ofcom to revise spectrum annual licence fees (ALF) to reflect full market value. The package of measures in that Direction were made in the context of delays in the liberalisation of 900 MHz and 1,800 MHz spectrum for 3G use. However, the policy focus has long moved on to promoting investment in mobile coverage, capacity and capability including 5G. Further, the High Court has rejected the Ofcom argument that in implementing the direction they did not have to have regard to their statutory duties, including encouraging investment.

It is therefore timely to reappraise the overall policy stance in relation to investment in mobile networks and Ofcom policy in relation to when recurring spectrum fees should be applied and on what basis. There is also a wider question in relation to assurance of licence renewal for existing spectrum.

It is proposed that:

- The Government review the spectrum annual licence fees element of the 2010 Ministerial direction, in light of current priorities, with a view to rescinding this aspect of the Direction.
- The Government consider issuing a statement of strategic priorities to Ofcom under the Digital Economy Act 2017 setting out priorities in relation to investment in mobile infrastructure and a supporting policy environment.
- Ofcom review the 2010 framework for spectrum pricing, in particular regarding the conditions under which explicit spectrum pricing should be imposed, having regard to the full set of circumstances in which spectrum users face the implicit price of spectrum.
- Ofcom put on hold the application of recurring spectrum fees in relation to 900 MHz and 1,800 MHz spectrum, pending the outcome of the review of the 2010 framework for spectrum pricing.

This is a timely opportunity to review priorities and reset the policy stance in a manner supportive of investment in mobile network infrastructure and the Governments 5G strategy. The Government and Ofcom should seize this opportunity.

2. Value of investment in mobile

The benefits of ongoing investment in mobile

Mobile has grown in importance, particularly following the introduction of multi-touch smartphones, coupled with apps stores from 2010. Mobile enables applications that are not feasible on a PC or via fixed connectivity, utilising location and other sensors, and connectivity on the go.

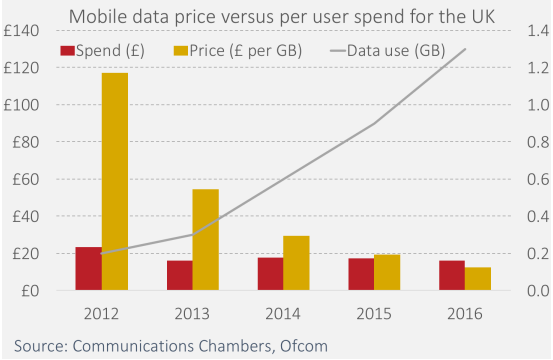
These developments have increased demand for ubiquitous coverage, for capacity (with mobile data growth of 65% for 2014/15 in the UK) and for technology enhancements and transitions (e.g. 4G to 5G) offering new capabilities. All of these enhancements require investment in capital and spectrum.

The mobile sector also contributes to productivity growth – where the UK has underperformed over the past decade – both directly (the contribution may be underestimated in the UK[1]), and indirectly as mobile networks and applications are utilised by enterprise and government.[2]

Finally, investment in new and more efficient technology lowers the unit cost and price of mobile services, thereby benefiting consumers and enterprise alike. The rate of unit price decline, driven by productivity growth and technology transitions (with the start of the 5G transition imminent) has been rapid.

As Figure 1 illustrates, whilst per user spend on mobile has been more or less constant, the unit price of mobile data use has plummeted driven by investment in more efficient technology.[3]

Figure 1: Declining mobile unit prices



Falling unit data costs have also supported, arguably driven, the extraordinary growth in mobile data linked to the use of connected applications.[4]

Ofcom duties and objectives

Ofcom have duties in relation to customers interests, investment and innovation in telecoms and the optimal use of spectrum. Ofcom have also placed particular emphasis on improving mobile coverage, and have both recognised and assessed the trade-off between coverage obligations attached to the planned auction of 700 MHz spectrum and auction proceeds, noting in paragraph 4.5 that:[5]

> *"If we included a high reserve price, then we may need to reduce the scale of the coverage obligations by a broadly equivalent amount, given that the scale of the obligations that we are proposing need to be proportionate to the potential value of the spectrum. In view of the particular*

[1] FT, *ONS's crossed telecom wires raise questions over inflation figures*, January 2018.
[2] Corrado and Jäger, *Communication Networks, ICT and Productivity Growth in Europe*, December 2014.
[3] Ofcom, Pricing report, 2017. *https://www.ofcom.org.uk/__data/assets/pdf_file/0028/98605/Pricing-report-2017.pdf*
[4] Williamson and Wood, Mobile value, spectrum and data demand – a bootstrap approach to estimation, *Digital Policy, Regulation and Governance*, Vol. 19 Issue: 1.
[5] Ofcom, *Improving mobile coverage: Proposals for coverage obligations in the award of the 700 MHz spectrum band*, March 2018.

> *weight that we are proposing to put on our duty to ensure widespread availability of mobile services, this consideration would point towards setting a low reserve price for the spectrum. Of course, there are other factors (relating to optimal use of spectrum and competition) that influence the choice of reserve price and we will therefore consider this point in more detail in the auction design consultation later this year."*

In relation to prices, Ofcom have tended to focus on consumer bills rather than the unit price of mobile data (bills are a product of consumption and unit price). A focus on bills detracts from the significant reductions in unit costs and prices for mobile data, driven by investment.[6] A dynamic view of unit pricing over time, and the linkage to investment, would reinforce investment within the mix of objectives.

Broader policy objectives

Ofcom's duties focus on sector outcomes *per se*, rather than broader economic outcomes.

Connectivity is a key element of information and communications technology, which has made an outsize contribution to productivity and income growth. Mobile price trends (if correctly measured) would also serve to reduce inflation.

Further, whilst spectrum related revenues are not a consideration in relation to spectrum management, the government does have a broader interest in the fiscal position. However, a broader view would consider the overall tax base which is enhanced by pro-growth policies. An estimate by Hazlett *et al* (2012) suggested that:[7]

> *"…the efficiencies associated with retail services in mobile markets are around 240 times as large as those associated with licence revenues."*

The real prize is maximising overall economic surplus and consumer benefit, which will indirectly contribute to the fiscal position.

Policy linkages

A policy stance supportive of investment should include measures to reduce the cost of investment and a credible commitment not to expropriate the returns from innovation and investment.

It is also essential that investment, and the full range of dynamic benefits investment can bring, are given due weight in day to day regulatory decisions.

A policy of reflecting the full economic value of spectrum via administrative prices imposed on spectrum holdings may not be consistent with these principles. Indeed, the Government has sought to lower the cost of infrastructure rollout, in particular via reforms to the UK Electronic Communications Code (ECC).

The National Infrastructure Commission (NIC) set out a number of options to improve outcomes in the mobile sector (which then Chair Lord Adonis described as 'deplorable'[8]) including the following observation in relation to spectrum fees:[9]

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[6] Williamson, *The price of telecoms – getting it right, why it matters*, February 2018.
[7] Hazlett, Munoz and Avanzini, *What Really Matters in Spectrum Allocation Design*, Northwestern Journal of Technology and Intellectual Property, Volume 10(3).
[8] Lord Adonis (then NIC Chair), *Urgent plan needed to tackle 'deplorable' mobile services*, December 2017.
The original source (NIC, *Connected Future*, March 2016) in relation to coverage is, however, more nuanced than the headline, noting in footnote 60 that "We note caution should be used in inferring coverage from OpenSignal's availability metric. It includes other factors – accounting for indoor connections and times of high congestion. Countries in the earlier stages of their 4G deployments can sometimes have higher availability scores as the numbers of 4G subscribers are typically small and con ned to large urban areas where new 4G networks are typically located."
[9] NIC, *Connected Future*, March 2016. Paragraph 3.62.

> *"Spectrum auction fees – often hundreds of millions of pounds – and ongoing annual license fees are another cost which makes business cases more of a challenge for operators and investors faced with uncertain decisions such rolling out infrastructure for new technology markets."*

The implications for spectrum allocation and efficiency also need to be considered (see Section 3), but in relation to investment there are theoretical, empirical and pragmatic reasons to believe that reduced cash flow is likely to reduce investment.

Imperfections in the market, due to information asymmetries and moral hazard, introduce a link between free cash flow and investment.[10] Further, a recent paper by Bolton, Wang and Yang (2014) concludes:[11]

> *"Investment distortions via asset sales are critical parts of risk management for firms that are severely financially constrained. Preserving liquidity is thus of the first-order importance to maximize firm value."*

Empirical evidence also supports a conclusion that reduced free cash flow would be likely to reduce investment. For example, Almeida, Campello and Weisbach (2007)[12] analyse data for manufacturing firms in the US and conclude:

> *"our results strongly suggest that financing frictions affect investment decisions."*

Further, Worthington (1995) found that the impact of cash flow constraints on investment was significantly greater in industries with high sunk costs.[13]

Consideration of how decisions are made pragmatically within companies also suggests that reduced cash flow would be likely to result in reduced investment.[14] Companies also seek to maintain a strong balance sheet and pay dividends, for example, the 2017 BT Annual Report states that: [15]

> *"Strategic investment, based on our financial strength, will ensure the long-term growth and health of our business. At the same time, we're working hard to reduce our net debt, support our pension fund in a responsible way and pay progressive dividends to our shareholders." Page 26.*

There are theoretical, empirical and pragmatic reasons to expect recurring spectrum fees to reduce the propensity to invest in mobile coverage, capacity and capability.

Conclusion

There has been a dramatic pivot to mobile applications and the importance of ubiquitous and more capable - including the potential of 5G - mobile networks is recognised. Priorities in relation to recurring spectrum fees should be reassessed in light of the need for investment in mobile networks, evidence of a trade-off between free cash flow and investment and the fact that operators are likely in any case to face the opportunity cost of spectrum use – absent administratively set fees – as argued in the following section.

[10] Holmstrom and Tirole, *Financial Intermediation, loanable funds, and the real sector*, The Quarterly Journal of Economics, Volume 112(3), August 1997.
[11] Bolton, Wang and Yang, *Corporate Finance and Risky Inalienable Human Capital*, May 2014.
[12] Almeida, Campello and Weisbach, *Financial Constraints, Asset Tangibility, and Corporate Investment*, 2007.
[13] Worthington, Investment, cash flows and sunk costs, The Journal of Industrial Economics, Volume 43(1), March 1995.
[14] Stein, Jeremy C, 1997, *Internal Capital Markets and the Competition for Corporate Resources*, The Journal of Finance, Vol. 52, pp. 111-114.
[15] *https://www.btplc.com/Sharesandperformance/Annualreportandreview/pdf/2017_BT_Annual_Report.pdf*

3. Optimal use of spectrum

Elements of optimal use of spectrum

Achieving the optimal use of spectrum comprises the following three elements:

- Judgement and cost-benefit analysis, in making high level decisions regarding the allocation of spectrum, including via the three yearly ITU-WRC conferences.
- The allocation of spectrum for a given, typically via auction, potentially constrained by spectrum caps.
- The efficient use and potential reallocation (between similar users and potential reassignment of spectrum between different uses).

The following focusses on the last element above.

The concept of opportunity cost in relation to efficient use

A key economic principle is that users of a resource face the opportunity cost of using it (the value of output foregone when spectrum is employed for one particular use rather than the next best alternative, namely the cost in terms of alternative use foregone).

The application of this principle to spectrum management in the UK was developed in a 2002 report by Professor Martin Cave for the Department of Trade and Industry and HM Treasury.[16] The report states that:

> *"The review's goal is to implement mechanisms which ensure spectrum is used efficiently. The review believes that the key means of achieving this goal is to ensure that spectrum users face an appropriate charge, explicit or implicit, which reflects the opportunity cost of their spectrum use." Paragraph 7.8.*

The above refers to "explicit or implicit" pricing, since a user may face the opportunity cost of a resource without facing an explicit ongoing price; as is the case, for example, in relation to land use where land is owned rather than leased.

Below, the question of whether mobile network operators face the opportunity cost of spectrum use is explored in relation to own use, amongst competing mobile users and in terms of alternative use.

Efficient 'own use' of spectrum

There are sound reasons for expecting mobile network operators to make efficient ongoing use of spectrum following initial allocation, since operators face continuous trade-offs in meeting data demand growth in terms of:

- The efficient use of existing spectrum (via technology investments including, for example, investment in more advanced antenna technology including MIMO and generational shifts e.g. 3G to 4G and 4G to 5G).
- More intensive use of existing spectrum (by adding transmitter sites that allow the same spectrum frequencies to be re-used in different areas).
- Acquisition of additional spectrum either via the primary market (auction) or secondary market (trading).

Evidence shows that operators take the implicit opportunity cost of spectrum into account in their decisions. For example, US operator Verizon decided the price for AWS spectrum was too high in Chicago and New York as the auction

[16] Professor Martin Cave, Review of Radio Spectrum Management for Department of Trade and Industry and HM Treasury, March 2002. http://archive.cochrane.org.uk/inside/uk-radio-spectrum-managment.pdf

price exceeded Verizon's estimate of the implicit opportunity cost:[17]

> *"…there's a price at which it makes more sense to add capacity by densifying the network, putting in small cells, than buying spectrum. And in some markets in that auction we crossed that threshold, and we say if we can add capacity through densification and we've been doing that for the past 4, 5 years now."*

Absent spectrum prices (which are not applied in the US) Verizon faced the opportunity cost of spectrum – either in terms of the price of additional spectrum at auction or in terms of the cost of adding capacity via network densification.

Further, one of the methods used to calculate opportunity cost is the 'avoided cost' methodology developed by Smith-NERA which calculates the cost – in terms of additional sites – required to compensate for the loss of an increment of spectrum.[18] Yet, as the Verizon example illustrates, market participants estimate and consider opportunity cost in coming to decisions regarding spectrum use and acquisition.

An administrative price need not be imposed in order for these trade-offs to motivate efficient use of spectrum by a given operator.[19] Mobile operators face their 'own use' opportunity cost implicitly, without explicit administratively determined prices.

Efficient spectrum assignment over time

The initial auction of spectrum is the primary way in which this is achieved, potentially with an administratively determined overlay of spectrum caps. However, how can we be confident, following the auction, that the assignment of spectrum between operators remains efficient?[20]

There are three reasons for concluding that assignment is likely to remain efficient over time: complementarity of spectrum and capital investment, the opportunity to trade spectrum and the prospect of future spectrum allocation by auction.

Complementarity of spectrum & capital investment

Once operators have acquired spectrum, they make complementary investments in sites and technology which are optimal given their spectrum holdings. Once sunk, these investments tend to imply a higher value for existing spectrum holdings by a given operator than the value to other operators and *vice versa*.

The opportunity to trade spectrum

The opportunity to trade spectrum is available. Trades have occurred in a number of markets,[21] whilst in the UK 1.4 GHz[22] spectrum and 28 GHz[23] has been traded, with Ofcom noting in relation to 28 GHz spectrum:

> *"…most of these 28GHz BFWA licences have been traded at some point since their initial award, in some cases more than once. This evidence of an active market in trading*

[17] *Verizon Communications Inc at Morgan Stanley Technology, Media and Telecom Conference 2018 – Transcript*, February 2018.
[18] Smith-NERA, Study into the use of Spectrum Pricing. Report for the Radiocommunications Agency, April 1996.
[19] An argument first developed in Williamson, Marks and Chan, *Spectrum annual licence fees – you cannot have your cake and eat it*, January 2014.
[20] Note in this regard that the introduction of recurring fees only when the existing licence term has expired, whilst designed to ensure that operators do not pay twice, is arbitrary in terms of arguments regarding the ongoing efficient use of spectrum. The reason for this is that an assignment could in principle become inefficient following initial assignment at any point during the licence term.
[21] RSPG, *RSPG Report on Efficient Awards and Efficient Use of Spectrum*, RSPG16-004 FINAL, February 2016.
[22] Qualcomm Press Release, *Qualcomm Agrees to Sell UK L-Band Spectrum to Vodafone and H3G*, August 2015.
[23] Ofcom, Variation of 28 GHz Broadband Fixed Wireless Access Licences, December 2012. Paragraph 4.18.

these particular spectrum licences suggests to us that the most valuable new uses and licensees will be able to gain access to this spectrum."

Spectrum reassignment can also occur via an acquisition, as the acquisition of UK Broadband – which held 40 MHz of 3.4GHz spectrum - in February 2018 by Three illustrates.

Further, whilst efficient spectrum trading may be sufficient to ensure that operators face the opportunity cost of spectrum, it is in general not necessary. The reason for this is twofold:

- First, consistent with the complementarity of spectrum and capital investment, the likelihood that reassignment – post primary allocation – is efficient is likely to be low.
- Second, the opportunity to acquire spectrum via future auctions helps ensure an efficient assignment of spectrum over time.

Finally, in relation to spectrum trading, administratively determined spectrum fees may reduce the likelihood of otherwise efficient trades occurring; as may uncertainty over licence renewal or the future level of fees.[24]

The prospect of future spectrum availability

Following the auction of 120 MHz of 2.1 GHz ('3G' spectrum) in 2000, there was a sustained period during which no new spectrum was assigned for mobile use. The next auction was not until 2014, when 235 MHz of 800 MHz and 2.6 GHz ('4G' spectrum) was auctioned.

However, there is now a regular pipeline of spectrum coming to market which provides opportunities for the market, and Ofcom, to rebalance spectrum portfolios at the margin. The auction of 190 MHz of 2.3 GHz and 3.4 GHz spectrum in 2018 is the most recent example.

Ofcom plan to auction 700 MHz and 3.6 GHz spectrum in 2019, with 700 MHz spectrum expected to be available for use by 2020 and 3.6 GHz available for mobile in many areas from 2020, but not necessarily nationwide until 2022.[25]

There are also large tranches of spectrum in so called 'mm-band' frequencies that are expected to be available for mobile use in future. For example, in its update to the 5G strategy the Government noted that:[26]

"We also want to see further progress on plans for licensing the 24.25-27.5 GHz band. The upper 1 GHz of this band is currently used by the Ministry of Defence. The Government will make the 26.5-27.5 GHz band available for 5G mobile, subject to the need to protect essential defence functions within the band."

There is a roadmap for spectrum release and ample opportunity for the market (and Ofcom) to ensure the efficient assignment of spectrum over time.

Alternative use

The final concern in relation to the optimal use of spectrum is ensuring that spectrum is assigned efficiently between competing uses. However, implicit in the policy stance of the Government and Ofcom to reallocate spectrum from other uses to mobile is recognition that the opportunity cost for mobile use exceeds that for alternative use at the margin.

This is reflected in the roadmap for spectrum availability discussed above, and in the target for the release of 500 MHz of spectrum held by the public sector by 2020, much of which is likely to be reallocated for mobile use.[27]

[24] Marks and Williamson, *Can spectrum trading and pricing co-exist?*, January 2011
[25] Ofcom, *Enabling 5G in the UK*, March 2018.
[26] UK Government, *Next Generation Mobile Technologies: An update to the 5G strategy for the UK*, December 2017.
[27] Ofcom, *Review of Public Sector Spectrum Release (PSSR)*, March 2016.

Conclusion

Mobile operators face their 'own use' opportunity cost of spectrum and a pipeline of spectrum (coupled with the opportunity to trade) provides an opportunity for the overall spectrum held by individual operators to shift in response to changes in incremental valuation.

Further, the opportunity cost of spectrum for mobile use exceeds the opportunity cost of spectrum for alternative use, as reflected in a policy of reallocating spectrum for mobile use. Therefore, the own use opportunity cost, the implicit price of spectrum in relation to mobile, is sufficient to ensure the optimal use and allocation of spectrum.

4. The development of spectrum fees

Development of administrative incentive pricing (AIP)

AIP was introduced in 1998 in the UK with the objective of promoting greater efficiency in the use of spectrum. The prices set were based on the value of the next best alternative using a method developed by Smith-NERA in 1996.

In 2002, the Independent Spectrum Review conducted by Professor Martin Cave recommended that spectrum users should face the opportunity cost of spectrum, either explicitly or implicitly, and that where explicit prices are set they should be set on the basis of opportunity cost.

Following review, Ofcom issued a revised framework for spectrum pricing in 2010.[28] This included the principle that AIP should be applied to spectrum that is expected to be in excess demand, and a principle that AIP should in general play a complementary role alongside secondary market trading.

The application of AIP has been progressively extended in the UK, with plans to also apply AIP to terrestrial broadcasting after 2020.[29]

In terms of outcomes in the UK, there is evidence has incentivised more efficient use of spectrum utilised by government agencies and sharing and reallocation of spectrum for mobile use:[30]

> *"there is emerging evidence that AIP, introduced to incentivise public sector users to use spectrum more effectively, has resulted in public sector spectrum being used more efficiently with potential future releases of spectrum being forecast. These changes include:*
>
> *• A switch of AIP from the Home Office to MOD in spectrum at 2302-2310 MHz, to reflect the Home Office's agreement to relinquish use of this spectrum; and*
>
> *• A proposed adjustment to MOD's AIP of 50% to reflect the agreement to share spectrum with civil fixed links at 7.9-8.4 GHz when this spectrum is made available.*
>
> *Other public sector users continue to review their spectrum holdings with a view to relinquishing spectrum and receiving AIP reductions."*

Further, an abatement of AIP was utilised to fund a study contributing to the release of 2.3 GHz spectrum for mobile:

> *"The CMU's highest priorities are to explore the potential for release or sharing of either or both of lower 2.3 GHz and 1.4 GHz given the high demand from mobile network operators (MNOs) for spectrum and the potential for their immediate commercial utility. The CMU has funded feasibility studies to look at protections for MOD systems in these bands for the first time through the abatement of AIP charges, providing a clear incentive and driver for Departments to progress work quickly."*

Spectrum pricing has been adopted in some other countries, for example, Australia; but not others, for example, the US (which has relied on primary auctions, trading and a two-sided incentive auction mechanism[31]). The US also operates with rolling licences and a presumption

[28] Ofcom, *Revised Framework for Spectrum Pricing*, December 2010.
[29] Ofcom, *Spectrum pricing for terrestrial broadcasting*, July 2013.
[30] UK Government Investments, *Public Sector Spectrum Release Programme, 2nd Annual Report by UKGI Spectrum Central Management Unit*, August 2017.
[31] FCC, *Broadcast Incentive Auction and Post-Auction Transition*.

of renewal, so the question of what to do at licence termination does not arise.

Annual Licence Fees (ALF)

In December 2010, the Government issued a Direction which, in addition to liberalising the use of 900 MHz and 1800 MHz spectrum, requires Ofcom to revise annual licence fees (ALF) to reflect full market value.[32]

Ofcom subsequently interpreted full market value as "the market-clearing price in a well-functioning market, or the forward-looking marginal opportunity cost of the spectrum".

One rationale, other than efficient allocation, for imposing AIP pricing for 900 and 1800 MHz spectrum, which was identified by Ofcom in a consultation in 2009, is to avoid asymmetric profit shocks. However, to the extent that this rationale held at the relevant time, it has fallen away given the passage of time. This was discussed in the September 2007 and February 2009 consultations on spectrum liberalisation and trading (at the time AIP rather than ALF was considered):[33]

> *"…we continue to acknowledge that large asymmetric profits shocks of this type resulting from regulatory policy could have an impact on investment incentives in the sector in general. Therefore, some form of intervention may be justified to prevent this." (Para A8.113, Ofcom, February 2009)*
>
> *"We consider that correctly applying AIP could substantially reduce asymmetric profit shocks since AIP should reflect the value of the spectrum." (Para A8.114, Ofcom, February 2009)*

However, the rationale for applying spectrum fees in order to facilitate spectrum liberalisation and to address asymmetric profit shocks - and any asymmetry of competition impact - has fallen away given the passage of time and subsequent developments.

Finally, in relation to the direction Ofcom argued that:[34]

> *"…we did not have any discretion to decide whether or not to set [annual licence fees] at full market value, since we had been directed by the Government to do so and we were required to implement that direction." Paragraph 1.22*

This stance arguably contributed to a far less conservative approach in proposing ALF fees than AIP fees, which have tended to be set at a significant discount on estimated market value/opportunity cost.

The ALF decision was appealed, and the Ofcom argument that it did not need to have regard to its duties was rejected:[35]

> *"The question therefore arises whether s.5 authorises the Secretary of State to direct Ofcom in exercising its s.12 powers to ignore the duties imposed on it by s.4(2) of CA 2003 and s.3(5) of WTA 2006. In my view, it does not. Parliament has imposed those duties on Ofcom (compatibly with Article 8 of the Framework Directive) to be performed "in carrying out" its radio spectrum functions. It did not obviously contemplate or in my view authorise the performance of the Article 8 duty by someone who was not the regulator and who was not carrying out the relevant function to which the duty relates. In the*

[32] Ofcom subsequently interpreted full market value as "the market-clearing price in a well-functioning market, or the forward-looking marginal opportunity cost of the spectrum" – in other words for practical purposes the interpretation is the same as that applied in estimating opportunity cost as an input to setting AIP.
[33] Ofcom, Application of spectrum liberalisation and trading to the mobile sector – A further consultation, February 2009 http://stakeholders.ofcom.org.uk/binaries/consultations/spectrumlib/annexes/annex8.pdf
[34] Ofcom, Annual licence fees for 900 MHz and 1800 MHz spectrum, September 2015. Paragraph 1.22
[35] Royal Courts of Justice, EE Ltd v Office of Communications & Ors, Approved Judgement, 22 November 2017.

absence of clear words, the s.4(2) duty is to be treated as non-delegable and there is nothing in s.5 of WTA 2006 which in terms allows the Secretary of State to relieve Ofcom of the statutory duties which Parliament has expressly imposed on it." Paragraph 54.

Conclusion

The guiding principle that led to the introduction of spectrum pricing was that spectrum users should face the opportunity cost of spectrum use, either via an explicit or implicit price. This principle is sound.

The implementation of spectrum pricing has, however, involved departures from this principle:

- The application of an explicit administrative price in relation to spectrum utilised for mobile, even though users implicitly face the opportunity cost of spectrum use.
- The proposed application of spectrum pricing as a policy instrument in relation to concerns regarding "asymmetric profits shocks" relating to spectrum liberalisation, and the set aside by Ofcom of their duties in deciding the level of such fees.

Given the judgment of the High Court in relation to proposed annual licence fees, and the recent emphasis on improving outcomes in the mobile sector in terms of coverage, capacity and delivery of the 5G strategy, it is timely to review the principles governing spectrum fees.

5. Trade-offs and way forward

Ofcom's duties

The Communications Act 2003 includes a principle duty for Ofcom "to further the interests of consumers in relevant markets". The following are further clauses that appear particularly relevant in relation to spectrum pricing, focussing on mobile spectrum use.

Ofcom is required to secure in the carrying out of their functions:

> *"(a) the optimal use for wireless telegraphy of the electro-magnetic spectrum;*
>
> *(b) the availability throughout the United Kingdom of a wide range of electronic communications services;"*

Ofcom must have regard to:

> *"(a) the principles under which regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed;"*

Further, as appropriate Ofcom may have regard to:

> *"(d) the desirability of encouraging investment and innovation in relevant markets;*
>
> *(e) the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom;"*

Trade-offs in relation to Ofcom's duties

Ofcom, in their 2010 revised framework for spectrum pricing, contemplate the possibility that spectrum pricing might impact negatively on investment:[36]

> *"… other users would be expected to react to an increase in fees through actions such as passing on the cost of spectrum to their consumers, reducing their investment or reducing their profit." Paragraph 4.40.*

Ofcom, in the 2013 consultation on annual licence fees, contemplate the possibility that spectrum pricing might also raise consumer prices – arguing that if they did so it would be efficient:[37]

> "…*we do not consider that there is a basis for Ofcom bringing about lower consumer prices if this entails introducing a market distortion."*

Further, Ofcom, in relation to the purpose of AIP, state the following in the 2010 revised framework for spectrum pricing:

> *"The rationale for AIP may be simply stated. If the price charged for any limited resource, whether it is energy, raw materials, land or spectrum, does not reflect its opportunity cost, there will be less incentive to use it efficiently, it will not be available for alternative uses or other users that could produce additional value and society will be worse off. For example, faced with a choice between investing in more advanced equipment and using more spectrum businesses will naturally tend to choose the option with lower costs. If the cost of spectrum reflects its true opportunity cost, and the cost of equipment also reflects its true value (as would be expected in a well-functioning market for equipment) then business will make the trade-off between*

[36] An alternative 'Econ 101' view would be that an efficient price for spectrum would remove economic rent associated with spectrum scarcity and would therefore have no impact on investment or end-user prices. However, if this were the case, it would do nothing to promote spectrum efficiency and would be a disproportionate measure.
[37] Ofcom, *Annual licence fees for 900 MHz and 1800 MHz spectrum - Consultation*, October 2013.

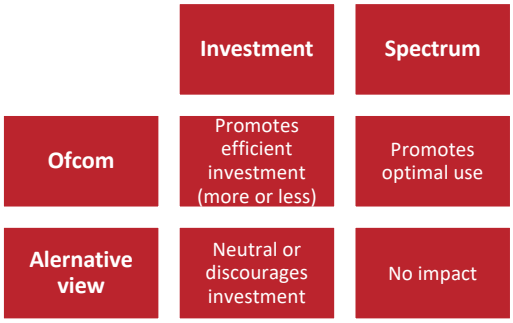
investment in spectrum and equipment in a way that maximises benefits generated from their use." Paragraph 3.34

Ofcom is not only arguing that spectrum fees are necessary to promote the optimal use of spectrum, but that any adverse impact on investment and service prices is a price worth paying in correcting a market distortion.

This perspective not only side-steps consideration of the anticipated impacts against the duties under the Act, but also – drawing on the analysis in this paper – fails to account for the fact that spectrum fees for mobile use are unlikely to contribute to promoting spectrum efficiency whilst potentially adversely impacting investment.

A summary of alternative views of the impact of applying spectrum pricing to spectrum utilised by mobile operators is provided in Figure 2.

Figure 2: Impact of AIP for mobile



The weight of evidence supports the alternative view, that administrative pricing of spectrum for mobile use is redundant in relation to the optimal use of spectrum, is therefore disproportionate and indeed is likely to prove harmful in terms of the achievement of other relevant duties.

A role for administrative spectrum pricing may remain in relation to government use

Government use differs from mobile use in terms of incentives for the optimal use of spectrum and therefore potentially in terms of the balance of argument in relation to administrative incentive pricing.

The reason that incentives differ and that an implicit price may not be sufficient flows from the fact that not all government use suffers from spectrum scarcity and that there are grounds for seeking a reallocation of spectrum at the margin from government use to mobile use based on competing use value estimates, for example, in relation to some spectrum held by the Ministry of Defense and for terrestrial broadcasting.[38]

Further, government users may not be responsive to an implicit price alone for institutional reasons.[39] Imposing an administrative price may therefore be appropriate and proportionate in relation to government use.

Aligning spectrum policy with Government priorities

The government has a wider set of priorities including mobile coverage, the 5G strategy and supporting productivity and income growth. Investment in enhanced mobile connectivity is key to meeting these objectives.

The Governments 5G strategy recognises this, noting that 5G networks will require a step change in investment and that the vast majority of investment will need to come from the private sector. The strategy is also clear about the

[38] Ofcom concluded that mobile would be a higher value use of 700 MHz spectrum currently utilised for terrestrial broadcasting. Ofcom, *Maximising the benefits of 700MHz clearance*, March 2016.

[39] Institutional reasons could include a lack of property rights over the spectrum in question, lack of profit motive and administrative claw back of the proceeds of asset sales. These constraints on responsiveness to an implicit opportunity cost arise in relation to terrestrial broadcasting and public-sector spectrum use, but not in relation to spectrum use by mobile operators.

respective roles of industry and government in delivering improved outcomes:[40]

> *"While industry is best placed to respond to market demand and determine the scope of 5G, the Government has an important role to play - creating a robust framework that helps to underpin and accelerate investment here in the UK; and helping to prove the business case for commercial investment in 5G infrastructure, particularly where increased investment is needed to cover the roll-out of small cells in connectivity 'hot spots'."*

Consistent with this, we propose that the Government consider rescinding the annual licence fee element of the 2010 Ministerial Direction (the original spectrum liberalisation objective has been met), and instead issue a statement of strategic priorities to Ofcom which is aligned with current priorities.

Revisiting the Ofcom principles governing spectrum pricing

Ofcom follow the following principle (principle 3) in deciding when spectrum pricing should be applied:[41]

> *"AIP should apply to spectrum that is expected to be in excess demand from existing and/or feasible alternative use, in future, if cost-based fees were applied. In determining feasible alternative uses, we will consider the relevant timeframe, any national or international regulatory constraints, the existence of equipment standards, and the availability and cost of equipment."*

Given that mobile operators face their own use opportunity cost of spectrum pricing absent administrative fees, a more nuanced approach than that in principle 3 is required.

Further, the implications of spectrum pricing should be teased out and assessed against the full set of relevant Ofcom duties, rather than basing the approach purely on an assessment in relation to the optimal use of spectrum.

A review of the Ofcom 2010 spectrum pricing framework is proposed in order to address these issues.

Moving away from administrative incentive pricing for mobile use would be consistent with prior shift from administrative 'beauty contests' to auctions' namely it would reduce the scope of administrative decisions in relation to spectrum allocation in favour of the market - where possible and consistent with public policy goals.

Complementary policy measures

The question of whether to apply recurring spectrum fees and at what level in relation to spectrum sold at auction in the UK arises after the expiry of the initial licence term of 20 years.

However, as the World Bank have noted, with trading and liberalisation of spectrum there may be no need for an expiry date: [42]

> *"If trading and liberalisation are introduced, the main purpose of imposing expiry dates falls away… Indeed, the presence of an expiry date may distort the market, as it creates investment uncertainty that may unduly reduce the value of usage rights towards the end of their duration."*

Greater assurance of spectrum rights can contribute to better outcomes for consumers and the economy. The reason for this is that

[40] Department for Culture, Media and Sport and HM-Treasury, *Next Generation Mobile Technologies: A 5G Strategy for the UK*, March 2017.
[41] Ofcom, *Revised Framework for Spectrum Pricing*, December 2010.
[42] Guermazi & Neto, *Mobile licence renewal: what are the issues? What is at stake?* World Bank Policy Research Working Paper 3729, October 2005.

renewal and prospect of future fees, including the possibility of fees that reflect investment in complementary assets which improve the value of spectrum, may discourage investment and innovation.

Alongside a review of the principles governing administrative spectrum pricing a review of the approach to license duration and renewal could be undertaken. Greater clarity over property rights, more in line with land, could see market participants taking a longer-term view in terms of investment, innovation, spectrum trading and sharing – unencumbered by uncertainty as license renewal is approached.

Conclusion

It is proposed that:

- The Government review the spectrum annual licence fees element of the 2010 Ministerial direction, in light of current priorities, with a view to rescinding this aspect of the Direction.
- The Government consider issuing a statement of strategic priorities to Ofcom under the Digital Economy Act 2017 setting out priorities in relation to investment in mobile infrastructure and a supporting policy environment.
- Ofcom review the 2010 framework for spectrum pricing, in particular regarding the conditions under which explicit spectrum pricing should be imposed, having regard to the full set of circumstances in which spectrum users face the implicit price of spectrum.
- Ofcom put on hold the application of recurring spectrum fees in relation to 900 MHz and 1,800 MHz spectrum, pending the outcome of the review of the 2010 framework for spectrum pricing.

This is a timely opportunity to review priorities and reset the policy stance in a manner supportive of investment in mobile network infrastructure and the Governments 5G strategy. The Government and Ofcom should seize this opportunity.