

Mobile spectrum licence duration and mobile network operators' investment decisions

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Ofcom is committed to encouraging debate on all aspects of media and communications regulation and to creating rigorous evidence to support its future decision-making. One of the ways we do this is through publishing discussion papers, extending across economics and other disciplines. The research aims to make substantial contributions to our knowledge and to generate a wider debate on the themes covered.

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Analysys Mason, who provided data on spectrum awards from the Analysys Mason Auction Tracker as well as data from the Telecoms Market Matrix.

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1. Introduction and background

- 1.1 Spectrum is a valuable limited resource crucial to delivering a wide range of wireless communication services, including mobile phones, satellites, and WiFi.
- 1.2 As the UK's communications regulator, Ofcom's principal duty is to further the interests of citizens and consumers, where appropriate by promoting competition. Ofcom is also required to secure the optimal use of the electromagnetic spectrum for wireless telegraphy. Among other factors, in performing its duties, Ofcom must have regard to the desirability of encouraging investment and innovation.¹
- 1.3 The structure of our spectrum licences is one way to encourage investment and innovation. For example, restrictions in a licence can preclude a particular kind of new use² and licence duration can potentially impact licensees' investment incentives.
- 1.4 In principle, there is a trade-off between length of licence term and different kinds of economic efficiency. Longer licence terms could increase mobile network operators' (MNOs) certainty about their spectrum access, and this could lead to increased investments in network infrastructure (dynamic efficiency). On the other hand, shorter licence terms could give the regulator the opportunity to reallocate the spectrum to the user who can make the highest value use of it (allocative efficiency).
- 1.5 Despite the potential importance of licence duration for MNOs' investment levels, there is limited empirical research available on how they interact.
- 1.6 The only research we are aware of is a paper by Jeanjean, Lebourges and Liang (hereafter JLL).³ They find a strong, positive relationship between licence duration and MNOs' investment levels.
- 1.7 The research in this discussion paper aims to expand on this limited evidence base by revisiting and building on the JLL paper. We commissioned CRA to undertake empirical research to revisit JLL's analysis with the latest data and extend the scope of the analysis to include methodological improvements and additional research questions.
- 1.8 In the next section we summarise the analysis and the key findings.

¹ Communications Act 2003, sections 3(1), 3(2)(a) and 3(4)(d).

² For example, some licences preclude mobile use because operators need to register the address of radio equipment including terminals using the spectrum, as well as their antenna height and antenna bearing.

³ Jeanjean, Francois & Lebourges, Marc & Liang, Julienne, 2019. "*The impact of licence duration on tangible investments of mobile operators*," Telecommunications Policy, Elsevier, vol. 43(9).

2. Summary and key findings

2.1 In this section we summarise CRA’s analysis and key findings.

Unlike JLL, CRA’s analysis did not find a statistically significant relationship between longer licence duration and higher investment levels

2.2 Using the latest available data, CRA revisited JLL’s analysis of the impact of licence duration on investment levels. While JLL found a strong, positive relationship between licence duration and MNOs’ investment levels, CRA did not find a statistically significant relationship.

2.3 The different results could be, in part, because data limitations meant that CRA could not perform the analysis over the exact same period as JLL. In addition, the data is inherently ‘noisy’ (it contains variation which is not informative) and aggregated (investments are recorded at the operator level and not the licence or spectrum frequency level). Despite the data covering a relatively long period of time, in practice it covers the 4G investment cycle and the beginning of the next (5G) and the end of the previous (3G) investment cycles. The foregoing factors made it difficult to establish a causal relationship.

2.4 Apart from revisiting the JLL analysis, CRA also considered two other ways in which licence duration could affect incentives to invest at different points in the investment cycle. Firstly, CRA assessed whether licence duration affects investment levels towards the end of the licence term. This could be because the licence holder might have limited investment incentives as the end of the licence term approaches if it cannot be certain that it will be re-awarded the spectrum. Secondly, CRA considered whether licence duration affects investment in the first one to five years following the licence award.⁴

Firstly, CRA’s results suggest that longer licence duration is associated with lower levels of investment towards the latter part of a licence term - however the relationship is not statistically robust

2.5 This analysis investigated whether MNOs reduce their investment towards the end of their licence terms. This might be the case because an MNO risks losing access to the licensed spectrum at the next award and the equipment purchased later in the licence term would be ‘stranded’. This risk might lead MNOs to not purchase the equipment in the first place, resulting in lower-quality services for customers.

⁴ CRA’s analysis departs from the JLL framework in the way it treats indefinite licences. Some countries in our sample issue licences which look similar to indefinite licences, as their renewal is guaranteed. This poses technical problems for the econometric analysis as results for estimations with these licences do not have a straightforward interpretation. To overcome this challenge, CRA treats licence duration as a categorical variable (more detail is provided in Annex 1). The group of indefinite licences in the analysis is defined as licences issued in the following countries: the Czech Republic, Estonia, Latvia, Spain, the UK and the USA. We have agreed this approach with CRA as we understand from the evidence available (see Annex A in recent OECD report on [“Developments in Spectrum Management for communication Services”](#), published in October 2022) that: (i) Estonia grants licences with unlimited duration subject to annual fees, (ii) the Czech Republic and Latvia have an automatic renewal regime, (iii) in Spain there is a strong presumption of renewal for another 20 years and (iv) in the US, operators may expect their licences to be renewed unless there is a failure to comply with the FCC’s rules or there are mutually exclusive applications. CRA also tested the affect of alternative definitions of this group.

2.6 More specifically, CRA measured overall levels of investment between the eleventh and the fifteenth year of MNOs' licences and assessed how investment levels differ between cases where the licence had a 15-year term (hence these were the last five years of the licence) and cases where it had a 20-year or indefinite duration⁵ (meaning there were five or more years remaining on the licence). The key result is that longer duration licences are associated with lower levels of investment towards the latter part of the licence term, but the results were not statistically robust.

Secondly, CRA did not find evidence that, at the country level or at the MNO level, investment levels are higher in the first one to five years following the licence award when the licence term is longer rather than shorter⁶

2.7 For relatively long licence durations (for example 20 years), we did not expect that licence duration would significantly impact on MNOs' investments immediately after an award. This is because whether a licence term is 20 years or indefinite might not matter for investment levels as the same initial infrastructure is required for both licence durations. Indeed, we did not find evidence that investments following the licence award are systematically higher for longer term licences than shorter term licences.

2.8 Finally, CRA considered whether licence duration may lead to higher quality services for customers.

Results suggest that higher investment levels are associated with increases in download speeds for customers, but the analysis did not find evidence of a relationship between licence duration and download speed

2.9 One of the reasons we are interested in investment levels is that we expect it to lead to improvements in customer welfare (for example, lower prices or higher quality). While we found that higher investments led to faster download speeds (a measure of service quality), longer licence duration did not.

2.10 Overall, the research in this discussion paper contributes to the evidence base on the relationship between licence duration and MNOs' investments. The findings challenge the proposition that longer licence durations lead to higher levels of investment by MNOs. However, data limitations mean that the findings do not provide a guide to the optimal licence duration. When making regulatory decisions on licence duration, Ofcom will continue to take account of the specific characteristics of the mobile spectrum - for example the uncertainty about future use cases - and the relevant market.

2.11 Full details of the data, methodology and results can be found in CRA's report in Annex 1.

⁵ Ofcom's most recently awarded mobile spectrum licences are an example of licences with an indefinite duration. They have (i) an indefinite term (i.e. they continue in force until revoked by Ofcom or surrendered by the licensee) and (ii) an initial term of 20 years during which Ofcom cannot revoke the licences for spectrum management reasons or charge additional licence fees. These auctions include the [2021 award](#) (700 MHz and 3.6-3.8 GHz), the [2018 award](#) (2.3 GHz and 3.4-3.6 GHz) and the [2013 award](#) (800 MHz and 2.6 GHz).

⁶ The analyses CRA performed are different for the country-level and MNO-level analysis. See Annex 1 for more detail.