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Agenda

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How many mobile network providers do we need?

The 4G spectrum auction in the UK has resulted in four mobile network operators being able to compete with new high-speed services. Is this enough? Bruce Lyons, Professor of Economics at the University of East Anglia and Deputy Director of the ESRC Centre for Competition Policy, discusses how recent research on the speed of uptake of mobile phones casts interesting light on the answer

As a result of the 4G spectrum auction in the UK, we can expect four firms to be competing with new high-speed services, particularly for smartphones and tablets.[1] The auction involved seven bidders, but two potential entrants dropped out near the end, leaving four familiar operators to pick up the main licences: Vodafone Ltd, Everything Everywhere Ltd (a joint venture of T-Mobile and Orange), Telefónica UK Ltd (O2), and Hutchison 3G UK Ltd (3). A fifth firm (BT subsidiary, Niche Spectrum Ventures Ltd) also won part of the spectrum, but will probably use this to facilitate broadband access in rural areas and Wi-Fi hotspots elsewhere. BT is not expected to rejoin the mobile market, which it entered with Cellnet in 1985 before selling out to Telefónica in 2005. So, it seems we will have four competing 4G operators plus one possible smaller operator with capacity.

Most of the press coverage has not been about the competitive consequences of having four operators, but about the £2.34 billion auction revenue that was raised for the Treasury.[2] This was disappointing on two counts. First, it compares very modestly with the £22.5 billion raised by the 3G spectrum auction in 2000,[3] just at the time that the dotcom boom was turning to bust, although no one expected that sort of revenue to be generated this time around. Second, it is less than the £3.5 billion budgeted in the Chancellor's autumn statement, thus leaving a large dent in George Osborne's attempts to stop the government deficit from rising.

Of course, disappointing auction revenue is important for taxpayers and for users of government services that may be cut, but in the long run it is not what matters most. In fact, there is a trade-off between raising revenue for the Treasury (maximised by selling a lucrative monopoly) and creating a competitive industry that is great for consumers but that leaves firms without excessive anticipated profits with which to bid for licences. Ofcom estimates that there will be some £20 billion extra consumer surplus as a result of rolling out 4G. Politicians, perhaps inevitably, are more bullish, with Culture Secretary, Maria Miller, predicting a £50 billion value to the UK economy.[4] The exact figure is impossible to predict accurately, but the ballpark figures indicate what is at stake. It is crucial that the structure of the market is designed so as to bring out the maximum benefits as soon as possible.

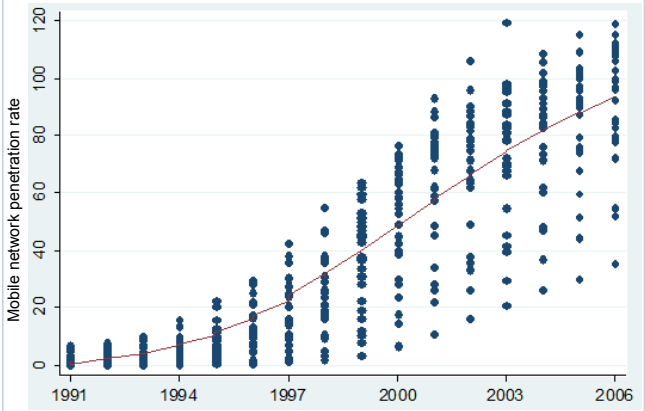
This brings us back to the question of what is enough. But first we need to ask: 'enough for what?' We usually think first of the effects of competition on price, then go on to consider product range, quality and innovation. However, an alternative approach is possible for evaluating the appropriate market structure in the context of introducing a new product. In joint work with Yan Li at the Centre for Competition Policy, I argue that the speed of consumer uptake of a new service (product diffusion) provides an important summary measure of how well the market is performing for potential consumers.[5] Like any other product, the demand for mobile phone services is influenced by a range of marketing and technical factors that constitute the overall product 'offer'. This offer includes price level, price structure (eg, the cost of making, relative to receiving, a call), reach (geographic coverage), services and reliability. Individual elements of the product offer are difficult to observe and measure on a consistent basis, either internationally or over time, but consumers buy only if this complex offer is attractive to them, so consumer uptake is a relatively straightforward summary indicator of consumer benefit.

This article first appeared as Lyons, B. (2013), 'How Many Mobile Network Providers do we Need?', *CCP Research Bulletin*, **25**, Spring.

Our research aimed to identify those features of the market that maximise the rate of diffusion of mobile telephony through the population. We focused on understanding the central period of diffusion in all 29 OECD countries plus China. Over 16 years from 1991, average market penetration across these countries rose from less than 2% to nearly 97%. Figure 1 below illustrates this growth of mobile network penetration, with each dot representing a different country and the curve showing the average over time. Some countries had achieved in excess of 100% penetration by 2006, with many individuals having multiple accounts
(eg, one for work and one personal). China, Canada and Mexico were the lowest achievers. Note the distinct S-shape of the curve, which is characteristic of the diffusion process—early adoption is slow as there are relatively few people to phone when they are away from a landline, but then growth takes off rapidly, before slowing again as maximum penetration is approached. We took this into account in specifying our empirical model.

Our main interest was in the slope of this diffusion curve for each country and how it increased or decreased with changes in, for example, market structure and technological developments. When the market is regulated, as it must be because of the scarcity of radio spectrum, it is particularly important to understand how the various potential regulatory levers (eg, number of firms, public ownership, price controls) affect the diffusion process. This period and set of countries provide a fascinating range of market structures. In four countries (including the UK), the mobile networks were always in private hands, and in three countries (China, Mexico and Turkey), they have always been nationalised. In the remaining 23 countries, privatisations took place during the period.

Figure 1 Growth curve of mobile network penetration



Note: Bandwidth = .8
Source: Lyons, B. (2013), 'How Many Mobile Network Providers do we Need?', *CCP Research Bulletin*, **25**, Spring.

There is a similar range of experiences with independent regulation (eg, Ofcom in the UK), which was not always established at the time of privatisation.

It is the range of international experiences with different numbers of mobile networks and each changing over time that helps us most in answering our question. In 1991, there were just five countries with two operators (including the UK), and the rest were monopolies. By 1999, every country had at least two operators and the USA had the highest number, with seven. In 2006, the average number of operators was 3.8; only three duopolies were left; the UK had five operators; and the USA and Canada were the only countries with six. This provides a wide range of observations and so allows our econometric study to estimate the effect of all market structures from monopoly to heptopoly (seven firms).

We found that consumer uptake was more rapid when operators were privatised. The presence of an independent regulator also had a modest positive effect. However, the effect of increasing the number of operators was much more important. Monopoly results in the slowest uptake, and duopoly is much faster. Adding a third is even faster, and five firms results in the most rapid consumer uptake. While our results did not identify four firms as a particularly attractive market structure, the general finding was that more firms resulted in speedier diffusion. However, there was no evidence of gain from having more than five.

We were also able to probe a little deeper to see whether the competition arising from more firms worked through price or through something else. In practice, it is difficult to measure price for mobile calls because of all the different pricing options that are offered. Nevertheless, taking a summary measure of the price of a three-minute call, we found that price accounted for up to half of the effect on more rapid uptake. This meant that much of the effect of competition had to take place through services, marketing and other aspects of the offer to potential customers. We found that privatisation was particularly effective for these non-price effects and independent regulators were good only for price control.

Needless to say, it is not only market structure that matters. Mobile penetration was slower in more urban economies, not least because of the lack of landlines as an alternative in rural areas. Initial uptake also depended positively on per-capita GDP. Some national markets were late to start but then tended to grow faster, with our model predicting full catch-up by around 2014.

Finally, technological developments had a major impact. In particular, digital communication was

introduced in the 1990s and brought new services (eg, text messaging), greater reliability and more privacy. This was a substantial boost to mobile subscriptions. Another aspect of new technology is also of considerable interest. Some countries quickly standardised on a particular digital technology (eg, GSM in Europe), while others (eg, Canada, New Zealand and the USA) allowed alternatives to develop simultaneously. We found that multiple technologies resulted in slower uptake as consumers were either confused, or held back to see which technology was going to be the most successful.

So, are four operators (plus BT with spectrum in the background) enough to maximise the speed of 4G uptake? Our research was not directly set up to address this technology generation question because we looked at the uptake of mobile subscriptions of all generations. Nevertheless, our results do suggest that four or five is about right, and that future mergers should be looked at very carefully if they would result in fewer operators.

Bruce Lyons

[1] Ofcom (2013), 'Ofcom Announces Winners of the 4G Mobile Auction', February 20th, available at http://media.ofcom.org.uk/2013/02/20/ofcom-announces-winners-of-the-4g-mobile-auction/.
[2] *The Telegraph* (2013), 'Blow for Osborne as Government Raises £1 bn Less than Expected from 4G Auction', February 20th, available at http://www.telegraph.co.uk/news/politics/9882387/Blow-for-Osborne-as-Government-raises-1-bn-less-than-expected-from-4G-auction.html.
[3] BBC (2000), 'UK Mobile Phone Auction Nets Billions', April 27th, available at http://news.bbc.co.uk/1/hi/business/727831.stm.
[4] 'Spectrum use is worth more than £50 billion to the UK economy and 4G mobile broadband is a key part of our digital growth strategy'. UK Government (2013), '4G Auction to Deliver a "Significant Economic Boost"', news story, available at https://www.gov.uk/government/news/4g-auction-to-deliver-a-significant-economic-boost.
[5] Li, Y. and Lyons, B. (2012), 'Market Structure, Regulation and the Speed of Mobile Network Penetration', *International Journal of Industrial Organization*, **30**, pp. 697–707.