

The Big Read 5G networks

5G: how the airwaves became an 'electromagnetic cash cow'

Do governments want the best 5G networks or to rake in billions from spectrum sales?

Nic Fildes in London 10 HOURS AGO

How do you put a price on a telecoms spectrum licence? Chinese operators have picked them up for free — part of Beijing's attempt to have a national rollout of 5G. Yet in parts of Europe recent auctions have been so expensive that at least one company has had to cut shareholder dividends. In the US — where President Donald Trump has declared that "[the race to 5G](#) is a race that America must win" — spectrum licences are being sold at historically low prices.

The answer to the question will determine not just the [future of the technological resource](#) — referred to as the "lifeblood of the mobile industry" — and the operators themselves, but will also have a major impact on the next stage in the development of the digital economy.

Carriers argue that 5G will offer a faster and more reliable service for everything from video streaming to advanced virtual reality experiences. Governments see the "race" to the new network technology as fundamental to ushering in a world of smart cities, autonomous cars and automated factories where faster, more responsive networks can handle huge amounts of data generated by new industries.

For the telecoms operators the licences are the "ticket to ride" — access to the infrastructure that will be critical to their future success, even existence. For governments they are no less important

yet some cash-strapped administrations have been sending out mixed signals over how to strike a balance between raising billions from a sector already straining to reduce costs while stimulating investment in the rapid deployment of [5G services](#).



Enrique Lloves, head of strategy for Telefónica: 'This money is not coming back to the industry and that is a concern for us' © Telefonica

It means that two decades after the 3G spectrum sales made headlines by racking up record sums — and almost bankrupting some players — a new spectrum price bonanza is evolving. Airwaves previously used for everything from academic satellites and analogue television broadcasts to wireless microphones used in theatres are being cleared and sold off to the telecoms industry for commercial use to meet the insatiable consumer demand for data.

Yet, says Jay Goldberg, a consultant with D2D Advisory, for all the hype operators are struggling to say whether they will make any profit from the new wireless technology. Much depends on the

release of spectrum to deliver on the promise of 5G without bankrupting operators, as almost happened with 3G.

“The risk is that 5G requires big spectrum purchases which only start to be profitable in 10 years,” he says.

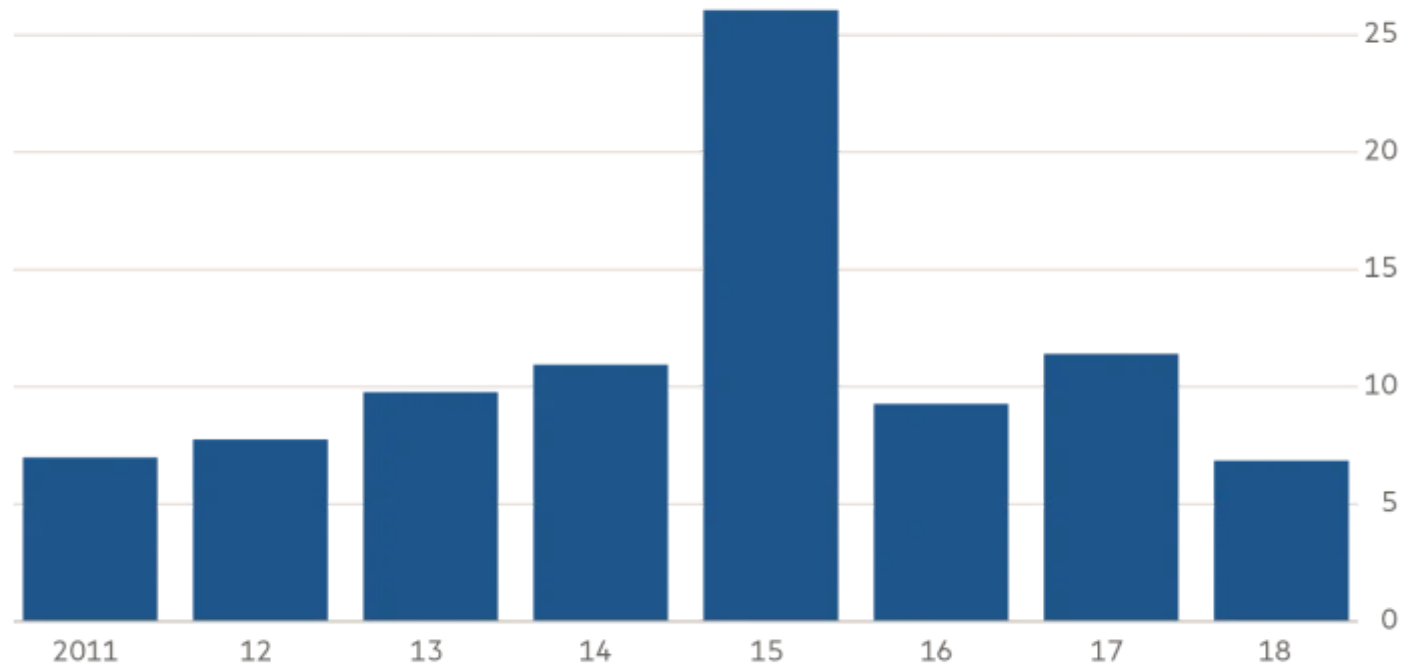
The race between nations — including China, [South Korea](#), the US and UK — to be the first to launch 5G has given rise to a different debate over who will dominate the next generation of wireless telephony and reap the most economic benefit. The [trade war between the US and China](#) has featured a battle over 5G and the role Chinese network equipment supplier [Huawei](#) plays in the global industry.

China granted its spectrum licences to the country's telecoms networks in June rather than selling them off. The US then unveiled its biggest ever sale of spectrum in July boasting of a plan to auction off, by the end of the year, more airwaves than the country's combined mobile industry currently employs. It has set the bidding for some of the very high frequency bandwidth at a value of one 10th of a cent per megahertz per capita making those airwaves some of the cheapest ever sold.

Other governments see spectrum — the airwaves used to carry mobile phone and other electromagnetic signals — as a cash cow. India's telecoms regulator has just proposed selling blocks of spectrum for 5G at a price that is 40 per cent above what was charged in other Asian markets.

Spectrum spend

Industry average (as % of total capex)



Source: MTN Consulting
© FT

Auctions in Italy and [Germany](#) have raised huge sums. Vodafone was forced to cut its dividend for the first time in its history following the German sale, amid industry warnings that the more they spend on spectrum, the less they have to spend on building the network via new masts, servers and base stations.

It appeared to be a thinly veiled threat to European politicians, who want a rapid deployment of 5G but seem reluctant to cap spectrum prices. According to MTN Consulting, spectrum prices

accounted for an average 11.4 per cent of the industry's capital expenditure between 2011 and 2018.

This debate is occurring as a fresh round of auctions is set to take place, stretching from the UK to India, the US and France in coming months. They will act as a further guide to government priorities when it comes to 5G plans.

“Some countries see this as a way of taxing our industry instead of helping new technologies,” says Enrique Lloves, head of strategy for Telefónica, the Spanish telecoms group. “This money is not coming back to the industry and that is a concern for us, for the consumers and the economy.”

Others dispute that high spectrum costs have a knock-on effect for consumer prices.



In June, Germany drew in €6.6bn from a 5G auction. Dirk Wössner, pictured, a member of the Deutsche Telekom board, said it had left a 'bitter taste' © Getty

“There is no evidence that higher spectrum costs have led to higher prices [for consumers],” says Paul Klemperer, the principal architect of Britain’s 3G sale in 2000. “If I inherit a house for free it does not mean that as a landlord I wouldn’t charge any rent.”

For the operators the dilemma is acute: pay too much and struggle to roll out a network, pay too little and they will lose access to 5G, customers and potentially their business.

European operators point to the case of Tele2 as an example of how things can go wrong. It lost out when 4G licences were sold in Norway in 2013 after the incumbent players were ambushed by a new entrant backed by billionaire Len Blavatnik. Tele2, based in neighbouring Sweden, was forced to exit Norway months later.

The rapid growth in the wireless industry in the 1990s, and the value attached to the airwaves, created the auction system which hands out licences. The spectrum was originally parcelled up and handed out for nominal sums in the 1980s to nascent wireless operators, such as BT Cellnet and Racal Electronics, the defence company that gave birth to Vodafone in the UK. Within 15 years, those licences developed into a multibillion-dollar industry largely built on thin air.

That bargain basement approach, however, came to a crashing halt in 2000 when the UK 3G auction raised a staggering £22.5bn from five operators, in what signalled a turning point for both the growth of the mobile industry in Europe and the value placed on spectrum. Yet the euphoria was shortlived after disappointing 3G auctions in Italy, the Netherlands and Switzerland.



Jessica Rosenworcel of the US Federal Communications Commission: 'Recent spectrum auctions in the United States haven't drawn the levels of demand we've seen in the past. We need to understand why' © Bloomberg

The value of spectrum dropped rapidly as Europe's largest telecoms companies spent too much capturing the 3G market. BT was forced to demerge its mobile arm after the UK and German auctions crippled its balance sheet with too much debt. Only £2.3bn was raised in the UK's 4G spectrum auction 13 years later, leaving then chancellor George Osborne nursing a £1.2bn shortfall in the public finances after he had budgeted for a much higher income from the sales.

There are numerous ways to auction spectrum from "simultaneous multiple round ascending" styles, through to straight beauty contests and sealed envelope bids. Their success or failure are determined by a number of factors including the number of licences on offer, the amount of spectrum being sold and conditions attached to each licence such as geographic coverage obligations. They can be designed to encourage new entrants — by offering more licences than there are existing networks — or to shackle larger companies that already have huge spectrum reserves by introducing caps.

How the blocks of spectrum are carved up can also have an effect. A roughly equal spread of lots can reduce competitive tension while wildly unequal blocks, as was the case in Italy, can generate a bidding frenzy as operators battle not to be left with an inferior portion of the airwaves.

A poor design can lead to a market distortion where some bidders overpay for spectrum or get less than they need to compete. "It's very, very hard to figure out what the best strategy might be," says one economist who specialises in spectrum auctions. "These auctions are just so complicated."



Former trade minister Patricia Hewitt announcing in 2000 that the UK 3G auction had raised a staggering £22.5bn © PA Archive/PA Images

For a time this was not a problem. The failure of 3G to live up to expectations had put a damper on auctions. In 2016 and 2017, sales in Slovakia, Spain, Ireland and the Czech Republic generated modest sums. That changed with the [2018 UK sale of spectrum](#) that can be used for 5G services. The £1.35bn spent by Britain's four operators looked low, but with less spectrum on sale, the price per megahertz proved to be double market estimates.

More was to come. Italy's populist government raised €6.5bn from an auction last October, which had been structured so that only two of the four mobile networks in the country would secure large blocks of spectrum. Nick Read, chief executive of Vodafone which stumped up €2.4bn for its slice of Italian spectrum, said that the "artificial auction" design had not created a fair balance.

The result sent shockwaves through the industry. Chief executives, already under pressure to invest billions in 5G and network expansion, were now being forced to pay through the nose for spectrum to do so. The Italian auction set a price per megahertz of €0.35 per capita compared with €0.036 in Finland in a sale held the same week.

In June, [Germany drew in €6.6bn](#) — more than double what had been expected — from a 5G auction. The bidding had been pushed higher by Drillisch, a smaller mobile player, but also by Berlin's decision to carve out a quarter of the spectrum for industrial users like the car industry which plan to use the faster network technology to develop more advanced manufacturing methods. That created a scarcity for the four remaining players looking to secure spectrum for commercial use.

Dirk Wössner, a member of the Deutsche Telekom board, said the high price had left a “bitter taste”. “The network rollout in Germany has suffered a significant setback,” he said. “The price could have been much lower . . . Network operators now lack the money to expand their networks.”

Asked if he fears that the impending UK auction could turn into another bidding frenzy, Philip Jansen, BT's chief executive, says: “I really hope not. It doesn't help anybody.”

Whether the auction results prove to be a “nightmare” for Germany and Italy is unclear — 5G is still a long way from taking off as a mainstream service. Yet the debate over how best to apportion spectrum is raging even in countries trying to win the race by handing it to the networks as fast as possible.

Jessica Rosenworcel, commissioner at the Federal Communications Commission — which runs US spectrum auctions, says it needs new entrants to the market.

“Recent spectrum auctions in the United States haven't drawn the levels of demand we've seen in the past,” she says. “We need to understand why. We should recognise that the success of our

future auctions depends on developing a new class of spectrum interests who can join the ranks of those who bid on airwaves and foster new wireless innovation.”

Spectrum wars: How fear of 'bedlam' gave way to a bidding frenzy



Ronald Coase was a British economist who was awarded the Nobel Prize in 1991 © AFP

Spectrum has not always been viewed as a potential cash cow by governments. Nobel laureate Ronald Coase, right, first laid out the case for the sale of radio airwaves in 1959 but his proposal was initially shouted down as being a recipe for “etheric bedlam”. Radio frequencies thus remained under the tight control of governments until 1990, when New Zealand became the first country to hold a spectrum auction.

That paved the way for the first US auction in July 1994. That five-day process generated \$617m in bids and proved to be a landmark event in the history of telecommunications, with \$60bn raised across 87 auctions over the next two decades. The economists behind the 1994 auction were later awarded the Golden Goose Award by Harvard University, which found they had used game theory to liberate the US from “wireless purgatory”.

The UK 3G auction six years later set a new high for a successful sale as 13 bidders battled ferociously for one of five licences to launch a 3G network.

The UK was the first country to hold a 3G auction at a time when cash-rich telecoms companies were engaged in a global land grab.

It was so successful because it struck the right balance between enticing new entrants to bid while deterring collusion between existing players, something that became a hallmark of successful auction processes.

Adding too much complexity into auctions can also produce a suboptimal result, with bidders either deterred from bidding or unsure of their best strategy.

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