The impact of spectrum prices on consumers

Executive summary

September 2019

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Introduction

With more than 5 billion unique subscribers worldwide, mobile communications is a general-purpose technology vital to innovation in most industries and sectors. It can increase business competitiveness, drive productivity growth and help improve living standards more broadly.

The radio spectrum that governments license to operators is central to the quality and affordability of mobile broadband services. However, some government policies – inadvertently or not – result in high prices being paid to access spectrum. This includes the design of spectrum awards, such as auctions and other types of assignment.

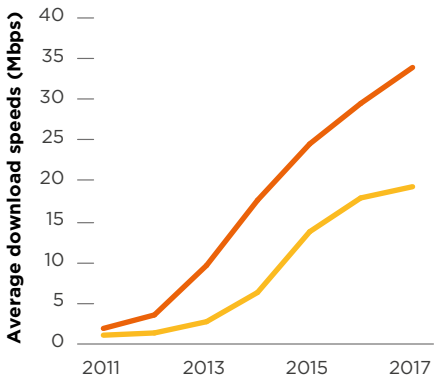
This study presents strong new evidence that expensive spectrum can cause negative consumer outcomes, including lower coverage levels and slower data speeds.

Trends in consumer benefits and spectrum prices

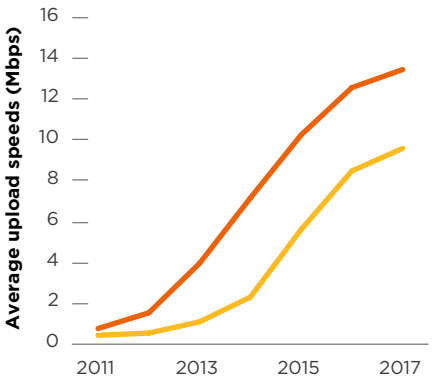
Mobile networks are regularly upgraded to offer improved benefits to consumers in terms of service quality and cost. For example, mobile coverage, data speeds, latency and the affordability of services have all improved significantly in recent years (see fig 1-3).

FIGURE 1

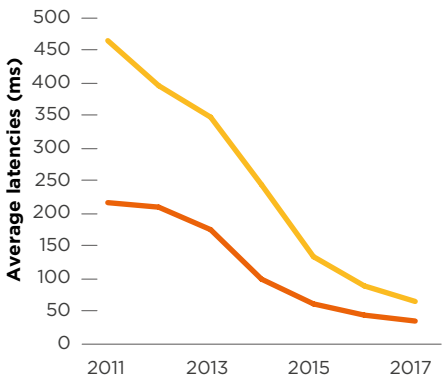
MOBILE DOWNLOAD SPEED IMPROVEMENTS, 2011–2017



MOBILE UPLOAD SPEED IMPROVEMENTS, 2011–2017



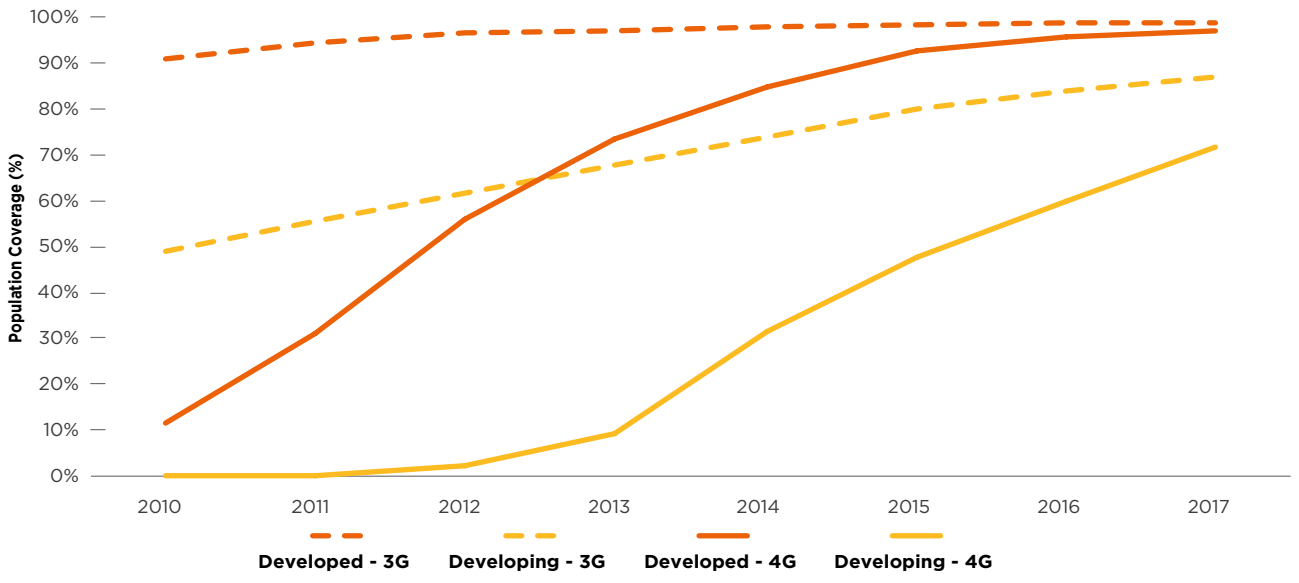
LATENCY IMPROVEMENTS, 2011–2017



Source: GSMA Intelligence calculations based on data provided by Ookla® Speedtest Intelligence®. Average speeds and latencies for each country were calculated based on the mean average of all tests performed by consumers in a given year (including on 2G, 3G and 4G networks). We then took the averages for developed and developing countries to produce the trends, with developed countries those classified as "high income" by the World Bank Income Classifications and developing countries those classified as "lower", "lower-middle" and "upper-middle" income countries.

FIGURE 2

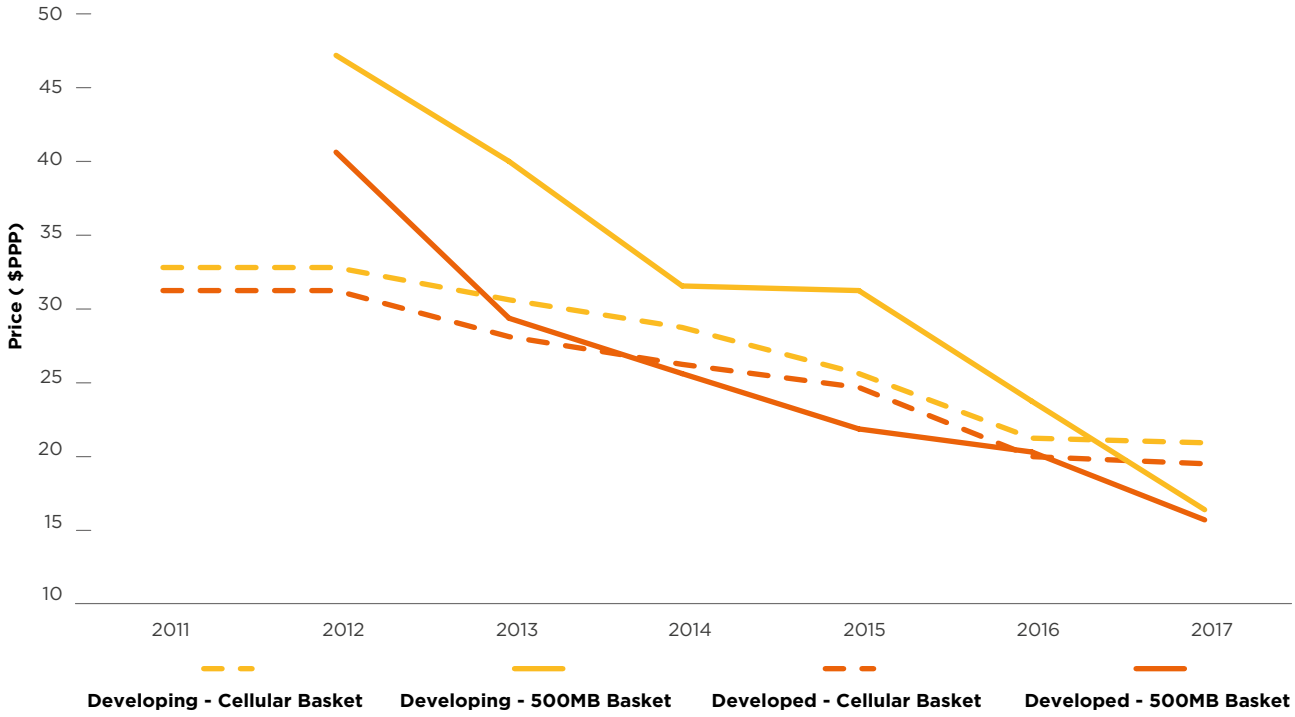
MOBILE COVERAGE IMPROVEMENTS, 2010–2017



Source. GSMA Intelligence

FIGURE 3

AVERAGE PRICE TRENDS, 2011–2017



Source: GSMA Intelligence calculations based on ITU pricing data. Definition of baskets and methods of data collection can be found in the ITU's annual Measuring Information Society Reports. Developed and developing pricing data is calculated by taking the mean average of high-income and non-high-income countries respectively (based on World Bank Income Classifications).

However, there are significant variations in these improvements between countries. Despite consumer outcomes generally improving over the period studied, there were significant differences as to the extent of these improvements across countries. For example, in 2017 almost 1 billion people were not covered by a 3G or 4G network, and 3.9 billion people in developing countries (more than 60% of the population) did not have a mobile internet connection.

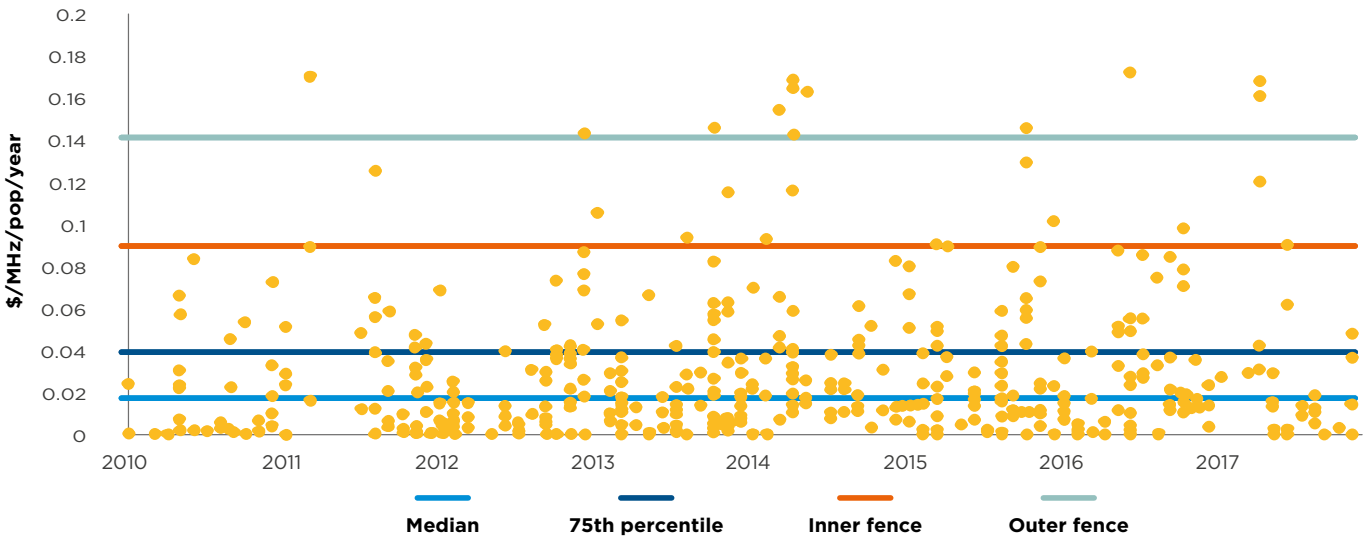
Many factors are likely to be at play, given the wide variations across countries in both demand- and supply-side factors such as disposable income, competition, upgrades in equipment and phone technologies, and geographic characteristics that impact the cost of rolling out networks. Different policy environments across countries, including spectrum management, may also have played an important role. Spectrum prices can play a significant role in consumer outcomes by influencing mobile operators' investment and pricing decisions.

Expensive spectrum can impact the mobile sector by reducing the funds available to undertake investments and generating upward pressure on consumer tariffs.

This is especially notable given that the amount mobile operators pay for spectrum varies significantly around the world (see fig 4). Strikingly, spectrum prices in developing countries have been found to be, on average, almost three times more expensive than in developed countries.[1] A key factor in this variation appears to be decisions by the government or regulator who may design awards to maximise state revenues, for example, by limiting the supply of spectrum.

FIGURE 4

SPECTRUM PRICES INCLUDING OUTLIERS, 2010–2017



Source: GSMA Intelligence. Spectrum prices ($/MHz/pop/year) have been adjusted by inflation, PPP (2016 prices) and licence duration, and aggregated by country, band, generation and assignment. All spectrum bands for which relevant data was available are included. The IQR is defined as the difference between the 1st and 3rd quartile. Outliers are classified as being above an "inner fence", i.e. above 3rd quartile + 1.5*IQR. Extreme outliers are classified as being above an "outer fence", i.e. above 3rd quartile + 3*IQR.

1. See 'Spectrum pricing in developing countries' GSMA (2018)

Research and findings

While previous research has shown a link between high spectrum prices and negative consumer outcomes, more work has been needed to establish whether this is a causal relationship rather than a correlation. Meanwhile, some economists and spectrum policy experts have argued that the cost of spectrum is sunk and so should not affect operators' consumer pricing or investment decisions.

This study looks at data from 229 operators in 64 countries (covering 30 developing countries and 34 developed countries) over the period 2010–2017. It is, to our knowledge, the first that uses an econometric model to consider the impact of spectrum pricing on a broad range of consumer outcomes – including consumer prices, network coverage and network quality (measured using download speeds, upload speeds and latencies). It controls other factors which could impact these consumer outcomes including on the supply and demand side (e.g. income per capita, market concentration and operator scale) as well as other spectrum factors (e.g. the amount of spectrum released and the timing of the assignment).

We find significant evidence to suggest a causal link between high spectrum prices and negative consumer outcomes.

FIGURE 5

KEY FINDINGS

	DEVELOPING COUNTRIES	DEVELOPED COUNTRIES
NETWORK COVERAGE	 **Strong evidence** that higher spectrum prices had a persistent negative impact on 4G coverage as well as a negative impact on 3G coverage in the short and medium term.	 **Strong evidence** that higher spectrum prices had a negative impact on 4G coverage.
NETWORK QUALITY	 **Strong evidence** that higher spectrum prices had a long-term negative impact on average network quality and 3G network quality, including download/upload speeds and latencies. **Some evidence** of negative impact on 4G network quality, particularly upload speeds, though this is not conclusive.	 **Strong evidence** that higher spectrum prices had a long-term negative impact on 4G download speeds. **Some evidence** of a negative impact on 4G upload speeds.
CONSUMER PRICES	 **Some evidence** that higher spectrum prices may have driven higher ARPU and voice and data prices, though the results are not conclusive because they are not robust to all analytical approaches.	 **Inconclusive evidence** – as results are not consistent we are unable to determine whether spectrum prices had an impact on consumer prices. More data is required to investigate.

Source: GSMA Intelligence

We also find that other spectrum policy factors play a significant role in slowing network rollout (i.e. reduced coverage) and reducing the quality of 3G and 4G networks. In particular, early release of spectrum and a sufficient amount of licenced spectrum are both found to be important drivers of consumer welfare.

Recommendations

These findings have important ramifications for regulators, particularly when so many are trying to prioritise improved coverage and increased investment in 4G and 5G. They also highlight how efforts to maximise spectrum revenues are not consistent with government objectives to leverage mobile technology to reduce poverty and achieve economic prosperity, including meeting the UN Sustainable Development Goals.

The study provides the following recommendations:

1. **Maximising revenues from spectrum awards should no longer be a measure of success**
   Spectrum prices can influence investment and pricing decisions and – when excessive – result in inefficient outcomes that have far-reaching negative consequences for consumers and the digital economy that outweigh the benefits from higher auction revenues. This study casts further doubt over the sunk-cost argument often misused to justify obtaining as high a spectrum price as possible.

   The primary objective should therefore be to assign spectrum to those users that will be able to extract most value from this scarce and finite resource for the benefit of society as a whole.

2. **Auctions can deliver inefficient outcomes when poorly designed**
   When well designed, auctions can be effective in delivering market-based solutions that allocate spectrum to those players that can generate most societal value from it. However, auctions can and do go wrong, especially when they are designed with other objectives in mind.

   For example, setting reserve prices aggressively or at levels that are too high is one reason why auctions can deliver inefficient outcomes, because it undermines the key price discovery function. As a result, precious spectrum may go unsold or be sold at such high levels that require mobile operators to reassess their investment plans or apply higher tariffs to recover costs.

3. **Artificially limiting the supply of spectrum, including through set-asides, risks slowing services and inflating prices**
   Governments often design awards with the intention of promoting competition and innovation in the sector – for example set-asides or reserved spectrum for a new entrant (or existing operator). While such policies may be designed with the right objectives in mind, they may also have unintended consequences if they are poorly designed or implemented and result in higher spectrum prices, thus harming consumers.

   Artificial spectrum scarcity is a frequent cause of high prices at auction. This can be a result of regulators holding spectrum back from the market entirely, setting it aside for new entrants or verticals, or using large lot sizes to minimise spectrum supply and thus drive up demand.

   The priority should be on releasing sufficient amounts of spectrum to meet consumer demand for high-speed connectivity and to support growing traffic. When operators are spectrum-constrained, they are likely to have to invest more on densifying their network in urban areas than they would otherwise. This in turn can constrain their ability to invest in the rest of the network and, especially, improve coverage.

4. **Spectrum should be released to the market as soon as there is a business case for operators to use it**
   The timely release of spectrum bands is vital to ensure that new services can be launched and existing services can handle greater data volumes. Early release of spectrum drives better consumer outcomes, which is important in a market where long-term value, innovation and cost reductions are driven through relatively short technology cycles.

   Unnecessary delays to spectrum awards risk harming mobile broadband service rollouts and leaving more people unconnected. If spectrum is released earlier, operators have more time to invest in making new technologies available nationwide. The spectrum also eases capacity constraints in urban areas so operators are better able to invest in rural areas.

5. **Policymakers should work with stakeholders to enable timely, fair and effective spectrum licensing to the benefit of society**
   Given the often-conflicting objectives between maximising auction revenues and supporting affordable, high-quality mobile services, a holistic and coordinated approach to mobile sector regulation by different parts of government is essential if ambitious digital inclusion and industrial policy objectives are to be realised.

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