

# Spectrum management in Latin America

Impacts on  
economic and social  
development



## GSMA

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# Executive summary

5G provides a unique opportunity to boost the economic transformation of Latin America, through the rollout of several use cases that will have an impact on the region's productivity and ability to improve the wellbeing of its citizens.<sup>1</sup>

Effective spectrum management is crucial to unlock the economic benefits of this digital transformation. Typically, this means that sufficient spectrum needs to be made available to the market under conditions that enable investment and innovation in the deployment of new networks and services.

However, an analysis of 2,300 assignments across 112 countries and more than 300 operators globally since 2010 shows significant variation in spectrum prices in Latin America, which cannot be explained by market factors. This report finds that some governments in the region prioritise other goals above efficient spectrum management.

## Key findings



**The average amount of spectrum assigned in the region is below international benchmarks such as EU and OECD countries.** This means that network deployment in Latin America is inherently more complex and expensive, as less spectrum available means there is a greater need to invest in base stations. Argentina and Ecuador are examples of countries with an artificial scarcity of spectrum, having 210 and 350 MHz of spectrum readily available, respectively. Making this spectrum available to the market would help accelerate the expansion of mobile network coverage and provide networks with improved capacity against a backdrop of strong data traffic growth.



**The total aggregate cost of spectrum in Latin America – the cost of assignment plus annual fees – adjusted by revenues and the amount of spectrum is more than double the costs seen in the EU and the OECD.** In Mexico, for instance, the high cost of annual fees set by the government resulted in operators returning spectrum and spectrum being left unassigned in recent auctions.



**Between 2010 and 2022, recurring revenues dropped by approximately 50% in current terms, while total spectrum costs increased by almost 40%.** As a result of the large imbalance between operator revenues and spectrum costs, the cost of spectrum as a percentage of recurring revenue (CPRR) almost tripled in the region. A prominent example is Ecuador, where annual spectrum fees were previously set by criteria that did not accurately reflect the change in market conditions over time. This resulted in the CPRR growing from 10% in 2010 to approximately 18% in 2022. Faced with this situation, the regulator established new regulations that will reduce the CPRR by 6 percentage points in the next few years.



**The main reason for the imbalance between spectrum costs and operator revenues is the design of public policy.** This is because the design of public policy in Latin America often results in the value of spectrum not reflecting the reality of the market in terms of operator revenues. Some governments focus on maximising state revenue, though this is a short-term approach that has high risks.



**When spectrum costs are set above the true market value, incentives for network investment are distorted.** Empirical evidence and analysis have shown that the total cost of spectrum affects investment conditions in the market, network innovation and the levels of connectivity that end users experience. Simulations of the impact of a reduction of the CPRR in Mexico, Ecuador, Colombia, Argentina, Peru and Paraguay show that significant improvements in network quality and the speed of coverage expansion in the country would be possible.<sup>2</sup>

<sup>1</sup> In 2021, mobile technologies and services generated 7.4% of Latin America's GDP. For more information, see [The Mobile Economy Latin America 2022](#).

<sup>2</sup> See [GSMA Latin America](#) for detailed studies on each country.





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## **Upcoming 5G assignments and licence renewals will largely determine the success of digital transformation strategies for each country in the region**

5G networks require significant amounts of spectrum across low, mid- and high bands. 5G assignments started in the region in 2021 and will speed up from 2023, with at least seven countries having scheduled or launched public consultations for 4G and 5G spectrum assignments. In addition, numerous spectrum licences are expiring between 2023 and 2025 across many countries; the renewal of these licences is an opportunity to adjust licence conditions to match the current reality of the market.

However, if the developments seen in some Latin American countries where spectrum has already been assigned for 5G networks are replicated elsewhere, the total cost of spectrum could go up by around 15% in the next five years across the region. For example, Chile's 5G assignment included a tie-breaking approach based on a first-price sealed-bid auction, which led to high spectrum costs. This may lead to a slower deployment of 5G in the country compared to previous network generations.

With the telecoms sector's revenues expected to remain either flat or declining, efficient spectrum assignments with conditions that reflect the reality of the market can help ensure the deployment of new technologies and support quality improvements in existing networks, furthering the universality of benefits derived from mobile technology. For example, Brazil's 5G auction prioritised investments and digital inclusion, which paved the way for 5G coverage to reach 46% just over a year after the spectrum was assigned.

# 01

## Introduction

In Latin America, mobile connectivity remains the foremost form of internet connectivity, especially as it is the only form of connectivity for many. However, to provide mobile internet services, operators need to have access to spectrum licences. As such, effective spectrum management is key to reducing the mobile internet usage and coverage gaps.

Effective spectrum management is also crucial to unlocking the economic benefits of digital transformation. 5G in particular represents a unique opportunity for the economic transformation of Latin America, as several 5G use cases will have a direct or indirect impact on the region's productivity and GDP. Spectrum assignments are necessary for the development of such digital infrastructure, enabling widespread deployments of next-generation internet services and their related benefits for both users and the economy.

Restricting, delaying or increasing the cost of spectrum access can therefore limit the deployment of infrastructure, reduce network quality and delay the launch of new technologies. Despite this, some governments in Latin America prioritise other goals over the efficient management of spectrum. This includes maximising state revenues to finance public expenditure, though this is a short-term approach

that has high risks. For example, with high spectrum prices the risk of failing to assign spectrum (i.e. no revenues for the public sector) also increases. Empirical evidence and analysis have shown that high spectrum costs can lead to a reduction in investment and network quality (poorer coverage, greater congestion, lower speeds and higher latency).<sup>3</sup>

The design of efficient spectrum management policies is key for Latin American governments to advance their digital transformation agendas. Spectrum assignment policies should focus on promoting the use of spectrum (as the resource is useless otherwise) and creating the conditions for it to be used efficiently (maximising the wellbeing of consumers, companies and the state). Normally, this means making sufficient spectrum available to the market under conditions that are appropriate for its efficient use.

This report shows the latest data on spectrum assignments in Latin America and provides an in-depth analysis of some recent cases. It also highlights the opportunities and risks associated with upcoming assignments and renewals in the region, including 5G spectrum assignments that will be necessary to support digital transformation in the region.

<sup>3</sup> [The impact of spectrum prices on consumers](#), GSMA, 2019

# 02

## Current state of spectrum licensing in Latin America

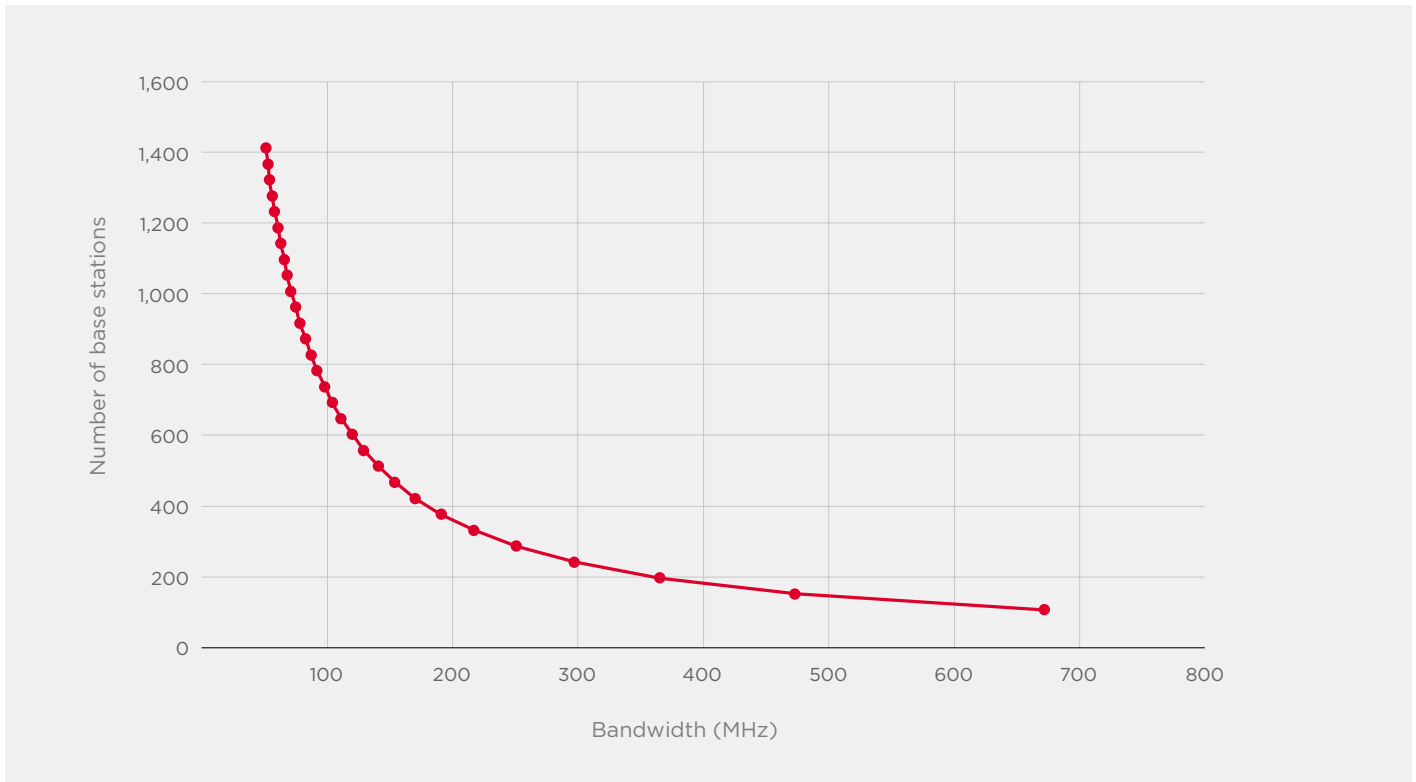


# Greater spectrum availability can reduce the number of base stations and improve the business case for network deployment

The relationship between the amount of assigned spectrum and the number of base stations required is inversely proportional. This means that the need for base station deployments decreases as the amount of spectrum a mobile network has increases.

Greater spectrum availability can also improve the quality of service by limiting congestion (lower latency and higher speed) and accelerate the deployment of new network technologies across a country, as less investment is needed for base stations to serve a given area.

**Figure 1. Amount of assigned spectrum versus number of base stations required**



Source: GSMA Intelligence



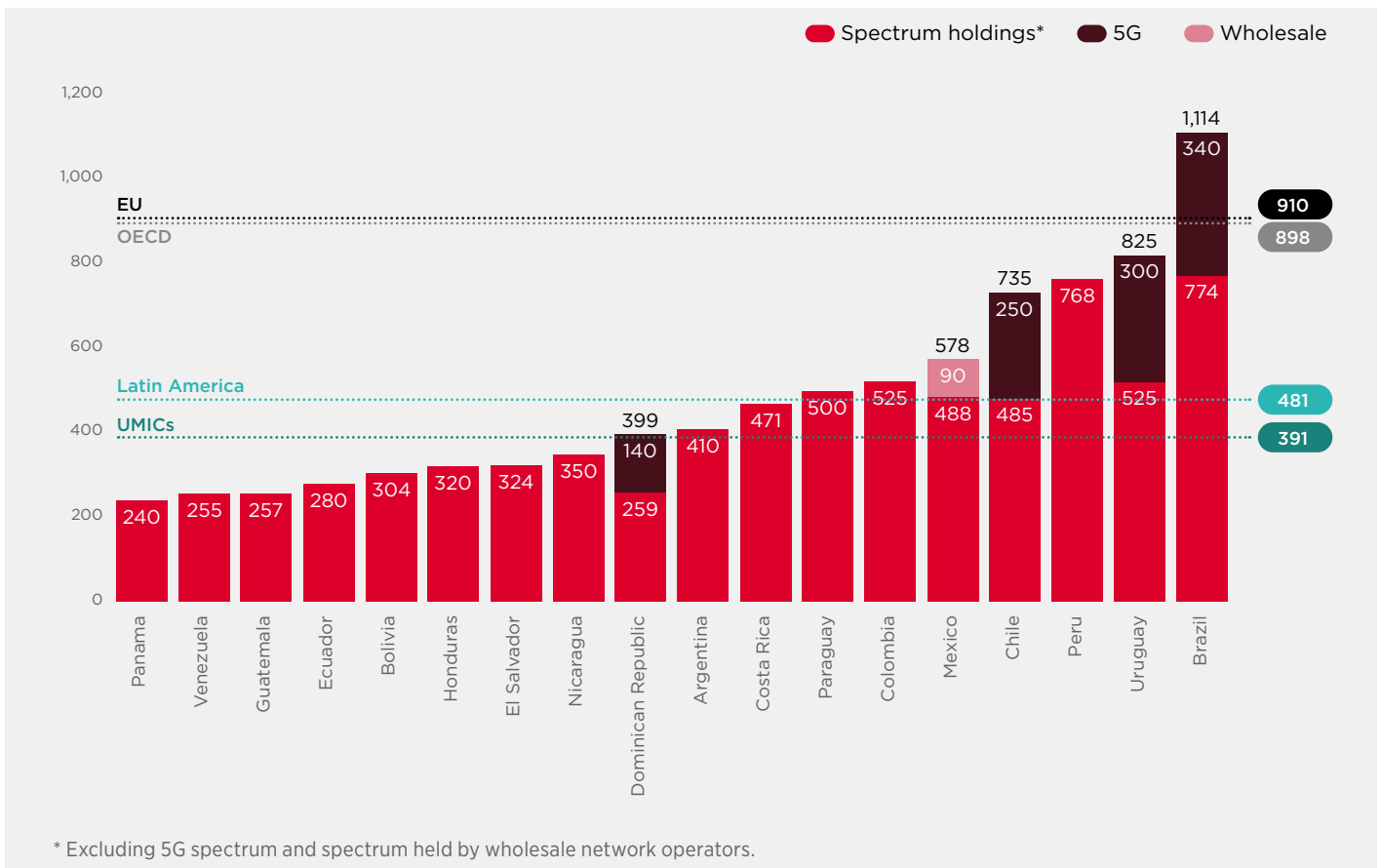
# The amount of spectrum assigned in Latin America is in line with countries with similar income levels but significantly below leading countries

This report provides a comparative analysis of countries in Latin America with leading countries globally and countries with a similar level of income per capita to the region.<sup>4</sup>

The average amount of spectrum assigned in Latin America is below international benchmarks, such as EU and OECD countries. This means that network deployment in Latin America is inherently more complex and expensive, as the lower amount of spectrum available means that more investment in base stations is needed.

Four countries in the region – Brazil, Chile, the Dominican Republic and Uruguay – have already auctioned frequencies for 5G deployment. This has helped establish Brazil, Chile and Uruguay as the countries with the largest amount of spectrum assigned in the region. Brazil stands out among these, with spectrum amounts in line with leading countries internationally.

**Figure 2. Spectrum holdings in Latin America at the end of 2022 (in MHz, excluding mmWave bands)**



Source: GSMA Intelligence

There is significant variation among the countries in the region that have not yet assigned spectrum for 5G. Panama, Venezuela, Guatemala and Ecuador are lagging behind in terms of spectrum assignments in the region. Spectrum assignments in Argentina, Paraguay, Colombia, Mexico and Costa Rica are in

line with the regional average, while Peru sits among the countries in the region with the most assignments despite not having auctioned spectrum for 5G yet. Chapter 4 explores the main reasons for such heterogeneity in spectrum availability.

<sup>4</sup> This includes countries from the European Union (EU) and the Organization for Economic Co-operation and Development (OECD), and countries with income levels that are similar to those of Latin America (upper-middle income levels), following the classification established by the World Bank. In the case of the OECD and upper-middle-income countries (UMICs), Latin American countries have been excluded, as they are grouped under the region being analysed in this report. China has been excluded from UMICs, as there is limited available information about spectrum payments.

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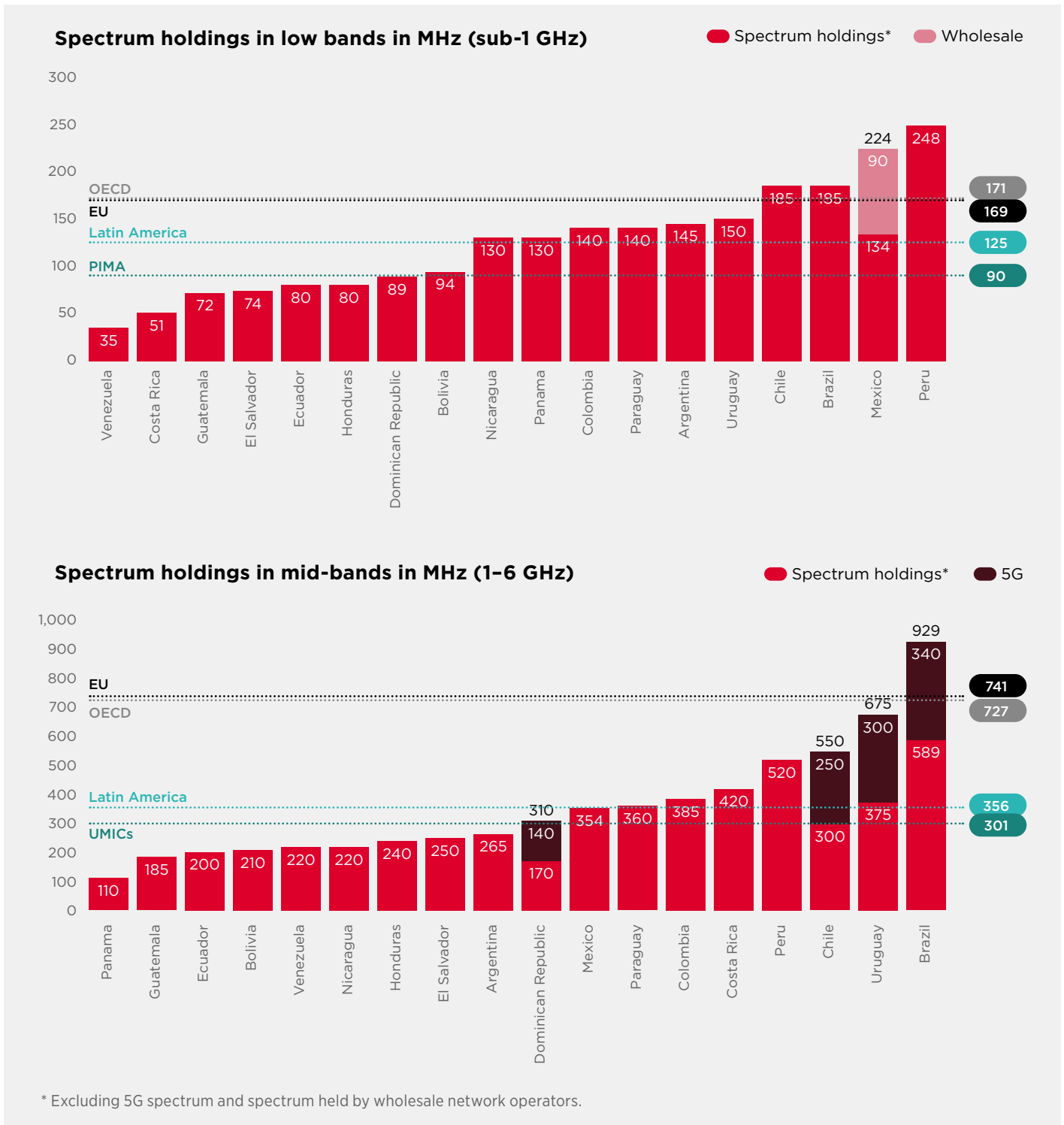
## **Spectrum availability is vital across low and mid-bands, but there is a scarcity of both in Latin America**

Low bands (sub-1 GHz frequencies) support coverage expansion in areas with low population density and help enable good quality of service indoors. Mid-bands (frequencies between 1 and 6 GHz) typically offer a good mix of coverage and capacity benefits. mmWave bands (between 24 and 86 GHz) have a shorter range but help provide greater capacity and higher speeds than any other band, which will be crucial in areas with high traffic and for a range of advanced 5G use cases.

Having a good mix of spectrum available across different frequencies gives operators options to build more efficient networks. For example, operators can use low bands to maximise the area covered, mid-bands to provide a combination of capacity and coverage, and mmWave bands for further capacity.



**Figure 3. Spectrum holdings by type of band in Latin America at the end of 2022**



Source: GSMA Intelligence

For low bands, the amount of spectrum assigned in Latin America is 30% below EU and OECD levels. Venezuela, Costa Rica, Guatemala and El Salvador are among those with less spectrum assigned in low bands. For mid-bands, the amount of spectrum assigned in the region is 50% below EU and OECD levels. Panama, Guatemala, Ecuador, Bolivia and Nicaragua have the least spectrum assigned in mid-bands.

Chile and Brazil are the only countries in Latin America to have assigned mmWave bands. Chile has granted 1,200 MHz in the 26 GHz band, while Brazil has assigned 1800 MHz for licences with national coverage and an average of 200 MHz in regional licences.

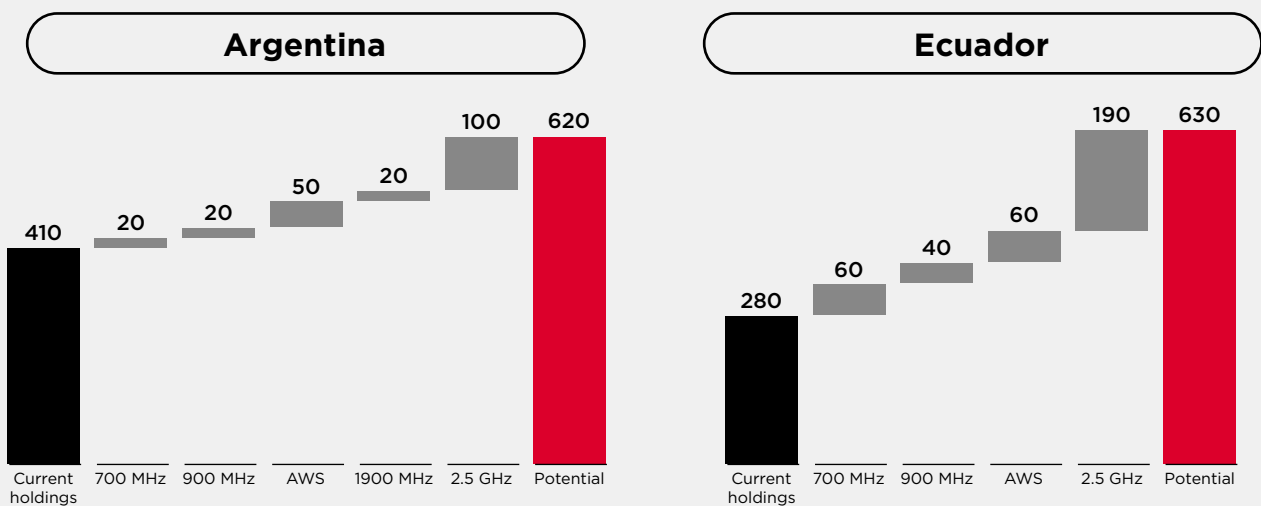
Overall, Latin America falls below international benchmarks in spectrum assigned across all bands, with a similar-sized gap in low and mid-bands. The lack of spectrum for operators means that there is insufficient network capacity to keep up with changes in consumer usage patterns, especially given

that data traffic per user in the region is growing exponentially. This is impacting the quality and cost of services that are needed to accommodate the increase in demand for mobile data in both urban and rural areas.

## Artificial scarcity of spectrum in Argentina and Ecuador: different reasons, same effects

Argentina and Ecuador have large amounts of spectrum available for immediate assignment. Argentina has 210 MHz of spectrum available,<sup>5</sup> which is equivalent to 50% of the total that is currently assigned. Additionally, there is 300 MHz available in the 3.5 GHz band, which is due to be assigned for the deployment of 5G networks. Ecuador has 350 MHz in low and mid-bands available for assignment in the short term, which would enable the country to more than double its current holdings.

**Figure 4. Spectrum availability (MHz) by band in Argentina and Ecuador**



Source: GSMA Intelligence

In Argentina, regulatory caps on the amount of spectrum each operator can have are the main reason for the scarcity of spectrum in the market.

Meanwhile, in Ecuador, high spectrum costs are the main reason. There is a need for more spectrum in the country, but high annual fees imposed on spectrum usage have become a significant barrier to new assignments. The country's regulator has acknowledged this and modified the calculation of annual spectrum fees before the assignment of frequencies for 5G.

In both cases, artificial spectrum scarcity impacts end users the most. High deployment costs for operators slow down improvements to the quality of the service in relation to coverage and network capacity, against a backdrop of strong data traffic growth.

<sup>5</sup> 210 MHz available across 700 MHz, 900 MHz, AWS, 1900 MHz and 2.5 GHz.



# 03

## Spectrum prices as a tool for efficient assignments



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## Spectrum costs in Latin America have largely been determined by non-market factors

The main public policy goal of spectrum management should be the assignment of spectrum to those who can make the most efficient use of it and, consequently, provide users with more and better services, maximising the wellbeing of society as a whole.

The most efficient mechanism of assignment depends on the level of demand:

- When there is sufficient spectrum for the expected demand, an administrative assignment with prices that cover management costs can result in an efficient and speedy assignment that allows the spectrum to be promptly put to use, promoting investment and maximising coverage and the quality of service.

- When demand is higher than the amount of spectrum available, setting prices through a competitive market mechanism, such as a well-designed auction, can create incentives to efficiently assign the resource.

However, there are multiple public policy design decisions that can affect (either directly or indirectly) the total spectrum assignment cost paid by operators. In both auctions and administrative assignments, some governments in Latin America have focused on short-term goals, such as the immediate maximisation of state revenues. This has direct negative consequences in the medium and long terms, including a delay in the development of infrastructure and digital services, as well as lower revenues.

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## The total cost of spectrum may include upfront payments, annual fees and additional obligations

The total cost of spectrum licences consists of three components:

- **Upfront payments:** Direct financial costs that operators pay for assignments and renewals.
- **Annual fees or charges<sup>6</sup> for initial assignments or renewals:** Direct financial costs for operators, which are typically proportional to the amount of spectrum owned or as a percentage of their revenue.
- **Additional obligations:** Some licences have additional obligations that operators have to meet. These include indirect costs for operators, such as quality of service requirements and obligations related to geographic coverage, deployment

of connectivity points or delivery of devices. If obligations are not met, operators are subject to fines and risk losing their spectrum licences.

In most countries in the region, assignments are made through objective selection processes that include upfront payments and, in some cases, deployment or investment obligations.

In terms of annual payments, the situation in the region is fairly diverse (see Figure 5). Some countries have set annual prices focusing on covering spectrum management costs instead of tax collection, while others have a clear focus on generating state revenues.

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<sup>6</sup> In Latin American countries, the following factors have been taken into account to set the price of fees: band type, amount of MHz assigned, number of base stations in operation, deployed technology, terminals and geographic regions being served, among others.

**Figure 5. Annual spectrum fees in Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay and Peru**



Source: GSMA Intelligence

# The significant variation in spectrum prices in Latin America cannot be explained by demand factors

There are several methodologies to standardise and compare spectrum prices across different countries and time periods. For example, metrics can include upfront payments (e.g. the price paid at the auction), annual fees, or both added and analysed together.

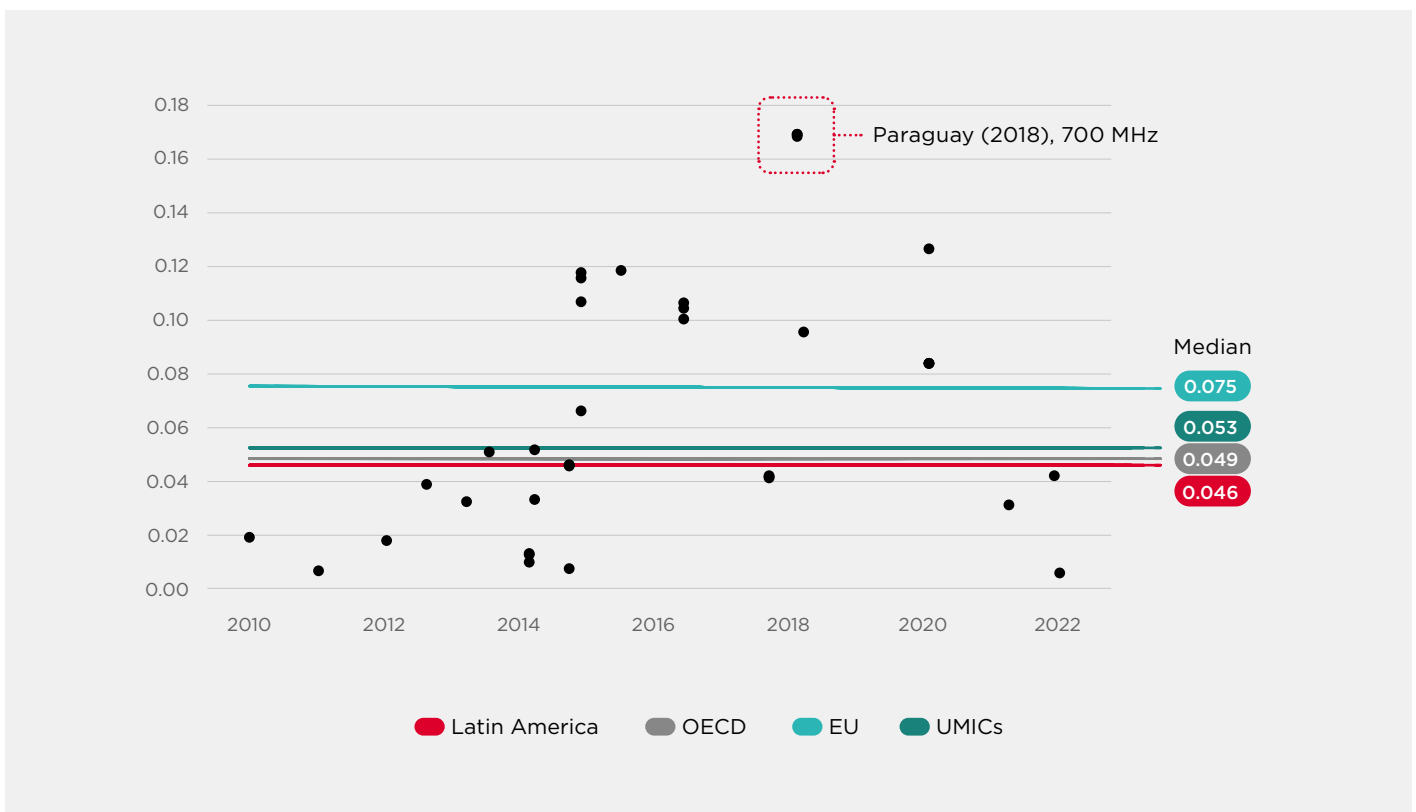
This study analyses the total cost, which includes both upfront payments and annual fees,<sup>7</sup> with a focus on two indicators: unit spectrum prices per person (\$/MHz/pop/year (PPP)) and spectrum cost as a percentage of recurring revenues (CPRR).

Unit spectrum prices per person allow us to assess the spectrum costs that operators face when providing services to their potential customer base during the period of the spectrum licence. The main advantage of this indicator is that it standardises the total cost by reducing it to a comparable unit internationally.

The CPRR includes recurring revenue generated by operators during the relevant time period. It provides an indication of spectrum profitability or return on investment and shows to what extent spectrum costs are in line with market revenues. The higher the CPRR, the greater the impact of spectrum costs in relation to recurring revenues.

Based on GSMA Intelligence global data of spectrum assignments, we analysed over 2,300 cases of identified assignments across 112 countries and over 300 operators around the world between 2010 and 2022. At the regional level, prices vary significantly, even after making adjustments according to amount of spectrum, population, cost of living and licence duration.

**Figure 6. Final assignment prices in Latin America (\$/MHz/pop/year (PPP 2022)) in low bands (sub-1 GHz)**

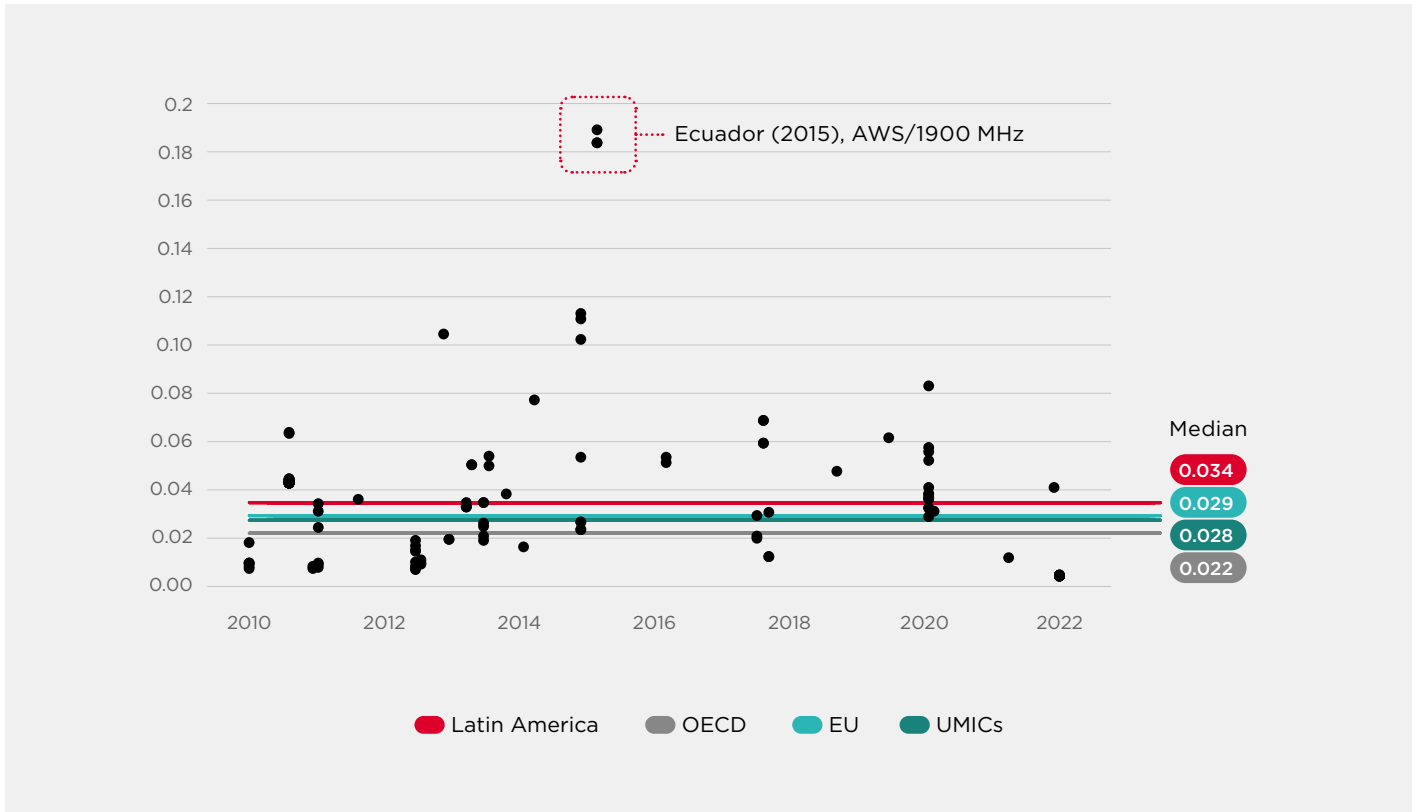


Source: GSMA Intelligence

<sup>7</sup> This does not include non-financial obligations that may be part of licences, such as coverage obligations or specific social investment obligations (e.g. delivery of devices, deployment of sites of connectivity points and provision of connections at no cost in public buildings).



**Figure 7. Final assignment prices in Latin America (\$/MHz/pop/year (PPP)) in mid-bands (1-6 GHz)**



Source: GSMA Intelligence

This variation in prices cannot be explained by demand or market factors. The role of external factors is significant, as governments can have a direct or indirect influence on total spectrum costs in various ways:

- **Setting high upfront or annual fees.**
- **Setting high reserve prices (i.e. the lowest price the government is willing to accept when licensing spectrum).** This can lead to unassigned spectrum or to final spectrum prices that are higher than the true market value.
- **Designing auctions with the main objective being the maximisation of state revenues.** This includes, for example, limiting the ability of participants to discover market prices during the auction process or through an inadequate planning or design of spectrum lots and their sizes. Such choices can maximise revenues in the short term but lead to inefficient assignments that discourage network investment and the deployment of new services.
- **Creating artificial scarcity and uncertainty.** Governments can create scarcity directly (by restricting the spectrum on offer) or indirectly (by creating uncertainty over future assignments by failing to set out a spectrum roadmap or establish a clear licence renewal process). Evidence shows that as the amount of spectrum held by each operator decreases there is an increase in unit spectrum prices.<sup>8</sup>

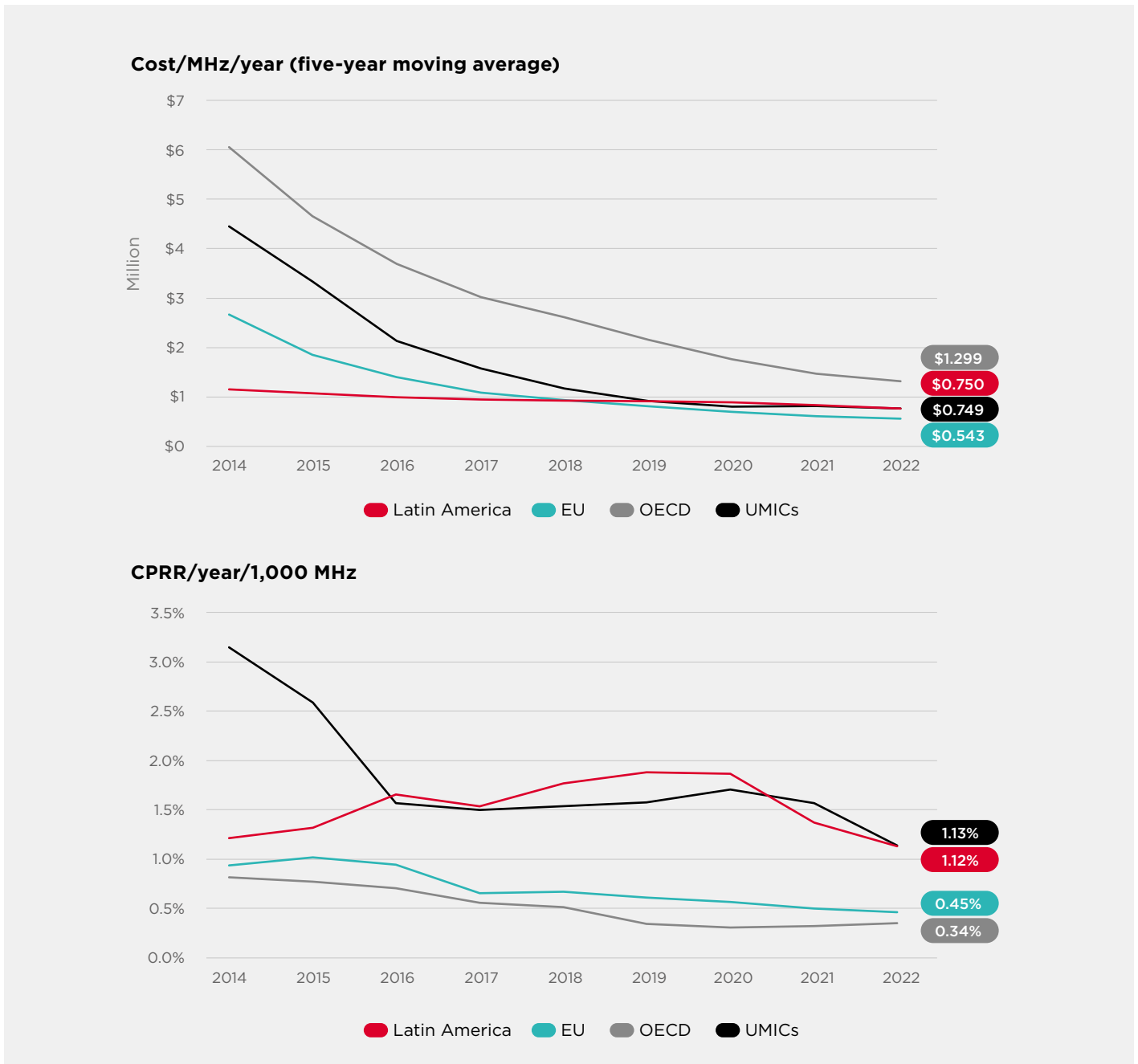
<sup>8</sup> Effective Spectrum Pricing: Supporting better quality and more affordable mobile services, GSMA, 2017

# Spectrum costs in Latin America are more than double those in the EU and the OECD, after adjusting by revenue and the amount of spectrum in the market

When analysing the total aggregate cost of spectrum (including assignment, obligations and annual fees) at the regional level, the price per MHz of spectrum assigned in Latin America is similar to other regions (40% higher than the value in the EU and around 40%

lower than in the OECD). However, the data shows that spectrum prices in Latin America are very high when taking into account the reality of the market in terms of revenue potential and available spectrum.

**Figure 8. Cost/MHz/year (five-year moving average) and CPRR/year/1000 MHz<sup>9</sup>**



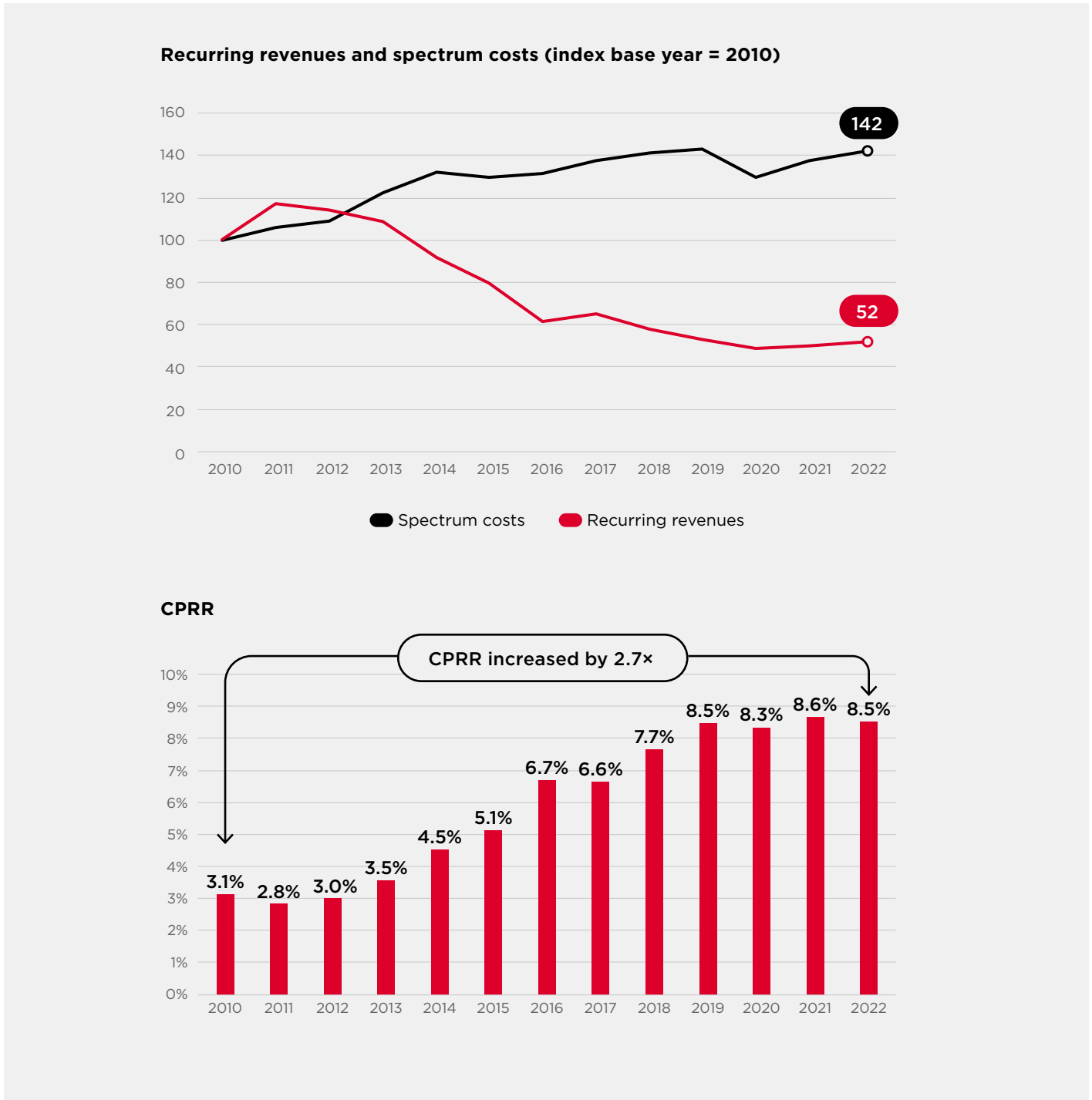
Source: GSMA Intelligence

<sup>9</sup> China is not included here as there is no publicly available information about the spectrum prices paid by operators. The US is included with a modification in the y-axis: the spectrum cost in the country in 2022 was \$3.5 million per MHz, for national and regional coverage licences.

The main reason for the imbalance between spectrum prices and operator revenues is the design of public policy, which has often resulted in the value of spectrum not reflecting the reality of the market in terms of operator revenues.

Between 2010 and 2022, recurring revenues in Latin America dropped by approximately 50% in current terms, while total spectrum costs increased by almost 40%. As a result of the large imbalance between revenues and costs, the cost of spectrum as a percentage of recurring revenues almost tripled in the region.

**Figure 9. Evolution of recurring revenues, spectrum costs and CPRR in Latin America**



Source: GSMA Intelligence




## High spectrum costs can create uncertainty in long-term investment cycles and impose financial restrictions

When spectrum costs are set above the true market value, this distorts incentives for network investment. Specifically, this restricts mobile operators' capital expenditure, as operators are obligated to ensure returns for their investors. When spectrum costs are not aligned with market revenues, the profitability of the sector is compromised, which has consequences on future investment decisions.

For example, if a mobile operator becomes less profitable in comparison to businesses in other

industries and mobile operators in other countries, the cost of capital in the long term will increase and impact future decisions regarding investment and consumer pricing. Even when spectrum costs are financed internally, mobile operators are often part of big multinational groups with centrally managed budgets. High recurring spectrum costs in a country can lead to a reduction, delay or change in investment plans.

**Figure 10. Impact of spectrum prices on the quality of service (coverage and speed) and final prices of services between developing and developed countries**

	Developing countries	Developed countries
 <b>Network coverage</b>	Slower 3G and 4G deployment	Slower 4G network deployment
 <b>Network quality</b>	Poor network quality	Lower 4G download speeds
 <b>Final price</b>	Potential impact of higher prices (evidence is not conclusive)	Inconclusive (better data is needed)

Source: Bahia & Castells (2022)

The total cost of spectrum impacts investment conditions in the market, innovation in network deployment and the levels of connectivity that end users experience. An econometric study<sup>10</sup> of 229 operators in 64 countries (34 developed and 30 developing) between 2010 and 2017 showed strong empirical evidence of the connection between high spectrum prices and slower infrastructure deployment and lower mobile data speeds.

<sup>10</sup> Bahia & Castells (2022)

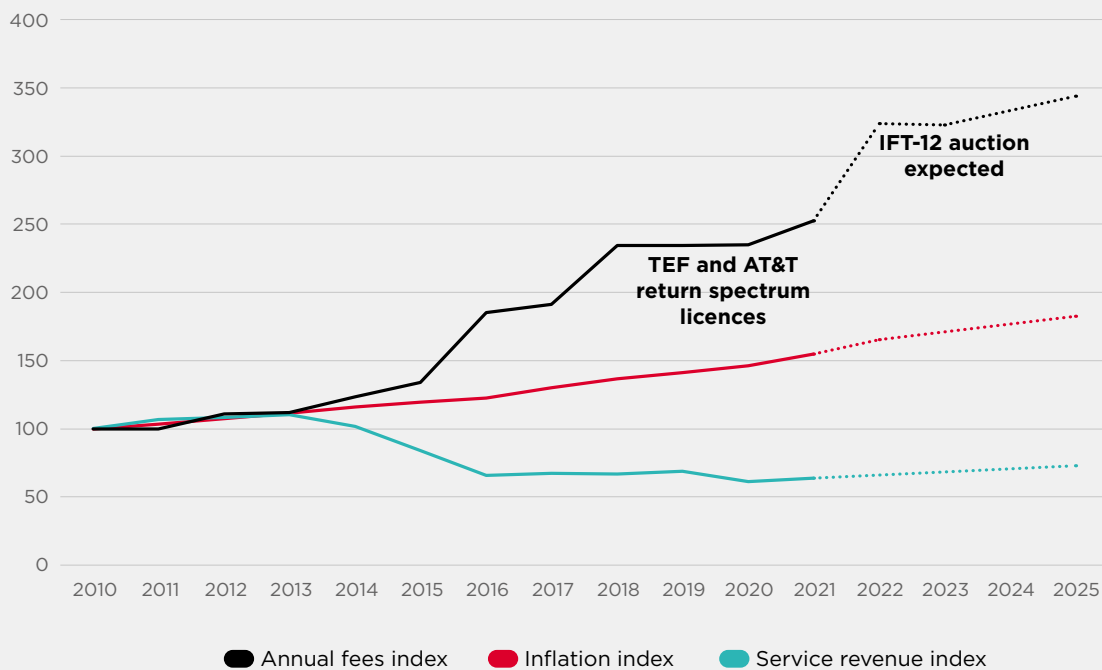




## Annual fees in Mexico: spectrum being returned to the regulator and the impact on end users

In Mexico, annual rights for spectrum usage – which are quotas set each year by the legislature in the Federal Rights Law – represent 85% of the total cost of spectrum. Annual rights have generally grown above the country's rate of inflation, while the telecoms sector's revenue has been either flat or declining. If there are no reforms and the current trend continues, the cost for operators will continue to grow, reducing their ability and incentives to invest in the deployment of new technologies.

**Figure 11. Annual rights, inflation and market development in Mexico (index base year = 2010)**

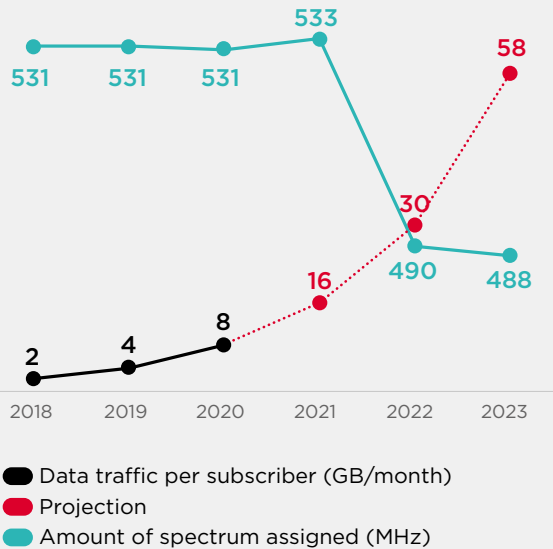


Source: GSMA Intelligence

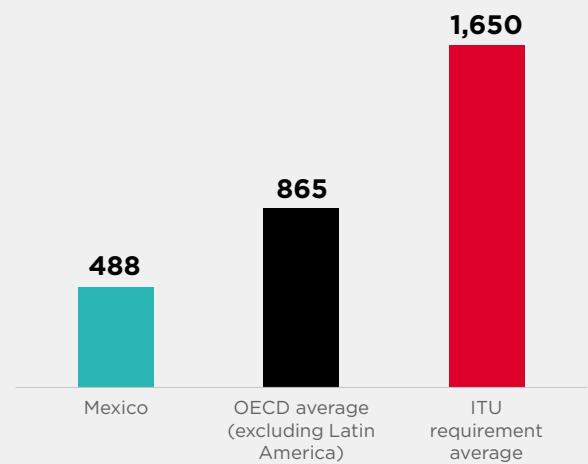
Spectrum costs rising at a much faster rate than operator revenues forced two operators to return spectrum between 2019 and 2023. Additionally, a spectrum auction in the country in 2021 ended with spectrum being unsold in 38 of the 41 blocks offered.<sup>11</sup> Mexico is the only country in the region where the amount of spectrum assigned for mobile services has reduced in recent years. Current levels sit below the ITU requirements and the OECD average.<sup>12</sup>

**Figure 12. Evolution of spectrum and traffic per subscriber in Mexico, and spectrum holdings in the country compared to the ITU requirement and OECD average**

**Amount of spectrum (MHz) and data traffic per subscriber (GB/month) in Mexico**



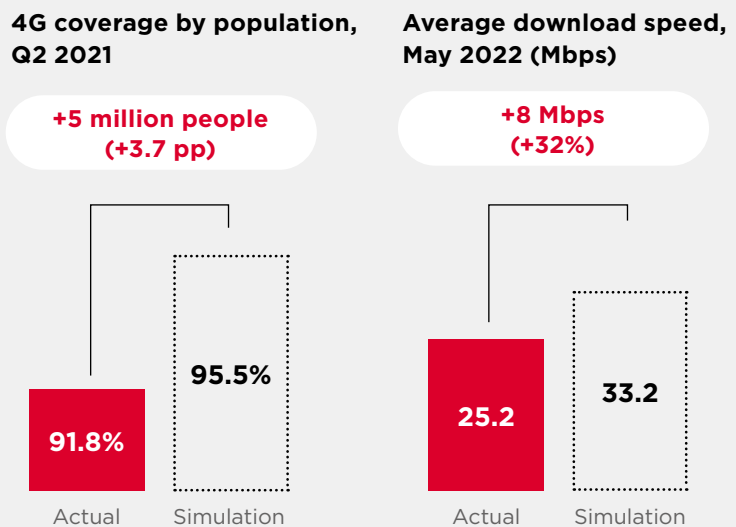
**Spectrum holdings in Mexico compared to the ITU requirement and OECD average (MHz)**



Source: GSMA Intelligence

Spectrum costs being more closely aligned with market conditions would promote further investment, more network deployment and improved connectivity for the country. A simulation of a scenario where spectrum prices in Mexico are aligned with the global average shows that an estimated 50% reduction in annual rights could have boosted 4G coverage to an additional 5 million citizens and increased mobile data download speeds by 30%.

**Figure 13. Simulating the impact of a 50% reduction in spectrum annual fees in Mexico**



Source: GSMA Intelligence

<sup>11</sup> In October 2021, 38 of the 41 blocks offered at the IFT-10 auction were unsold. The auction included the participation of AT&T and Telcel. The assignments included a block in the 2.5 GHz band, a block of 800 MHz for cell regions 1 to 4 and another block for the Metropolitan Area of the Valley of Mexico. Based on the area, up to 100 MHz of bandwidth was offered, out of which only 13 MHz was assigned, leaving entire blocks in AWS and 1900 MHz unallocated.

<sup>12</sup> This analysis does not include the 90 MHz assigned for wholesale services in the 700 MHz band.

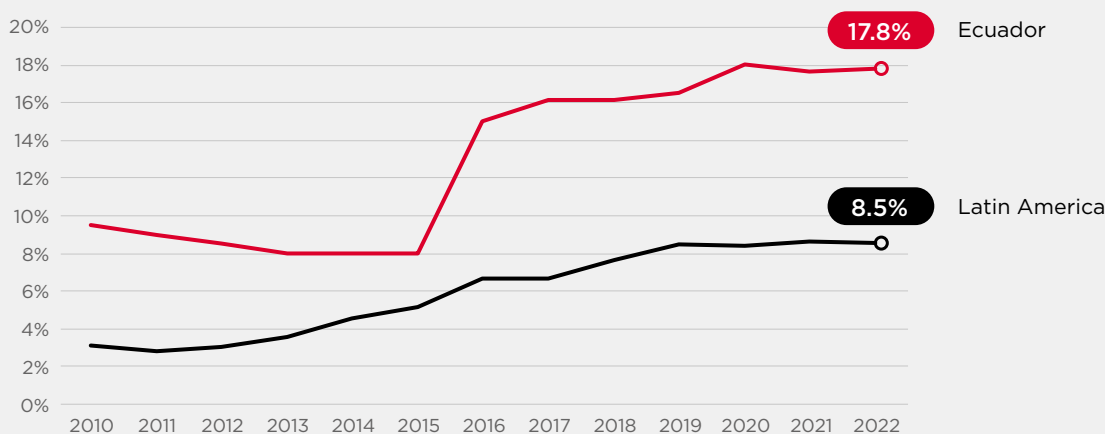


## Annual fees in Ecuador: reducing spectrum costs to promote investment

In Ecuador, players from both the private and public sectors identified spectrum costs as a challenging issue that needed to be addressed. In 2020, the country's Ministry of Telecommunications and Information Society issued Ministerial Decision O13-2020, which stated the need to adjust spectrum fees at the national level in order to promote coverage expansion and the affordability of mobile services.

As a result, Ecuador's telecoms regulator, Arcotel, published Resolution 06-08 in December 2022, with new regulations to calculate the right of usage of radio spectrum, its renewal and the fees imposed on its use and exploitation. The calculation now takes into consideration the number of sites, districts, frequencies and bandwidth. This new formula to calculate monthly fees on spectrum usage will lead to a gradual reduction of over 80% in costs for frequencies assigned to mobile in the next four years.

**Figure 14. Evolution of CPRR in Ecuador in comparison to Latin America 2010-2022**

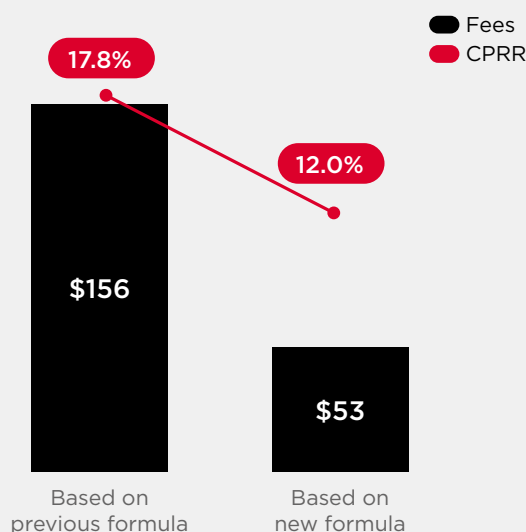


Source: GSMA Intelligence

Based on the previous formula, annual fees represented approximately 50% of the total cost of spectrum in Ecuador. Fees were largely based on criteria that did not accurately reflect the change in market conditions over time. As a result, the annual cost of spectrum as a percentage of recurring revenue for operators increased from 10% in 2010 to nearly 18% in 2022. This was higher than in any other country in the region and three times higher than the Latin American average.

Under the new regulations, the total cost of spectrum paid by operators annually will be reduced by 66%. With spectrum costs being more aligned with the reality of the market, investment conditions in the sector will improve, which can translate into better network coverage and capacity in the next few years.

**Figure 15. Projection of total spectrum costs and CPRR in Ecuador under the new regulations (million)**



Source: GSMA Intelligence



# 04

## Policy actions needed to support efficient spectrum management





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## Having sufficient spectrum available under conditions that reflect market reality results in an efficient use of the resource

To maximise the socioeconomic benefits of spectrum assignments, policymakers should:

- ensure that spectrum is assigned to those who can make the best use of it (**efficient assignments**)
- make available sufficient spectrum to enable the effective deployment of high-quality mobile networks and services in terms of coverage and capacity (**productive efficiency**)
- create assignment conditions that promote investment and innovation in network deployment and the provision of new life-enhancing services, as seen with 5G and next-generation technologies (**dynamic efficiency**).

To promote efficient spectrum management, regulators should have in place spectrum-licensing frameworks that:

- ensure operators have access to sufficient spectrum
- provide predictability to inform new and necessary network investment
- avoid onerous restrictions on spectrum use that could distort investment decisions.

This chapter highlights best regulatory practices to ensure timely spectrum availability and efficient spectrum management, based on global experiences.<sup>13</sup>



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<sup>13</sup> Myers, Geoffrey (2023). Spectrum Auctions: Designing markets to benefit the public, industry and the economy, London: LSE Press, pp. 115–136; GSMA (2016). Mejores prácticas en el otorgamiento de licencias de uso de espectro para servicios móviles; GSMA (2022). 5G Spectrum: GSMA Public Policy Position; GSMA (2021). Spectrum Pricing: GSMA Public Policy Position; GSMA (2021). Auction Best Practice: GSMA Public Policy Position; GSMA (2022). Best Practice in Mobile Spectrum Licensing



# Public policy and regulations must ensure efficient spectrum management

Policymakers should facilitate predictability in the telecoms sector by coordinating assignments based on expected spectrum needs in the future.

Important factors that need to be considered include deployment, coverage and service obligations, in addition to licence duration and renewal conditions.






**Figure 16. Best practices in spectrum management**

Area	Best practices	
	<b>Renewal terms</b>	Certainty over renewal processes and criteria allows operators to plan for future investments and ensure service continuity. For example, if a spectrum assignment is not renewed, operators may purchase other spectrum licences or make relevant network investments to minimise the risk of service interruption. Licence renewal decisions should be made in due time in order to ensure continued investment in mobile network development.
	<b>Roadmaps and planning</b>	Efficient spectrum assignment requires transparency and clarity in the assignment process. This is why governments should publish roadmaps, which should include an audit of the current use of spectrum that identifies the bands that can be reassigned for more efficient use; a schedule of future spectrum availability for mobile; an overview of the spectrum assignment approach; and terms and processes for licence renewals.
	<b>Avoiding artificial spectrum scarcity</b>	Sufficient amounts of spectrum are vital in the provision of affordable and high-quality mobile broadband services. When artificial spectrum scarcity is created, network deployment costs go up and pressure to access an artificially scarce resource increases.
	<b>Licence duration</b>	The profitability of mobile network investment plans heavily relies on timely investment. A licence duration that is too short may result in an operator failing to invest in less profitable areas (typically rural or low-demand areas).
	<b>Technology and service neutrality</b>	Technology neutrality enables mobile operators to use the spectrum efficiently instead of depending on declining technologies and services. It allows consumers to access more effective and spectrum-efficient technologies.
	<b>Harmonisation and assignments by band type</b>	Spectrum assignments must consider harmonised and prioritised spectrum bands for mobile services. For example, operators require access to low, mid- and high bands for 5G to provide services in all areas and develop use cases that make use of such technology.
	<b>Commercial flexibility in resource management</b>	The shared and voluntary use of spectrum can help improve mobile services. Governments should allow operators to share, transfer or lease spectrum to other operators that can make better use of the resource.
	<b>Obligations imposed on spectrum assignments</b>	Annual or regulatory fees associated with the provision or use of spectrum should be predictable and limited to recovering the regulator's management and monitoring costs.

When choosing auctions as a mechanism for spectrum assignments (for example, when demand for the resource exceeds the amount of spectrum offered), it is advisable to follow a series of guiding principles to ensure a transparent, impartial and

legally robust auction. This allows spectrum to be assigned to those who will make more efficient use of it, supporting competitive and high-quality mobile services.

**Figure 17. Best practices in spectrum auctions**

Best practice area	Recommendations
 <b>Auctions should prioritise the promotion of affordable and high-quality mobile services</b>	<p>When choosing auctions as an assignment mechanism, the main goal must be to ensure that spectrum is assigned to operators that can make more efficient use of the resource i.e. operators that can support long-term investment to promote affordable and high-quality services to benefit users.</p>
 <b>Reserve prices in auctions should be set at low but non-trivial levels</b>	<p>High reserve prices that result in unassigned spectrum do not support either economic efficiency or the maximisation of state revenues. For auctions, regulators must set reserve prices that avoid speculation. They should promote participation and let the market discover the inherent prices in a competitive process.</p>
 <b>Coverage and quality obligations must be considered when designing auctions</b>	<p>In some cases, spectrum auctions include coverage and quality obligations, which can be a financial burden for licensees. This must be taken into account when establishing reserve prices and designing auction formats. For example, coverage obligations should not foster an inefficient duplication of networks in non-profitable areas, which can discourage bids from qualified applicants.</p>
 <b>Spectrum caps and set-asides can distort the level playing field</b>	<p>Specific measures to increase competition, such as caps or set-asides in spectrum assignments, should be a last resort. Before taking such measures, governments should assess the benefits and costs of alternative options. Auctions should be open to all qualified applicants who are committed to deploying a network and delivering services, on fair and equal conditions. This additional spectrum can help bring more benefits to society if it is made available to operators.</p>
 <b>Award design choices can impact outcomes</b>	<p>Spectrum awards must be governed by transparent criteria that prioritise efficiency and the quick deployment of new technologies. Usually, the most effective processes involve multi-round ascending auctions, since they allow bidders to discover the preferences of all participants. Options include offering small block sizes that support varying levels of demand from operators and flexible game rules so that bidders can aggregate complementary licences and/or move to substitutes during the auction.<sup>14</sup></p>

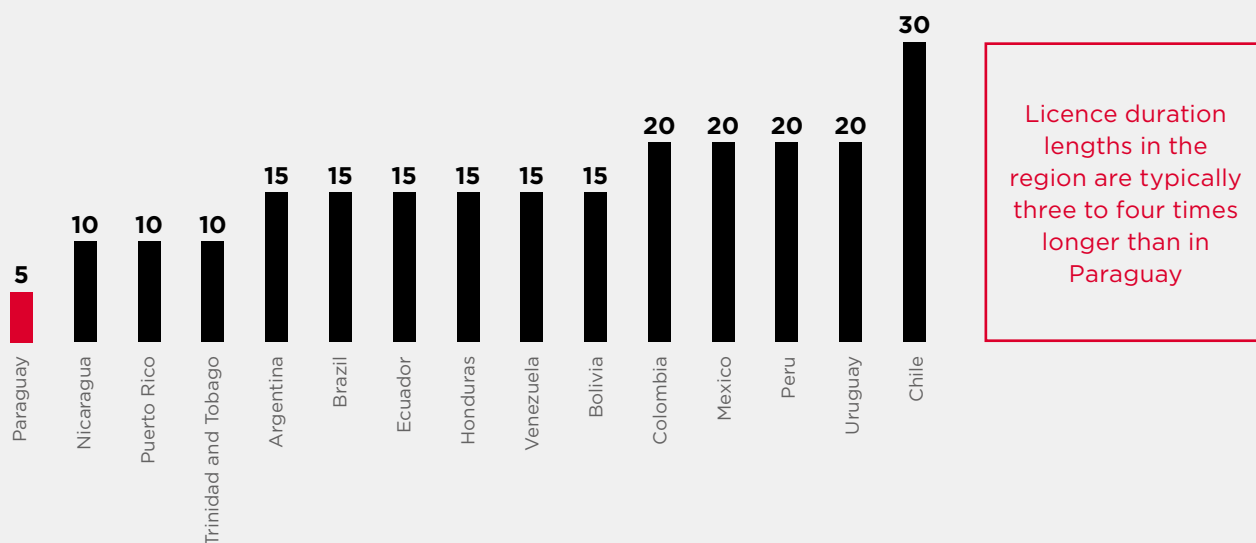
<sup>14</sup> [Spectrum pricing: GSMA Public Policy Position, 2021](#)



## Licence duration in Paraguay: uncertainty about investment plans

Paraguay is the only country in Latin America where spectrum licences have a duration of only five years. The licence duration in other countries in the region is typically three to four times longer than this. Some recent 5G assignments have granted an even longer duration to add certainty for planning investments: Brazil granted 5G licences with a duration of 40 years, compared to the country's standard licence duration of 15 years. Similarly, outside of Latin America, Spain granted mmWave licences with a 40-year duration, which is twice the length of the typical licence duration in the country.

**Figure 18. Licence duration in Latin America (years)**

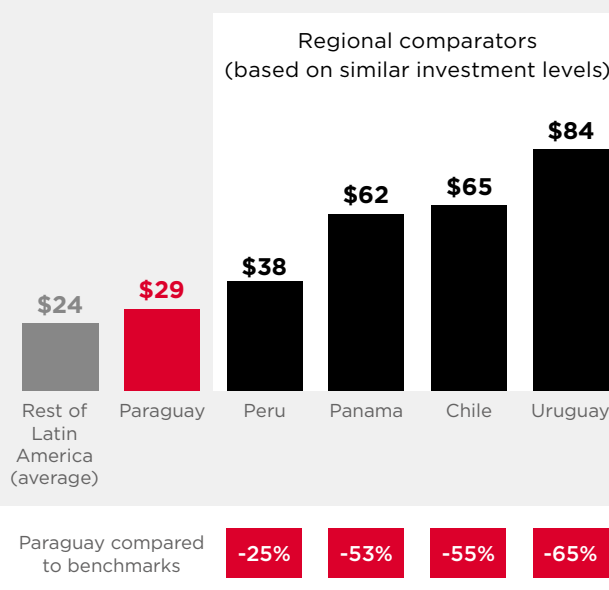


Source: GSMA Intelligence

The deployment of new technologies requires significant investment, so licences need to be valid for a long enough period of time to recoup the costs. Shorter licence durations create uncertainty in the sector, which can lead to a reduction of total investment. In particular, this impacts investments that have a lower expected return, such as in less dense and affluent areas.

Longer licence terms can provide operators with the certainty needed to make long-term investments. Greater certainty in Paraguay over long-term investment plans could move investment levels closer to regional benchmarks, bringing the socioeconomic benefits associated with new technologies such as 5G to the entire population.

**Figure 19. Capex per subscriber<sup>15</sup> in Paraguay in 2022, compared to regional benchmarks**



Source: GSMA Intelligence

<sup>15</sup> Spectrum costs are not included.

# 05

**Future spectrum assignments are key to the success of the digital economy in Latin America**



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## New 5G assignments and licence renewals will determine the success of digital transformation in Latin America

5G spectrum assignments are needed to support digital transformation strategies and the widespread adoption of 5G mobile services in Latin America. However, 5G networks require large amounts of additional spectrum across low, mid- and high bands. A detailed supply-and-demand analysis estimates that most markets will need around 2 GHz in mid-bands by 2030.<sup>16</sup> Additionally, the availability of 5 GHz of mmWave spectrum<sup>17</sup> would help meet the demands of several 5G use cases, while additional spectrum in low bands (specifically in the 600 MHz band)<sup>18</sup> would increase download speeds in rural areas.

Some of these assignments started in the region in 2021. Assignments will speed up in 2023,<sup>19,20</sup> with at least seven countries having scheduled or launched public consultations for 4G and 5G spectrum auctions. In addition, numerous spectrum licences are expiring between 2023 and 2025 across many countries; the renewal of these licences is an opportunity to adjust licence conditions to match the current reality of the market.



<sup>16</sup> [Vision 2030: Insights for Mid-band Spectrum Needs](#), GSMA, 2021

<sup>17</sup> [Vision 2030: mmWave Spectrum Needs](#), GSMA, 2022

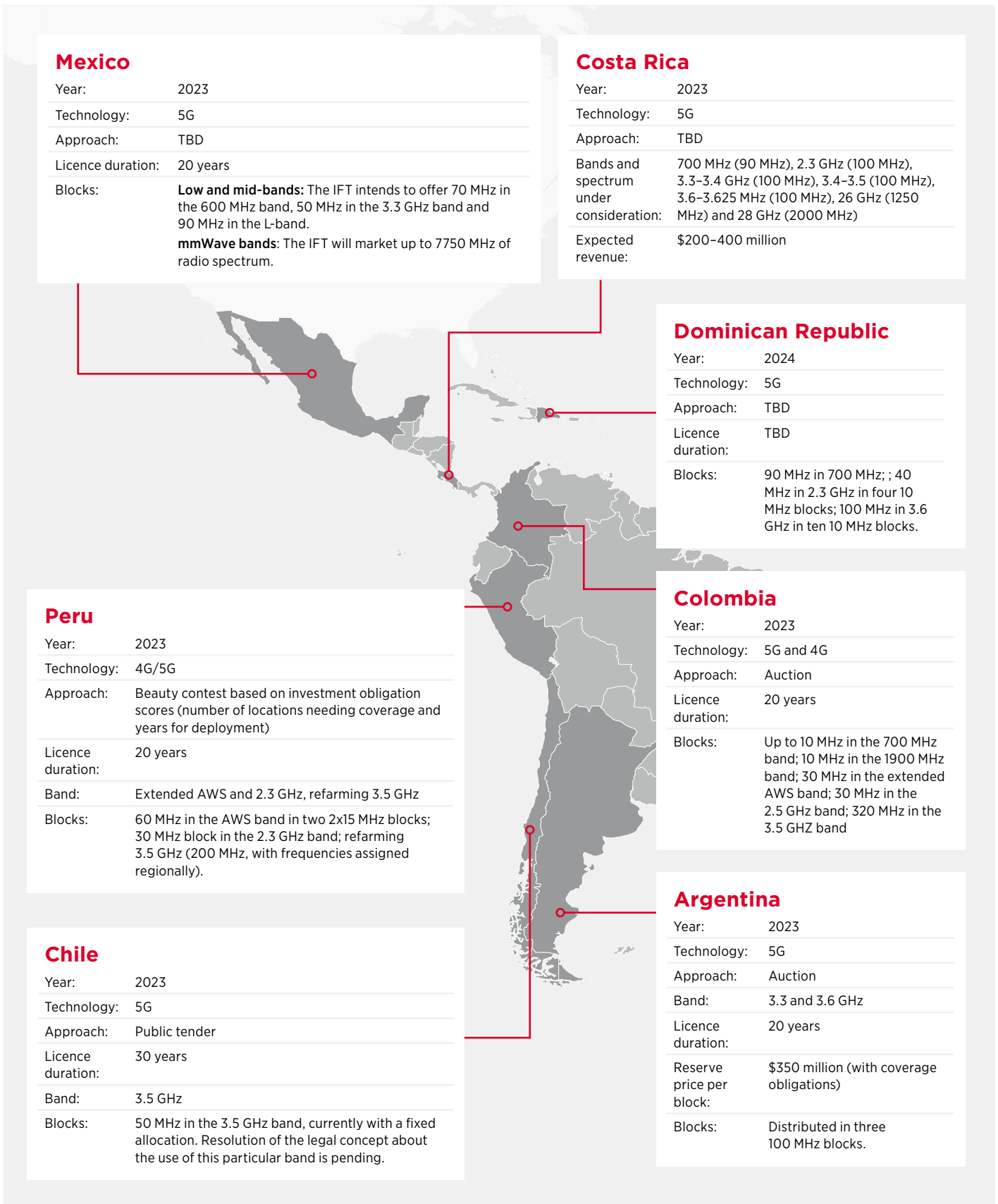
<sup>18</sup> [Vision 2030: Low-Band Spectrum for 5G](#), GSMA, 2022

<sup>19</sup> In May 2023, Uruguay completed its auction for the 3.5 GHz band, assigning three 100 MHz blocks (3.3–3.4 GHz, 3.6–3.7 GHz and 3.7–3.8 GHz), generating \$84.23 million in total revenue.

<sup>20</sup> In June 2023, Peru allocated to Bitel 60 MHz in the AWS-3 band and 30 MHz in 2,300 MHz for a total of \$600 million.

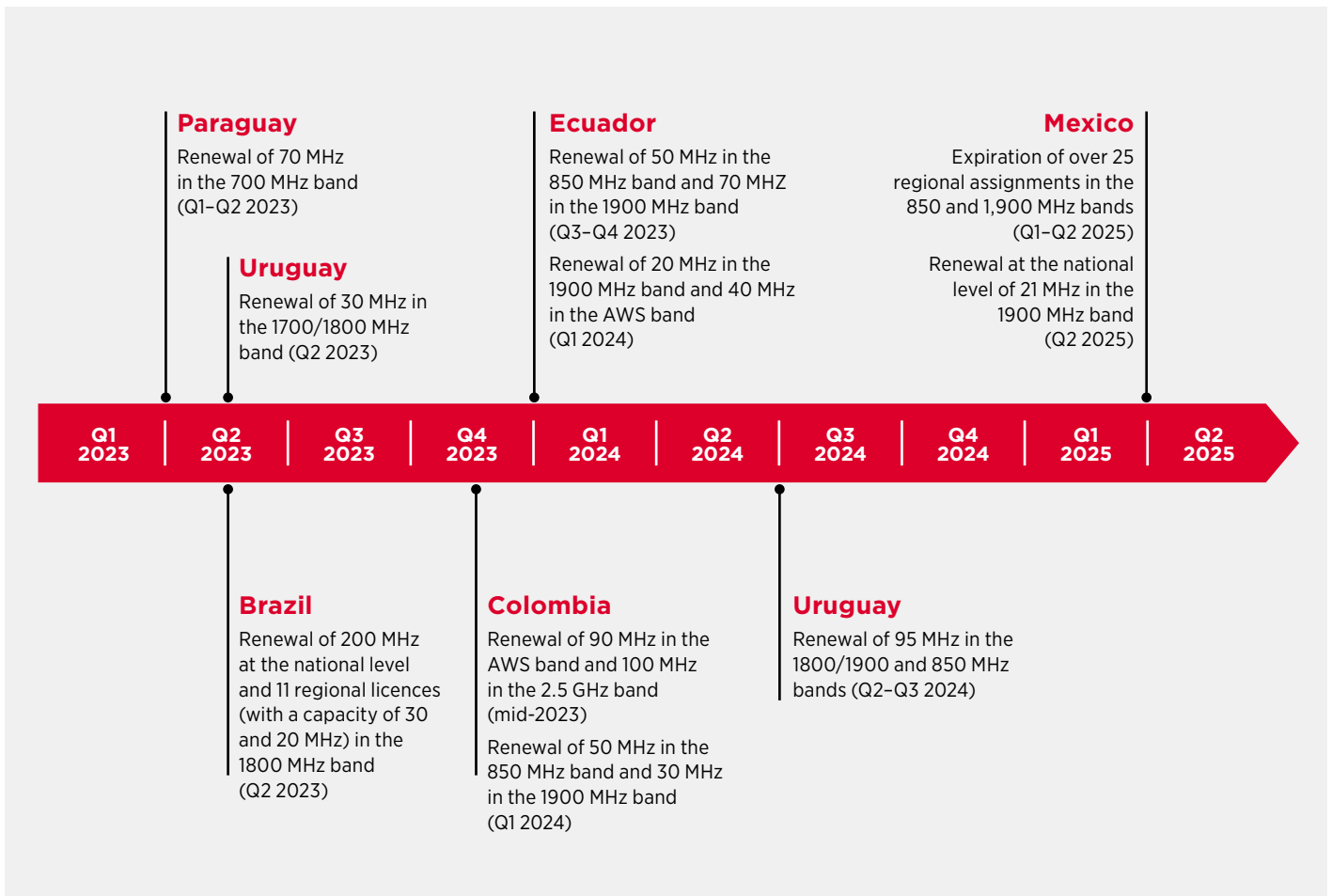


**Figure 20. Upcoming spectrum auctions in Latin America**



Source: GSMA Intelligence

**Figure 21. Spectrum renewals in the region, 2023-2025**



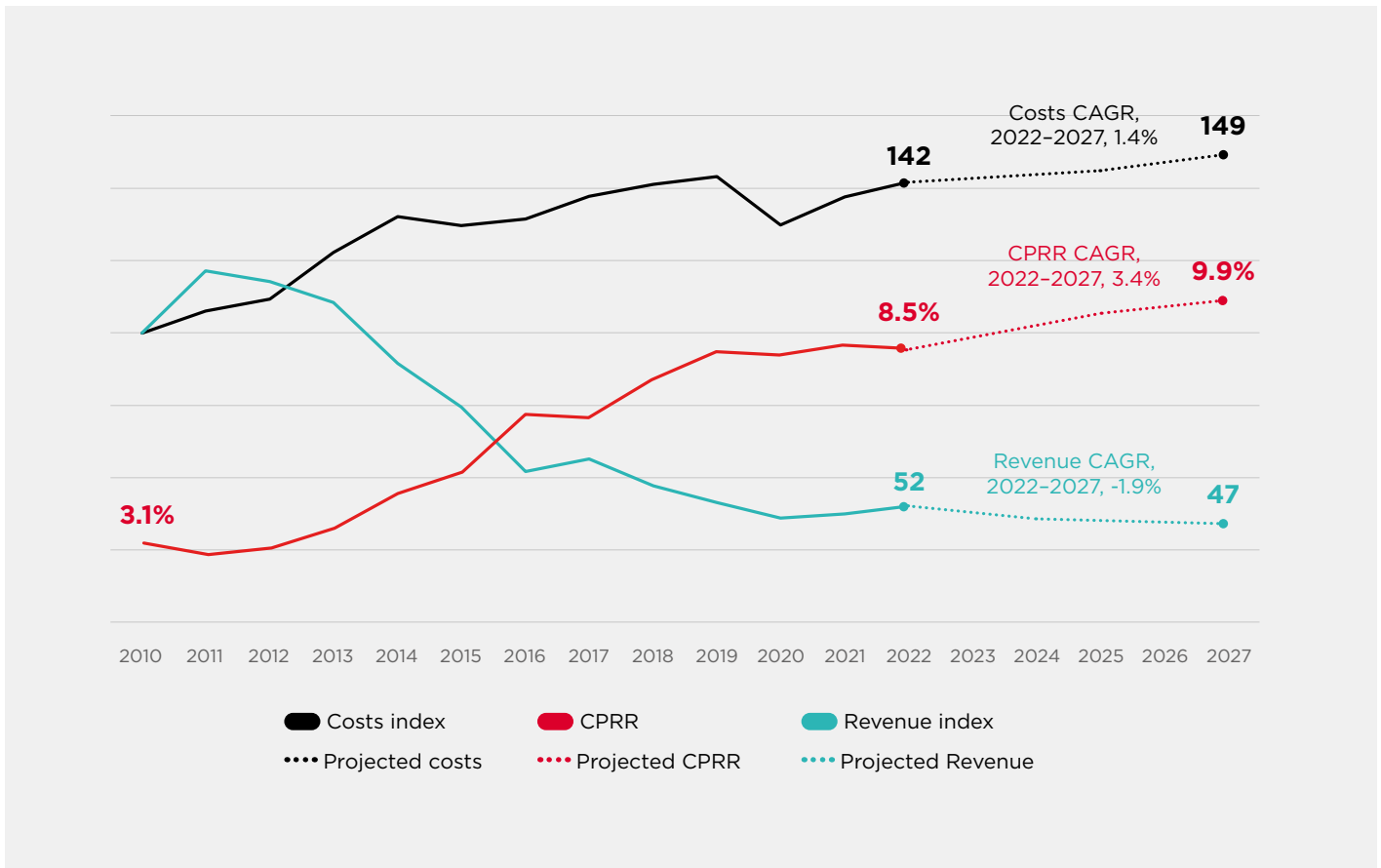
Source: GSMA Intelligence

## Investments needed to complete the development of 4G and 5G networks will be at risk if the total cost of spectrum is set above its true market value

Upcoming assignments and renewals represent both an opportunity and a risk for regulators looking to implement best practices for efficient spectrum management. Efficient spectrum assignments could ensure the deployment of new technologies and support an improvement in quality of existing networks, furthering the universality of benefits derived from mobile technology.

However, new business opportunities for operators investing in 5G networks appear to be limited in the short term. A global mobile internet consumer survey conducted by GSMA Intelligence at the end of 2022 shows that users who intend to upgrade to 5G are only willing to pay an additional 6% on average compared to what they currently pay for their 4G subscription. At the aggregate level, the sector’s revenue is going to remain flat or even decline in the next five years.

**Figure 22. Evolution of the total cost of spectrum and recurring revenue (index base year = 2010) and CPRR**



Source: GSMA Intelligence

If the developments seen in some Latin American countries where spectrum has already been assigned for 5G are replicated elsewhere,<sup>21</sup> assignments in the region could raise the price of spectrum by around 15% in the next five years, from \$2.45 billion today to \$2.8 billion by 2027. With mostly flat recurring revenues expected, the CPRR would increase by 1.4 percentage points, rising from 8.5% to 9.9% in the next five years. If the evolution of spectrum costs is not aligned with market revenues and the profitability of the sector is compromised, this could affect future investment decisions.

In this context, where short-term business opportunities for operators are limited and the growing demand for mobile data means that operators need additional spectrum for 4G and 5G networks, efficient spectrum assignment adjusted to the reality of the market will be crucial to promoting investment and innovation in the deployment of networks and new services.

<sup>21</sup> Projections of the impact of future 5G spectrum assignments in Latin America. Blocks by country: 300 MHz in the 3.5 GHz band (69,383 \$/MHz/year) and 3000 MHz in mmWave bands (1,911 \$/MHz/year). Values established based on auctions in Brazil, Chile, Dominican Republic and Uruguay for 3.5 GHz and based on Brazil for mmWave bands (as Chile chose a beauty contest approach).



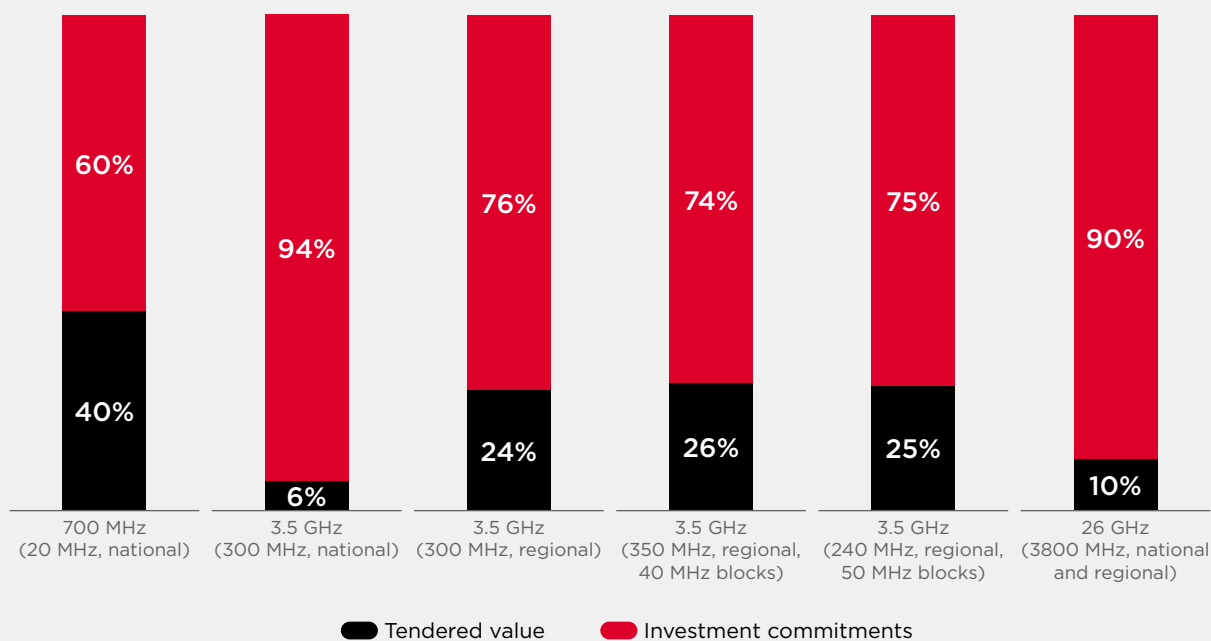
## 5G auction in Brazil: auction design promotes the deployment of new technologies and digital inclusion

Brazil's spectrum auction in 2021 was the largest spectrum auction in the history of the country and the region. During the process, 1920 MHz of spectrum was assigned exclusively for national coverage licences (including mmWave bands), plus regional assignments.<sup>22</sup>

For its 5G auction, the Brazilian regulator set the goal of maximising digital inclusion and innovation instead of focusing on revenue generation. While Brazil chose an ascending first-price auction approach, it allowed the possibility of paying for most of the spectrum through obligations or investment commitments associated with infrastructure plans aligned with the country's universal access policy.

Commitments to invest in network deployment accounted for up to 94% of the auction value, depending on the band offered. This involved commitments to coverage and ensuring the quality of connectivity by guaranteeing 5G in 26 capital cities, 1,174 towns with over 30,000 inhabitants and 4,396 towns with fewer than 30,000 inhabitants.

**Figure 23. Distribution of total spectrum payments by frequency band in Brazil**



Source: Anatel, GSMA Intelligence

Brazil's 5G auction shows that for authorities prioritising coverage expansion and closing the digital divide, innovative alternatives (i.e. obligations) can be considered in order to improve spectrum access and support operator investments. A year after the auction, Brazil managed to reach 5G coverage of almost 35% of the population, which represents a faster rate of coverage rollout than with 4G (which reached 30% of the population one year after assignment).<sup>23</sup>

<sup>22</sup> At the regional level, 13 lots of an average of 42.5 MHz were assigned in the 2.3 GHz band, six 80 MHz lots were assigned in the 3.5 GHz band and eleven 200 MHz lots were assigned in the 26 GHz band.

<sup>23</sup> By the end of the first quarter of 2023, according to Anatel's calculations, 5G population coverage reached 46%.

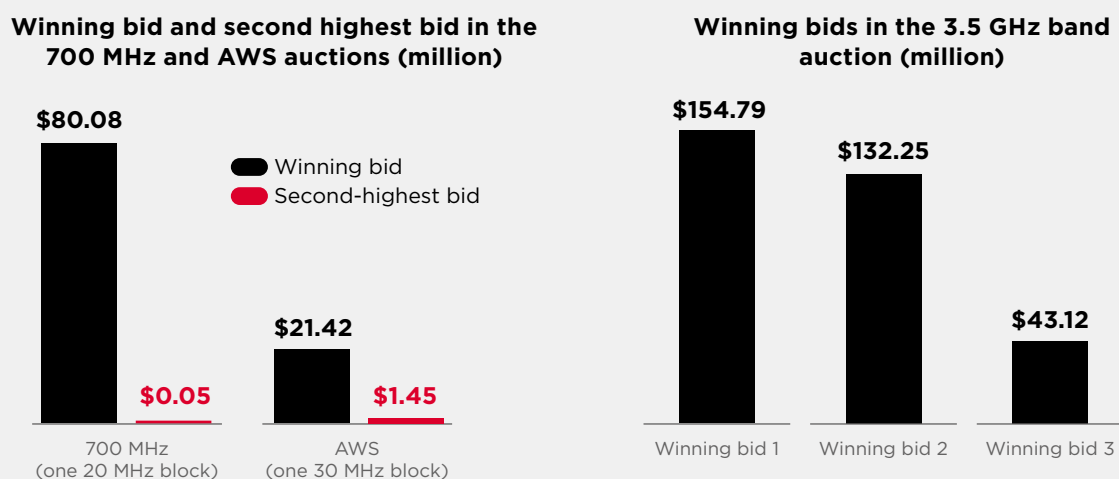


## 5G auction in Chile: tension between efficient assignment and revenue maximisation

Historically, Chile has assigned spectrum with the main purpose of promoting investment in network infrastructure and improving services and connectivity for end users. This is reflected, for example, by the country's 30-year spectrum licence duration, which is the longest in the region. Chile initially intended to allocate the maximum amount of spectrum available in the country's 5G auction in 2021. However, the tie-breaking criteria chosen by Subtel, the country's telecoms regulator, involved a first-price sealed-bid auction. A downside of this format is that the lack of a price discovery process can lead to artificially high licence costs.

This tie-breaking approach caused an artificial increase in licence costs, as evidenced by the discrepancy between the winning bid and the second-highest bid for AWS and 700 MHz bands. Assignment results for the 3.5 GHz band also showed an increase in licence costs: two operators paid three to four times the amount paid by the company that made the lowest bid for a same-size block.

**Figure 24. Auction results for 700 MHz, AWS and 3.5 GHz in Chile**

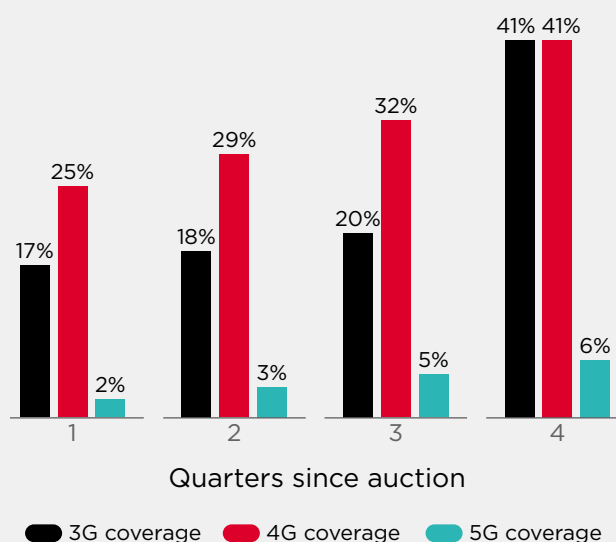


Source: Subtel, GSMA Intelligence

An auction design that allows bidders to get information about the true market value based on bids made by other operators can help promote efficient spectrum assignment. The lack of price discovery in this tie-breaking process led to overpriced spectrum in the 700 MHz, AWS and 3.5 GHz bands.

Currently, the pace of 5G deployment in Chile has been much slower than the deployment of previous network technologies, which could be related to high spectrum costs, as the total cost of spectrum can affect investment conditions in the market, innovation in network deployment and the levels of connectivity experienced by end users.

**Figure 25. 3G, 4G and 5G coverage in Chile a year after initial assignments (% of population)**



Source: GSMA Intelligence



**GSMA Head Office**

1 Angel Lane

London

EC4R 3AB

United Kingdom

Tel: +44 (0)20 7356 0600

Fax: +44 (0)20 7356 0601

