

## 4G&5G connectivity competitiveness 2020

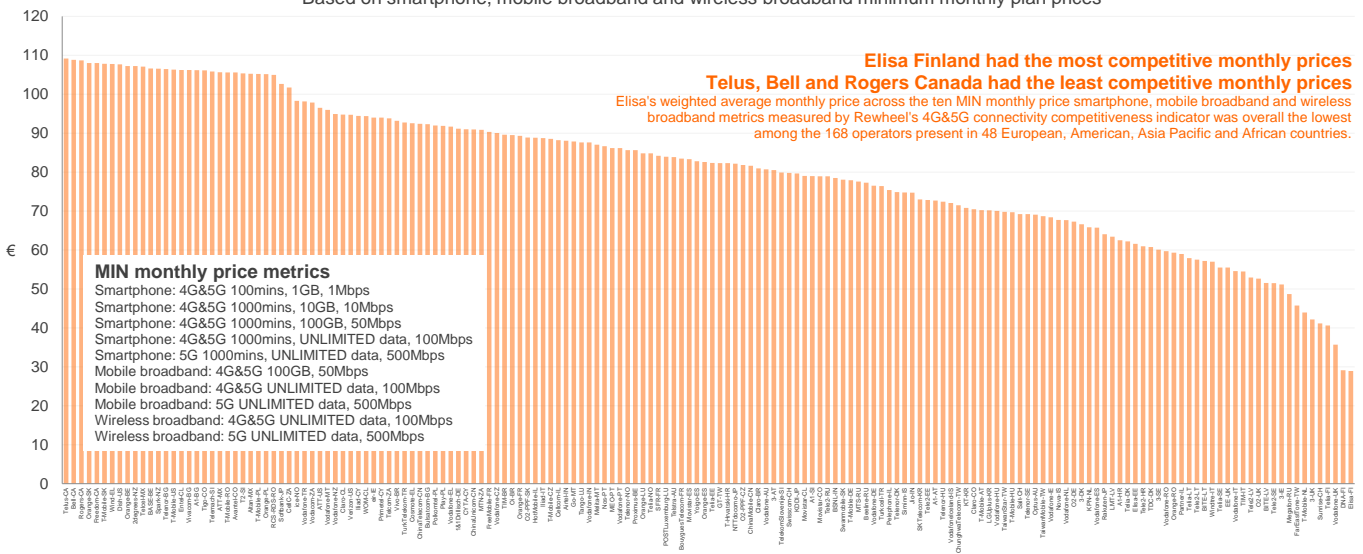
Elisa Finland had overall the most competitive 4G&5G connectivity monthly prices in 2H2020 among 168 mobile network operators present in 48 European, American, Asia Pacific and African countries.

Rewheel research PRO study, November 2020

### 4G&5G connectivity competitiveness – Operators

- Elisa's weighted average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics measured by Rewheel's 4G&5G connectivity competitiveness indicator was overall the lowest among the 168 operators present in 48 European, American, Asia Pacific and African countries.
- Telus, Bell and Rogers Canada were the operators with the least competitive monthly prices (i.e. highest weighted average monthly prices).

4G&5G connectivity competitiveness - 2H2020 operator rankings  
Based on smartphone, mobile broadband and wireless broadband minimum monthly plan prices



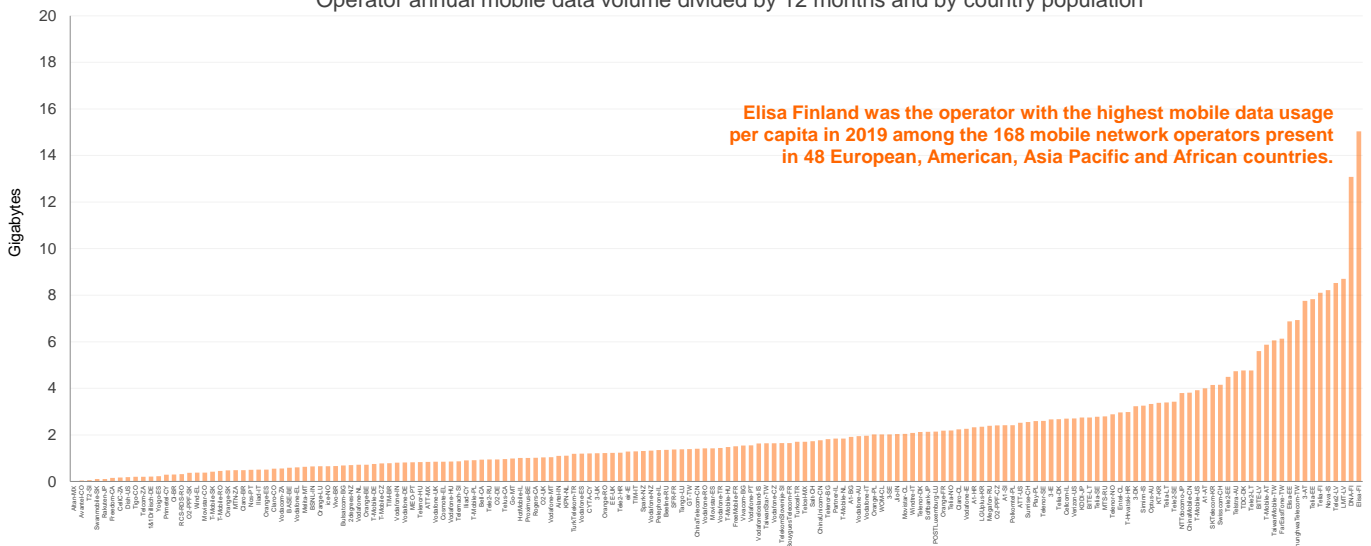
The chart depicts the weighted average monthly price per operator across the 10 MIN monthly price smartphone, mobile & wireless broadband metrics. Operators that did not sell a plan that met all the criteria listed above for a given metric (e.g. 5G smartphone plan with 1000mins, UNLIMITED data and 500Mbps) were assigned the highest monthly price among all 168 operators for that given metric.

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### Mobile data usage per capita – Operators

- Elisa Finland was the operator with the highest mobile data usage per capita in 2019 among the 168 mobile network operators present in 48 European, American, Asia Pacific and African countries.

Mobile data usage per capita - 2019 operators rankings  
Operator annual mobile data volume divided by 12 months and by country population



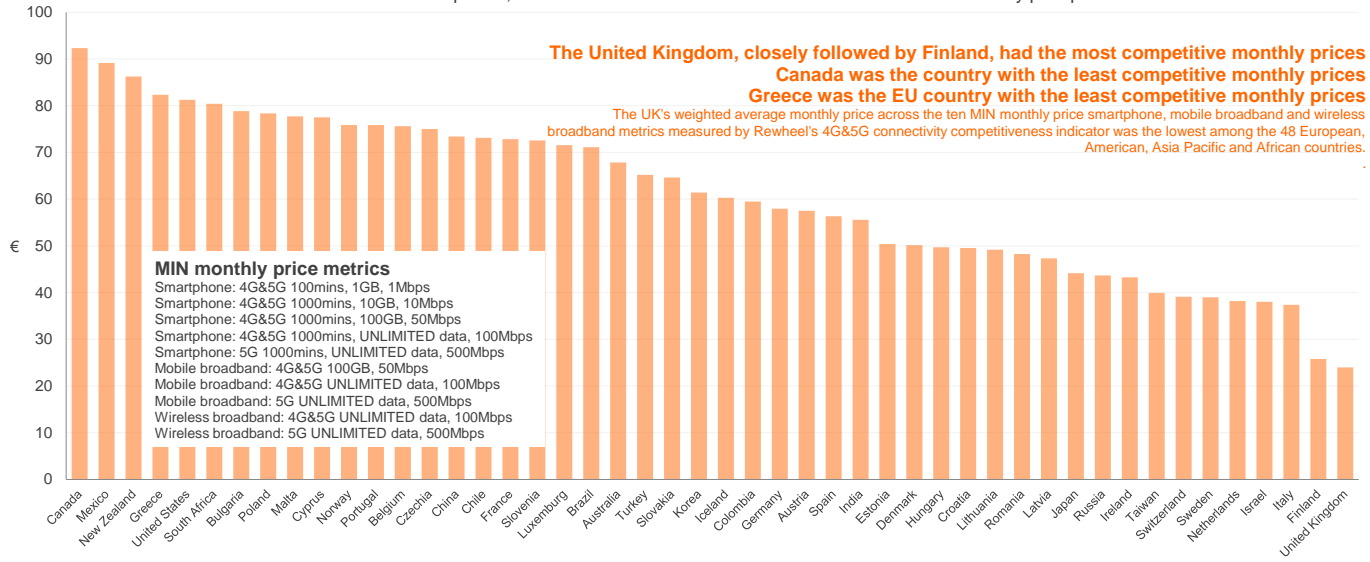
For operators that do not report their annual mobile data volume or their average mobile data usage per subscriber Rewheel estimated the volume using the regulator reported country volume and/or their competitor reported volume/s.

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### 4G&5G connectivity competitiveness – Countries

- The United Kingdom's weighted average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics measured by Rewheel's 4G&5G connectivity competitiveness indicator was overall the lowest among the 48 European, American, Asia Pacific and African countries.
- Canada was the country with the least competitive monthly prices (i.e. highest weighted average monthly price).
- Greece was the EU country with the least competitive monthly prices (i.e. highest weighted average monthly price among EU countries).

4G&5G connectivity competitiveness - 2H2020 country rankings  
Based on smartphone, mobile broadband and wireless broadband minimum monthly plan prices

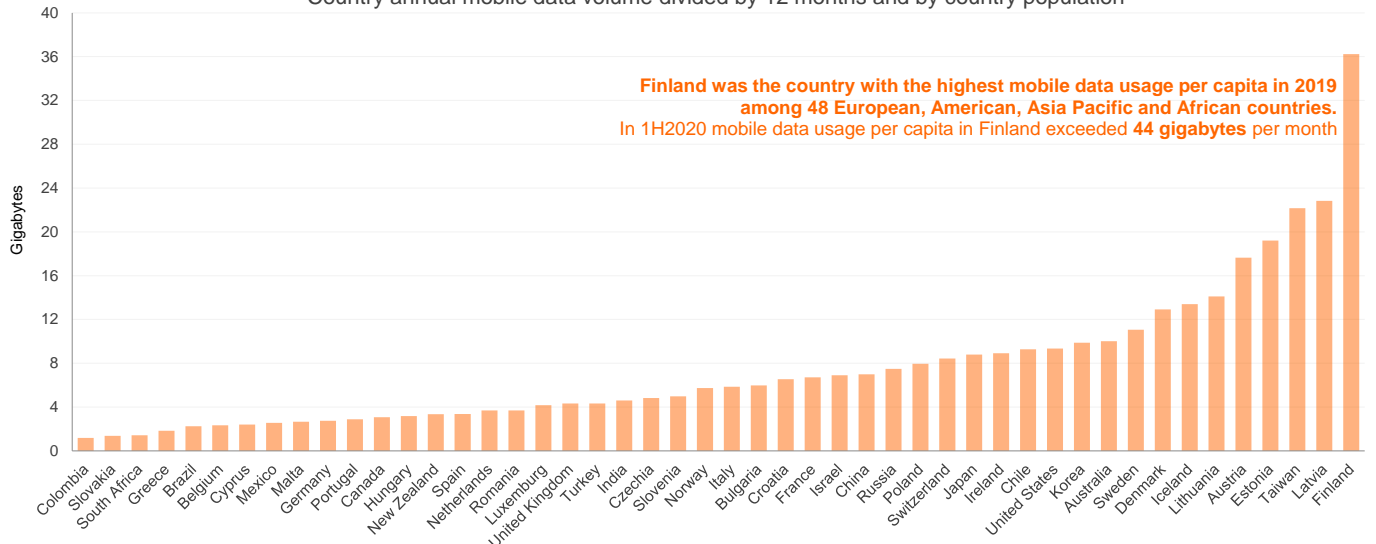


The chart depicts the weighted average monthly price per country across the 10 MIN monthly price smartphone, mobile & wireless broadband metrics. Countries where operators did not sell a plan that met all the criteria listed above for a given metric (e.g. 5G smartphone plan with 1000mins, UNLIMITED data and 500Mbps) were assigned the highest monthly price among all 48 countries for that given metric. research.rewheel.fi ©

### Mobile data usage per capita – Countries

- Finland was the country with the highest mobile data usage per capita in 2019 among the 48 European, American, Asia Pacific and African countries.

Mobile data usage per capita - 2019 country rankings  
Country annual mobile data volume divided by 12 months and by country population



For countries that do not report their annual mobile data volume or their average mobile data usage per subscriber/capita Rewheel estimated the volume using the volume/s reported by one or more operators present in the country. research.rewheel.fi ©

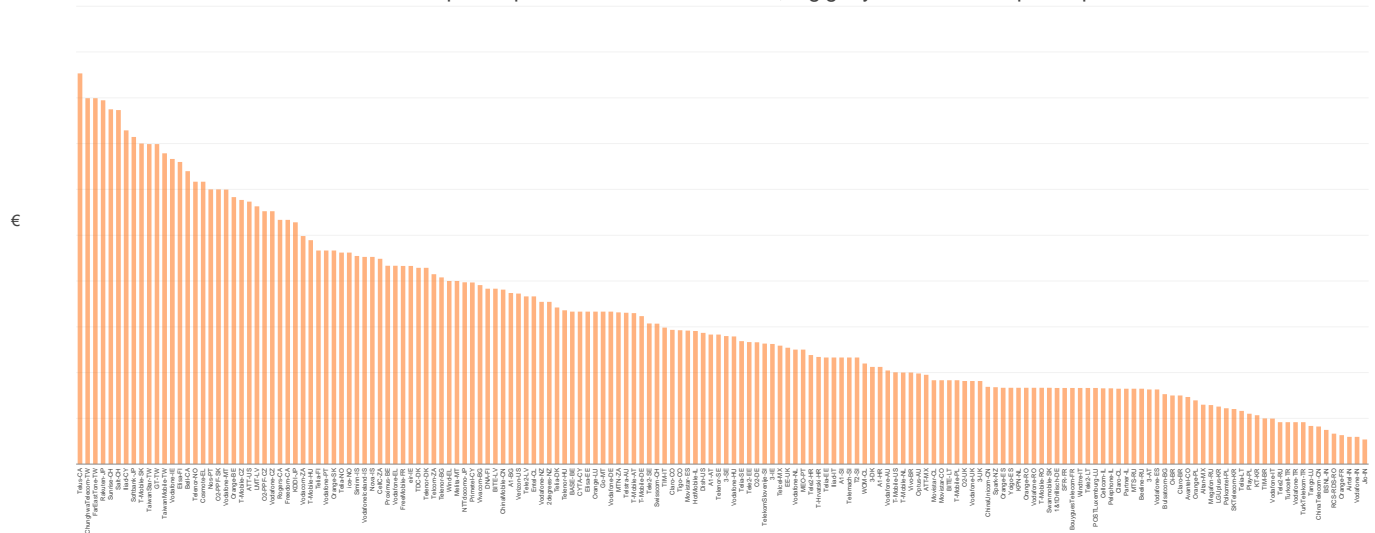
Sample charts and tables

The charts and tables presented below are free samples that are selectively included in this public version of the report. The PRO full version of the report contains many more charts and tables. For the detailed list of charts and tables see the Table of Contents below.

MIN monthly price for 1 gigabyte: 4G&5G smartphone plans with at least 100mins, 1 gigabyte and 1Mbit/s peak speed

- Jio India was the operator in 2H2020 with the lowest monthly price for a 4G or 5G smartphone plan that included at least 100mins, 1 gigabyte and 1 Mbit/s peak speed.
- Telus Canada was the operator in 2H2020 with the highest monthly price (~16x higher than Jio's).

MIN monthly price for 1 gigabyte - 2H2020 operator rankings  
4G&5G smartphone plans with at least 100mins, 1 gigabyte and 1Mbit/s peak speed



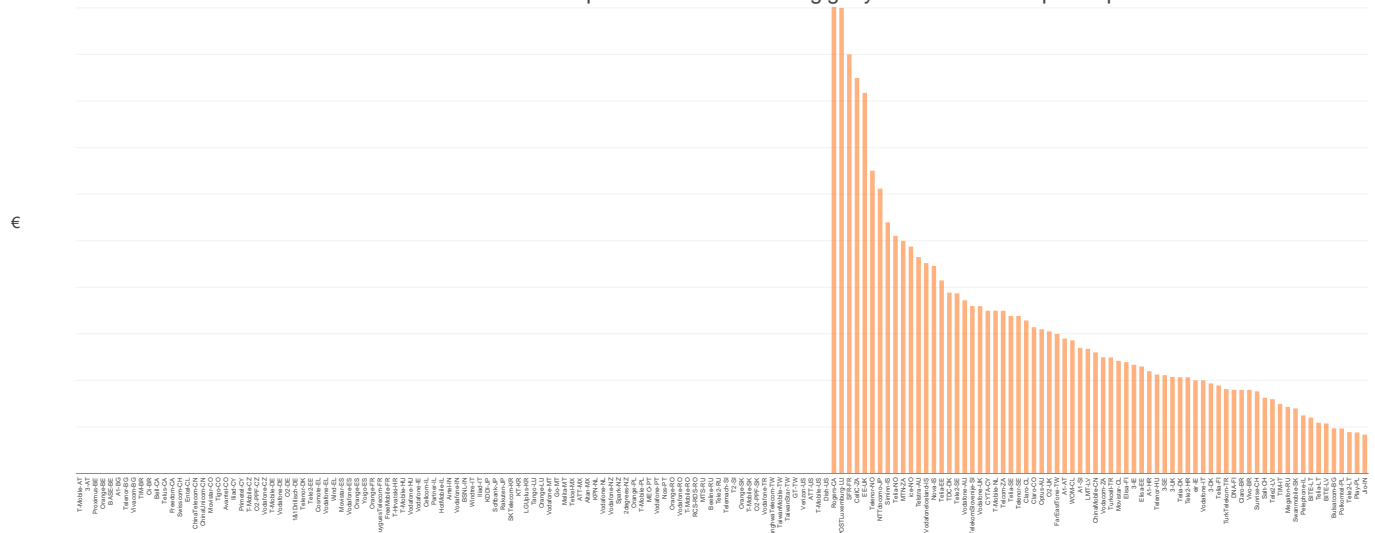
Minimum monthly retail price (incl. VAT & tax) for a given gigabyte allowance among all eligible tariffs logged in the database for operator. Unlimited data volume tariffs had no finite gigabyte volume (i.e. no throttling or deprioritization) or at least 1000 gigabytes.

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MIN monthly price for 100 gigabytes: 4G&5G mobile broadband plans with at least 100 gigabytes and 50Mbit/s peak speed

- Jio India was the operator in 2H2020 with the lowest monthly price for a 4G or 5G mobile broadband plan that included at least 100 gigabytes and 50 Mbit/s peak speed.
- Rogers Canada was the operator in 2H2020 with the highest monthly price (~17x higher than Jio's).

MIN monthly price for 100 gigabytes - 2H2020 operator rankings  
4G&5G mobile broadband plans with at least 100 gigabytes and 50Mbit/s peak speed



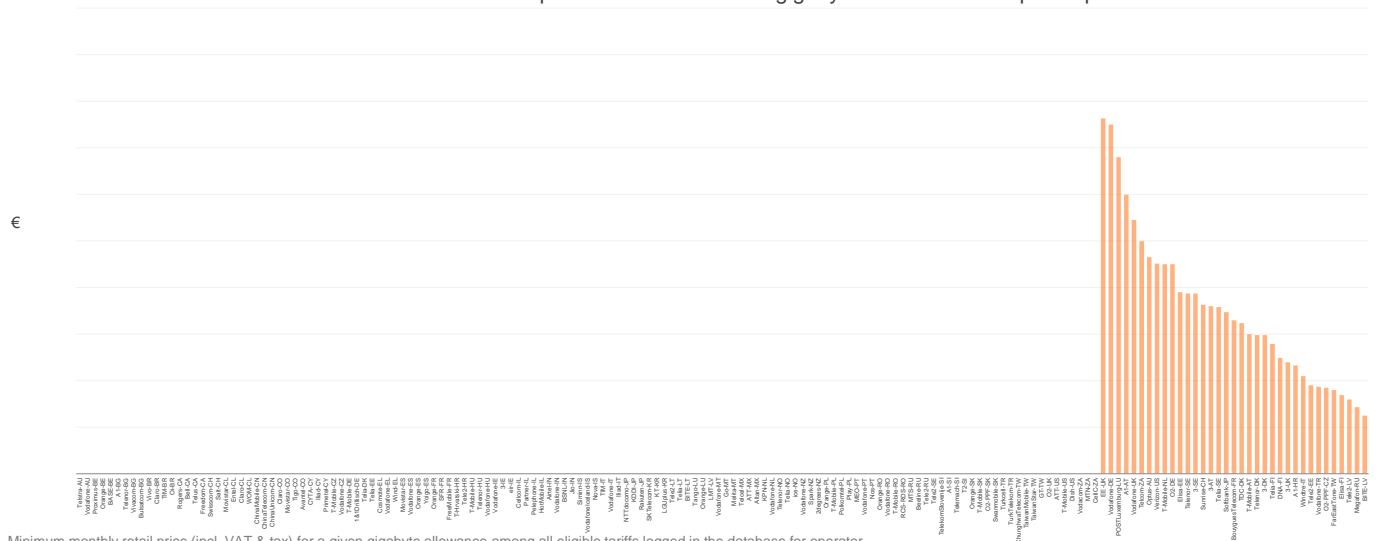
Minimum monthly retail price (incl. VAT & tax) for a given gigabyte allowance among all eligible tariffs logged in the database for operator. Unlimited data volume tariffs had no finite gigabyte volume (i.e. no throttling or deprioritization) or at least 1000 gigabytes.

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**MIN monthly price for UNLIMITED data: 4G&5G wireless broadband plans with at least 1000 gigabytes and 100Mbit/s peak speed**

- BITE Latvia was the operator in 2H2020 with the lowest monthly price for a 4G or 5G wireless broadband plan that included at least 1000 gigabytes and 100 Mbit/s peak speed.
- Everything Everywhere (EE) UK was the operator in 2H2020 with the highest monthly price (~6x higher than BITE's).

MIN monthly price for UNLIMITED data - 2H2020 operator rankings  
4G&5G wireless broadband plans with at least 1000 gigabytes and 100Mbit/s peak speed



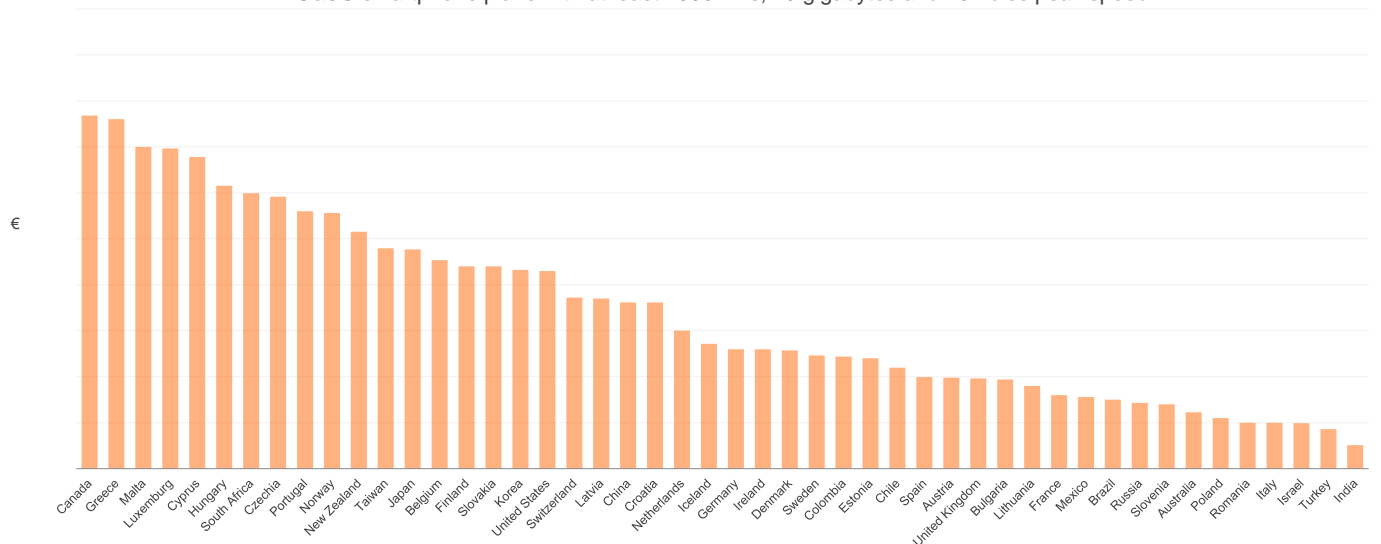
Minimum monthly retail price (incl. VAT & tax) for a given gigabyte allowance among all eligible tariffs logged in the database for operator. Unlimited data volume tariffs had no finite gigabyte volume (i.e. no throttling or deprioritization) or at least 1000 gigabytes. Wireless broadband plans are 4G or 5G fixed wireless access (FWA) or stationary home broadband plans that may or may not require an external antenna.

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**MIN monthly price for 10 gigabytes: 4G&5G smartphone plans with at least 1000mins, 10 gigabytes and 10Mbit/s peak speed**

- India was the country in 2H2020 with the lowest monthly price for a 4G or 5G smartphone plan that included at least 1000mins, 10 gigabyte and 10 Mbit/s peak speed.
- Canada and Greece were the countries in 2H2020 with the highest monthly prices (~15x higher than India's).

MIN monthly price for 10 gigabytes - 2H2020 country rankings  
4G&5G smartphone plans with at least 1000mins, 10 gigabytes and 10Mbit/s peak speed



Minimum monthly retail price (incl. VAT & tax) for a given gigabyte allowance among all eligible tariffs logged in the database for country. Unlimited data volume tariffs had no finite gigabyte volume (i.e. no throttling or deprioritization) or at least 1000 gigabytes.

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Mobile data pricing, mobile operator competitiveness rankings, market modelling & analysis, competition analysis (consolidation, 4 to 3 mobile mergers, effective remedies, new market entries), MNO near-zero marginal data cost, MVNO economics, mobile capacity-only play, mobile centric convergence (MCC) pro-competitive strategies and 4<sup>th</sup> MNO business case.

Founded in 2009 and incorporated in Finland, Rewheel is a privately owned independent telecom research firm and boutique management consultancy. Our clients are mobile network operators, telco groups, MVNO groups, competition authorities, telecom sector regulators, governments, global internet firms, mobile data-centric start-ups, PE and VC investors.

Rewheel has delivered management consultancy work for clients in the United Kingdom, United States, Ireland, Switzerland, Finland, Sweden, Belgium, Greece, Poland, Slovenia, Hungary, Russia, Romania.

The following authorities have acquired access to Rewheel's independent pricing, mobile market competitiveness, 4 to 3 merger analysis and remedy assessment research: The European Commission Directorate for Competition, the United States Department of Justice, the New York, California and many other US State Attorney General Offices, the national competition authorities of Canada, Australia, the Netherlands and Greece, the Ministry of Economic Affairs of the Netherlands, the Ministry of Industry and Trade of Czechia, the Korean Electronics and Telecommunication Research Institute, the sector regulators of the United Kingdom, Germany, France, the Netherlands, Ireland, Finland, etc.

Rewheel's mobile data pricing, strategy, competition analysis, merger assessment, network economics, spectrum, profitability and competitiveness focused reports have been cited by OECD Economic Surveys, The Economist, The Financial Times, The New York Times, Reuters, Bloomberg, WSJ and publicly referenced by the UK telecoms regulator Ofcom, BIPT, Vodafone, Telefonica, Tele2, Elisa, DNA, GSMA, VPs of the EU Commission responsible for Competition, MEPs, IEEE, ITU.

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#### **The state of 4G&5G pricing in Latin America, August 2020**

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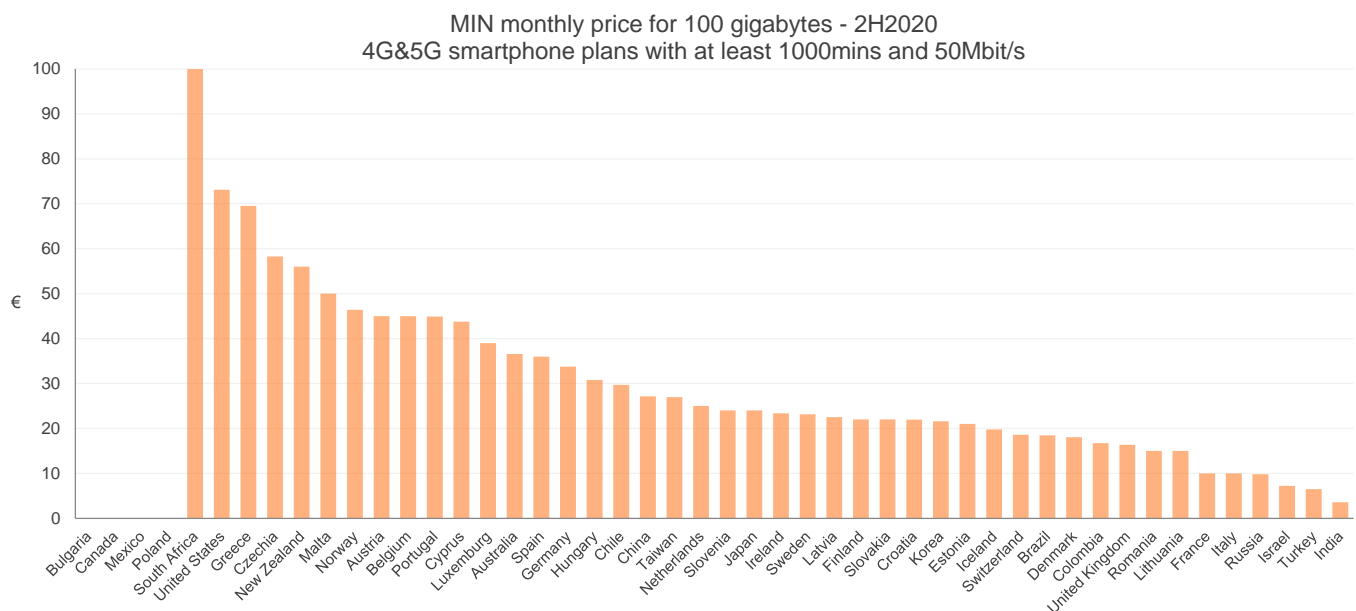
## 1 Context and methodology

### 1.1 Study context

Rewheel's Digital Fuel Monitor (DFMonitor) bi-annual releases have been tracking 4G&5G broadband prices in 48 European, American, Asia Pacific and African countries since the first half of 2014. In the 14<sup>th</sup> release<sup>1</sup> 2H2020 DFMonitor tracked and analysed the state of 4G&5G broadband pricing during the second half of 2020 (September 2020 prices) and as well the historic development of prices dating back to the first half of 2014. The 14<sup>th</sup> release 2H2020 included prices from 168 mobile network operators (that are part of 92 operator groups), 79 operator sub-brands and 70 major MVNOs that were present in the 48 European, American, Asia Pacific and African countries.

DFMonitor uses a number of competitiveness metrics (such as *MIN monthly price for UNLIMITED data*, *MEDIAN monthly price for UNLIMITED data*, *% of plans with UNLIMITED data*, *MEDIAN monthly price*, *MEDIAN gigabyte price*, *MAX gigabytes that 5, 10, 20, 25, 30, 40, 50, 60, 70 and 80 EUR bought* and *MIN monthly price for 1, 5, 10, 50, 100, 300, 500 and 1000 gigabytes*) to analyse the 4G&5G broadband prices and rank the 48 countries included in the international comparison.

In DFMonitor bi-annual studies countries are ranked based on their performance in each one of the competitiveness price metrics detailed above. For example, as seen in the chart below during the 2H2020, India was the country with lowest monthly price for a 4G or 5G smartphone plan that included at least 1000 minutes, 100 gigabytes and 50 Mbit/s peak speed.



Minimum monthly retail price (incl. VAT & tax) for a given gigabyte allowance among all eligible tariffs logged in the database for country. Unlimited data volume tariffs had no finite gigabyte volume (i.e. no throttling or deprioritization) or at least 1000 gigabytes.

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DFMonitor's bi-annual studies do not include operator rankings, neither for specific price metrics (e.g. MIN monthly price for 100 gigabytes) nor an overall price competitiveness operator ranking.

In light of the above we decided to complement DFMonitor's bi-annual 4G&5G broadband pricing comparison studies with an annual study focused on mobile network operator 4G&5G connectivity competitiveness. In the annual 4G&5G connectivity competitiveness studies we will rank every year all the mobile network operators present in the 48 European, American, Asia Pacific and African countries tracked by DFMonitor based on their average monthly price across ten metrics.

The first annual 4G&5G connectivity competitiveness study presented herein uses the 4G&5G prices tracked by DFMonitor's 14<sup>th</sup> release 2H2020 (September 2020 prices). Subsequent 4G&5G connectivity competitiveness studies will be released during the fourth quarter of each year and will be based on DFMonitor tracked prices from the second half of each year.

<sup>1</sup>[http://research.rewheel.fi/downloads/The\\_state\\_of\\_4G\\_5G\\_pricing\\_DFMonitor\\_14\\_release\\_2H2020\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/The_state_of_4G_5G_pricing_DFMonitor_14_release_2H2020_PUBLIC.pdf)

The annual 4G&5G connectivity competitiveness studies will also include the mobile data usage per capita and mobile data usage per subscriber operator and country rankings. Previously, we reported the mobile data usage operator and country rankings in Rewheel's annual "*capacity utilization and 5G capacity potential*" studies. We reported the 2018 operator and country mobile data usage rankings in our "*2018 capacity utilization and 5G capacity potential of mobile operator existing macro cell site grids*" study<sup>2</sup>.

Herein, in the 4G&5G connectivity competitiveness 2020 study we will report the 2019 mobile data usage rankings for all 168 operators present across the 48 European, American, Asia Pacific and African countries. We will report the 2020 mobile data usage rankings in the next annual release of the 4G&5G connectivity competitiveness study that will be released during the fourth quarter of 2021.

Mobile data usage is primarily driven, as we have shown in many of our studies (for example see our "*Unlimited mobile data – Why Finland is different*" study<sup>3</sup>) by the availability and affordability of smartphone and particularly mobile broadband and/or wireless broadband 4G&5G plans with very large (500, 1000 or more gigabytes) or unlimited data volume.

## 1.2 4G&5G connectivity competitiveness methodology

Rewheel's 4G&5G connectivity competitiveness indicator comprises of ten MIN (minimum) monthly price metrics. The indicator includes five smartphone plan, three mobile broadband plan and two wireless broadband plan MIN monthly price metrics detailed below:

1. MIN monthly price for 1 gigabyte: 4G or 5G smartphone plans with at least 100 minutes, 1 gigabyte and 1 Mbit/s peak speed
2. MIN monthly price for 10 gigabytes: 4G or 5G smartphone plans with at least 1000 minutes, 10 gigabytes and 10 Mbit/s peak speed
3. MIN monthly price for 100 gigabytes: 4G or 5G smartphone plans with at least 1000 minutes, 100 gigabytes and 50 Mbit/s peak speed
4. MIN monthly price for UNLIMITED data: 4G or 5G smartphone plans with at least 1000 minutes, 1000 gigabytes and 100 Mbit/s peak speed
5. MIN monthly price for UNLIMITED 5G data: 5G smartphone plans with at least 1000 minutes, 1000 gigabytes and 500 Mbit/s peak speed
6. MIN monthly price for 100 gigabytes: 4G or 5G mobile broadband plans with at least 100 gigabytes and 50 Mbit/s peak speed
7. MIN monthly price for UNLIMITED data: 4G or 5G mobile broadband plans with at least 1000 gigabytes and 100 Mbit/s peak speed
8. MIN monthly price for UNLIMITED 5G data: 5G mobile broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed
9. MIN monthly price for UNLIMITED data: 4G or 5G wireless broadband plans with at least 1000 gigabytes and 100 Mbit/s peak speed
10. MIN monthly price for UNLIMITED 5G data: 5G wireless broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed

Mobile broadband plans were plans with full mobility (i.e. the data can be used anywhere in the country) while wireless broadband plans were fixed wireless access (FWA) or stationary home broadband plans that may or may not require an external antenna. The tariff eligibility rules used herein for the compilation of Rewheel's 4G&5G connectivity competitiveness rankings are identical with the DFMonitor tariff eligibility rules, described in detailed here<sup>4</sup>.

### MIN monthly price rankings

The 168 mobile network operators present in the 48 European, American, Asia Pacific and African countries where ranked from highest monthly price to lowest monthly price in each of the ten metrics listed above. In accordance with the DFMonitor methodology for each mobile network operator we selected as the MIN monthly price per metric the lowest price sold by its main brand, any of each sub-brands or any of its MVNOs.

We have designated 1&1 Drillisch in Germany and Dish in the United States as mobile network operators. 1&1 Drillisch and Dish, the 4 to 3 merger mandated new entrants in Germany and in the US, currently operate as MVNOs on Telefonica's Germany and T-Mobile's US networks respectively. Nevertheless, 1&1 Drillisch and Dish hold adequate spectrum and have imminent plans to become the 4<sup>th</sup> MNO in their respective markets by building 5G networks.

In addition to ranking the 168 operators we also ranked the 48 countries from highest monthly price to lowest monthly price in each of the ten metrics listed above. For each country we selected as the MIN monthly price per metric the lowest price sold by any operator main brand, sub-brands or MVNOs.

<sup>2</sup>[http://research.rewheel.fi/downloads/2018\\_capacity\\_utilization\\_potential\\_macro\\_site\\_grids\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/2018_capacity_utilization_potential_macro_site_grids_PUBLIC.pdf)

<sup>3</sup>[http://research.rewheel.fi/downloads/Unlimited\\_mobile\\_data\\_Finland\\_different\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/Unlimited_mobile_data_Finland_different_PUBLIC.pdf)

<sup>4</sup>[http://research.rewheel.fi/downloads/The\\_state\\_of\\_4G\\_5G\\_pricing\\_DFMonitor\\_14\\_release\\_2H2020\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/The_state_of_4G_5G_pricing_DFMonitor_14_release_2H2020_PUBLIC.pdf)

## 4G&5G connectivity competitiveness indicator rankings

The 4G&5G connectivity competitiveness indicator was designed to be a forward-looking proxy of an operator or a country overall price competitiveness with particular focus on UNLIMITED smartphone, mobile broadband and wireless broadband 4G and even more so UNLIMITED 5G data. We calculated and presented three versions of the 4G&5G connectivity competitiveness indicator.

- a. Average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics (applies to both operators and countries)
- b. Weighted average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics (applies to both operators and countries)
- c. Market share adjusted average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics (applies only to operators)

In the first version we simply averaged the MIN monthly price for an operator or a country across the ten smartphone, mobile broadband and wireless broadband metrics. By design, the 4G&5G connectivity competitiveness average indicator is a weighted average function of five smartphone plan MIN monthly prices (i.e. 50% weight in smartphone plan prices), three mobile broadband plan MIN monthly prices (i.e. 30% weight in mobile broadband plan prices) and two wireless broadband plan MIN monthly prices (i.e. 20% weight in wireless broadband plan prices).

It is important to note that operators that did not sell a plan that met all the criteria listed above for a given metric were assigned the highest monthly price among all 168 operators for that given metric. For example, operators that did not sell 5G mobile broadband plans with UNLIMITED data and 500 Mbit/s peak speed were assigned a monthly price of 54.78 EUR.

In other words, operators that have not yet launch 5G and/or did not sell plans with large or unlimited data volume during September 2020 were penalized in the average monthly price indicator calculation. Rewheel's 4G&5G connectivity competitiveness indicator was designed to single out operators that sell at competitive monthly prices plans across all ten smartphone, mobile broadband and wireless broadband metrics. This applies both to operators and as well to countries. Hence, in subsequent releases an operator (or a country) may significantly improve its rankings if it launches at competitive monthly prices smartphone, mobile broadband and wireless broadband 4G (and in particular 5G) plans with unlimited data volume. For example, this might very well apply to French operators that had not yet launch 5G plans during September 2020 but after securing 3.6 GHz spectrum will probably launch 5G during the 1H2020.

In the second weighted average version of the indicator we allocated individual weights to each of the ten MIN monthly price metrics as seen below.

1. MIN monthly price for 1 gigabyte: 4G or 5G smartphone plans with at least 100 minutes, 1 gigabyte and 1 Mbit/s peak speed **5%**
2. MIN monthly price for 10 gigabytes: 4G or 5G smartphone plans with at least 1000 minutes, 10 gigabytes and 10 Mbit/s peak speed **7%**
3. MIN monthly price for 100 gigabytes: 4G or 5G smartphone plans with at least 1000 minutes, 100 gigabytes and 50 Mbit/s peak speed **9%**
4. MIN monthly price for UNLIMITED data: 4G or 5G smartphone plans with at least 1000 minutes, 1000 gigabytes and 100 Mbit/s peak speed **10%**
5. MIN monthly price for UNLIMITED 5G data: 5G smartphone plans with at least 1000 minutes, 1000 gigabytes and 500 Mbit/s peak speed **11%**
6. MIN monthly price for 100 gigabytes: 4G or 5G mobile broadband plans with at least 100 gigabytes and 50 Mbit/s peak speed **10%**
7. MIN monthly price for UNLIMITED data: 4G or 5G mobile broadband plans with at least 1000 gigabytes and 100 Mbit/s peak speed **11%**
8. MIN monthly price for UNLIMITED 5G data: 5G mobile broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed **12%**
9. MIN monthly price for UNLIMITED data: 4G or 5G wireless broadband plans with at least 1000 gigabytes and 100 Mbit/s peak speed **12%**
10. MIN monthly price for UNLIMITED 5G data: 5G wireless broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed **13%**

In the weighted average version of the indicator we assigned higher weights to plans representing use cases that typically generate higher data usage. We assigned a total weight of 25% to wireless broadband plans typically position as home broadband substitutes of fixed broadband, a total weight of 33% to mobile broadband plans typically position both as home broadband substitutes of fixed broadband and as well for complimentary out of home use and a total weight of 42% to smartphone plans.

Furthermore, we assigned higher weights to 5G plans, to plans that include higher data or unlimited data volumes, to plans that have higher speeds and to plans that while they offer the same amount of data volume and speed will typically generate higher data volume. For example, we assigned the highest individual weight of 13% to 5G wireless broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed, the second highest weight of 12% to 5G mobile broadband plans with at least 1000 gigabytes and 500 Mbit/s peak speed and the third highest weight to 5G smartphone plans with at least 1000 minutes, 1000 gigabytes and 500 Mbit/s peak speed.

In the third market share adjusted average version of the indicator we adjusted the average monthly price across the ten MIN monthly price smartphone, mobile broadband and wireless broadband metrics by the operator subscriber (total SIMs excluding m2m) share. The rationale behind this adjustment lies on our prior research findings showing that monthly prices in mobile markets are moderately driven (among other factors) by the mobile network operator market (subscriber) share. In our January 2019 study<sup>5</sup> titled “4G prices as a function market concentration, number of MNOs, operator subscriber share, position, group affiliation and country general price level” we showed that the higher the mobile network operator subscriber share the higher the monthly price it charges.

Undeniably, new entrants with very low market share typically charge very low prices in order to attract as many customers as possible as fast as possible. Often the monthly prices charge by new entrants are near or below the level that may ensure long term profitability (buying market share). For example, see our “Iliad’s 4th MNO venture into Italy – Will it pay off?” study<sup>6</sup>. Hence, our objective with the market share adjusted version of the 4G&5G connectivity competitiveness indicator is to single out operators that charge competitive prices to a significant share of the market (i.e. sustained long term profitability).

The market share adjusted version of the indicator effectively improves the competitiveness rankings of operators with high market share (e.g. Swisscom Switzerland, ~60% subscriber share, ranks as the 45<sup>th</sup> most competitive operator in the market share adjusted average version and as the 74<sup>th</sup> most competitive operator in the average version) and worsens the ranking of operators with low market share (e.g. Salt Switzerland, ~16% subscriber share, ranks as 64<sup>th</sup> most competitive operator in the market share adjusted average version and as the 41<sup>st</sup> most competitive operator in the average version). For more see section 2.3 of the PRO full report version.

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<sup>5</sup>[http://research.rewheel.fi/downloads/4G\\_prices\\_vs\\_number\\_MNOs\\_position\\_\\_share\\_concentration\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/4G_prices_vs_number_MNOs_position__share_concentration_PUBLIC.pdf)

<sup>6</sup>[http://research.rewheel.fi/downloads/Iliad\\_4th\\_MNO\\_venture\\_into\\_Italy\\_PUBLIC.pdf](http://research.rewheel.fi/downloads/Iliad_4th_MNO_venture_into_Italy_PUBLIC.pdf)