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on the review of the roaming market

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1. INTRODUCTION

The roaming policy is a European success story, giving millions of consumers and businesses in the EU the benefits of staying connected without surcharges in the Digital Single Market. Since 15 June 2017, Union residents have access to mobile services (voice, SMS and data) at no extra costs when travelling periodically in the European Union ('EU')/European Economic Area ('EEA'). In these cases, mobile operators are not allowed to levy any charges in addition to the domestic price for roaming services. These roaming rules are widely known as "**Roam-Like-At-Home" ('RLAH')**.

In 2022, the RLAH rules were revised. These rules are now included in Regulation (EU) 2022/612 (hereinafter 'Roaming Regulation') ([1]) which also extended their application for an additional 10 years till June 2032. The Roaming Regulation includes provisions regulating roaming both at wholesale and retail levels.

At the wholesale level, mobile network operators must meet all reasonable requests for wholesale roaming access, in particular in a manner that allows the roaming providers to replicate the retail mobile services offered domestically where it is technically feasible to do so on the visited network ([2]).

At the retail level, this translates into the fact that roaming providers must not apply surcharges to the domestic retail price to customers in any Member States for (i) making and receiving calls, (ii) sending and receiving SMS messages, (iii) using an internet connection, for non-permanent journeys.

The Roaming Regulation also defines the safeguards rules – fair use policy and the sustainability derogation – whose aim is to ensure sustainability for operators while allowing for a high level of consumer protection. The application of these safeguards was further detailed in the Commission Implementing Regulation (EU) 2016/2286 (hereinafter the 'Implementing Regulation' or 'CIR') ([3]) adopted in December 2016 ([4]).

Finally, the Roaming Regulation reflects the specific characteristics of Union-wide roaming services and therefore complements Directive (EU) 2018/1972 establishing the

([1]) Regulation (EU) 2022/612 of the European Parliament and of the Council of 6 April 2022 on roaming on public mobile communications networks within the Union (OJ L 115, 13.4.2022, p. 1–37).

([2]) Mobile network operators may refuse requests for wholesale roaming access only on the basis of objective criteria, such as technical feasibility and network integrity. Commercial considerations are not grounds for refusing requests for wholesale roaming access in order to limit the provision of competing roaming services.

([3]) Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016 laying down detailed rules on the application of fair use policy and on the methodology for assessing the sustainability of the abolition of retail roaming surcharges and on the application to be submitted by a roaming provider for the purposes of that assessment.

([4]) These measures were adopted to prevent abusive or anomalous use of roaming services, such as permanent roaming at domestic prices, that may have detrimental effects on the domestic markets. In these scenarios, mobile operators may apply a fair use policy. The Implementing Regulation (EU) 2016/2286 also provided complementary measures aiming to ensure that operators can provide regulated retail roaming services in a sustainable way. In this context the term "sustainable" means that operators can either fully recover the cost of providing retail roaming services or at least that the incurred negative retail roaming margin is very small (less than 3%) compared to their domestic profits.

European Electronic Communications Code ('Code' or 'EECC') ([5]) introducing exceptional measures departing from the rules otherwise applicable under the Code, namely that prices for service offerings are to be determined by commercial agreement in the absence of significant market power ([6]).

Since the adoption of the recast Roaming Regulation in 2022 and in line with its reporting obligations laid down in the Regulation ([7]), on 15 January 2024, the Commission published a Staff Working Document ('SWD') on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainable derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 (hereinafter '2023 Review Report'). The 2023 Review Report concluded on the overall success of the fair use policy ('FUP') mechanisms as they currently exist. Union residents enjoy mobile services while travelling in the EU/EEA under RLAH conditions. The existing fair use policy mechanisms have been widely implemented by operators and allowed them to ensure RLAH benefits to periodic travellers while addressing abusive or anomalous use of roaming. Finally, no major impact has been observed on the domestic markets: the tariff structure and availability of domestic mobile subscriptions remained unchanged.

The Roaming Regulation further mandates the Commission to submit, by 30 June 2025, a comprehensive review report to the European Parliament (EP) and the Council assessing the functioning of the roaming market under the RLAH rules. This SWD and the related Report are submitted by the Commission to the European Parliament and the Council for the purposes of reviewing the functioning of the roaming market.

2. SCOPE OF THE ROAMING REGULATION AND MAIN PROVISIONS

2.1. What is roaming?

Roaming, in the meaning of the Roaming Regulation, is a service that allows a roaming customer (consumer or business) of a Mobile (Virtual) Network Operator (M(V)NO) (operator A) in one EU/EEA country (country A) to have access to mobile services (voice, SMS and data) provided by an MNO (operator B) via a terrestrial public mobile communications network in another Union/EEA country (country B) when travelling ([8]). The mobile operator A ensures that its customers remain connected to a mobile network of the operator B when travelling abroad and using a mobile device for making and receiving calls, SMS and using data services within the EU. Operator A, offering roaming services to its own customers ("retail roaming services") in another country has to buy them from an MNO, Operator B, located in the visited country ("wholesale roaming services"). To this end, commercial wholesale roaming agreements between service providers A and B have to be concluded. In practice, when a customer of Operator A places

([5]) Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (OJ L 321, 17.12.2018, p. 36–214).

([6]) See Recital (11) of the Roaming Regulation.

([7]) Article 7 of the Roaming Regulation

([8]) A roaming service can be provided domestically (national roaming), i.e., a mobile operator uses the network of another operator to provide mobile services to its customers domestically. However, national roaming is not within the scope of the Roaming Regulation. The latter only regulates international roaming in the EU/EEA, i.e., roaming on a foreign network within the EU/EEA.

a call or uses mobile data while roaming abroad in country B, that service is provided by a mobile Operator B in the visited country B. The roaming customer's home Operator A has to pay the visited Operator B for that service, at wholesale level. These payments are called wholesale roaming charges. The level of those charges is capped by the Roaming Regulation and subject to a decreasing glidepath.

2.2. What is "Roam-Like-At-Home" (RLAH)?

Since 15 June 2017 customers can have access to mobile services (voice, SMS and data) at no extra cost when they travel periodically in the EU/EEA. In these cases, mobile operators have, as a main principle, not been allowed to levy any charges in addition to the domestic price for the provision of roaming services (voice, SMS and data) to their customers when they periodically travel in the EU/EEA. Pursuant to Article 5 of Regulation (EU) 2022/612, in order to prevent abusive or anomalous usage of regulated roaming services by roaming customers - such as the use of such services by roaming customers in a Member State other than that of their domestic provider for purposes other than periodic travel, mobile operators may apply a fair use policy, which shall enable the roaming provider's customers to consume volumes of regulated retail roaming services at the applicable domestic retail price that are consistent with their respective tariff plans.

2.3. How is "Roam-Like-At-Home" regulated in order to be sustainable over time?

For the implementation of 'Roam-Like-At-Home' in a sustainable manner for operators throughout the Union, the following safeguards have been set out:

At retail level, where operators have the obligation to provide roaming services at the same conditions as domestically for periodic travelling, they were given the possibility to apply: (a) a fair use policy to prevent abusive or anomalous use of roaming services at domestic prices (such as permanent roaming); and (b) exceptional and temporary derogations to forestall any risk of domestic price increases.

At wholesale level, where operators have a wholesale access obligation to ensure the provision of roaming services, in order to make wholesale costs sustainable in a Roam-Like-at-Home regime, there has been a substantial reduction of wholesale roaming price caps applicable to wholesale agreements between operators, while ensuring that operators providing the wholesale service can recover their costs.

2.4. Main new provisions introduced under the 2022 recast

In 2022, the recast Regulation introduced some new provisions in the regulation to increase consumer benefits and protection. The validity of the Roaming Regulation is set for 10 years, until 2032, extending the RLAH regime and therefore providing certainty in the market. The new **quality of service** ('QoS') measures, that clarified the previous provisions, ensure that roaming customers can at least have the same level of roaming

quality abroad, e.g. speed and network generation, as they normally have at home, when this is technically feasible. Moreover, mobile network operators in the visited country are required to give visited mobile operators access to all network technologies and generations upon a reasonable wholesale roaming access request.

When it comes to **emergency communications**, improved rules were introduced to ensure that customers who are roaming can seamlessly access emergency services without the risk of being charged. They can, for example, call the single European emergency number, 112, all over the EU or use SMS or emergency applications without any surcharges. In addition, travellers should be informed about the means of reaching emergency services, including those designed for end users with disabilities, in the EU/EEA country they are visiting.

To protect roaming customers from **unexpected surcharges**, new rules were introduced to ensure that roaming providers give sufficient information to their customers about the increased costs they might incur from using value-added services while roaming as well as connecting to a non-terrestrial network such as on a ship or plane. Roaming customers now benefit from automatic cut-off limits once they have consumed EUR 50 or EUR 100 of roaming services, instead of having to opt-in to such a service as was the case in the previous regulation.

Lastly, the Roaming Regulation continues to ensure that roaming without surcharges and the enhanced benefits for consumers is sustainable for operators. At wholesale level, **the price caps have been further substantially reduced in 2022**, in particular for data traffic. The wholesale glidepath ensures progressive reductions of the data roaming caps every year until 2027 (reaching EUR 1 per GB), in order to ensure that market players can benefit from wholesale rates that allow for the sustainable provision of roaming services to their customers without levying any charge on top of the domestic price. The wholesale roaming price caps also ensure that wholesale costs are fully recovered by the operator providing the wholesale roaming service. Additionally, the decreasing wholesale caps ensure also benefits on the retail side, since surcharges exceptionally applied to consumers are constantly decreasing, given that the wholesale cap also represents the maximum retail surcharge applicable by operators.

3. SCOPE OF THE REVIEW REQUIREMENTS

The review requirements are laid down in Article 21(1) of the Roaming Regulation and include, inter alia, an assessment of:

(a) the impact of the roll-out and implementation of next generation mobile communications networks and technologies on the roaming market;

(b) the effectiveness of the quality of service obligations with regard to roaming customers, the availability and quality of services, including those which are an alternative to regulated retail voice, SMS and data roaming services, in particular in light of technological developments and of the access to the different network technologies and generations;

(c) the degree of competition in both the retail and wholesale roaming markets, in particular the actual wholesale rates paid by the operators and the competitive situation of small, independent or newly started operators, and MVNOs, including the competition effects of

commercial wholesale roaming agreements, of traffic traded on trading platforms and similar instruments and the degree of interconnection between operators;

(d) the evolution of the machine-to-machine roaming, including roaming on IoT devices;

(e) the extent to which the implementation of the measures provided for in Article 3, in particular on the basis of the information provided by the national regulatory authorities, of the procedure for prior authorisation laid down in Article 3(6), has produced results in the development of competition in the internal market for regulated roaming services;

(f) the evolution of the retail tariff plans available;

(g) changes in data consumption patterns for both domestic and roaming services, including changes in travel patterns of European end-users caused by circumstances such as pandemics, for example COVID-19, or natural disasters;

(h) the ability of home network operators to sustain their domestic charging model and the extent to which exceptional retail roaming surcharges have been authorised pursuant to Article 6;

(i) the ability of visited network operators to recover the efficiently incurred costs of providing regulated wholesale roaming services, taking into account the latest information on network deployment, as well as developments in technical capabilities, pricing models and constraints of the networks, for instance the possibility of including cost model calculations based on capacity rather than consumption;

(j) the impact of the application of fair use policies by operators, including on consumption by end-users, in accordance with the implementing acts adopted pursuant to Article 7, including the identification of any inconsistencies in the application and implementation of such fair use policies; as well as the effectiveness and proportionality of the general application of such policies;

(k) the extent to which roaming customers and operators face problems in relation to value-added services and the implementation of the database of numbering ranges for value-added services established pursuant to Article 16, first paragraph, point (a);

(l) the application of the measures of this Regulation and complaints related to the use of emergency communications while roaming;

(m) complaints related to inadvertent roaming.

All the elements listed above are analysed and assessed in this SWD.

4. METHODOLOGY

This SWD and the Report to the European Parliament and the Council were prepared based on a range of inputs, including BEREC's data collection exercises, two Eurobarometer surveys, as well as external and internal studies and analyses.

4.1. BEREC's data collection

BEREC has established an articulated and well-functioning monitoring system for the Regulation (EU) 2022/612 that provides a considerable amount of data collected for roaming policy and monitoring purposes. The data collection is managed by BEREC on the basis of the legal obligations laid down in Art. 17 and 21 of the Roaming Regulation. BEREC has coordinated regular data collections initially on a biannual basis and since 2022, due to the simplification and administrative burden reduction brought by the roaming regulation review, on an annual basis. BEREC published these data and analysed them in its International Roamign Benchmark Data and Monitoring reports as well as in its Opinion on the functioning of the roaming market. The analysis presented in this SWD is based on the Commission analysis of the results of these data collections and on the BEREC Opinion ([9]).

In 2023, 25 EU/EEA National Regulatory Authorities ('NRAs') and 133 telecommunications operators, including 79 MNOs and 54 MVNOs replied to the surveys. Therefore, they ensure a complete representation of the EEA mobile market in terms of MNOs, and they offer a good coverage of the MVNOs segment.

Among other topics, the "transparency questionnaires" conducted by BEREC serve to monitor in detail whether and how operators have implemented fair use policy measures. Over the years, the reference questionnaire has been changed; therefore, any inconsistency in data availability between questions has to be attributed to such changes. The "data questionnaire" presents detailed information on volumes and revenues of both domestic and roaming volumes as reported by mobile operators in the EEA. More specifically, roaming volumes and revenues are reported at the retail as well as at the wholesale level.

Most of the analyses presented in this SWD are performed on a subsample of operators, namely those that have always replied to the Benchmark questionnaire since 2016 Q4. This choice has been made to ensure comparability over time of the figures presented. It explains why there are some discrepancies between data presented by the Commission to ensure comparability and data presented by BEREC in its reports.

([9]) BEREC input on EC's request for expert views on Regulation (EU) 2022/612 on roaming on public mobile communications networks within the Union published on 28 March 2025 (BoR(25)), hereinafter "BEREC Opinion".

4.2. Eurobarometer studies

Results from two different Eurobarometer studies are considered in this report. It should be noted that the two studies differ in methodology and are therefore not comparable. The data cannot be used to interpret increases or decreases at face value but can serve as good indications of trends from one to the other Eurobarometer.

Flash Eurobarometer 521([10])

The Flash Eurobarometer 521 on roaming targets EU residents. In each of the 27 Member States, Ipsos European Public Affairs interviewed a representative sample of residents, aged 16 and over, who had travelled to another country in the EU or EEA (Iceland, Liechtenstein or Norway) in the past two years and who are able to call, text or use mobile internet on their mobile phone when travelling in the EU. It should be noted that these roamers represent approximately 43% of the overall population of mobile users, given that some EU customers do not travel outside their country. Between 27 February and 3 March 2023, 5 271 interviews were conducted via mobile phones.

Special Eurobarometer 560 ([11])

In 2025, the Special Eurobarometer 560 on e-communications was conducted and covered some chosen questions on roaming QoS and roaming usage. It was conducted between 09 January and 4 February 2025 and 26,354 respondents from different social and demographic groups were interviewed in the appropriate national language in all Member States. Out of the total respondents 31% had travelled in the EU/EEA in the last two years and replied to questions about roaming.

4.3. Study on "Mobile and fixed broadband prices in Europe"

The price analysis in Section *5.5.1* has been carried out using data presented in the study "Mobile and fixed broadband prices in Europe". ([12]) Once a year, the contractor who authored this study (Empirica) collects information on mobile prices by scanning the three largest mobile operators' websites in each Member State. They collect information on the price and the characteristics of tariff plans offered by operators. Based on this information they build mobile baskets that are representative of different levels of voice minutes, SMS and data consumption. ([13]) Even though data refer to only the three largest operators in

([10]) Flash Eurobarometer 521, European Commission, July 2023.

([11]) Not yet published. Reference: Specific contract SC CNECT/2024/02.

([12]) Study SMART number 2019/0018, ISBN 978-92-76-53077-0. See the following links for further details:https://digital-strategy.ec.europa.eu/en/news/mobile-broadband-prices-went-down-europe-2018;https://digital-strategy.ec.europa.eu/en/library/mobile-broadband-prices-europe-2019; https://digital-strategy.ec.europa.eu/en/library/mobile-and-fixed-broadband-prices-europe-2020;https://digital-strategy.ec.europa.eu/en/library/mobile-and-fixed-broadband-prices-europe-2021; https://www.digital-strategy.ec.europa.eu/en/library/mobile-and-fixed-broadband-prices-europe-2022 ; The data used for 2023 and 2024 is taken from the databases that will feed into the 2023 and 2024 broadband prices studies that are yet to be published.

([13]) As an example, the highest consumption level for 2017-2021 period is associated with Basket '20 GB and 300 calls'.

each Member State ([14]), given their combined positions on the markets, they are deemed to be representative of the overall country specific price dynamics. Based on the information collected, Empirica estimates the price of each basket in each Member State.

Following the market evolution of mobile services and consumption patterns, Empirica updated the usage baskets in 2022 by removing less used baskets and including more representative baskets in their data set. Therefore, some of the baskets were renamed, while others were removed. New baskets were also added to the 2022 data set to reflect the increased needs of some categories of consumers (e.g. a basket with 50GB allowance) and more detailed analysis of their price evolution will be included in the next review report that will cover the price changes between 2022 and 2024. The composition of the baskets analysed in Section *5.5.1* is presented in the following table:

Table 1: Mobile basket description

Usage basket	Volumes included
MBB2 (changed to MBB1 in 2022)	1 GB mobile data with no calls
MBB3 (not available in 2022)	2 GB mobile data with no calls
MBB4 (changed to MBB2 in 2022)	5 GB mobile data with no calls
MBB5 (MBB4 in 2022)	20 GB mobile data with no calls
I2 (I1 in 2022)	1 GB mobile data with 30 calls
I3 (not available in 2022)	2 GB mobile data with 100 calls
I5 (changed to I4 in 2022)	20 GB mobile data with 300 calls
I6 (changed to I2 in 2022)	5 GB mobile data with 30 calls
I7 (not available in 2022)	20 GB mobile data with 100 calls

Source: Empirica Mobile prices database

4.4. Axon Cost Model

In order to assess the costs of providing wholesale roaming services in the 30 EU/EEA countries for the purposes of the roaming review, an independent study was commissioned ([15]). The objective of the study was to build on the experience of the previous review of the Roaming Regulation and enhance the existing bottom-up cost model to estimate the efficient costs of providing wholesale roaming services and mobile voice call termination services by mobile network operators in the EEA, under the current market conditions. For the purposes of this SWD, the main focus of this summary of the study is on the estimated costs related to roaming.

The cost study was conducted by Axon Partners Group (hereinafter, 'Axon') from May 2023 to December 2024. At the start of the study, a first workshop with all relevant stakeholders was organised on 21 June 2023 in order to collect feedback on the methodology proposed by Axon. A comprehensive data gathering was then conducted in August-September 2023, via the NRAs, in order to obtain, from mobile operators, the

([14]) Except when only two operators are available in a country.

([15]) Study CNECT/2022/OP/0065: "Assessment of the cost of providing mobile telecom services in the EU/EEA countries", Axon Partners Group Consulting, published 18/12/2024, available here.

relevant information and inputs needed to populate a country-specific model for each Member State.

4.5. IoT/M2M Study

For assessing the evolution of machine-to-machine roaming, including roaming on IoT devices, the Commission used as a reference source an independent study ([16]) conducted by the consortium of Axon Partners Group Consulting S.L.U. (hereinafter, 'Axon'), ICF S.A. (hereinafter, 'ICF') and Consultores de Automatización y Robótica S.A. (hereinafter, 'CARSA'). The commissioned consortium conducted the study in the period from March 2023 to July 2024, covering both past evolution and future trends.

The main purpose of this study was to identify IoT-related deficiencies in various IoT-related EU regulatory areas (e.g., spectrum, numbering, competition, etc.), including in relation to the provision of roaming services. The study analysed the structure of the IoT market, and the relevant technologies, challenges and competitive situation, distinguishing between four market layers in the IoT value chain (i.e., IoT hardware, IoT connectivity, including roaming connectivity providers, IoT applications, and IoT consumer or business users). The study's results built on desk data research, including on BEREC's publicly available data, assessment of relevant stakeholders' inputs, and workshop exchanges with relevant stakeholders, including one roaming-dedicated workshop.

4.6. Quality of Service Study

To assess the Quality-of-Service (QoS) performance of roaming services, the Commission used as its basic resource the independent study ([17]) performed by Mozark. The objective of the study was to assess the effectiveness of the QoS obligations by performing specific QoS measurements of the service for domestic and roaming data services. The study included measurements of the download and upload speeds, latency, as well as measurements regarding the time for the handover when crossing the borders between countries. Conclusions were drawn after the comparison of the values of the parameters between the roaming end-users and (i) the same users in their home networks, (ii) the domestic end-users of the visiting network and (iii) other roamers in the same visited network. The study covered 20 Member States - 2 cities per Member State, with measurements from approximately 50 mobile operators (changing roles home/visiting, depending on the country), through drive test covering approximately 12,000 km.

4.7. Technological development

The starting point for the evaluation of the technological trends and how they are expected to affect wholesale and retail roaming during the next period, was the independent study

([16]) Study on an enabling framework for IoT ecosystem development in Europe, published on 20/12/2024, available here.

([17]) Not published yet. Reference number: EC-CNECT/2024/OP-0084.

performed by WIK ([18]) for the Commission in the context of the previous review of the roaming regulation. The conclusions of the study were validated with input from more recent studies, such as the study on wholesale mobile connectivity, trends and issues for emerging mobile technologies and deployments ([19]) performed by WIK for BEREC, while valuable input was also taken from the independent study on an enabling framework for IoT ecosystem development in Europe ([20]) performed by Axon Partners Group, ICF and CARSA for the Commission. Finally, desk research was used for complementing and re-evaluating the interim conclusions, as well as for input regarding the technological trends that have emerged in the period following the previous review of the roaming regulation.

5. COMPETITION IN THE RETAIL MARKETS

5.1. Evolution of retail (outbound) roaming volumes

In 2017, the introduction of RLAH had triggered an immediate and massive increase in retail roaming traffic in the first year, for both mobile data consumption while roaming (increase by a factor of 5 ([21]) and roaming phone calls made (increase by a factor of 2.5 ([22])).

5.1.1. The increase in roaming traffic is led by mobile data consumption

The analysis of the mobile data consumption while roaming shows a continuous increase in volume since the introduction of RLAH in 2017. Notably, the most roaming-intense quarter (Q3) has seen a significant increase in data consumption, with a **48-fold increase since the introduction of the RLAH regime in 2017 ([23])**, demonstrating the important demand from EU consumers for roaming services and its relevance in achieving a digital single market.

([18]) FinalReportSMART20180012.pdf

([19]) https://www.berec.europa.eu/en/document-categories/berec/reports/study-on-wholesale-mobile-connectivity-trends-and-issues-for-emerging-mobile-technologies-and-deployments

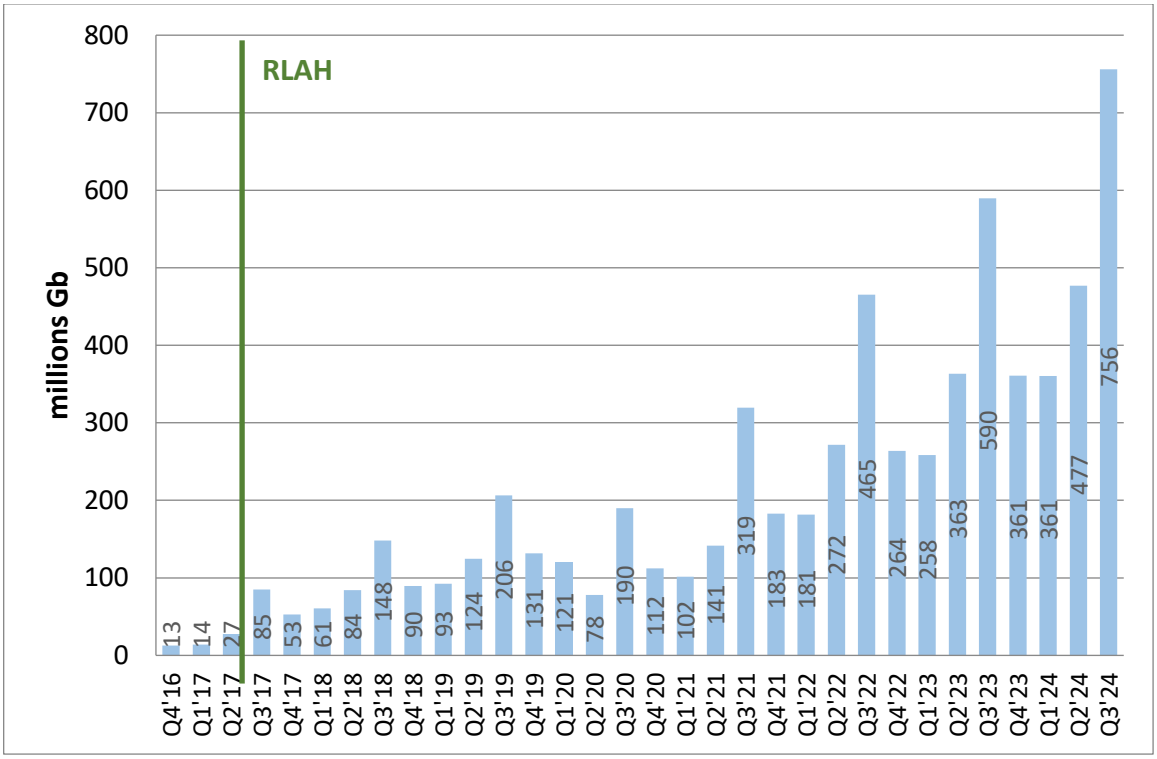
([20]) Study on an enabling framework for IoT ecosystem development in Europe, published on 20/12/2024, available here.

([21]) Q3 2017 compared to one year before.

([22]) Ibid.

([23]) Q3 2017 compared to Q3 2024.

Figure 1: EU27 retail roaming data traffic, Q4 2016 – Q3 2024 (millions of GB)



Source: BEREC BMK data processed by JRC

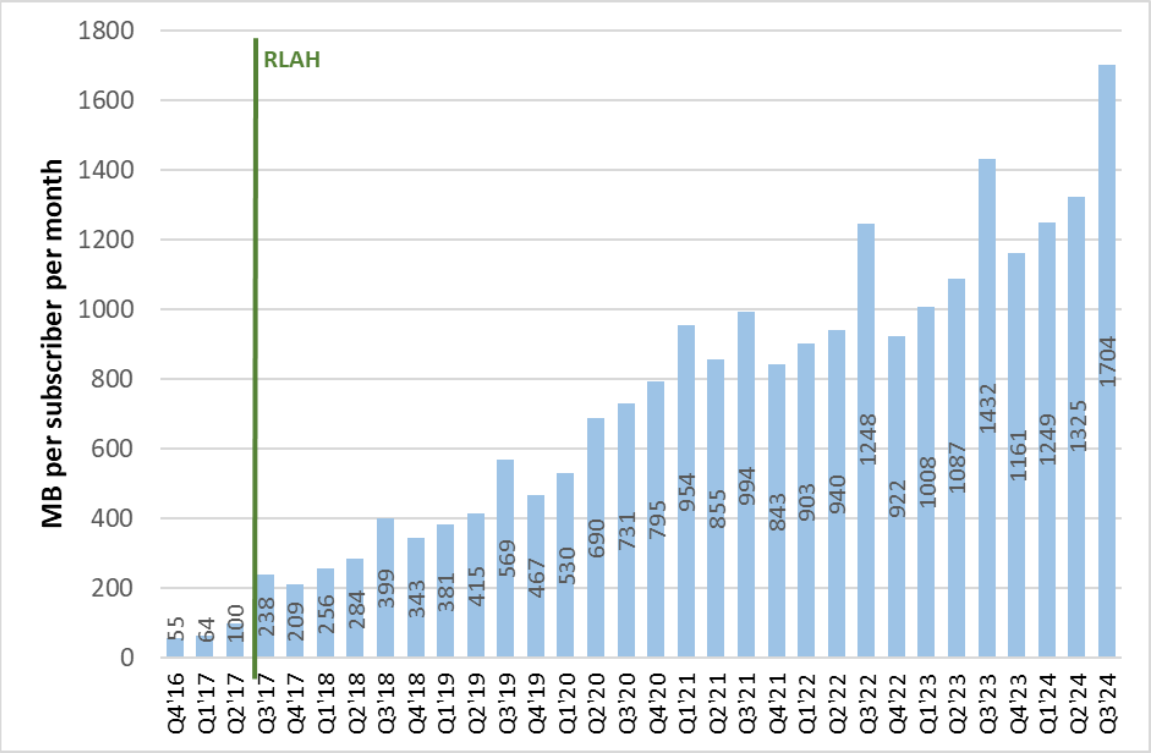
Since the previous review exercise in 2019 ([24]), the consumption increased by 267% (Q3 2019 compared to Q3 2024), indicating that EU consumers' demand is still increasing.

This trend is further underscored by looking at the data consumption by roaming customers: since the introduction of RLAH in Q3 2017, the average data roaming consumption per roaming subscriber for the same period (Q3) increased by 616%, reaching 1704 MB in Q3 2024 ([25]).

([24]) See COM(2019) 616 final & SWD(2019) 416 final.

([25]) Ibid.

Figure 2: EU27 average data roaming consumption per roaming subscriber, Q4 2016 – Q3 2024 (MB per month)

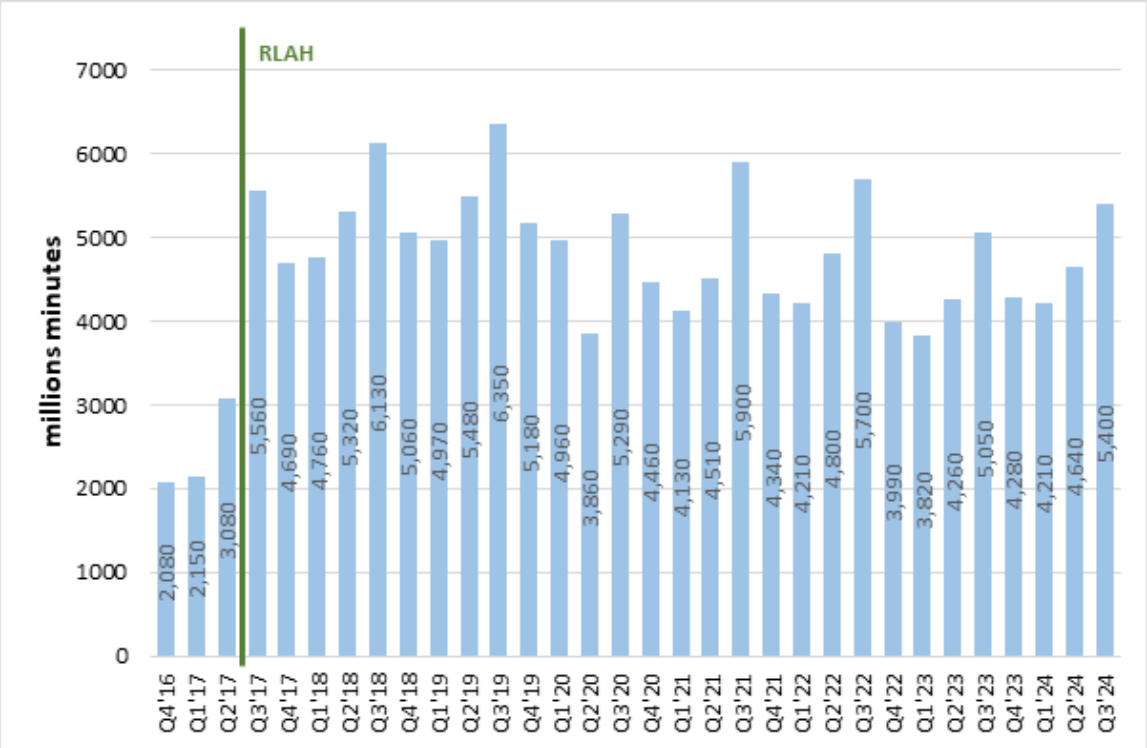


Source: BEREC BMK data processed by JRC

Over the last 5 years, the average quarterly (Q3) consumption has steadily increased by around 32.5% per year, showing an increasing demand.

On the other hand, a notable trend has emerged for roaming voice traffic: seasonal fluctuations aside, the retail roaming voice traffic has been steadily decreasing, with a peak of 6,350 million minutes in Q3 2019, followed by 5,290 million minutes in Q3 2020, 5,900 million minutes in Q3 2021, 5,700 million minutes in Q3 2022, 5,050 million minutes in Q3 2023 and 5,400 million minutes in Q3 2024 (See *Figure 3*).

Figure 3: EU27 retail roaming voice traffic (calls made), Q4 2016 – Q3 2024 (millions of minutes).



Source: BEREC BMK data processed by JRC

These two parallel trends (i.e. continuous increase of roaming data consumption and decreasing consumption of retail roaming voice services) are consistent with the broader patterns observed at the domestic level ([26]). They might be attributed to the evolution of digital usages in the EU with the continuous development of Over-The-Top (OTT) platforms, which offer voice and messaging services ([27]) over the internet gaining increasing importance as a complement to traditional calls and SMS.

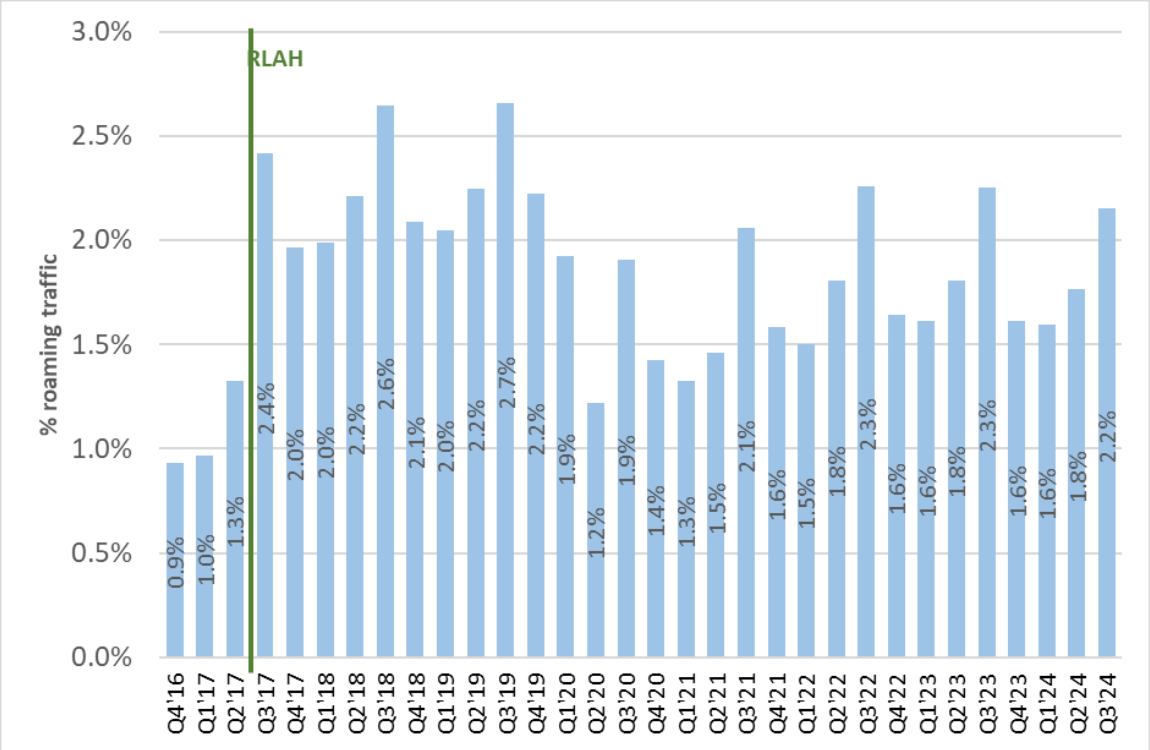
5.1.2. Retail outbound roaming traffic remains a small fraction of overall traffic

The evidence shows that, despite the massive increase in data roaming consumption, the latter remains only a small fraction of the overall traffic. In the latest data, in Q3 2024, data roaming consumption represented 2.2% of the overall data traffic in the RLAH area.

([26]) BEREC Opinion BoR(25) 48.

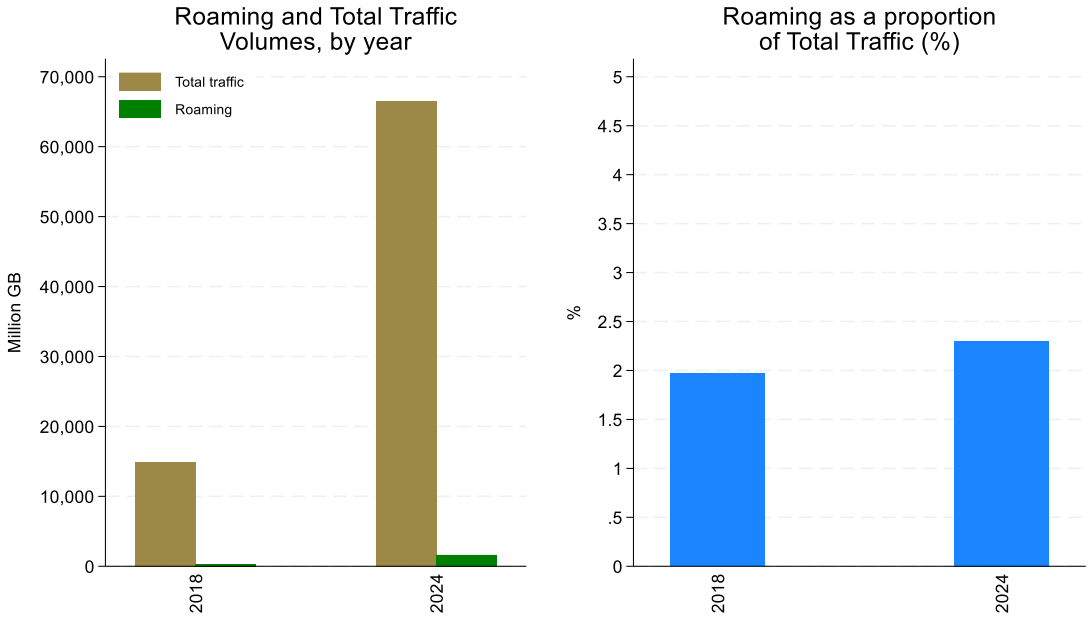
([27]) See also BEREC Opinion BoR(25) 48: commenting on the decline in SMS usage (while roaming and at domestic level), BEREC considers that this "can be attributed to a large extend to an increasing reliance on OTT messaging services".

Figure 4: EU27 retail roaming data traffic over total traffic, Q4 2016 – Q3 2024



Source: BEREC BMK data processed by JRC

Figure 5: EU27 retail roaming data traffic in 2018 compared to 2024 (histogram on the left). Roaming data traffic compared to total traffic in 2024 (histogram on the right)



Source: BEREC BMK data processed by JRC

A comparison of data roaming volumes between 2018 and 2024 – two years after the introduction of the RLAH regime – demonstrates that data roaming volumes represent a small fraction of total traffic in the EU, well below 2.5% of the total traffic. The consistent

growth in MB consumed by roamers, as shown in *Figure 2* , underscores the significant benefit that this small fraction of traffic brings to EU consumers (see Section *5.7*), in an efficient manner.

5.2. Implementation of fair use policy

Roaming providers should be able to apply FUP mechanisms to the consumption of regulated retail roaming services provided at the applicable domestic retail price. Under Article 21(j) of the Roaming Regulation, the Commission shall assess "*the impact of the application of fair use policies by operators*" when conducting its reviews.

Implementing Regulation (EU) 2016/2286 ([28]) lays down detailed rules to ensure a consistent implementation of fair use policies that roaming providers may apply in order to avoid anomalous or abusive use of regulated retail roaming services under the RLAH regime that could have detrimental effects on domestic markets. The 2023 Review Report ([29]) published on 15 January 2024 analysed in detail the application of FUP mechanisms ([30]) and demonstrated that these measures continue to be effective and widely implemented by all operators ([31]). The updated analysis – including 2023 and 2024 data – confirms the general findings of the 2023 Review Report (i.e. FUPs are fit for purpose and have limited impact on consumers) while identifying new trends.

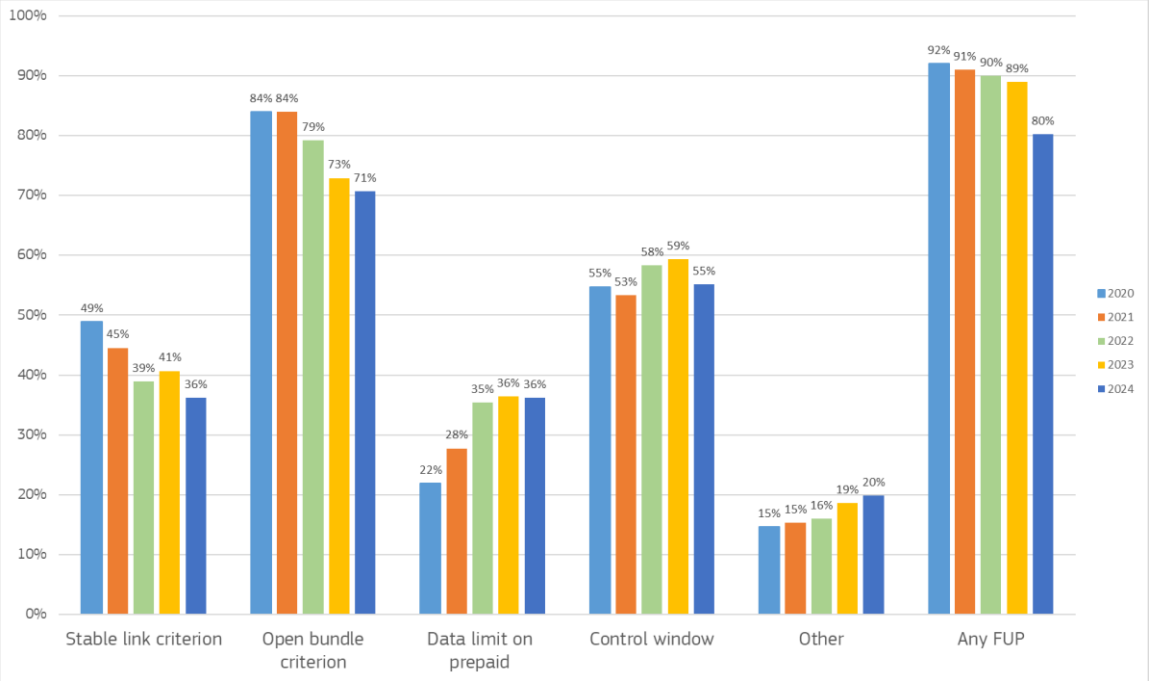
([28]) Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016 laying down detailed rules on the application of fair use policy and on the methodology for assessing the sustainability of the abolition of retail roaming surcharges and on the application to be submitted by a roaming provider for the purposes of that assessment, OJ L 344, 17.12.2016, p. 46–62.

([29]) SWD(2024) 8, Commission Staff Working document on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainability derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016.

([30]) For detailed explanations on the Fair Use Policy mechanisms, please refer to the section 4.1 of the Commission Staff Working Document on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainability derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016 (SWD(2024)8).

([31]) MNOs and MVNOs.

Figure 6: Percentage of operators (MNOs and MVNOs combined) applying each FUP mechanism over the total number of respondents, by instrument and year.

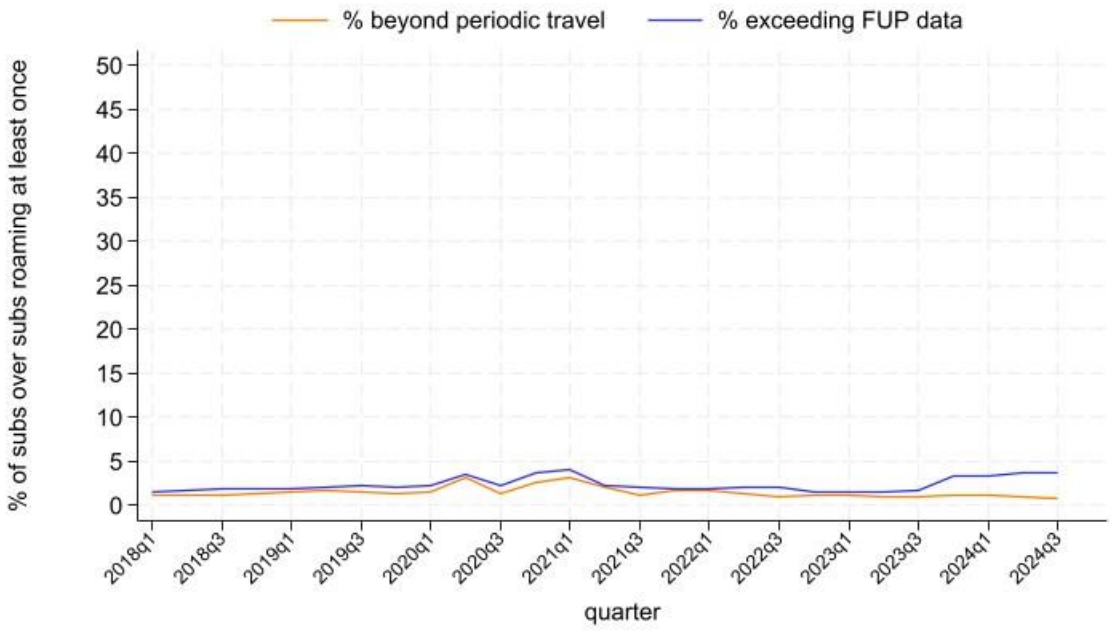


Source: JRC elaborations on BEREC Transparency data

In the last three years, more than 80% of the MNOs and MVNOs (combined) applied at least one of the instruments. A significant majority of operators (79% of the MNOs and 61% of the MVNOs in 2024) have applied the open data bundle limits. A sizeable number of mobile operators apply other criteria, notably the control window mechanism (58% of the MNOs and 53% of the MVNOs in 2024), the stable link criterion (36% of the MNOs and 36% of the MVNOs in 2024) and the pre-paid limits (32% of the MNOs and 43% of the MVNOs in 2024). It is noteworthy to mention that MVNOs are more inclined to apply FUP measures on pre-paid tariffs than MNOs. The preferred FUP measure used by MVNOs is the fair use limit on open data bundles (61% in 2024). The usage of all the other FUP measures by MVNOs is rather stable. ([32])

([32]) See Table A in the Annex on individual data for MNOs and MVNOs.

Figure 7: Percentage of users with usage going beyond periodic travel (control mechanism and stable link criterion) or exceeding FUP on data (open data bundle or pre-paid data limits), over users who roamed at least once in the reference period, by quarter (2018-2024).



Source: JRC calculation on BEREC Benchmark questionnaires data.

While the FUP limitations remain commonly applied by operators, the vast majority of roaming customers never reach these limits. Overall, among all roaming consumers, the share that consume roaming services **beyond periodic travel ([33])** was lower than or equal to 3% ([34]) in all quarters since 2018. Similarly, the number of roaming customers **exceeding the FUP limit on data ([35])** was less than or equal to 4% ([36]) in the last four years (*Figure 7*).

In total, **only 4.65% of the data roamers went above their fair use policies in Q3 2024**. These numbers confirm that FUP is applied in exceptional cases and that the RLAH regime is effective in covering EU consumers' needs when travelling, while being sustainable for the roaming providers.

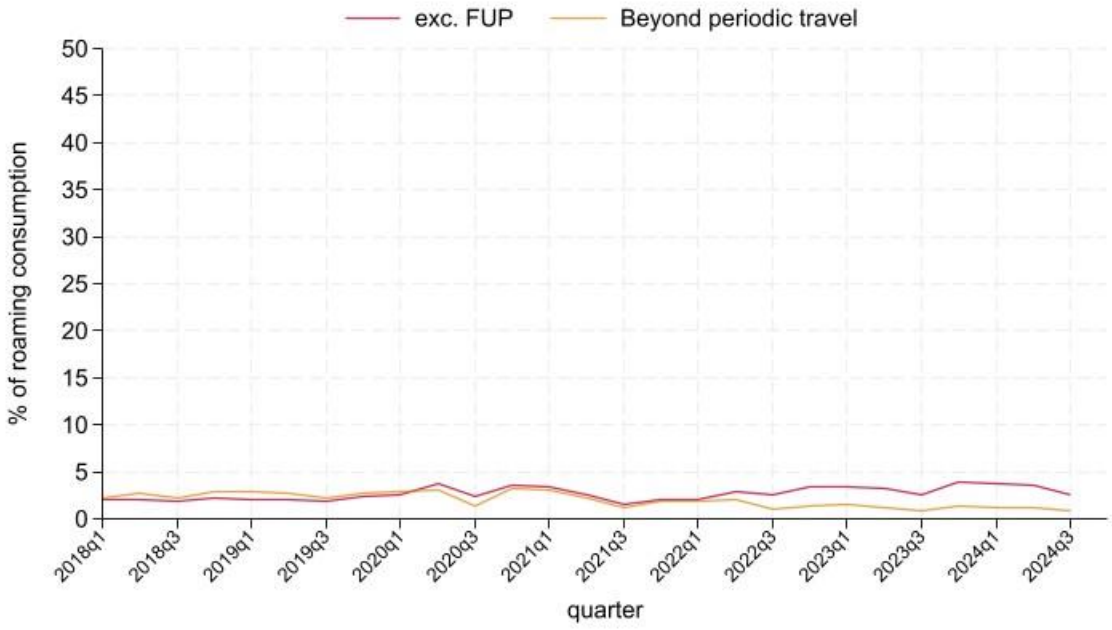
([33]) i.e. going above the control mechanism and/or the stable link criterion.

([34]) In Q3 2024, 0.87% of the roamers were identified with usage going beyond periodic travel.

([35]) i.e. going above their roaming data allowance, either on pre-paid or open data bundles.

([36]) In Q3 2024, the share of users exceeding their FUP data limit was 3.78%.

Figure 8: Percentage of data roaming volumes reported as usage beyond periodic travel (control mechanism and stable link criterion) or exceeding FUP on data (open data bundle or pre-paid data limits), over total data roaming volumes, by quarter (Q1 2018 – Q3 2024).



Source: JRC calculation on BEREC Benchmark questionnaires data.

Similarly, data collected on overall roaming traffic show that exceeding **FUP data volumes ([37])** stayed around 3% of the total roaming data consumption in the last years (3.33% in Q3 2023 and 2.6% in Q3 2024). Likewise, the roaming data volumes identified as going **beyond periodic travel ([38])** represented less than 1.5% of the total data roaming consumption in the last years (0.86% in Q4 2024). Overall, **only 3.46% of the total data roaming volume in Q3 2024 exceeded the fair use policies**, underlying again how exceptional these measures are.

In its Opinion ([39]), BEREC confirms that the FUP successfully limits excessive use while ensuring the vast majority of roaming volumes are provided under domestic terms. BEREC also notes that the percentage of data roaming volume going above the FUP is very low making it exceptional. In addition, BEREC recalls that any amendment should be approached with caution. BEREC also notes that there is some room for improvements while maintaining most of the current mechanisms (for details, see section BEREC Opinion) further below).

Effectiveness of the FUP mechanisms

In the data collected by BEREC over the last years (last one in 2024), the operators acknowledged the effectiveness of the FUP when it comes to successfully addressing abusive or anomalous use of regulated roaming services at domestic prices by individual users. 96% of the operators ([40]) considered the **stable link criterion** as either *effective* or

([37]) i.e. above the open bundle allowance or the pre-paid data limits.

([38]) i.e. going above the control mechanism and/or the stable link criterion.

([39]) BoR(25) 48, p.25.

([40]) MNOs and MVNOs combined.

partially effective in 2024 ([41]). Regarding the **open data bundle limits**, 99% of operators ([42]) considered it as either effective or partially effective in 2022 ([43]) and 2023 ([44]). This number dropped to 49% in 2024 with 50% of respondents considering it ineffective (but not unnecessary) ([45]). A similar trend can be observed for the **control mechanism**: 92% of the respondents considered it effective or partially effective in 2023 while only 40% in 2024. The drop in the perceived effectiveness of the open data bundle limits and control mechanisms is not fully corroborated by the BEREC Opinion and will therefore be further monitored in the next reporting exercise([46]). Finally, on the "other FUP mechanisms" (also known as "other objective indicators") ([47]) only three respondents provided an answer in 2024 (and six in 2023) making the results difficult to interpret and assess.

Cost and complexity of the FUP mechanisms

The FUP enable operators to successfully address abusive or anomalous use of roaming services at domestic prices, for other purposes than periodic travelling, by individual customers ([48]). However, some operators consider that these instruments are costly and complex to implement. 39% of the respondents find the **control window mechanism** to be very difficult to implement. On the **open data bundle limits**, 49% of the operators consider it either relatively difficult or very difficult to implement while this number reaches 67% for the "**other FUP mechanisms**" ([49]). The Commission notes that costs incurred by the control window mechanism mostly arose during the implementation phase and any amendment would also generate extra costs. BEREC confirms this in its Opinion ([50]). Now that most of the operators are applying the fair use policies, the constraints are limited but it could be more problematic for new entrants.

BEREC Opinion ([51])

In its 2025 Opinion ([52]), BEREC acknowledges that FUP mechanisms have been instrumental and remain necessary for the functioning of the RLAH. In addition, BEREC recalls that any amendment should be approached with caution. BEREC also notes that there is some room for improvements while maintaining most of the current mechanisms.

([41]) See Table B2 in the Annex.
([42]) MNOs and MVNOs combined.
([43]) See 2023 Review Report.
([44]) See Table B1 in the Annex.
([45]) See Table B2 in the Annex.
([46]) See Tables B in the Annex.
([47]) It refers to two indicators listed under Article 4(4), subparagraph 7 of the Commission Implementing Regulation (EU) 2016/2286: (i) long inactivity of a given SIM card associated with use mostly, if not exclusively, while roaming and (ii) subscription and sequential use of multiple SIM cards by the same customer while roaming.
([48]) BEREC considers that "the current FUP measures address effectively the consumption needs of EU consumers travelling in the EU/EEA while protecting operators from anomalous and abusive usage" (See BoR(25)48, p.26).
([49]) See Table C2 in the Annex.
([50]) BEREC notes that it must also be taken into account that roaming providers have already implemented costly measures, especially with view to FUPs. These investments should not be devalued by significant changes, BoR(25)48.
([51]) BoR(25)48.

On the FUP for **open data bundles**, BEREC noted that there is an increasing number of instances where the calculation methodology results in cases where the roaming data allowance exceeds the total data volume included in the domestic plan. BEREC recommends that the data roaming allowance should, at most, correspond to the total data volume included in the customer's domestic offer. The Commission recalls that the RLAH principle gives the roaming customers the right to use roaming services in the same way as at home. Therefore, a roaming provider would not need to offer more roaming data volume than at home in the case where the FUP calculation formula would lead to such a case. Regarding the **control mechanism**, BEREC notes that it is generally considered as useful in preventing anomalous and abusive usage. However, stakeholders expressed concerns about its complexity, both in terms of implementation and in effectively communicating it to customers. BEREC notes that the fair use policy mechanisms for **pre-paid offer** and "**organised resale**" are quite complex to implement and to communicate to the customers. This is consistent with the Commission findings in this report. BEREC proposes to clarify this in the Regulation. Additionally, BEREC proposes that the Commission could reassess whether the two-week warning period remains necessary after an abusive or anomalous usage has been proven. Finally, BEREC suggests that the provisions on the maximum wholesale charges in currencies other than euro could be streamlined ([53]).

Conclusion

The FUP mechanisms remain essential for ensuring sustainable RLAH in the EU/EEA. These mechanisms benefit operators while allowing EU residents to use mobile services in the same way when travelling as they do in their home country. However, the Commission also takes note of BEREC's suggestions and shares BEREC's view that any amendments should be approached with caution and should not alter the current regime.

5.3. Application of the derogation mechanism

Overview of the sustainability derogation mechanism

The derogation mechanism has acted as an effective safeguard against possible distortions in the few domestic markets where such a risk had been identified. The derogation mechanism is still used and useful as a safety net. In this way, operators can avoid domestic price increases in case they are able to demonstrate a likely relevant negative margin for providing regulated roaming services. The sustainability derogation system may have also contributed to preventing the increase in domestic prices when RLAH came into force. The 3% limit for the negative margin, set in CIR as a minimal condition for the NRAs to

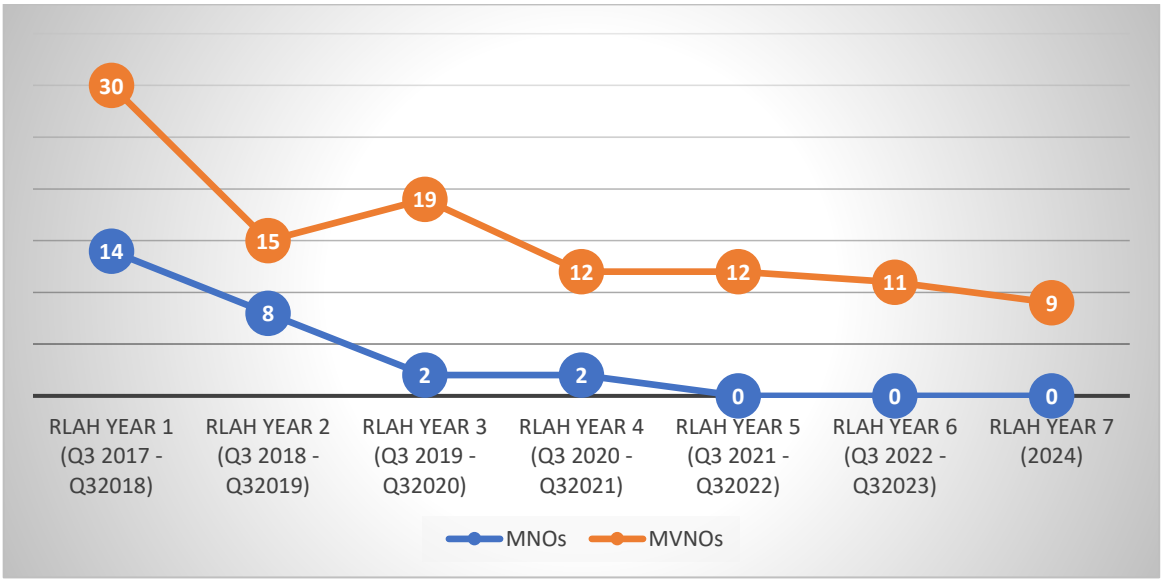
([53]) In its Opinion, BEREC explains: "For currencies other than the euro, the maximum charges are subject to an annual revision starting from 2023, based on the average of the reference exchange rates published on three specified dates in the Official Journal of the European Union. These annually adjusted limits for non-euro currencies take effect from 15 May. Conversely, reductions in the maximum regulated wholesale charges (denominated in euro) come into effect from 1 January. To enhance consistency and streamline the derivation of the fair use allowance adjustments, BEREC recommends aligning both dates to 1 January".

grant derogations, has not introduced issues to the sustainability objectives of the derogations.

Mobile operators that have demonstrated that they are not able to recover their actual and projected costs of providing regulated roaming services without increasing their domestic prices in order to provide RLAH have been granted a sustainability derogation by the NRA, at their request. Unless renewed, a sustainability derogation expires after one year time.

Figure 9 below presents the number of derogations granted in all years of RLAH application, by type of operator (MNO and MVNO).

Figure 9: Sustainability derogations granted by NRAs since RLAH, MNOs and MVNOs



Source: For the interval 15 June 2017 – 30 September 2023 (i.e., RLAH YEAR 1 to 6), based on data collected by BEREC for Transparency report (2018, 2019, 2020, 2021, and 2022 and 2023). For 2024 (i.e., RLAH year 7), based on the information recorded in the 2025 BEREC Opinion.

MVNOs have been the main recipients of the sustainability derogation given their specific situation in the wholesale roaming market ([54]). Since 2022, no MNOs have been granted sustainability derogations. Likewise, since 2022, operators that were granted a sustainability derogation have had a very small market share in their respective countries.

The improvement of the sustainability conditions may explain the declining number of derogations granted. Contributing factors are the lowering of wholesale roaming charges and the ability of operators to negotiate better terms for their roaming access agreements.

The actual roaming voice and data traffic that is subject to surcharges due to sustanability derogations is marginal and continues to decrease. Since the third quarter of 2022, this

([54]) MVNOs do not have their own mobile networks and therefore cannot host roaming traffic from foreign operators' subscribers. Consequently, in bilateral wholesale roaming negotiations, where the price of wholesale roaming traffic is negotiated (below the regulated wholesale price cap set in the Roaming Regulation), MVNOs cannot exchange roaming traffic with their counterpart. They must buy the full roaming traffic that their subscribers generate on a MNO's network.

traffic is below 0.82% in each country where sustainability derogations have been granted ([55]).

Effectiveness of the sustainability derogation mechanism

In its 2025 Opinion ([56]), BEREC notes that the sustainability derogationm mechanism is effective but that its complexity impacts its efficiency. The number of applications for sustainability derogations is decreasing but the mechanism remains a relevant component of the RLAH framework. BEREC underlines that the mechanism is difficult to apply in practice as regards the effect on competitiveness it can have on operators applying the authorised surcharges.

In general, end-users have a low incentive and are less likely to switch operators for the reason of prices applied to roaming services. Most end users use roaming services for the purpose of periodic travelling. Consequently, the prices applied by the operator for domestic services are a more decisive factor for the choice of tariff and subscription than roaming.

In its 2025 Opinion ([57]) BEREC repeats some of the suggestions made in the 2019 Opinion ([58]) to clarify what could be made with regard to the sustainability rules. BEREC's proposals concern improvements in the text of the CIR's, and will be considered by the Commission in the next review of the CIR.

BEREC also proposes the introduction of a derogation mechanism at the wholesale level, accessible to visited mobile network operators that are unable to recover their costs of providing roaming services from the applicable roaming wholesale caps. This new proposal is closely linked with BEREC's suggestion for setting the roaming wholesale caps by disregarding the costs of outlier countries/operators. The Commission continues to monitor the developments in the wholesale roaming market to ensure that wholesale roaming caps are set at a level that provides cost recovery for operators.

Conclusion on sustainability derogations

Since the introduction of the RLAH rules, the sustainability derogation rules have worked effectively as also confirmed by BEREC's 2025 Opinion ([59]). There is a clear trend of decreasing the number of operators in need of sustainability derogations. Of the submitted derogation requests, most have been granted to providers with a small market share, and very few were rejected. In some Member States where derogations were granted, surcharges were not applied. The volumes of voice and data roaming services subject to sustainability surcharges have dropped below 0.82% in every considered Member State. These positive outcomes can mainly be explained by the lowering of wholesale roaming

[55]) For more detailed data and analysis on the sustainability derogation mechanism, please refer to the section 5 of the Commission Staff Working Document on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainability derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016 (SWD(2024)8).

([56]) BoR(25) 48.

([57]) BoR(25) 48.

([58]) BoR (19) 101.

([59]) BoR(25) 48.

caps and the fact that, in some cases, the wholesale roaming charges effectively applied were even below the caps.

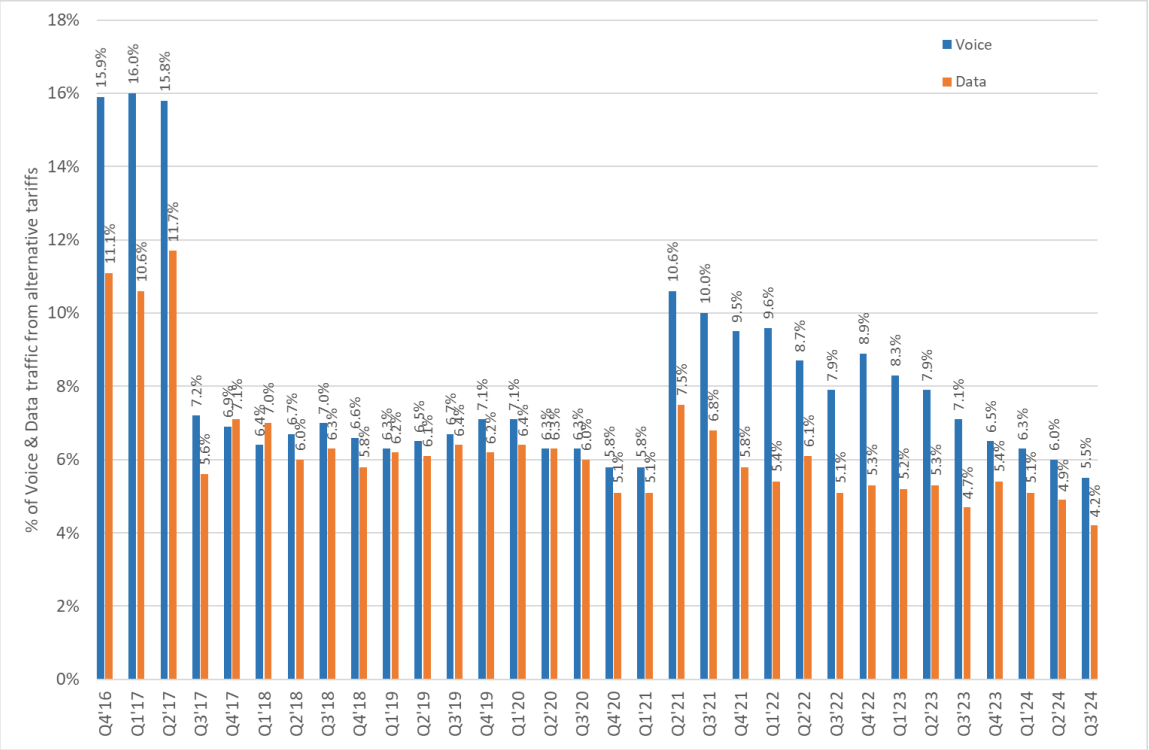
The derogation mechanism is acting as an effective safeguard against possible distortions in the few domestic markets where such a risk could emerge and has also allowed operators in these markets to keep their competitive domestic charging model and in particular their very low-price level for domestic mobile data services, while allowing end-users to still greatly benefit from the roaming reform.

5.4. Use of alternative roaming tariff plans

The needs of roaming customers vary based on their travel purpose and destination. As a result, any roaming provider can offer alternative roaming tariffs, and customers may actively select options other than the default RLAH conditions. While a roaming provider is not obligated to provide roaming services, in the case that an operator does so, RLAH has to be offered by default. All roaming customers who choose an alternative tariff instead of a regulated RLAH offer must be made aware of the roaming benefits that they would forfeit. According to Article 8 of the Roaming Regulation any roaming customer may, at any time, request to switch back to or from a regulated roaming tariff free of charge.

One-third of operators provide alternative roaming tariffs, which come in daily (14 operators), weekly (18 operators), monthly (39 operators), or other package types (19 operators), designed for particular needs or customer categories. These tariffs may include surcharges for EEA roaming as well as added voice/data allowances or reduced rates for countries outside of the EEA, for example the United Kingdom (UK), Switzerland, the United States of America (USA), and Türkiye among others. According to the 31st BEREC International Roaming Benchmark Data and Monitoring Report, 19 % of the operators offering alternative tariffs indicated that they apply a surcharge for roaming in EU/EEA destinations to some of the alternative tariffs. For these alternative tariffs with a surcharge for EEA roaming, 41 % of the respondents with such surcharges indicated that they include non-EU/EEA destinations with no surcharge or at a reduced rate.

Figure 10: Percentage of roaming voice and data traffic from alternative tariffs in total EU27 roaming traffic, Q4 2016 – Q3 2024



Source: BEREC BMK data processed by JRC

Despite one-third of operators having alternative offerings, in Q3 2024, the proportion of roaming call minutes made within the EU27 by subscribers on alternative tariffs is as low as 5.5%, while the corresponding data usage share is 4.2%. Both figures are following a consistent downward trend. Estonia reports the highest percentage of roaming calls made on alternative tariffs, followed by Luxembourg, Slovakia, Ireland, Poland and Germany. The highest retail EU/EEA roaming data volumes from alternative tariffs are found among Estonian users, followed by Poland, Germany, Slovakia and Luxembourg. In 15 Member States for calls and 18 for data. This percentage is less than 1% of all the volumes consumed. According to BEREC in Q3 2024, an average of 4.17 % EEA roaming enabled customers are subscribed to an alternative tariff.

5.5. Evolution of domestic tariff plans

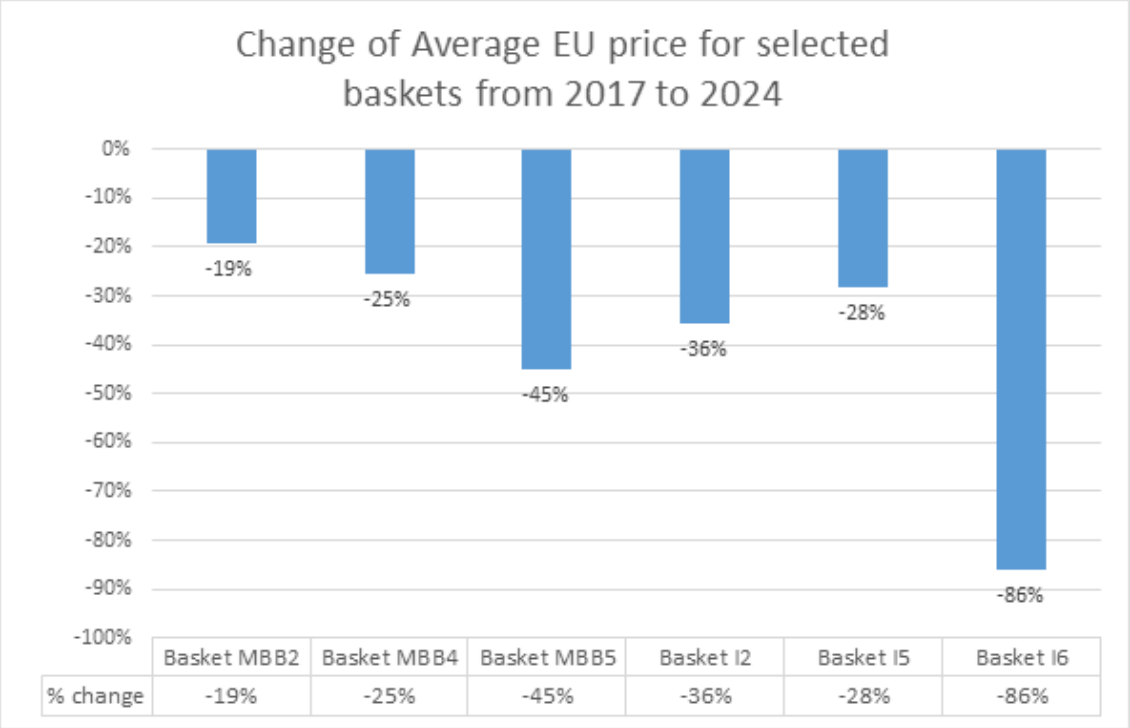
BEREC data indicates that the Average Revenue Per Paying User (ARRPU) has remained stable from 2019 to 2024, with constant prices and expanded services, such as larger data volumes. In any case, changes in ARRPU could not be solely attributed to the introduction of RLAH, as pricing is influenced by factors like inflation and competition. BEREC notes a trend towards unlimited tariff plans and highlights the FUP for open data bundles as crucial for the sustainability of the RLAH framework. Regarding the Roaming Regulation's impact on domestic markets, NRAs and BEREC can't precisely assess its effects due to the dynamic nature of the electronic communications services and networks markets, influenced by various external factors. They cannot clearly identify which changes are due to the introduction of the RLAH regime versus independent developments.

BEREC continues to monitor these markets but has found no evidence of mobile providers exiting due to the Roaming Regulation's obligations.

5.5.1. Domestic prices

The findings from the study "Mobile Broadband Prices in Europe" ([60]) conducted from 2017 to 2024 reveal a downward trend in average prices across the EU following the implementation of RLAH. As illustrated in *Figure 11*, the EU average minimal prices for all baskets decreased by 19 to 86% between 2017 and 2024. Notably, the prices for higher data allowance baskets dropped more significantly compared to those with lower allowances. This points to a significant reduction in prices for mobile broadband plans that offer higher data allowances, providing more value to consumers.

Figure 11: Evolution of domestic prices



Source: Empirica data processed by JRC

Based on the information in the table below, mobile broadband prices have decreased in 2024 compared to 2022. On average, mobile broadband prices, for the usage baskets shown below, are roughly 16% lower. Only the price of the lowest allowance of 1GB data-only basket increased slightly.

([60]) Empirica's studies adhere to the minimal normalized prices in euro (€/Purchasing Power Parity) across each EU Member State for a collection of baskets. The details regarding the consumption included in each analyzed basket can be found in Section 3 (Methodology).

Table 2: Change in the average EU price for mobile services, 2022-2024.

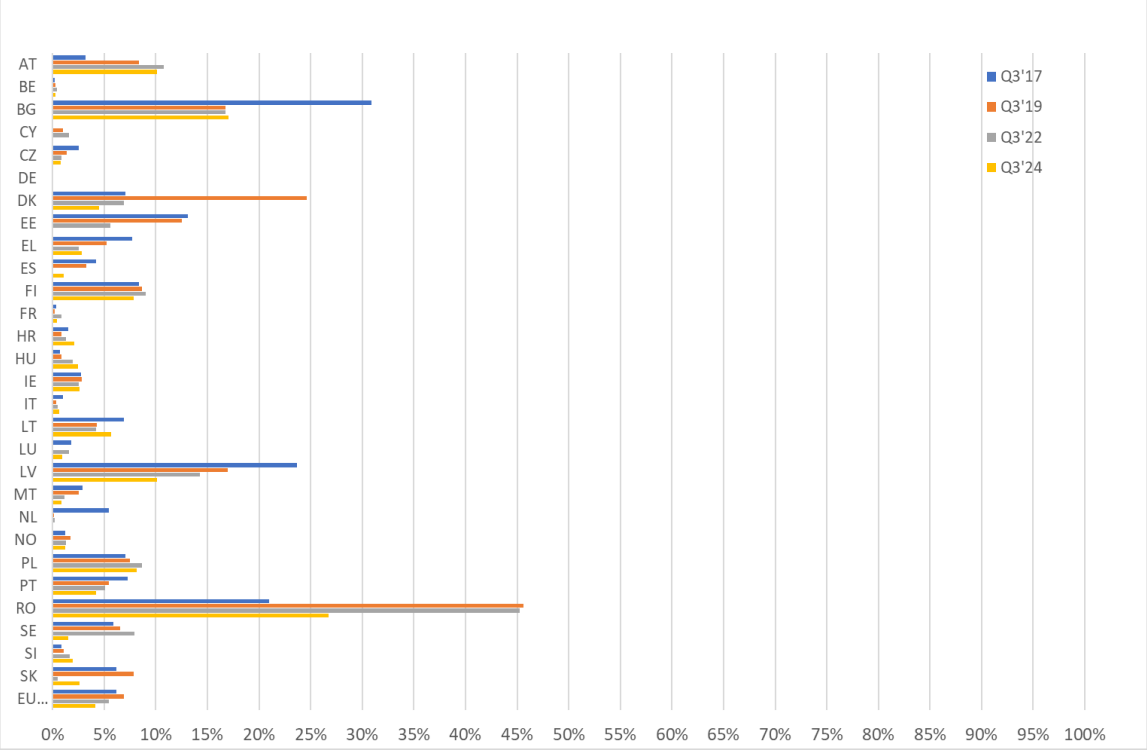
	1 GB	5 GB	20 GB	50 GB
Change in average EU price for data only baskets	3.63%	-14.14%	-26.03%	-26.20%
	1 GB, 30 calls	**5 GB, 30 calls**	**20 GB, 300 calls**	**50 GB, 100 calls**
Change in average EU price for data and voice baskets	-8.11%	-12.26%	-22.85%	-23.11%

Source: Empirica data processed by JRC

5.5.2. Domestic-only tariff plans

The Roaming Regulation does not oblige operators to provide roaming services. Mobile operators can provide tariff plans that do not include regulated roaming services. BEREC notes in its Opinion ([61]) that these plans are primarily used as fixed-mobile substitutes in areas without fixed broadband access (e.g., due to high connection costs for fixed broadband), as well as for regional applications such as public Wi-Fi hotspots (e.g., in public transportation). This highlights the continued relevance of domestic-only plans in addressing specific connectivity gaps and use cases, while also confirming that such plans are not designed for roaming purposes.

Figure 12: Percentage of domestic-only subscribers per country



Source: BEREC BMK data processed by JRC

A small percentage of EU/EEA users subscribe to domestic-only plans. The BEREC Opinion ([62]) indicates that the average share of domestic-only tariffs within the EU/EEA

([61]) BoR(25)48.

([62]) *Ibidem.*

using roaming-enabled SIM has declined from 4.4% to 3.2% from Q4 2021 to Q3 2024. SIM cards designated for domestic-only use (i.e., those that do not offer roaming services abroad) may include SIM cards intended for fixed locations (such as in routers), prepaid options, low-cost tariffs aimed at domestic consumption, or specific plans (e.g., for corporate clients, children, machine-to-machine (M2M), or business-to-business (B2B)). As of Q3 2024, the percentage of subscribers on domestic-only tariffs in EU/EEA countries is 3% for MNOs and 2% for MVNOs.

There has been no significant variation over time in the average number of subscribers to domestic-only plans in EU/EEA countries, although country-specific figures show considerable differences. Domestic-only tariff options remain limited, except in Poland, Romania, Austria, Latvia, and Bulgaria, where over 10% of users are on such plans. From Q2 2020 to Q3 2024, this percentage has significantly decreased in Romania, Estonia and Latvia, but has seen a slight increase in Finland. Based on data from Q3 2024, in 20 Union countries, the share of subscribers on domestic-only plans is very minimal, reaching up to 5%.

5.6. Third country roaming

The benefits of the RLAH policy for consumers are so visible that the EU roaming policy has paved the way for several regions outside the EU to introduce measures to lower roaming charges in cross-border settings to address similar market failures. The six Western Balkan countries replicated in their Regional Roaming Agreements (RRA) the EU roaming policies in the region and a full RLAH regime between themselves since July 2021, including the detailed fair use policies.

Since the introduction of RLAH, several third countries – also geographically located quite far from the EU – have expressed their interest in joining the EU RLAH area or at least reducing roaming prices with the EU ([63]). Beyond the economic benefits for third country consumers, it also seems that in certain cases, especially for candidate countries, being able to freely use mobile devices while periodically travelling in the RLAH area represents a symbolic value of belonging to the "EU family". Moreover, operators in Ukraine, Moldova and Western Balkans, respectively, have voluntary arrangements in place with some EU operators for lowering roaming charges.

5.6.1. Extending roam-like-at-home to third countries

The Roaming Regulation encourages initiatives that aim to lower the roaming charges for roaming services between the Union and third countries on a reciprocal basis. International roaming plays a significant and strategic role in geopolitical position of the European Union in relations with its neighbours, capable of gaining citizens' support. The EU has already made steps towards extending the RLAH area to countries entering the single market, like in the case of the EEA and lately also to some candidate countries. The extension of RLAH benefits to third countries requires the incorporation in these countries' legal order of the roaming acquis. This acquis includes, beyond the mere roaming rules,

([63]) Interest has been expressed by Western Balkan countries, Ukraine, Moldova, Georgia, Azerbaijan, UK, Switzerland, Israel, Morocco and Japan.

also parts of the Code, the BEREC Regulation and the Delegated Act on termination rates. Any such arrangement also needs to fully respect the EU's international trade obligations.

Several third countries have expressed interest in joining the RLAH area, including Ukraine, Moldova and the Western Balkans. Ukraine and Moldova have Association Agreements with the EU that allow for their internal market access. The RLAH policy can thus be extended to the association partners before enlargement, subject to full incorporation in the national law of the "EU roaming acquis" and EU Council endorsement. The association partners can then request access to the internal market for the roaming sub-sector that is part of the telecom sector.

Ukraine has notified the national law approximated to the EU roaming acquis in November 2024 and in June 2025 and the Commission adopted its positive assessment and draft decision for including Ukraine into the EU Roam Like at Home (RLAH) area. The Commission's proposal requires approval by the EU Council before a final decision can be adopted, to effectively extend the EU RLAH area to Ukraine. Moldova has notified to the Commission its alignment with the EU roaming acquis and could also join the RLAH area, subject to a positive assessment of the degree of alignment.

The Commission will observe the outcome of extending the RLAH to the two candidates and other potential candidates such as in the Western Balkans, in the short and long term

5.6.2. Rest of the World (RoW) roaming prices

BEREC collects data on roaming rates outside the EU/EEA in order to assess the potential impact of the Roaming Regulation on these roaming services. The data is presented in BEREC's International Roaming Benchmark Reports ([64]). The data, which is collected annually, indicates that the retail rest of the world roaming prices have been quite stable for voice, SMS and data services since 2021.

Between Q4 2020 and Q3 2024, the average retail rates for data roaming in the RoW decreased from EUR 10.87/GB to EUR 5.16/GB. The average retail price per minute for RoW roaming voice calls received and made decreased in the same period by 13% and 8%, respectively. The average EEA price for RoW roaming SMS services declined from 10.98 to 5.71 EUR cents/unit.

Consumer benefits

However, high roaming surcharges in third countries remain an obstacle to seamless connectivity and the unreasonably high prices lead to increasing risks of bill shocks for end-users ([65]). The Roaming Regulation lays down transparency and consumption monitoring rules to protect roaming users from bill-shocks. For example, operators apply an automatic cut-off limit for roaming consumption once surcharges reach 50 EUR and 100 EUR (See Section *5.7.2*). In addition, BEREC suggests that the Roaming Regulation should introduce tools enabling roaming customers to opt out of consuming data roaming

([64]) BoR (24) 38.

([65]) The Commission has received in 2022 a complaint for a bill shock while roaming in the Western Balkans, where an EU consumer was charged 1400€ for a 12 hour stay in Serbia.

services when connected to Rest of the World networks (see also Section *5.7.2.4* on inadvertent roaming).

In its 2025 Opinion ([66]), BEREC notes that many operators include non-EU/EEA destinations in their RLAH FUP. BEREC also recalls that FUP volumes for open data bundles are in general quite high so that extending it (always on a voluntary basis) to cover non-EEA countries will not result in subscribers not having the volumes they need when travelling in the EU/EEA. In this context BEREC proposes to explicitly include this possibility in the Roaming Regulation.

The Commission recalls that the Roaming Regulation lays down the rights and obligations for roaming in the EU. It lays down the right for any roaming customer to consume a minimum amount of regulated roaming services within the Internal Market. It is not consistent that these minimum rules include also roaming in third countries. It is undoubtedly a benefit for the consumer to use roaming services at RLAH conditions also in a third country. However, consuming roaming services outside of the EU/EEA should not lead to the consumption of the minimum guaranteed volumes of regulated roaming services in the EU/EEA.

5.6.3. Impact of BREXIT on roaming with the United Kingdom

The United Kingdom (UK) officially left the EU at the end of the transitional regime on 1 January 2021. In the fields of electronic communications, a Notice ([67]) had been published by the Commission on 18 December 2020, to prepare for the actual withdrawal and its consequences on the electronic communications markets.

The UK ceased to be bound by EU rules, including the *Roam-Like-at-Home* regime and, by inference, the fair use policies. Since then, UK and EU operators, respectively, can levy additional roaming charges for roaming between the UK and EU and therefore surcharge consumers.

After the end of the RLAH regime, most of UK's main MNOs have reintroduced retail surcharges for roaming in the EU for their customers, while many European operators maintained favourable conditions and preserved roaming without surcharges within the United Kingdom for their subscribers, to the benefit of European consumers. The Commission welcomes those initiatives to apply RLAH in third countries, on a voluntary basis. However, the Commission recalls that third country roaming traffic cannot be deducted from the minimum roaming data allowance that the end-user is ensured to enjoy under the roaming rules while travelling in the EU. While extending the RLAH benefits to third countries is beneficial for consumers, it should not negatively affect the minimum rights that consumers have for roaming in the EU.

A snapshot of the roaming conditions in subscription plans offered by some of the major UK mobile operators reveals that roaming in the RLAH area often incurs a daily charge for the UK end user (e.g., £2/day for one major MNO). Additionally, when the roaming customer exceeds the "data allowance", the retail surcharges applied are consistently

([66]) BoR (25)48.

([67]) European Commission, Notice to stakeholders: withdrawal of the United Kingdom and EU rules in the fields of electronic communications, 18 December 2020.

higher (around £3 - £3.5/GB) than those regulated in the RLAH area, set at the wholesale cap levels (EUR 1.30/GB in 2025 and decreasing to EUR 1/GB as of 2027).

5.7. Consumer protection and perception

5.7.1. Consumer perception

Consumer awareness of the RLAH regime

On the consumer side, **awareness** of the RLAH benefits is increasing, as confirmed by the Eurobarometer 521 study, with an overwhelming majority of travellers acknowledging that they are aware they can use roaming services without surcharges while periodically travelling (83% for calls, 81% for messages, and 82% for data). In terms of **transparency**, EU residents also found useful the welcome-message (so-called "Welcome SMS") – improved under Regulation (EU) 2022/612 - including personalised pricing information on roaming while abroad. European consumers consider that they are benefiting from Roam-Like-at-Home rules (84%) and that they have been able to stay connected abroad as in their home country (80%). The more recent Eurobarometer 560 confirms these findings, as 78% of respondents feel that they benefit from roaming without surcharges. Eurobarometer 521 results also showed that 49% of respondents still occasionally or even in some cases for the whole time of their stay abroad, limit their roaming data usage. In that regard, Eurobarometer 521 results indicated that customers with lower awareness of the rules are more likely to limit their usage. ([68]) The more recent Eurobarometer 560 shows that 40% of the respondents have limited the amount of mobile data used to avoid surcharges when travelling in the EU/EEA. It also shows that 34% of the respondents have switched off data roaming to avoid surcharges and 27% have activated a special data roaming plan offered by their mobile operators to avoid surcharges.

Overall, data suggest that RLAH is benefiting most people in the Union, but the situation for consumers could still be improved. In that regard, the Commission already noted in its 2023 FUP Review Report ([69]) that transparency (See Section *5.7.2*) and access to information is of particular importance to increase awareness of the EU consumers on the RLAH regime.

In its Opinion BEREC noted that the majority of NRAs reported fewer than 50 consumer complaints. In the most populated countries, where the highest numbers were recorded, the reported figures consistently remained below 300. The most common complaint in the period Q4 2022 to Q3 2024 is about inadvertent roaming ([70]) (35%), followed by lack of transparency about tariffs and roaming conditions (19%), complaints about the application of RLAH tariffs (14%) and FUP (7%). The low number of complaints confirms that the roaming rules generally work well and that consumers benefit from RLAH conditions, but that issues often arise where consumers are not sufficiently aware or informed about the roaming conditions.

([68]) Flash Eurobarometer 521 – Roaming.

([69]) SWD(2024) 8 final.

(70) Inadvertent roaming is when a roaming user unintentionally connects to a network, e.g. to a third country network in a border region or to a network on a ship or plane.

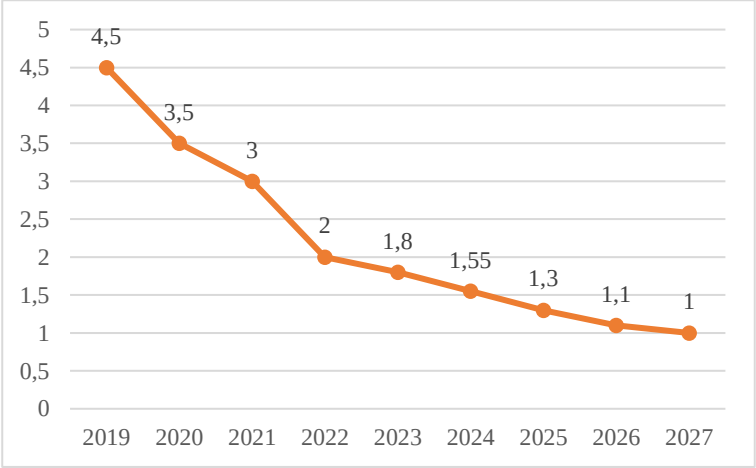
Enhanced consumer benefits under the FUP with the current wholesale charges glidepath

The wholesale glidepath (until 2027) improved roaming conditions for EU consumers, in particular regarding two aspects:

- There is an **automatic and progressive increase in consumers' roaming data allowance for subscribers of unlimited data plans**, resulting from the annual reduction in wholesale data caps (i.e., a glidepath towards EUR 1/GB by 2027 – See *Figure 13* below). This mechanism enhances conditions for users of unlimited data bundles ([71]) and further reduces the potential for surcharges ([72]).

- Additionally, in exceptional cases where fair use limits are exceeded, **any applicable surcharges imposed by operators are capped at the level of the wholesale caps**. These surcharges will follow the glidepath, reaching EUR 0.019 per minute for voice and EUR 0.003 per SMS by 2024, and EUR 1/GB for data by 2027.

Figure 13: Decreasing trend of the data surcharge operators can apply over the years (€/GB))



Source: Regulation (EU) 2022/612 of the European Parliament and of the Council

5.7.2. Transparency measures

The Roaming Regulation introduced new enhanced transparency measures under Articles 13, 14, 15 and 16 covering, in particular (i) the welcome message but also (ii) value-added services, (iii) emergency communications, (iv) inadvertent roaming and (v) QoS.

5.7.2.1. Welcome message

([71]) There two types of open bundles: (i) unlimited data tariffs (also called unlimited data plans – mentioned here), and (ii) tariffs where the implicit domestic unit price for data is lower than the regulated maximum wholesale caps.

([72]) For more detailed explanations, please refer to the Figure 2 of the Section 4.1 of the Commission Staff Working Document on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainability derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016 (SWD(2024)8).

Each time a roaming customer crosses a border, the operator is obliged to send a so-called "welcome-message". This is an automated message with clear personalised pricing information, any applicable fair use policy (which includes any roaming data allowance) and applicable surcharges as well as information about services that are not covered by the roaming rules and information about emergency communications. All the elements to be listed in this "Welcome-message" are listed under articles 13, 14 and 15 of the Roaming Regulation.

In the Roaming Regulation, the elements to be listed under the welcome message have been extended, to the benefit of the EU consumers. It should now include (i) basic personalised pricing information and information about surcharges, (ii) information about Value-Added Services (VAS), (iii) information on pricing which applies for voice, SMS and data roaming services when connecting to a non-terrestrial public mobile communications network and (iv) emergency communications.

Information to be included:

- basic personalised pricing information, expressed in the currency of the home bill, on the roaming charges for making and receiving calls and for sending SMS messages (Article 13(1)),
- that the customer can obtain more detailed personalised pricing information about calls and SMS by means of call or SMS to a free-of-charge number (Article 13(2)),
- The potential risk of increased charges due to use of value-added-services, including a link to access free of charge to a dedicated webpage providing information about the types of services that may be subject to increased costs (Article 13(1)),
- On the occasion of each message, customers shall have the opportunity to give notice to the roaming provider, free of charge and in an easy manner, that they do not require the automatic message (Article 13(1)),
- Alert that the customer is using regulated data roaming services (Article 14(2),
- basic personlised tariff information on the charges for regulated data roaming, in the currency of the home bill (Article 14(2)),
- Any fair use policy that the roaming customer is subject to within the Union and the surcharges which apply in excess of any limits under that fair use policy (Articles 13(1) and 14(2)),
- any surcharge applied (Articles 13(1) and 14(2)),
- That the customer can access emergency services free of charge by calling the single European emergency number '112' as well as a link to access, free of charge, a dedicated webpage, accessible to persons with disabilities, which provides information on alternative means of access to emergency services (Article 15),
- Where public warning mobile applications are deployed, information indicating that public warnings may be received by a public warning mobile application (Article 15).

<u>When entering a third country:</u>

- basic personalised pricing information, expressed in the currency of the home bill, on the roaming charges for making and receiving calls and for sending SMS messages (Article 13(1)),
- basic personalised pricing information, expressed in the currency of the home bill, on the roaming charges for sending SMS messages (Article 13(1)),
- On the occasion of each message, customers shall have the opportunity to give notice to the roaming provider, free of charge and in an easy manner, that they do not require the automatic message (Article 13(1)),
- Alert that the customer is using data roaming services (Article 14(2),
- basic personlised tariff information on the charges, in the currency of the home bill (Article 14(2)),
- In case the cut-off facility is not available, the customer shall be informed by SMS when crossing the border (14(7)).

When connecting to a non-terrestrial network:

- basic personalised pricing information, expressed in the currency of the home bill, on the roaming charges for making and receiving calls and for sending SMS messages (Article 13(1)),
- basic personalised pricing information, expressed in the currency of the home bill, on the roaming charges for sending SMS messages (Article 13(1)),
- On the occasion of each message, customers shall have the opportunity to give notice to the roaming provider, free of charge and in an easy manner, that they do not require the automatic message (Article 13(1)),
- Alert that the customer is using data roaming services (Article 14(2),
- basic personlised tariff information on the charges, in the currency of the home bill (Article 14(2)),
- In case the cut-off facility is not available, the customer shall be informed by SMS when crossing the border (14(7)).

Roaming providers shall provide customers with disabilities with the basic personalised pricing information automatically, by voice call, free of charge, if they so request.

In general, 71% of the respondents to the Eurobarometer 2023 ([73]), said that they find the welcome message with information about roaming conditions and personalised pricing information useful, going up to even 92% of respondents in some Member States, demonstrating its added value for EU residents. The welcome message is informative and comprehensive, ensuring that roaming customers can make informed choices about their roaming consumption. Customers who do not wish to receive the message can opt out from it.

BEREC data shows that the compliance with these transparency rules is not sufficient. In many cases roaming customers do not receive all the relevant information that is mandated by the Roaming Regulation.

([73]) Q15 – Eurobarometer 521

Table 3: Information provided by operators in the Welcome SMS ([74]) (2023)

In the EU/EEA Welcome SMS, do you provide information about…	**Number of operators that replied ([75])**	**Percentage of operators replying positively**
Application of the domestic tariff to roaming consumption	113	91%
The FUP volume limit	99	74%
The level of surcharges when exceeding FUP	98	74%
The possibility of different charges when using VAS	87	67%
Public warning systems	96	63%
How to reach local emergency services	105	77%
Pricing on non-terrestrial networks (in case of Welcome SMS on non-terrestrial network)	98	78%
Link to website or app with further information	105	76%

Source: 2023 BEREC Transparency data processed by JRC.

When it comes to the completeness of the welcome message, data suggests that there are big discrepancies between the operators. *Table 3* shows that apart from the application of the domestic tariff to roaming consumption, all the other items to be included in the Welcome message are not widely being communicated to the customers: around 37% and 22% of the operators are still not communicating all the relevant information to the consumers. It is noticeable that most of the information still has a high rate of inclusion in the message. By not giving all relevant information to customers, they lose the possibility to make informed choices about their roaming consumption. In light of the above, the Commission considers that NRAs need to ensure that the rules are properly implemented.

In contradiction to the findings of the Commission, in its Opinion, BEREC noted that the content of the welcome message has been significantly extended by the Roaming Regulation. According to BEREC, this may have undermined the objective of providing information in a clear and effective manner to the customers. In this context, BEREC proposes to limit the frequency ([76]) and/or the content of the welcome message only to essential information (pricing conditions, European emergency number '112', operator customer service) and a link to an operator' s dedicated roaming webpage that would provide additional information, regarding VAS and alternative means to contact emergency services.

The welcome message serves to give roaming customers immediate and complete information about the roaming conditions that they are subject to. It is a valuable way for roaming customers to stay informed and take informed decisions about their roaming usage. Citizens confirm that they find this information useful to a high degree. Customers who do not wish to receive such information have the possibility to opt out from receiving such messages. Ensuring the completeness and correctness of the information in the welcome messages is necessary for the consumer protection. It is the responsibility of the NRAs and BEREC to monitor the implementation of these obligations.

([74]) Here SMS is understood as "message". The welcome message can be delivered in different forms and does not necessarily need to be in the form of an SMS message.

([75]) Over 119 operators in total.

([76]) BEREC considers that crossing intra EU/EEA border should not generate another welcome message, with the exception of cases when customer is crossing non-EU/EEA borders or generally countries when different pricing applies.

5.7.2.2. Value-added services (VAS) and the implementation of the database of numbering ranges for VAS

The Commission found in the 2022 Impact Assessment on the Roaming Regulation ([77]), that roaming customers often incurred large bills due to a lack of transparency about value-added service numbers and their associated higher charges across the Union.

In order to tackle this issue, the recast introduced several new provisions:

- Under Article 13(1) of the Roaming Regulation ([78]), the roaming provider shall provide their roaming customers with information on the potential risk of increased charges due to the use of VAS. This information shall also include a link to access a dedicated webpage providing additional information about services that may be subject to increased costs and, where available, about numbering ranges for VAS. This information can be retrieved from the dedicated database on VAS, where NRAs provide information about such services. The webpage shall also include information about charges applicable to freephone numbers while roaming.

- Under Article 16 of the Roaming Regulation ([79]), a Union-wide database of numbering ranges for value-added services was established by BEREC, in order to address the issue of non-harmonization across the Union.

BEREC data collection results show that only a limited number of NRAs received complaints on VAS in 2023: among the 20 respondents, 12 did not receive any complaint, 6 received up to 10 complaints, 1 received between 11 and 50 complaints and 1 received between 51 and 100 complaints ([80]). The number of complaints has decreased compared to the data collected in 2022([81]), prior to the introduction of the new transparency rules. Among the various categories of complaints, those related to VAS are among the least frequently reported and have a low occurrence rate (i.e. most NRAs reported up to 10 complaints). This suggests that the new measures introduced on VAS are working well and EU consumers are better informed.

Table 4: Informing consumers on value-added services (2023)

Which type of information do you provide on VAS charges in a roaming context?	Number of operators that replied ([82])	% of operators replying yes
Exact VAS charges	77	36%
General information	82	76%
Other	35	20%

Source: 2023 BEREC Transparency data processed by JRC.

([77]) Impact assessment report - SWD(2021)28.

([78]) See also recital 37.

([79]) See also recital 59.

([80]) See Table E in the Annex.

([81]) In 2022, among the 11 NRAs that answered the question, 9 NRAs reported “up to 10” complaints related to VAS, 1 NRA “between 11 and 50” complaints and 1 NRA “between 51 and 100” complaints.

([82]) Over 119 operators.

Aside from the low number of complaints, operators are also informing their customers on VAS as demonstrated by data provided under *Table 4*. Operators either communicate on the exact applicable VAS charges (36%) or provide "general information" (76%) to their customers.

While the Commission acknowledges that informing EU consumers is of utmost importance, the data collected does not allow for a thorough assessment of the provisions on VAS. Under Article 13 of the Roaming Regulation, "roaming providers shall provide roaming customers (…) with information on the potential risks of increased charges due to the use of value-added services by means of an automatic message (…). Such information shall include a link to access, free of charge, a dedicated webpage providing up-to-date information". However, the data collected does not fully cover these specific points. The available data does not give sufficient information about the compliance with the transparency obligation. It is not possible to conclude whether operators do inform their customers about VAS or not. From the data available it seems that only 76% give general information about VAS. The compliance with this transparency obligation should be further monitored.

In its Opinion ([83]), BEREC proposes to enhance the clarity of the VAS provision by including a specific provision in the Roaming Regulation stating that the RLAH principle does not apply to calls made or SMS sent by roaming subscribers towards numbers used for value-added services, such as free-phone numbers. In addition, BEREC suggests enhancing clarity on the current requirements on VAS. To avoid any duplication with the BEREC VAS database, BEREC suggests making it sufficient for operators to include instructive information on their websites (and via the customer service) indicating that VAS might not be charged under RLAH especially for free phone number ([84]) and to provide a link to the BEREC database. However, it should be noted that the BEREC database on VAS as it currently stands, is not created as a tool for consumers.

Assessing its database on VAS, BEREC also notes that the VAS provisions in the Roaming Regulation may have been subject to divergent interpretation by operators, leading to different results ([85]). Therefore, BEREC would welcome a clarification and simplification of the provisions to ensure a uniform application of the rules.

5.7.2.3. Emergency communications

The Roaming Regulation includes additional provisions on the access to emergency communications. Aside from the wholesale obligation to include the (free and unconditional) access to emergency services in the reference offers negotiated between operators ([86]), new provisions were also adopted at retail level, to the benefit of the EU consumers. This includes:

- The obligation to adequately inform roaming consumers about the means of access to emergency services in the visited Member States (Article 15). Information on

([83]) BoR(25) 48.

([84]) which are the VAS number the more often subject to complaints.

([85]) According to BEREC, some operators do not include detailed information on a dedicated webpage but refer to the BEREC database.

([86]) Article 3(6) and Article 12 of the Roaming Regulation.

emergency services, including the availability of 112, is part of the elements to be covered in the Welcome message. Customers shall also be informed of alternative ways to contact emergency services, including options for people with disabilities. Member States with public warning mobile apps should also notify roaming customers about their availability in the visited country.

- The establishment of a single database of access points to emergency services by BEREC, as required by Article 16.

The results from the BEREC data collection show that the number of complaints received on emergency services is very low: only 1 NRA received up to 10 complaints in 2024. This is the category for which NRAs received the least of complaints in 2024 ([87]). This suggests that the new provisions introduced in the 2022 recast are efficiently working and benefiting the EU consumers.

On the operators' side, only 2% ([88]) of the operators have encountered obstacles in ensuring access to emergency services for roaming subscribers in 2023.

In its Opinion, BEREC also noted that the complaints submitted to NRAs regarding the use of emergency services while roaming are very rare. On the industry side, operators did not identify any major difficulty in the implementation of the new measures. Some of them reported that only few consumers read additional information provided through the link in the Welcome message, suggesting that this could be streamlined.

When it comes to the database, comments expressed under Section *5.7.2.2* are also relevant for emergency services. In addition, BEREC suggests that the Roaming Regulation could clarify that only the Single European Emergency Number '112' number should be explicitly mentioned in the welcome message (and no national numbers). Alternative means of access to emergency services should only cover means other than calling "112", such as texting 112, app designed for users with disabilities, etc. When it comes to the BEREC database on emergency services, BEREC reiterates its suggestions expressed for the VAS database, in terms of clarification of its scope and possible simplification in its implementation (e.g. allowing operators to insert a direct link) (See Section *5.7.2.2*).

5.7.2.4. Inadvertent roaming

A roaming customer can connect to a non-terrestrial public mobile communications network, such as on-board marine vessels ([89]) or on aircraft ([90]), that are provided through types of radio networks other than terrestrial networks. These types of services are outside the scope of the roaming price regulation. Charges incurred by roaming customers when they intentionally or inadvertently connect to non-terrestrial networks are significantly higher than tariffs for regulated roaming services. Roaming customers are accustomed to benefiting from RLAH and the use of roaming services at domestic prices. Due to the absence of a consistent approach to transparency and safeguard measures for connections to non-terrestrial networks, roaming customers are at greater risk of bill-shock.

([87]) See Table E in the Annex.

([88]) 2024 BEREC Transparency data processed by JRC.

([89]) MCV services are defined in Commission Decision 2010/166/EU (17).

([90]) MCA services are defined in Commission Decision 2008/294/EC (18).

Transparency measures are necessary in order to protect end-users from inadvertent roaming.

Inadvertent roaming can have significant consequences in two scenarios. Firstly, near the EU's external borders, there is a risk of inadvertently connecting to a third-country network, where roaming surcharges can be significantly higher than RLAH conditions, even if the customer is still physically located within the EU ([91]). Secondly, connecting to a non-terrestrial network on board marines' vessels and aircraft, can result in exceptionally high charges for the customer ([92]).

Therefore, additional transparency rules were added to the Roaming Regulation to enhance the end user protection. The Roaming Regulation lays down that, in addition to informing roaming customers about how to avoid inadvertent roaming in border regions and on-board vessels and aircraft, roaming providers are to take all reasonable steps to avoid these connections. Measures that operators should take include network operation measures, financial limits and an opt-out mechanism. Moreover, a roaming customers should receive an automatic message with price information every time a connection to such a network is made. NRAs also have a responsibility to monitor and take measures against inadvertent roaming within their Member States.

BEREC data collection results show that **inadvertent roaming** is the most common subject of consumers' complaints before the NRAs: in 2024, 1 NRAs received between 101 and 200 complaints, 2 NRAs between 51 and 100 complaints, 6 NRAs between 11 and 50 complaints and 10 NRAs up to ten complaints. This was already the case in 2023 (see Table E2 in the Annex).

The 2023 Eurobarometer confirms that inadvertent roaming is a concern for roaming customers. The findings indicate that 23% of consumers travelling close to an external EU border and 13% travelling on a boat actively restrict their roaming usage to avoid surchargers for roaming outside the EU ([93]).

Table 5: Non-EU/EEA destinations, inadvertant roaming and non-terrestrial

	Number of operators that replied	**% of operators replying yes**
Do you provide information on how to avoid inadvertent roaming in border regions?	99	81%
Do you provide information on how to avoid inadvertent roaming on non-terrestrial networks?	90	76%
Do you provide measures to protect consumers from paying for inadvertent roaming in the EU/EEA?	100	89%

Source: 2023 BEREC Transparency data processed by BEREC

([91]) See Recital 48 of the Roaming Regulation.

([92]) See Recital 46 of the Roaming Regulation.

([93]) In total 25% of the respondents replied that they took restrictive measures during their stay, and 49% replied that they took restrictive measures occasionally during their stay. Restrictive measures include switch off their mobile phone, switch off data roaming and limit the amount of data used.

Data suggest that operators are taking measures to address the issue of inadvertent roaming (89% provide consumers with measures to avoid unexpected surcharges), especially in border regions (81% of them provide information on how to avoid it) and also when connecting to non-terrestrial networks (76% of the operators provided information to their customers on how to avoid it). However, compliance with the transparency obligations must be improved and should be further monitored and supervised. Roaming providers have an obligation to inform their customers about inadvertent roaming, to empower end-user to make active choices about their consumption. The fact that compliance with this obligation is 81% and 76%, respectively, cannot be considered a sufficient level of compliance.

Similarly, BEREC's Opinion found that inadvertent roaming remains the first source of consumer complaints, often occurring in EU border regions ([94]). While operators have taken extra steps to protect consumers, such as disabling roaming (70% of respondents mentioned this mitigating measure), BEREC believes that current provisions can be improved. BEREC suggests introducing tools enabling roaming customer to opt-out of consuming data roaming services when connected to third countries' networks (See section *5.6.2*). In addition, when it comes to non-terrestrial networks and in order to prevent bill shocks, BEREC suggests introducing an opt-in system for roaming services on these networks. The Commission also recalls that according to the Roaming Regulation national regulatory authorities shall monitor and collect information on inadvertent roaming and take appropriate measures.

([94]) Almost half of these were submitted by end users who inadvertently roamed on a non-EEA network while remaining within EEA territory.

6. ASSESSMENT OF THE COSTS OF PROVIDING WHOLESALE ROAMING SERVICES

According to the Roaming Regulation the wholesale caps should be set at a level that ensures that visited network operators are able to recover the efficiently incurred costs of providing regulated wholesale roaming services. The Commission therefore needs to assess the costs of providing wholesale roaming services in the EU/EEA. This section will present the Commission's approach to cost modelling that is based on an updated cost model developed for the purposes of this review following a coherent approach with the previous relevant estimates provided for these services. The section will describe, the assumptions and methodological decisions made, the results under different scenarios and information on additional necessary costs that must be taken into account when evaluating the total costs faced by a visited mobile network operator for providing roaming services.

6.1. Cost of providing wholesale roaming service

This section briefly describes the main features of the new Axon cost model (hereinafter, the 'Cost Model'). This cost model published by the Commission on 18 December 2024 is an update of the model previously developed by Axon in 2019 for the purpose of the 2019 Roaming Review ([95]). The methodology used in this exercise has not changed significantly and largely remains the same, except for the incorporation of 5G and Machine-to-Machine ('M2M') services into the model.

The objective of the study was to build on the experience of the previous review of the Roaming Regulation and enhance the existing bottom-up cost model to estimate the efficient costs of providing wholesale roaming services and mobile voice call termination services by mobile network operators in the EEA, under the current market conditions. In addition, the cost model also covers 5G services that have not been covered by the old cost model. Additional information on the methodological approach followed and the results of the cost model are included in the full list of materials published with the Axon's cost model ([96]). The aim was to build 30 models with a similar skeleton, based on country-specific input where relevant, facilitating as best possible the estimation of the relevant mobile wholesale costs in each of the 30 countries.

The models would rely on country-specific input where relevant and, where not, on average/common values across the EU/EEA. On 8 January 2024 the first draft cost model was shared with stakeholders for consultation, followed by a second version of the draft model shared on 17 April 2024 for a second round of consultation ([97]). The relevant comments and suggestions received during both consultations were implemented in the

([95]) SWD(2019)416, Commission Staff Working Document – Report from the Commission to the European Parliament and the Council on the review of the roaming market.

([96]) Finalisation of the mobile cost model for roaming and the delegated act on a single EU-wide mobile voice call termination | Shaping Europe's digital future.

([97]) To ensure transparency throughout the project, several steps were taken to associate the NRAs, operators, and other stakeholders. First, two workshops were held and two rounds of consultation were organised over the period going from January to May 2024. Also, a Steering Committee composed by experts from NRAs was established and regular meetings between the Commission, Axon and the Steering Committee were held throughout the project. The Steering Committee consisted of representatives from 4 NRAs proposed by BEREC Working group dealing with roaming.

draft final model, which was presented to stakeholders at a second workshop on 4 July 2024. The cost model was then finalised and published on 18 December 2024.

6.1.1. The approach and methodology followed by Axon

The Axon cost model estimates the costs of providing wholesale mobile roaming services as well as voice termination ([98]) in 23 EU/EEA countries ([99]). Each cost model contains a number of adaptable scenarios, allowing the Commission services to evaluate many different scenarios in each country. Any cost model enables the user to evaluate costs of all elements required to offer mobile services. For the purposes of the current roaming review, the relevant costs to be estimated are those related to wholesale roaming services, specifically the estimated costs for:

- Data roaming
- Outgoing voice calls
- Outgoing SMS

Each service and related costs can be evaluated under a number of scenarios. For this purpose, it must be noted, that not all scenarios reconcile and as a result, any estimated cost should be evaluated together with the full list of materials published to avoid conclusions based on scenarios which do not reconcile. Furthermore, one should bear in mind that the results produced by the model do not include the costs of international transit nor the cost of terminating a roaming call. Hence, these costs need to be added to the costs estimated by the model when assessing the total costs of providing wholesale roaming services. This addition of transit and termination costs is described further in *Section 6.4*.

The Axon cost model is based on a number of methodological choices. First of all, the model is a bottom-up model, calculating the provision of a service under a given set of methodologies and scenarios. A bottom-up model involves a reasonable approximation of the network that a reference operator would need in order to meet the coverage and capacity requirements of the users. It produces a reasonable approximation of the costs that such an operator would bear and provides service-level results under different scenarios.

A bottom-up model resorts to a number of methods dealing with various aspects of the economics of a communications network. These methodological considerations include the choice of cost standard, the type of operator modelled, the method to forecast the volumes, allocation of joint and common costs as well as seasonality. In *Table 6*, an overview of each methodological aspect is presented together with the approach adopted.

([98]) Cost estimates for termination services are not presented in this report. They can be found in the the Axon study's material published here.

([99]) Iceland, Liechtenstein, Netherlands, Finland, Estonia, Latvia and Lithuania decided not to participate in the data collection.

Table 6: The methodological aspects considered in the Axon cost model

Methodological aspect	Approach Adopted
Cost standard	► Pure LRIC (termination) and LRIC+ (rest of the services).
Cost categories considered	► Network CapEx. ► Network OpEx. ► General and administration costs (G&A). ► Wholesale specific costs
Modelled operator	► Hypothetical Efficient operator, with a market share equal to 1/#MNOs (subject to a minimum of 20%).
Depreciation methodology	► Economic depreciation. ► Two economic depreciation scenarios are included based on (i) demand or (ii) revenues as the relevant production factors.
Modelled period	► 2022-2032
Volume forecasts	► Projections are based on an assessment of historical traffic patterns and data provided by the stakeholders. ► A total of three scenarios are included to assess alternative volume forecasts (conservative, base case and aggressive).
Allocation of joint and common costs	Two cost allocation modules are available in the model: ► *Network module*: Joint and common costs are allocated to services based on their network usage, by using a routing factors matrix. ► *Regulatory policy module*: The allocations performed in the network module are adjusted to take into account regulatory policy decisions (e.g. re-allocation of the joint and common costs initially allocated to the voice/SMS termination service to voice/SMS origination). Please refer to the descriptive manual for further indications on how this is implemented.
Treatment of seasonality	► The impact of seasonality on all domestic and roaming services was assessed (when data was provided) based on the monthly evolution of traffic. ► Three alternative seasonality scenarios are included in the model depending on the minimum threshold required between monthly fluctuations and the yearly average to consider that seasonality exists.

Source: Axon, CNECT/2022/OP/0065

The following section further describes the choice of cost standards, general cost allocation, as well as the approach followed to take seasonality into consideration. The full description of the methodological approaches taken by Axon is to be found in the methodological approach document available here.

6.1.2. Choice of cost standards and general cost allocation

The Axon cost model allocates costs related to wholesale roaming services following the so called Long-Run Incremental Cost (LRIC) plus some allocation of joint and common costs (LRIC+). This cost standard can be divided in two parts, essentially the LRIC and the plus (+). LRIC is a way to derive the cost of producing an additional increment of a given output, when assessed over a long period of time (long-run). In economic theory, the long-run means that all inputs relevant to the production of the output are considered variable. The increment refers to the relevant part (service) of interest in the specific situation, here roaming services. The LRIC cost standard encompasses solely the elements needed to provide this specific service. As an illustrative example, the incremental cost of data roaming is therefore the total cost for a fully functioning mobile network minus the cost of an identical network unable to provide data roaming. Accordingly, the LRIC cost standard leaves out any joint and common costs needed in this case for both e.g. data and voice, as only the elements solely linked (i.e. not shared by other services) to data roaming are considered relevant in the LRIC cost standard.

The LRIC+ cost standard allows for including joint and common costs which are relevant for other services as well. Clearly, costs estimated under the LRIC+ cost standard are higher than costs derived under LRIC. However, as these shared elements are also necessary for the relevant service, and in line with the regulatory obligation for the wholesale roaming cap to cover such costs, the Axon Cost model deploys the LRIC+ standard for all services related to roaming. This approach ensures that for shared equipment needed for e.g. data and voice the costs are captured in the estimation. As companies need to recover joint and common costs to ensure long-term sustainability, joint and common costs are shared among the services that generate them and accordingly recovered by any price cap set above the estimated costs for those services.

In contrast, incoming voice (voice termination) is calculated purely on the basis of the LRIC cost standard (pure LRIC), in accordance with the Commission's 2009 Recommendation on Termination Rates, which recommends the estimation of termination rates based on a bottom-up pure LRIC approach ([100]).

6.2. Modelled scenarios

The Axon cost model estimates costs for mobile services under a given set of scenarios. Understanding these scenarios is key to assess the costs produced by the model, as different scenarios produce different results. Furthermore, some scenarios have proven not to

([100]) Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (OJ L 124, 20.5.2009, p. 67–74), available here.

reconcile optimally, so any results obtained through these scenarios should be treated with the utmost caution.

The remainder of this section presents and discusses the various scenarios and highlights the scenarios that do not reconcile. The cover sheet of the cost model allows the user to choose between the scenarios. The scenario chosen will implement a number of calculations within the cost model. All NRAs have received a cost model tailored to the specific country but with similar modules and possibilities for changing the scenarios.

Table 7: List of different Cost Model Scenarios

Scenario	Alternatives	Description
Annualisation criteria	Economic depreciation based on ARPU ([101])	► Revenues act as the modulation factor in economic depreciation
	Economic depreciation based on demand	► Demand acts as the modulation factor in economic depreciation
Roaming increment	Specific roaming increment	► Roaming traffic is grouped in a single increment
	Joint roaming and domestic increment	► Roaming and domestic traffic are assessed within the same increment
Allocation of wholesale specific costs	Allocation based on GB	► Wholesale specific costs allocated to services based on equivalent GB
	Allocation based on drivers	► Wholesale specific costs allocated to services based on equivalent GB/TAPs ([102])
Threshold to identify seasonal patterns	10%	► Areas are considered as seasonal when the traffic in the peak month (net of structural growth) is above the traffic in the average month by 10%
	30%	► …The threshold is set at 30%
	50%	► …The threshold is set at 50%
Demand	Conservative	► Domestic data traffic forecast based on the historic growth rate with a 30% YoY reduction in the annual growth rate

([101]) Average revenue per user.

([102]) Transferred Account Procedure. In order to use GBs and TAPs as the selected regression drivers, services' demand (in terms of minutes, SMSs or MB) needs to be converted into these units. A TAP record is generated for each data session. Therefore, the number of TAP records generated depends on the traffic, measured in MB and the average size of a data session (measured in MB per session).

Scenario	Alternatives	Description
	Base-case	► …Considering a 20% YoY reduction in the annual growth rate
	Aggressive	► …Considering a 10% YoY reduction in the annual growth rate
Allocation of common costs	Common costs allocated based on traffic	► It allocates the common costs of data services between traditional services to end-customers and M2M services by taking into account their split of traffic (volumes of GB)
	Common costs allocated based on customers	► It allocates the common costs of data services between traditional services to end-customers and M2M services by taking into account their split of customers

Source: Axon, CNECT/2022/OP/0065

6.3. Results derived from the cost model

This section shows the results from the Axon cost model, as published together with the full set of materials ([103]). The costs shown below indicate the efficiently incurred costs, as defined in the published materials, of providing regulated wholesale roaming services for the visited network in a specific country. Costs are shown both including and excluding termination and/or transit and each presentation of results must be carefully evaluated to avoid incorrect conclusions.

The results and scenarios shown below do not necessarily reflect the Commission services' preferences and do not need to represent the combination of scenarios that reconciles the best with MNOs' financial and operational reality. The combination of scenarios considered here, represents stakeholders' preferred option for each of the 6 scenarios. Specifically, the results throughout this section are derived under the following assumptions (see *Table 7* for a description of each scenario):

- Annualization criteria 'Economic depreciation based on demand'
- Roaming increment 'Specific roaming increment'
- Allocation of wholesale specific costs 'Allocation based on drivers'
- Threshold to identify seasonal patterns '50%'
- Demand 'Base case'
- Common cost allocation 'Common costs allocated based on traffic'

The unit cost estimates shown in this section in *Figure 14* (for data), *Figure 15* (for voice) and *Figure 16* (for SMS) are the network costs as produced by the Axon cost model under the above-mentioned scenario, without the estimated additional costs for termination and

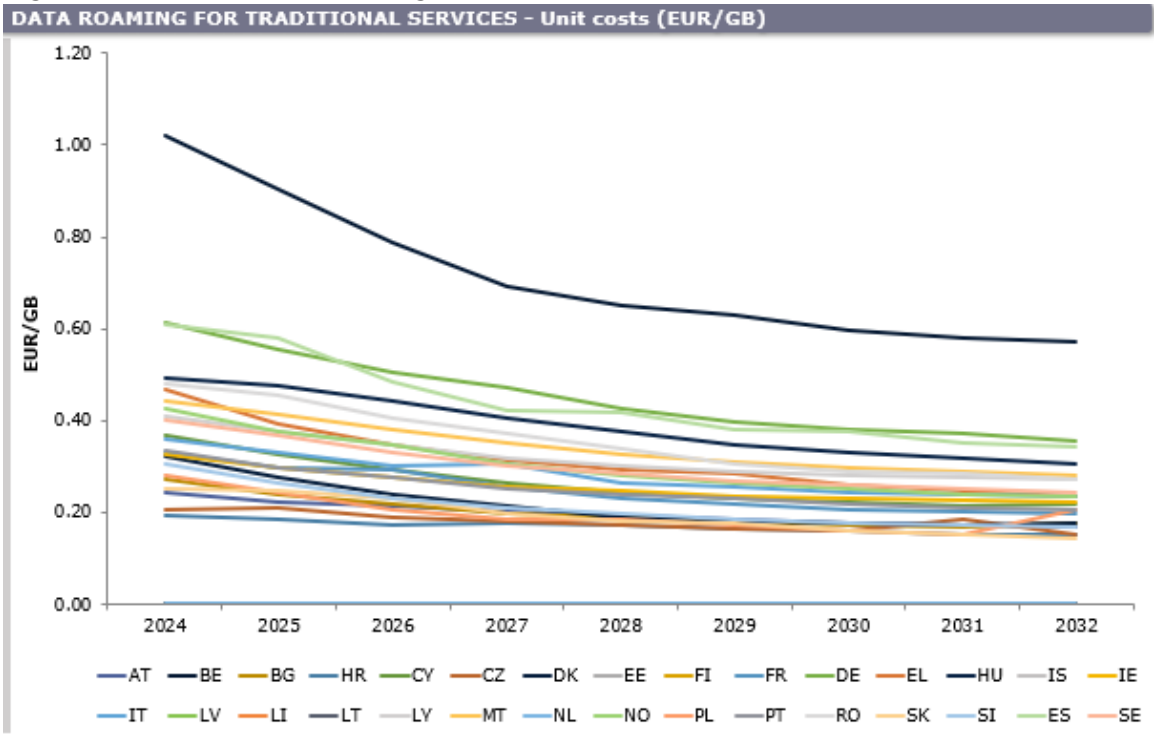
([103]) The "Presentation of results" sheet is available here.

transit. Therefore, these estimates do not show the full costs incurred by the visited operator for providing wholesale roaming services.

The cost model estimates that costs are declining across all countries, ranging between 0.2 and 1 €/GB in 2024, and converging downward to a range of 0.2 to 0.6 €/GB by 2032. The EU/EEA average in 2024 is estimated at 0.4 €/GB, while the average in 2032 is expected to decrease to 0.2 €/GB.

Throughout the entire modelled period, the highest cost of providing data roaming services is observed in Belgium. This is primarily due to lower consumption patterns in Belgium compared to the EU/EEA average, which result in reduced economies of scale and, consequently, higher unit costs for services. Additionally, certain network elements in Belgium have higher unit costs than the EU/EEA average, further driving the overall costs upwards.

Figure 14: Estimated data roaming unit costs in EUR/GB, transit costs not included



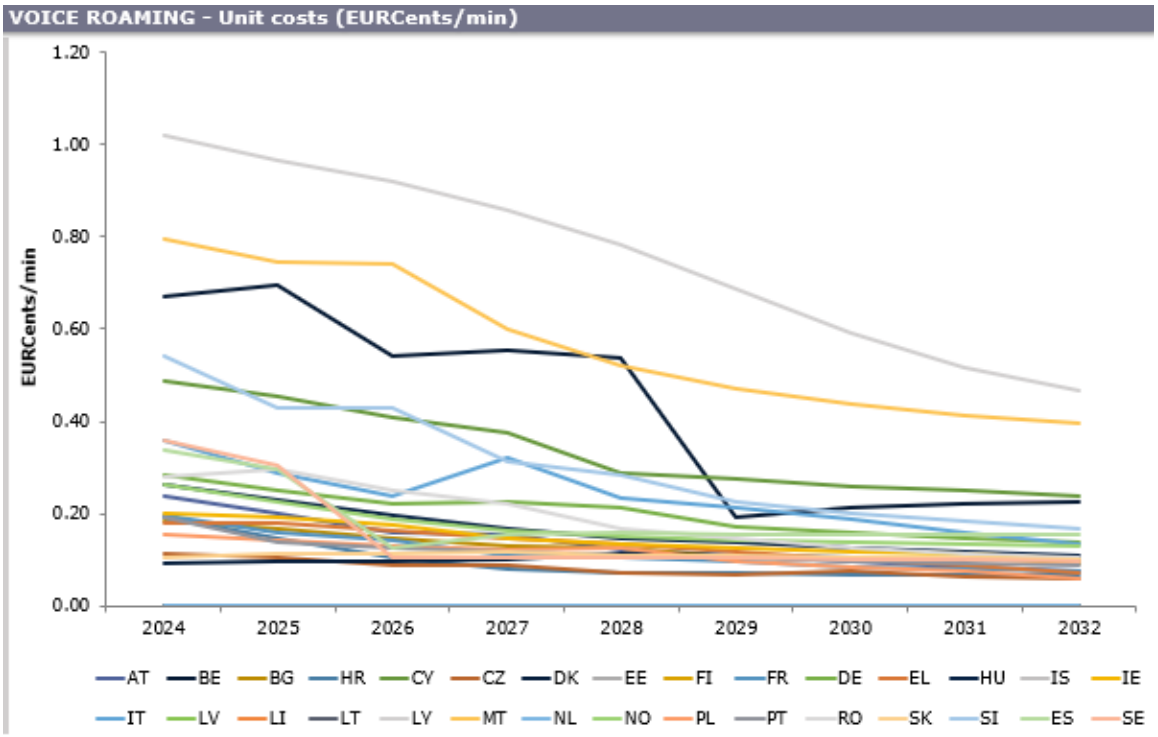
Source: Axon, CNECT/2022/OP/0065

In 2024, voice roaming costs are estimated between 0.1 and 1 EURcents/minute, without including costs of transit and termination (*Figure 15*). Czech Republic and Slovakia display the lowest costs whereas Luxembourg and Malta are the two highest cost countries. The estimated costs for 2032 converge to a range of 0.1 to 0.5 EURcents/minute for almost all countries, with Luxembourg and Malta being the only countries remaining above 0.2 €cents per minute throughout the period.

The higher wholesale cost of providing mobile services in Luxembourg compared to the EU average can be attributed to several factors. As one of the smallest EU countries, Luxembourg's limited market size results in lower economies of scale, driving up unit costs. Additionally, the country faces higher infrastructure costs per user due to its small population and specific geographic and demographic conditions. Similarly, Malta also

experiences limited economies of scale due to its small population, which raises per-user costs for operators. Furthermore, high estimates for Malta are driven by the thickness of walls in Maltese buildings, requiring operators to build and maintain a comparatively larger number of sites than elsewhere seen. Together, these factors contribute to higher wholesale costs in both countries.

Figure 15: Estimated voice roaming unit costs in EURcents/min, transit and termination costs not included



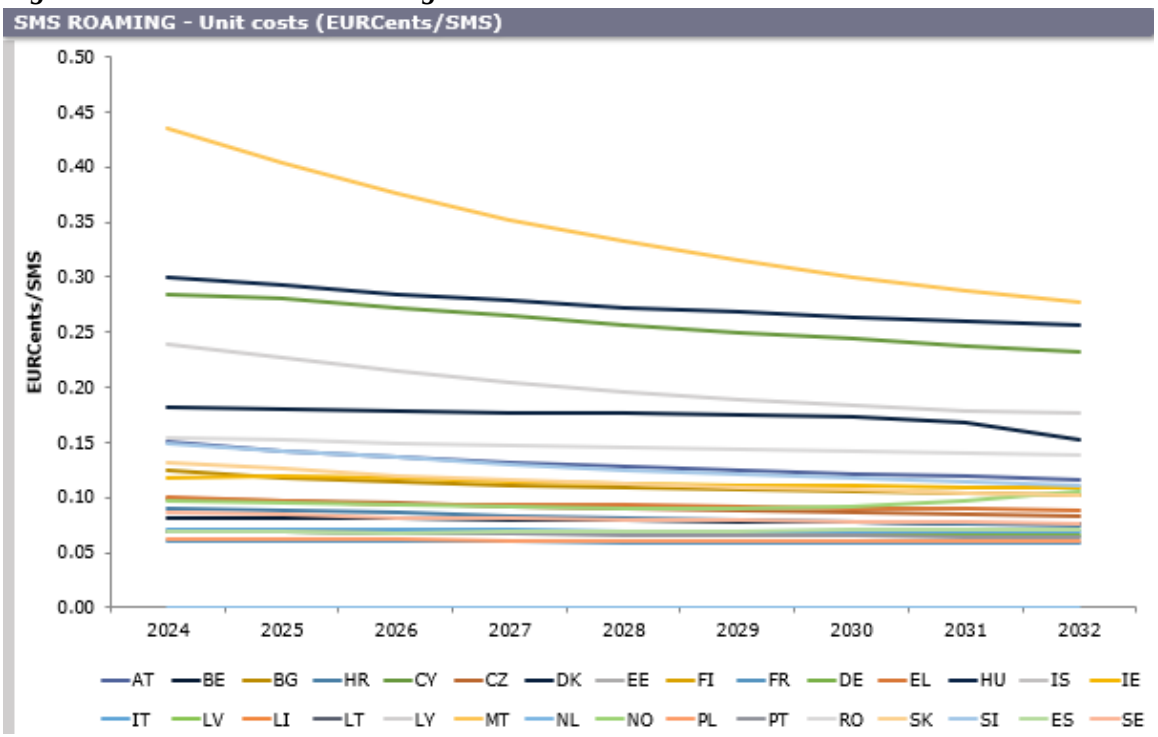
Source: Axon, CNECT/2022/OP/0065

The cost model estimates for wholesale SMS roaming between 2024 and 2032 show a moderate downward trend, but with less significant convergence compared to roaming voice and data. For 2024, unit costs across EU/EEA countries range between 0.05 and 0.44 EURcents/SMS, with the highest costs observed in smaller markets, such as Malta and Luxembourg. By 2032, costs are projected to converge slightly, ranging between 0.05 and 0.28 EURcents/SMS, indicating a reduction in the disparity between high-cost and low-cost countries.

While a few countries display slight downward convergence in costs, the difference between the highest and lowest-cost countries remains notable. The sixfold difference seen in 2024 is projected to decrease by 2032, but less significantly than the convergence observed for roaming voice and data. This stability is likely attributed to the simpler cost structure of SMS services compared to more complex services like voice or data.

In summary, wholesale SMS roaming costs exhibit relative stability and only moderate convergence between 2024 and 2032, with variations across countries reflecting market-specific conditions and economies of scale.

Figure 16: Estimated SMS roaming unit costs in EURcents/SMS



Source: Axon, CNECT/2022/OP/0065

6.4. Estimated total costs including transit and termination.

The Axon cost model estimates network costs incurred by an efficient operator. Accordingly, any additional (non-network) costs incurred by the visited network when providing wholesale roaming services must be considered in order to ensure full cost recovery.

For roaming data services, transit rates must be added to the estimated network costs. For voice roaming, transit and call termination rates must also be taken into account. This is because the visited network is paying the network operator where the call placed by the roaming customer will terminate. For example, a Spanish customer visiting Germany makes a call back to Spain. To complete the call, the German (visited) operator must first originate the call on the German operator's network (cost shown in *Figure 15*) and then transit the call through a number of countries back to Spain where the call is finally terminated at the receiver. The German operator must cover these transit and termination costs; therefore, these costs must be considered to ensure cost-recovery by the German (visited) operator.

As roaming SMS messages are transited without extra costs incurred by the visited network, for the purpose of comparison, no further costs need to be added to these estimates. For this purpose and to illustrate a more complete estimate of the cost of providing roaming voice and data services, this section describes these results of the model including transit and call termination costs.

In the context of termination rates, the Commission has established a union-wide mobile termination rate, of 0.2 EURcent/min as of 2024, pursuant to its Delegated Regulation on

termination rates (EU) 2021/654 ([104]) (the 'Delegated Regulation'). Although the Commission has reassessed the costs associated with providing call termination services as part of its new cost model project, for the purposes of this review, it will rely solely on the currently applicable mobile termination rate, as stipulated in the Delegated Regulation, of 0.2 EURcent/min.

The estimated transit costs used are based on a data collection performed by Axon Consulting and the Commission, where operators provided transit costs incurred in year 2022 and 2023. These calculations are subject to some uncertainty, as not all operators (or even countries) were able to reply to this specific data collection. However, from the reported data available to the Commission services, the following average transit costs have been estimated:

- Transit price for roaming data services, 2023: 0.095 EUR/GB
- Transit price for roaming voice services, 2023: 0.40 EURcents/minute

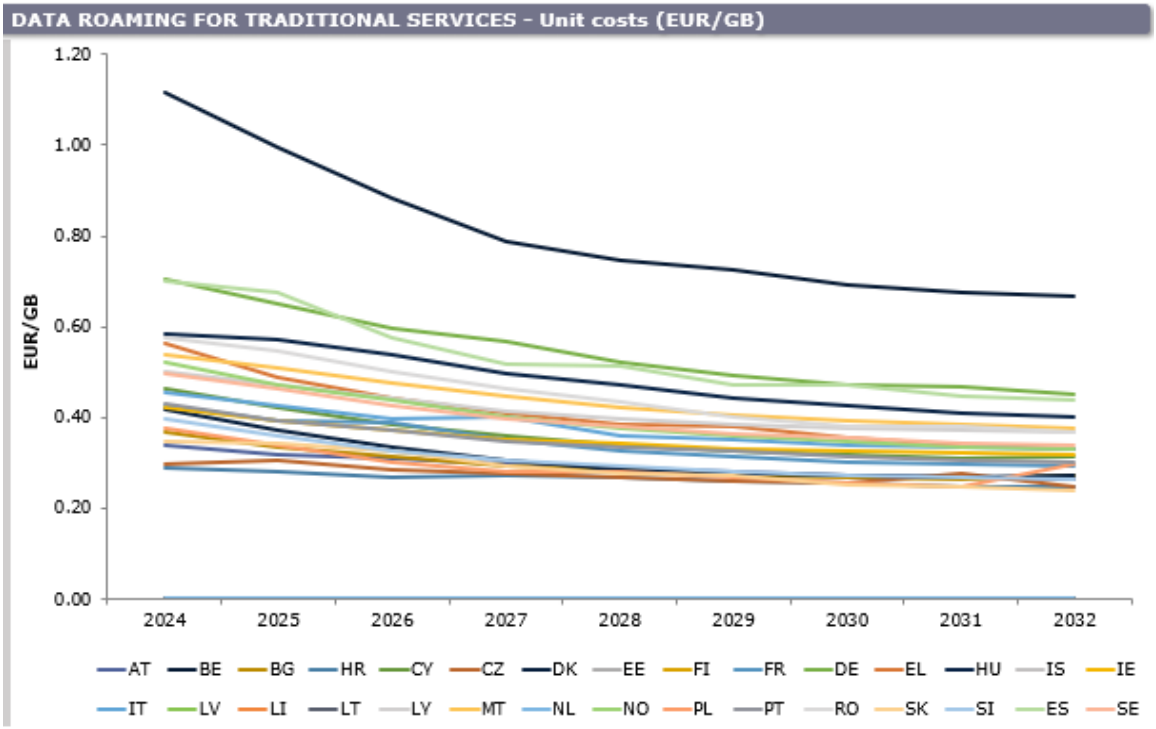
As these estimates are only available for year 2023, these costs are applied to each year under evaluation here. The above transit costs were consulted with operators during the second consultation round in April 2024, where 79% of stakeholders agreed or partially agreed with these estimates. It must be noted that those who disagreed had contradictory views and considered the estimate to be either too high or too low. These differing views were further discussed during the stakeholder workshop, where the Commission services addressed questions and provided clarifications on the methodology. As no compelling evidence was provided to justify an alternative quantification, the estimates were retained as a balanced and pragmatic reference point for the model.

Taking the transit prices as described above into account, the resulting costs of providing wholesale roaming data services are presented in *Figure 14*. The trends observed above still remain, with the range of estimates shifted upwards. Adding the estimated transit costs results in costs between 0.3 and 1 EUR/GB in 2024, converging towards a range of 0.2 and 0.7 EUR/GB in 2032.

The estimated costs in *Figure 17* represent values more accurately displaying how much the visited network must be paid by the visiting network to ensure cost recovery.

([104]) Commission Delegated Regulation (EU) 2021/654 of 18 December 2020 supplementing Directive (EU) 2018/1972 of the European Parliament and of the Council by setting a single maximum Union-wide mobile voice termination rate and a single maximum Union-wide fixed voice termination rate (CDR) (OJ L 137, 22.4.2021, p. 1–9).

Figure 17: Estimated data roaming unit costs in EUR/GB, including transit costs

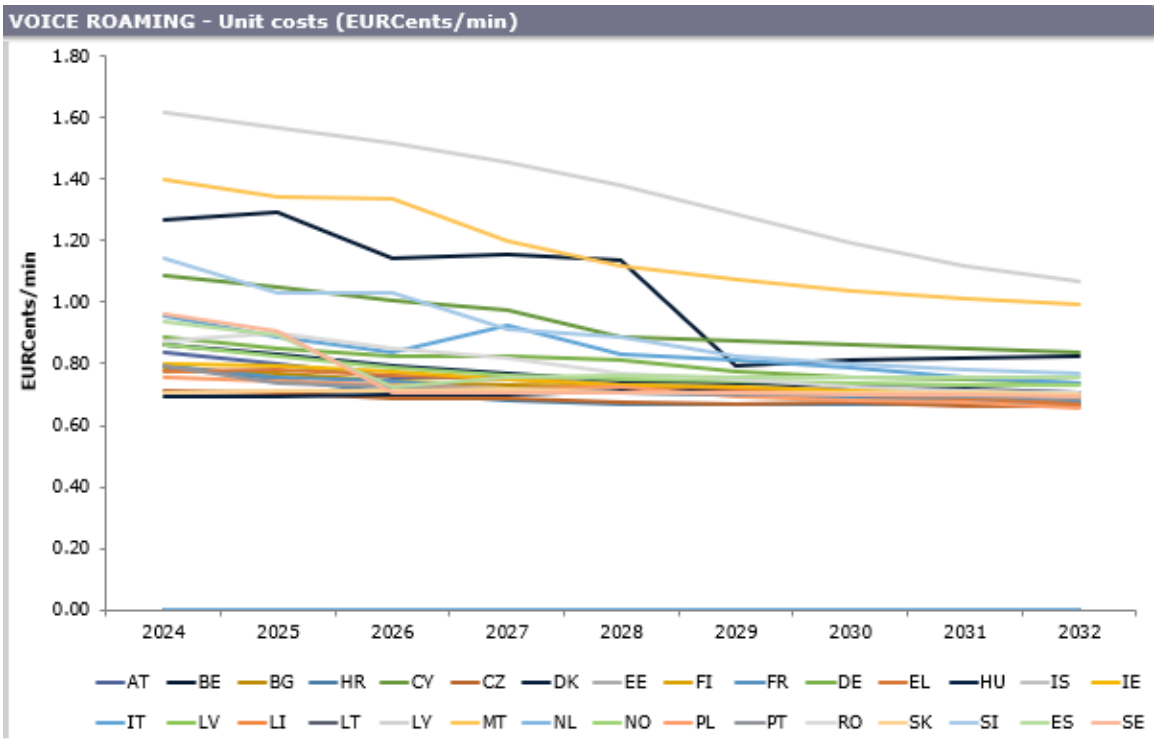


Source: Axon, CNECT/2022/OP/0065

Comparing the unit costs presented in *Figure 17* (i.e. including transit) with the estimates solely from the model in *Figure 14*, it is clear that transit costs contribute significantly to the total costs estimates (in the range of 8% for the highest estimated costs and 33% for the lowest).

For voice roaming services, the additional costs faced by the visited network are transit and termination. The total costs for wholesale voice roaming, including transit and termination, are shown in *Figure 18*. In 2024, costs in all countries were roughly between 0.7 and 1.6 EURcents/min, converging towards a range of 0.6 and 1 EURcents/min in 2032. As was the case in *Figure 16*, almost all countries have seen decreasing estimates of costs, with Luxembourg and Malta maintaining a comparatively high estimate throughout the period.

Figure 18: Estimated voice roaming unit costs in EURcents/min, including transit and termination costs



Source: Axon, CNECT/2022/OP/0065

Regarding voice roaming services, the impact of adding transit and termination is even more significant than for data. Compared with *Figure 15*, it is clear that transit and termination costs significantly increase the estimated costs faced by the visited operator. In *Figure 18*, costs estimates ranging between 0.1 and 0.6 EURcents/min were presented, illustrating the significant impact of an additional 0.6 EURcents/min to the total cost.

For the reasons outlined and described above, transit and termination costs must always be included, whenever assessing the total costs faced (and to be recovered) by visited operators for hosting roaming customers from abroad on their network.

6.5. Impact of 5G

The cost model demonstrates that the implementation of 5G has led to a significant decrease in unit costs for the efficient operator. The model shows that the average unit cost per GB has decreased by 60-70% over the 10-year period, from EUR 0.10-0.20 in the pre-5G era to EUR 0.02-0.05 in the 5G era. This decrease in unit costs is driven by the improved network efficiency and capacity utilization enabled by 5G, as well as the increased adoption of software-defined networking and network functions virtualization.

The cost model suggests that the implementation of 5G has been a key driver of the decrease in unit costs, and that the efficient operator has been able to take advantage of the improved network efficiency and capacity utilization to reduce its costs. The model also suggests that the operator's investment in 5G has been a sound one, as it has enabled the operator to reduce its costs and improve its profitability.

Overall, the cost model demonstrates that the implementation of 5G has had a positive impact on the efficient operator's cost structure, leading to a significant decrease in unit costs and improved profitability. The model provides a clear and compelling case for the adoption of 5G and suggests that operators who invest in 5G will be able to reduce their costs and improve their competitiveness in the market.

6.6. BEREC opinion on the cost model and estimates

In its Opinion, BEREC provided analysis regarding the relation between wholesale prices and costs. BEREC's analysis involves comparing current and estimated wholesale costs and wholesale caps for the relevant roaming services. The analysis combines estimates from the Axon cost model with estimates for transit and termination costs, using the best available estimates of the full range of costs implied in the provision of wholesale roaming services. These results are then compared with the wholesale price caps set out in the Roaming Regulation and the reported actual charges operators apply for all roaming services. This comparison is made separately for unbalanced traffic and total traffic.

BEREC concludes that for roaming voice services, the price caps established by the 2022 Regulation adequately cover the wholesale costs for providing roaming voice calls, with a sufficient margin to allow for potential further reductions in the price cap.

Regarding roaming data services, BEREC notes that the data price cap is higher than all Axon cost calculations for all 23 countries for all modelled years, with the exception of Belgium, where the maximum data unit costs are close to the price caps for the years 2026-2032. BEREC also observes that the actual unbalanced rates and costs are generally in line, with the average EEA unbalanced rate being almost equal to the average EEA maximum cost in 2023, and the average EEA maximum cost being 12% higher than the average EEA unbalanced rate in 2024.

BEREC highlights that there are some cases where unit costs are higher than the price cap. For example, in Luxembourg, the costs of voice roaming are higher than the wholesale price cap for 2022 and 2023, although only in 36 out of 72 scenarios. Similarly, in Malta, the unit cost for roaming SMS services is always higher than the price cap for all scenarios considered in the model. Furthermore, Belgium's costs of data roaming services are very high compared to those of other Member States and are close to the price cap for the whole period 2022-2032.

BEREC considers that further reductions in wholesale roaming caps have been an effective and transparent tool for fostering fair competition and ensuring sustainable conditions for RLAH, particularly for MVNOs. However, it also notes that lower wholesale caps can create new challenges. For instance, in the case of open data bundles, operators may be obliged to offer higher data volumes, which could potentially undermine the long-term sustainability of RLAH offers.

In light of this, BEREC recommends that the setting of wholesale caps should be based on the most representative cost scenario, while excluding outliers where appropriate. This approach would allow for a reasonable margin that enables both competition and offer differentiation. To avoid a situation where wholesale caps fall below actual cost levels,

BEREC proposes the introduction of a sustainability mechanism at the wholesale level. Such a mechanism would provide for a targeted derogation for MNOs who can demonstrate, with substantiated evidence, that they are unable to offer wholesale roaming services within the cap due to higher network costs. While acknowledging that outlier costs may be excluded from the cap-setting process, BEREC emphasizes that any derogation should be strictly limited to exceptional cases.

7. COMPETITION IN WHOLESALE ROAMING MARKETS

7.1. Evolution of wholesale (inbound) roaming volumes: inbounder and outbounder countries

The impact of RLAH on operators can vary markedly depending on the traffic flows of the given operator's customer base and time of the year. Based on its traffic flows, an operator can be classified as an outbounder or inbounder operator.

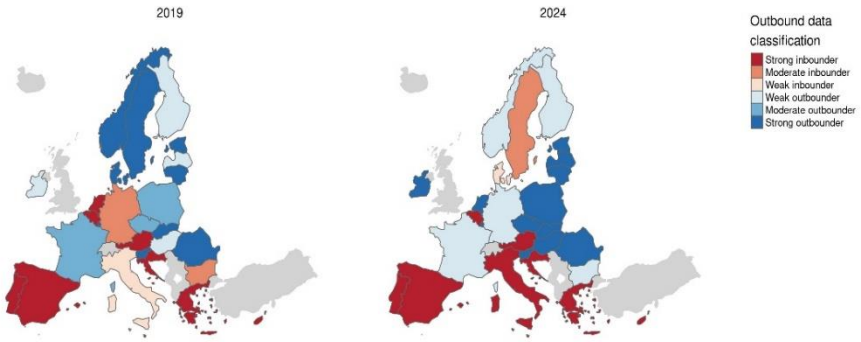
An outbounder operator has a customer base which consumes more mobile services abroad (i.e. on the networks of partner operators in other EU/EEA countries), than those consumed by the partner operators' customer base on its own network. Conversely, an inbounder operator has a customer base which consumes less mobile services abroad than those consumed by the partner operators' customer base on its own network. The analysis below looks at the impact of the introduction of RLAH on outbounder and inbounder countries separately. Due to tourist flows, typically, operators in Northern European countries are net outbounder operators of roaming traffic.

Based on the data gathered for the BEREC's International Roaming Benchmark Reports, the following figures show the relation between inbound and outbound traffic, for data - inbounder and outbounder countries (*Figure 19*), for voice - inbounder and outbounder countries (*Figure 20*). Inbounder (resp. outbounder) countries are defined as countries whose total inbound roaming volume is greater (resp. smaller) than the total outbound roaming volume since the first year of RLAH (2017).

For data services, in 2019, southern European countries like Portugal, Spain, Greece and Croatia, were strong inbounders, reflecting their role as key destinations for inbound data traffic. Meanwhile, northern and eastern European countries, such as Poland and the Baltic States, were primarily strong or moderate outbounders, reflecting higher outbound data usage. Central Europe showed a mix of inbound and outbound roles, reflecting balanced traffic patterns.

By 2024, eastern Europe strengthened its role as strong outbounder, with increased outbound data roaming activity. Southern Europe, particularly Spain and Greece, remained key inbounders, though their intensity slightly decreased. Central European countries shifted toward weak outbound roles, indicating a rebalancing of traffic dynamics. For data services, 10 out of the 27 countries (AT, BE, CY, EL, ES, HR, IT, MT, PT, and SE) included in the exercise (i.e. the 27 EU Member States plus Norway) are net inbounders of roaming data traffic, 13 are net outbounders (CZ, EE, HU, IE, LT, LU, LV, NL, PL, RO, SI and SK) while the remaining 6 (BG, DE, DK, FI, FR, and NO) are without clear outbound/inbound pattern.

Figure 19: Data services, classification of inbound/outbound countries based on net outbound roaming data volumes.

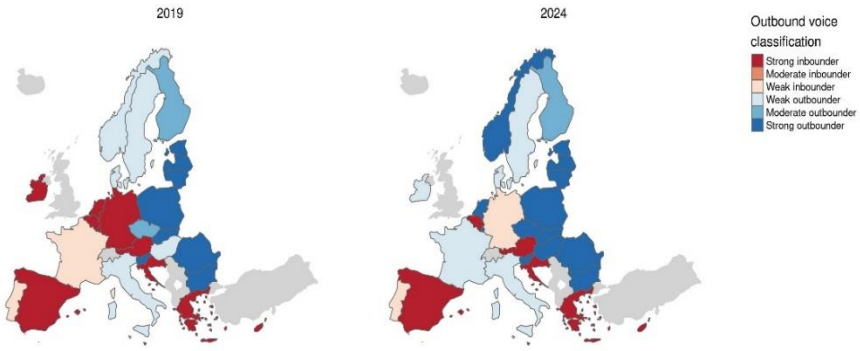


Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

Between 2019 and 2024, there have been noticeable shifts in inbound and outbound roaming classifications for voice services across Europe. In 2019, many western and southern European countries, such as Germany, Italy, and France, were classified as strong or moderate inbounders, indicating they were key receivers of inbound roaming traffic. Conversely, northern and eastern Europe displayed a mix of moderate inbound and outbound classifications.

By 2024, there is a marked shift towards stronger outbound classifications in northern and eastern European countries, such as Poland and the Baltic States. At the same time, southern European countries like Spain and Greece have maintained their strong inbound roles, though some areas show reduced intensity. Notably, France and Germany transitioned to more balanced traffic levels. For voice services, 9 (AT, BE, CY, DE, EL, ES, HR, MT, and PT) out of the 26 countries providing the data (i.e. the 25 Member States plus Norway) are net inbounders of roaming voice traffic, 13 countries (EE, FI, HU, IE, LU, NL, NO, LT, LV, PL, RO, SI and SK) are net outbounders while the remaining 4 are without clear outbound/inbound pattern (DK, FR, IT, and SE).

Figure 20: Voice services, classification of inbound/outbound countries based on net outbound roaming voice volumes.



Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

The analysis of both voice and data roaming services between 2019 and 2024 highlights a clear shift in traffic dynamics across Europe. Northern and eastern European countries have increasingly taken on stronger outbound roles, reflecting higher outbound activity for both voice and data services. Conversely, southern European countries, particularly Spain and Greece have remained dominant inbounders, although with some reductions in intensity over time. Central Europe has shown a rebalancing, transitioning towards more moderate roles in both inbound and outbound classification.

Figure 21: Inbounder and outbounder EEA countries (2019 vs 2024)



Source: JRC calculations based on BEREC BMK data

7.2. Evolution of wholesale prices

7.2.1. Wholesale roaming prices have been steadily decreasing

When a customer from a visiting operator roams on the network of a visited roaming partner operator in another EU country, the visiting operator needs to pay charges to access the network of the visited operator, the so-called wholesale roaming charges. The introduction of RLAH was accompanied by considerable reductions in maximum regulated wholesale roaming prices and appears to have triggered further reductions in actual wholesale roaming prices.

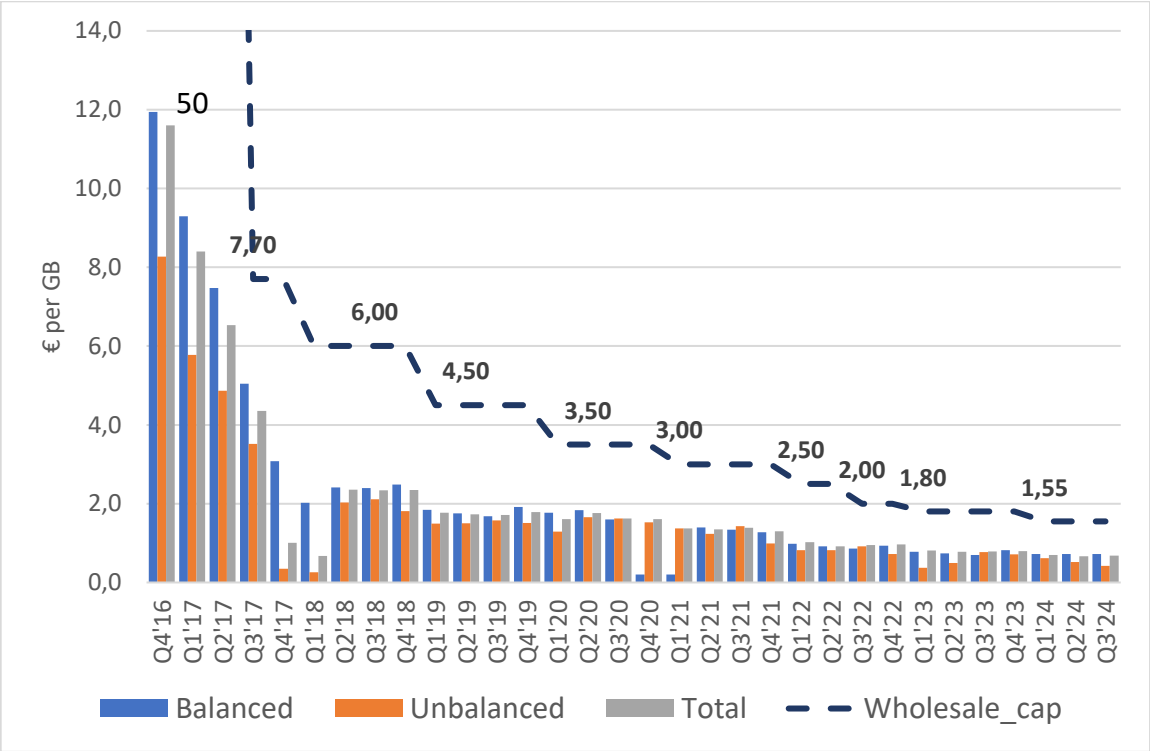
The average EEA wholesale roaming price for data services, after the sharp drop following the implementation of RLAH in 2017, remained relatively stable between 2018 and 2021. However, it began decreasing in 2021, coinciding with the reduction in the regulated price cap. The price further declined between 2022 and Q3 2024 due to the next step in the regulated glide path (*Figure* 22). Specifically, the average wholesale price for data fell from 1.7 EUR/GB in Q1 2019 ([105]) to 0.7 EUR/GB in Q1 2024, representing a decrease of nearly 60%.

As demonstrated in the figure, wholesale prices for net outbound (unbalanced) roaming traffic were even lower, with rates at 0.6 EUR/GB in Q1 2024 compared to 1.5 EUR/GB in Q1 2019, a reduction of 40%. The wholesale prices actually applied throughout the

([105]) The Roaming Regulation has been previously reviewed in 2019.

observed period were more than 50% lower than the regulated wholesale roaming caps, resulting in a difference of nearly 76% in Q3 2024 ([106]).

Figure 22: Data services: development of the average wholesale roaming rate for data in the EEA, Q4 2016 to Q3 2024



Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

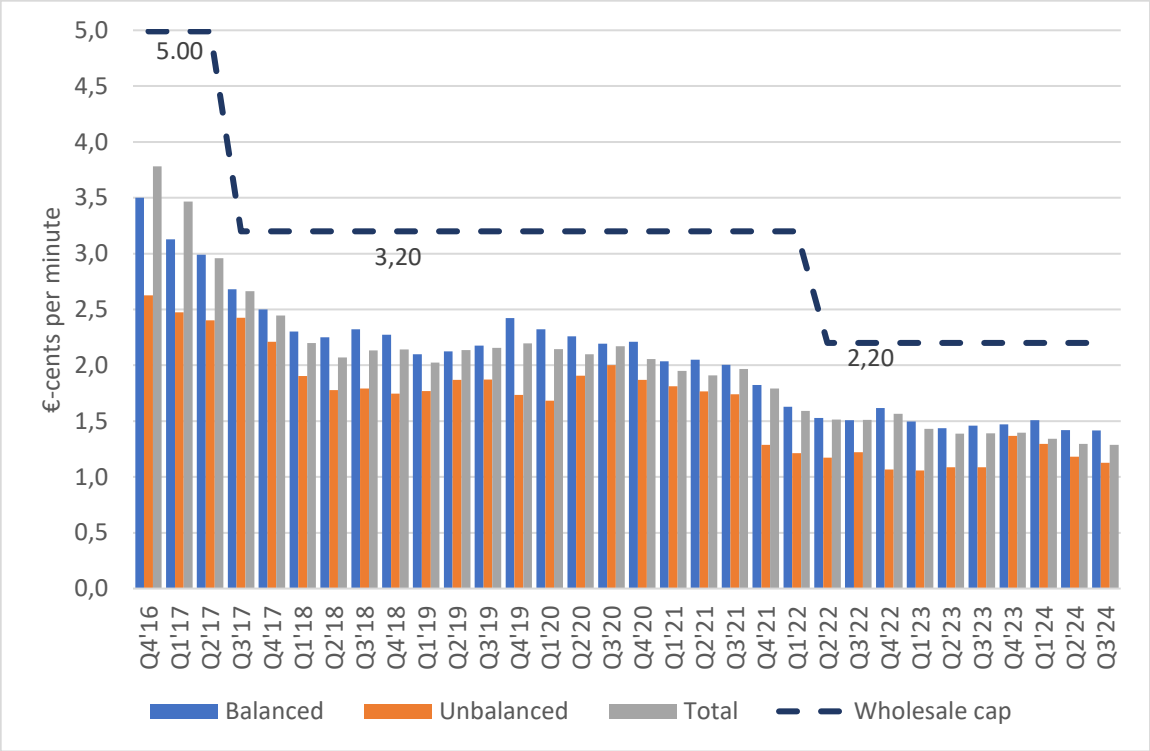
The average EEA wholesale roaming price for voice services shows a decreasing trend (*Figure* 23). The average wholesale roaming price for outgoing voice traffic fell from 2.02 EUR cents/min in Q1 2019 to 1.34 EUR cents/min in Q1 2024, representing a decrease of 34%. Wholesale prices for net outbound (unbalanced) roaming traffic—which refers to the portion of roaming traffic generating net payments from one operator to another—are even lower, showing a decrease of 27% (from 1.77 EUR cents/min in Q1 2019 to 1.29 EUR cents/min in Q3 2024).

Similarly to the data services, throughout the observed period, the actual applied wholesale roaming prices were approximately 50% lower than the regulated wholesale voice roaming cap imposed by the Roaming Regulation. Furthermore, the decline in applied wholesale prices corresponds to the decrease in wholesale caps from Q2 2022, with actual applied prices remaining around 50% lower than the wholesale caps in Q3 2024 ([107]).

([106]) In 2024 the wholesale roaming data cap was 1.55 EUR/GB and the average price charged in Q3 2024 was 0.68 EUR/GB.

([107]) In 2024 the wholesale roaming voice cap was 2.2 EURcent/min and the average price charged in Q3 2024 was 1.29 EURcent/min.

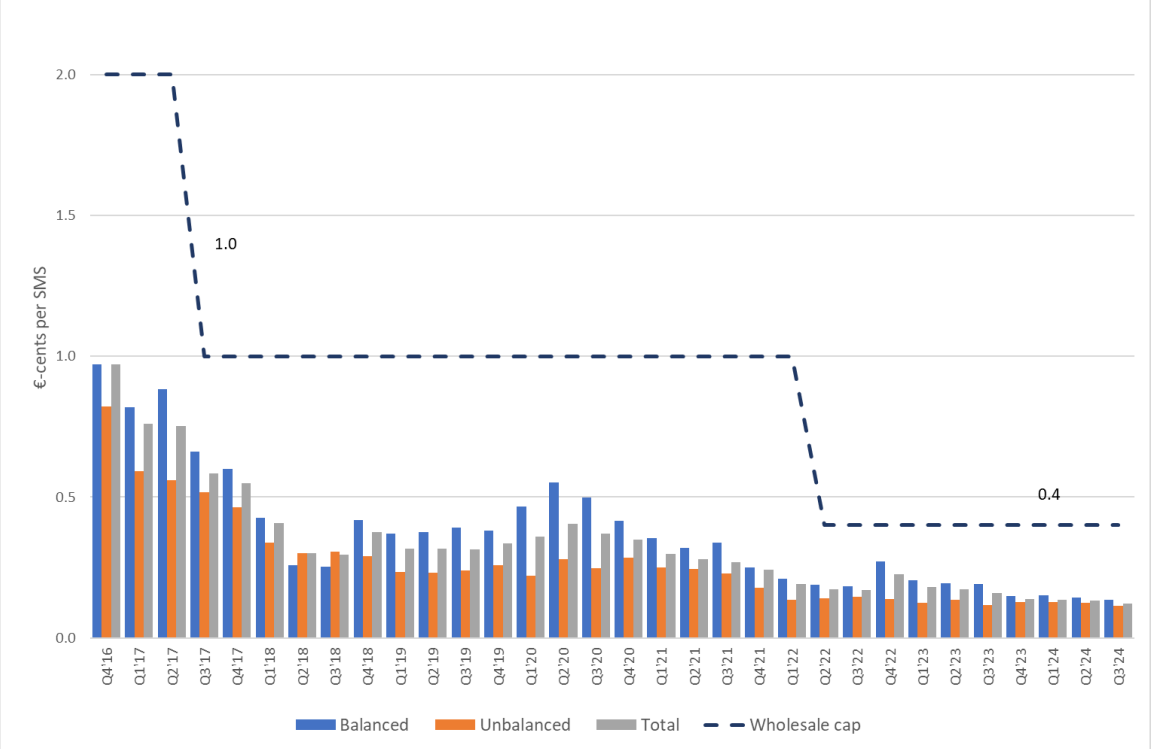
Figure 23: Voice services: development of the average wholesale roaming rate for voice in the EEA, Q4 2016 to Q3 2024



Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

For wholesale SMS roaming services (*Figure* 24), total costs dropped significantly during the initial years of RLAH. Between 2017 and 2021, the actual prices paid for wholesale SMS roaming decreased by 75% (from 0.76 EUR cents/SMS in Q4 2016 to 0.19 EUR cents/SMS in Q4 2021). Prices continued to decline, reaching 0.12 EUR cents/SMS in Q3 2024, with the difference between the actual prices applied and the regulated wholesale roaming cap remaining around 85%.

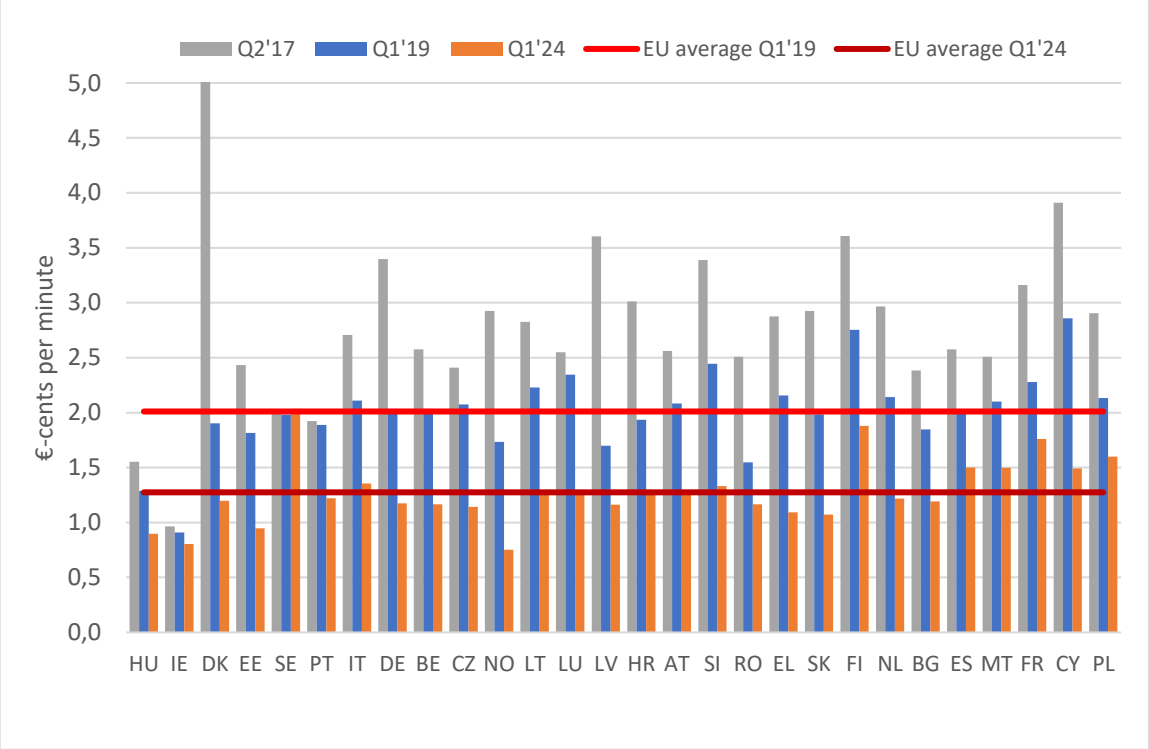
Figure 24: SMS services: development of the average wholesale roaming rate for SMS in the EEA, Q4 2016 to Q3 2024



Source: Data collected for the 19th – 30th International Roaming BEREC Benchmark Reports. JRC calculations

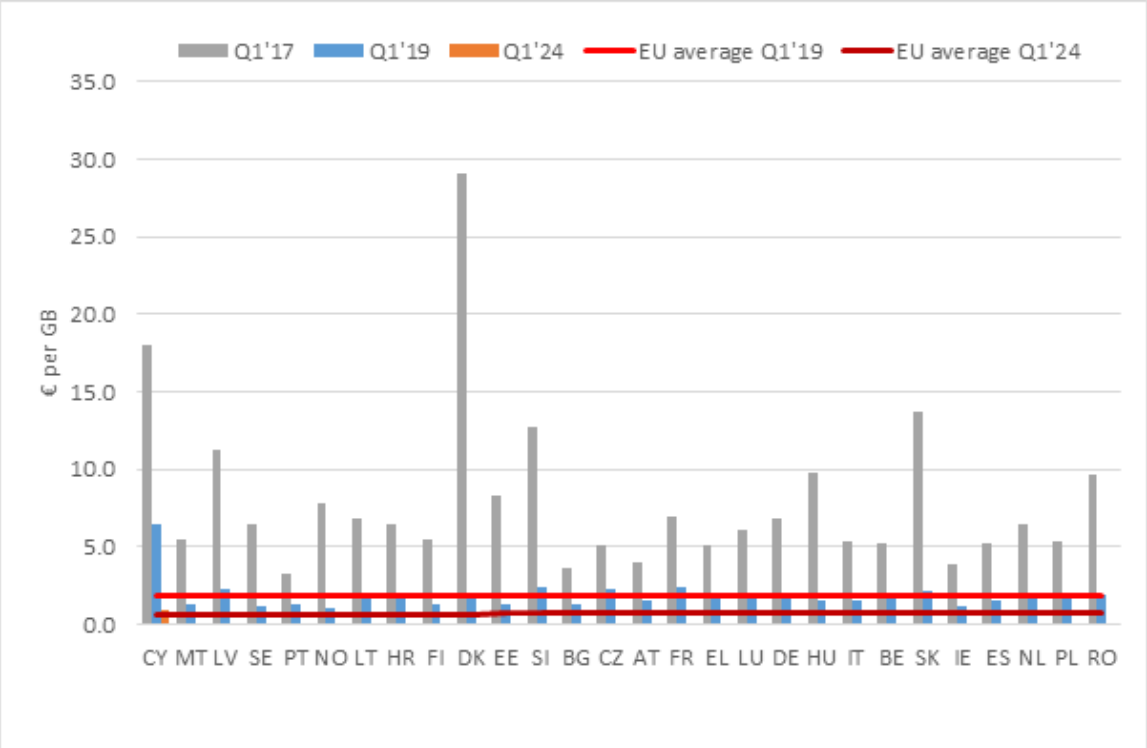
The decline in wholesale roaming prices is observed in all Member States (*Figure 25* and *Figure 26*), showing the last quarter before RLAH, Q2 2017, and the last quarter available, Q3 2024). This decline is determined mainly by two factors. First, new (and, for data, annually decreasing) maximum wholesale roaming prices laid down in the Roaming Regulation have acted as much lower ceilings on prices, triggering competitive market dynamics between operators offering wholesale roaming access below those ceilings. Second, the introduction of RLAH has resulted in significant increases in roaming volumes (as shown in *Section 5.1.1*), thereby fuelling further competition in wholesale roaming prices.

Figure 25: Voice services: average wholesale roaming rate for voice in the Member States, Q2 2017, Q1 2019 and Q1 2024



Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

Figure 26: Data services: average wholesale roaming rate for data in the Member States, Q2 2017, Q1 2019 and Q1 2024



Source: Data collected for the 19th – 31st International Roaming BEREC Benchmark Reports. JRC calculations

The decreasing wholesale roaming prices have had considerably positive impact on the market dynamics. Firstly, lower wholesale roaming prices have greatly mitigated any potential impact from the introduction of RLAH on outbounder operators (See *Section 7.1*), as they have contributed to reduce their wholesale roaming payments and therefore increased sustainability of RLAH. Secondly, such reductions, together with the fact that average wholesale market prices have been below the regulated maximum wholesale tariffs, confirm that net inbounder operators have been able to meet the increasing demand in roaming services, while at the same time recover the cost of their network investments, including the cost of capital. Thirdly, such reductions in wholesale roaming prices are a sign of a better functioning internal market at wholesale level, at least as regards a significant share of bilateral relationships between operators. The impossibility to maintain excessive prices for retail roaming services on the various national markets, combined with the release of pent-up demand through the application of RLAH at retail level, appears to have played a positive role in that regard. These market dynamics are going in the positive direction and the Commission will continue to monitor their developments also in view of the evolving and changing telecommunications landscape.

7.2.2. Situation of MVNOs

An MVNO, operates without owning a radio access network in the country or countries where it provides services. Consequently, an MVNO cannot accommodate roaming traffic from foreign MNOs in exchange for the roaming traffic it sends to those MNOs. Instead, MVNOs must purchase outbound roaming traffic generated by their customers abroad at wholesale rates, without the ability to trade or exchange this traffic for inbound roaming traffic.

This structural difference places MVNOs in a distinct position from MNOs when negotiating wholesale roaming access, as noted by BEREC in its Opinion as well as its previous opinions (2019 and 2021). These challenges contribute to MVNOs' difficulty in competing with MNOs. The primary reason lies in their reliance on MNOs for network access, both domestically and internationally. Additionally, due to their typically smaller size, MVNOs often lack significant purchasing power and do not have access to significant volume-based discounts.

Compared to MNOs, MVNOs have weaker negotiating power to conclude bilateral wholesale agreements with MNOs. Hence, many MVNOs are constrained to paying wholesale prices at regulated caps. In BEREC's recent call for input to NRAs in September and October 2024, concerns were raised by MVNOs regarding the current operation of the wholesale market, particularly in anticipation of future trends. They point out that MVNOs, as buyers without reciprocal arrangements, frequently face charges close to the regulated price caps.

While the Commission acknowledges these trends, the available data is not sufficient to bring full understanding of the issue. The annual BEREC benchmark data collection lacks sufficient data as less than 25% of MVNOs report information on the lowest and highest

prices paid, with only approximately 1% reporting data on the lowest and highest prices charged.

8. QUALITY OF SERVICE (QOS)

RLAH means that roaming customers should be able to use their mobile services on the same conditions also when roaming in the EU/EEA without additional charges, i.e. the same service abroad for the same price. QoS ([108]) is an integral part of the product whose price is regulated. The CIR, in its Article 3 (2), lays down that any fair use policy applied by a roaming provider shall ensure that all such roaming customers have access to regulated retail roaming services at domestic price during periodic travel in the Union under the same conditions as if such services were consumed domestically.

In the Impact Assessment ([109]) to the Roaming Regulation, the Commission demonstrated the need to introduce rules to ensure that operators can provide roaming services with the same QoS and that their wholesale roaming access is not limited by the access givers. It would further enable home operators to access the same network generations that they offer domestically and hereby tackle also the issue of some M(V)NOs only being granted access to 3G services ([110]). This new measure was supported by BEREC ([111]).

The Roaming Regulation lays down QoS obligations at both retail and wholesale levels. At retail level, roaming providers have to ensure that roaming customers at least have the same quality of their roaming service as they normally have at home, when this is technically feasible. At wholesale level, visited operators have to ensure that all reasonable wholesale access requests are met and that a wholesale access seeker is given access to all technologies and networks in order to be able to provide the QoS level that they normally provide their customers at home. The wholesale level obligation ensures that visited operators do not limit wholesale access to certain networks or technologies. With the increasing 5G coverage and deployment, it is expected that the current discrepancies in QoS between domestic and roaming services will disappear. The Roaming Regulation foresees a level of flexibility for roaming services to catch up with gradual technological developments.

([108]) Beyond the intrinsic performance of the mobile network itself, there are multiple factors, influencing the QoS, and in particular the data speed, experienced by an end-user at a specific location and a specific point in time (e.g. network capacity solicited by other users simultaneously, particular end-user equipment used, meteorological conditions). On any given network, the QoS may vary across end-users and time, be they local or roaming end users.

([109]) SWD(2021) 28, Commission Staff Working Document Accompanying the Proposal for a Regulation of the European Parliament and of the Council on roaming on public mobile telecommunications networks within the Union (recast), 24.02.2021.

([110]) SWD(2021) 28, Commission Staff Working Document Accompanying the Proposal for a Regulation of the European Parliament and of the Council on roaming on public mobile telecommunications networks within the Union (recast), 24.02.2021, p. 39.

([111]) BEREC Opinion on the proposal of the Commission for amending the Roaming Regulation BoR (21) 59, p. 2.

8.1. QoS Study

The QoS that the roaming users enjoy compared to their home network performance and the visited network's domestic performance was assessed and evaluated via a dedicated study, which involved specific QoS measurements (including download (DL) and upload (UL) speeds, latency, user experience, etc.) across several Member States and using SIM cards from different mobile operators. The study covered 20 countries ([112]). The results showed that the roaming regulation does not have yet the desired effect, as far as the specific requirements for QoS are concerned.

It is important to emphasize that this is the first study of its kind on QoS within the context of the RLAH regime. All the findings presented below should be carefully evaluated and will be closely monitored by the Commission.

Table 8: Roaming performance according to Download (DL) and Upload (UL) speeds KPI

	DL speed	**UL speed**
Comparison with the home network		
Roaming performance worse	76%	63%
Roaming performance better	7%	7%
Roaming performance at the same level	17%	30%
Comparison with the visited network		
Roaming performance worse	80%	68%
Roaming performance better	6%	8%
Roaming performance at the same level	14%	24%

Source: QoS Study conducted by the Commission ([113])

When it comes to **download (DL) speed**, in more than 3 out of 4 cases (76%) of the tests performed showed that the roaming end-users do not enjoy the same performance as they do on their home network. The same behaviour was exhibited when comparing the roaming end-user DL speed to the DL speed experienced by the visited network's end-users: performance was poorer in 80% of the test cases. The opposite results, i.e., roaming end-users outperforming in terms of DL speed their home network, or the visited network were apparently significantly less: 7% for the former and only 6% for the latter. In the rest of the cases, DL speed for the roamer was at the same level (within a range of ± 10%) with the home (17%) or the visited network (14%).

The same trend – with a slight improvement for end users – was also exhibited when testing the **upload (UL) speed**: in 63% of the tests, the roaming user's upload speed was lower

([112]) France, Luxembourg, Belgium, Netherland, Germany, Sweden, Finland, Latvia, Poland, Czech Republic, Austria, Slovakia, Hungary, Croatia, Romania, Bulgaria, Greece, Italy, Spain and Portugal.

([113]) Not published yet. Reference number: EC-CNECT/2024/OP-0084.

than the home network upload speed, in 7% better and in 30% at the same level. Compared to the visited network, the performance was worse in 68% of the cases, better in 8% and at the same level 24%.

In the vast majority of the cases where roaming performance was poorer than the home, it was also poorer than the visited network (84% for DL speed, 78% for UL speed and 91% for latency). This is the worst scenario for an end user, where the roaming performance is poorer than the home network, even though the visited network could offer better performance.

With minor exceptions, **latency** also exhibits a degradation (i.e., it increases) while roaming (92% of the test cases compared to the home network and 90% compared to the visited network). The same behaviour stands also true for internet browsing. However, it should be noted that the increased latency values for roaming end users can at least partially be attributed to the home routing configuration, where all data traffic is routed back to the end users home network before being delivered at the handset.

The availability of the 5G network to roaming end users was at a "good" but not "perfect" level: in over 70% of the test instances roamers were registered in 5G networks.

Finally, data from tests performed show that **handover between mobile networks** across borders remains inconsistent, with some regions experiencing significant delays in network reconnection, exceeding 10 minutes to re-establish service.

8.2. Consumer perspective

The most recent BEREC BMK data shows that access seekers still encounter issues with gaining wholesale roaming access to all technologies. Similar problems were reported by some stakeholders, in particular MVNOs, also during the previous review of the Roaming Regulation. The improved wholesale roaming access rules should help to facilitate such problems. Further monitoring will be necessary to assess the full effects of the new rules. At wholesale level 20% of access seekers have experienced problems with gaining access to 5G technologies and 14% have encountered problems when it comes to 4G technologies. 10% have encountered implementation problems with 5G and 30% with 5G standalone.

At retail level 72% of respondents confirm that they offer 5G technologies to their roaming customers, while 20% offer 5G standalone. The corresponding number is 100% for 4G roaming.

In the 2023 Review Report ([114]), the Commission presents detailed findings on QoS from the consumer perspective. According to the findings of the Eurobarometer survey approximately one in four consumers have experienced lower quality of their roaming service than what they usually have at home, such as lower speed and different network generation. The more recent Eurobarometer 560 shows that 34% of the respondents who had travelled in the past two years (11% of total respondents to Eurobarometer) have experienced lower mobile internet speed compared to what they usually have domestically.

([114]) SWD(2024) 8, Commission Staff Working document on the findings of the 2023 periodic review of the rules on roaming fair use policy and the sustainability derogation laid down in the Commission Implementing Regulation (EU) 2016/2286 of 15 December 2016.

32% of the respondents have experienced a lower broadband standard compared to domestically.

The Roaming Regulation lays down detailed rules on transparency measures to ensure that end users are informed about their roaming services and can make informed choices about their roaming usage. Roaming providers have to give their customers clear and comprehensible information on the conditions and the quality of the roaming service when roaming. In addition, roaming providers shall publish information about the reasons why the roaming service is potentially offered under conditions that are less advantageous than those offered domestically. That information shall include factors that can have an impact on the quality of the roaming service to which the roaming customer subscribes, such as network generations and technologies available to the roaming customer in a visited Member State. The latest BEREC BMK data shows that 53% operators inform their customers about the difference between the network technologies and generations available when roaming. Even less, only 45% of the operators provide their customers with information about QoS while roaming.

These findings show that roaming customers are not adequately informed about their service when roaming. The implementation of these obligations requires further monitoring and supervisions by the NRAs. This is particularly important taking into account the identified issues with regard to considerably lower levels of QoS when roaming than compared to domestic QoS, as described in section 8.1.

8.3. BEREC Opinion

BEREC anticipates that as 2G and 3G technologies are phased out and 5G adoption becomes more widespread the number of subscribers able to access 5G while roaming will increase. Simultaneously, the proportion of domestic tariffs without 5G services is expected to decline. 5G Standalone (SA) is expected to be the next evolutionary step, gradually becoming available on networks that have fully implemented this technology and for users with subscriptions that allow domestic access to a 5G SA network.

BEREC considers that the QoS obligation set out in Article 4 of the Regulation is a fundamental component of the RLAH regime, constituting an essential element in empowering end-users and fostering the development of the internal telecommunications market. Consequently, BEREC supports maintaining the current obligations without amendments. Because NRAs have received next to no consumer complaints on roaming QoS, BEREC considers that the rules are effective. However, the Commission QoS study indicates that there are in fact identified issues. Consumers may be less inclined to take action in case of QoS variations, or they may be less sensitive to such variations as long as they can still access and use their services even when the overall QoS is not as good as domestically. Nevertheless, it is necessary to explore the underlying reasons for the lower roaming QoS. BEREC also notes that there are not any end-user complaints regarding systematic or unreasonable delays in handover between networks at internal Union border crossings. Finally, QoS does not seem to be a problematic issue at the moment for M2M services, but it is envisaged that demands for QoS requirements will increase in the future.

8.4. Conclusion on QoS

The assessment of the roaming performance and the implementation of the QoS obligations clearly show that there is room for improvement towards the goal of achieving similar QoS performance for the roaming users, as they enjoy in their home networks. However, in most cases, the latest available technology (5G) is available in the visited networks and most of the consumers have not complained about experiencing lower QoS while roaming. In addition, BEREC supports maintaining the current QoS obligations without amendments.

The available data and the Study on QoS roaming do not offer insights into the reasons for the lower QoS when roaming. Better understanding the results of the Study would require further monitoring and assessment. Moreover, the available data shows that roaming customers are not adequately informed about the QoS when roaming. It would therefore be recommended to closely monitor the compliance of the operators with the QoS obligations at national level, i.e., by the NRA, to identify whether there is a systematic degradation of the QoS that roamers enjoy, and if yes, to identify the exact limitation (technical or commercial).

9. TECHNOLOGICAL DEVELOPMENTS

9.1. 5G deployment in the EU/EEA area and its impact on roaming QoS

5G coverage in the EU has reached 94.35% and roll out is still ongoing. High quality 5G coverage extends to 67.72% of the EU territory (based on main pioneer bands), with the large majority of the deployment of 5G not being standalone. ([115])

The Roaming QoS obligations aim to ensure that access seekers can provide their customers with relevant QoS levels of roaming services, subject to technical availability. As explained in Section *8* (QoS section), the Roaming Regulation ensures gradual implementation of the QoS obligations in view of the gradual technological developments such as ongoing 5G roll out. Specifically for roaming, 5G network slicing could give MNOs and MVNOs the possibility to extend the reach of their networks in other countries and offer their subscribers mobile connectivity services while they are travelling abroad, with no roaming costs and – in the case that the service is provided by their home operator – without the need to change the number they could be reached at. The administrator of the 5G-slice may offer services with improved QoS and experience due to their level of freedom in configuring the network parameters. Services can be customized to meet the exact needs of the subscribers, while careful planning minimises the risk of network congestion or unavailability. The operators could even offer a seamless environment, no matter if their subscribers are in their home country or if they are currently roaming. In addition, network slicing offers increased security as user traffic is isolated from the rest of the visited network.

5G network slicing can also be a fit-for-purpose solution for IoT services, since it allows full flexibility for the creation of a dedicated environment with configurable

([115]) Report on the State of the Digital Decade 2025, European Union, 2025.

characteristics. Therefore, the slice may address the needs of different types of subscribers, human or M2M/IoT, offering that way enhanced customer experience. On the other hand, this solution requires extensive collaboration between operators, providers of equipment and hardware and other stakeholders that will finally enable the use of 5G slicing in roaming. Apart from this, during the implementation phase, a great number of bilateral agreements will have to take place in order to allow 5G slicing to be used to a large extent. To this day, 5G network slicing solutions have not been adopted massively in the market, neither are there any indications that these are expected to be used in the near to mid-term future. While 5G network slicing could have an impact on regulated roaming, this technology has not been widely adopted yet. In this context, it does not exert any competitive constraint or behave as a constraint on regulated roaming. Therefore, 5G network slicing has not contributed to any change in the regulated roaming landscape.

BEREC also recognizes in its Opinion ([116]) that 5G network slicing is in an incipient state and there are currently very few –if any- roaming agreements in place. Both technical interfaces and the integration of roaming value-added services delivered by third parties need further harmonisation, while to take full advantage of slicing, demanding configuration at both 5G core and 5G radio network has to be implemented, while implementation should be widespread in most European networks. Under this light, BEREC concludes that it is still premature to take slicing into account in the next Roaming Regulation review.

9.2. The evolution of the M2M/IoT roaming market

Both recital (21) of the Roaming Regulation and recital (249) of the EECC, define machine to machine (M2M) as services involving an automated transfer of data and information between devices or software-based applications with limited or no human interaction. From a technical perspective, Internet of Things (IoT) and M2M are not the same. Recital (12) of the EECC also implies this. Generally, M2M may be regarded as a subset of IoT. However, recital (68) of the Roaming Regulation puts IoT and M2M on equal footing, due to their similar role as important drivers for digitising the EU's industry and builders of EU's policies in sectors such as health, energy, environment, and transport. Therefore, across this section, M2M and IoT will be used with the same broad understanding.

Roaming, a facility offered by cellular-based technologies only, is not the sole connectivity solution for M2M/IoT devices. Recital (68) of the Roaming Regulation calls upon the Commission to "regularly assess the role of roaming in the market for machine-to-machine connectivity and in the IoT market" while BEREC should "collect the necessary data to allow the monitoring of the elements to be assessed in the Commission's reports on the development of machine-to-machine roaming and IoT devices provided for in this Regulation, taking into account cellular connectivity solutions based on unlicensed spectrum".

([116]) BoR(25)48.

There are various technologies able to provide connectivity for M2M/IoT devices, which may be divided into short-range ([117]) and wide-area ([118]). These technologies compete against each other to a higher or lesser degree, depending on the specific connectivity needs of the M2M/IoT use cases. Highly elaborated M2M/IoT use cases require the constant use of more than one connectivity technology ([119]). By 2028, the connectivity market in Europe ([120]) for M2M/IoT is likely to drop from its 2025 peak, at which time it will represent only 8% of the total M2M/IoT value chain revenues. This indicates an intense price competition in the M2M/IoT connectivity market to which cellular technologies supporting roaming are also largely exposed ([121]). Only a limited number of M2M/IoT use cases are, in fact, highly reliant on cellular technologies supporting roaming (e.g., automotive, some niche health applications, under certain circumstances, some energy sector applications, etc.) ([122]) while, in many instances, the M2M/IoT customers may exert a countervailing buying power.

Against this background, any potential regulatory intervention on the roaming market for M2M/IoT should consider the wider connectivity environment for M2M/IoT, in order to maintain, as much as possible, the same level playing field between the various providers of connectivity solutions for M2M /IoT use cases. This section is divided into three main parts, as follows: (i) an overview of the roaming connectivity market for M2M/IoT (i.e., 9.2.1., below), (ii) a summary of the current regulatory framework of roaming for M2M/IoT (i.e., 9.2.2., below), and (iii) a brief assessment of the permanent roaming (non)regulation for M2M/IoT (i.e., 9.2.3., below).

9.2.1. The roaming connectivity market for M2M/IoT

The basic functionality that roaming may offer to M2M/IoT use cases is the provision of cross border connectivity. Usually, short range technologies are not able to provide cross border connectivity. On the other hand, all wide-area technologies can provide cross border connectivity either on the basis of roaming agreements (2/3/4/5G networks, LPWAN-LTE, LPWAN-NB-IoT), extension of a global network (LPWAN-Sigfox), complex network server configurations (LPWAN-LoRaWAN), or due to their in-built nature (satellite technologies).

Therefore, if basic cross-border connectivity is the main requirement of a specific M2M/IoT use case, then **all wide-area technologies, including those based on**

([117]) Short-range largely consists of unlicensed radio technologies, with a typical range of up to 100 meters, and include Wi-Fi, Mesh protocols, Bluetooth and Bluetooth Low-Energy ('BLE') and Radio Frequency Identification ('RFID'). More details are available on Axon-ICF-Carsa study, pages 51 and 203 to 206.

([118]) Wide-area comprises licensed cellular networks (2/3/4/5G), licensed or unlicensed low-power wide area network technologies ('LPWAN'), with a typical range of more than 100 meters, as well as satellite connectivity technologies. More details are available on Axon-ICF-Carsa study, pages 52 and 207 to 209.

([119]) One example is that of connected cars requiring, at the same time, both short-range and wide-area connectivity solutions. More details are available on Axon-ICF-Carsa study, pages 63 and 64.

([120]) In this context Europe covers the EU Member States (except for Cyprus and Malta), Iceland, Montenegro, Norway, Russia, Serbia, Switzerland, Turkey, Ukraine, and the United Kingdom.

([121]) More details are available on Axon-ICF-Carsa study, pages 44 and 45.

([122]) More details are available on Axon-ICF-Carsa study, pages 56 and 63.

unlicensed spectrum (e.g., LPWAN-Sigfox, LPWAN-LoRaWAN), compete against each other. However, other additional requirements (e.g., reliability, throughput, coverage, power consumption, etc.) may render cellular technologies using licensed spectrum at least a technical competitive advantage over the other wide-area technologies, emphasising thus the roaming factor's role.

The Axon-ICF-Carsa study assessed ([123]) these complex interactions for four key M2M/IoT verticals, namely for mobility, health, energy, and agriculture. The mobility sector has the strongest need for cross-border connectivity, usually linked with high throughputs. For the mobility sector cellular technologies are crucial and cannot be easily replaced by other alternatives. M2M/IoT applications in the health sector also rely on cellular technologies, for convenience and reliability reasons, with cross-border connectivity an important requirement. As regards the energy sector the situation is more nuanced due to its more localised needs, sometimes in remote areas. For the energy sector, LPWAN and satellite may offer suitable alternatives to cellular technologies, although the latter may have a head in case of specific M2M/IoT applications requiring higher data throughputs. Finally, for the agriculture sector the cross-border connectivity is not a standard requirement. In this case, LPWAN is the most convenient technology due to its possibility of covering large distances and low power consumption, while in more remote areas may be complemented by satellite technologies.

BEREC data ([124]) shows that the number of connected objects to cellular networks in the EU/EEA has constantly surpassed the 100 million-threshold since the last quarter of 2021. Of these the vast majority (i.e. around 90%) are roaming-enabled, meaning capable of staying connected if ever passing the national border. A significant (around 30%) and ever-increasing number of roaming-enabled objects are effectively roaming in the EU/EEA, while a notable share (i.e., most likely around 5%) are used in permanent roaming in the EU/EEA. On average, connected objects use more domestic data than in roaming in the EU/EEA (i.e. 0.81GB/month/connected object vs. 0.12 GB/month/connected object, in the latest quarter for which data is available). The same is true for calls and SMS usage, although these services are less relevant for M2M/IoT scenarios.

In its input, BEREC underlined the increasing number of wholesale roaming access agreements for M2M/IoT, including those allowing permanent roaming for M2M/IoT ([125]).

9.2.2. The currently applicable regulatory framework to roaming for M2M/IoT

The Roaming Regulation does not exclude roaming for M2M/IoT from its application scope ([126]). Therefore, equal to the case of roaming for interpersonal communications, roaming access providers must, for instance, meet all reasonable access requests for wholesale roaming for M2M/IoT use cases ([127]), while being able to impose conditions preventing the misuse of such wholesale roaming access services, including against

([123]) Axon-ICF-Carsa study, pages 61 to 63.

([124]) BoR (24) 165, BEREC Report on M2M and permanent roaming, Figures 3-6, pages 8 to 10, and 30th BEREC BMK.

([125]) BoR (25) 48, BEREC input on EC's request for expert views on Regulation (EU) 2022/612 on roaming on public mobile communications networks within the Union, page 60.

([126]) Recital (21) of the Roaming Regulation.

([127]) Article 3(1) of the Roaming Regulation.

permanent roaming([128]). Likewise, on the retail side, providers of roaming services for M2M/IoT use cases must, for instance, observe the prohibition of levying any surcharge in addition to the domestic retail prices for roaming services provided to their end users in any other Member State([129]), while being able to apply to their end users a roaming fair use policy([130]). However, on the retail side, providers of roaming services for M2M/IoT use are expressly exempted([131]) from the following obligations in relation to their end users of data services: (i) the automatic sending of messages containing basic personalised tariff information every time end users enter another EU Member State([132]), and (ii) the application of the financial or volume limit facility to avoid end users suffering so called bill shocks([133]).

Without prejudice to the above-mentioned, permanent roaming for M2M/IoT is subject to commercial negotiations and can be agreed by two roaming partners in a wholesale roaming agreement([134]). The Roaming Regulation lays the ground for mobile network operators to increasingly respond to and accept all reasonable requests for wholesale roaming agreements on reasonable terms and explicitly allow permanent roaming for M2M/IoT([135]). In the current sophisticated economic environment characterised by global supply chains spanning several countries or continents, permanent roaming may become increasingly important for several M2M/IoT use cases([136]).

Building on the importance of cellular technologies' connectivity for M2M/IoT for the four critical verticals (i.e., mobility, health, energy, and agriculture, etc.), as mentioned in 9.2.1., above, the Axon-ICF-Carsa study mapped the high and low relevance of permanent roaming for M2M/IoT use cases, as shown in the below table. ([137])

([128]) Article 3(6) second subparagraph of the Roaming Regulation.

([129]) Article 4(1) of the Roaming Regulation.

([130]) Article 5 of the Roaming Regulation.

([131]) According to Article 14(5) of the Roaming Regulation.

([132]) Obligation set in Article 14(2) of the Roaming Regulation.

([133]) Obligation set in Article 14(4) of the Roaming Regulation.

([134]) Recital (21) of the Roaming Regulation.

([135]) Recital (21) of the Roaming Regulation.

([136]) BoR (24) 165, BEREC Report, on M2M and permanent roaming page 5.

([137]) As mentioned in the Axon-ICF-Carsa study, the relevance of permanent roaming is not necessarily limited to the mentioned M2M/IoT use cases and not equal to all undertakings using M2M/IoT applications. For instance, an aggressive business strategy for expansion beyond national borders may lead to a need of permanent roaming even in areas where this factor is of relatively low relevance. On the other hand, alternative connectivity solutions may diminish the relative dependence on roaming for certain undertakings or for specific M2M/IoT use cases.

Table 9: The relevance degree of permanent roaming for M2M/IoT use cases

Relevance Degree	Permanent roaming use cases
High	Transport, asset and fleet tracking; (some) connected vehicles; other mobility use-cases, logistics; niche health applications
Low/No relevance	Smart metering, smart lighting, smart homes; facility management, most environmental or animal monitoring; typical health and energy use cases; most agricultural use cases; most industrial use cases

Source: The Axon-ICF-Carsa study, page 136

Finally, as regards the M2M/IoT use cases, roaming partners may agree to apply alternative tariff schemes, for instance based on the number of connected devices per month, instead of the consumed data volumes([138]).

9.2.3. Assessment of the permanent roaming (non)regulation for M2M/IoT

In its input, BEREC invited the Commission to further study the M2M/IoT market and potential regulatory measures in order to prevent competitive imbalance between large groups and smaller operators across the EEA([139]). The main area of interest for potential competitive imbalances is the permanent roaming for M2M/IoT. As mentioned before, according to the Roaming Regulation, permanent roaming for M2M/IoT is subject to commercial negotiations between roaming partners. In case of proven competitive constraints, a regulation of permanent roaming for M2M/IoT may be envisaged.

Directive (EU) 2018/1972 provides the basic principle of regulatory intervention for electronic communications markets, according to which any regulation at wholesale level must be underpinned by competitive problems identified at the retail level([140]). In this case, there may be two indicators for potential competitive problems at the retail level: (i) a lack of availability for permanent roaming connectivity, and (ii) high prices for permanent roaming connectivity. The retail level mainly consists of M2M/IoT end users, as well as M2M/IoT application and platform providers, and to a lesser extent M2M/IoT hardware manufacturers.

The exchanges carried out in the context of the Axon-ICF-Carsa study (i.e., interviews of, workshops with, and written feedback from the whole M2M/IoT value chain stakeholders) revealed no major concerns from the retail side of the market related to the availability for permanent roaming connectivity in the EU/EEA([141]) or to its price level. The M2M/IoT industry expressed relaxed views about permanent roaming connectivity in the EU/EEA, due to its relatively easy access to a wide range of alternative technologies to avoid dependence on (permanent) roaming for its cross-border needs([142]). In this respect, the IoT

([138]) Recital (21) of the Roaming Regulation.

([139]) BoR (25) 48, BEREC input on EC's request for expert views on Regulation (EU) 2022/612 on roaming on public mobile communications networks within the Union, page 62.

([140]) Recital (29) of the Directive (EU) 2018/1972.

([141]) Axon-ICF-Carsa study, page 135.

([142]) Axon-ICF-Carsa study, pages 135 to 139.

industry often quoted eSIM cards ([143]), LoRaWAN technology, LEO-based satellite connectivity([144]) or the implementation of edge technologies([145]) as viable solutions to limit the dependence on (permanent) roaming, if not avoiding it alltogether.

Based on IoT industry's feedback and other assessed general statistical trends, the Axon-ICF-Carsa study concludes that alternative technologies to cellular offer credible technical and commercial substitutes for many, and perhaps the majority, of IoT cross-border use cases. While cellular roaming may remain the default technical option for specific M2M/IoT use cases, the clear competitive constraints exercised by alternative technologies should also reduce the roaming connectivity providers' market power. In fact, the M2M/IoT use cases with limited alternative options to cellular technologies, and therefore potentially exposed to retail competitive problems as regards the (permanent) roaming connectivity, remain those with high bandwidth, and low latency and jitter requirements, such as certain automated mobility applications or niche cross-border health applications([146]).

Moreover, the retail side of the M2M/IoT (permanent) roaming connectivity market may exert a real countervailing buyer's power. In general, this limits the ability of providers of (permanent) roaming connectivity for M2M/IoT use cases, both MNOs and MVNOs, to raise their retail prices.

As regards the wholesale side of the market (i.e., the relationships between access providers and access seekers of permanent roaming connectivity for M2M/IoT use cases), according to BEREC data, the EEA average price for wholesale inbound permanent roaming (EUR per GB) has constantly been well below the EU regulated wholesale roaming cap per GB, as shown in the below figure.

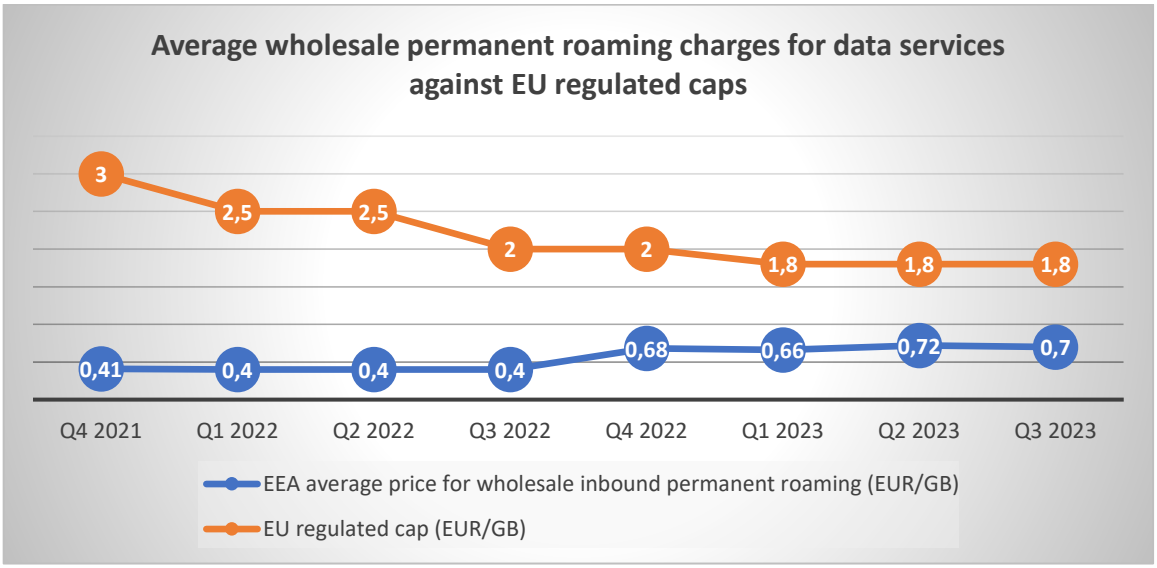
([143]) eSIM cards are embedded (pre-installed) into the hardware of a mobile device, by contrast to legacy, removable SIM cards. eSIM cards offer remote provisioning and profile management. Moreover, eSIM technology can support multiple profiles on a single device. This facilitates the switch between service providers or networks. In addition, this allows IoT users to optimize their connectivity by selecting dynamically, based on their location and usage, the most cost-effective network and service. eSIM technology is suitable especially for the automotive industry, a sector for which permanent roaming is highly relevant. Source: Axon-ICF-Carsa study, page 137.

([144]) Stakeholders considered LEO-based satellite connectivity an alternative even for transportation and logistics sectors which normally are heavily reliant on cellular connectivity, and therefore on (permanent) roaming. Source: the Axon-ICF-Carsa study, page 138.

([145]) The implementation of edge technologies means moving more computation power/resources on the edge, instead of loading massive amounts of data in a central command unit in the cloud. This is done mainly to speed up response time and to increase the level of security for M2M/IoT devices. The side effect of these techniques is to decrease data consumption, including in roaming. Source: the Axon-ICF-Carsa study, pages 138-139.

([146]) Axon-ICF-Carsa study, pages 139 and 140.

Figure 27: Average wholesale permanent roaming charges for data services against EU regulated caps



Source: 30th BEREC BMK

This is likely to indicate a rather competitive wholesale market for M2M/IoT permanent roaming connectivity. There are both direct and indirect competitive constraints exerted against the wholesale charges for M2M/IoT permanent roaming connectivity. The fact that each EU/EEA country has at least three MNOs able to provide (permanent) roaming connectivity, including for M2M/IoT use cases, represents a direct competitive constraint, albeit this may vary according to the level of competition intensity between the existing MNOs in a certain EU/EEA country. Indirect competitive constraints are exerted by wholesale access charges to alternative technologies, and even by wholesale access charges to periodic roaming connectivity since the latter are regulated.

However, this general picture may obscure the difficulties access seekers, and especially MVNOs, could face when negotiating permanent roaming agreements with some MNOs. The Axon-ICF-Carsa study identified([147]) a list of practices employed by MNOs to exploit their strong market position in relation to access seekers, as follows: (i) the imposition of exclusive roaming access agreements, (ii) the imposition of hard-to-achieve minimum purchasing service volumes, as a condition for concluding permanent roaming agreements, or other unfavourable wholesale pricing conditions, (iii) restricting access seekers in their choice of technical alternatives (if they roam through a mix of complementary technologies), and (iv) outright refusal to even negotiate a permanent roaming agreement.

The Axon-ICF-Carsa study considered([148]) that the described wholesale practices cannot be effectively tackled by *ex ante* or *ex post* regulatory intervention, due to the exclusion of the mobile markets from the list of EU market susceptible to *ex ante* regulation and the unlikely reach by any mobile operator in the EU/EEA of market dominance standard, according to the competition law criteria.

([147]) Axon-ICF-Carsa study, page 144.

([148]) Axon-ICF-Carsa study, pages 144-145.

In general, BEREC considers that, in light of the current situation of the market, no further regulatory measures should be taken as regards permanent roaming and M2M/IoT services. BEREC observes that the widespread use of permanent roaming for any service would blur the lines between the international roaming market and the domestic mobile access and origination markets. On the other hand, in BEREC's view, the expected growth of the market could increase the competitive risks since large operators would be able to easily provide permanent roaming offers while smaller MNOs and MVNOs may be ousted from these deals, due to their more reduced bargaining power.

In addition to the invitation addressed to the Commission to study the market and potential regulatory measures in order to prevent competitive imbalance between large groups and smaller operators across the EEA, BEREC made some suggestions for further clarifications on permanent roaming and the scope of the applications of the roaming rules related to IoT services.

To conclude with, it seems there are no compelling reasons that would justify a strong and extensive regulatory intervention as regards the permanent roaming connectivity conditions for M2M/IoT. The corresponding retail side seems to be characterized by intense competition and countervailing buyer's power, while the wholesale charges for access seekers of permanent roaming connectivity appear to be relatively low. This does not exclude though a more targeted regulatory intervention, depending on the circumstances.

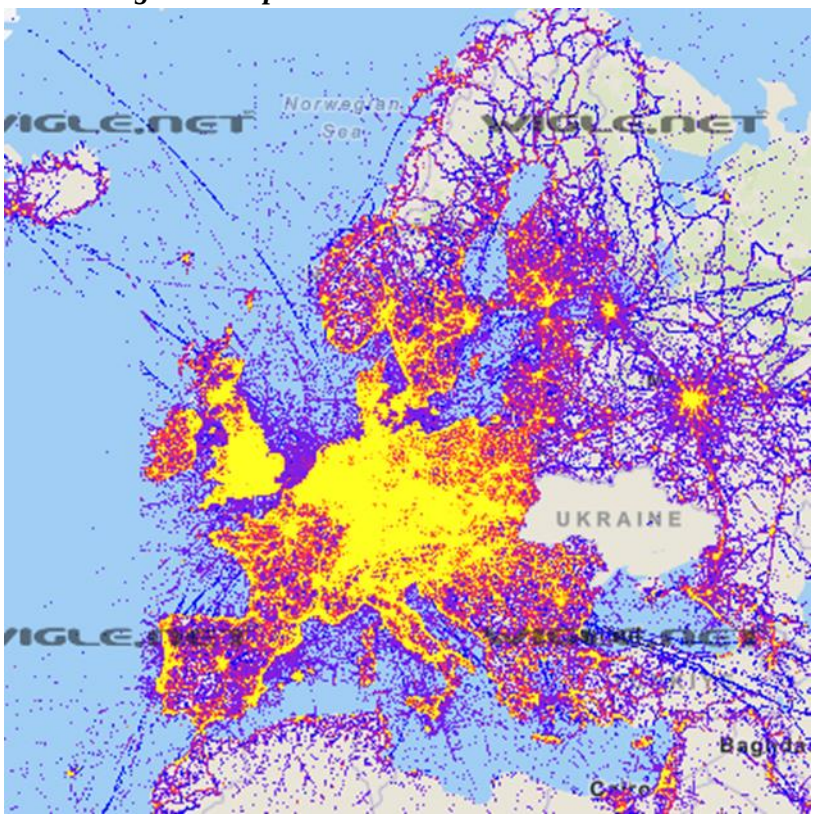
9.3. Wi-Fi and Wi-Fi aggregation

Wi-Fi technology has been increasingly used as a direct substitute for mobile data, or combined with OTT services, as an indirect substitute for mobile voice and SMS services. It remains attractive thanks to its cost, convenience and quality. Two different types of Wi-Fi networks can be identified: (i) private/ in-building Wi-Fi networks, such as the ones deployed in homes, businesses and hotels and (ii) public Wi-Fi hotspots, offering connectivity services to wider open air, in many cases, areas. Both types have been used to offload mobile traffic, either domestic or roaming.

In domestic use, Wi-Fi has been widely used for replacing mobile data in private environments while some operators integrate "Wi-Fi calling" in their service offering to allow users to make/receive calls and send/receive SMS messages in areas with poor cellular coverage. Public Wi-Fi hotspots, especially when aggregated, may play a more significant role as a potential substitute for roaming services.

The availability and coverage of Wi-Fi networks has increased significantly in Europe, as can be seen in the following picture.

Figure 28: Wi-Fi Coverage in Europe



Source: WiGLE: Wireless Network Mapping

The important role played by Wi-Fi in the EU connectivity landscape has been recognized and addressed by the WiFi4EU initiative. WiFi4EU gives free internet access to local residents and visitors throughout the entire EU in the main centres of community life (parks, squares, libraries, public buildings, hospitals, etc.), powering also digital services (eHealth, eTourism, eLearning and eGovernment).

The use of Wi-Fi as a replacement for roaming has some clear advantages, such as the avoidance of roaming costs, the Wi-Fi global availability on many devices and the provision of better connectivity especially in indoor areas. On the other hand, the weakness is the Wi-Fi network's reliability, accessibility, throughput and security.

Even though Wi-Fi is a direct substitute, with increased availability in all Member States, it is not expected that it could replace mobile data roaming connectivity. The mobile network has strong advantages that cannot be met by the Wi-Fi aggregated networks, such as the ubiquitous coverage and the smooth handover while moving. The availability of 5G networks to a large extent in all countries allows for data connections with better quality and increased speed. Many users have turned to unlimited data packages, removing that way an existing restriction for mobile networks. Over and above all, RLAH allows users to use the data of their home subscription without any additional charge, diminishing that way the need of the users to find ways to circumvent roaming. *Figure 3*, showing the increase of average roaming data consumption per user since 2016, confirms the above conclusion.

BEREC ([149]) also takes the view that despite Wi-Fi, as well as other technologies, such as LoRaWAN and satellite solutions, being alternatives technologies, they are not considered to have a relevant impact on traditional roaming services, because they are used as a complement, or for a specific implementation, but not as a substitute for traditional mobile roaming. They point to the different reach and indoor coverage capabilities of these technologies compared to terrestrial mobile services.

9.4. OTT voice and messaging

The combination of Wi-Fi with OTT services may act as a replacement for traditional voice and SMS services. OTT services are already replacing mobile calls and SMS for certain purposes, domestically as well as when roaming, in both the business and consumer sector. The popularity of OTTs constantly increases, and many platforms have been introduced to cover the users' needs, such as WhatsApp, Facebook Messenger, iMessage, and Signal Messenger. At the same time other platforms/applications, like Instagram and Snapchat, are used also as OTT services for specific user groups. This popularity on the other hand has created a fragmentation of users, which in turn forms an additional burden on the caller: to identify the application with which a certain user can be reached. Thus, the lack of interoperability between the OTT services makes any-to-any communication very difficult.

On the other hand, OTTs have some big advantages compared to traditional voice calls, such as the creation and administration of user groups and the option of video calls, the latter especially in cases where the data connection is uncharged (e.g. Wi-Fi). Moreover, OTT services could limit the potential for mobile operators to increase voice and messaging prices, if cost-effective data roaming or alternatives are available.

As a conclusion, OTT services will continue to be used both in the domestic environment and while roaming. However, with the development of unlimited data plans in the RLAH environment, it is highly unlikely that OTTs will replace traditional roaming mobile voice and SMS services in the mid-term future.

9.5. Embedded SIM (eSIM)

The implementation of eSIMs allow the mobile subscriber to store and administer multiple SIM profiles in the same device. It should be noted though that until now and in most cases ([150])the user of the eSIM may have only one active profile at a time. In the 2018 study on technological developments this was raised as a limitation that could be addressed through GSMA standards. eSIM could also enable customers to select separate specialist roaming providers on their mobile handset or facilitate their use of local mobile providers. However, customer take-up of specialist services might be limited, while the use of local mobile providers presents other challenges, including trust (for the end-user), identification and security. It is possible that the threat of such competition could limit the ability of

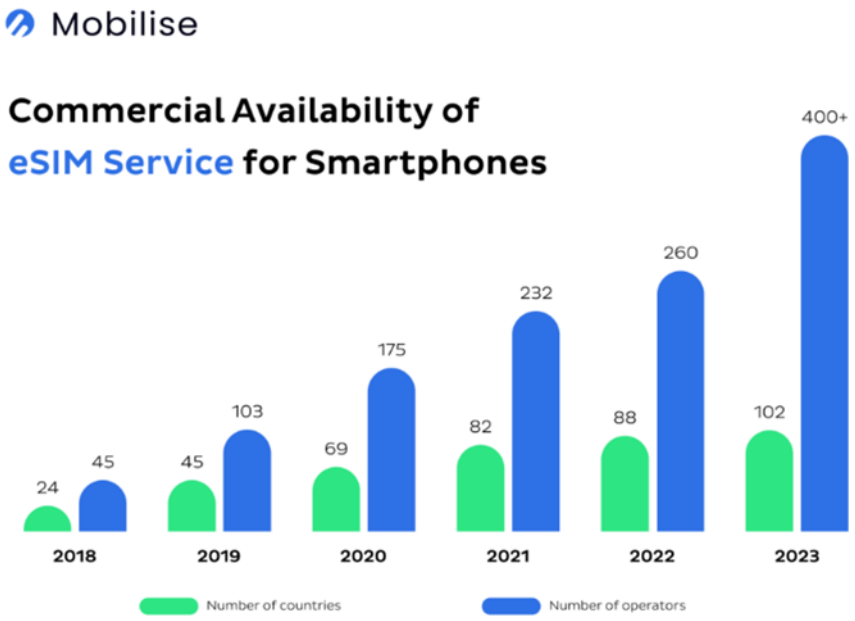
([149]) BoR(25)48.

([150]) Google has introduced the option of having 2 eSIMs active simultaneously in its Pixel 7/Pixel 7 pro smartphones.

MNOs to raise prices, but the adoption of eSIM in consumer devices for the purpose of bypassing roaming services, especially in a RLAH environment and its impact has yet to be seen.

The growing numbers of eSIM-enabled smartphones/smartwatches and of operators with commercial availability of eSIM Service for Smartphones ([151]) will inevitably lead to higher penetration of eSIMs in the market. It is indicative that the number of new eSIM enabled devices increased by a factor of 10 between 2018 and 2023, reaching 231 new eSIM enabled devices in 2023, out of which, 60% were smartphones. Smartphone manufacturers have followed different approaches to the introduction of eSIMs, varying from eSIM-only models (e.g. Apple in the US) and eSIM in all models (Google, Apple), to eSIM in some models (Samsung, Xiaomi, ZTE Motorola, Vivo, Huawei, Oppo etc.) or not at all ([152]).

Figure 29: Commercial availability of smartphones



Source: 100+ eSIM statistics telecom service providers need to know in 2024

The most significant prospects of eSIM could be in connectivity for IoT including connected cars, where its use is already established. One of the most remarkable advantages of an IoT eSIM compared to an IoT traditional SIM is that it can be reprogrammed to switch between networks without requiring the user to replace a physical SIM card. With this characteristic, eSIMs may be used as an alternative to permanent roaming. For instance, a connected car equipped with an eSIM may not need to permanently roam in the country it is sold, if its eSIM is provisioned with a mobile subscription in this country. This functionality would not be possible if the car was equipped with a traditional SIM and the agreement for permanent roaming would be the only option. On the other hand, eSIMs require a more complex and costly set up, as it requires an infrastructure that supports eSIM provisioning and management within the car.

([151]) www.mobiliseglobal.com

([152]) GSMA-Welcome-and-eSIM-Market-China-and-Beyond.pdf

The eSIM technology continues to gain importance and will likely gain further importance in the forthcoming years. It is an important development that could facilitate competition and switching in mobile connectivity including roaming. Its effects on competition may differ for different market segments and depend on the way the standard is implemented and influenced by different interest groups including mobile network operators and device manufacturers. It is unlikely that eSIM will impact regulated roaming within the EU/EEA in a way that will change the market dynamics. Rather, it is more likely that eSIMs affect roaming in the rest of the world, since, there, the roaming costs for the subscribers increase significantly. On the issue of the eSIMs, BEREC notes that they may impact rest of the world roaming tariffs if they become widespread in the market, but security aspects relating to the use of travel eSIM should also be considered.

In both consumer and IoT segments, the penetration of eSIMs mainly depends on the willingness of the device manufacturers to include eSIM technology in more of their devices and the decision of the operators to take the risk of losing the strong bond with the subscriber through the traditional SIM card and adopt eSIMs.

9.6. Satellite communications

Low Earth Orbit (LEO) satellite communications have emerged as an alternative to traditional roaming services for several reasons, but especially for their global coverage, which allows users to roam without restrictions. The standardization of the integration of satellite components in the 5G architecture ([153]) played a key role in enabling Non-Terrestrial Networks (NTN) to be used for, among others, extending the coverage of the networks, addressing specific requirements of IoT (e.g. exchange of small amounts of traffic- optimization for low power usage) and global roaming, allowing e.g. global tracking and tracing to be globally available. Inclusion of satellite technology into 5G standards (direct to device – D2D) enables users to communicate through the LEO satellites with their standard industry consumer phones. The additional fact that, apart from the radio access level, standardization covers also the core network level, allows the interoperability of the terrestrial and non-terrestrial networks in the same way all standard terrestrial MNOs (Mobile Network Operators) do for wholesale roaming, i.e., by using the standardised GSMA technical network interfaces and commercial processes for International Wholesale Roaming.

LEO-based satellites are placed in orbit at a distance of between 160 to and 1 600 km from the Earth's surface in a constellation arrangement which allows them to achieve relatively good connectivity performances, especially in terms of coverage and reduced latency ([154]). Although 5G still offers better network performance, including higher bandwidth, lower latency, and higher efficiency, LEO-based satellite connectivity may become a serious contender for cellular connectivity solutions. In any event, LEO-based connectivity is

([153]) Specification # 21.917.

([154]) For example, the distance between the satellite and the smartphone in a specific implementation varies between 525Km and 951 Km, resulting at a round-trip delay of 7-16 msec for single-hop communication between a smartphone and a Starlink gateway. This calculation considers propagation delay only, excluding additional latency from active equipment such as protocol packetization and doppler-shift compensation (Analysis Mason Satellite direct-to-device: the characteristics of D2D constellations will limit SpaceX's ability to dominate).

suitable for IoT use cases in all environments including remote, rural, and maritime environments.

Apart from the clear benefits of LEO satellites regarding latency, significant effort has been put into increasing the available capacity of the satellites to accommodate the continuously increasing demands for bandwidth.

The first steps for the integrations of terrestrial and NTN have been taken, although still at a very early stage. For example, the agreement between T-Mobile and SpaceX ([155]) focuses on extending the coverage of the network by offering an additional layer of connectivity in previously unreachable areas. According to the relevant announcement, in the areas covered only by satellite, the users will have access to text messaging services, including SMS, MMS and participating messaging apps. As recently announced ([156]), the functionality is under beta testing with real users, while the initial list with few Android smartphones as eligible devices to test the network has been enriched with Apple's iPhone devices ([157]). Additionally, in case of a wide adoption of this solution, a denser network of satellites may be required to be implemented to be in position to cope with the total demand for traffic.

It is noted that according to input that reached BEREC, non-terrestrial networks based on low Earth orbit satellite are an alternative from a technological perspective but are rather used in places where terrestrial roaming is not available. As the prices for such access are very high, they do not seem to be a substitute for EU regulated roaming.

As a conclusion, LEO satellites and D2D communications, although in the long term may significantly affect roaming, they cannot be considered as an alternative to roaming in the RLAH environment in the short to medium term.

9.7. Online Trading platforms

In its 2020 review of the Roaming Regulation, the Commission identified online trading platforms as a technological development that could boost competition. The 2022 recast of the Roaming Regulation includes clarifications to facilitate and encourage trading platforms as an alternative way of wholesale negotiations. The 2018 study on technological developments identified two main benefits, which can help boost competition in wholesale roaming, if these new models are widely adopted. Firstly, such models can anonymise trading, which is currently conducted through face-to-face bilateral negotiations. Secondly, they can break the link between outbound and inbound traffic, which penalises operators and MVNOs with lower countervailing power. If such new models were indeed widely adopted and managed to achieve these expectations, they could in the long run abolish the need for regulating wholesale roaming rates. Currently, there is one such platform available on the market providing trading services for operators.

Under the most recent data collected by BEREC, only eight operators in EU/EEA reported having used trading platforms or hubs from October 2023 until the first quarter of 2024. In

([155]) T-Mobile Takes Coverage Above and Beyond With SpaceX - T-Mobile Newsroom.

([156]) December 2024, T-Mobile Opens Registration for Direct-to-Cell Satellite Service Beta Test with Starlink - T-Mobile Newsroom.

([157]) Apple's iPhones to support Starlink direct-to-cell coverage in US | Reuters.

contrast, more than 70 operators concluded direct roaming agreements in the same period. Operators did not report information on pricing schemes used.

Although exchanges on platforms could potentially benefit roaming markets by enhancing price transparency and promoting competition, their limited reach prevents them from being effective in reducing wholesale prices to a sufficient extent to justify lifting the regulatory obligations under the Roaming Regulation.

10. CONCLUSION

Since the entry into force of the recast Roaming Regulation, in 2022, the RLAH regime continues benefiting to the European consumers all around the EU/EEA and contributes to achieving a true digital single market.

10.1. The Roaming Regulation effectively provides benefits

The Roaming Regulation has been and is still instrumental in creating a true digital single market, effectively addressing the main problem of roaming charges and bridging the gap between national markets, allowing Europeans to freely use mobile connectivity services while traveling in the EU/EEA. Two years after the recast, the Roaming Regulation continues to ensure the effective and sustainable provision of Roam Like at Home (RLAH) services, while maintaining essential safeguards, including the derogations mechanism and Fair Use Policy (FUP), which have proven crucial in keeping the regime sustainable (Section *5.2*). The FUP measures are widely applied and considered effective by operators and have limited impact on consumers.

The 2022 recast has also led to a significant reduction in the maximum level of FUP surcharges for data, capping them with a glide path leading to EUR 1/GB in 2027, to the benefit of the EU consumers. The introduction of improved transparency measures has empowered consumers to make informed decisions and reduced the risk of incurring additional costs because of non-awareness (e.g. for value added services, for use on non-terrestrial networks on ships and planes), while the establishment of BEREC's databases has provided a valuable resource for monitoring the enforcement of these measures.

In its Opinion ([158]), BEREC reiterated its position expressed in previous report, affirming that "the abolition of retail roaming charges within the EEA (…), has proven to be a clear and tangible success for consumers and of European integration, and a substantial contribution to the further completion of the Single Market". BEREC also assessed that the new provisions introduced in the 2022 recast of the Roaming Regulation have been effective.

([158]) BoR(25) 48.

10.2. The Roaming Regulation is efficiently enabling end users to benefit from mobile services cross borders throughout the single market

The abolition of roaming surcharges continues to bring relevant economic benefits to EU end-users and has continued to be accompanied by a regulation of wholesale prices for the roaming services. The 2022 recast introduced a further gradual reduction of the wholesale caps for SMS, calls and data, estimated on the efficient costs of providing the relevant roaming services. (Section 7). This has enabled operators to provide RLAH without incurring sustainability problems on the retail side, as demonstrated also by the reduced requests for derogation (Section 5.3) and ensuring cost recovery on the wholesale side (Section 6). The revised glide path has therefore efficiently balanced the interests of those supplying the network service to other operators (wholesale side, where cost recovery is relevant) and those supplying the roaming service to end-users (retail side, where the sustainability is relevant). Following the publication of the latest cost model study, it appears that there may be room for improvement and possible further reductions of the caps.

In its Opinion ([159]), BEREC declared that "BEREC holds that the regulatory costs associated with the implementation of the roaming rules are unequivocally outweighed by the tangible benefits of the RLAH approach for European citizens and businesses". However, BEREC also recognised opportunities for further enhancements, particularly in reducing the administrative burden by streamlining the annual data collection process. These improvements can be implemented at a "working level" and do not necessitate changes to the existing regulation.

10.3. The Roaming Regulation is still the most relevant instrument

As part of this review exercise, the Commission assessed all technological developments that could influence the Roam Like at Home (RLAH) regime. In particular, the Commission analysed all technologies that could potentially act as a substitute or exert competitive constraints on the roaming services. The conclusion reached is that while there is potential, there is still no evidence of significant impact, substitutability, or competitive pressure. No significant developments have occurred since the last review. Even with the extensive coverage of 5G, its impacts on roaming markets in terms of services have yet to be seen.

Therefore, the RLAH regime remains fit for purpose and is still the only instrument that allows for the achievement of a true digital single market. Furthermore, this is a proportionate instrument, valid for a limited period of time (until 2032). As of today, the competitive conditions are not expected to change within this timeframe, but the Commission will continue to monitor any developments.

([159]) *Ibid.*

10.4. The Roaming Regulation is coherent with the other legal tools

No inconsistencies have been identified between the Roaming Regulation and other relevant legal instruments, which could potentially create redundancy and undermine the Regulation's effectiveness. This assessment is supported by the BEREC Opinion, which has not identified any significant contradictions between the roaming rules and other EU legal acts. In addition, no NRA, operator or stakeholder has reported any inconsistencies between the Roaming Regulation and other EU legislation.

10.5. The Roaming Regulation delivers uncontested EU Added value

The benefits of the EU's action on roaming continue to be widely recognized by consumers and market players alike. European consumers declare that they are benefiting from Roam-Like-at-Home rules (84%) and that they have been able to use their phone abroad as in their home country (80%). This success is also demonstrated by the evolution of volumes, with data consumption while roaming continuously increasing, reaching 1495 MB per month, per roaming subscriber in Q3 2023 (compared to 100 MB per month, per subscriber in Q2 2017, just before the introduction of the RLAH regime).

It is widely recognized that the establishment of a true digital single market could only be achieved at the Union level, addressing the market failure that had been identified in the 2020 impact assessment. At the same time, the findings of this report show that this initiative has had no negative impact on national markets, thereby demonstrating once again its relevance and added value.

Consulted on the EU added value, BEREC claimed ([160]) that "it is difficult to envisage how national-level legal instruments alone could have resulted in the current achievements in terms of pricing, quality, and transparency at the EU/EEA level", supporting the results of the RLAH regime. The added value is even more evident when assessing third countries' roaming prices: while they have also declined since the adoption of the RLAH regime, they remain substantially higher than in the EU/EEA.

10.6. The Commission will continue to monitor the implementation of the Roaming Regulation

This review covering all the relevant factors outlined in Article 21 of the Roaming Regulation concludes that the RLAH regime remains fit for purpose, effectively achieving its objectives of promoting competition, reducing prices and improving the quality of roaming services, for the benefit of European consumers.

As in 2019, the review shows that, despite signs of competitive dynamics on both the retail and wholesale roaming markets, the underlying basic competition conditions have not changed substantially and are not likely to change in the foreseeable future.

([160]) BoR(25) 48.

The overall framework of the Roaming Regulation has proven to be effective, also in intensifying competition at wholesale level and creating dynamics in the wholesale market, with wholesale roaming prices steadily decreasing and remaining well below the regulated wholesale caps.

The example of Brexit, with the full deregulation of roaming services between the EU and the UK, highlighted the importance of the current RLAH framework and the need to maintain it to ensure free retail roaming services for EU consumers. In parallel, the RLAH area is likely to see its first enlargement in the next months to include Ukraine and Moldova, subject to a positive assessment of its alignment with EU legislation – a process that will be monitored by the Commission.

Based on the cost model results and the BEREC opinion, the Commission will, in particular, further monitor and assess the market dynamics and potential impacts of reductions in wholesale caps, given the economic space indicated by the cost model.

BEREC suggested in its Opinion that other improvements to the already well-functioning roaming rules could be considered as regards clarifying certain FUP mechanisms, better designing the welcome message and transparency measures (including the databases) and ensuring that inadvertent roaming problems are effectively tackled. The implementation of these rules requires further monitoring. Similarly, the findings on QoS will require close monitoring by NRAs and the Commission of the currently applicable QoS provisions. Additionally, some other improvements, suggested by BEREC, such as streamlining the data collection process with the NRAs and BEREC, could also be implemented without amending the Roaming Regulation.

Overall, the suggested improvements do not call into question the general principles underlying the Regulation, which remain relevant and effective and should be maintained. This is especially important as this successful European framework is soon set to be extended to other non-EU countries.

11. ANNEX

Table A: Absolute number and percentage of operators applying each type of FUP mechanism over total respondents (excluding missing values), 2022-2024

Year	Mechanism	MNO	MVNO	Tot applying each mechanism	MNO	MVNO	Tot applying each mechanism
2022	Stable link criterion	37	19	56	40%	37%	39%
	Open data bundle limits	82	32	114	88%	63%	79%
	Data limit on prepaid	26	25	51	28%	49%	35%
	Control window	53	31	84	57%	61%	58%
	Other mechanism	14	9	23	15%	18%	16%
2023	Stable link criterion	30	18	48	43%	37%	41%
	Open data bundle limits	60	26	86	87%	53%	73%
	Data limit on prepaid	21	22	43	30%	45%	36%
	Control window	41	29	70	59%	59%	59%
	Other mechanism	12	10	22	17%	20%	19%
2024	Stable link criterion	24	18	42	36%	36%	36%
	Open data bundle limits	52	30	82	79%	61%	71%
	Data limit on prepaid	21	21	42	32%	43%	36%
	Control window	38	26	64	58%	53%	55%
	Other mechanism	13	10	23	20%	20%	20%

Source: JRC calculation on BEREC Transparency data

Table B1: Operator's views on the effectiveness of FUP mechanisms – only operators implementing each type of FUP (2023)

	Operators (MNOs and MVNOs included)				
	Stable link	Open data bundle limits	Control mechanism	Data pre-paid	Other FUP mechanisms
Effective	44%	47%	36%	60%	17%
Partially effective	42%	52%	55%	40%	33%
Ineffective	11%	0%	4%	0%	17%
Unnecessary	2%	1%	4%	0%	33%
Total number of operators applying each mechanism	45	83	67	15	6

Source: JRC calculation on BEREC Transparency data.

Table B2: Operator's views on the effectiveness of FUP mechanisms – only operators implementing each type of FUP (2024)

	Operators (MNOs and MVNOs included)				
	Stable link	**Open data bundle limits**	**Control mechanism**	**Data pre-paid**	**Other FUP mechanisms**
Effective	55%	49%	33%	33%	53%
Partially effective	41%	0%	7%	33%	24%
Ineffective	5%	50%	57%	33%	24%
Unnecessary	0%	1%	3%	0%	0%
Total number of operators applying each mechanism	22	80	60	17	3

Source: JRC calculation on BEREC Transparency data.

Table C1: Operator's views on the complexity to apply each FUP mechanism – only operators implementing each type of FUP.(2023)

	Operators (MNOs and MVNOs included)				
	Stable link	**Open data bundle limits**	**Control mechanism**	**Data pre-paid**	**Other FUP mechanisms**
Easy to implement	40%	26%	8%	15%	11%
Relatively easy	19%	24%	21%	23%	11%
Relatively difficult	11%	39%	41%	31%	33%
Very difficult to implement	30%	12%	30%	31%	44%
Total number of operators applying each mechanism	47	85	66	39	9

Source: JRC calculation on BEREC Transparency data.

Table C2: Operator's views on the complexity to apply each FUP mechanism – only operators implementing each type of FUP.(2024)

	Operators (MNOs and MVNOs included)				
	Stable link	**Open data bundle limits**	**Control mechanism**	**Data pre-paid**	**Other FUP mechanisms**
Easy to implement	40%	30%	7%	16%	17%
Relatively easy	18%	21%	21%	24%	17%
Relatively difficult	10%	38%	33%	24%	50%
Very difficult to implement	33%	11%	39%	35%	17%
Total number of operators applying each mechanism	40	80	61	37	6

Source: JRC calculation on BEREC Transparency data.

Table D: Types of complaints related to FUP issues made by consumers and received at least once by European NRAs

	NRAs receiving each complaint					% over total number of respondents				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
End-users were not aware that in roaming a data FUP could be applied	8	11	13	8	11	29%	39%	62%	38%	58%
End-users complained about the amount of volume included in the FUP	6	7	12	14	8	21%	25%	57%	61%	42%
Surcharges were applied despite users being unaware that the fair use limit had been reached.	4	6	8	10	6	14%	21%	44%	45%	30%
Customers were alerted and in spite of changing their usage pattern, the operator surcharged them once the observational period had ended	4	3	4	3	1	14%	11%	22%	14%	5%
Customers were not alerted of opportunities to change their usage pattern once the observational period had ended	2	3	4	2	1	7%	11%	22%	10%	5%
Customers were unaware, by looking at their contracts, of the documents they would need to provide to prove normal residency or stable links (where this is required)	3	5	1	7	5	11%	18%	6%	33%	25%

Source: JRC calculation on BEREC Transparency data.

Table E1: How many complaints related to roaming have you received in each category? (Consumer complaints) – 2024

	No. Countries that replied							% of the total respondents					
How many complaints related to roaming have you received in each category?	None	up to 10	between 11-50	between 51-100	between 101-200	more than 200	Tot.	none	up to 10	between 11-50	between 51-100	between 101-200	more than 200
Fair Use Policy (FUP)	8	10	6	0	0	0	24	33%	42%	25%	0%	0%	0%
inadvertent roaming	5	10	6	2	1	0	24	22%	39%	17%	13%	9%	0%
related to lack of information	10	7	6	1	1	0	25	17%	46%	29%	8%	0%	0%
Value-added services (VAS), including premium rate services (PRS)	10	12	1	0	0	0	23	60%	30%	5%	5%	0%	0%
QoS	10	12	1	0	0	0	23	48%	48%	5%	0%	0%	0%
emergency services	22	1	0	0	0	0	23	90%	10%	0%	0%	0%	0%
non-terrestrial networks	14	8	3	0	0	0	25	29%	54%	13%	4%	0%	0%

Source: 2024 BEREC data collection– Questionnaire for NRAs.

Table E2: How many complaints related to roaming have you received in each category? (Consumer complaints) – 2023

	No. Countries that replied							% of the total respondents					
How many complaints related to roaming have you received in each category?	None	up to 10	between 11-50	between 51-100	between 101-200	more than 200	Tot.	none	up to 10	between 11-50	between 51-100	between 101-200	more than 200
Fair Use Policy (FUP)	5	9	8	0	0	0	22	23 %	41%	36%	0%	0%	0%
inadvertent roaming	5	9	4	3	2	0	23	22 %	39%	17%	13%	9%	0%
related to lack of information	4	11	7	2	0	0	24	17 %	46%	29%	8%	0%	0%
Value-added services (VAS), including premium rate services (PRS)	12	6	1	0	0	0	20	60 %	30%	5%	5%	0%	0%
QoS	10	10	1	0	0	0	21	48 %	48%	5%	0%	0%	0%
emergency services	19	2	0	0	0	0	21	90 %	10%	0%	0%	0%	0%
non-terrestrial networks	7	13	3	1	0	0	24	29 %	54%	13%	4%	0%	0%

Source: 2023 BEREC data collection– Questionnaire for NRAs

Table E3: How many complaints related to roaming have you received in each category? (Consumer complaints) – 2022

	No. Countries that replied							% of the total respondents					
How many complaints related to roaming have you received in each category?	None	up to 10	between 11-50	between 51-100	between 101-200	more than 200	Tot.	none	up to 10	between 11-50	between 51-100	between 101-200	more than 200
Fair Use Policy (FUP)	11	5	1	1	0	0	18	61%	28%	6%	0%	0%	0%
inadvertent roaming	10	7	1	2	0	0	20	22%	39%	17%	13%	9%	0%
related to lack of information	9	4	4	1	0	0	18	17%	46%	29%	8%	0%	0%
Value-added services (VAS), including premium rate services (PRS)	9	1	1	0	0	0	11	60%	30%	5%	5%	0%	0%
QoS	13	2	1	0	0	0	16	48%	48%	5%	0%	0%	0%
emergency services	6	1	0	0	0	0	7	90%	10%	0%	0%	0%	0%
non-terrestrial networks	11	3	0	0	0	0	14	29%	54%	13%	4%	0%	0%

Source: 2022 BEREC data collection– Questionnaire for NRAs