

# Comparison and Critical Comparison of Charges for Data Roaming

Projekt Seminar: Business Information Systems V

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## 2. Introduction

In an era where globalization is increasingly prominent, the role and relevance of data roaming have undergone a significant transformation. The necessity for constant connectivity to mobile services, irrespective of geographical location, has become a critical aspect of modern communication. When individuals travel abroad, they cannot rely on their Domestic Service Provider (DSP) due to geographical limitations. Instead, they must depend on the network of a Foreign Service Provider (FSP). However, this is not the case with multinational operators like Deutsche Telekom or Vodafone, which own networks across various countries. (Spruytte et al., 2017, p.718ff)

This scenario, where a user connects to an FSP's network while abroad, is called international mobile roaming (IMR). In this process, the FSP charges a wholesale roaming fee on the DSP for providing network access to the end user. As a result, the DSP compensates for this expense by charging the user a retail roaming fee. Traditionally, these roaming charges have been substantially higher than local service rates, leading to a general hesitancy among users to engage in roaming services. This has had financial implications for both DSPs and FSPs, as many travelers would opt to switch off their mobile phones entirely during their stay abroad. This issue is not limited to leisure travel but also affects businesses, with employees incurring significant roaming costs during work-related travel.

In response to these challenges, the European Commission took steps to regulate the retail roaming and international wholesale markets within the European Economic Area (EEA). They introduced a strategy to reduce retail roaming charges, leading to the Roam Like At Home (RLAH) policy. RLAH allows users within the EEA to use mobile services in any other EEA country at the same price as in their home country, effectively bringing roaming charges down to zero. (Vogelsang, 2016, p.807ff)

## 3. Roaming

### 3.1 Definition of Roaming

Roaming is a telecommunications service that enables a subscriber from one network operator to utilize the services provided by a different operator when they are within the latter's coverage area. There are four primary categories of roaming:

- 1. International Roaming:** This refers to the capability of using the services of an operator located in a foreign country.
- 2. Inter-Regional Roaming:** This allows a subscriber to use the services of a different operator within the same country. Specifically, this occurs in regions where the two operators do not have overlapping service areas.
- 3. National Roaming:** This enables a subscriber to use the services of a different operator within the same country. This is particularly relevant in areas where the service regions of the operators either overlap or are substantially similar.
- 4. Inter-Technology Roaming:** This type of roaming occurs between different technological platforms. Examples include roaming between 2G and 3G networks or between Cellular and WLAN networks.

In recent years, roaming over GSM networks has emerged as a significant service. It has generated substantial revenue for network operators. By the end of 2001, operators had established over 20,000 roaming agreements. It is estimated that over 6 billion roaming calls were made in GSM networks in the year 2000 alone. (Stuhmeier, 2012, p.597ff)

Roaming enhances network connectivity by increasing the number of customers that can be reached. It also allows users to access the service across a broader area, including globally in the case of GSM. This increase in connectivity and usage leads to an increase in the value of the service and network. According to Reed's law, the total value of the network is proportional to the number of customers  $N$ . This is due to connection, pairing, and group forming effects, represented as:

$$Total\ value = c_1 \cdot N + c_2 \cdot N^2 + c_3 \cdot 2^N$$

Another theory, known as the KK-law, is named after Matti Kalervo and Kalevi Kilkki. It suggests that the value of the service or network is directly proportional to its penetration within the population, where K is the size of the population, p indicates penetration, and r is the average group size. The KK-law is expressed as follows:

$$Total\ value = K * \{m_1 * p + m_2 * p^2 + (m_3 * p^3) / (r - 2 - (r - 3) * p)\}$$

Roaming not only increases penetration but also emphasizes the importance of interoperability between different operators and services. For instance, the growth of SMS usage in the United States escalated after operators signed interoperability agreements. The number of sent SMS messages nearly doubled from 820 million to 1.600 million within three months. (Pohjola, 2003, p.1ff)

### 3.2 History of Mobile Communication

To understand what data roaming is, one has to understand the development and definitions behind mobile communication. In 1992 the members of the European Union initiated this process with the launch of the Global System for mobile Communication (GSM). This technology quickly evolved into the ad-hoc word standard for mobile communication. With the standardization of GSM emerging technologies in different aspects began to standardize. For example, the General Packet Radio Service (GPRS), Enhanced Data rates for Global Evolution (EDGE), the Universal Mobile Telecommunication System (UMTS) and the High Speed Data Access (HSPA). (Luttinen and Katz, 2016, p.18ff)

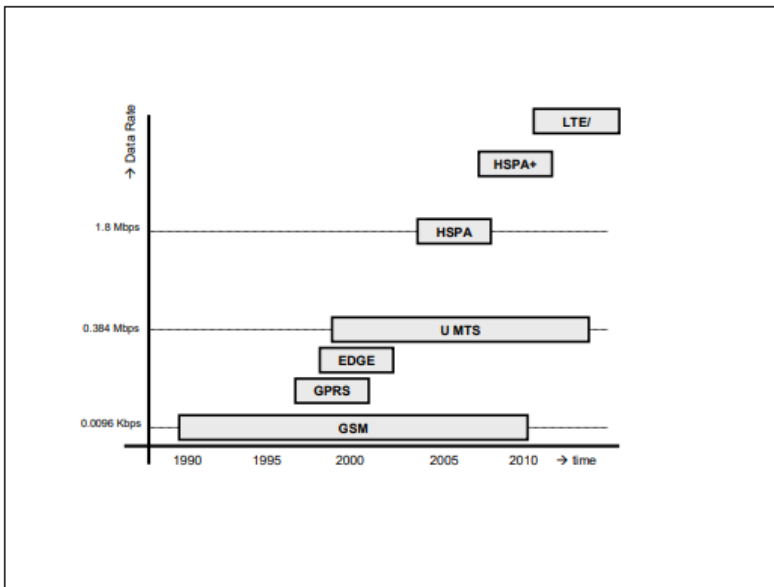


Figure 1: Roadmap Mobile Communication

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### 3.2.1 Global System for Mobile Communication (GSM)

Since GSM was primarily designed for voice services, the data service was a low speed service with maximum data rate of 9.6 Kbps. It allowed for email text, low speed web browsing etc. To encounter the low data rate another system emerged out of GSM, HSCSD was born. HSCSD stands for High Speed Circuit Switched Data and was incredibly inefficient since it required large capacity extensions in the radio network for it to function properly.

### 3.2.2 General Packet Radio Service (GPRS)

Afterwards, the General Packet Radio Service (GPRS) was rolled out. Positioned as an intermediary between GSM and UMTS, it was often termed as 2.5G, providing packet data services atop the GSM structure. The evolution continued with Enhanced Data rates for Global Evolution (EDGE). While it built upon GPRS, many operators in Europe bypassed it, transitioning directly to UMTS. However, EDGE found its niche, especially outside of Europe.

### 3.2.3 Universal Mobile Telecommunication System (UMTS)

Universal Mobile Telecommunication system (UMTS), representing the 3G era, adopted the WCDMA radio access method. WCDMA was initially standardized by the International Telecommunication Union (ITU). It was a significant jump from GSM, in the need for fresh investments since the existing GSM infrastructure wasn't compatible.

### 3.2.4 High Speed Data Access (HSPA)

High Speed Data Access (HSPA) has revolutionized the telecommunications industry by enhancing mobile data speeds and network capacity. It builds on the existing UMTS network using WCDMA methods. HSPA is divided into Upload Data Access (HSUPA) and Download Data Access (HSDPA). HSDPA offers speeds up to 3.6 Mbps, while the advanced Evolved HSPA or HSPA+ can reach up to 42 Mbps for downloads.

### 3.2.5 The Long Term Evolution (LTE)

The Long Term Evolution (LTE) is positioned as an evolution from HSPA and HSPA+ to HSOPA. By using the new access method Orthogonal Frequency Division Multiplexing Access (OFDMA), LTE introduces new radio interface and new data services to the mobile communication networks. It promises stellar data speeds and is steering towards an All-IP network, indicating a future where all services, will be IP protocol-based. (Vroljik and Bouwman, 2008, pp.21ff)

## 3.3 Overview of technologies

### 3.3.1 Data Rates

When it comes to mobile communication, data transmission speed stands out as a critical component driving its advancement. The technology known as WCDMA offers users data speeds that peak at around 384 Kbps. On the other side of the spectrum, we have HSPA, a more advanced system. This technology shows download speeds that can go up to 14.4 Mbps and upload speeds that reach 5.76 Mbps. However, in



everyday usage, one can typically expect HSPA's download speeds to hover between 1.8 to 3.6 Mbps.

### 3.3.2 Latency

In telecommunications, Latency refers to the delay or round trip time it takes for a signal to travel through a system and back. This time is crucial for the efficiency of mobile communication. HSPA technology has notably improved latency, making real-time interactions like voice calls, video chats, and gaming possible. However, systems like GPRS and UMTS have delays that make services like VoIP (Voice over Internet Protocol) not possible. A detailed comparison of latency across these technologies is illustrated in Figure 2.

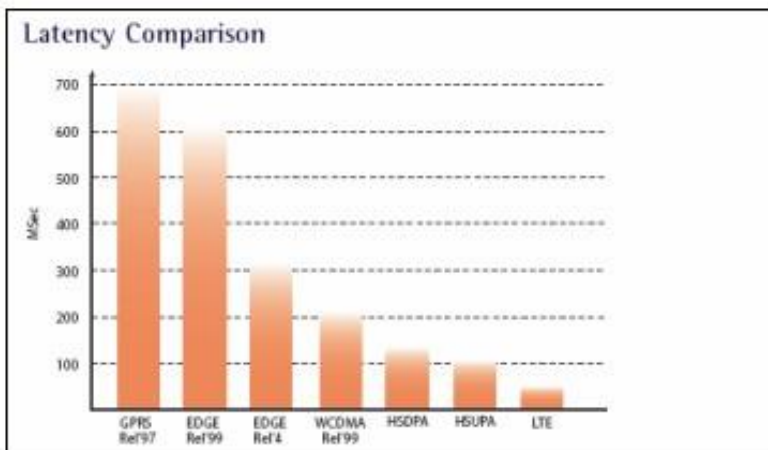


Figure 2: Latency Comparison

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### 3.3.3 Spectral Efficiency

Spectral efficiency measures how many bits per second can be transmitted for each unit of frequency, represented as bit/s/Hz. For instance, a system sending data at 50 Kbps within a 200 KHz bandwidth has a spectral efficiency of 0.25 bit/s/Hz. This metric indicates the effective use of frequency for data communication. As mobile communication evolves, spectral efficiency is improving. This efficiency is influenced by the radio interface and system characteristics but doesn't consider the mobile

operator's network design. Enhanced spectral efficiency reduces the cost per bit transmitted, benefiting both national and roaming data services. However, these benefits rely on consistent spectrum, system costs and optimal use of spectral capabilities. Overall, advancements in spectral efficiency lead to reduced data transmission costs since more data can be transferred within the same frequency bandwidth. (Vrolijk and Bouwman, 2008, pp.23ff)

## 4. Data Markets

### 4.1 Roaming Prices

#### 4.1.1 Introduction

Concerns about the complexity and high costs of international roaming charges have plagued GSM operators since the late 1990s. These operators are often criticized for not adequately informing customers about these fees, which don't seem to reflect the actual service costs. The International Telecommunications Users Group (INTUG), which includes various telecommunications stakeholders, has been proactive in surveying these charges. Despite the critical nature of GSM roaming services for business users, National Regulatory Authorities (NRAs) have paid little attention to the issue. The market competition is minimal, with slow entry of new operators and only superficial competition among existing ones. The emergence of Mobile Virtual Network Operators (MVNOs) has been sluggish, with only a few successful examples in the UK. GSM Roaming has now become a global service, and the GSM Global Roaming Forum (GGRF) has been established to address the complex issues related to contracts, tariffs, regulations, and privacy across different network technologies. (Falch and Tadayoni, 2014, pp.89ff)

#### 4.1.2 Study

INTUG Europe, the International Telecommunications Users Group, is an organization that represents the interests of telecommunications users across Europe. In their study on GSM roaming prices, INTUG Europe undertook a detailed analysis by collecting data from the websites of major GSM operators and through direct communication with customer service departments. The study focused on the largest operators within EU member states including Norway due to its similar competition laws under the European Economic Area agreement. The cost analysis was based on a model call lasting 2 minutes and 15 seconds, with the aim of determining the cost in Euros, excluding VAT, and using business subscription rates as the benchmark. (Sutherland, 2010a, pp.6f)

The research conducted by INTUG Europe revealed significant challenges in obtaining transparent information about roaming charges. Operators frequently avoided taking responsibility for price changes, which were often attributed to currency fluctuations

or tariff revisions by other operators. This lack of clear information poses difficulties for customers trying to understand and verify their roaming charges and raises potential compliance issues with EU consumer protection directives.

Calling to Denmark from Ireland		EirCell	Esat Digifone
Danish subscriber	Sonofon	2.14 (1.85)	2.21 (2.11)
	TeleDanmark Mobil	2.14 (2.05)	2.21 (2.12)
Irish subscriber	Non-roaming	1.25 (1.74)	1.24 (1.57)

Figure 3: Denmark and Ireland prices in Euro

Kommentiert [FM3]: Suth law 14

Calling to Ireland from Denmark		Sonofon	TeleDanmark Mobil
Irish subscriber	EirCell	1.95 (2.80)	1.36 (2.90)
	Esat Digifone	1.02 (2.20)	0.87 (1.96)
Danish subscriber	Non-roaming	n/a (1.42)	0.93 (1.37)

Figure 4: Denmark and Ireland prices in Euro

Kommentiert [FM4]: Suth law 14

The study's findings indicated that while home operators should ideally provide accurate roaming pricing, many, including Greek operators Panafon and TeleSTET, and Telecom Italia Mobile and Telecel in Portugal, failed to do so. This absence of information hinders customers' ability to verify or dispute their bills. The study observed a trend towards more standardized roaming prices since 1999. It also noted a decrease in surcharges for certain subscriber groups, mirroring the general decrease in international call prices in some European countries.

In addition, the study's broader tariff comparison revealed that roaming prices were substantially higher than domestic prices, sometimes by a factor of 10 compared to low-cost calling options. This was particularly evident in closely linked countries such as France and Belgium, indicating that the structure of roaming charges needs further examination. (Sutherland, 2000, p.14ff)

#### 4.2 Inter-Operator Agreement and Non-Discrimination

In the 1990s, Europe's GSM network saw significant expansion, with operators acquiring licenses in both the 900 MHz and 1800 MHz bands. The first inter-operator roaming agreement was established in 1992, setting a precedent. This precedent aimed to provide a network of agreements for consistent international mobile roaming (IMR) services. To manage this growing network of agreements, the GSM Association proposed the Standard Terms for International Roaming Agreements (STIRA). However, STIRA faced legal challenges under the EC Treaty's competition law. This law prohibited agreements that limited market entry or set unfair trading conditions.

In 1997, the European Commission (EC) responded to various challenges by granting a letter of comfort for STIRA. This approval came with conditions, specifically improvements in service distribution or economic progress, to ensure consumers received fair benefits. The exemption granted by this approval was limited to the EU and EEA, leaving potential conflicts with laws like the USA's Sherman Act unaddressed. STIRA's primary goal was to simplify the negotiation process for international mobile roaming (IMR) services. It aimed to speed up the availability of IMR services, ensure wide coverage, and promote fairness and non-discrimination among operators. However, the principle of non-discrimination, intended to ensure fairness, inadvertently led to suppressed competition.

STIRA's technology evenly distributed roaming customers, a method that could potentially lead to higher prices without retail competition. A major point of contention with STIRA was its exclusion of non-spectrum license holders, like MVNOs, from inter-operator roaming agreements. This raised concerns about compliance with the European Commission's (EC) conditions. The initial pricing mechanism under STIRA, known as the Normal Network Tariff (NNT), allowed visited operators to charge a standard retail tariff as the wholesale charge. Home operators could then add a margin of up to fifteen percent. However, the DG Competition criticized this approach for not being cost-reflective. They advocated for an alternative scheme, the Inter-Operator Tariff (IOT).

The transition to Inter-Operator Tariffs (IOTs) did not lead to the anticipated reduction in retail roaming prices. Instead, it resulted in a significant increase in wholesale charges, creating a disconnect from retail prices. Some operators even raised their charges by over 200%. The DG Competition's goal of implementing cost-reflective IOTs

was not achieved, as operators, lacking competitive pressure, did not reduce prices. Despite the rapid expansion of international mobile roaming (IMR) services, providing customers with extensive roaming access, the economic benefits were predominantly captured by operators. They achieved this through high prices and profits, while consumers did not receive a fair share of the benefits. The lack of competitive pricing in IMR services meant that prices remained high or even increased.

Looking back, the shift from Normal Network Tariffs (NNTs) to IOTs is now viewed as a misstep. This shift occurred during a time when retail prices were decreasing due to competition, but wholesale prices were left to the discretion of the operators. The absence of regulatory oversight to ensure cost-oriented wholesale prices led to consumers facing consistently high prices. This situation was further worsened by the introduction of expensive mobile broadband roaming services. (Sutherland, 2010a, p.3ff)

#### 4.3 Traffic Direction

When mobile operators faced complaints about high roaming charges, they responded by pointing to upcoming technological advancements. They believed these advancements would soon allow them to direct customers to specific foreign networks. This new capability was expected to introduce competition and lead to wholesale price discounting, potentially eliminating the need for regulatory intervention. The idea was that a foreign operator could exert buyer power by redirecting traffic away from a network that raised prices, or use the threat of redirection to negotiate significant discounts. This approach would be a shift from the previous model, where customers had an equal chance of connecting to any network when abroad.

However, the implementation of this strategy faced a hurdle due to the non-discrimination obligation in STIRA. This obligation prevented operators from selectively directing traffic to certain networks. The negotiations between operators were also shaped by the bilateral nature of traffic exchange. In this system, each pair of operators traded traffic and revenue. An operator's bargaining power was often weakened if they required coverage in a country that was a significant business or tourist destination. Before the capability of traffic direction was available, an operator's only form of leverage was the threat of terminating a roaming contract.

However, this was largely ineffective, as it would lead to the loss of incoming roaming traffic and revenue, benefiting domestic competitors instead.

To increase incoming traffic, operators would enhance network coverage and signal strength at strategic locations such as airports. Vodafone, for instance, had managed to direct over 90% of its traffic by 2005, allowing it to internalize roaming and negotiate third-party deals, potentially to the detriment of its domestic rivals. Operators formed alliances to secure roaming traffic, often resulting in the provision of IMR services at high wholesale prices, which softened competition in the retail market and could lead to consumers facing excessively high per-call prices. These alliances were inspired by similar strategies in the airline industry. The danger of such alliances was that they could lock up traffic, leaving little chance for operators to switch to a rival group, which could impede competition in the IMR wholesale market. The dynamics of the relationships between operators became crucial, with many discounts remaining opaque to those outside these alliances.

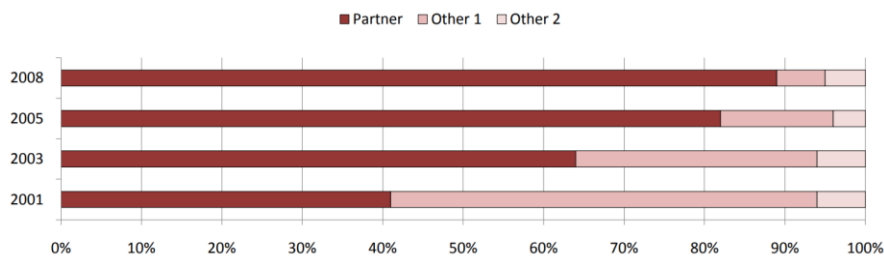


Figure 5: Traffic directed to a partner network

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Research indicated that without complete control, traffic direction did not necessarily lead to a more efficient market. It was suggested that a wholesale price cap might be necessary to achieve efficiency. Traffic direction was enabled through technologies like preferred and forbidden network lists on SIM cards, Over The Air (OTA) instructions, and Prohibited Visitor Location Registers (PVLR).

Despite some operators offering substantial discounts on IOTs, the extent of savings from traffic direction and whether these savings were passed on to retail customers was unclear. The costs of developing traffic direction technologies were also not well documented, but operators continued to maintain multiple contracts in each country to ensure coverage and revenue generation. (Sutherland, 2010a, p.12ff)

## 4.4 Pricing Strategies

### 4.4.1 Pricing Schemes

Pricing schemes in the telecommunications industry are a critical aspect of business strategy. They play a significant role in influencing consumer behavior, shaping regulatory responses, and defining the competitive dynamics of the market. For example, Vodafone's strategy in the roaming services market has unfolded gradually and detailed. It has been characterized by a slow integration of acquisitions and strategic use of its expansive geographical presence to outmaneuver competitors. (Vrolijk and Bouwman, 2008, p.50)

Initially, Vodafone's operations seemed disjointed, more like a collection of independent entities than a unified multinational corporation. Over time, however, Vodafone began to harness its international reach. This allowed the company to present a more unified front and become more competitive on a global scale.

In January 2001, Vodafone launched the Eurocall scheme. This was a crucial move in its roaming strategy and one that required notification to the European Commission due to potential competitive impacts. This initiative later expanded into Worldcall and ultimately evolved into the Vodafone Passport program. With the lifting of certain regulatory restrictions, Vodafone Passport introduced a new pricing structure for roaming services. It did away with monthly fees and introduced a small setup charge for each roaming call, followed by standard home network charges. This model was particularly advantageous for longer calls, suggesting a targeted approach towards high-spending and enterprise customers.

The Eurocall scheme included Vodafone Group companies and affiliates. They committed to discounted Inter-Operator Tariffs (IOTs) and set a maximum retail roaming charge of €0.80 per minute. The aim was to simplify and standardize roaming tariffs across the network, making it more attractive to high-value customers. The European Commission's approval was crucial for these agreements. They had the potential to limit competition, aligning with Article 81 (1) of the EC Treaty. Nonetheless, exemptions were possible under specific provisions of Article 81 (3).

By September 2006, Vodafone's Passport program had achieved considerable success, attracting around ten million customers. To expand the program's scope, Vodafone established partnerships with various international operators. They employed traffic direction technology, ensuring that most roaming traffic was channeled through its network and those of its partners. As Vodafone's influence grew, competitors such as

Kommentiert [FM6]: F: 20. Vrolijk and Bouwman, 2008  
50-55 / 73-85

Kommentiert [FM7]: F: Suth comp 20



T-Mobile, with its WorldClass program, launched similar initiatives. All these developments occurred against the backdrop of the second Roaming Regulation, a period marked by a rise in competitive roaming plans.

The European Commission conducted three consultations on International Mobile Roaming (IMR) charges. The level of debate intensified as operators grasped the seriousness of the EC's intentions. These consultations exposed a rift between political and economic viewpoints on roaming charges. The first consultation, in early 2006, was met with skepticism, particularly from the GSM Association (GSMA). Many operators preferred to work within the existing legislative framework rather than face new regulations.

The second consultation brought forth the Home Pricing Principle and suggested a wholesale cap on roaming charges. This elicited a range of reactions. Some industry stakeholders, like the European Telecommunications Network Operators' Association (ETNO), felt that market forces were already reducing prices. Others raised concerns about potential discriminatory effects and the challenges of cost recovery.

By the third consultation in May 2008, the EC was re-evaluating the first Roaming Regulation. They considered extending it to include caps on SMS and mobile broadband. The GSMA and operators voiced opposition, particularly to retail caps. They argued that the market was already competitive and that further regulation could suppress this competition. Despite these claims, evidence pointed to a significant reduction in roaming revenues and an uptick in costs due to the regulation. The consultations also looked into the emerging market of mobile broadband roaming. Operators described it as a nascent market, despite the long availability of the technology. This suggested a market failure, possibly due to excessively high prices.

The discussions underscored the complexities of the roaming market. They highlighted the difficulty in communicating the cost differences between domestic and roaming services to customers, the impact of wholesale price caps on smaller operators, and the protracted realization of savings from volume discount agreements. There was also no consensus on the definition of competition or the market structures needed to encourage it.

In conclusion, Vodafone's roaming strategy has unfolded as a tale of gradual adaptation and strategic positioning. This evolution has taken place within a tightly regulated and fiercely competitive international market. The company has worked to

streamline its services and pricing, a task that involved navigating the intricacies of regulatory challenges and market dynamics. These efforts by Vodafone mirror the broader struggles faced by industry players and regulators in the dynamic world of global telecommunications. (Sutherland, 2010a, p.20ff)

#### 4.4.2 Price Transparency

Price transparency is a crucial issue in reducing International Mobile Roaming (IMR) prices without market distortion. The question was whether informing customers of their IMR charges would prompt them to use less roaming or seek alternatives, pressuring operators to lower prices. The EC's 2000 sector inquiry pinpointed consumer information scarcity as a major issue, which operators tried to mitigate with a code of conduct. Announced just before an EC briefing on the sector inquiry's progress, compliance was initially poor, but operators quickly adjusted after an evaluation. Despite a revised code reflecting best practices, a 2006 Eurobarometer survey revealed that over forty percent of Europeans were unclear about IMR costs. Surveys in Finland and Ireland echoed this lack of awareness, casting doubt on the code's effectiveness. (Vrolijk and Bouwman, 2008, p.73ff)

Regulators in Arab states' complaints led to another attempt at a code of conduct and a website to inform consumers about IMR prices, but these efforts went unevaluated. In the EU's 1999 legislative review, there were calls for operators to provide real-time IMR pricing, which the GSMA claimed would be prohibitively expensive due to the advanced signaling required. No source for this cost estimate was provided. Commissioner Reding's 2005 initiative, a website listing EU roaming prices, prompted the GSM Association to launch a similar site. A 2007 European Parliament report considered various technical solutions for price transparency, suggesting that such services could come at a cost to customers. Yet, the Roaming Regulation mandated operators to send free price alerts to customers traveling in the EU.

The assumption was that clearer, lower prices would boost IMR service usage, but the economic downturn complicated data interpretation. Vodafone's CEO noted a significant drop in IMR revenues, coinciding with decreased business travel. O2's data suggested that EU price transparency didn't spur increased usage compared to other regions. The United Arab Emirates and Bahrain implemented EU-style price alerts, but without assessing the impact or consumer benefit. The 2007 Roaming Regulation revision tackled 'bill shock' by setting a default spending limit with mandatory

customer alerts, implemented in 2010 despite the cost to operators, who have yet to disclose exact figures. The FCC's investigation into 'bill shock' reflects a broader concern. While businesses may be less price-sensitive, negotiating lower rates and limiting IMR use, evidence suggests some consumers opt for local SIM cards to avoid high charges. Despite regulatory efforts to enhance price transparency, its cost-effectiveness and impact on price and usage levels remain uncertain. (Sutherland, 2010a, p.25ff)

**Overview of the mobile turnover of Belgian mobile operators in 2015 (x1000)**

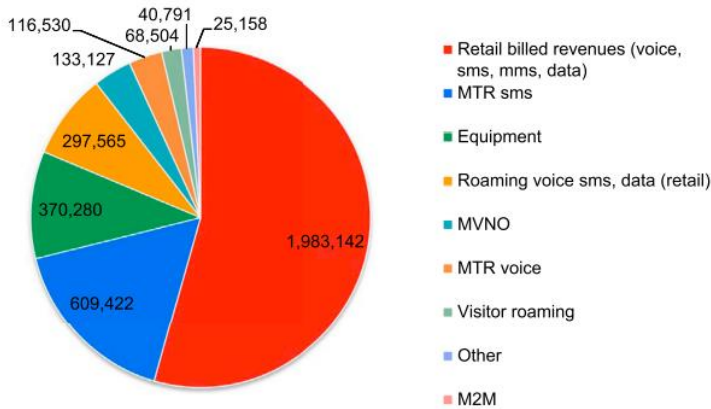


Fig. 6. Overview of the mobile turnover of Belgian operators in 2015 (BIPT, 2016a).

**Table 5**  
International operators active in the EU (DFMonitor, 2016).

MNO	Number of countries
Vodafone	15
Deutsche Telekom	11
Orange, TeliaSonera	8
Hutchison, Tele2, Telefonica	6
Telenor	5
TelekomAustria	4
KPN	3
Belgacom, BITE, Elisa, Iliad, PPF	2

Figure 6: Overview of the turnover of Belgian mobile operators

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#### 4.5 Economic and Business Impact of Cutting Roaming Fees

The decision to eliminate roaming charges by 2017 is set to favor consumers. However, it will also bring significant changes to the business models of telecom operators, including both MNOs and MVNOs (Mobile (Virtual) Network Operators). These operators will be subject to a new limitation preventing them from imposing extra fees for roaming services. Instead, they must price these services at the same level as domestic charges, even though their roaming costs do not decrease. (Muñoz-Acevedo and Grzybowski, 2023, p.16ff)

##### 4.5.1 Impact for Telecom Operators

The primary effect of scrapping retail roaming fees is a direct hit to the additional revenue for operators. The extent of this impact is not uniform. It varies widely, influenced by whether an operator owns a network and by their geographic presence.

##### 4.5.2 Impact for MNOs: Geographical Location

The implications of eradicating roaming fees are highly dependent on the country where the operator is active. This is due to the different travel patterns of users. For example, operators in countries with a high volume of outgoing roaming, such as Sweden, will see a decline in revenue. In contrast, those in countries with high tourist inflows may see benefits. However, they must also invest in enhancing network capacity to handle the increased load.

##### 4.5.3 Impact of Geographical Coverage

Operators that provide services across national borders can secure more favorable wholesale roaming rates. They do this by utilizing their own network infrastructures across countries. This strategic position allows them to manage costs more effectively. This is in contrast to operators who only operate within a single country's borders.

#### 4.5.4 Impact for MVNOs

MVNOs, which lack their own network infrastructure, face distinct challenges. They rent network capacity from MNOs and compete in the market, often holding a smaller market share. These operators bear costs when their customers use roaming services. However, they do not have the ability to offset these costs with wholesale revenue, as they do not host roaming customers. Their limited capacity to negotiate lower wholesale fees often leaves them at a disadvantage. They depend on regulatory caps to maintain economic viability. (Spruytte et al., 2017, p.724ff)

## 5. Regulations

### 5.1 Second Roaming Regulation

The roaming regulations introduced in the European Union between 2007 and 2017 were a significant success. These regulations came about due to concerns over high roaming charges and a lack of transparency in the market. Investigations revealed that roaming prices were substantially higher than domestic call rates, a disparity that couldn't be justified by the cost of providing services.

The aim of these regulations was to drastically reduce international roaming charges within the EU. Initially, limits were set on charges for voice services and outgoing calls while roaming. Over time, these caps were extended to SMS and data services. Before June 15, 2017, using mobile services abroad in Europe cost extra. The 'Roam Like At Home' (RLAH) policy ended these fees within the European Economic Area, allowing users to roam without extra charges. This change started in the early 2000s when the European Commission tackled high roaming rates and unclear pricing. The EU's journey to regulate roaming began with a 2005 study showing roaming prices were much higher than domestic calls and the actual service cost. The first roaming regulation in 2007 set price limits for calls made and received abroad. Later regulations in 2009, 2012, 2015, and 2017 added rules for SMS and mobile internet, protections against high data roaming bills, and steps to increase competition. (Infante and Vallejo, 2012, p.739ff)

In 2013, the 'Connected Continent' package aimed for a single telecom market, leading to the end of roaming charges in 2017 and a fair use policy in 2016. This policy set usage limits to prevent misuse. The regulation also included mobile termination rates (MTR) and market changes through mergers. The regulation impacted mobile operators' income. Main income sources were domestic service use, retail roaming fees (before RLAH), and wholesale roaming charges. The regulation directly reduced roaming income, possibly causing higher domestic prices to make up for lost profits, known as the 'waterbed' effect.

These regulations played a crucial role in fostering competition in the mobile market and advancing the EU's digital single market. However, they also presented challenges. There were variations in travel and phone usage patterns across different countries, as well as differences in costs for mobile operators. This could lead to competitive imbalances and difficulties for some operators. Additionally, the increase in roaming service usage raised operators' costs, potentially impacting competition

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and investment in the industry. There was also a concern that mobile operators might increase domestic prices to compensate for the reduced roaming revenues.

Despite these challenges, the regulations had a significant positive impact on consumers and brought about notable changes in the mobile phone market, although they also introduced complex issues related to market competition and the financial health of mobile operators. (Sutherland, 2010b, p.16ff)

### 5.1.1 Waterbed Effect

The concept of the 'waterbed effect' in economics refers to a situation where regulating one price in a multi-product firm leads to changes in its other unregulated prices. This effect is not a direct consequence of the regulation but rather a result of the firm's efforts to maximize profits. For instance, if a firm is forced to lower prices in one area, it might increase prices in another to compensate for the lost revenue.

A study by Genakos and Valletti (2007) demonstrated this effect in the context of mobile termination rates. When these rates were regulated and reduced, there was an observable increase in other unregulated prices by the operators. This effect was particularly evident in the case of international roaming regulations (RR-I and RR-II) in the EU. Operators responded to these regulations by raising wholesale prices for non-European operators and increasing retail charges for Europeans roaming outside the EU/EEA. This led to higher costs for non-EU/EEA consumers traveling to Europe and for EU citizens traveling beyond Europe.

The extent of these price increases and the creation of differential wholesale prices for non-EU/EEA operators need thorough documentation to fully assess the economic consequences and the scale of the waterbed effect. The ability of EU/EEA operators to raise wholesale prices suggests they have significant market power. Conversely, imposing a retail price cap on roaming charges for EU citizens traveling outside the EU/EEA could potentially lead operators to negotiate lower wholesale rates.

The text also highlights the political need to acknowledge the relationship between price increases and the introduction of roaming regulations. The European Commission (EC) is urged to coordinate a response with various international bodies and use its programs to support regulators in developing countries to better understand their roaming markets. The situation is complex in some holiday

destinations and small island developing states (SIDS), where local operators might rely heavily on international mobile roaming (IMR) revenues. In such cases, inflated wholesale roaming rates might be overlooked by non-EU regulators if their operators benefit from them.

The lesson for regulators worldwide is that efforts to lower roaming rates can inadvertently lead to increases in other roaming prices. Therefore, any regulatory measures should be carefully evaluated and coordinated. The EC is also encouraged to consider extending its regulated wholesale offer to non-EU countries, possibly on a reciprocal basis, and to support legal and practical aspects of such arrangements. (Sutherland, 2010a, p.32)

#### 5.1.2 Hubs

In the world of mobile telecommunications, the structure and dynamics of inter-operator roaming agreements have undergone significant changes over time. Roaming agreements between mobile network operators have evolved from bilateral contracts to a more interconnected system. This change was driven by the increasing number of operators and the growing complexity of technologies. The GSM Association responded by initiating an initiative that led to the creation of roaming hubs. These hubs, operated by various entities, allow operators, especially newer or smaller ones, to offer their customers wider roaming access across numerous networks.

A key challenge in this setup is the need for individual negotiations to establish mutual roaming agreements. Operators often prefer directing traffic to a single partner in a country to secure discounts, rather than spreading it across multiple operators. The standard pricing model in these hubs is based on a non-discounted rate, with any potential discounts being a matter of separate negotiations.

These hubs function as connection points for operators, without directly engaging in wholesaling. They support network connections but leave pricing and discount discussions to the operators. The market could potentially welcome a new type of hub that includes wholesaling and discounting services, but this is currently hindered by operators' preference for bilateral deals.



The possibility of the European Commission supporting the development of an independent, neutral hub that engages in wholesaling is suggested. This could encourage a more competitive and rapidly evolving market. Additionally, there's a recommendation for regulatory adjustments to allow more open trading and ensure that all operators, regardless of their license type, have access to regulated wholesale prices. (Sutherland, 2010b, p.21ff)

### 5.1.3 Price Caps

The European Union's strategy for managing the high costs of international mobile roaming (IMR) within its member states centered on implementing a regulatory framework. This framework primarily focused on setting price caps for both retail and wholesale mobile services. The EU chose this approach over other methods, such as self-regulation or collaborative regulatory efforts, largely due to doubts about the market's ability to independently lower prices to a reasonable level.

Central to this initiative was the creation of a dual system of price caps, covering both retail and wholesale mobile services. The goal was to establish a glide path for prices, with periodic reviews and adjustments. This was to ensure that consumer costs remained controlled. This decision was shaped by the substantial size of the IMR market within the EU. The market was not only financially significant but also affected a large number of EU citizens, especially those traveling for leisure.

The expected benefits for consumers from this regulatory move were projected to be considerable. The highest gains were anticipated from the implementation of both retail and wholesale price caps. However, these projections were not later recalibrated or validated with real-world data following the implementation of the caps. The process of setting these price caps was not straightforward and involved extensive discussions and negotiations within various EU bodies. The final outcome was a compromise that balanced different viewpoints and interests. The regulation was primarily aimed at reducing the financial burden of roaming charges on businesses operating across EU borders, which were seen as a significant impediment to economic efficiency and competitiveness.

In the course of refining the price cap strategy, external consultations were sought, leading to recommendations for unified caps for certain types of calls and adjustments to the margins to ensure smaller operators were not unduly

disadvantaged. This approach was based on the assumption that retail competition was more effective than wholesale in terms of passing benefits back to consumers. Outside the EU, countries like Switzerland, which were not EU members, aligned themselves with the EU's regulatory framework, finding it more practical to include themselves in the EU's regulated tariff plans. This was partly due to the convenience of explaining their inclusion to consumers given Switzerland's geographical proximity to many EU countries.

The effectiveness of the regulation was monitored through various reports that assessed compliance levels. These reports indicated a high degree of adherence to the regulation, although there were instances of misclassification by some operators. The impact of the regulation was also evaluated in terms of its effects on industry profits and consumer welfare, with different scenarios considered to understand the range of possible outcomes.

Special attention was directed towards regulating SMS prices, in response to studies revealing significant price differences between roaming and domestic rates. This resulted in the implementation of SMS price caps, aimed at shifting the balance towards consumer interests. Additionally, the regulation extended into mobile data roaming, a relatively new market with distinct characteristics compared to voice and SMS services. A major challenge in this area was the absence of established cost-calculation methods for mobile broadband services. Another issue was the considerable investments needed by operators to upgrade their networks to accommodate these services. (Sutherland, 2010a, p.28ff)

## 5.2 Regulated Competition

### 5.2.1 Limited Competition

Before the implementation of EU regulations, high wholesale prices were largely responsible for the elevated retail roaming prices compared to domestic rates. This dynamic shifted post-2007 with the introduction of wholesale caps, which led to a noticeable decrease in retail prices for intra-EU international roaming. Despite this change, a significant challenge emerged at the retail level of the market.

The issue at the retail level stems from the control home providers have over E.164 numbers, which are used for both domestic and roaming services. This control makes it challenging for alternative providers to offer comparable international roaming services. While frequent travelers have some options like dual SIM phones or global

MVNOs, these alternatives are not practical for occasional travelers, who typically rely on their domestic subscription when abroad.

This reliance on domestic subscriptions for roaming services means that most consumers base their choice of mobile operator on domestic factors, such as price and handset subsidies, rather than on roaming tariffs. As a result, there's little incentive for operators to engage in price competition for international roaming services. Studies have shown that the demand for international roaming voice services is relatively inelastic, with elasticity values ranging from -0.2 to -0.4. In contrast, data roaming services exhibit a more elastic demand.

Despite the presence of large European operator groups with access to cost-efficient wholesale inputs, these groups have not significantly lowered their alternative roaming tariffs. In some instances, these alternative tariffs have even exceeded the regulated Eurotariff. The European Commission has approached the expansion of these large groups into trans-national markets with caution, considering the potential impacts on smaller, independent operators. The Commission aims to strike a balance between fostering competition among large groups and protecting smaller national players.

The overarching conclusion is that the retail level of the international roaming market suffers from limited competition, a situation not solely attributable to the wholesale market's dynamics. The European Commission anticipates that the introduction of decoupling measures in upcoming regulations will stimulate competition at the retail level. These measures, scheduled for implementation by 2014, will enable consumers to independently select their domestic and international roaming providers. The effectiveness of these measures will largely depend on the consumers' willingness to explore alternative roaming options and the operators' motivation to compete for these customers. (Infante and Vallejo, 2012, p.742ff)

### 5.2.2 Imperfect Wholesale Competition

The evolution of wholesale competition in international roaming markets has undergone significant changes over the years. Initially, retail operators lacked the capability to choose their preferred wholesale international roaming providers in each visited country. This led to a scattered distribution of wholesale traffic and minimal

competition at the wholesale level, as operators had little control over which network their customers would use while roaming.

With technological advancements, home operators gained the ability to direct a larger portion of their voice traffic to networks of their choice. This development, coupled with an increase in the number of mobile network operators (MNOs) in various countries, was expected to foster price-based competition in the wholesale roaming market. However, the reality proved to be more complex due to the emergence of large transnational groups and roaming alliances, as well as the intricacies of roaming hubs.

In this market, every MNO can both receive and provide roaming traffic, making the selection of a roaming partner a strategic decision that goes beyond just price considerations. Large MNOs often prefer to negotiate traffic steering deals with other large players, focusing on reciprocal benefits rather than engaging with smaller operators who offer lower prices but less outbound traffic.

This dynamic places smaller MNOs at a disadvantage, as they struggle to compete for significant volumes of wholesale traffic. The reciprocal nature of these agreements also affects the actual cost of international roaming services. When traffic is balanced between two MNOs, the real cost is essentially the management of the other party's traffic on their network. However, these wholesale rates often become a benchmark for setting retail prices, even though they may not accurately reflect the underlying costs.

Large operator groups tend to keep as much international roaming traffic within their networks as possible. For them, the wholesale price is more of a formal figure rather than an actual cost indicator, especially for balanced and intra-group traffic. The pricing for unbalanced traffic is influenced by strategies of internalization and alliances among large groups.

Small independent operators, without the advantage of large volumes of international roaming traffic, have advocated for regulated wholesale prices to prevent being edged out of the market. However, fully grasping these market dynamics is challenging due to the scarcity of detailed, publicly accessible data on wholesale agreements. These agreements are typically intricate and confidential. Mobile Virtual Network Operators (MVNOs), which primarily concentrate on domestic services, depend on their host MNOs for international roaming services. In negotiating their

own wholesale agreements, they encounter various obstacles, such as limited economies of scale and constrained access to essential industry resources.

In conclusion, while there has been a shift from a non-competitive market due to the inability to steer traffic to a more controlled environment, this hasn't necessarily translated into increased competition. The significant presence of intra-group and balanced traffic reduces the relevance of nominal prices, and the impact of unbalanced traffic on the market is still not fully understood. Further empirical research is needed to shed light on these aspects. MVNOs, in particular, have not been able to capitalize on lower regulated wholesale prices, limiting their ability to offer competitive retail roaming prices. (Infante and Vallejo, 2012, p.743ff)

### 5.2.3 Wholesale Reductions

Regulatory theories often recommend minimal intervention. They suggest that managing prices at the wholesale level should enable competition at the retail level. This concept is based on the assumption that market forces, once activated at the wholesale stage, will naturally extend to the retail level, ensuring fair pricing and competition. However, the international roaming market presents a unique challenge to this theory.

The experience of the European Union with roaming regulations provides valuable insights. Despite efforts to regulate wholesale rates, the expected benefits to retail prices have not been fully realized. The reduction in wholesale rates did lead to lower retail prices, but the difference between the two, known as the retail markup, remained relatively unchanged. This suggests that without specific retail measures, the advantages of wholesale price reductions might not fully reach consumers.

For incoming calls within the EU, the situation is even more illustrative. While retail prices were regulated, wholesale charges were largely left to market forces. Before regulation, the retail markup was significantly high. After regulation, there was only a minor decrease in this markup, despite lower wholesale rates. This indicates that reductions in wholesale rates do not automatically result in lower retail prices.

This scenario in the EU highlights an important aspect of international roaming market dynamics: regulating wholesale prices alone may not be enough to ensure competitive pricing at the retail level. The complexity of the market calls for a more

comprehensive approach that includes both wholesale and retail measures. Such an approach is necessary to ensure that consumers truly benefit from reduced prices, in line with broader goals like making international roaming more affordable and facilitating cross-border communication.

This discussion emphasizes the need for a balanced regulatory strategy in the international roaming market. It points out the importance of not just focusing on wholesale price regulation but also considering its impact on retail prices. This is crucial for achieving the ultimate aim of providing affordable and competitive international roaming services. (Infante and Vallejo, 2012, p.745ff)

### 5.3 The Current EU Roaming Regulation

#### 5.3.1 The Legislative Position

The European Union implemented a major shift in its roaming regulations, effective from June 15, 2017. This crucial change, known as Roam Like At Home (RLAH), marked the end of additional roaming charges that mobile operators previously imposed on consumers within the EU. This decision was the result of a series of regulatory reforms. It began with the Telecom Single Market Regulation (TSM) in 2015, which revised the earlier Roaming III Regulation.

The TSM Regulation introduced a transitional phase leading up to the complete abolition of roaming surcharges. During this period, mobile operators were permitted to add a limited surcharge to domestic prices for roaming services. This was a temporary measure, designed to ensure a smooth transition from the Roaming III regime to the new RLAH environment. In addition, the TSM Regulation included provisions for a Fair Use Policy. This policy set limits on the volume of roaming traffic a consumer could use without incurring extra charges. In preparation for the RLAH transition, the EU legislator also established wholesale tariffs between operators for roaming services. These tariffs were set to gradually decrease over several years. They started from 7.7 euros per GB in June 2017 and were planned to reduce to 2.5 euros per GB by January 2022. This gradual reduction of tariffs was part of a broader strategy. It aimed to balance the interests of mobile operators and consumers.

However, setting these wholesale tariffs proved challenging. The cost study conducted by the European Commission to inform the tariff levels underwent review and

political negotiation. This often led to tariffs that did not accurately reflect the actual costs of providing roaming services. The discrepancy between costs and tariffs has been a contentious issue. It significantly impacts the business models of mobile operators in Europe. The RLAH policy also included measures to prevent system abuse, such as the implementation of a Fair Use Policy. This policy aimed to prevent situations where roaming services were used excessively in a manner not consistent with periodic travel. It was designed to prevent 'permanent roaming' or the creation of pan-EU Mobile Virtual Network Operators (MVNOs) based on the rights conferred under the TSM Regulation.

Despite these measures, the transition to RLAH has brought to light the inherent conflict between wholesale and retail charges in the roaming market. While retail roaming surcharges have been largely eliminated, the wholesale charges for delivering these services have not been reduced to zero. This has led to a situation where the wholesale prices agreed upon are significantly higher than the actual costs of providing the services. They are also much higher than the rates offered for national roaming. (Shortall, 2019, p.17ff)

### 5.3.2 The Market Reaction to RLAH

The market's response to the implementation of Roam Like At Home (RLAH) has been quite significant. Following the abolition of retail roaming rates, there was a dramatic increase in traffic volumes. This surge was particularly evident after the introduction of RLAH services on June 15, 2017. A report by BEREC, the body representing National Regulators in the EU, highlighted this growth. It showed a staggering 148.43% increase in data traffic in the third quarter of 2017 and a 134.09% increase in the second quarter, compared to the previous quarters. Similarly, outgoing international calls and SMS services saw substantial growth in the same period.

The increase in roaming traffic in the European Economic Area (EEA) countries during the third quarter of 2017, which coincides with the summer period, is attributed to the RLAH services. This indicates that the 2015 update to the Roaming Regulation significantly boosted the international roaming market. Consumers, responding rationally to the reduced roaming prices, increased their usage of each service, especially data. However, the level of roaming service usage still remains below domestic usage levels.

This discrepancy might be due to either a lack of consumer awareness or limitations imposed by operators. Data from a special Eurobarometer survey suggested that only 62% of citizens were aware of the end of roaming charges since June 2017, a decrease from 71% at the time the charges ended. Additionally, the report indicated that consumers often limit their usage, mainly by switching off data roaming, since June 2017. While this behavior explains part of the difference between domestic and intra-EU usage patterns, it doesn't account for the entire discrepancy. (Shortall, 2019, p.19ff)

#### 5.4 Delivering Sustainable RLAH

The development of a sustainable Roam Like At Home (RLAH) system, through efficient wholesale pricing, involves addressing the current limitations in wireless capacity trading. Presently, roaming and MVNOs purchase capacity within rigid structures. These structures don't allow for innovative or flexible use of capacity. The existing trading system, largely orchestrated by the GSMA, is inefficient. Roaming agreements are negotiated in large, biannual 'bazaar' style events. This model, functional for its current scope, is impractical for a more expansive and inclusive market.

The primary issues with this system are its inefficiency and the high level of wholesale pricing that results from its contract structures. A more open trading system for wireless capacity is needed. One that allows access to anyone with innovative ideas, not just network operators. Breaking the link between inbound and outbound traffic is crucial for creating a competitive wholesale roaming market. This shift would focus on price as the central aspect of transactions, enabling all operators to compete both in the wholesale and retail markets.

However, large operators, especially those with significant inbound traffic, lack incentive to move away from the current system. An online trading platform for wireless capacity could introduce a more efficient trading system. This platform could support bids for composite data/voice/SMS products or standalone data products. The success of such a platform depends on the participation of larger group companies, which currently enjoy a competitive advantage.

One solution might be to impose obligations on operators to sell a certain percentage of their capacity on this platform. This approach is similar to regulations in the energy



markets in the EU and beyond. However, resistance from larger operators is a significant hurdle. The obligation to participate could be time-limited. The aim is to establish a liquid roaming market that would eventually become self-sustaining.

A wireless capacity trading platform could help maintain costs close to the marginal cost of production. This is crucial for the long-term viability of RLAH, especially in the evolving 5G environment. The European Commission is tasked with reviewing the RLAH model and proposing amendments if necessary. This review should consider introducing measures to compel a minimum level of participation on an exchange platform. Such measures would ensure sufficient liquidity and establish an operative market process for wholesale roaming markets. (Shortall, 2019, p.19ff)

## 6. Conclusion

Exploring data roaming charges reveals a dynamic picture, shaped by the ever-changing world of mobile communication technologies and regulatory frameworks. This deep dive into the sector sheds light on both its challenges and opportunities. The transition from traditional GSM to advanced LTE technologies has not only revolutionized connectivity but also profoundly impacted the economics of data roaming. This technological evolution highlights how crucial advancements are in defining user experiences and pricing strategies within the telecommunications industry.

An analysis of roaming pricing strategies, especially within frameworks like Roam Like At Home (RLAH) in the European Economic Area, illuminates the complex relationship between regulatory policies and market dynamics. These initiatives aim to lessen the financial burden on consumers. They also highlight the delicate balance needed between regulatory goals, operator economics, and consumer benefits.

The impact of regulatory measures on roaming fees goes beyond immediate pricing changes. It affects the long-term business strategies of telecom operators. While reducing roaming charges presents revenue challenges, it also creates opportunities for increased usage, customer satisfaction, and loyalty. This dual impact highlights the importance of a nuanced understanding of the economic and business consequences of these regulatory decisions.

Looking to the future, the world of data roaming charges is a dynamic field of interest. Future research could explore the long-term effects of current regulatory frameworks. It could also examine consumer reactions to changing pricing models and the impact of emerging technologies like 5G on global roaming practices. The continuous advancements in mobile communication technologies, alongside evolving regulatory and consumer landscapes, emphasize the need for ongoing study and adaptation in this area.

In summary, understanding data roaming charges is vital in a world that is increasingly interconnected. This understanding provides insights into the intersection of technology, economics, and regulation. It offers a guide for future innovations and strategies in the telecommunications industry. As global connectivity grows, the importance of understanding and optimizing data roaming charges becomes more crucial. It is key to shaping user experiences and industry practices.

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