

International roaming in the EU: current overview, challenges, opportunities and solutions

Abstract

As technology evolves and globalization continues, the need for reasonably priced roaming services has never been higher. In 2007, the European Commission (EC) introduced a first set of regulatory decisions to cap the maximal roaming fee end users have to pay for voice services. In the years after, additional price caps have been introduced for SMS and data, initially only for end users, in a later stage also for the wholesale tariff. The final step, Roaming Like at Home (RLAH), will start to take effect in June 2017; from then on end users will pay the same price (for voice, SMS and data) when roaming like in their domestic country.

The effect of RLAH on the business case of each mobile operator is hard to predict, as the different national markets are extremely heterogeneous and operators face large discrepancies in terms of roaming usage and network costs due to different traveling patterns and various other reasons that cannot be harmonized (geography, economics, working force, usage history, etc.). Furthermore, competition in the telecom market will no longer be a purely national matter, as the decision to abolish roaming tariffs will fully open up cross-border competition.

This paper aims at providing insights in the effect of RLAH for both the end user as well as the mobile operators. Following a literature survey approach, including an overview of the roaming regulation process from 2007 up to now, the paper discusses possible effects the RLAH initiative might trigger, going from lower wholesale prices for mobile operators to higher retail prices for end users. Additionally, as the European Commission strives for a digital single market, this paper presents a number of technical solutions (carrier portability, software-based SIMs, cross-border IMSI, Roaming like a Local, Wi-Fi offloading) that may pose a - partial or full - alternative for roaming and explains how these may impact cross-border competition both positively and negatively. The solutions are assessed against two axes: (1) generating the best possible outcome for the end customers (in all countries) and (2) ensuring the best level playing field for (virtual) mobile operators in Europe, which will of course involve trade-offs on different levels.

Keywords – international roaming; policy; RLAH; Roam Like At Home

1. Introduction and motivation

The globalization of the world is changing the way we live. The increased integration between European countries as well as the increasing prosperity of the EU citizens has led to an increase in intra-European travel (Eurostat, n.d.). People have always had an interest in using mobile services while travelling internationally, and the smartphone revolution – always being connected – has only increased this trend.

When using mobile services in a foreign country, your local provider – the Domestic Service Provider (DSP) – cannot rely on its own network for voice or data transmissions (unless it is a cross-country operator such as Vodafone or Deutsche Telekom, owning networks in multiple countries). Because of this, users have no other choice than to rely on the network of an operator in the visited country – a Foreign Service Provider (FSP). When a user is connected on an FSP's network, using a process referred to as international mobile roaming (IMR), the DSP will be charged a fee (the wholesale roaming fee¹) by the FSP, as the FSP is offering connectivity to the end user on behalf of the DSP. The DSP of course will recuperate this cost on the retail level by charging the end user a retail roaming charge.

In the past, retail pricing for roaming services was significantly higher than retail pricing for local services, resulting in travelers being reluctant to use IMR. Users were afraid of receiving high bills (causing “bill shocks”) when using (data) roaming services. This resulted in most of the travelers deciding to switch off their mobile handset during the whole trip, switch off the data roaming capabilities of their mobile phone or smartphone, or only connect to the Internet using public or private Wi-Fi access points (European Commission, 2014a). This impacted both DSPs and FSPs, as additional revenues were hampered due to a more limited usage of mobile services when roaming. Furthermore, as Neelie Kroes (European Commissioner for the Digital Agenda) indicated: “**It's** not just a fight between holiday-makers and telecoms companies. Millions of businesses face extra costs because of roaming, (...) Roaming makes no sense in a (European) single market – **it's** economic madness” (European Commission, 2014b). In other words, the European roaming problem not only affects people who travel for pleasure but also businesses whose employees travel around Europe, which translates into significant roaming bills.

To counter these problems caused by high mobile retail roaming prices, the European Commission (EC) started to regulate the international wholesale and retail roaming markets within the European Economic Area (EEA). Their purpose was, and still is, to reduce retail roaming charges to zero (i.e. lowering roaming pricing to the same level as local retail pricing) in other words, roam like at home (RLAH). This means that every citizen of a country in the EEA will be able use their mobile services in every other country of the EEA at the same price as in their own domestic country. At first, this approach seems to yield nothing but benefits for the customer; however, there are a number of threats and consequences that may arise as a direct result of RLAH: Will pricing differences arise between countries where a lot of travelers travel to in comparison to countries where a lot of travelers travel from? Will virtual operators (MVNOs – Mobile Virtual Network Operators) face a

¹ Please note the difference between wholesale costs, wholesale charges and wholesale caps. Wholesale costs denote the actual cost for the foreign service operator (FSP) to allow roamers' traffic on its network. The wholesale cap is the maximum fee this FSP may charge the DSP, and has been set by Europe Commission. The wholesale charge, ideally, lies in between the wholesale cost and wholesale cap, and is the actual fee the DSP pays to the FSP, based on inter-operator negotiations. The wholesale charge is therefore frequently referred to as inter-operator tariff. The retail roaming charge is the fee an end user pays the DSP when roaming.

competitive disadvantage in the national market as they only have an outflow of roaming wholesale cost, which can no longer be recuperated? Are the benefits for international providers significant or rather disruptive to good market functioning? In this paper, we discuss a number of these (unwanted) effects and how these might affect the end users.

This paper starts by giving a short overview of the evolution of roaming in the EU, focusing on the events that led to the introduction of RLAH. In section 3, we link the evolution of wholesale caps to the actually paid wholesale rates. Section 4 discusses the economic and business impact for customers and telecom operators. Based on both the technological possibilities and economic implications, a number of possible strategies and solutions for the future are discussed in section 5. Finally, section 6 concludes the paper.

At the beginning of this publication, we would like to stress that the goal of this writing is to provide a high level overview of both the past and upcoming roaming legislative steps, supported by actual figures, and the effects on the business case of different mobile (virtual) network operators. This also implies that a quantitative cost-benefit analysis is not within the scope of this publication, due to the fact that this type of data is kept highly confidential by mobile operators. Furthermore, as the evolution towards RLAH is an ongoing process, new effects may arise quickly as the market adapts to the new ruleset. We would therefore ask the reader to acknowledge the timestamp of this paper, being beginning of January 2017.

2. The evolution of roaming in the EU

This chapter will give a rather brief overview of the major developments and EU initiatives on international roaming. For a detailed and historic overview of how the EU increasingly regulated the international roaming market, we refer to Infante, and Vallejo (2012). For a larger view on the recent developments in other regions outside the EU, we refer to the OECD (Bourassa et al., 2016) and ITU (ITU, n.d.); both institutions describe the progress made in reducing roaming prices in various regions throughout the world and give an overview of the work done by wireless industry associations and regional bodies. Sutherland (2012) and Marcus (n.d.) have also published articles describing the evolution of international roaming in different regions, including amongst others the EU, USA, and Asia.

In 1999, the international telecommunications **users'** association (INTUG) analyzed the price difference between international calls (a call from the home country to another country) and roaming calls (making a call when roaming internationally), indicating that the price range between the two type of calls is unjustified and could not be convincingly motivated by underlying technical explanation (Sutherland, 1999; European Commission, 2000). INTUG furthermore pointed out that the underlying wholesale roaming markets are not competitive. Following up on this complaint, the EC started to be concerned about the high prices of roaming and launched a sector investigation, which led to the conclusion that there was a market failure in the International Roaming Services (IRS) wholesale markets. This market failure existed because of a lack of competition among operators, due to the absence of incentives for the operators. Therefore, the EC decided to include this market ("national wholesale market for international roaming services on public mobile networks") in the 2003 EC recommendation on relevant markets, making it become subject to ex-ante regulation. This regulatory framework supports that ex-ante regulatory obligations should only be imposed where there is no effective competition, and this only on operators designated as having

significant market power (European Commission, 2012). The national regulatory authorities (NRAs) were obliged to define and assess the conditions of effective competition. However, assessment - by the NRAs as well as the European Regulators Group (ERG) and its successor the Body of European Regulators for Electronic Communications (BEREC) - of the IMR market demonstrated that it was not possible for an NRA to effectively address the high level of wholesale Union-wide roaming charges. The explanation for this can be found in the combination of (1) the cross-border nature of international roaming and (2) the fact that NRAs can only impose remedies on operators in their own territory (Infante, and Vallejo, 2012). As NRAs were not able to successfully tackle high roaming costs independently and because the pressure from Member States and the European Parliament grew accordingly, the EC imposed a roaming regulation (the so-called Eurotariff) for the whole EEA in 2007 (directly applicable in all Member States) based on the following key facts:

- (1) both wholesale and retail prices were not justified by the underlying costs (international roaming charges were 3–5 times higher than the costs (Falch and Tadayoni, 2014)),
- (2) the lack of retail price transparency (most of consumers were not aware of the high charges for incoming calls),
- (3) both issues could not be solved using the existing regulatory tools (Scaramuzzi, 2009).

This 2007 Roaming Regulation (Roaming I) introduced caps for voice wholesale and retail prices (for both incoming and outgoing calls), effectively forcing the operators to use this so-called Eurotariff by default. Operators were (and are) however still allowed to charge other pricing tariffs, but only to those customers who would choose for such alternative plans voluntarily. Examples of these plans are Vodafone Eurotraveller or Daily Travel Passport: 'Day-roaming passes' or 'Weekly roaming passes' that provide a certain number of roaming units for a fixed fee. Additionally, each customer would receive a free text message when travelling, informing him/her about the roaming charges, in order to increase transparency about pricing.

In June 2009, the Roaming Regulation I was reviewed, leading to Roaming II. The EC decided to continue its price caps strategy for voice, lowering them in order to reduce the gap between wholesale and retail prices. Additionally, SMS and data service prices were regulated. For SMS, both wholesale and retail caps were imposed (for both incoming and outgoing), whereas for data services, the regulation remained limited to wholesale caps (because the market for data services was then still emerging, and its estimated evolution was not completely clear). Finally, a feature to protect consumers from "bill shocks" was introduced: if a certain billing amount for data services is reached (€50 excl. VAT by default), the operator is obliged to notify its user. At this point, users can decide to spend more money on data services or stop the service.

The imposed regulations reduced retail roaming charges for intra-European traffic significantly². This especially was true for data services: though a significant reduction in wholesale charges was imposed, reduction in retail roaming charges then (in 2012) did not follow at all (BEREC, 2012a). This observation was also found by Infante and Vallejo (2012), who used empirical data to show that "wholesale regulation alone does not suffice to ensure that competition at wholesale level is passed on to the retail level". Similarly, based on the reasonable assumption that wholesale prices are

² When comparing pricing in 2011 with extra-European traffic prices, so called Rest of the World (RoW traffic), prices were about three times as high as prices for intra-European traffic (Infante and Vallejo, 2012). Now (beginning of 2017), the difference is up to 20 times or higher. As a (Belgian) Proximus customer roaming in the USA, for example, you pay €3 per minute of calling and close to €15 per MB of data (Proximus, 2016). The roaming tariffs for Orange when travelling to the USA are €1.18 per minute, €2.9 per minute from China. Every MB will cost you €13.31 (Orange, 2016). r

related to the respective cost for the operators, BEREC assessed the wholesale roaming market and conducted an estimation of the wholesale roaming costs to better estimate the pricing regulation (BEREC, 2010a). As the report pointed out that costs had decreased over the years, it was decided to further reduce roaming fees, for both retail and wholesale.

As a result, the EC decided in 2012 to review the regulation, lowering once again the existing caps and adding retail caps for data services for the first time (Roaming III). Table 1 and Figure 1 present the evolution of the regulated wholesale and retail prices of voice calls, SMS and data services for the three roaming regulations induced by the EC.

Table 1: Evolution of wholesale and retail price caps (eurocents, excl. VAT) for voice calls, SMS and data services

		Outbound call (€/minute)		SMS (€/SMS)		Data (€/MB)	
		Wholesale	Retail	Wholesale	Retail	Wholesale	Retail
Roaming I	30 Aug. 2007	30	49				
	30 Aug. 2008	28	46				
Roaming II	1 July 2009	26	43	4	11	100	
	1 July 2010	22	39	4	11	80	
Roaming III	1 July 2011	18	35	4	11	50	
	1 July 2012	14	29	3	9	25	70
	1 July 2013	10	24	2	8	15	45
	1 July 2014	5	19	2	6	5	20
	1 July 2015	5	19	2	6	5	20

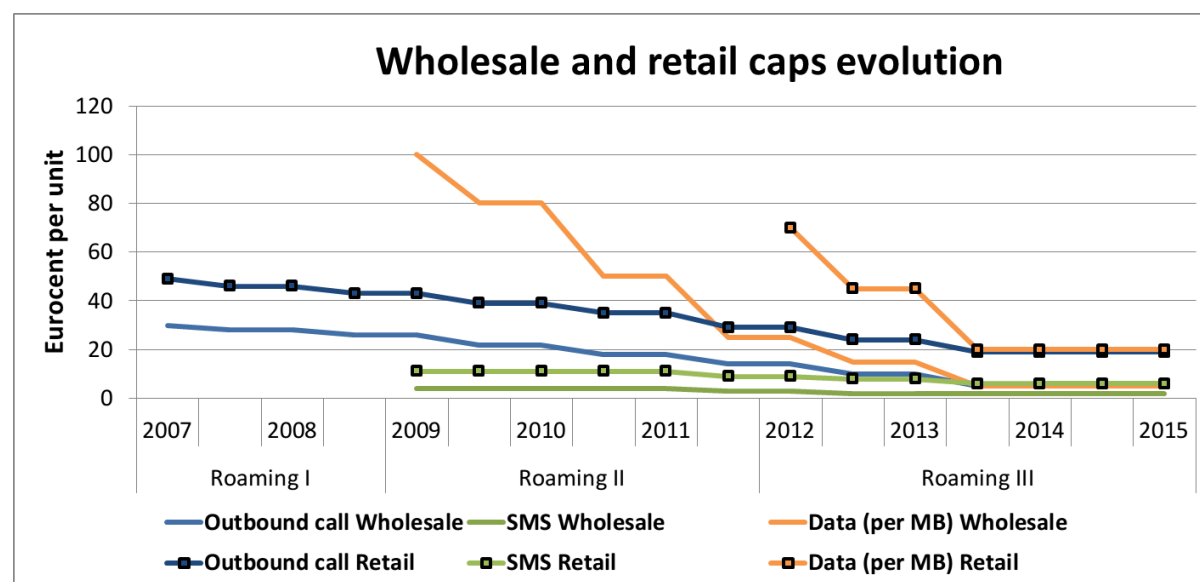


Figure 1: Evolution of wholesale and retail price caps (eurocents, excl. VAT) for voice calls, SMS and data services

During all transitory phases the European Commission, together with BEREC, also assessed other approaches that could lead to a full elimination of price difference between domestic and roaming tariffs (European Commission, 2011a; BEREC, 2010a; BEREC, 2011a). Two alternative approaches mentioned in 2010 were “Roam Like at Home (RLAH)” and “Roam Like a Local (RLAL)”. RLAH implies operators charging the same price for international (within the EEA) roaming services as for domestic mobile services, whereas RLAL entails that an end-user should be paying a price which fits

the mobile market of the visited country (see further in section 5.4). Both approaches indicate that all underlying costs (transit, fixed and operational) related to roaming would become completely invisible to the end user. Although RLAH is considered the most straightforward and consumer-friendly option, some issues could arise, such as arbitrage of SIM cards from countries with low domestic prices being used in countries with high domestic prices (so called permanent roaming, see further in 4.2.2). In 2011, stakeholders (consumer bodies, regulators and industry stakeholders) indicated that RLAH was a better option than RLAL, because RLAL would complicate the tariff structure (European Commission, 2011a). BEREC pointed out that RLAH would be more transparent, however “not suitable for 2012, to be reconsidered in subsequent review of regulation for post-2015” (BEREC, 2010a). Hence, the continuation of the existing price cap model was favored by most stakeholder groups.

Suddenly, in September 2013, one year after Roaming III came into force, Commissioner Neelie Kroes introduced her plans to impose “Roam Like at Home (RLAH)” (European Commission, 2013). The EU Parliament highly welcomed this initiative and voted to abolish retail roaming surcharges in April 2014, hoping for a quick implementation at the end of 2015 (European Commission, 2014c). This deadline was exceeded, partly due to the legislative procedure in Europe, giving the same weight to the European Parliament as to the Council of the European Union. It was in the Council that the Member States heated up the discussion, questioning under which conditions to abolish retail roaming charges, pointing out that these charges represent a significant part of the overall mobile revenues of telecom players (which is discussed in section 3). Member States wanted to assure a smooth and painless transition for the telecom sector and agreed that legislators first had to reassess the wholesale roaming market before retail roaming charges could be reduced to zero within the EU.

After lengthy discussions, it was only in November 2015 that the legislative process was finalized, postponing the deadline of the reduction-to-zero strategy to June 2017, on the condition that the wholesale market is reformed by that date. This means that, after more than 10 years of regulations and price caps, European retail roaming surcharges will be abolished entirely and users will be charged their domestic prices when travelling within the EU allowing them to ‘roam like at home’. In the meantime, and despite the delayed introduction of RLAH, a trend towards RLAH was already observed in the market as more and more operators introduced RLAH-style tariff plans. BEREC reported that in 2015, more than 25% of the larger operators in the EEA offer such a mobile plan, creating more market dynamics (BEREC, 2015a). In 2016, the number increased to 37% of the operators in the EEA. BEREC acknowledges that “there is already a significant number of roaming providers offering pure RLAH tariffs for their customers without any limitation beyond the volume limits included in the domestic offers” (BEREC, 2016a).

In order to build up to RLAH an intermediate regulation was introduced (Table 1). Whereas the three initial roaming actions stated absolute limits for retail prices (e.g. wholesale cap of 20 eurocent per MB for data from 01/07/2015, see Table 1), this last step lowered the retail caps to the sum of the domestic price plus the wholesale prices for calls, SMS and data. This intermediate phase is called the ‘RLAH+’ phase as during this period the end-user is paying its domestic price + a small surcharge. For data, for example, the retail cap is currently set to the sum of the domestic retail price plus 5 cents (the wholesale rate). If the retail rate for data is considered 10 €/MB, the retail roaming cap would thus be 15 €/MB. Important to notice is that, during the RLAH+ phase the absolute caps of

Roaming III are still in effect, meaning that relative caps (Table 1) cannot surpass the caps of Roaming III effectively protecting the end-users of any temporarily price increases.

Table 2: Intermediate step of the retail price caps (eurocents, excl. VAT) for voice calls, SMS and data services, leading up to the introduction of Roaming Like At Home (European Commission, 2015a)

		Outbound call (€/minute)		SMS (€/SMS)		Data (€/MB)	
		Wholesale	Retail	Wholesale	Retail	Wholesale	Retail
RLAH+ phase	30 April 2016 until 14 June 2017	5	Domestic + 5	2	Domestic + 2	5	Domestic + 5

In June 2016, the European Commission proposed new wholesale rates that will, if accepted, come into effect from the 15th of June 2017 onwards (European Commission, 2016a). These proposed rates are based on a review of the wholesale roaming market combined with a cost model. The proposed rates were discussed in the European Parliament, leading to an agreement on 29 November 2016 (European Parliament, 2016), and in the Council, leading to an agreement on 2 December 2016 (European Council, 2016). As a next step, a trialogue procedure started on 14 December, leading up to the ultimate negotiations on the final wholesale roaming caps before the approval of the EU Parliament, expected in February 2017. It should be noted that the discussions in Council and Parliament were rendered more difficult due to the interference of legislative decisions regarding the Fair Use Policy for RLAH and the sustainability derogation for operators (more about Fair use Policies in 4.2.2), as these discussions took place in the same timeframe.

Table 3: Newly proposed wholesale rates, which take effect on the 15th of June 2017 (if accepted) in support of the RLAH initiative.

		Outbound call (€/minute)		SMS (€/SMS)		Data (€/MB)	
		Wholesale	Retail	Wholesale	Retail	Wholesale	Retail
RLAH	From 15 June 2017	4	Domestic	1	Domestic	0.85	Domestic

Though the abolition of roaming pricing in Europe is beneficial for every European traveler, it is likely to have a negative impact on most operators (apart from larger cross-country operators such as Telefónica or Vodafone). The impact on the business case for the different operators is not comparable, on the one hand due to the differences between MNOs and MVNOs, but on the other hand due to the significant differences between the member states, such as the levels of retail tariffs, cost structures, and travelling and consumption patterns. With RLAH, it can be expected that the use of roaming services will grow, bigger wholesale bills for the operators. In addition, they will have to face the increasing demands on their networks.

It can be concluded that roaming in Europe has gone through multiple processes of regulation since 2007, first by imposing wholesale and retail price caps for calls, then for SMS and finally for data. The next step is to abolish the retail roaming charges entirely, resulting in users paying the same price whatever the country (of the EC) they are visiting; hence permitting them to “roam like at home”.

There however remain several aspects that need further clarification, especially for the operators, as questions rise how they are going to sustain this transition. This paper aims at listing the threats and opportunities, as well as proposing solutions or strategies for the future.

3. Description of the mobile data roaming market

Section 2 provided an overview of both previous and future intended steps regarding the European roaming legislation, while section 4 will list potential strategies for the future from the viewpoint of different operators. This section links both by analyzing if evidence supports the claims made by different kinds of stakeholders: it compares the imposed wholesale caps to the actually paid wholesale rates and the underlying wholesale costs (section 3.1). Afterwards, in section 3.2, a number of examples of the predicted impact of the RLAH+ phase by mobile operators are added (taken Belgium as an exemplary country).

3.1. Linking legislation to actually paid wholesale rates

When mapping the average paid wholesale rates on the evolution of the wholesale caps (the analysis first focuses on mobile data as the decrease of these wholesale caps has been most significant in the last years), the average paid wholesale rate has constantly been below the actual cap Figure 2. The downward trend is clearly noticeable, even when the wholesale caps are stable and bigger step are detected when lower caps are imposed (e.g. Q3 2012 and Q3 2014).

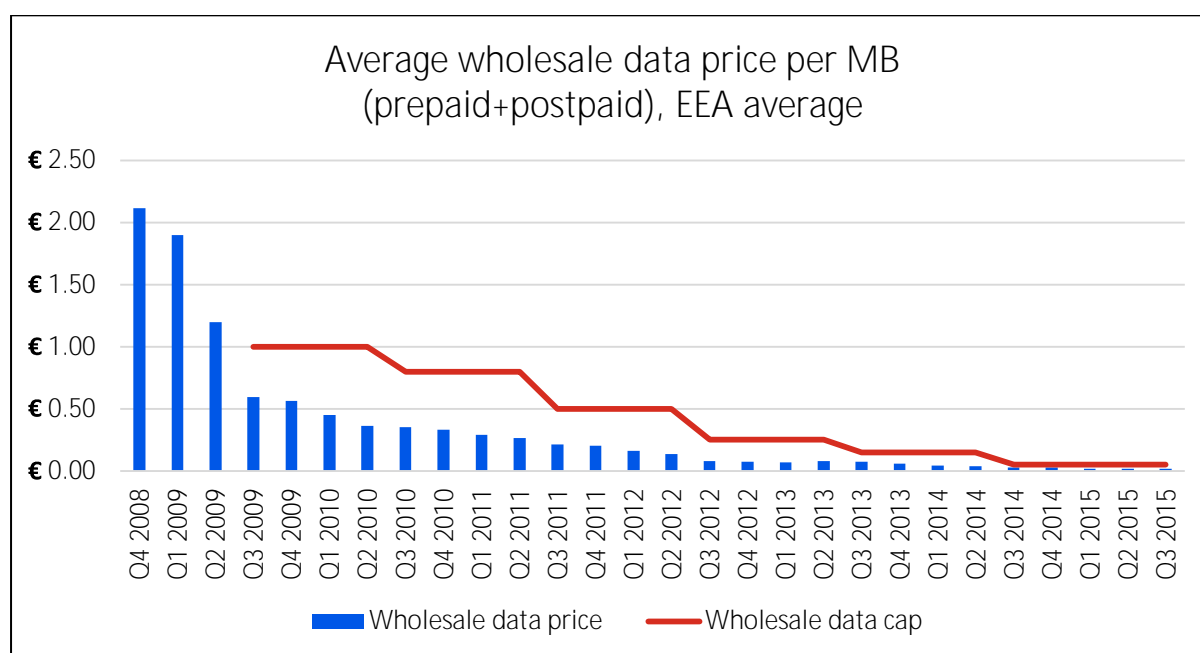


Figure 2: Overview of the EEA average of the wholesale data price per MB (prepaid and postpaid) and the matching wholesale cap, (BEREC, 2016c).

Negotiations on bilateral wholesale agreements between operators are based upon a set of different pricing models (fixed rate, balanced/unbalanced pricing, volume commitment, etc.). The balanced/unbalanced pricing model is rather important to zoom in on (BEREC, 2016b). In this kind of agreement, two operators agree to send traffic over each other's network. If both operators send an equal amount of traffic, the exchange is balanced and so are the costs and revenues of each operator, resulting in a financial zero-sum game. In case the amounts are unbalanced, the netto

sender operator (the operator with more outgoing traffic) pays a pre-discussed wholesale rate to the netto receiving operator.

According to (BEREC, 2016b) the relevant benchmark for wholesale costs is the wholesale rate for unbalanced traffic, given that prices for balanced traffic are merely a bilateral transfer between operators with no net cost for any of the parties. When zooming in on the wholesale rates for unbalanced traffic, Figure 3, it becomes clear that median value (as indicated by the thicker line in the boxplot) at about 1.4 eurocent/MB is even lower than the average wholesale rate in Q3 2015, see Figure 2(which combined both balanced and unbalanced traffic). The data as seen in was collected by BEREC and supplied by the different NRAs. A reason why the rates are higher for balanced than for unbalanced is not provided.

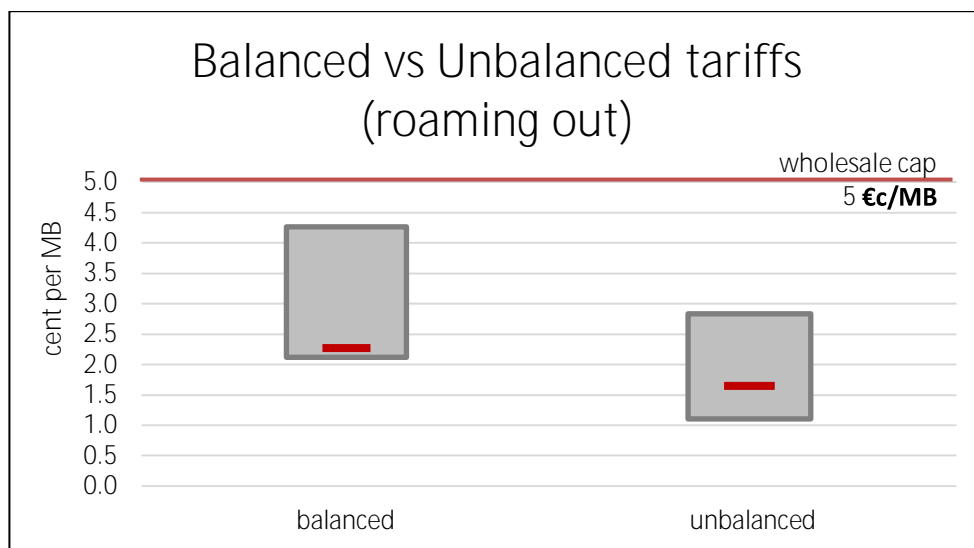


Figure 3: Overview of the actually paid wholesale rates, with the distinction between balanced and unbalanced traffic (BEREC, 2016b).

Prices that are considerably lower than the imposed caps might suggest a competitive market. However, the wholesale roaming market should not be considered a competitive market, for a number of reasons as discussed in European Commission (2016e):

- The specific character of the mobile market: the choice of FSPs in the visited country is limited, and some of them are difficult to avoid (in view of coverage and capacity), further limiting competition;
- The bilateral nature of wholesale roaming agreements: the main negotiation driver is the amount of traffic that can be balanced rather than the price;
- No real wholesale roaming substitute: there exists no alternative to roaming that achieves the same coverage and flexibility;
- The de facto exclusion of MVNOs from the wholesale roaming market

When furthermore comparing the wholesale rates with the estimation of the maximal wholesale cost as made by BEREC in 2010 (BEREC, 2010a) and 2012 (BEREC, 2012b) one can see that the maximal costs are below the actually paid fee (Table 4). The result of this analysis, being that caps are significantly higher than rates, and rates in turn significantly higher than maximal costs, suggests that there is room for further reducing the wholesale roaming caps.

Table 4: Overview of the estimated maximal underlying cost of providing roaming

	Max	Cap		Max	Cap	
	2010	Until 01/07/'10	From 01/07/'10	2012	Until 01/07/'12	From 01/07/'12
Outgoing Voice (€/min)	9.7	26	22	5	18	14
SMS (€/SMS)	2.7	4	4	1	4	3
Data (€/MB)	15	100	80	5	50	25

When looking into the estimation study executed by TERA consultants (TERA Consultants, 2016) and shown in Figure 4, which has been an important input in the discussion for the newly proposed wholesale rates, we clearly see that the wholesale rates (median value about 1.4 eurocent/MB), which are considerably lower than the imposed caps, are far above the actual costs Figure 4. The results and validity of the TERA report have been discussed by people of Rewheel in (Rewheel, 2016).

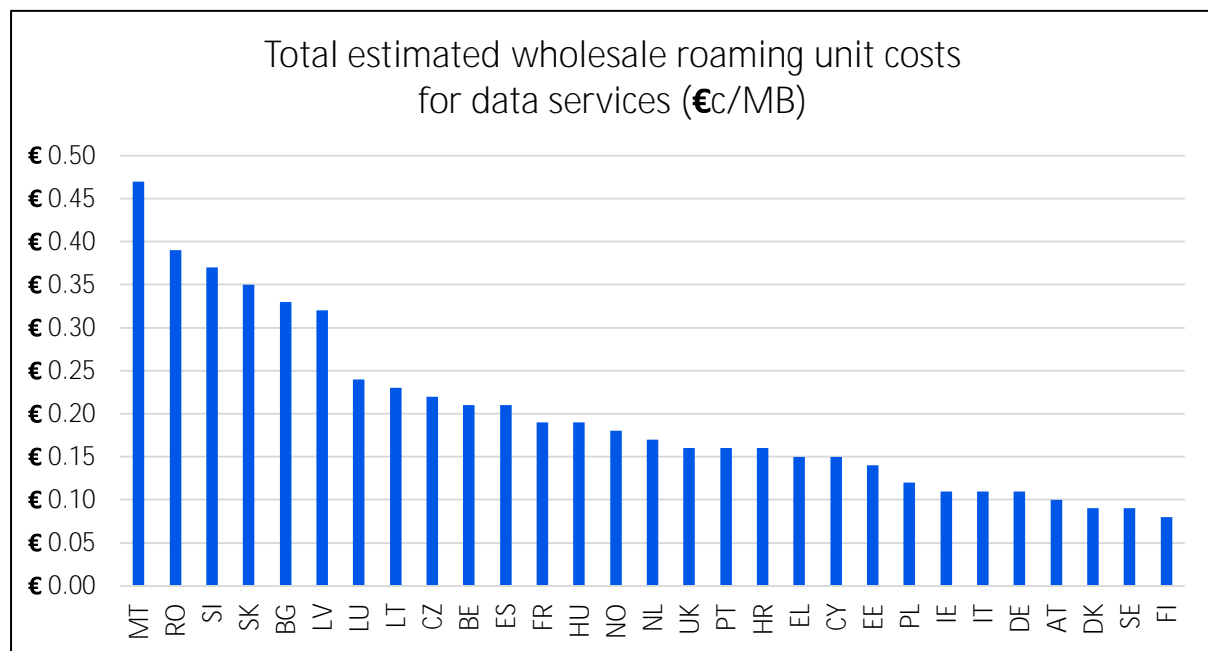


Figure 4: Total estimated wholesale roaming unit costs for data service (€/MB) as calculated by TERA consultants (2016)

When RLAH comes into effect, mobile operators will no longer be allowed to charge additional fees on top of the domestic retail price. In other words, the domestic retail price should cover the entire wholesale rate, all internal costs (administration, billing, ...) and preferably still include some profit margin. When comparing the domestic retail price per GB with the currently proposed new

wholesale rates of 8.5 euro/GB (Table 3), we see that this newly proposed cap is higher than average (data-only) domestic retail price per GB in 26 out of 28 EU states. Similar results are found for non-data-only deals and are discussed in more detail in (Rewheel, 2016).

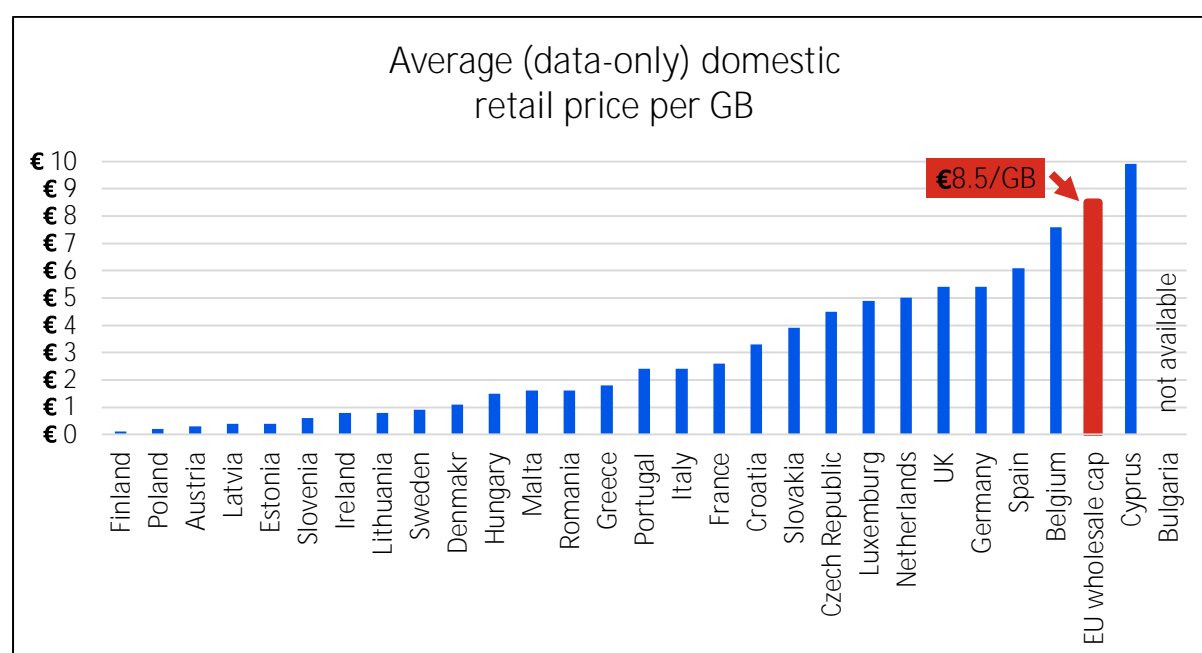


Figure 5: Average domestic retail price per GB for data-only subscriptions

From the suggested caps (and thus the maximal fee an operator will have to pay for a GB of outgoing roaming traffic) and the current retail pricing for mobile data, we can deduct that the average domestic revenue per GB is much lower than this suggested cap (and thus cost for a mobile operator), which might suggest that the current caps should further be decreased to have any effect, as discussed in more detail in (Rewheel, 2016).

The differences between operators should not be neglected in this analysis. Larger MNOs typically have sufficient bargaining power to discuss wholesale tariffs that are well below the caps, whereas MVNOs and small MNOs typically lack this power, ending up paying a wholesale rate that is very closely to the caps. They should search for an alternative way to compensate this potential revenue loss.. This is also confirmed by BEREC: “Light and full mobile virtual network operators (MVNOs) see their position as weak compared to MNOs due to their lack of volumes and associated negotiating power. Overall, these operators are not seen to benefit from the lower actual observed wholesale tariffs, especially for data, when compared with the current wholesale caps.” (BEREC, 2016b).

When looking at the link between the actually wholesale rates and the caps for voice calls and SMS we see a different story; for both the actually paid rates have consistently been very close to the wholesale caps as can be deducted from BEREC (2016c). Due to the massive growth in mobile data usage and new services (e.g. WhatsApp) which pose alternatives for both voice and SMS, we have chosen to focus on mobile data.

From the analysis of supporting data evidence, it becomes clear that a general conclusion cannot be drawn. Different types of mobile operators will be impacted differently by RLAH. Section 4 discusses a number of factors which largely determine how much operators will be impacted and how this

impact may be leveled, but we first provide exemplary estimations on the impact of the RLAH+ phase by a number of Belgian mobile operators in the next paragraph.

3.2. An example from the Belgian telecom market

In 2015, the Belgian NRA presented an overview of the mobile turnover of Belgian operators as shown in Figure 6. The figure shows that the retail roaming revenues for the main Belgian operators represented almost 300 million euros in 2015, which is 8.2% of their total mobile turnover. Wholesale roaming revenues make up another 2% (69 million) of their turnover (BIPT, 2016). Given the fact that RLAH reduces the retail rate for roaming for end-users to zero, this entire 8.2% of the mobile turnover is at risk.

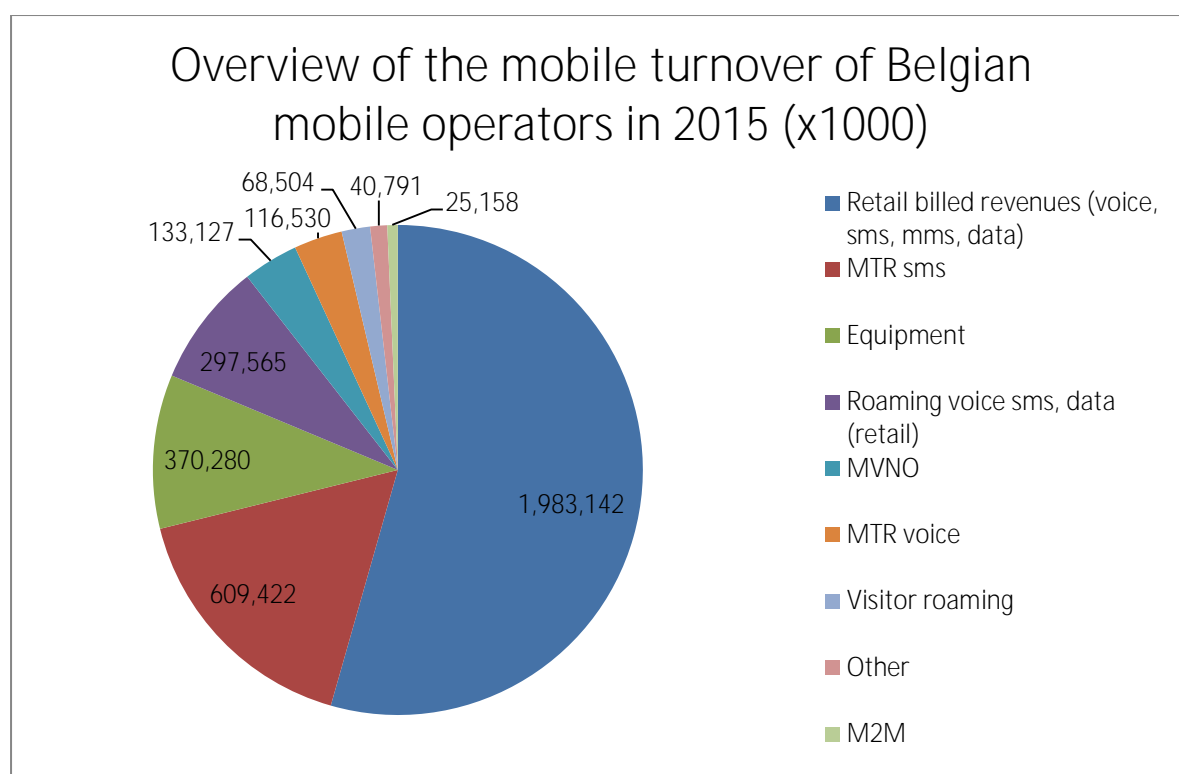


Figure 6: Overview of the mobile turnover of Belgian operators in 2015 (BIPT, 2016)

This risk of revenue loss has also been discussed by the mobile operators in their financial reports. For 2016, Proximus predicted a negative impact of 28 million on their roaming revenues to the RLAH+ retail caps; Mobistar predicted a negative impact of 24.5 million. Both MNOs however mention that the given figure will most likely be lower due to a positive elasticity effect on the retail usage.

4. Economic and business impact of cutting roaming fees

The prospects of abolishing roaming pricing by 2017 are of course beneficial for travelling customers, but also clearly impact the business case for all telecom operators, both MNOs and MVNOs (Mobile (Virtual) Network Operators), as the previous section shows. Operators will no longer be able to charge roaming fees to customers on the retail level, meaning they will only be

compensated with the same price they charge their customers for domestic services, while their roaming expenses remain. The absolute impact will depend on the type of operator and its geographical coverage and location. This section describes these different impact factors and proposes remedies operators can take to counter or at least minimize them.

4.1. Impact for telecom operators

As mentioned above, the main impact of reducing retail roaming fees to zero is that the operators can no longer charge their customers an additional fee for using mobile services abroad. There are however large differences between different types of operators. For MNOs (owning their own network), the distinction needs to be made between geographical location and geographical coverage. Besides, the costs of providing connectivity (and therefore RLAH) vary significantly across the EU, underpinned by significant differences in, e.g., spectrum costs, labor and property costs, and coverage obligations and costs due to different geographies, which are major drivers of the cost of providing mobile services (BEREC, 2014a). For MVNOs (not having an own physical network), the situation has to be assessed differently.

4.1.1. Impact for MNOs: geographical location

The impact of cutting roaming fees is significantly different depending on the country the operator is active in, mainly because of the different travelling patterns of end users, making operators face either incoming roaming traffic (net receiver) or outgoing roaming traffic (net sender) (BEREC, 2016b).

For net sender countries (e.g. Scandinavian countries such as Sweden) have much more outgoing roaming traffic, which makes the wholesale costs for these operators unbalanced (the balanced/unbalanced pricing model has been discussed in section 3). By abolishing the retail roaming fees, revenue losses occur. On the other hand, countries with a lot of incoming traffic from tourists, such as Spain and Greece, have an incentive to keep wholesale charges high as operators need to invest in capacity to allow the additional roaming traffic on their networks³ (BEREC, 2014a).

4.1.2. Impact of geographical coverage

One specific category of telecom operators in Europe are those whose coverage region extends beyond national borders, the so-called cross-country operators. Table 3 shows an overview of the international operators active in Europe, as well as the number of countries they serve. Operators who are part of a cross-country group, will be able to get cheap wholesale roaming prices by using their own network facilities (Falch and Tadayoni, 2014). They can steer their roaming traffic, making wholesale just at cost while other operators face a (negotiation) markup (BEREC, 2014a).

Table 3: International operators active in the EU (DFMonitor, 2016)

MNO	Number of countries
Vodafone	15
Deutsche Telekom	11
Orange, TeliaSonera	8
Hutchison, Tele2, Telefonica	6

³ For popular travel destinations, the network demands are obviously higher in the touristic season; this so called seasonality effect requires network operators to be able to cope with much more incoming roaming traffic during only a short period per year. According to (European Commission, 2016c), “the effective impact of seasonality on the estimation of the upper bound of wholesale roaming costs in the EEA remains **small**.”.

Telenor	5
TelekomAustria	4
KPN	3
Belgacom, BITE, Elisa, Iliad, PPF	2

4.1.3. Impact for MVNOs

Finally, there are MVNOs, those who do not own a physical network. MVNOs resell capacity they rent from an MNO and hence challenge the incumbent operators, though often take up only a small part of the domestic market. MVNOs incur costs when their customers are travelling, but they do not have wholesale incomes as they cannot host any roamers on their network⁴. They experience absolute traffic imbalances and, in most cases, they do not have the bargaining power to negotiate wholesale roaming fees significantly below the wholesale caps, as mentioned in 3.1. Hence, MVNOs prefer that the EC sets lower wholesale caps, this to mitigate an outflow of wholesale transaction which cannot be recuperated on the retail level, and to assure a positive business case for these smaller players. If this issue is not tackled accordingly, the introduction of RLAH might have a negative side effect on the level of competition within the national market (MVNO Europe, 2015).

4.2. How to reduce or counter this impact?

As described above, a number of operators across Europe will experience a significant influence from cutting the roaming fees. The European Commission has calculated that RLAH would be unsustainable for 12% of the operators in the EEA (European Commission, 2016b). This impact assessment was made with the assumption that consumers would be able to use RLAH for 90 days a year (which was stated in the first draft of the fair use policy). In the meanwhile, the fair use policy has widened (e.g. there are no longer any cut-off limits, see further in section 4.2.2), meaning the impact could affect even more operators. Taking into account the economical principle that there's no such thing as a free lunch, operators will want to recuperate their wholesale roaming costs, which can they no longer pass on to the retail customers. As a result, there is a risk these mobile operators will increase domestic prices in order to compensate for potential wholesale losses (this is the so called 'waterbed effect', see section 4.2.1). Secondly, to prevent abuse of RLAH by "permanent roaming", Fair Use Limits can protect the providers (section 4.2.2). Finally, operators might be able to lower their costs by negotiating new inter-operator (wholesale) pricing (section 4.2.3).

4.2.1. Raise domestic prices

As already mentioned above, a first possibility is to raise the domestic prices, also known as the waterbed effect. When the retail roaming prices decrease on one side, the domestic prices could increase on the other side (Falch and Tadayoni, 2014). This situation is unfavorable as everyone, also the customers who never roam, will need to pay higher domestic prices to cover the losses made by

⁴ All types of MVNOs - except for full-MVNOs - are technically unable to accept any incoming roaming traffic. From a technical point of view, full-MVNOs are able to accept incoming roaming traffic, though from an economic point of view this will never happen: the wholesale prices a full-MVNO could charge a DSP can never undercut the prices of its host-MNO. Taking into account even the slightest pricing margin, the wholesale prices a full-MVNO can offer to a DSP will always be higher than the ones from the underlying MNO; in other words, a DSP will always cooperate with the MNO for the simple reason that its wholesale prices are lower.

the customers who do roam. This means that only the people who roam frequently will benefit from this situation. Research by BEREC has proven that the average amount of citizens in the EEA who travel at least once a year is 35% and the average days abroad within the EEA is 5.7 days (BEREC, 2014a). Looking at these numbers, we can say that a large group of customers (mostly low-income workers and elderly people) will need to pay more so that a small group of customers who frequently roam will pay less (in general business people). How much domestic prices should increase to cover for the losses will strongly depend on the local situation (geographical location, net sender/receiver country).

Additionally, it should be noted that, although the waterbed effect may occur, its impact will be limited by free market competition - no operator will increase retail pricing to the extent that he will lose competitive power. Especially, operators in competitive markets (e.g. the UK or France) might be reluctant to increase their domestic prices in order to protect their market share.

4.2.2. Fair use limits

When customers do not need to pay roaming surcharges, they might be tempted to purchase a SIM-card of a foreign operator that offers lower pricing than any domestic operator, hence enjoy cheaper pricing and use roaming also when being at home. This scenario, known as permanent roaming, will lead to higher wholesale roaming charges for the foreign operator, leading again to the waterbed effect. On a larger scale, permanent roaming will also detriment the telecom sector in those countries with – on average – more expensive mobile prices.

Fair Use Limits (FULs) are a way to counter this problem: they set a maximum amount of roaming per customer per time period. When the customer exceeds this limit, he will need to pay a surcharge. FULs can be implemented in different ways. The limit can be set to a specific amount of roaming (e.g. number of SMS, minutes outgoing calls, MB) per day, per week, per month or even per year. When the FUL is exceeded, a fair surcharge per usage or daily/weekly flat fee could be levied. There will be a need of some caps for the FUL. In December 2016, the EC has formally adopted a roaming fair use policy (European Commission, 2016d). This FUP sets no specific limits, but allows mobile operators to ask their NRA to apply surcharges to the retail roaming rates of specific users in case any abuse of RLAH is detected.

Alternatively, instead of sticking with the domestic operator and accepting the charges for usage beyond the FUL, an end user could switch over to Local Breakout (LBO). LBO is a decoupling⁵ mechanism with minimal configuration, which allows a user to buy a roaming bundle from an FSP. All data (LBO is not applicable to voice and SMS) is directly charged from the prepaid bundle. As calling (VOIP) and texting (e.g. WhatsApp) is increasingly done via the Internet, heavy users could still benefit from an LBO package with much more volume than the volume limit of the FUL.

4.2.3. Decrease wholesale roaming prices

The third remedy discussed here focuses on the cost side: the best solution for operators might be to reduce wholesale charges, the price a DSP needs to pay to the FSP when a DSP's customer is roaming on the FSP's network. In the past, these wholesale prices were high, allowing the FSP to

⁵ The term decoupling denotes splitting the roaming and domestic services provided to a single subscriber (Infante, 2012). In its roaming regulation of 2012 (Roaming III), Europe included two methods for technical interaction between operators: the decoupling methods of single International Mobile Subscriber Identity (single IMSI) and Local Breakout (LBO). In its most recent Regulation of 2015, the European Commission abolished the obligation for operators to implement the single-IMSI method, it was not commercially viable because of high negotiation and technical implementation cost. The LBO-obligation is maintained, anticipating a larger demand for data roaming services in the future.

take significant margins on his own cost (Falch and Tadayoni, 2014). Though local (national) competition has decreased domestic tariffs, the lack of competition on the international roaming market has left the wholesale roaming prices rather high when compared to the wholesale cost.

As part of their policy, the EC has set wholesale caps for roaming. Finding a correct level for these caps is not easy. Setting the caps too low (below-cost) will put pressure on the FSP providing roaming to customers of foreign providers (again risking a raise in domestic pricing of this FSP) (BEREC, 2016). If these caps are too high, they will not achieve the intended goal. Hence, the best option is to set the wholesale caps just above the cost of the FSP, so there is a small margin that can be used to improve the quality of the visited network while the costs for the DSP are not too high. As mentioned in section 2, the European Commission has recently proposed new wholesale rates which will, if accepted, take effect from June 2017.

4.3.4 Exemption mechanism

Finally, the European Commission will include an exemption mechanism for the specific case when an operator is not able to recover its overall costs of providing roaming services (being forced to sell below cost) (European Commission, 2016c). In this case, the operator can be exempted from the obligation to provide RLAH and will be able to apply a surcharge for roaming services (the current proposal proposes maximal surcharge rates equal to the wholesale rates (as shown in Table 3; though this proposal has not been accepted yet), in order to ensure its business case. The details of this exemption mechanism, as well as the details of the Fair Use Limit, will be determined by the European Commission and published by 15 December 2016.

5. Solutions and strategies for the future

This final section takes the economic impact described in the previous section as input to discuss potential solutions and strategies for the future of mobile networks in Europe.

5.1. Carrier portability and alternative SIM approaches

Technical regulation in the form of number portability - enabling users to switch (domestic) network providers - is legally guaranteed in the European regulatory framework for fixed networks as well as for mobile networks. A proper extension of number portability to the concept of carrier portability can provide a solution for stimulating competition on the markets for international roaming from the customers' perspective (Knieps, 2014). In order to implement carrier portability, customers should have the right to switch mobile communications providers at any time. The switch should be carried out without undue delay within the shortest possible period of time. The following requirements for carrier portability are made (Knieps, 2014):

- (1) Users must have the option to buy a SIM-unlocked handset enabling the use of alternative SIM cards of different providers. This is a precondition for changing carriers for outgoing communications (voice, SMS, data services) in international roaming. The chosen FSP would provide the visiting customer with an identity in its network by means of a new SIM card.
- (2) Temporary number portability is an essential precondition for competition in the international mobile communications market. It allows mobile service customers to receive incoming voice, SMS and data roaming services on a visited network under their home mobile number when switching to a different provider only for a limited period of time or

only for roaming services. Currently, this is rather difficult since the DSP has full control over the E.164 numbers⁶ of its customers, both for domestic and roaming services.

- (3) The DSP should not be regulatory enforced to carry out the billing function for international roaming services because the FSP also has the possibility to handle the billing for his roaming services. The DSP however should be regulatory obliged to provide the relevant source data on the identity and creditworthiness of its home customers if the DSP is not handling the billing.

Carrier portability can be implemented if alternatives for the default hardware SIMs are used. On the one hand, there are physical SIMs with remote provisioning (such as the Apple SIM), on the other hand, there are soft SIMs (GSMA Intelligence, 2015).

SIMs with remote provisioning capabilities are very similar to ordinary SIMs (they can be removed from the (smart)phone or tablet), the main difference is that these SIMs can store the credentials of multiple mobile networks. This means that customers can buy multiple packages (from different mobile operators, even in different countries). A precondition of course is that the (smart)phone is not SIM-locked. Remote provisioning would allow an end-user to easily switch (churn) between mobile operators; while abroad a user might choose to buy a local mobile package because it is cheaper than roaming. Even in the case of RLAH (zero retail roaming fees), it may be more interesting to buy a local package from a foreign mobile operator than using your domestic volume (taking into account the current domestic prices - Figure 5).

Soft SIMs are (as the name indicates) entirely software based and are no longer a combination of software and cryptographic hardware. These could, much as SIMs with remote provisioning, store the credentials of multiple mobile operators. The main difference between both types is the fact that a soft SIM is not built on top of cryptographic hardware. Soft SIMs hence require the applications (the software) to store the credentials necessary for implementing the same security measures as a hardware SIM.

5.2. Strategies for big operators: cross-border competition and traffic steering

As mentioned above, cross-country operators have significant advantages over national operators. Given the fact that the wholesale roaming market has an oligopolistic character (transaction costs make dealing with more than three/four operators per country not economically viable), larger operators are frequently preferred over smaller ones. Not only give these asymmetric traffic flows the larger operators leverage over smaller ones (wholesale roaming agreements are generally driven by amounts of traffic that can be offered by the FSP), avoiding them is often hard because of their larger network coverage and capacity. This section details the best strategies for large, international operators to maximize their business case, though some may conflict with smaller operators' goals. The best way for larger, international operators to further leverage their negotiation and scales power, is to direct roamers to preferred networks. By using this process of traffic steering, the DSP can make sure the customer's traffic is "steered" over the foreign network of the DSP's choosing. Furthermore, cross-country operators can internalize roaming costs by steering the customer's traffic to one of its subsidiaries that is operating in the travel destination. This type of cross-border

⁶ E.164 sets the general format for international telephone numbers and is part of the international public telecommunication numbering plan (an ITU-T recommendation).

competition results in more affordable access and pan-European (cross-country) networks implying cost reductions for both network deployment and operating expenditures effectively benefiting from economies of scale.

This method is already used today: over the last years, a significant increase in the number of mergers in the mobile telecom market can be observed for example in Austria (Hutchinson/Orange), Ireland (Three/Telefonica), Belgium (Liberty Global/Base) and Germany (Telefonica/E-Plus). However, due to the boundaries set by spectrum auctions and the country-specific IMSI (International Mobile Subscriber Identity) codes, the European telecom sector remains heavily fragmented: access availability, quality and prices vary significantly across the continent with telecom markets defined by national borders. To stimulate cross-border competition, the Commission, the European Parliament and the Council of the EU could use their regulatory powers to make it relatively more attractive to operate cross-border networks instead of focusing on domestic markets (Aghion, 2002). A possible policy is introducing supra-national allocation of radio spectrum (Mariniello, 2105). Now, the allocation in the EU is done by Member States within a framework of international coordination and harmonization, designed to counter cross-border interference. Auctions in different countries are run at different times, each assignment procedure has its own participation cost, bidders that want to operate in multiple countries are likely to calculate their bids for individual lots and face the risk of paying too much in early auctions if they fail to secure complementing licenses in later auctions, etc. This not only hinders the creation of operators with a larger European footprint, but also has a negative effect on network coverage and penetration. A move towards EU-level assignment of spectrum could prove to be a solution that incentivizes the deployment of networks with a larger European footprint.

On the downside, and important to be mentioned, stimulating this strategy gives large MNOs an advantage over smaller ones and may result in reduced overall competition in the market, increased pressure put on the smaller operators, leading eventually to higher prices for customers. This trade-off between larger merging operators, having more wholesale negotiating power, and protecting smaller companies currently is – and will remain – a difficult balancing act.

5.3. Strategies for smaller operators: IMSI beyond national borders or stricter regulation?

It is clear that MVNOs and smaller operators should remain on the market (see above), but that specific strategies should be followed to ensure this. This section sums a number of potential solutions that could prove beneficial for the market position and economic viability of smaller operators (including MVNOs).

One of the advantages of cross-country operators is that they can steer traffic to subsidiaries operating in different countries. Smaller operators without such subsidiaries or partners cannot do this, they are linked to the country-specific IMSI (International Mobile Subscriber Identity). Recently, the Belgian (BIPT) and Luxembourg (ILR) telecom regulators made it possible to link a Luxembourg IMSI to a Belgian mobile number and the other way around (BIPT, 2016b). This is an interesting strategy since IMSIs are normally bound by national borders. The agreement makes it possible for operators to offer their services directly (i.e. not using IMR) to customers in both their own country of operation and the other country while using either a location-based or a uniform pricing. By signing bilateral agreements with operators from other countries for a kind of “usage-based network lease”, domestic operators can provide their users a transparent experience and themselves be reduced of high wholesale fees. For smaller operators, this presents a more attractive option than a pure wholesale negotiation process, as larger operators (1) prefer a reciprocal agreement with other

large operators based on the balanced/unbalanced pricing model and (2) because they often renounce starting the costly and time-consuming negotiation process for low volumes of traffic.

Hence, this option of signing bilateral agreements based on pan-national IMSI may help smaller operators to secure their business case against high roaming fees. The European Commission could stimulate this by setting a unified Mobile Country Code for the whole of Europe. Another option that can secure the business case of smaller operators is a stricter regulation. If all operators would be obliged to disclose their wholesale fees to all NRAs, the latter would have a better overview of potential market failures and could interfere accordingly. However, given the variety and diversity in operators and offers across Europe, applying a specific tariff for each individual situation is in practice not feasible. Although it is true that clear differences of negotiated wholesale rates exists, one cannot judge that the cheapest wholesale rates should be applied to all other operators, or that contracts with higher wholesale tariffs are subject to excessive pricing.

A third option, specifically for MVNOs, to render the latter's business case more sustainable and to circumvent their lack of leverage, would be to impose a rule that allows MVNOs to obtain the same conditions and charges for wholesale roaming services as their host-MNO has negotiated with other FSPs. The tricky side to this solution would be that business-sensitive information between two parties (the DSP and the FSP) needs to be revealed to a third party, the MVNO in question.

5.4. 'Roam like a local' instead of 'Roam like at home'?

As discussed above, one of the potential hazards of RLAH is that users might be tempted to buy a SIM-card from a cheaper foreign operator and thus constantly roam, also when in their domestic country. As a countermeasure, the EC is looking into fair use limits to counter this so-called permanent roaming (see section 4.2.2). Alternatively, instead of RLAH, one could suggest 'roaming like a local' (RLAL) which was introduced in 2011 by BEREC (BEREC, 2014b) and discussed in (Marcus, 2013). The idea behind RLAL is simple enough; pricing structures can be implemented such that - when abroad - roaming users can be charged, by their DSP, the same prices as the current average prices of the country they are visiting.

This would clearly tackle the issue of permanent roaming, as choosing a foreign operator will no longer result in cheaper prices compared to local operators. However, this approach lacks consumer transparency and, more importantly, simplicity as retail roaming prices cannot be considered uniform (different types and sizes of bundles, unlimited packages, etc.) and may either be higher or lower than in the domestic country⁷. Additionally, this approach requires the EC to provide regular updates of the average prices for each country (or worse, to have each MNO be in possession of the latest tariff plans for all bundles for all subscribers, across data, voice and SMS, for all Member States) and requires mobile operators to adjust their pricing accordingly, which will no doubt lead to additional overhead and a more difficult billing process. These are exactly the reasons which made RLAL the less attractive approach compared to RLAH.

⁷ Indeed, mobile prices have always varied significantly across Member States and still do, with average retail revenues per user (ARPU) in 2015 ranging from €3.70 per month in Latvia to € 25.40 per month in Norway, with a weighted average of €14.3 per month (BEREC, 2016b).

5.5. Wi-Fi offloading as a complement for mobile data roaming

Wi-Fi has more than once been proposed as a viable solution for offloading mobile data as it offers cheap access to the Internet (Marcus, 2013). In Europe, a number of examples can be found of mobile operators offering so called dual-access wireless networks (combining both mobile and Wi-Fi). If sufficient access points are installed, Wi-Fi access is available in all public places, allowing users to effectively switch between mobile data and Wi-Fi.

When abroad, users typically use Wi-Fi only when stationary (in a coffee shop, in a hotel, ...) as these offer (free) Wi-Fi access; as a result, Wi-Fi seems an unlikely solution for offloading data when roaming. However, as mobile operators have started to team up, sharing their Wi-Fi networks with other operators, they have managed to also provide Wi-Fi access to their users when roaming. The best example for this in Europe is the FON-network (FON, n.d.). FON joins a set of (inter)national Wi-Fi networks into one single network. Operators choosing to cooperate with FON, open up their network by broadcasting a FON-SSID, effectively allowing users of other operators to go online. In return, their own users can enjoy free Wi-Fi access via FON when abroad. Another example is the initiative as proposed by the European Commission: WiFi4EU (European Commission, 2016e) which proposes an investment of €120 million to deploy free Wi-Fi access in public spaces. The WiFi4EU scheme is expected to be approved in 2017.

As reaching a ubiquitous Wi-Fi coverage is not feasible in practice, Wi-Fi should be seen as complementary service to roaming, as it can effectively reduce the overall roaming usage, but can never fully substitute it.

6. Summary and conclusion

Roaming in Europe has gone through multiple processes of regulation since 2007, first imposing wholesale and retail price caps for voice services, then for SMS and finally for data. The next step is lowering roaming prices to the level of domestic retail prices, which will permit users to roam like at home. However, there are several aspects that the EC still has to clarify, especially for the operators, as there are doubts about how they are going to sustain this transition: while the fee end users pay for roaming will be reduced to zero, the fee a domestic mobile operator pays the foreign operator will not.

As operators see a decline in revenue, they could look for new possibilities to cover their costs. The impact for the customers of these approaches will strongly depend on how the providers cope with these regulations: increasing domestic pricing may prove to generate an unwanted outcome given the potential negative impact on the operator's customer base. Other approaches may include the further decrease of wholesale roaming prices or the implementation of the FULs.

The real impact of the latest roaming initiative of the EC, Roaming Like At Home, is hard to predict as the outcome will differ per operator and depends on a lot of factors: the geographic location, the number of countries in which the operator is active and whether the operator is a MNO or MVNO; an advantage for a larger operator can easily prove to be a disadvantage for a smaller one. There is no universal strategy applicable for every MNO because of their inherent diversity and, correlated, the various heterogeneous markets in which they are active. As long as significant structural differences between EU countries continue to exist, it will be hard to come up with a single ideal solution for uniform roaming tariffs in the entire EU.

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