AALBORG UNIVERSITY
COPENHAGEN

Semester: 4th semester

Title: Telecom operators Challenges within Europe

Project Period: 18/10/2016 -05/01/2017

Semester Theme: Thesis

Aalborg University Copenhagen
A.C. Meyers Vænge 15
2450 København SV

Semester Coordinator: Henning Olesen

Secretary: Maiken Keller

Supervisor(s):
Morten Falch
Falch@cmi.aau.dk

Project group no.: 1

Members and signatures:

Ali El-Jechy
Aeljec14@student.aau.dk

In 2007, European Commission presented price cap regulation on the telecom market. It was just for the call roaming. After few years later, then have introduced price caps for SMS and data roaming. And now European Commission aiming to have a single European telecom market, so they have mentioned that they will implement Roam Like At Home RLAH concept, which will take effect in June 2017, telecom operators will not be able anymore to charge end-users for their roaming, and so end users will pay same prices as domestic prices. While telecom operators still have to pay foreign operators on the wholesale price level.
RLAH have few impacts on the business model of each telecom operator which is hard to predict as the different nations markets are heterogeneous and operators face large discrepancies in terms of roaming usage due to different traveling patterns between the European countries.
The aim of this thesis is to provide a preview in the effect of RLAH for the end users and European telecom operators. The data will introduce how roaming regulations have revised and developed from 2007 until now in details. Finally the thesis represents some suggestions and strategies that could be implemented on the European market to tackle the issue of RLAH. The thesis will explain the negative and positive side effects of these suggestions and strategies that were presented by The Body of European Regulators for Electronic Communications BEREC.

Copies:
Pages: 81
Finished: 05.January.2017

By signing this document each group member confirms that all have participated equally in the project work and that they collectively are responsible for the content of the project report. Furthermore each group member is liable for that there is no plagiarism in the report.

Telecom operators Challenges within Europe

1. Table of Contents

Table of Figures

Acknowledgement

I would like to dedicate special thanks and my deep appreciation to my supervisor Morten Falch for his full and helpful guidance during this master thesis.

Hint: All the data collected in this thesis are updated until the 25th December .2016

Chapter 1

In this chapter, an Introduction for international data roaming will be explained first with the challenges that it is facing.
Second, a Motivation for choosing international data roaming as a topic for this thesis will be mentioned.
Third, Research question will be introduced in order to reform the thesis and direct it to select a related data to answer these questions. Answers for these questions will be presented in the Analysis chapter.
Fourth, Delimitation part used to frame the thesis and give a reader an overview of what will be extended from this thesis.

1. Introduction

Globalization has changed our needs, behaviors, and life style in general. It has also increased the integration between European countries as well as increasing the prosperity of the EU citizens. This has in turn led to an increase in the intra-European travel. People have always had an interest in using mobile services while being abroad, and smartphone devices' revolution with all of its diverse social and professional media has changed the behavior of the end users in using their devices to be always connected with others while being abroad.[1]

While end users are abroad and using their devices in the visited country, their domestic service provider cannot rely on its network for data connectivity unless it is a cross-boarder operator owning their networks' infrastructure in multiple countries .In regards to that, users have no other choice than using the network of the visited country. Also, when a user uses the visited network operator, using a process referred to as international data roaming, the domestic service provider will be charged a fee by the visited service provider as they are offering their services to connect the users on behalf of the domestic service provider. At the end, the domestic service provider will add this cost on the retail level by charging the end user a retail roaming charge.

European Union has been the first region to interfere in the international roaming services market. In 2007, the first regulation was introduced. It included calls and sms and has since that year, being revised several times and

developed to reach its latest version which took place in the summer of 2012(European Commission, Brussels 2015).

International Roaming is the ability of customers to use their phones outside their geographical country coverage, provided by their national network operator. Data roaming refers to the use of mobile data services whilst abroad. While travelling, it is important for the traveller to get in touch with family and friends. This kind of communication requires Internet access, where the traveller can login to Facebook, share important moments on Snapchat, and have a video call on Viber. Currently it is cheap enough to get a call while traveling in European countries, or to send an SMS, but the prices for Internet access are very high, which makes it difficult for the traveller to use Internet while travelling in the EU countries.

Unfortunately, abroad users were afraid of receiving high bills services, which resulting in travellers being dissenting to international data roaming services anymore. This has led to an impact on the telecom operators were the additional revenue hampered due to the limited usage of mobile services while abroad. Furthermore as Neelie Kroes (European commissioner for the digital agenda) indicated:" it's not just a fight between holidaymakers and telecom operators. Million of businesses face extra costs because of roaming, roaming makes no sense in a European single market, its economic madness"[3]. In other words, the European roaming affects not only people who travel for pleasure but also business whose employee travel around the European countries, which translates into significant roaming bills.

The number of intra-EU travellers have been increased in the last years and their interest focuses now in using their domestic mobile services in a convenient and transparent way while being abroad.[3]As a fact of that European Commission came up with a new method called RLAH (Roam Like At Home). This method shall take place in June 2017, which means that end users will pay the same prices for their communication services usage while being abroad for the same price as if they were in their homeland. This method will bring some economic and business effects to the European telecom operators because they will not be able to charge their subscribers for their abroad roaming usage anymore. In the same time, the domestic telecom operators still have to pay the foreign telecom operator on the wholesale level for connecting their subscribers while being abroad. Also another challenge is the differences in the traveling ratio between the countries such as north countries and south countries will make it very complicated for European Telecom Operators and European regulators.

European going through whirlpool in regards to how to implement wholesale data roaming regulation and how to let end-users be satisfied with the prices of using services abroad (Data), also another issue that what European commission promised customers that they will not allow telecom operators anymore to charge them for using their data abroad but they didn't take in a case what will happen to the telecom operators business in the countries which their outgoing data ratio much more higher than the ingoing data .

This thesis gives a general overview of the evolution of international data roaming in the EU from 2007 until now. Additionally, a brief details on the economic and business impacts for customers and telecom operators. Based on both the technological possibilities and economic implications, number of possible strategies and solutions for the future will be presented and discusses in details to gather them and come up finally with a conclusion.

Motivation

The author chose international data roaming topic because it is a hot topic in the European market and still under development. Also, it went through many discussions and developments to reach the level it has reached today.

On the hand, this topic covers the courses that the author has learned in the field of ICTE Aalborg University.

In addition to that, there are two incentive reasons, which stand behind the author's decision of choosing International Data Roaming as topic for my master thesis.

The first reason is the technological innovation. In other words, what can a new technology do in changing people's life if they perceive it with attractiveness. Also the extend that it can impact existing alternative technologies, which are adopted by the existing firms/organizations for several years.

The second reason is an academic one, since International Data roaming is a topic, which matches the author's field of study and investigating it will hone the author's skills in transforming technological capabilities into business value.

But off course those two reasons were not enough to finalize the process of selecting an appropriate and interesting topic for the master thesis, so discussions were essentially needed in order to have a clear vision.

The author has discussed the topic with his supervisor Morten Falch several times. The information he gained through those discussions has cleared the vision and motivated him more to write about this topic.

Problem formulation

In this sub-chapter, the main questions will be pointed and will be explained later in the thesis .the main question will elaborate about the challenges that telecom operators in EU are facing and how they have prepared for the new regulations in a way that has changed their prices.

This thesis focuses on the telecom market of the European countries, since the EU Commission will release a new method, called RLAH (Roam Like At Home). This means that telecom operators will not be able to charge their customers any extra fees anymore for their usage of (data, sms, call) while being abroad. RLAH has an effect on the telecom operators business that is hard to predict in terms of roaming usage due to the different travelling ration between the countries. This implied that in some cases telecom operators would not be able to cover the cost of the roaming charges.

Main questions:

4.2.2 How telecom operators can get a fund to cover the cost of international data roaming wholesale charges in interaction with RLAH?

4.2.2 Could wholesale price regulation be a part of the solution of the problem mentioned above in the first question?

Delimitation

In this sub chapter, delimitation used to frame the thesis with borders because in many fields there is a lack of information, so the author focused on a parts where there are enough data to be collected and used in the thesis.

To get the purpose of this thesis, it is a must to set borders to what intended to be achieved. These limitations are necessary due to the lack of information in some areas of the research, but it will also give to the reader a good understanding regarding the scope of this thesis. So in this thesis, the author will not go deeply with the technical development but the readers will get enough understanding about the technical side.

Delimitations list:

- This thesis will not explain deeply the technical aspect of international data roaming; mostly the focus will be on the market side.
- In this thesis, the focus will be mostly on the European union market.
- The object of this Thesis is in the European market, nevertheless, some references might be made to another countries, but no further analysis or deeply details will be elaborated.
- In this thesis the cost analysis part will be about few Scandinavians countries.

Chapter 2

2. Methodology

In this chapter, methodology part will be introduced, which is a frame to create a flow for the thesis and a way in which data are collected.

Methodology part also describes the methods used to produce the outcomes for this thesis and answering the questions of the problem formulation.
There will be a drawing diagram showing the structure of the thesis.

Diagram

The methodology diagram seek to show how the process developed, showing different parts which were used in the report, these parts are the research part & the theoretical framework to come up with an analysis and conclusion.
The accumulation of knowledge from the methods used was compiled in a Comprehensive manner through a dynamic process

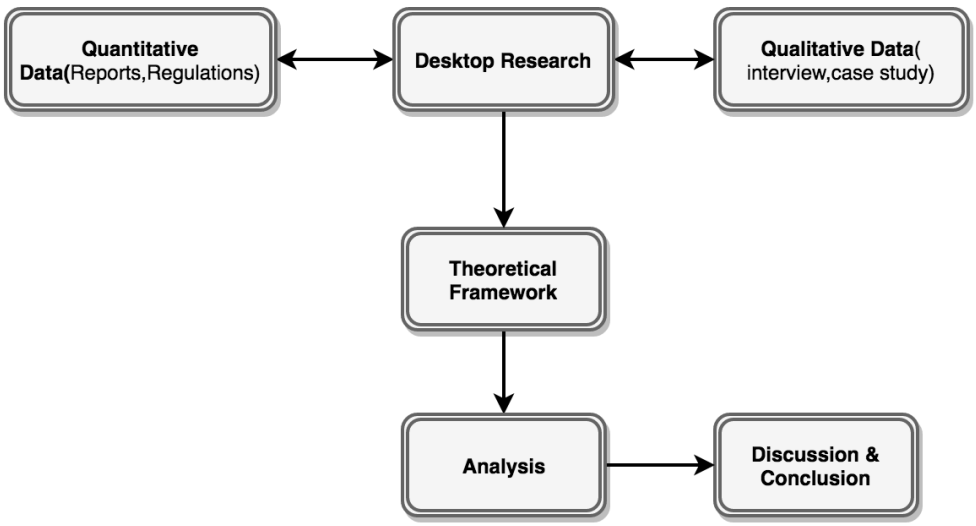


Figure 1 - Methodology Diagram

Desktop research

Desktop research was used in order to get a brief knowledge about the thesis topic that included the study of all the available material on the subject (academic research, EU data roaming regulations and telecom reports).
That research was needed to understand the market and the relation with the EU data roaming regulation. Also, it was meant that the technology used in this field to get a pure picture of how each of them could create challenges to change the strategy of the telecom operators business.

In order to get the most useful and reliable information the Aalborg University List of Databases and Vendors were used to select resources: IEEE Xplore Digital Library, Google Scholar, Electronics and communication abstracts and DTU university library, BEREC.

Primary research

The primary research for a project is divided in qualitative and quantitative research. However, for the current project primary quantitative research will be included since there are numerical data that could add validity to the project.

Quantitative research

For the quantitative research a market share and other useful data (ratio of travelers, prices, etc..) were conducted by going through some website reports such as BEREC and other sources to discover the different between wholesale prices in different countries in Europe .These data will give a better overview to be used in the analysis chapter later in the thesis.

Qualitative research (Interview)

An interview will be with the Telecom industry association in Denmark with the director Jakob Willer, which we are going to discuss some point's regard the topic. Since Jakob Willer has a deep experience with the international data roaming in Europe, it will be a great step to have an interview and gain much more knowledge regards the topic.
Another interview were done with Rikke Johan (a Political Advisor - MEP Jens Rohde, European Parliament), which we had discussion about the different prices of wholesale charges in different countries in Europe and the update of Fair Use Policy draft (FUP).
All the data regards the interviews will be included in the appendix part.

Chapter 3

In this chapter, different theories presented and discussed from known resource such as Tommaso Valletti & Christos Genakos to be used later in the analysis chapter.

3. Theoretical framework

3.1 Market Structure

This sub chapter will elaborate on market formation theory by Karen Collins in a book called "Exploring businesses"[4]. The theory will be the base for understanding the market and industry in the analysis chapter.

> *There are four types of competition in a free market system: perfect competition, monopolistic competition, oligopoly, and monopoly.*

3.1.1 Perfect Competition

Perfect competition exists when there are many consumers buying a standardized product from numerous small businesses. Because no seller is big enough or influential enough to affect price, sellers and buyers accept the going price. For example, when a commercial fisher brings his fish to the local market, he has little control over the price he gets and must accept the going rate.[4]
In the telecom industry market in Europe, it is classified as a competitive market but still have few big operators that there have a huge power on a market (cross-border operators), but mainly it is a competitive market.

Supply & demand

To check how perfect competition works, we need to understand how buyers and sellers interact in a market to set prices. In a market characterized by perfect competition, price is determined through the mechanisms of supply and demand. Prices are influenced both by the supply of products from sellers and by the demand for products by buyers.[4]

In order to illustrate this concept, a supply and demand schedule will be created for one particular good sold at one point in time. Then defining demand and create a demand curve, and define supply and create a supply curve. So it shows how supply and demand interacts to create an equilibrium price, the price at which buyers are willing to purchase the amount that sellers are willing to sell.

Demand

Demand is the quantity of a product that buyers are willing to purchase at various prices. The quantity of a product that people are willing to buy depends on its price. Customers normally are willing to buy less of a product when prices rise and more of a product when prices fall. *Karen Collins* said "we find products more attractive at lower prices, and we buy more at lower prices because our income goes further".
The same with the telecom market, when European Commission reduced the prices for international data roaming, then the demand on data have increased widely and customers started to use data much more than before.

Supply

Is the quantity of a product that sellers are willing to sell at various prices. The quantity of a product that a business is willing to sell depends on its price.

Businesses are more willing to sell a product when the price rises and less willing to sell it when prices fall, also businesses are set up to make profits, and there are larger profits to be made when prices are high.

Equilibrium Price

We can now see how the market mechanism works under perfect competition. We do this by plotting both the supply curve and the demand curve on one graph, the point at which the two curves intersect is the equilibrium price. At this point, buyers' demand for apples and sellers' supply of apples is in equilibrium.

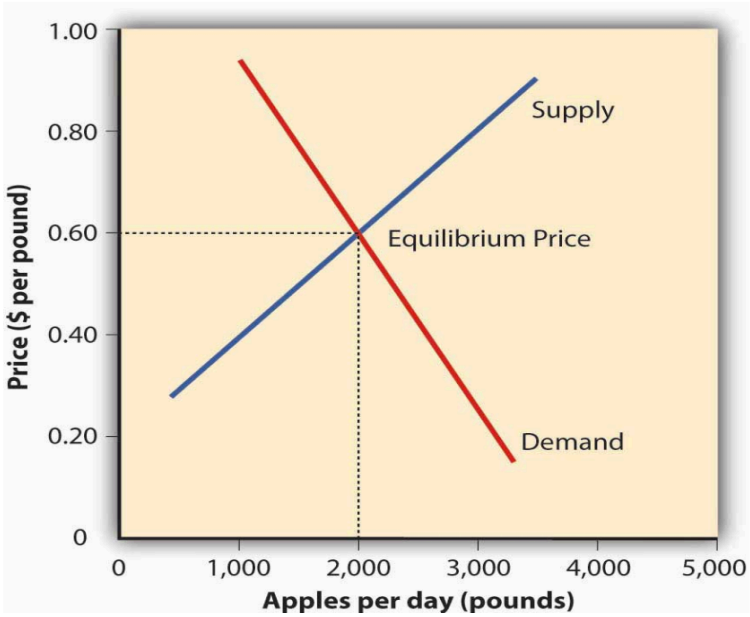


Figure 2 Equilibrium Curve[4]

When the market is characterized by perfect competition, many small companies sell identical products, because no company is large enough to control prices, each simply accepts the market price, so the price is determined by supply and demand methods as described above.
In this figure above, is what exactly European Commission is willing to achieve. They have developed the regulations of international data roaming several times and reduced the wholesale prices cap, but they still studying all the circumstances from different sides to predict the equilibrium price for wholesale cap.
The main problem is that south European countries negotiating to raise wholesale price caps to benefit as much they can, because they are classified as tourist countries (which means they have very high incoming traffic), while north countries " such as Denmark, Sweden" are negotiating to lower wholesale caps, because their incoming traffic is very low.

3.1.2 Oligopoly

Oligopoly means few sellers. In an oligopolistic market, each seller supplies a large portion of all the products sold in the marketplace. In addition, because the cost of starting a business in an oligopolistic industry is usually high, the number of firms entering it is low.

Companies in oligopolistic industries include such large-scale enterprises as automobile companies and airlines. As large firms supplying a sizable portion of a market, these companies have some control over the prices they charge. But there's a catch: because products are fairly similar, when one company lowers

prices, others are often forced to follow suit to remain competitive. You see this practice all the time in the airline industry: When American Airlines announces a fare decrease, Continental, United Airlines, and others do likewise. When one automaker offers a special deal, its competitors usually come up with similar promotions. [4]
Another example is between the big mobile network operators MNOs in Denmark (Telenor and YouSee) both of them have their own infrastructure and we know to enter this market with your own infrastructure its very high costly. Those two companies have some control over the prices they charge, but their products are similar, so when one of them lowers prices, the other operator forced to follow to remain in the competitive market.

3.1.3 Monopoly

In terms of the number of sellers and degree of competition, monopolies lie at the opposite end of the spectrum from perfect competition. In perfect competition, there are many small companies, none of which can control prices. They simply accept the market price determined by supply and demand. In a monopoly, however, there's only one seller in the market. The market could be a geographical area, such as a city or a regional area, and doesn't necessarily have to be an entire country.
At the beginning of telecommunication sector, there were few operators in Europe with their own infrastructure and they had a power of controlling prices because it was hard to enter to this market due to the high costly infrastructure, so the market were classified as monopolistic market. So these telecom operators had a power to control the prices and charge high prices.

Natural monopolies include public utilities, such as electricity and gas suppliers. Such enterprises require huge investments, and it would be inefficient to duplicate the products that they provide. They inhibit competition, but they're legal because they're important to society. In exchange for the right to conduct business without competition, they're regulated. For instance, they can't charge whatever prices they want, but they must adhere to government-controlled prices. As a rule, they're required to serve all customers, even if doing so isn't cost efficient.

A legal monopoly arises when a company receives a patent giving it exclusive use of an invented product or process. Patents are issued for a limited time generally twenty years. During this period other companies cannot use the invented product or process without permission from the patent holder. Patents allow

companies a certain period to recover the heavy costs of researching and developing products and technologies. [4]

3.1.4 Regulated Monopoly and Unregulated Competition

Mark Armstrong has defined and explained well how the difference between theory and a real world market "In an economic paradise, where a regulator is omniscient, benevolent, and able to fulfill any promise he makes, competition cannot improve upon regulated monopoly. The regulator will ensure the firm produces the ideal range of services at the lowest possible cost and will set welfare maximizing prices for these services".[5]

While, the real world market differs from the theoretical side. Regulators invariably lack important information about the markets they oversee such as regulators cannot have full access to the whole data of the cost and revenues from the telecom operators and in the other hand, Regulators cannot fully trust the data receiving from the telecom operators since they will always play a character to increase their revenue, and so will not be able to direct and control perfectly the activities of a monopoly producer. Because of its daily operation in the industry and its direct contact with consumers, the regulated firm will be better informed than the regulator about the demand for the regulated services it supplies, the minimum possible current cost of delivering the services, and the potential for less costly future provision. This information asymmetry generally gives rise to an unavoidable trade-off between rent and efficiency: the firm can be motivated to operate efficiently, but only if it is awarded substantial rent for doing so.
In particular, the firm will operate at minimum cost and attempt to satisfy the needs and desires of customers only if it is awarded the full surplus that its activities generate. However, such a generous award to the regulated firm typically will provide it with significant rent, and thereby reduce the net benefits enjoyed by consumers. To limit the rent that accrues to the regulated firm, some inefficiency typically is tolerated.

In the European telecom market, European Commission would regulate the monopolistic market in regards not to allow telecom operators to offer high prices and control the market. In a regulated monopoly market, regulators implement few strategies to control telecom operators such as Price caps, quality of service. Also Regulators in the telecom market raised a rule that forced MNOs to let new comers (MVNOs) in the market to rent MNOs infrastructure.

In unregulated competition market, telecom operators will be forced by the market to lower their prices and innovate on the technological and market side to reduce their costs and attract much more customers.
So to reflect unregulated competition on the international data roaming, telecom operators will come up with new strategies and starting to offer “Roam Like At Home “service with competitive packages prices in the early edge to stay in front on the market and compete other operators to attract much more subscribers. In this case there will be no need for regulations to be implemented, because in a competitive market, the market is forcing telecom operator to lower their prices as much as they can for the end-users.

3.2 Waterbed theory by Valetti & Genakos

Statement in January 2010 by Tommaso **Valletti, Christos Genakos**
"Governments have come to regulate the fees mobile networks charge others for calling their customers. This column warns about the "waterbed effect" – pressing down these "call termination" fees could cause another set of prices to rise. Any welfare analysis of regulation cannot ignore the presence of this effect."[6]

The effect whereby regulation of one of the prices of a multiproduct firm causes one or more of its other unregulated prices to change as a result of the firm's profit-maximizing behavior. The magnitude of the change depends on a number of factors such as intensity of competition, market dynamics, market position, elasticity of demand [7]. An example of that: imagine you plunge into a pool or you sit in the middle of a waterbed, the water level simply rises at the edges.

The overall idea behind Waterbed Effect that were explained by "***Tommaso Valletti****, Professor of Economics at Imperial College Business School*"[6], that mobile operators can be seen as a platform that supplies services such as "voice, sms, data " to the end users and they can set different prices for the users of that platform. Mobile operator is a bottleneck for received services and money can be made over their termination and they can take these termination revenues into the company account. The higher these revenues, the lower price an operator would charge its customers, many operators pass through some of its revenue to their consumers to attract much more customers subscriber and be in front on the competition with others, which will increases the termination revenues earned. While if regulation reduces termination charges and hence revenues, mobile operators will not be able to offer low price subscriptions for their customers, they will have to raise their prices .The idea presented above called "Waterbed Effect" which you pressing down prices in one side causes another side to rise the prices.

In a telecom market, mobile operators will compete by offering attractive prices for end-users. In doing so, they will consider all the revenues that will accrue from acquiring a customer and all the costs of servicing that customer. When the revenue stream of the telecom operators increases, then they will offer lower prices for their end-users, it's a general strategy for the telecom operators to pass-through some of their revenue to the end-users to compete in a market, because by lowering their prices they will increase the number of subscribers which it results an increase in the termination revenues earned. And the opposite way it's true, when the revenue of telecom operator decreases, then

they will raise their prices to cover the cost, these 2 situations are defined under a method called “waterbed effect”.

In different market structure, waterbed effect could be strong or weak: if the telecom market is under a perfect competition market, then telecom operators would expect to make zero excess economic profits, considering that the telecom operators revenue reduced, operators will not raise the prices because there are under a perfect competition market, so they still offer lower prices to compete in the market but not under the cost, and in this situation, “waterbed effect” will be very weak.[8]

Waterbed effect tested in mobile telephony by Christos Genakos and Tommaso Valletti

They have tested waterbed over 20 countries for fixed-to-mobile market and their empirical analysis results reveals that both competition and market saturation, but most importantly their interaction affect the overall impact of the waterbed effect on prices (the waterbed effect is stronger the more intense competition is in markets with high levels of market penetration and high termination rates).

In the test they have made, they provided that the first econometric evidence that the introduction of regulation that cut 10 % of the telecom industry revenue resulted to a 10 % waterbed effect on average, although the waterbed effect is high also provides evidence that it is not full: accounting measures of profits are positively related to mobile termination rate "MTR", thus mobile firms suffer from cuts in termination rates.

Any welfare analysis of regulation of termination rates cannot ignore the presence side of the waterbed effect theory. In a case if the demand for mobile subscription were very inelastic, the socially optimal MTR would be the cost of termination (though the regulation of MTR would impact on the distribution of consumer surplus among fixed and mobile subscribers). If instead, the mobile market was not saturated and still growing there would be a great need to calibrate carefully the optimal MTR.
In their analysis on the existence and magnitude of the waterbed effect is also relevant in the current debate of regulation of international roaming charges. The European Commission has voted in 2007 to cap roaming charges of making and receiving phone calls within the EU.[8]
Their aim is to reduce the cost of making a mobile phone calls while abroad for end users. Hence, a reduction in roaming charges may cause a similar waterbed phenomenon, whereby prices of domestic calls may increase as operators seek

to compensate for their lost revenue elsewhere. While the magnitude of the waterbed effect caused by this new legislation is debatable, their results demonstrate that regulators have to acknowledge its existence and carefully account for it in their welfare calculations.

They have mentioned that having price data on a larger number of mobile operators within countries, would allow for joint country-time fixed effects to be properly controlled for in the empirical specification. Furthermore, to investigate the marginal consumer's behavior before and after the introduction of regulation and their elasticity regarding the waterbed effect, more detailed consumer level information is required. On the other hand, given the non-linear retail price schedules and the complex incentives schemes (handsets, personal vs. business buyers' contracts) provided by mobile operators, more detailed customer information at a country level would allow them to model more satisfactorily the effect of competition and market penetration on the waterbed effect. Such a structural model would also enable them to quantify the effects of various regulatory interventions and their welfare implications.

Chapter 4

4 Background & Findings

In this chapter, All the data were collected in regards to have a brief overview on international data roaming in Europe to be used later in the analysis chapter, and the European regulations process will be introduced from 2007 until now, to show the development of regulations.

4.1 International Data Roaming

Definition

The international roaming regulation is different from other kinds of telecom regulation, as the regulation covers the entire EU market, without any considerations to national differences in levels of pricing and competition structures.
Roaming is the ability of subscriber to a particular network to use the mobile phone on another operator's network while abroad, this require a roaming agreement between the networks and an exchange of information between these networks for authentication and billing purposes.

Network operators exchange billing information for roaming customers:

The visited network captures the details of every session of data services and voice calls in a Call Detail Record (CDR) and this record information on the (location, sending party, receiving party, time of connection, session duration and size measured in MB or KB). After that the visited network operator then uses these details to calculate the wholesale roaming charge payable by your home network. The data records, including the applicable wholesale charges, will be saved in a TAP file (Transferred Account Procedure).[9]

Services such as Data clearing house are used to send TAP files from the visited network to your home network. Data clearinghouse acts as a hub for the distribution of TAP files and provides the home network with services such as reporting to assist the home network in running its roaming business. Your home network then pays the visited network the appropriate wholesale charges.[9]

4.2 European market

4.2.1 Market structure

International service roaming is based of wholesale roaming services for access and capacity offered by mobile network operator to foreign mobile network operators in another country, so the national network operator pays to connect their customer with the visited network operator in the other country.
Roaming services costs consist of mobile origination, international transit, billing and accounting costs. These costs imply that the cost for international roaming is higher than the costs of providing the service within ones network, roaming charges have always been characterized as unreasonably high compared to the actual costs for providing them.[10]

Before the EU regulation was implemented in 2007, the roaming market presented very low competition level due to inelastic demand for the services, very few or non-existent alternatives that substituted for the service, lack of transparency regarding charges and natural oligopolies with low competition. Additionally, another reason for the high international roaming prices can be the low customer awareness regarding roaming tariffs as this is in principle, not a criterion based on which customers pick their mobile operator, which remains an issue today. The situation is to a certain extent reversed due to the proliferation of mobile network operators and MVNOs, technological advancements, roaming substitutes such as VoIP services, global SIM cards, Wi-Fi access, harder negotiations and alliances at the wholesale level, increased transparency due to EU regulation.[10]

Price cap method has been implemented with the first regulation on 2007,that reduces the prices in both retail and wholesale roaming annually and the aim of this process is to lower the prices for end-users and reach the goal of having single market of telecommunication in Europe.
International roaming in Europe presents differences between countries, such as the tourism scale, the revenue stream that roaming fees produce is relatively significant in Spain. In Spain, the market has seen changes in the revenue stream in the mobile telecommunication sector from 2007 until these days, roaming revenue has decreased due to the price caps regulation.[10]

In the Touristic European countries, roaming revenues for telecoms has an important value in regards for the revenues that can be achieved. And with the countries with much lower tourism ratio (ingoing traffic are much lower then the outgoing traffic) such as Denmark will not generate that much revenue as tourist countries. Provided that the wholesale and retail prices area also kept balanced. Different conditions and parameters of the roaming market in each country in Europe make it impossible for European regulators to eliminate of roaming charges to be implemented.[10]

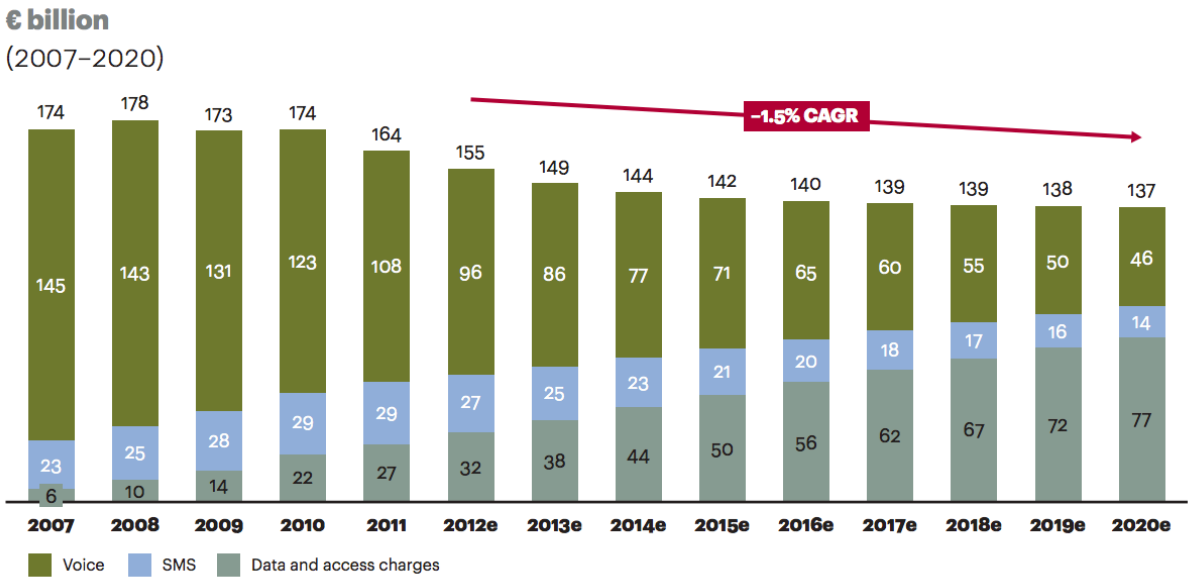


Figure 3 European Mobile Revenue 2007-2020[11]

In that figure above, it shows how mobile data usage has been growing and its expected to increase in growing as much as people are more attracted to use smart devices. Also highlight that the behavior of customers was moved from using calls and sms to using data services.

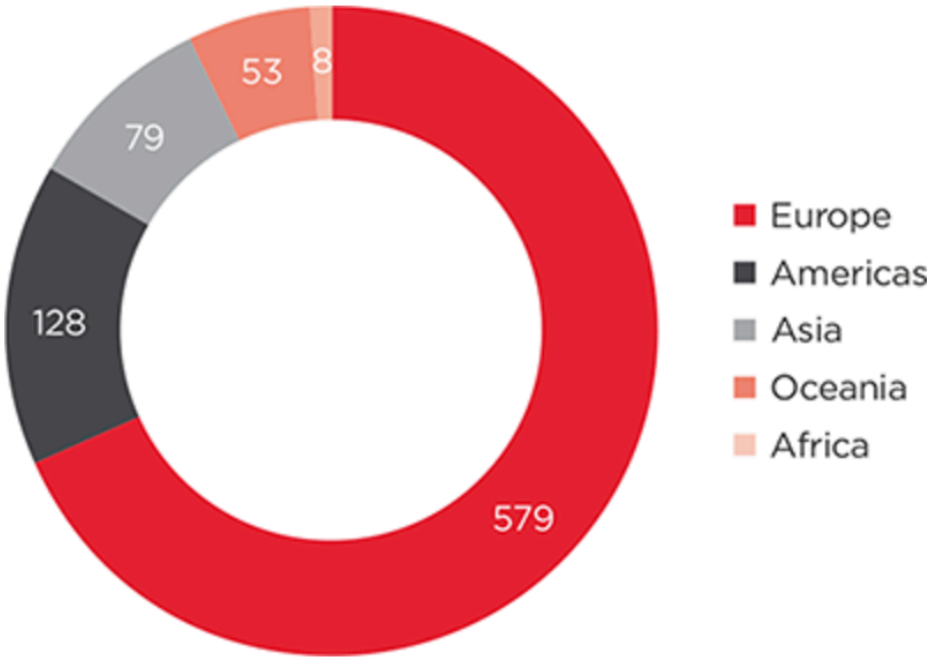
The estimate of AT.Kearnay, is that mobile revenues will decline from €164 billion in 2011 to around €137 billion in 2020, if nothing in the market changes, the decline in revenues associated with voice calls could be as high as 57 per cent, dropping from €108 billion in 2011 to €46 billion in 2020, as both revenues and unit prices fall.
This reflects mobile termination rate reductions, but also more generous bundles and increasingly unlimited voice tariffs. Revenues from text messaging are already declining, and if SMSs are still in use at all in 2020 and continue to be charged on a per message basis, the revenue attributed to them is likely to be low. The estimate of €14 billion is based on the current attribution of revenues.[11]

This case, its similar to the Spanish market were will be explained later, that the Spanish that shuffle off around 15% on the annual basis. Also another case from the Spanish study though, can be that despite the increase in usage of roaming services, there was a decrease in total revenue, meaning that the decline due to the price caps was higher than the influx of revenues from the increase in usage.

From that perspective, European union stresses retail and wholesale regulation prices, as regulating only retail prices would not be enough to control the market and create a competitive market to achieve a single telecommunication market, plus it would leave thin margin for profit to the wholesale buyers (MVNO) that don't own infrastructure to connect their customers. Meanwhile, reducing wholesale prices it was not passed on to the retail level where charges remained close to the price caps.
In the other hand, for those telecom operators that are defined as cross-border operators to provide roaming services in different countries using their own infrastructure have not very interesting in bringing down wholesale and retail prices.(M.Falch and Tadayoni 2014)

4.2.2 MVNOs

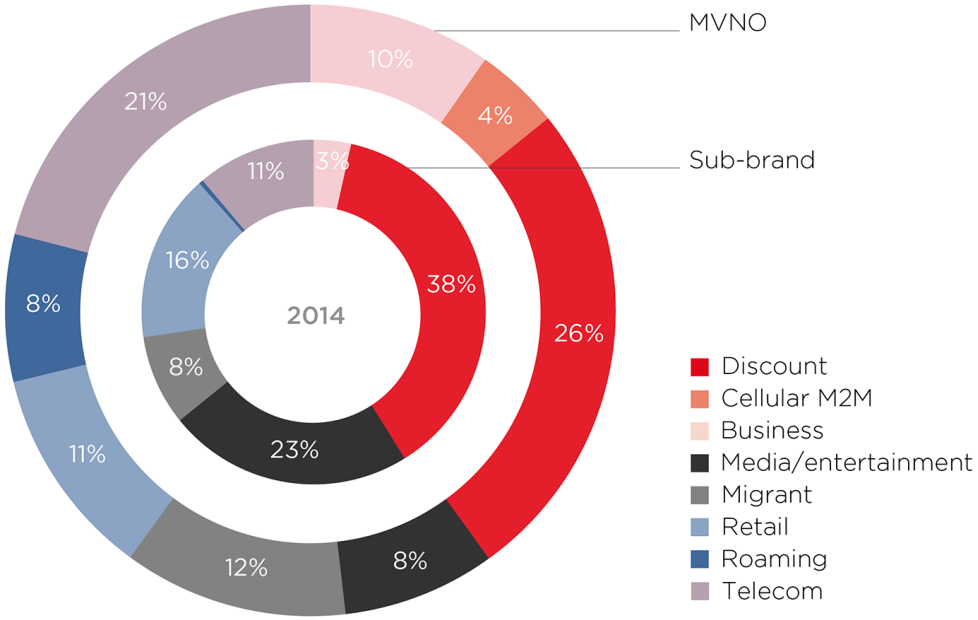
There are Mobile Network Operators that host 943 Mobile Virtual Network Operators (MVNOs) with 255 of them being MNO sub-brands, as of May 2014. This represents a total of almost 1,200 mobile service providers worldwide hosted by MNOs, a number that was down to 1,036 in 2012, according to GSMA Intelligence. The strategy of Mobile Virtual Network Operators was well known, but until the EU implemented the wholesale regulation, these virtual networks would have to negotiate and get wholesale deals directly from telecom operators. This regulation was very successful in helping the proliferation of these operations especially in Europe. GSMA Intelligence report has identified 8 separate categories of MVNOs, namely discount, telecom, media/entertainment, migrant, retail, business, roaming and M2M. As in 2012, 'discount' and 'telecom' MVNOs are the most prominent types of operation, accounting for 46% of the global MVNO market, while 19% are owned by companies that come from adjacent industries (for example retailers, banks, TV or media organizations), leaving 34% of the market to specialized providers focused on segments such as business, migrant, M2M and roamers. [13]
All the values are available in the figures down:



Global MVNO split by region, 2014

Source: GSMA Intelligence

Figure 4 global MVNOs[13]



Market segmentation by category, MVNOs and sub-brands, global, 2014

Figure 5 Market Segmentation[14]

Many MVNOs went out of the market due to the high competition in the European market and low margins on top of the capped wholesale prices, due to the fact that mobile virtual network operators operate with low margins has brought the prices and profit margin down for network operators also.

Why MVNOs are important:

In the European market, regulators have been particularly active, which is home to 2/3 of domestic MVNOs. They have encouraged MVNOs to enter the market because it is a ways to increase competition and reduce prices. So as we can see in the figure down, the number of MVNOs increased widely since EC have introduced the first regulations on the telecom market on 2007.

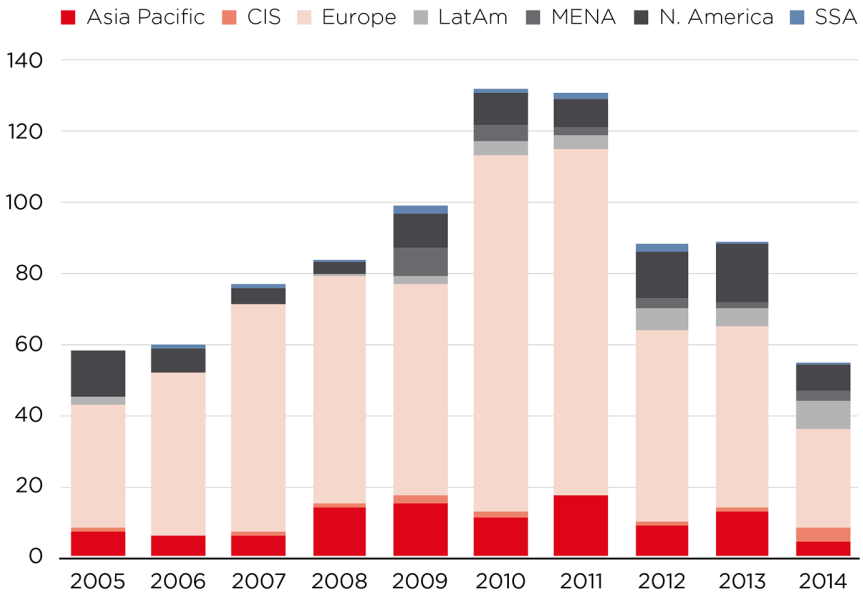


Figure 6 Increasing number of MVNOS in Europe[13]

European Commission have used MVNOs directly as a regulatory instrument, EC have applied conditions related to MVNO access before approving mergers between MNOs to preserve competition in the European telecom market. For example, before mergers 3 with Telefónica in Ireland, 3 was required to commit to seeing up to 30% of the merged company's network capacity to two MVNOs. The conventional wisdom among many regulators, politicians, and policymakers is that the more operators or MVNOs in a given market, the better the competition will work. If European Commission raise RLAH concept without taking in case that retail and wholesale prices measures are connected, then it will forces MVNOs that are not able to negotiate wholesale roaming access at

lower prices to offer roaming services to their subscribers with negative margins. And such these situations will lead these MVNOs to run out of the market because they will not be able to cover the costs of roaming. Additionally to that, it has to be mentioned that, MVNOs do not have any income of the data roaming since they do not own any infrastructure, so their business models in this way will be unbalanced to survive and compete in the market. If MVNOs runs out of the market, then the level of competition will be reduced and again we will have few big operators (MNOs) controlling the prices over the European market which means monopoly market will appear again in Europe.[13]

4.2.3 Google concept

Google aims to create a global network that will cost the same to use for calls, texts and data no matter where a customer is located. Google is in talks towards a deal with Hutchison Whampoa, the owner of the mobile operator 3, that will allow Americans to use their phones abroad at no extra cost, industry sources have disclosed.[15]

There plans to link with "3" telecom operator to get an access to the wholesale mobile service in different countries such as UK, Italy and another countries. This is an even more ambitious plan than that of the European Digital Single Market and looking at the track record of Europe and Google, Google will possibly make this a reality sooner than the EU, although the regulatory barriers all over the world to overcome will create many obstacles for them. [15]

The way Google plans to achieve this is not to build an entire new network but instead rely on the wholesale market. The idea for the analysts is that Google will "use its network to put pressure on the pricing of America's biggest mobile operators, AT&T and Verizon, who enjoy higher profit margins than their European counterparts ".[15]

4.2.4 Spanish market

The reason of choosing Spanish market, because their tourism market income is very high.

In 2011 the European Commission Vice President Neelie Kroes, “pleaded for an end to mobile roaming fees within the European Union. “The ex-commissioner Neelie Kroes had a very noble principle to reduce the “mobile roaming fees within Europe which would be great news for the millions of Spanish residents who regularly travel for work and pleasure. In 2011, Spain's mobile phone companies notched up roaming revenue of over €700 million, according to the national Telecommunications agency the CMT.”[16]

Additionally, In her point of view, the telecom sector is an exception to the European standard of a common market and as such during her speech she mentions "There is no other sector of our incomplete European single market where the barriers are so unneeded, and yet so high". Kroes also said "pan-European operators helping consumers take advantage of a borderless market" as well as "increased investment in quality networks and content".[16]

The EU Council realizing the market might not be ready for the regulations of ending roaming fess because the revenue of the telecoms has been decreases in the last years, in that case, it will be a sensitive measurement environment to study the Spanish market to preform the analysis since Spain is a leading country in term of tourism "the ingoing traffic level is very high " and it has one of the largest telecom operators in Europe "Telefónica".

The Spanish market has been hit in the recent years, a recession spreading all over the western world, and the European countries that relies on services such as tourism, and it resulted that in 2012 the revenue of the Spanish telecom market declined by 15.19%.[17]
In this figure down, it shows the Evolution of total revenues of the roaming service in the market Spanish (millions of euros)
Note: Red color means = Wholesale service revenue & Blue color mean = Final service revenue

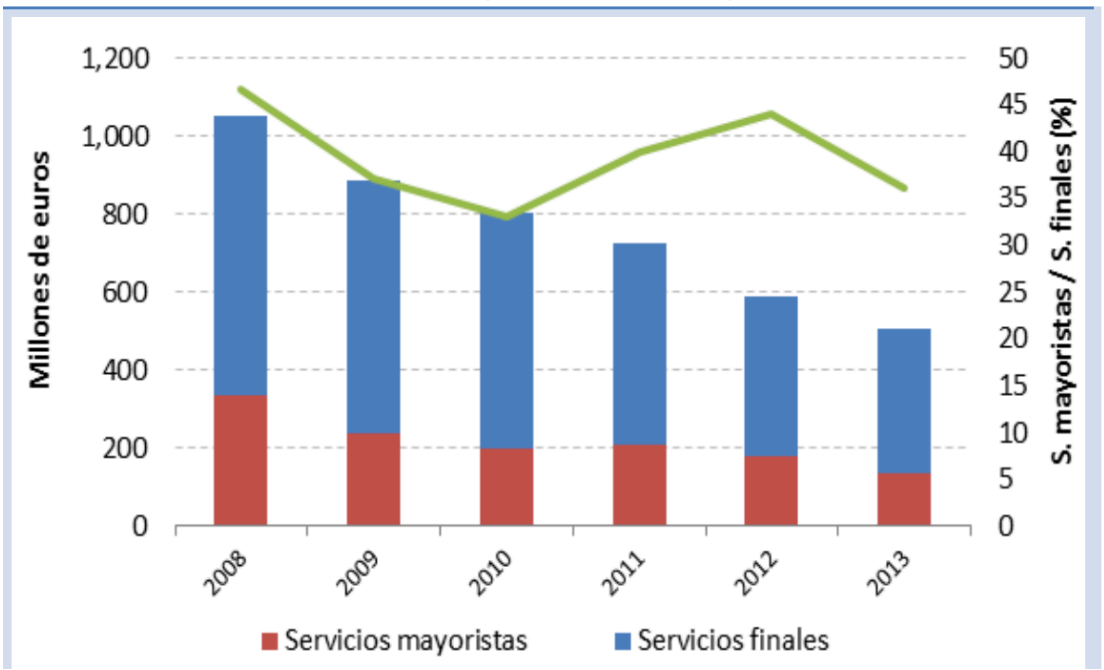


Figure 7 Evolution of total revenues of the roaming service in the Spanish market (millions of euros)[17]

The figure reveals the declining trend in income linked to these services in recent years. This decrease has been produced mainly by the reduction of the price in the communications between member countries of the European Union. Finally, the figure shows how the relative weight of the wholesale segment has remained constant in recent years, representing on average close to 40% of the total revenues of the final international roaming services.[17]

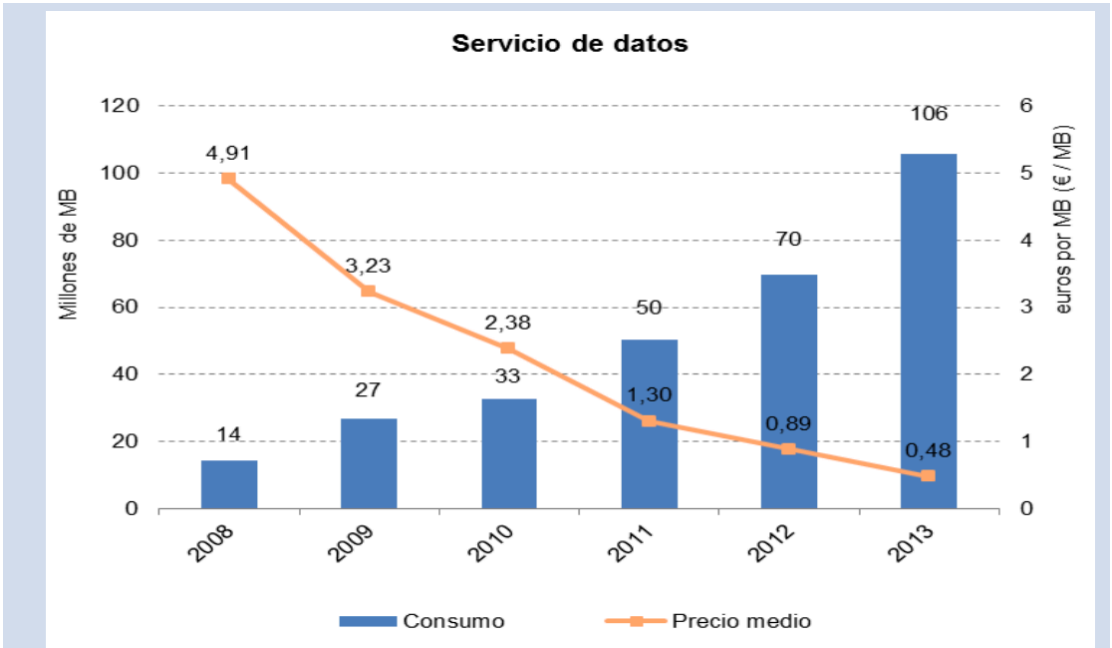


Figure 8 Data service [17]

For data services, the decline in prices has brought about a considerable increase of the consumption of data service by the end-users. As can be seen in the above graph, while that the price per MB offered by Spanish operators to their users has decreased from € 4.91 in 2008 to € 0.48 in 2013, data service consumption has grown exponentially, having increased by about ten times since 2008 and almost doubled in just the last year.

What are the impacts of roaming regulations and RLAH on the Spanish market:

After introducing the regulations on the telecom market on 2007, they implementing price caps on Calls and SMSs, so telecom operators had to decrease the prices to not be over the price caps. After that on 2012 the regulations included Data price caps that again reduced the prices for data usage. As a result of that, the revenue of the Spanish telecom operators were reduced as shown in figure 7, the revenue decreased slightly from 2008 until 2013.

Few impacts could Roam Like At Home RLAH bring to the Spanish market, first it will cut of revenue of the telecom operators since regulators will reduce price caps that Spanish telecom operators will charge other operators on the wholesale level. And that's will effect on reduction on innovation and development of the Spanish market, because they will not have enough revenue to innovate and develop their infrastructure.
Second, due to Spanish it is a touristic country, so the ingoing traffic is very high, which means they need to have a very powerful infrastructure to offer a good quality of service coverage. And in a case of implementing RLAH, the volume of incoming data traffic will be high which will have a pressure on the telecom operators infrastructure to connect all of these traffics. If Spanish telecom operators will have a pressure on their infrastructure and get technical issues to not be able to connect or offer Quality of Service, then it will end up that customers will not enjoy their roaming while abroad in Spain, which will bring a real impact on the Spanish telecom market.

That is why Spanish operators and other touristic countries are negotiating with the European commission to raise the level of wholesale price caps, to be able to offer a good quality of service and have a power to connect all the ingoing traffics without any doubt. Otherwise, they will be unable to connect all the ingoing traffics, which the goal of the RLAH to have a single digital market and their main goal is to let users be connected in any country in Europe with same prices as home and with the same quality of service.

4.3 Wholesale roaming market

Wholesale prices are the costs that operators charge each other while their customers use another operator's infrastructure to connect and use their mobile services such as Calls, SMS and Data while abroad.

Wholesale prices for operators:

The price for wholesale data taken from Jakob willer (Danish telecom industry)

The Commission proposed wholesale data roaming cap of €8.5/GB (around 63 Danish kroner), appears to be carefully calibrated to protect the very high domestic retail prices charged by operators in tight oligopoly markets (Germany, Spain) while penalizing operators with competitive much lower domestic retail prices (Finland, Denmark, Poland).(Moniter 2016,Wholesale price)

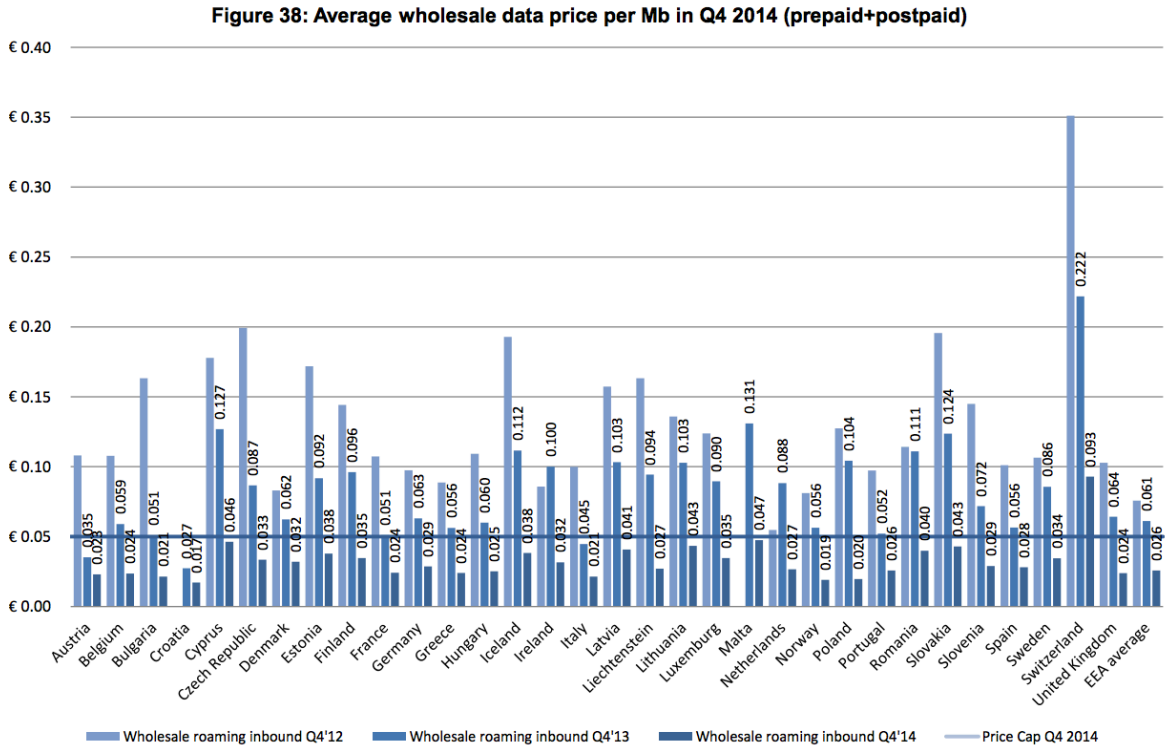


Figure 9 Average Wholesale data price per MB in 2014[19]

In this table it shows how wholesale prices per Mb dropped down during the time from 2012 until the end of 2014.But until now European Commission didn't

finalized the last version of regulation regards wholesale prices because it's a complex process due to the difference ratio of travelers for each country and the amount of ingoing data traffic in the north countries are much lower than the amount of ingoing data traffic in the south countries such as Spain and Portugal.

How wholesale agreements working between telecom operators:

Operators sign 2 types of wholesale agreements:
First agreement called "International Roaming Agreements or Standard International roaming", which specify the operational and technical aspects of the roaming relationship, standard roaming are valid until further notice with the possibility to terminate them after a period of notice of 6 months. While the second are "Roaming Discount Agreements" annexes to the international roaming agreements and specify the commercial aspects of the agreement including the prices that have to be paid, the discount agreements typically have duration of 12 months. (BEREC 2016,wholesale market)
The reason given by operators for the annual renegotiation of discounts is the unpredictable nature of the market with a high degree of regulatory uncertainly, unpredictable traffic ratio, frequent merges and other changes of ownership. These need to be balanced by the transaction cost of negotiating agreements, in addition some discounts agreements are automatically renewed every year unless one party objects.

The strategy that operators apply to have a better coverage is that they make more than one agreement with another operators in each European country, and also in this way they get more inbound roaming revenue and lower outbound cost. Most operators have one preferred network in each country to which they try to steer their traffic.

When mobile network operators negotiate national and international roaming agreements they are for the most part bilateral each operator gets roaming access to the other operator's network. Some of advantages of bilateral agreements: operators build partnerships agreements to add a value of services for end users, enlarge roaming coverage to the benefit of customers and secure inbound roaming traffic and revenue that can partly offset the outbound roaming cost.
Each operator applies a number of discount price models and these different models are combined in many cases such as (balanced/unbalanced agreement

might include a min. volume/revenue commitment). Also there can be also different models for different services in the same discount agreement (one for voice and the other for data services).

The most common price models will be introduced shortly “Fixed rate and Balanced/unbalanced: (BEREC 2016 , Wholesale market)

Fixed rate it means a discount rate per unit per service or percentage of the regulation cap and **Balanced/unbalanced** it’s a pricing method in bilateral discount agreements, each party exchanges traffic and the net sender of traffic gets an additional discount on the amount of traffic that exceeds the amount of traffic received from the roaming partner. In this way when operators send more traffic it results a reduction in the net senders average cost. But in many cases this model not used when the situation of traffic is highly imbalanced.

While operators come into choosing a pricing model they go through some specific elements to each individual negotiation and the discounts level negotiated. These specific elements are traffic volumes and the ratio of imbalances in inbound and outbound volumes. Higher outbound volumes give an operator more bargaining power, but highly imbalanced traffic flows complicate negotiations. There are also some other important elements that have to be mentioned are national market share, mobile termination ratio cost and network quality, so an operator with a high national market share and great network quality of service will secure better discount agreements regards their national power in the market.

Some operators report that a high level of outbound traffic gives operators bargaining power that can result in higher discounts for the net buyer of roaming services than they have to give to the net receiving party. Other operators report that the net seller of roaming services has the advantage since it is usually the seller who has the geographical advantage, the best network in a popular roaming country (BEREC 2016 , wholesale market). In addition, some operators also highlight that operators with a pan-European presence or associated with larger markets have a stronger bargaining power compared with operators with smaller footprints, namely the ones that only operate in one EEA country.

Many operators say that they are agnostic about the price model and that the choice depends on the wishes of the other party and what model will benefit their net position in a particular case.
Some operators report that if they compete in the domestic market with an operator that is part of a pan-European group, they are not able to negotiate reasonable roaming discounts with other members of this group in visited

markets and thus have to rely on agreements with smaller operators in those countries.(BEREC 2016, wholesale market)

In the other hand, most group operators they are applying internal transfer pricing that is based on an arm's length principle, the internal rate is based on the market rates offered to external partners. One group reports that this market rate is calculated as the average rate charged to the main trading partners. One group applies bill and keep while another group uses zero pricing between subsidiaries.(BEREC 2016,wholesale market)

Permanent roaming and M2M communication:

Mobile operators described permanent roaming as an arbitrage service and as an implementation for M2M services.
Permanent roaming caused by an arbitrage service could result if wholesale caps are set too low and there are no sufficient measures in the regulation. But, currently the Roaming Regulation allows operators to include conditions in their reference offer for wholesale roaming access to prevent permanent roaming or abusive use of wholesale roaming access.

Different point of views were explained about M2M, some operators argue that national networks are dimensioned and built to host domestic SIM cards. They see the risk that if a highly increased volume of foreign SIMs used for M2M communication gets located on a permanent basis, this can create problems of capacity management and possible network congestion in the visited networks. In the one hand, also this could be a consequence if RLAH "Roam Like At Home" gets introduced without proper strategy safeguards and foreign users stay for a long time in a visited network with extended usage.

Additionally for that case, BEREC has requested information on whether the MNOs apply any mechanisms to control the level of permanent roaming in their networks. MNOs were also asked if they had separate M2M roaming agreements containing special conditions for similar kinds of traffic. (BEREC 2016, wholesale market)

Most of the MNOs have responded that in the present time, not implemented any measures to discourage permanent roaming. Some of them explained that it is not necessary since all usage is charged and others even highlight that they encourage usage by using mechanisms like volume commitments, revenue commitments in their wholesale roaming agreements.

Some mentioned that they might introduce mechanisms in the future to prevent permanent roaming, if wholesale roaming caps fall below the relevant costs.

Very few MNOs answered that there are explicit consumption limits in their wholesale roaming agreements. Just one mobile network operator highlighted that they have a strategy such as fair use limit that is based on a maximum number of days per SIM per year to prevent permanent roaming by retail consumers. And only around 20 % of responding MNOs have some kind of mechanism in their wholesale roaming agreement to discourage permanent roaming. Such mechanisms seem to be in the shape of price differentiation. Permanent roaming can for example be excluded from any discounts, and the ratio difference between discounted and non-discounted rates seems to be a crucial element for MNOs to control permanent roaming.(BEREC 2016,Wholesale market)

Ratio of travellers between the European countries:

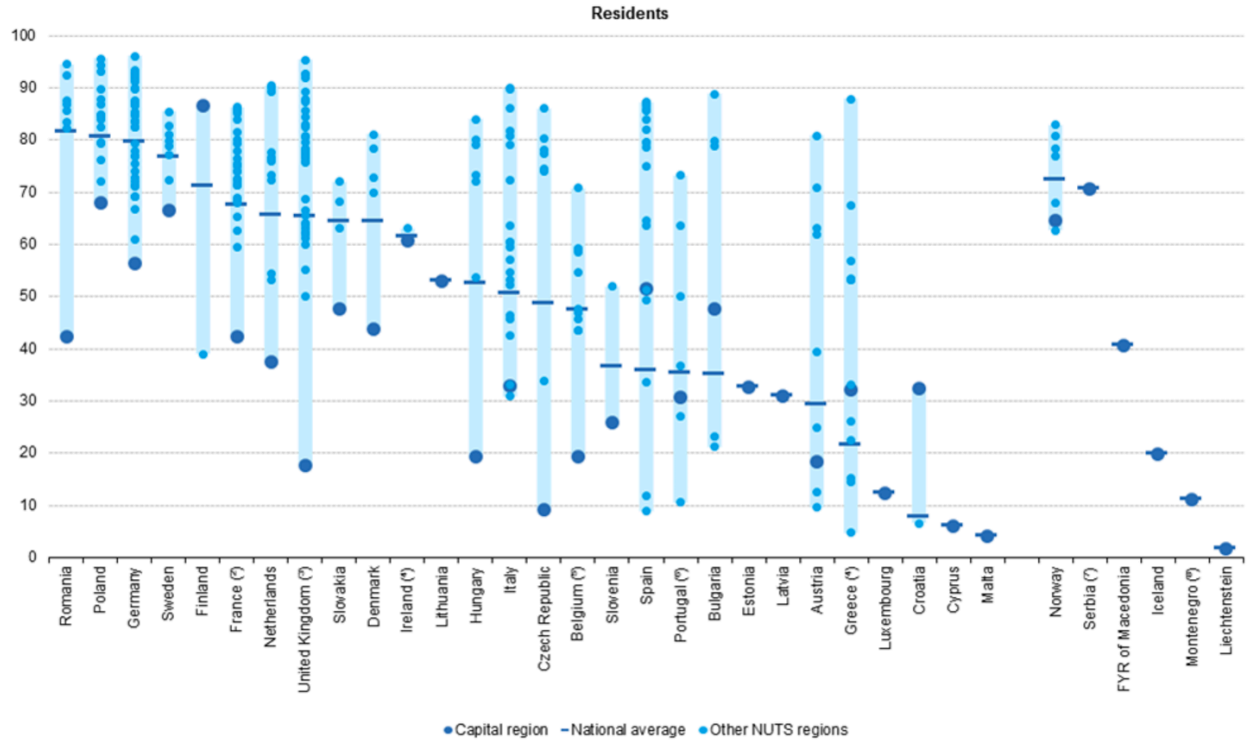


Figure 10 the difference ration of travellers between the European countries[1]

The light turquoise shaded is showing the range of the highest to lower region for each country while the blue bar shows the national average.
The blue circle shows the capital city region.

This figure has been used here to show the difference ratio of travellers between the north and south European countries, which means that there is a vast gap between the outgoing and ingoing data traffic as we can see in the figure above (Denmark is much lower than Spain regards the number of travellers that comes to the country)

4.4 History of roaming in EU

An overview of the development of international roaming in Europe will be presented from 2007 until 2012. The information combined with the theory will be useful in the analysis chapter.

2007 regulation:

The first Regulation on international roaming services was published on 29 June 2007, the primary provisions capped wholesale and retail charges voice calls for the Euro tariff and set a number of transparency provisions to help to ensure that consumers were well informed. The provisions of the Regulation entered into force at different times, with retail and transparency provisions taking full effect by the end of September 2007 and wholesale provisions calculated annually from the end of August 2007.[21]
Roaming I introduced caps for voice wholesale and retail prices, forcing the operators to use Euro tariff by default. Telecom operators still allowed to charge other pricing tariffs but only to those customers who would choose for such alternative subscriptions voluntarily.

2009 regulation:

On 7 May 2008, the Commission launched a public consultation on the functioning of the 2007 Regulation. The European commission decided to continue on its prices caps strategy for voice and lowering them in order to reduce the gap between wholesale and retail prices. Bill shock case was introduced to protect customers, so if a certain billing amount of data services reached 50€ excl. VAT, then the operator has to notify the user, then users are freely allowed to decide to spend more money on the data services or to stop it. They views expressed in response to the consultation were substantially reflected in the Commission's legislative proposals, published on 23 September 2008, to extend the 2007 Regulation in duration and scope. On 22 April 2009, the European Parliament adopted Regulation (EC) No 544/2009 at first reading, with a view to amending Regulation (EC) No 717/2007. [21]

Subsequently, on 8 June 2009 the Council of EU Telecoms Ministers formally adopted the new EU roaming rules approved by the European Parliament. The definitive text of Regulation (EC) No 544/2009 was published in the Official Journal of the European Union on 29 June 2009.

In particular, the Regulation introduced the following measures related to price control, applicable from 1 July 2009 to 30 June 2012:

• An extension of wholesale and retail price regulation for voice, with a yearly decrease in the level of the caps.
• Price regulation of SMS roaming services at both the wholesale and retail levels.
• Price regulation of data roaming services at the wholesale level.

And from July 2010 to June 2012:
• Retail transparency measures to protect consumers from "bill shock" when data roaming.

2012 regulation:

On 29 June 2010, the Commission published an interim Report on the functioning of the 2009 Regulation. The Commission's Digital Agenda for Europe8 also included a target for roaming, where 'the difference between roaming and national tariffs should approach zero by 2015. [21]

In accordance with the 2009 Regulation, BEREC (Body of European Regulators for Electronic Communications) provided advice to the Commission on the functioning of the Regulation and future regulatory options in its December 2010 Report, supplemented by its February 2011 response to the Commission's public consultation, the Commission then published a full review of the functioning of the Regulation and legislative proposals for a new Regulation in July 2011. On 30 May 2012 the Council of the European Union approved the International Roaming Regulation III, which entered into force on 1 July 2012. The Regulation introduced the following measures applicable from 1 July 2012:

• An extension of wholesale and retail price regulation for voice, SMS with a yearly decrease in the level of the caps to be in force until July 2022 for wholesale services and until July 2017 for the euro tariffs.

• Price regulation of data roaming services at the retail level to be in force until July 2017.

• The obligation for MNOs to meet all reasonable requests for wholesale roaming access, which comprises direct wholesale roaming access and wholesale roaming resale access under the rules set out in the Roaming Regulation.

The regulation does also include provisions on the separate sale of roaming services that will enter into force on 1 July 2014.

In 2013,European commission introduced RLAH strategy, being the most ambitious plan in 26 years of telecoms market reformations. With RLAH strategy it allows end users to use their mobile device abroad in the EEA countries without any surcharges.

This point out that all the underlying costs, transit costs and fixed costs that are related to roaming would become completely invisible to the end user.

In 2014,European Parliament voted to finally abolish retail roaming surcharges in order to allow customers to be able to roam like at home, and from that point onwards, legislators were charged with working out details of how this could be made possible, reaching an agreement across all the EU member states.
The Impact on the business case for the different operators is not comparable, on the one hand due to the differences between MNO & MVNO, but on the other hand due to the significant differences between the member states such as the level of retail tariffs, costs and the ratio of travelling and consumption of services. With RLAH, the number of consumers using roaming services will increase which will mean less revenue and bigger wholesale bills for the operators and in addition they will have to face the increasing demand on their networks.

In 2015:

European commission stated that the reduction to zero strategy is planned to be finished by June 2017,this means that after more than 10 years of regulations and price caps will be abolished entirely and Europeans will be able to travel and use their mobile device services just like at home with no extra cost. In order to completely build up to the point where no additional roaming fess are allowed, an intermediate RLAH regulation has been introduced which is referred to as the RLAH+phase, as operators can now only charge the domestic price per unit plus a small surcharge which equals to their maximum wholesale cost.

On 26 November 2015, 2 years after the first draft text was introduced by the European Commission, the Regulation (EU) No. 2015/2120 of the European Parliament and of the Council laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications

networks within the Union was published. This amendment to the Regulation (EU) No 531/2012 sets out the principle of (RLAH) where, from 15 June 2017, telecom operators were not be able anymore to surcharges for regulated retail roaming services until a yet to be defined minimum fair use limit (FUP) has been reached provided that the issues identified at wholesale level have been addressed and the proposed solutions are applicable by then.

Specifically regarding to the Benchmark Report "BEREC", the applicable provisions on the Roaming Regulation (EU) No 531/2012 were kept unchanged and therefore the basis for this data collection is maintained.[19]

RLAH (Roam Like At Home)

The concept behind RLAH implies that mobile subscribers when visiting another country can use their mobile phone as if they were in their home country without incurring any extra charges on the bill.
So, they can make a local call in the visited country, call back home, call a third country, access mobile data as their home mobile subscription incurring no extra charges, if any charges were involved they would occur if usage when roaming went beyond their allocation of minutes and/or data of their monthly subscription and these charges would be at the same level as if the subscribers were in their home country.
RLAH have few impacts regards the telecommunication market and competition since many operators with high outgoing traffic will not be able to cover the costs if their users use their data services abroad for a long term, so in term to implement RLAH there should be fair use policy at the retail level approach to be implemented in order to prevent any anomalous usage.

In these days, some operators started to offer different packages, that are similar process to the RLAH, these packages could be just for voice and some other packages could be just for using data, while some of them were restricted to a specific geographical areas, for example: customers from Denmark get offers from there operators to roam in Sweden and Norwegian for free, without any extra charge but if they use their data in another country they will have to pay extra.

Many operators are offering RLAH with fair use policy, for example usage of 3GB per moth or 6GB per year or 90 days abroad. France and Poland were one of the

first countries that applied FUP, operators in these countries offering roaming within a range of 10 to 60 days per year regards to the volume of FUP.[20]
Many operators were not able to predict the exact volume of usage of services (voice, sms, data) before and after offering RLAH packages, while few operators managed to analyze it and they reported that the average increase of data usage is around 90%-200% after offering RLAH, in the result of that operators will face a huge increase in demand of roaming services from the end-users and those users later after implementing the regulation they will not pay any more high prices for roaming.[20]

4.5 Price Cap

Here in this point, it shows the improvement of the regulations how reduced price caps for the international roaming (Voice calls, SMS, Data). This information will be useful to collaborate in the analysis chapter.

In this table, the maximum tariffs prices are explained and shown how the prices decreased from 2014 until 2016. And with the new regulations there will be no more extra roaming fee which are given by the European commission:

	1 July 2014	30 April 2016**	15 June 2017***
Outgoing voice calls (per minute)	€0.19	domestic price + up to €0.05	no extra roaming fee, same as domestic price
Incoming voice calls (per minute)	€0.05	€0.0114	no extra roaming fee, same as domestic price
Outgoing texts (per SMS message)	€0.06	domestic price + up to €0.02	no extra roaming fee, same as domestic price
Online (data download, per MB*)	€0.20	domestic price + up to €0.05	no extra roaming fee, same as domestic price

Figure 11 The maximum tariffs (excluding VAT) for calls, texts and data[22]

These price caps are the maximum permissible prices. Operators are free to offer cheaper rates, so to be on the lookout for better deals.

Customers were worrying about the domestic prices if it is going to increase since users will be able to use their phone abroad with same price as home, but since EU regulations have been introduced to reduce international roaming charges, domestic mobile prices have been decreasing as well by the time and a transition period has been agreed to make the abolition of roaming charges sustainable throughout Europe without an increase in domestic prices.[23]

This transition period will ensure that when the end date comes on June 2017, the wholesale costs of operators when they offer mobile communications services outside of their country will sufficiently have decreased by market

forces or through another regulatory intervention for roaming without charges to be sustainable.

In addition for what mentioned above, regulation includes safeguards rule strategy, which that can be used by mobile operators to prevent a necessary abusive use of roaming services, such as permanent roaming which otherwise could be the source of distortions on domestic markets.

In some specific and exceptional circumstances where the provision of roaming services at domestic prices is proved to make the domestic charging model of an operator unsustainable, the Regulation foresees, as an exception, the possibility for that operator to still apply a surcharge to its roaming customers, only if the national regulatory authority agrees in order to avoid an increase in the domestic prices of that operator.[2]

The European Commission establishes the price cap of wholesale roaming charges that operators will charge each other for using their network from 15 June 2017, for calls, SMS and data. In effect the Commission proposes to reduce current wholesale roaming charges caps to €0.04/ minute of call made, €0.01 / SMS and €0.0085 per MB of data transmitted. Comparing these prices with the previous caps, the reduction of caps are -20%, -50%, -83% respectively. The Commission proposes the price caps values remain unchanged from 15 June 2017 until 30 June 2022 (with a review in 2019). [24]
It also mentioned the possibility for telecom operators to conclude a wholesale agreement to opt out of applying these wholesale caps and negotiate better deals.

The European Parliament committee responsible, the Committee on Industry, Research and Energy (ITRE), published the draft report on 16 September 2016. The committee adopted this on 29 November 2016. The report calls for a reduction in the Commission's proposed wholesale roaming caps for calls from €0.04 per minute to €0.03 and for data, the main point of discrepancy. Whereas the Commission proposed a single wholesale price cap for data (€8.5/GB) for 5 years period, the industry committee is proposing a departing wholesale data cap that is lower (€4/GB, €1 lower than the rapporteur's pristine proposal). This price would drop on a yearly substructure, to take account of the falling unit price of data. The report argues that to remain in line with consumer utilization in the long run, data caps should decrement over the years and that the Commission's proposed wholesale data roaming cap of €8.5/GB is much higher than both domestic retail data prices and wholesale authentic costs across all EU

Member States, as illustrated in the figure below:

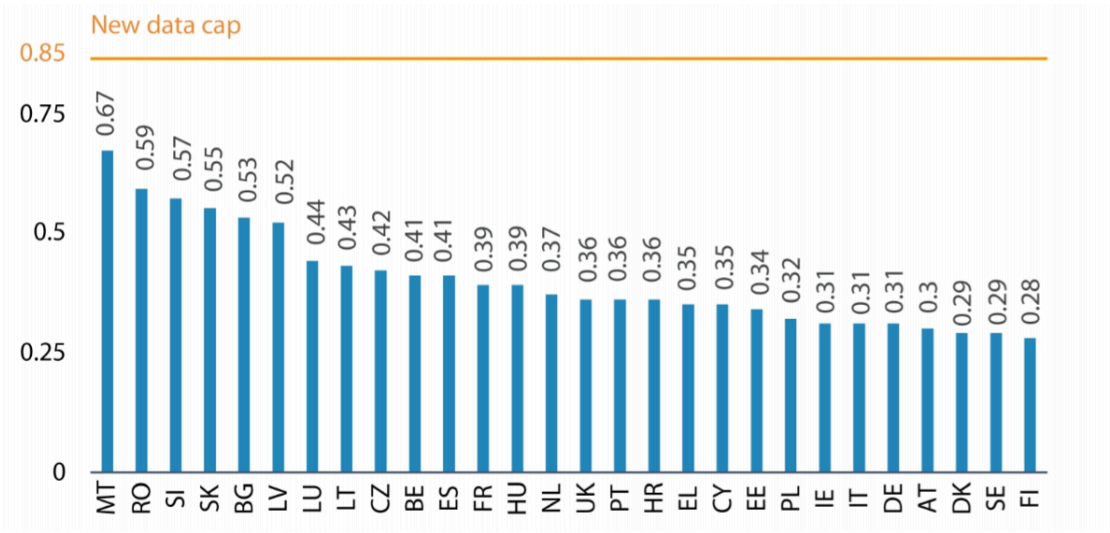


Figure 12 Wholesale data costs including transit costs (€ cent/MB) 2016[24]

The situation has been discussed at the Council, where a general approach was concurred on 2 December 2016: the Council is proposing to depart from higher data caps than those proposed by the Commission and ITRE: starting at €0.01/MB in mid-June 2017 but decrementing gradually to €0.005/MB in mid-2021.

The general approach includes an incipient mechanism at wholesale level to ascertain sustainability in exceptional circumstances. Operators unable to recuperate their costs could ask their national regulator for sanction to apply a surcharge. However, even when exceptionally applying a surcharge, the total wholesale charge for data would not be sanctioned to exceed €0.0085/MB.

In the figure, it shows how the wholesale prices are different in each country and there is a huge gap between north and south countries such as Denmark (0.29€) and Spain (0.41€)

4.6 Fair use policy

The concept behind this policy is to limit the amount of consumer's data usage abroad to not risk the telecom operators of receiving a high wholesale bill.
First draft of a fair use limit policy has been published on 05.09.2016. It would have limited the amount of free roaming to ninety days in a year and a maximum of thirty consecutive days, after which regulated roaming charges would apply. The proposal also stated that "the customer should nevertheless be able to consume volumes of such services equivalent to at least the average volume consumed domestically by the customers of the tariff plan in question", preventing operators from setting low data limits.(GSMA 2016,Fair use policy)

However, the proposal was hastily withdrawn just a few days after being published because consumers were unhappy with this policy. Only a note on the Commission's web site remained: "An initial draft was published on 5.9.2016. The Commission services have, on the instruction of President Juncker, withdrawn the draft and are working on a new version".

The telecom operators slammed the policy also, they were claiming that it would be too complex to implement and it's unclear for consumers. Furthermore, 30 consecutive days granted to each consumer would have already covered 100% of the needs of the European citizens, also a legal concerns in Denmark, the maximum length of contract is 6 months so customers would have been able to reset their roaming subscription twice a year.(GSMA 2016,Fair use policy)

On 15/12/2016, European Commission released a latest draft of Fair Use Policy "FUP", and 2 main points from the last draft were not changed because they explained if Fair Use Policy rules are entirely left to the choice of the operator:

Then users do not fully enjoy the benefits of RLAH and continue to pay a roaming surcharge in addition to the domestic price during at least part of their travelling time abroad in the EU.
On the other hand, if FUP rules are inadequately defined at EU level: The permanent use of domestic tariffs while roaming may lead to wholesale level consequences for the home operator and ultimately may affect its ability to serve its domestic customers with competitive roaming services when they periodically travel.[26]

The 2 main points that were unchanged from the previous draft are:[26]

- A FUP may be applied in order to prevent abusive or anomalous usage of regulated roaming services such as the use of such services by roaming

customers in a Member State other than that of their domestic provider for purposes other than periodic travel.

- Any FUP shall enable the roaming provider's customers to consume volumes of regulated retail roaming services at the applicable domestic retail price that are consistent with their respective tariff plans.

Additionally to the rules mentioned above, telecom operators should not impose a limit on the volumes of mobile services available to the roaming customer other than the domestic level, while the customer abroad in the European countries, also these domestic limits should include any applicable FUP as regards domestic usage of the tariff plan.

A few rules of the last version of FUP regulation will be presented:[27]

- In a specific situation, telecom operators may apply to its national regulatory for an authorization to apply a surcharge on its roaming customers. Any of these applications, required all the necessary information to demonstrate that, in the absence of any retail roaming surcharges, the provider is unable to recover its costs of providing roaming services.
- In order to enable customers to consume volumes of regulated retail roaming services at the applicable domestic retail price that are consistent with their respective domestic tariff plans, the roaming provider should as a general rule not impose a limit on the volumes of mobile services available to the roaming customer other than the domestic limit, when that customer is periodically travelling in the Union. Such domestic limits should include any applicable fair use policy as regards domestic usage of the tariff plan.
- In order to address the risk that pre-paid subscriptions, which do not entail a long-term commitment, are used for permanent roaming purposes only, the roaming provider should be entitled, in the alternative to requiring the provision of evidence of residence or of stable links entailing frequent and substantial presence on the territory of the Member State of that roaming provider to limit the usage of regulated retail roaming data services at the applicable domestic retail price with a pre-paid subscription to the volumes that can be bought at the wholesale roaming data cap by the remaining monetary amount, excluding VAT, available on that pre-paid subscription at the time of the roaming consumption.

4.7 Transparency

When a roaming service provider applies a fair use policy, it shall include in contracts with roaming customers all the terms and conditions associated with that policy, including any control mechanism applied.

As part of the fair use policy, the provider shall put in place transparent, simple and efficient procedures to address complaints of customers relating to the application of a fair use policy. This is without prejudice to the rights of the roaming customer, to avail of (transparent, simple, fair) and prompt out-of-court dispute resolution procedures established in the Member State of the roaming provider.(EC n.d. , regulatory framework)

Where there is objective and substantiated evidence indicating a risk of abusive or anomalous use of a specific regulated roaming retail service within the Union at the domestic retail price by a given customer the roaming provider may apply a surcharge for the provision of that specific service, after alerting the customer about the detected behavior pattern indicating such a risk and about the possibility of such a surcharge for any further use of regulated retail roaming services by that customer. Furthermore, the roaming provider shall cease to apply the surcharge as soon as the customer's usage no longer indicates a risk of abusive or anomalous use of the regulated retail roaming service in question.

Where a roaming provider establishes that SIM cards have been the objects organized resale to persons who neither normally resides in nor have stable links entailing frequent and substantial presence in the Member State of the retail roaming provider to enable consumption of regulated retail roaming services other than for the purpose of periodic travel outside that Member State in accordance with an article from the European commission regulatory framework ("*Where the roaming provider establishes, with objective and substantiated evidence, that a number of SIM cards have been the object of organized resale to persons not effectively residing in or having stable links entailing frequent and substantial presence in the Member State of that retail roaming provider in order to enable consumption of regulated retail roaming services provided at the applicable domestic retail price other than for the purpose of periodic travel, the roaming provider may take immediate proportionate measures in order to ensure compliance with all conditions of the underlying contract*"(EC n.d. , regulatory framework)), the operator shall notify to the national regulatory authority the evidence characterizing the systematic abuse in question and the measure taken to ensure compliance with all conditions of the underlying contract at the latest at the same time as such measure is taken.

4.8 Economic impact of cutting roaming fees

The strategy of cutting roaming fees has a beneficial phase for the end customers which they will not pay anymore extra money for using their devices while abroad, but the impact will be on the operators both (MNO and MVNO), operators will not be able anymore to charge roaming fees to customers on the retail level, meaning they will be only be compensated with the same price they charge their customers for domestic prices, while their roaming expenses remain. The impact will depend on the type of operator and its geographical coverage and location.

Impact for telecom operators

Geographical location

The impact of data roaming regulation on 2017 is significally different depending on the country the operators is active in, mainly because of the different traveling ratio of end users, making operators face either incoming roaming traffic or outgoing roaming traffic.

An example of that Denmark has much more outgoing roaming traffic because people in Denmark travel a lot to the south of Europe. So as a direct result, wholesale costs for these operators will be very high and by abolishing the retail roaming fees, they will suffer significant revenue losses. As a result of these losses, mobile operators will increase domestic prices in order to compensate for these wholesale losses that is called “waterbed effect”, Waterbed effect will be introduced and used in the thesis that has been tested by Tommaso Valletti.

On the other hand, Gunther H. Oettinger (European commissioner for digital economy and society) said: “ The commission does not believe that there is a risk of a rise in mobile service prices as a result of the progressive elimination of roaming. The elimination of roaming surcharge is a long-standing goal for which the agreement was reached by the European Parliament and the Council on the Commissions proposal.

The agreement foresees a clear timeline with all necessary steps to be undertaken. To abolish roaming charges a series of technical conditions have to be fulfilled. In particular, the wholesale roaming market needs to evolve, either through market forces or another regulatory intervention, to a level that makes the end of retail roaming surcharges sustainable throughout the EU as of 15 June 2017. Meanwhile, already from 30 April 2016, roaming prices will further decrease substantially. Roaming providers will only be able to charge a small

amount in addition to domestic prices. That additional amount will be at most 25% of current retail roaming caps for calls made and data and 33% of current retail roaming caps for text messages.

Now the agreed text will have to be translated and legally checked to be formally approves by the Council. It will then be transmitted to the European Parliament for its second reading vote and adoption, after which it will be published in the Official Journal and will officially, enter into force."[29]

In order to mitigate an waterbed effect caused by roamers, the European commission will propose a Fair Use limit that operators can apply once RLAH is into effect (Fair use limit set a maximum amount of roaming usage per customer per time period).
Also, in the specific case when an operator is not able to recover its overall costs of providing roaming services, these operators can be exempted from the obligation to provide RLAH and will be able to apply a surcharge for roaming services, in order to ensure its business case. These exemptions cases will be determined in details by the European Commission and published at the end of December 2016.[23]

Impact of geographical Coverage

One specific category of telecom operators in Europe is those coverage region extends beyond national borders, called "cross-country" operators. Operators who are part of a cross-country group will be able to get cheap wholesale roaming prices by using their own network infrastructure, they can steer their roaming traffic and internalize their costs.

Impacts for MVNOs

MVNOs, those who don't own a physical network infrastructure, they 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.

In a situation as roaming, MVNOs incur in costs when their customers are travelling but they don't have wholesale incomes as they cannot host any roamers on their networks since they don't own the infrastructure.

They experience absolute traffic imbalances and they don't have the bargaining power to negotiate wholesale roaming fees that are lower than the ceiling caps imposed by the European Commission .For them the risk of waterbed effect is even more pertinent than for MNOs with high outgoing roaming traffic. If this issue in not tackled accordingly, the implementation of RLAH strategy might have a negative side effect on the level of competition within the national market.(MVNO Europe 2015)

In June 2016 the European Commission has proposed a significant reduction of the wholesale caps for data, voice and SMS. MVNOs are looking forward for lower caps while from the other side southern countries are advocates of higher capes. The debate is complex, as nobody can exactly predict the spot in order to offer RLAH on a sustainable way to fit with the situation.

As BEREC has pointed out, the situation is complex because of the differences between operators and the strong variations in travel patterns of consumers from individual member states. In the next months, legislators at the EU-level are charged with the difficult task to make trade-offs between the policy objectives of promoting greater use of roaming services, protecting the business case of mobile operators and protecting European consumers.[31]

4.9 Impacts of RLAH (Roam Like At Home)

Europe is suffering the worst identity crisis since the union was created, because politicians and bureaucrats are desperate to demonstrate doing something good for the European citizen. They thought cheap roaming was a sure thing to win satisfaction, but no it will not bring a positive impact for the customers.

As what John Strand from the Strand consultant company in Denmark said "unfortunately, they policymakers who make these simple calculations do not see what will happen in relation to changing consumption behavior, the development of national prices, the availability of services, the supply of mobile plans, pricing in the national wholesale market, the changed the distribution terms, and how to "roam like home" will affect many MVNOs in Europe"[32].

RLAH have many impacts on the economic and market of the telecom industries, since this process will reduce the prices and results in cutting telecom industries revenue so in this case they will not have business cases to build new networks or infrastructure, so the innovation process will be dropped down.
Some of the impacts will be introduced down:

In the Scandinavia countries like Denmark with a low ingoing traffic, that they are offering low prices will be forced to raise prices to eliminate the gap between national prices and the different roaming fees outside Denmark. While countries with high prices such as Germany will have to reduce their prices to counter the arbitrage that this model creates specially for the small operators and MVNOs they will look at the arbitrage opportunities by moving traffic from a wholesale model agreement to a roaming model. For example: some network operators with MVNOs clients and with corporate clients across a number of countries with they serve by using a combination of their own networks and MVNO agreements, in this case they can save technical costs, time and paperwork associated with being in dialogue with regulatory authorities.

Number of subscriptions will be reduced with a narrower range, and for the mobile operators with mobile broadband products will be trying to compete in the market with fixed broadband providers may withdraw from the Internet service provider market which will result in a huge economic consequences if their customers take the product abroad and consume large amounts of data service.

4.10 Suggestions to reduce the economic and business impacts of cutting fees

In this part, the suggestions have been made by the "The Body of European Regulators for Electronic Communications" BEREC.

4.10.1 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 large scale, permanent roaming will also detriment the telecom sector in those countries with on average more expensive mobile prices. Fair use limit 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.

FUL can be implemented in different ways, the limit can be set to a specific amount of roaming 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 Fair use limit.

4.10.2 Raise domestic prices

When retail-roaming prices decrease on one side, the domestic prices will increase on the other side, this method called waterbed effect that has been mention above earlier. 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 the customers who do roam and that's unfair. This means that only the people who roam frequently will benefit from this situation.

The average amount of citizens in the EEA who travel at least once a year is 35% and the average days abroad within EEA is 5.7 days has been proven by a research of BEREC[31]. Looking at these numbers, we can say that a large group of customers will need to pay more so that a small group of customers who frequently roam will pay less (business people).

This is an undesired outcome, how much domestic prices should increase to cover the losses will strongly depend on the country in which the mobile operator is active. Additionally operators in competitive market might be

reluctant to increase their domestic prices, protecting their market share. Hence, the degree of possibility to raise domestic prices also depends on the competitive environment within a country.

4.10.3 Decrease wholesale roaming prices

In this part, the focus is on the cost side, the best solution for operators might be to reduce wholesale charges (specially for the countries were their outgoing traffic are much higher than the ingoing traffic). In the past, these wholesale prices were high, allowing the Foreign Service provider to take significant margins on his own cost. Though national competition has decreased domestic tariffs, the lack of competition on the international roaming market has left the wholesale roaming prices unchanged. As until recently, these high wholesale prices could be charged directly to the end customers as a part of their roaming fess, there was no pressing need for sharp reduction of these wholesale charges.

As part of their policy, the European commission has set wholesale caps for roaming. Finding a correct level of these caps is not easy. Setting the caps too low below the cost will put pressure on the foreign service provider providing roaming to customers of foreign providers (risking a raise in domestic prices of this foreign service provider).[31]

If they set caps too high, they will not be very effective, if its too high then there will be a pressure on the domestic service providers which they will have to pay the wholesale charges for the foreign providers and if the outgoing traffic are much more higher the ingoing traffic, then they will end in a situation loosing revenue (instead of earning money from the end users, they will pay extra or they will again increase the domestic prices to cover the cost). Hence, the best option is to set the wholesale caps just above the cost of the FSP, so there is small margin that can be used to improve the quality of the visited network and the cost for the domestic service provider are not too high.

4.11 Strategies for the future

4.11.1 Carrier portability and Apple SIM

This solution is an alternative solution for RLAH. If this solution was implemented then there will be no reason to implement RLAH, because customers will apply the other solution.

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 customer's perspective. 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.[33]
The following requirements for carrier portability are made[33]:

- 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 traffic in international roaming. The chosen FSP would provide the visiting customer with an identity in its network by means of a new SIM card.

- Temporary number portability is an essential precondition for competition in the international mobile communications market. It allows mobile service customers to receive incoming data roaming service 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 service. Currently, this is rather difficult since the DSP has fill control over the E.164 numbers (E.164 sets the general format for international telephone numbers and is a part of the international public telecommunication numbering plan) of its customers both for domestic and roaming services.

- The DSP should not be regulatory enforced to carry out the incasso function for international roaming services because the FSP also has the possibility to handle the billing for his roaming service. 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 handing the billing.

Additionally, Knieps and Zenhausern from the" Institute of Transport Science and Regional Policy"[33] suggest that the current price as well as decoupling

regulations should be abandoned and that the European regulators should instead implement the concept of carrier portability.

In addition, measures of consumer protection such as information policies to avoid bill shocks should be obligatory for all mobile operators. This approach tackles the discrimination between home and visiting customers. As soon as consumers are free to choose any contract for mobile communications originating or received in the visited country, they are no longer forced into contractual relations with the home carrier or alternative-roaming providers.

A variation on this carrier portability is the new SIM technology released by Apple which will allow customers to take out short-term data plans with different mobile phone providers when needed and it also allows traveler to use a local network for data connections without the need to obtain a new SIM card from a local provider.
This application of carrier portability is one step closer to an entirely software based SIM for any country, which would give customers huge freedom in choosing their mobile suppliers.

ChatSim Service (Its an alternative solution before RLAH)

Its a solution for users to buy Sims-cards and use it instead of roaming, because roaming prices are expensive and users were afraid to use it because of the “Bill Shock”, So ChatSim service allowing users to use few apps to connect and communicate while abroad for a standard price as its shown in the figure (36 € /year) and then a user can use this service unlimited during a year to communicate over (Facebook messenger, Whatsapp and some other applications. But the idea now how these businesses could survive after implementing RLAH, which will set the roaming fees on zero and not allow operators to charge their subscribers.

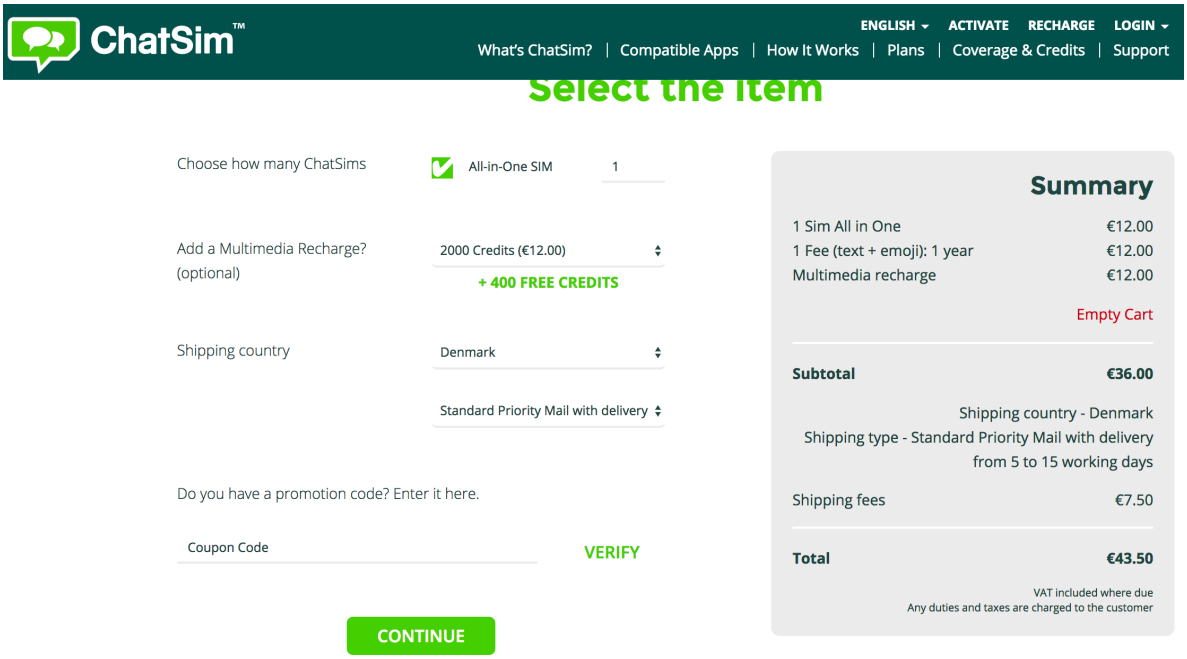


Figure 13 ChatSim Provider in Italy[34]

What will happen to services like this after implementing RLAH?

After implementing Roam Like At Home on June 2017, one option for the ChatSim business and other similar businesses in Europe could be possible to survive after implementing RLAH concept is that if the theory of Valletti happened on a telecom market " when the regulators decrease the prices on the wholesale level and not allow operators to charge their customers then on the other side the prices of domestic price will raise ", so when domestic prices raises and becomes expensive and then customers will search for another solutions and services that let them save the cost of roaming , so they move to subscribe with ChatSim service or similar services like that to save the cost of roaming and continue connected while abroad to communicate over the apps .

4.11.2 Cross-border and traffic competition (for big operators)

Cross-border operators have huge advantages over national operators when it comes to roaming cost and fees. In order to keep wholesale costs under control, it is essential 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 DSPs choosing. Before 2003,traffic steering was not possible: when abroad, the customer itself was given a list of FSPs to connect to, leading to an incontrollable wholesale market. The introduction of traffic steering made it possible to direct customer's traffic, which is especially advantageous for larger operators with high negotiating power.

Furthermore, cross-border country operators can internalize roaming costs by steering of the customer's traffic to one of its subsidiaries that is operating in the travel destination. This type of cross-border competition results in more affordable access and pan-European networks implying cost reductions for both network deployment and operating expenditures effectively benefiting from economics of scale, though this would not necessarily imply that a uniform tariff for all EU users should emerge in such a market, or that Commission should impose such a price.

There is a significant increase in the amount of operator's mergers in the mobile telecom market such as Germany (Telefónica & E-plus). 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 prices. (Philippe Aghion, Nick Bloom, Richard Blundell , Competition and Innovation 2014)

A possible policy is introducing supra-national allocation of radio spectrum, now the allocation in the EU is done by member state 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. This not only hinders the creation of operators with a large European footprint, but also has a negative effect on

network coverage and penetration. To reduce costs for operators and incentivize the deployment of networks with a larger European footprint, there should be a move towards EU-level assignments of spectrum.[36]

At the end, its important to be mentioned, stimulating this strategy gives large MNOs an advantage over smaller ones or MVNOs and may result in only large cross-country operators remaining, hence leading to less competition and higher prices for customers. This trade-off between large merging operators having more wholesale negotiating power and protecting smaller companies currently will remain a difficult balancing process.

4.11.3 IMSI (International Mobile Subscriber Identity) beyond national borders (for small operators)

IMSI have be done by the Belgian and Luxemburg telecom regulators and they made it possible to combine a Luxemburg IMSI to a Belgian mobile number and the other way around. This is an interesting strategy since IMSIs, are normally bound by national borders. The agreement makes it possible for operators offer their services to customers in both their own country of operation and the other country and 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 large operators prefer a reciprocal agreement with other large operators based on "exchanging traffic" and because they often renounce starting the costly ad time consuming negotiation process for low volumes of traffic.

Hence, the option of signing bilateral agreements based on pan-national IMSI may be the only option for 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.
Traditional operators however renounce this evolution, as they fear the increase in competition and the loss of roaming revenues.

4.11.4 Roam Like Local instead of RLAH

When users will no longer pay roaming fees, they might be tempted to buy a SIM-card from a cheaper foreign operator and thus constantly roam, also in their domestic country. As a countermeasure, the EC is looking into fair use limits to counter this so-called permanent roaming. Alternatively, instead of "roaming like at home", one could suggest " roam like a local" which has been introduced in 2011 by BEREC (BEREC Response to the European Commission Public Consultation, 2011)

The idea behind Roam Like a Local "RLAL" is simple enough process. Pricing structures can be implemented so that roaming users can be charged by their DSP, approximately the same prices as the current average prices of the country in which they are visiting.

This would clearly tackle the issue of permanent, as choosing a foreign operator will no longer result in cheaper prices compared to when choosing for a local operator. However, this approach lacks consumer transparency and simplicity as retail roaming charges are no longer uniform and may either be higher or lower than in the domestic country, which is exactly the strong suit of RLAH. Additionally, this approach requires EC to provide regular updates of the average prices for each country and requires mobile operators to adjust their pricing accordingly, which will no doubt lead to additional overhead and more difficult billing.

4.11.5 WIFI offloading

Wi-Fi has more than once been proposed as a viable solution for offloading mobile data as it offers cheap access to the Internet. In Europe a number of examples can be found of mobile operators offering so called dual wireless access network. 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 service.(Aijaz and Amani ,survey on mobile data offloading2013)

When abroad, users typically use Wi-Fi only when stationary such as coffee shop, restaurants, and hotels as these offers free Wi-Fi access, as a result, Wi-Fi seems an unlikely solution for offloading data when roaming.

However, mobile operators have started to team up, sharing their Wi-Fi networks with other operators, resulting in users also having access to Wi-Fi service when roaming. The best example for this in Europe s the FON-netowrk.FON joins a set of national and international Wi-Fi networks into one single network.
Operators choose to open up their Wi-Fi network via FON, in return this allows them and their users to access other FON networks.[39]
Using Wi-Fi offloading seems a good solution in theory, but may result in unbalanced relationships if the exchanged traffic in between different participating operators is not comparable.

Chapter 5

5 Analysis

In this chapter, all the theories, data collected that are related to international data roaming will be reflected in this chapter for analyzing and coming out with a conclusion.

International data roaming is one of the popular topics in Europe. Regulators have promised that on 15,June 2017 will implement RLAH, which means that operators will not be able anymore to charge their subscribers for their roaming usage abroad, but they still have to pay each other on the wholesale level, that make it very complicated for the regulators since many operators have mentioned that the regulations will cut their revenue and in many cases they will not be able to cover the cost of roaming, specially operators that are not cross-borders.

International data roaming have several impacts on the telecom operators in Europe as has been mentioned earlier in the thesis, few strategies and solutions have been highlighted and explained .In this chapter both sides will be explained from different point of views with respect to the European Commission, Telecom operators and the interviews.

International data roaming went through a long negotiation and still not completely done, because of the complexity of collecting related information from the Telecom operators about their real revenue and cost of data roaming. Many operators will not give their real data to the regulators, since they would generate as much as they can revenue and they would not like to have a cut in their revenue. Also, the new regulatory method RLAH will prevent telecom operators to charge customers, but in the same time they will have to pay for other foreign telecom operators for connecting their customers while abroad.

Another complexity of regulating data roaming, it's the different prices and costs of data roaming between the European countries as it shown in Figure 9, there are differences between the countries such as in Denmark the wholesale data roaming price is 0.032€/MB while in Switzerland is 0.083€/MB, and the differences between prices on the wholesale level make it difficult for the regulators to find a way to regulate these prices and reach Single Digital European Market, since many telecom operators specially in the Scandinavia countries(Denmark, Sweden) explained that ,if the regulators will regulate International data roaming with implementing RLAH, then they will not be able

to charge their customers anymore and their ingoing and outgoing traffic are not balanced ,it will resulted that these telecom operators will have a very weak position on the market and specially those MVNOs(those that have no infrastructure) , because it will come to a point that they will not be able to cover the cost of data roaming services .

Another challenge is the tourism ratio differences between the European countries, that means that in many countries their have a huge gap between the ingoing and outgoing traffic. As have been shown in Figure 8, there is a huge difference in the travellers ration between the north and south countries (like Denmark have much lower ratio than the Spain) which means that Spain will benefit from the ingoing traffic to their country and will charge Danish telecom operators to connect their customers while abroad in Spain. That's will put the Danish telecom operators in a risk if their users stay for a long time in Spain and consume high data roaming services to not be able to cover the cost of the wholesale charges and in this situation Danish operators will have just an option is to raise their domestic prices to cover the cost and this called "waterbed effect" that have been introduced by Valletti.

5.1 European market

Customers behavior in Europe have changed in last few years .The consumption of data have increased widely which means the revenue for telecom operators on the data have increased while the consumption for voice and SMSs have decreased as have been shown in figure 3.
The cost of providing data roaming services varies significally across Europe, difference sin the spectrum cost, labour and property cost, and specially the ingoing and outgoing traffic is unbalanced in many countries. These differences in cost have been shown in figure 12 (in Denmark it is 0.29 €cent /MB while in Romania 0.59 € cent/MB). Also in some countries (touristic) roaming services might be the main driver of demand for network capacity.

In Europe, European Commission aiming to achieve a single digital European market, but its hard to be achieved, because there are many differences in the costs of offering roaming, different taxes and different labour, spectrum cost and so on.
Roaming market were classified on a very low competition level due to inelastic demand for the services and very few operators were in the market because of the high costly prices to enter the market before implementing regulations on 2007.
After implementing a regulations on 2007, price cap were implemented which leads to reduce the prices and limit it, so operators cant charge customers over the level of price cap.

An impact of the price caps could be shown in figure 3 (European mobile revenue) which shows how the revenue declined from 174 billion € the raise of regulations in 2007 and how it will continue decreasing to reach 140 billion € in 2016, because these regulations forced telecom operators to decrease the prices.

In the another hand, Regulators aims of implementing such regulations is to protect the market and keep it competitive, since they have 579 MVNOs (figure 4) in the European market, and without these regulations, MVNOS will be set in a risk situation that will not be able to compete in the market because the prices of roaming are very high and they will not be able to cover the costs. But regulators have to take in focus that MVNOs will have the biggest impacts of implementing RLAH regulation because they will not benefit from ingoing traffic, since they do not own an infrastructure to connect ingoing traffics, but in the one hand, they have to pay wholesale charges for other foreign operators because they will connect their subscribers. That is why MVNOs are negotiating with European Commission to decrease wholesale price to the lowest level to be able to cover the costs and stay in the market.

The role of MVNOs is very important in the European telecom market, because they are the way to increase competition in the market and led big operators to decrease the prices. So European regulators have encouraged MVNOs and implemented some regulations to increase the number of MVNOs, and we can see that in figure 6, which the numbers of MVNOs have increased rapidly between 2007 and 2001.

European Commission have used MVNOs directly as a regulatory instrument, European Commission have applied conditions related to MVNO access before approving mergers between MNOs to preserve competition in the European telecom market. For example, before mergers 3 telecom operator with Telefónica in Ireland, 3 was required to commit to seeing up to 30% of the merged company's network capacity to two MVNOs. The conventional wisdom among many regulators, politicians, and policymakers is that the more operators or MVNOs in a given market, the better the competition will work.

5.2 Spanish Market

Roaming share in the Spanish telecom market were between 9% and 6% from 2007 to 2011 of the total market share, its hard to get data from their revenue stream, because most of these telecom operators are listed in the stock market and as such they might interested in showing that such substantial part of their revenue under threat. To force Regulators not to implement any regulations that can harm or cut their revenue stream.

An example can be presented is Telefónica stock, which has been its highest revenue on 2007, this telecom operator defined as cross-border operator because have infrastructure in different European countries.

Figure 14 Telefónica Stock Value[40]

The usage of roaming has increased after the implementation of regulation on 2007, but it wasn't enough to compensate for the reductions in prices. EC have showed on their survey study that 72% of Europeans still limited their usage of devices while abroad. This might reduce the number of European users that limited their usage and achieve even bigger growth in usage.

Spanish roaming market share and consumption: data were collected from previous figures in the report (figures number: 7 and 8)

Year	Wholesale Revenue (Millions)	Total Revenue (Millions)	% Of Wholesale Revenue	Prices for MB (€)	Consumption of MB (Million)
2008	380	1200	31.6%	4.91	14
2009	220	900	24.4%	3.23	27
2010	200	800	25%	2.38	33
2011	190	730	27.3%	1.30	50
2012	180	590	30.5%	0.89	70
2013	160	500	32%	0.48	106

Table 1– Roaming market share in Spain and consumption from 2008-2013

Based on the calculations in the above table, we can conclude that the revenue dropped rapidly from 2008 until 2010, but after 2010 it shows the reductions on revenue was slightly slow but on the same time the consumption of data increased very high until it reached 106 MB (million). That means the regulation of price caps of reducing prices was higher than usage of data services that leads to loose in the wholesale revenue and total revenue and also a market competition could have an impact on operators to compete on the market by lowering their prices. But the table also shows that the percentage of wholesale revenue had a big chart from the total revenue.

What we can understand from the Spanish market that the reduction of price caps had an impact on the revenue for telecom operators as shown in the table above, so European Commission have to take in case that Spain has a high incoming traffic with high consumption but still the revenue decreasing year by year, so that's why they are negotiating with the European commission to increase the wholesale cap prices, so they can charge operators more higher to raise their revenue, while in some countries like Denmark they will have really a big impact on their markets since they are not specified as a real tourist country as Spain ,so they will not benefit if the wholesale price cap raised up ,but in contrary they will be forced to pay the other telecom operators wholesale charges and being able to charge their customers which will lead that they will cover their costs , and at the end, who is responsible to cover the gap of these costs. Of course it will be the end-users, so in the Danish market, operators will have just an option to raise the domestic prices to cover the cost and here we

come back to the theory that Valletti explained and tested on the telephone market, which called "Waterbed effect".

5.3 Impact for telecom operators

Geographical location

The different travelling ration of end users between the European countries, making operators to face either incoming or outgoing roaming traffic, and that's in such cases like Denmark they are facing a low ration of travellers which means very low ingoing traffic but in the same time very high outgoing traffic which as been shown in figure (8) and that means that operators in Denmark will have a very high wholesale charges to pay the foreign operators to connect their customers and the risk is if their marginal revenue will be decreased to be under the marginal cost so operators will have to find a way to cover their looses, in this case they will not be able to cover the costs and then they will be forced to raise their domestic prices and these phenomena called "waterbed effect" or implement FUP to limit their subscribers for roaming usage while abroad . Additionally to that as what " **Jakob Willer** " mentioned in the interview, the strategy of operators could be changed and they will offer new subscription packages such as an expensive package if users would chose to roam while abroad and other packages just to use it in Denmark.

In the other hand, the commission does not believe that there is a risk of a rise in mobile domestic prices as a result of the progressive elimination of roaming. The elimination of roaming surcharge is a long-standing goal for which the agreement was reached by the European Parliament and the Council on the Commissions proposal. Additionally to that, in order to mitigate waterbed effect, they have proposed FUP, so in this way operators can limit the data usage abroad to not risk their businesses to loose and they have mentioned that if an operator could come with evidence reports that they cannot cover the costs of roaming, then they will have a permission to add surcharges to their subscribers in order to cover the costs ad safe their business.

2nd impact on the telecom operators is geographical Coverage

Its about those strong power telecom operators which they have branches in different countries those coverage region extends beyond national borders. Those operators who are par of a cross-country group will be able to get cheap wholesale roaming prices by using their own network infrastructure, they can balance their costs by the outgoing and ingoing traffic, also their customers will not drop off to another networks while they abroad, they will still be connected with the same operator and in this way operators will save the cost of wholesale charges to pay to another telecom operators.

National operators, small operators that don't have their own infrastructure, and operators in Nordic countries (Denmark, Norway, Sweden) want lower wholesale data caps because their outgoing traffic is very much higher than the ingoing traffic, additionally some large operators, want to ascertain that the caps are high enough to recuperate all wholesale costs.
The association of MNVOs Europe worried about a lack situation of coherence between the regulatory obligations at retail level (a FUP without duration period or volume constraint) and the underlying economics for operators at the wholesale level (the Commission proposed wholesale roaming data caps). It wants to bulwark alternative operators offering the most competitive deals from 'margin squeeze' situations and asks for the wholesale market data caps to be further reduced.[24]

While other operators, including large operators which called cross-border operators that have coverage in more than one European country, want to ascertain that the caps are high enough to recuperate all costs and withal sanction for investment in their networks. Countries with a plethora of incoming traffic from tourists argue that they require investing in capacity to sanction for the supplemental roaming traffic on their networks.

Additionally, the European Telecommunications Network Operators' Association (ETNO) and GSMA, have published a joint statement, setting out their concerns" that fair use limits in terms of volume are required to fight against abuses or anomalous use. Simple volume-based fair use limits would help address problems of abuse and anomalous behavior, while also improving sustainability for some operators and clarity for customers".[41]

Impacts for MVNOs

MVNOs incur in costs when their subscribers are abroad in European countries, because they don't have their own infrastructure so they will not have any business model about the ingoing traffic, so they just have one way traffic that is the outgoing traffic and in this way they will end in a risky situation that they will not be able to cover their costs and they don't have the power to negotiate with the regulators.

Furthermore, as presented in figure (4), the number of MVNOs has decreased in Europe to 579 MVNOs since the start of regulation in 2007, because they cant compete with the big telecom operators and they are worried what will happen to their business if the European Commission apply RLAH regulation, because in this scenario they will be unable to charge their subscribers for the roaming services abroad, but they still have to pay other operators in the wholesale level. So they are arguing with the regulators to lower the wholesale caps as much as they can and apply Fair Use Policy FUP to protect their business from any permanent travellers abroad usage. So Regulators have to take in case while studying the market of telecom operators that there is a big impact on the MVNOs market and have to protect them in a way to still be able to compete in a market and not run out of the market.

Impacts of RLAH (Roam Like At Home)

The concept behind RLAH it's to reduce the prices for the end-users by not allowing operators to charge them for the data roaming while abroad, but this concept will have few impacts or consequences on the telecom side which will cut a part of their revenue and many telecom operators mentioned that they will not be able to innovate or develop their infrastructure anymore.

Telecom operators from different European countries have different point of view, countries such as Spain and Greece would like to increase the wholesale cap so they will be able to develop their infrastructure and be able cover the high ingoing data traffic while other operators such as in Denmark would like to lower the wholesale cap as much they can because their outgoing traffic is very high and they are offering a cheap domestic prices.

Additionally to that, **Jakob Willer** "a director at the Telecom association industry in Copenhagen, Denmark" suggested that regulators could implement FUP with a volume concept not a period limits, as shown in the figure down:

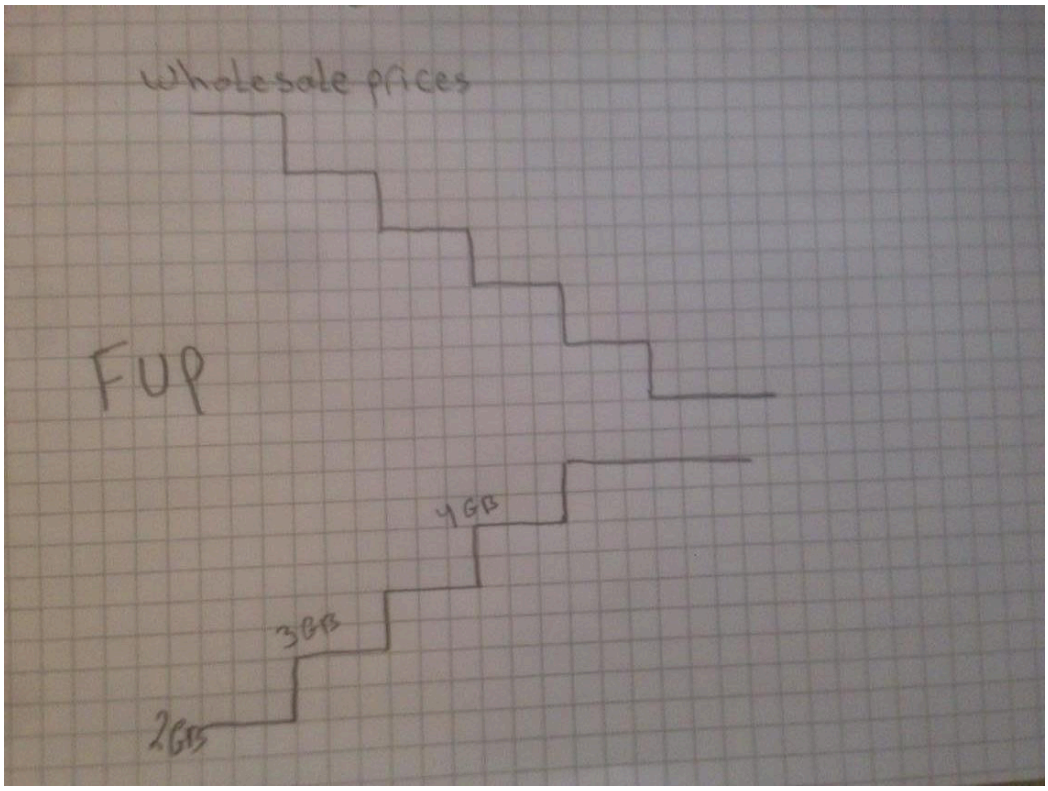


Figure 15 A suggestion solution by Jakob Willer (interview)

In this figure, he presented that regulators can create a process on a time table, for example in the first year wholesale prices are 0.085 €/GB and the data allowance abroad are 2GB per user and after a while (1 or 2 years) they can lower the prices for wholesale to be approximately 0.076 and to increase the data allowance 1GB more to be 3GB at all and so on keeping doing that process to end with a suitable wholesale prices and data volume.

The EC has had a dream of creating a Digital Single Market but the authenticity is that there are 27 different countries in Europe each with their own currency and government. Importantly, costs to deliver mobile traffic differ significantly across the states. Building a network in Luxembourg is considerably less expensive than Sweden, a country 36 times as large. Not only does each state has a unique set of incumbents and challengers, but also there are different mobile regulations, spectrum rules, VAT and contract requirements. It's understandable that the EU wants mobile prices to be the same across 27 countries, but then it should allow prices to evolve with the market forces of consolidation and efficiency.[32]

Some of the most important impacts of RLAH are these will affect the national prices in some countries like Denmark (as shown in figure 8, the percentage of incoming travelers are very low), because they have low prices they will be forced to raise the domestic prices to cover the gap between the national prices and costs of roaming fees from other operators (specially because their ingoing traffic is much lower than the outgoing traffic) so they will not really benefit from the wholesale charges enough to balance their prices, While another countries like Spain that have high domestic prices will have to reduce their prices to counter the arbitrage that this model creates , specially with MVNOs they will move their traffic from a wholesale model agreement to a roaming model.

5.4 Suggestions and strategies

Suggestion by BEREC:

Fair use limits

In the present time, FUP it's a perfect solution to protect telecom operators from any abuse usage from their subscribers and to reduce the business & economic impacts of cutting fess.
European Commission has released a first draft of FUP, which implies a limitation for travelers to be max. 90 days a year but customers were unhappy and they regretted this regulation, so EC cancelled this draft and released a new final draft on 15/DEC/2016.
The final draft includes 2 types of contracts: the pre-paid & competitive contract and both will be explained down with examples.

With the pre-paid contract, while customers are abroad they can benefit from RLAH up the amount of their credit remaining for that month they are, and for data they can use a volume equivalent to the value of their remaining monthly credit at the wholesale roaming data price cap. An example of that lets say Sarah has a 25 euro pay/month and she has 15 euro remaining on her account, then she can use the value of her remaining credit for the time she is abroad with a volume of data equivalent to the value of her credit, by calculating that with the wholesale roaming data price cap (wholesale data price cap is 0.85/MB) so she gets in roaming the volume of she paid for in terms of wholesale data cap.

With the competitive contracts that offer data at very low domestic prices below the wholesale cap, customers will be able to benefit a full allowance of calls and texts while for data, they will have twice the volume of data equivalent to the value of their monthly contracts in wholesale roaming data price caps.
An example of that: Sarah pays 70€ monthly contract, and the subscription package includes unlimited usage of data, calls and texts, then when she is abroad she will have unlimited calls & texts but for the data, she will get twice the equivalent of 70 € worth of data at the wholesale roaming data price cap, for example 0.85 cent/MB means more than 16GB.
The plan that European Commission aimed to protect consumers and the telecom European market:
Operators will be able to ask the consumers to prove that they live or have a stable link to a specific country before benefiting from RLAH in the contract and operators can only use the information they gather for billing purpose to check to what extent customers are suing data services abroad compared o their consumption at home. And if the usage extent more than 4 months, billing data suggests that a consumer has been abroad more than home, then they can send a

warning message. This message will warn the consumers that they have 2 weeks to inform their telecom operator about their roaming charge.

Raise domestic prices

This solution is unfavorable because the prices will rise for all subscribers also for those who never roam while abroad, because those customers will have to pay high domestic prices to cover the losses made by the customers who do roam and this situation is unfair.

By looking on the average amount of citizens in Europe who travel we can see that a small group of people just 35% who frequently roam, so a large group of people will be forced to pay high domestic prices to let the small group of people benefit from roaming.

Furthermore, its hard to predict how much should regulators increase prices to cover the losses because it will depends on the country in which the mobile operator is active, and many operators will afraid of raising the prices because they would prefer to still be competitive in the market and protect their market share.

Decrease wholesale roaming prices

Before implementing wholesale price caps, telecom operators were charging high prices and these extra charges were added to the end-users bill. But after implementing price caps, telecom operators have reduced the level of prices, but regulators still can not find the correct level of these caps and its not easy since we have mentioned that before, there are many differences in the costs of offering wholesale roaming in the European countries and the ratio of travellers is not the same between the European countries.

Regulators have discussed if they set wholesale caps too below the cost, then they will put pressure on the foreign service providers and they set it too high, then there will be a pressure on the domestic service providers, and in some cases they will not be able to cover the costs of roaming since after implementing RLAH, they will not be able anymore to add these extra charges to the end users. The best solution on that time, is to set the wholesale caps just able the cost of the FSP, so there is a small margin that can be sued to improve the quality of service of the visited country and the cost for the domestic service providers are not too high. But still this solution is not a favorable solution for the telecom operators because they will still have a cut in their revenue.

In this part, strategies that could be implemented for the cross-border operators and small operators in the future will be presented:
All the strategies have been made by BEREC

Carrier portability and Apple SIM
This solution is an alternative solution for RLAH. If this solution was implemented then there will be no reason to implement RLAH, because customers will apply the other solution.
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. And in order to do it, users must have the option to buy unlocked-SIM handset enabling the use of alternative SIM cards of different providers. This is a precondition for changing carriers for outgoing traffic in international roaming. The chosen Foreign Service provider would provide the visiting customer with an identity in its network by means of a new SIM card.

Apply company have released a new SIM card that would give customers a he freedom in choosing their mobile suppliers, which allows customers to take out short -turn data plans with different mobile providers when needed and it also allows traveler to use a local network for data connections without the need to obtain a new SIM card from a local provider.
In Italy, ChatSim Provider have released a service which will allow customers to subscribe around 36€ /yearly without any extra charges and benefit from roaming on a very cheap prices. But these roaming are limited on few applications such as (Facebook messenger, Whatsapp) and if European Commission implement RLAH concept, then there will be no more need for services like this, because already telecom operators will not be able to charge customers for roaming, but if the domestic prices increases in Europe, then customers will tend to use services like ChatSim to save some money.
If the domestic prices will be decreased as EC promised, then ChatSim service will run out of the market, because then there will be no more need for services like this, since the prices of roaming offered from the telecom operators will be the same or lower as EC promised.

Also as discussed earlier in section 4.2.3 (Google concept)
Google aims to create a global network that will cost the same to use for calls, texts and data no matter where a customer is located
There plans to link with “3” telecom operator to get an access to the wholesale mobile service in different countries such as UK, Italy and another countries. This is an even more ambitious plan than that of the European Digital Single Market.

Their concept will be tested in America, and their aim is to put a pressure on the pricing of the biggest telecom operators in USA.

Steering (a solution for big operators)

A strategy that could be beneficial for cross-border operators is steering, which will allow large operators to direct their customer traffic to their operators in the visited country. In this way these operators will save a lot of roaming costs.

Furthermore, we can see there is an increase in operator's mergers in the mobile market such as in Germany (Telefónica and E-Plus). So both telecom operators will have a connection to steer their subscribers between each other's.

But this strategy will harm small operators and MVNOs, and may result those just large operators to remain in the market. That mean, monopoly market will appear again in the market, and just powerful operators will stay in the market and control prices and off course increase the prices to generate extra revenue.

IMSI (a solution for small operators to remain in the European telecom market)

International mobile subscriber identity, make it possible for operators offer their services to customers in both their own country of operation and the other country by using either a location-based or a uniform pricing. This issue has been implemented between Belgian and Luxembourg telecom regulators.

This strategy may be the only option for small operators to remain in the market and compete another operators, so may European commission stimulate this by applying a unified mobile country code for the whole Europe.

Roam Like Local

In 2011, BEREC have suggested a concept called Roam Like a Local RLAL, which means pricing structures can be implemented so users can be charged by their domestic service providers the same prices as the current average prices of the country that they are visiting. BEREC have mentioned this concept because they were worried after applying RLAH, customers will buy SIM cards from a cheaper foreign countries "permanent roaming" .So the process of RLAL will tackle the issue of permanent roaming, because foreign operators will be no longer cheaper compared to the local operator.

But this approach will be difficult to be implemented since it has few challenges.

European Commission have to provide regular updates of the average prices for each country and requires mobile operators to adjust their pricing accordingly, which will be so complex to be done.

Wi-Fi offloading

Wi-Fi has been proposed as a solution, and there is a number of examples can be found of mobile operators offering dual wireless access network.
An example of that FON network. FON network joins set of national and international Wi-Fi network into one single network, but this solution may results in unbalanced relationships if the exchange traffic in between different participating operators is not comparable (some operators will have a pressure on their Wi-Fi points, but others maybe will have a slightly low traffic).

Answering the main questions:

How telecom operators can get a fund to cover the cost of international data roaming wholesale charges in interaction with RLAH?

Telecom operators have few options to get a fund to cover the cost of international data roaming wholesale charges by applying Fair Use Policy "FUP". This solution is beneficial for all operators (big MNOs, small MNOS, and MVNOs), which means they can stop the abuse usage of roaming by their customers by siting a cap for the volume of data allowance abroad or as mentioned earlier of the last version of FUP, 2 options were announced:

- With the pre-paid contract, while customers are abroad they can benefit from RLAH up the amount of their credit remaining for that month they are, and for data they can use a volume equivalent to the value of their remaining monthly credit at the wholesale roaming data price cap.

- The competitive contracts that offer data at very low domestic prices below the wholesale cap, customers will be able to benefit a full allowance of calls and texts while for data, they will have twice the volume of data equivalent to the value of their monthly contracts in wholesale roaming data price caps.

Few strategies were mentioned earlier, but each has advantages and disadvantages (an advantage of a larger operator can easily prove to be a disadvantages for a smaller operator or MVNOs).
For large operators (cross-borders) could use Steering solution to cover their costs.

For Small operators could use International mobile subscriber identity IMSI to cover their costs and remain in the market.
But at the end, its hard for the European Commission to predict the impacts of RLAH on the early stage, is hard to predict as the outcome will differ per operator and depends on a lot of factors (geographic location, the number of countries in which the operator is active "cross-border operator", and if the operator is a MNO or MVNO)

Could wholesale price regulation be a part of the solution of the problem mentioned above in the first question?

Wholesale price regulation could be a solution but in 2 different situations.
First, If European commission raise the wholesale cap, telecom operators (especially in the tourist countries like Spain, Portugal, Italy) will benefit from rising the prices and they could cover the costs and generate more revenue, hence their ingoing traffic will be much more higher than the outgoing traffic). While in the other hand, raising the wholesale caps will affect negatively on the telecom operators in countries such as Denmark, Norway (which are not classified as tourist countries) and their outgoing traffic is much more higher their ingoing traffic. It will put these telecom operators in a risk not being able to cover the costs of roaming, if there is no Fair Use Policy applied.
Also MVNOs will have no power to compete in the market and they will run out of the European market, hence they can not generate any revenue from the ingoing traffic, because they don not own the infrastructure. While they still have to pay wholesale charges to the foreign operators for the outgoing traffic of their subscribers.

The Second suggestion, if European Commission decrease wholesale price cap too much, then telecom operators in the tourist countries will negotiate that their revenue have decreased and they could not be able to connect all the subscribers and in the same time they will not have a capital for new investments and innovations. While this suggestion will help operators in the non tourist countries and MVNOs to cover the costs of wholesale charges and still be able to compete in the European market.

So what we can understand from these 2 suggestions, that wholesale cap regulation could be a solution but European regulators have to find a way to balance the level of caps. Wholesale price cap regulation is like double-edged sword.

6 Discussion and Conclusion

This Thesis aimed at giving an overview of the data roaming regulation process in Europe, looking both at the past and the future. Roaming in Europe has gone through multiple processes of regulation since 2007, first imposing wholesale and retail prices for calls, then for SMS and finally for data. The next step is lowering roaming prices to the level of domestic retail prices, which in other words will permit users to roam like at home "RLAH".

However, there are several aspects that the European Commission still has to clarify, especially for the telecom operators, as there are doubts about how they are going to sustain this transaction: while the fee end users pay for roaming will be reduced to zero, the fee domestic mobile operator pays the foreign operator will not be reduced to zero. To prevent abuse and "permanent roaming ", the EC might have to introduce Fair Use Limits policy "FUP". While the goal of RLAH is for end users to roam like at home anywhere in Europe, the goal is not to choose for the cheapest foreign mobile operator and thus constantly roam at home.

As operators will see a decline in revenue, they will need to look for new possibilities or strategies to cover their costs. The impact for the customers of these approaches will strongly depend on how the providers cope with these regulations: increased the national prices "Waterbed effect" may prove to be the unwanted outcomes as this will have negative impact on the operators customers base. Other approaches may include the further decrease of wholesale roaming prices or the implementation of the FUP.

The roaming regulations imposed by the EU will push operators to explore new opportunities in the Single European Market. Some may help customers to quickly switch between operators and pick a plan suited for their needs, whereas other strategies may help maximize profits or optimize costs for the operators.

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 of a larger operator can easily prove to be a disadvantages for a smaller operator. There is no universal strategy applicable for every MNO because of their inherent diversity and correlate the various heterogeneous markets in which they are active.

As long as significant structural differences between EU countries to exist, it will be hard to come up with a single ideal solution for uniform tariffs in the entire EU.

7 References

1. Euro Statistic. http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Share_of_nights_spent_by_residents_and_non-residents_in_tourist_accommodation_establishments,_by_NUTS_2_regions,_2014_(%C2%B9)_(%25_of_total_nights_spent)_RYB2016.png. Published 2014.
2. Commission, European Brussels 30 June 2015. European Commission - Fact Sheet Roaming charges and open Internet: questions and answers.
3. Commission E. *Roaming : 300 Million Extra Customers for Telecoms Companies When Roaming Charges End , Survey Shows Texting Better than Calling Recent Price Cuts*.; 2014.
4. Collins K. *Exploring Business, v. 1.0*. http://catalog.flatworldknowledge.com/bookhub/7?e=collins-ch01_s05#collins-chab.
5. Armstrong M. *Regulation ,Liberalization and Competition*.; 2006.
6. Valletti T. waterbed effect. http://voxeu.org/article/mobile-regulation-and-waterbed-effect.
7. Batelco co. *The Waterbed Effect Explained in Relation to Roaming*.; 2009.
8. Valletti T. *Beware the Waterbed Effect*.
9. GSM. Mobile SMS and Data Roaming Explained. *Most*. 2008:1-8.
10. Marcus JS, Philbeck I. *Study on the Options for Addressing Competition Problems in the EU Roaming Market*.; 2010.
11. AT.Kearney. *A Future Policy Framework for Growth*.
12. Falch M, Tadayoni R. *Regulation of International Roaming Data Services within the EU*. Vol 11.; 2014. doi:10.1007/s10368-013-0246-7.
13. GSMA. The global MVNOs landscape. https://www.gsmaintelligence.com/research/2014/06/the-global-mvno-landscape-201214/433/.
14. Market segmentation. https://www.gsmaintelligence.com/research/2015/02/the-global-mvno-footprint-a-changing-environment/490/.
15. Globale netowrk by Google. http://www.telegraph.co.uk/finance/11516189/Google-in-talks-with-mobile-operators-for-cheap-overseas-calls.html.
16. Mills G. Roaming fees. 2013. http://www.thelocal.es/20130531/we-need-to-scrap-mobile-roaming-fees.
17. CMT. *CMT*.; 2015.
18. Moniter DF. Wholesale prices. http://www.dfmonitor.eu/insights/2016_june_premium_eu_data_roaming_wholesale_cap/. Published 2016.
19. BEREC. *International Roaming BEREC Benchmark Data Report October 2014 – March 2015*.; 2015.
20. BEREC. *Wholesale Roaming Market*.; 2016.
21. BEREC. *International Roaming BEREC Benchmark Data Report April 2013 – September 2013*.; 2014.
22. Comission E. roaming tariffs. https://ec.europa.eu/digital-single-market/en/roaming-tariffs.
23. European Comission. Roaming. https://ec.europa.eu/digital-single-

market/en/roaming.
24. EC. *Briefing EU Legislation in Progress December 2016*.; 2016.
25. GSMA fair use policy. *Fair Use Policy*.; 2016.
26. European Comission. *Additional Analysis FUP*.; 2016.
27. *Roaming Implementing Act*.; 2016.
28. EC. *Implementation of the Regulatory Framework*.
29. Oettinger H. Parliament Questions. http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2015-010567&language=EN. Published 2015.
30. Europe M. MVNO EUROPE IS COMMITTED TO THE EFFECTIVE END OF ROAMING CHARGES. 2015. http://mvnoeurope.eu/mvnos-committed-to-effective-end-roaming-charges/.
31. BEREC. *Analysis of the Impacts of "Roam Like at Home" (RLAH)*.; 2014.
32. Strand J. John Strand Consultant. http://www.strandconsult.dk/sw7241.asp.
33. Zenhäusern GK and P. *Regulatory Fallacies in Global Telecommunications: The Case of International Mobile Roaming*.; 2013.
34. ChatSim.
35. Philippe Aghion, Nick Bloom, Richard Blundell RG and PH. COMPETITION AND INNOVATION: AN INVERTED-U RELATIONSHIP. In: Oxford university; 2014.
36. MARIO MARINIELLO AND FRANCESCOSALEMI. *ADDRESSING FRAGMENTATION IN EU MOBILE TELECOMS MARKETS*.; 2015.
37. BEREC. *BEREC Response to the European Commission*.; 2011.
38. Aijaz A, Amani M. *A Survey on Mobile Data Offloading*.; 2013.
39. FON. https://fon.com/.
40. Telefoncia stock analysis. http://www.nasdaq.com/symbol/tef/interactive-chart.
41. GSMA E&. ETNO and GSMA: Towards an Effective Fair-Use Policy for Roam-Like-At-Home. http://www.gsma.com/gsmaeurope/positions-and-publications/etno-gsma-towards-effective-fair-use-policy-roam-like-home/.

8 Appendix

Interview with Jakob Willer

Jakob Willer is a director at the Telecom association industry in Copenhagen, Denmark.

During the meeting we went through many points, mainly about the economic and business side of the data roaming. We have discussed the main problem of having RLAH method or in other word; roaming charges for customers will be zero, so telecom operators will not be able anymore to charge customers for their international roaming in Europe.

The problem is that political has promised that roaming will be free but nothing is free, historically they have regulated roaming in 2007 and implemented some method down level by reducing retail prices and wholesale prices, there was some kind of since. But now they want the roaming to be zero and we still have wholesale prices and they want to implement it on 2017 and we are already at the end of 2016 and until now they don't know how to regulate the wholesale charges.

European commission suggested for roaming charges it will be around 65 Danish kroner / GB data which means that a typical Danish subscription has around 20 GB and the average revenue for the Danish company is 120 DKK/monthly, and if you calculate it and deduct the cost from the revenue it will be shown that its really bad for the telecom operators which they will not be able to cover the cost of roaming.

Two things could help:
Fair use policy & reduce wholesale prices. But for the fair use policy option, the commission suggested is 90 days for the fair use policy but doesn't make a sense for the customers. But the only thing that can help is to use volume cap usage on monthly basis.

Interview with Rikke Johan

Rikke Johan Political Advisor - MEP Jens Rohde

The discussion was about the wholesale caps and fair use from different points of view from the European Parliament, Commission, BEUC and Industries.
"*The regulation did not, however, address the wholesale roaming market, on account of the need to investigate market conditions in more depth. A review for the European Commission concluded that national wholesale roaming markets are not working well and need regulatory intervention. It therefore proposed a regulation establishing the maximum level of wholesale roaming charges that telecoms operators can charge each other, to take effect from 15 June 2017. Stakeholder reactions are divided: while consumers would enjoy free roaming, operators are worried about recovering costs at wholesale level*".

On 29 November, Parliament's Industry Committee voted for a reduction in the call and data wholesale caps proposed by the Commission.

The interview was short, so Rikke Johan have sent few articles that were written by Jens Rohde to use it in the thesis.