

Deniau, Philippe; Jauniaux, Laure; Lebourges, Marc

## Conference Paper

# EU retail roaming regulation triggers competition mechanisms of wholesale roaming markets that make wholesale prices competitive

27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016

### Provided in Cooperation with:

International Telecommunications Society (ITS)

*Suggested Citation:* Deniau, Philippe; Jauniaux, Laure; Lebourges, Marc (2016) : EU retail roaming regulation triggers competition mechanisms of wholesale roaming markets that make wholesale prices competitive, 27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/148664>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# EU retail roaming regulation triggers competition mechanisms of wholesale roaming markets that make wholesale prices competitive

Philippe Deniau, Laure Jauniaux and Marc Lebourges<sup>1</sup>

## Abstract

*The European Commission (EC) draft Regulation (2016)<sup>2</sup> on wholesale roaming market proposes a massive decrease of the regulated roaming wholesale price caps for data with a drop from €5ct/MB to €0.85 ct/MB to enable the abolition of retail roaming surcharges in Europe by 15 June 2017. However, according to both the “TSM” Regulation text (2015/2120 25<sup>th</sup> November 2015) itself which imposes the implementation of Roaming Like At Home (RLAH) in Europe and to the decision of the European Court of Justice upholding the first European roaming regulation (ECJ C-58/08 8 June 2010), a wholesale roaming regulation can be justified in parallel of retail regulation only in case of market failure in the wholesale market and in order to prevent the existence of competitive distortions between mobile operators on the internal market. Therefore, wholesale roaming markets regulation should only address identified competitiveness issues. This paper deals with the question of the competitiveness of the wholesale roaming market regarding two angles: the existence of competitive mechanisms and incentives in wholesale roaming markets and the average level of wholesale roaming market prices in comparison with the corresponding level of full production costs. It shows that wholesale roaming markets exhibit competition mechanisms and incentives triggered by roaming volume growth resulting from the perspective of RLAH retail regulation. It also shows that in 2015, the average level of wholesale roaming market prices in Europe is equivalent to the average level of wholesale roaming production costs. Therefore the wholesale roaming market is competitive. Strong regulatory intervention such as large decrease of wholesale roaming caps is neither justified nor proportionate, generates serious risk of distortion of visited markets and jeopardises investments in mobile networks.*

## I. Introduction

On 15 June 2016, the EC issued a legislative proposal to review current wholesale roaming caps for voice, SMS and data services. The proposal included a technical report analyzing the functioning of the wholesale market and estimated wholesale roaming costs to assess if the current market conditions enable the implementation of Roaming Like at Home (RLAH)<sup>3</sup>. It concludes that that a drastic decrease of data wholesale caps is needed.

As demonstrated in Jauniaux et al. (2015)<sup>4</sup>, a new wholesale roaming markets regulation consisting in revising the current wholesale caps is not a prerequisite to enable RLAH within EEA countries. RLAH is sustainable with current roaming wholesale markets conditions in the vast majority of EEA Member States. In addition, according to both the TSM text itself and the decision of the European Court of Justice upholding the first European roaming regulation (ECJ C-58/08 8 June 2010), the justification of regulating wholesale roaming market in parallel with retail roaming regulation is to prevent competitive distortions between mobile operators in the internal market. Hence, wholesale roaming markets regulation should only address identified competitiveness issues if any. Therefore, the only

---

<sup>1</sup> Orange Regulatory Affairs. Preliminary version presenting the authors' views, which does not engage Orange.

<sup>2</sup> [http://ec.europa.eu/newsroom/dae/document.cfm?doc\\_id=16211](http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=16211)

<sup>3</sup> The cost model used for the preparation of the legislative proposal was elaborated by TERA. The model produces implausible results, for instance when comparing with the detailed and robust cost models prepared by the French, the Spanish or the German regulators. The cost model's estimates of the unit data traffic cost also appear to be several times below the actual costs in all countries for which it has been possible to do the comparison. It reflects inappropriate cost standard and is based on discretionary and unreliable methodological choices.

<sup>4</sup> Jauniaux et al. "Roam Like At Home: Balancing Political Objective with Heterogeneity of Mobile Costs and Usages in Europe".

question is whether the wholesale international roaming market is currently competitive in order to know if and how wholesale roaming market should be regulated.

This paper analyses this issue from two angles:

- Assessing the degree of competitiveness of international wholesale roaming market mechanisms and incentives
- Comparing the current level of wholesale roaming inbound prices to wholesale roaming inbound full costs in order to evaluate if roaming prices are competitive.

The outcome of this analysis is that prices exhibit competitive response to volume growth, competitive prices with normal relations between prices and costs and therefore that there is no ground for wholesale regulation to impose a global reduction of wholesale price levels. If any, the role of regulation in the wholesale market is to provide regulated prices above market prices as a safety net for all categories of providers and buyers. The current proposal for new wholesale roaming data caps, in a competitive market, does not guarantee that visited networks can recover their costs, generates significant risks of distorting visited markets and is a negative signal for mobile infrastructure investment.

The paper is organized as follows. The second section presents how the wholesale international roaming market works and drives the fast downward trend of wholesale roaming market prices. The third section proves that in 2015 the average EU level of wholesale inbound roaming prices does not exceeds the average EU level of wholesale roaming costs. The fourth section concludes that wholesale roaming market is competitive in the EU and does not require intrusive regulation.

## II. International wholesale roaming market mechanisms are competitive

The analysis of wholesale roaming market's mechanisms shows that competition takes place. In subsection 2.1., it is explained why competition in wholesale roaming is triggered by RLAH retail regulation. It is shown that mobile network operators and full MVNOs can choose between different types of access and several competing wholesale roaming offers, whereas securing the ability of light MVNOs to provide RLAH is an issue for national rather than for European regulation. Subsection 2.2. proves that the evolution of wholesale roaming prices over time and across geographies can only be explained by effective competition in roaming wholesale markets and not by the regulation.

### 2.1. The analysis of the functioning of the international wholesale roaming market reflects that there is no competition issue

This section assesses the degree of competitiveness of wholesale market mechanisms regarding the situation of each kind of actors.

#### 2.1.1. RLAH retail regulation triggers wholesale roaming competition

Retail roaming regulation triggers wholesale roaming market competitive mechanisms for two main reasons: (a) as volume growth cannot be translated into additional retail revenues, buyers in the wholesale market need to fiercely negotiate in order to get the best deals (b) wholesalers are no longer deterred of providing competitive wholesale prices by concerns of maintaining retail revenues as those are already determined by regulation. Furthermore, 'smaller' operators tend to be the most aggressive on the roaming wholesale market in order to compensate for the lower domestic

utilization of their network infrastructure, the cost of which is comparable to the costs of larger operators.

#### 2.1.2. The situation of light MVNOs

Light MVNOs must pass all their traffic through their host MNOs because they do not have their own SIM cards and core network equipments. A light MVNO cannot get “Roaming OUT” services directly through visited public mobile network operators.

However, this situation is independent from the characteristics of the international wholesale roaming market but depends on the conditions negotiated between the host MNO and the light MVNOs in the domestic market and notably of the integration of “Roaming out” in the access conditions proposed by the host MNO as roaming is no more an independent service but a component of the mobile offer. Full MVNO also often request their host MNOs to provide wholesale roaming resale access, although they can also use alternative solutions as explained in the following paragraphs. Therefore, addressing the situation of MVNOs should be a national issue and out of the scope of the European wholesale roaming regulation. If necessary, specific provisions ensuring the competency of National Regulatory Authorities to address issues related to the offering of RLAH by MVNOs may be included in the wholesale roaming Regulation.

#### 2.1.3. Even the smaller full MVNOs and MNOS can offer retail international roaming services via existing Roaming hubs and dual IMSI solution

Small and recently established mobile operators in particular with relatively low numbers of employees dedicated to negotiating roaming and clearing agreements can choose to pass roaming traffic through third-party hubs in order to increase rapidly their coverage.

This type of access is of course more costly taken apart but results from a global business choice made by the operator, as the technical provision of roaming services is totally externalized. The contract negotiation generally remains in the hands of operators but it can also be handled by the hub.

This type of access is essentially used by full MVNOs and small MNOs. But largest and more mature mobile operators can also use this kind of solution for punctual needs. They tend to cherry-pick relationships.

An operator can also propose to its clients the establishment of an ongoing relationship between the end-user and an alternative roaming provider probably but not necessarily based in the end-user’s home country, via what is called the “dual IMSI” solution. It is essentially used by MVNOs and MNOs new in the market to get coverage. There are four or five competing “Dual IMSI” products offered currently in the market.

#### 2.1.4. Full MVNOs can negotiate their wholesale “Roaming out” prices with visited MNOs or group of MNOs

The Roaming III Regulation ensures that there is no entry barrier to wholesale roaming market. According to Article 3, *“mobile network operators shall meet all reasonable requests for wholesale roaming access”*. In addition, full MVNOs have a very good negotiation position as they are “net senders” and so only have “Roaming OUT” wholesale volumes to buy. Full MVNOs cannot offer RIN services in return as antennas are operated by their host MNO. Considering they can negotiate with at least three operators per Member State and that they do not ask for “Roaming IN” volumes in return, visited operators compete with each other to offer their best prices to get this “net” traffic and the corresponding revenue.

We see that in this case even operators with low traffic volumes are generally able to negotiate low wholesale charges. MNOs are looking for every potential revenue sources coming from the sale of

“Roaming in” volumes especially in the context of RLAH implementation. Indeed, RLAH retail regulation implies that the general level of retail price applying to roaming provision will not be affected by wholesale roaming prices. Hence, MNO are not deterred because of potential knock-on effects on the general level of retail roaming price, from lowering wholesale price to secure large wholesale roaming sales, as the general retail roaming level of price is ruled by RLAH obligation.

Full MVNOs could also form an alliance together for example to negotiate better prices. But to date, we are not aware of any alliance between full MVNOs or more generally between small actors, which would have naturally emerged if mutualizing volume demand was required to obtain low prices.

#### 2.1.5. MNOs adopt voluntarist retail strategy to grow in volumes and optimise conditions on the wholesale market

A MNO can negotiate directly with a visited mobile network operator or with a MNO operating as a group. Currently, some operators initially with low volumes of roaming traffic have already included RLAH services in their domestic offer. This shows that the present situation of the wholesale roaming market is not an obstacle to the implementation of RLAH. Some MNOs have even conducted an voluntarist retail policy which leads to a significant increase of volumes of “Roaming out”. With these high volumes, they can obtain very low wholesale prices equivalent to big actors or even lower and also more roaming traffic in return. Some historically small actors in wholesale roaming market recently became big ones thanks to this strategy. It illustrates that the market forces induce a decline in price independently of the tightening of the European regulation.

#### 2.1.6. Matching the various needs of wholesale roaming clients justifies the requirement of market flexibility

To match the various needs of wholesale customers, roaming wholesale market must be extremely flexible and creative concerning the type, location, duration and pricing formulae. This could not be satisfied if prices and offers were mainly driven by regulation. It is only if prices and offers are mainly driven by commercial negotiations that the wide variety of needs of wholesale customers may be met.

### 2.2 The wholesale roaming prices show a steady downward trend independently of caps' evolution

The competitiveness of the market is reflected in the wholesale prices evolution. This section compares the evolutions of wholesale roaming prices and caps.

Wholesale prices decreases observed these last years come from two factors:

- High volumes growth due to retail price decrease imposed by roaming retail regulation. This induces high volumes of wholesale “roaming in” bought and thus a better power to negotiate good unit prices letting play the competition between different providers. Sellers on this market are not deterred from lowering wholesale roaming price by concerns over potential knock-effects on the prices of retail roaming provision as the latter is ruled independently by RLAH retail obligation.
- Cost efficiency gains due to technical evolution.

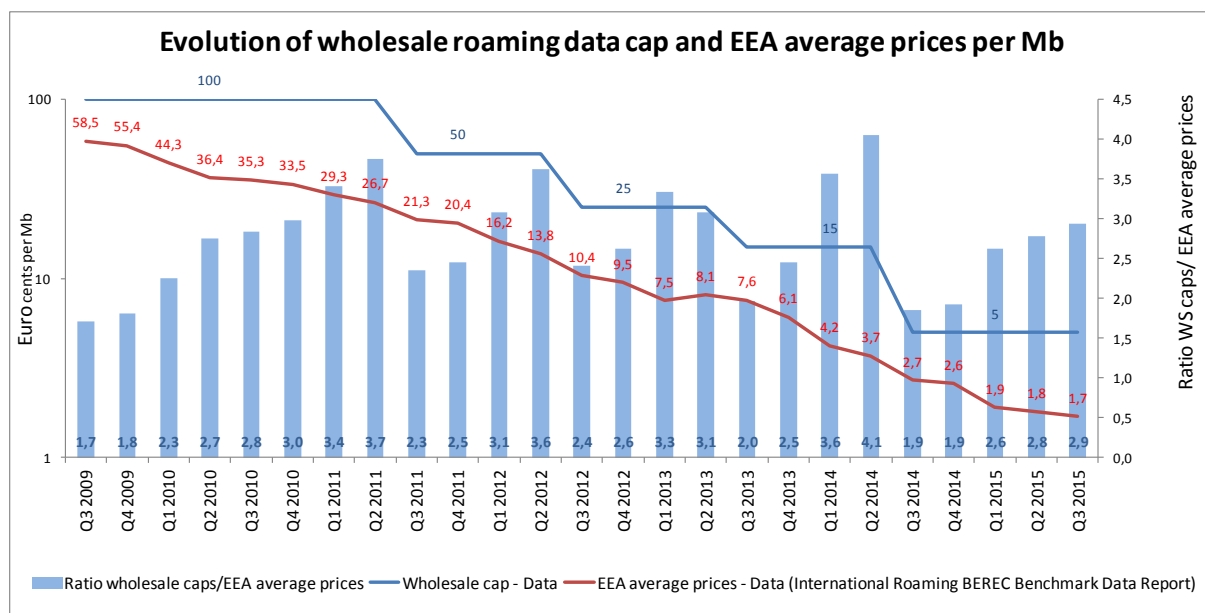
As figures in this section clearly illustrate it, the evolution of wholesale prices is not induced by the evolution of wholesale caps, but by the growth of retail volumes triggering competitive mechanisms and incentives present in the wholesale roaming market.

## 2.2.1. The recent steady decline of EU average wholesale data prices is independent of wholesale regulation

Figure 1 shows that EU average price for data decreases significantly independently of the caps' evolution. The evolution is presented on a log scale<sup>5</sup> (see figure 1).

A provider is always tempted to offer lower wholesale prices to capture new clients. This negotiation process leads to prices that are close to full costs or even drop below in some countries. A mobile operator is thus bound to offer wholesale prices that are competitive. Wholesale regulation is unnecessary in the purpose to lower wholesale prices.

**Figure 1. Evolution of EU wholesale average price per Mbyte**



Source: International roaming BEREC data report

The figure 2 demonstrates clearly that wholesale roaming data prices evolve independently of wholesale data roaming caps. It considers a period without change in terms of wholesale roaming caps (Q3 2014/ Q3 2015). From July 2014, the wholesale cost of roaming is capped at 5 EU cents per megabyte (red line in the figure below).

This figure shows the level of inbound wholesale data roaming price in each EEA country and the price evolution between Q3 2014 and Q3 2015 (the most recent BEREC data available<sup>6</sup>) :

- The blue curve represents the BEREC data roaming inbound wholesale price practiced in each EEA country in Q3 2014. The green curve shows the same BEREC data one year later in Q3 2015;
- The blue sticks represent the wholesale roaming inbound price evolution in each EEA country between Q3 2014 and Q3 2015, period where there is no change in terms of regulated wholesale caps.

There is a high heterogeneity in EEA countries' data wholesale roaming price evolution which cannot be attributed to wholesale roaming regulation (no change in regulated wholesale caps). For instance,

<sup>5</sup> The interest of a log scale is to represent on a same graph the evolution of a variable that has a large amplitude variation. The amplitude is particularly important for wholesale data prices and less for voice and SMS prices that's why we use the log scale only for data in order to better represent the price evolution and especially recent changes.

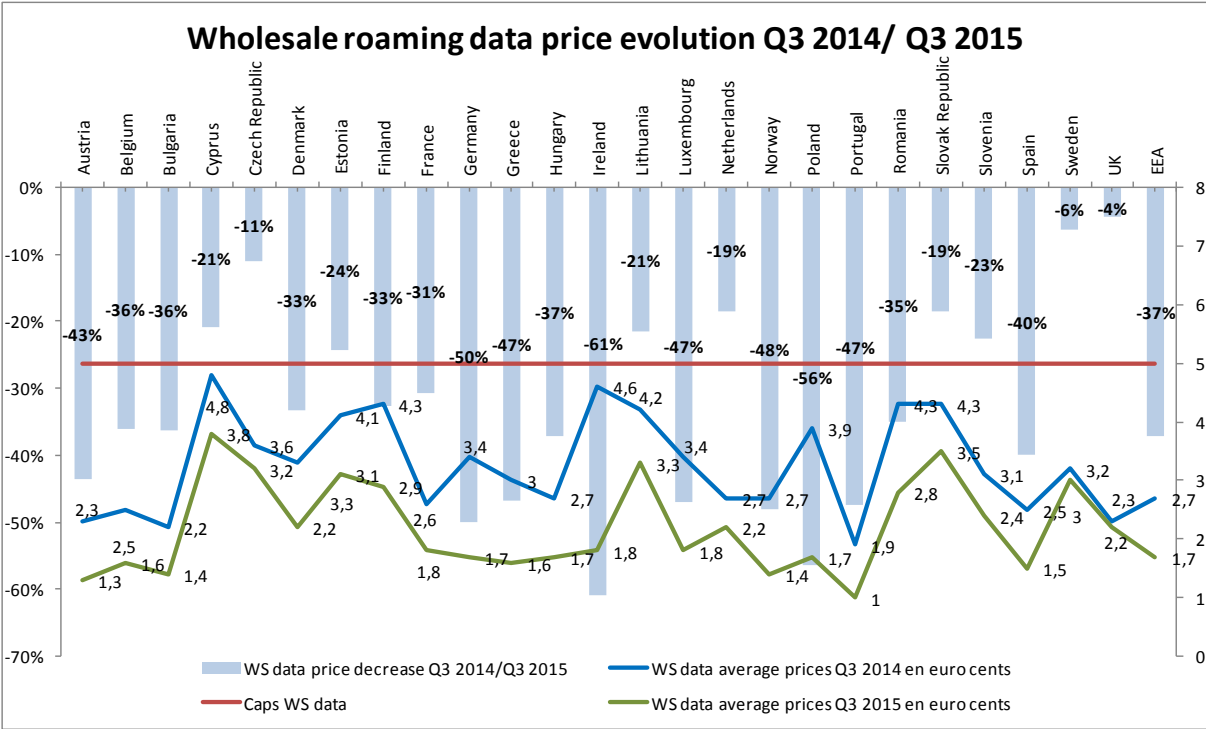
<sup>6</sup> [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015](http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015)

wholesale data roaming price decreases only by 4% in UK against 43% in Austria whereas the wholesale data price was at the same level (2.3 Euro cents) in Q3 2014.

Prices do not converge towards a unique value near the cap (blue and green curves have the same shape) but are heterogeneous between countries and far away from the wholesale cap: EEA average price in Q3 2015 is of 1.7 EUR cents nearly three times lower than the caps.

The level and the persisting disparities between countries demonstrate that competition takes place in the market.

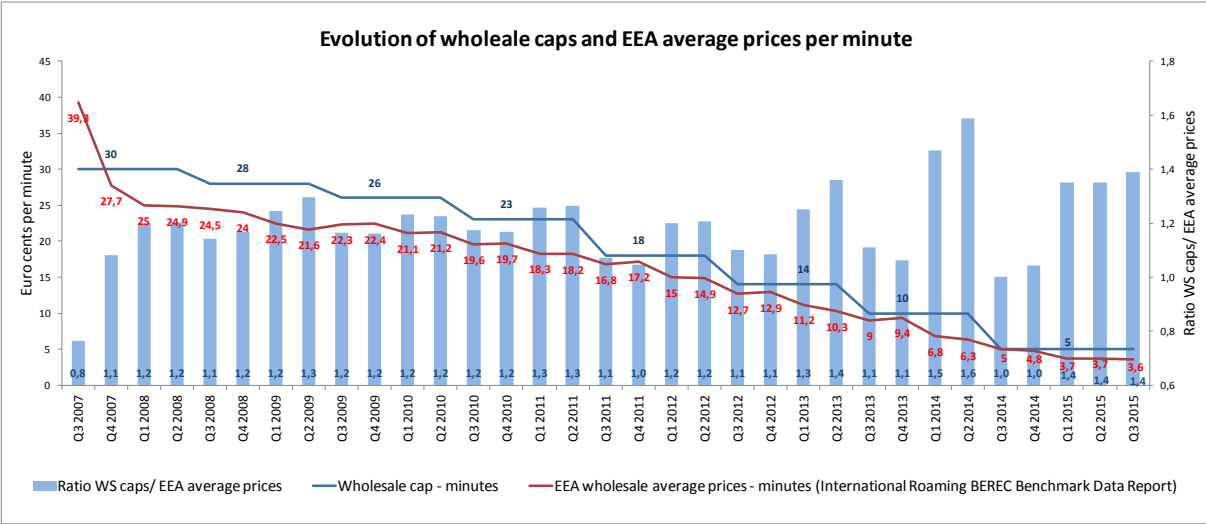
**Figure 2. Wholesale data price evolution in a period without regulatory change**



2.2.2. A decline of EU voice average price despite the stability of wholesale caps

Figure 3 shows that voice market prices keep on decreasing even when caps are stable.

**Figure 3. Evolution of EU wholesale average prices per minute**



Source: International roaming BEREC data report

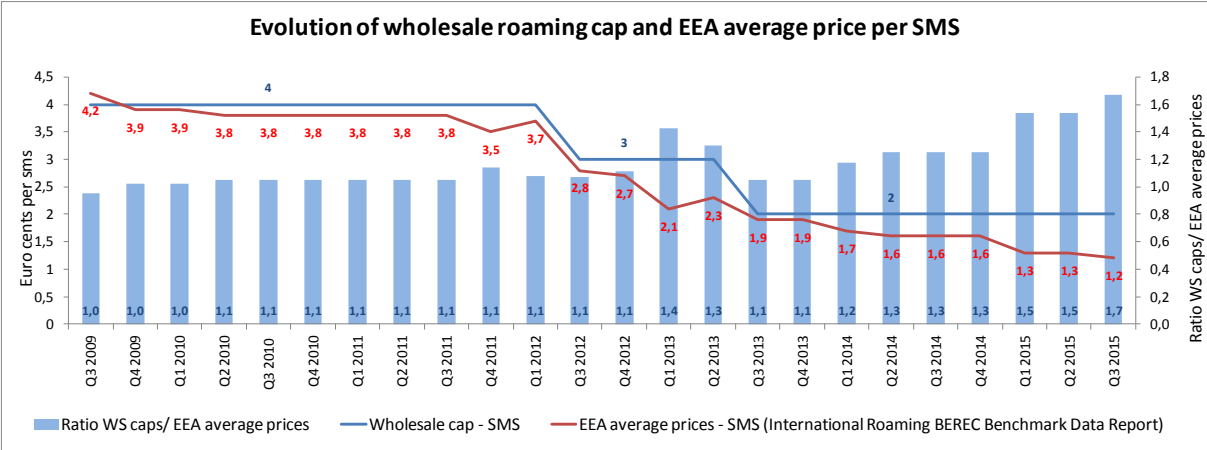
The decrease is notably limited by a lesser traffic growth, technical evolution more concentrated on data than on voice services. Wholesale roaming voice price evolution is also influenced by the continuous heterogeneity of mobile termination rates (MTR) across Europe.

Today, there is no much room to lower wholesale voice caps as the mobile termination rate is in average higher than 1 eurocent per minute in Europe. As a reminder, the termination rate normally corresponds to the pure incremental cost of a minute of a domestic half call. The pure incremental costs of an end-to-end mobile minute corresponding to 2 half calls, should therefore be around 2 eurocents. As full costs normally are above twice pure incremental costs, the full cost of an end to end mobile call should at least be in the range of 4 eurocents which is approximately the current level of EEA average price per minute (3.6 eurocents per minute).

2.2.3. There are fewer stakes on SMS

The figure 4 demonstrates that there is a continuous decrease in SMS wholesale price independently of the evolution of regulatory caps.

Figure 4. Evolution of EU SMS wholesale average prices



Source: International roaming BEREC data report

To conclude this section, the analysis of wholesale roaming market mechanisms shows that full MVNOs and MNOs have room to negotiate. The market presents all the characteristics of a competitive market. The competitiveness of wholesale roaming market is being reflected in the current trends of EU market prices, responding by sharp decreases to volume growth independently of regulatory decisions and well below wholesale caps.

III. The current level of wholesale roaming inbound prices are equivalent to roaming wholesale costs at EU level

To complete the assessment of the competitiveness of the wholesale roaming market and to evaluate if prices are competitive, this section compares the current level of wholesale inbound roaming average prices to wholesale inbound roaming costs. As mentioned earlier, regulatory intervention on the wholesale market would only be justified to address competition issues on the roaming wholesale market.

Concerning wholesale inbound roaming prices, we use the data published each quarter by BEREC in its benchmark report on international roaming prices, with extensive data collected from European operators.



Concerning wholesale inbound roaming cost, we model the costs of a generic European operator using the cost model of a French generic operator publicly available on the website of Arcep, the French regulator (ARCEP publishes each year the costs model of a generic French mobile operator), adjusted in order to replace the average usage of French mobile subscribers by the average usage of European subscribers. This adjustment is required to compare wholesale roaming prices and wholesale roaming costs in average in Europe, for a consistent basket of usage. We consider that using a European adjusted model of a French generic operator is relevant for the purpose of this general analysis, as metropolitan France (to which Arcep model applies) and European Union have very similar demographic densities, which is a strong determinant of network cost per subscriber: 113 inhabitants/km<sup>2</sup> for EU vs. 118 inhabitants/km<sup>2</sup> for metropolitan France, according to Wikipedia. Our estimation takes into account seasonality cost for voice and data services. In its proposal in Recital 15, EC indicates taking into consideration the potential impact of the seasonal nature of roaming traffic in order to mitigate any cost increases caused by seasonal traffic variability but it roundly rejects considering seasonality for data services. We demonstrate in this section that it leads to underestimate drastically roaming costs.

### 3.1. Estimating the level of EU wholesale inbound roaming prices

The BEREC benchmark report gives each quarter data relative to wholesale inbound roaming prices in each country. Wholesale inbound roaming prices are those paid by visiting mobile operators to European operators to offer roaming out services to their clients when they travel into Europe. The latest one has been published on March, the 1st 2016<sup>7</sup>. In this report, the average wholesale prices to have access to each country’s network while roaming out is available for voice, SMS and data services. The EU average data are presented in Table 1. For 2013 and 2014, we calculate the annual average data. For 2015, we use the most recent BEREC data relative to the third quarter. In addition, we also made the estimation considering the wholesale caps proposed by EC in its Impact Assessment document on wholesale roaming legislative proposal (see Table 1).

**Table 1. EU average wholesale inbound roaming unit prices**

	2013	2014	Q3 2015	Q3 2015
Minute	10	5,7	3,6	4
SMS	2,5	1,6	1,2	1
Data (price per Mbyte)	6,8	3,3	1,7	0,85

Source: International roaming BEREC benchmark data report

To obtain the level of wholesale inbound roaming prices, we need to have estimations on the average consumption made by Europeans when they roam in another European country. In the absence of data relative to European roaming consumption per client, we will consider in the spirit of RLAH that a roamer have the same consumption patterns when he travels than at home. Thus, EU monthly average domestic consumption per client coming from BEREC RLAH is used as a proxy to estimate the EU average consumptions of roamers when they are visiting another European country.

In the document “International Roaming: Analysis of the impacts of “Roam Like at Home” (RLAH)” published by BEREC in December 2014<sup>8</sup>, we can gather for voice, SMS and data the monthly European average consumption per client for the year 2013 using the data collected over EU28. Countries are weighted by their number of SIM cards. For 2014, we can gather the same data from BEREC report on the wholesale roaming market (2016).

<sup>7</sup> The document is available at: [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015](http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015)

<sup>8</sup> [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah](http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah)

For 2015, we use the traffic evolutions given by WCIS (see Table 2).

**Table 2. EU average AUPU evolution – 2013/2015**

	2015
Voice AUPU evolution	10%
SMS AUPU evolution	-6%
Data AUPU evolution	29%

Source: WCIS – average 4 last quarters' data for each year with the latest figure in Q3 2015.

We assess wholesale inbound roaming prices on this basket of EU average domestic usage. Weighted European average monthly domestic consumptions per client are presented in Table 3:

**Table 3. Weighted EU monthly average domestic consumptions per client – 2013/2015**

	2013	2014	2015e
Minute	125	136	147
SMS	76	73	70
Data (MB)	292	413	580

Source: BEREC data, WCIS evolution and Orange calculations

The EU average wholesale inbound roaming prices are presented in Table 4.

**Table 4. EU wholesale inbound roaming price for a basket of yearly EU domestic usage/user**

	2013	2014	Q3 2015
EU average wholesale roaming price for an EU average yearly domestic usage basket (€/subscriber)	34,3	22,5	16,0

Source: BEREC data, WCIS evolution and Orange calculations

### 3.2. Estimating the level of EU average wholesale inbound roaming costs for EU average basket under RLAH

In this subsection, we estimate the full wholesale costs of roaming activity at EU level. In subsection 3.2.1, we estimate the average cost per user of a generic European operator, modelled as the cost per user of a French generic operator, according to ARCEP model, adjusted to take into account European average domestic usage instead of French average domestic usage. In subsection 3.2.2, we convert network costs for a domestic usage into network costs roaming usage by taking into account to some degree the specific seasonality of roaming activity as compared to domestic activity. Finally, in subsection 3.2.3 second we add specific wholesale roaming commercial and marketing costs plus a contribution to the MNO common costs.

#### 3.2.1. Estimation of domestic network costs relative to a basket of EU average consumption

We consider that the characteristics of a European generic operator are likened to those of the generic operator in Metropolitan France with network costs dimensioned for EU average consumptions. There is no a priori bias to consider this hypothesis. Furthermore, the population density that is the most important factor to consider estimating unit costs and the main source of economies of scale is very close between European Union (113 inhabitant/ km<sup>2</sup>) and Metropolitan

France (118 inhabitant/ km<sup>2</sup>). So the generic operator in Metropolitan France appears to be a fairly good model to approximate the network costs of average European generic operator.

For practical reasons, we use the ARCEP model of a generic mobile operator in France to estimate its annual network costs<sup>9</sup>. ARCEP model of a generic operator has been designed taking into account the actual costs and technical configurations of actual metropolitan French operators. According to the ARCEP model the network costs for a generic mobile operator is of 157 million euros per month in 2015<sup>10</sup>. These network costs are calculated on the basis of French pattern of consumptions. To calibrate the ARCEP model on EU average consumptions, we use data from RLAH BEREC report<sup>11</sup> in order to express the EU average consumption in terms of French ones. We observe that:

- The EU average minutes consumption represents 77% of the French consumption;
- The EU average SMS consumption represents 35% of the French consumption;
- The EU average Mbytes consumption represents 151% of the French consumption.

We apply these coefficients on the consumption per user in the data of ARCEP model of a French generic operator. We obtain network costs slightly inferior to those based on the French consumptions i.e. 151,7 million euros instead of 156.6 million euros in 2015. The number of domestic subscribers in 2015 of the generic mobile operator is 20.4 million<sup>12</sup>. This calculation shows that network costs for an EU average basket are quite stable over the period and represent 7.4 euros in 2015 (see Table 5).

**Table 5. Mobile network costs for a domestic usage**

	2013	2014	2015e
Total monthly French mobile network costs - French consumptions -Generic operator ARCEP model in M€	159,5	155,7	156,6
Total monthly French mobile network costs - EU consumptions -Generic operator ARCEP model in M€	157,9	152,5	151,3
Average nb of mobile subscribers (M2M clients excluded) in millions of clients	20,9	20,6	20,4
Mobile network costs for EU average basket	7,6	7,4	7,4

Source: Generic mobile operator ARCEP model – calibrated by Orange for EU consumption

3.2.2. Estimation of network costs for EU average basket including to some degree the seasonality effect of roaming inbound traffic

For data traffic, the wholesale roaming market draft Regulation deliberately ignores the impact on cost allocation of the specific seasonality of roaming traffic as compared to domestic traffic. EC justifies its choice indicating in Recital (15) of the draft regulation that domestic data traffic is experiencing an strong growth trend so that any seasonal traffic in a year would be outweighed by the total domestic traffic demand in the future. This logic is flawed.

<sup>9</sup> Without prejudice of remarks which Orange may formulate in parallel on the Arcep model.  
<sup>10</sup> The network costs of the ARCEP model account for the costs associated with roaming in activity. However, correcting the global network costs to withdraw those induced by routing roaming in traffic over the period considered would have no material effect on the present analysis.  
<sup>11</sup> [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah](http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah)  
<sup>12</sup> Exclude the M2M clients as cards generate very little traffic therefore very little costs.

First, it overlooks the fact that international roaming traffic is often geographically concentrated and may be the main driver of network dimensioning, in contradiction with the view expressed in Recital (15). This point is analysed in detail in a study published by the Spanish regulator, the CNMC Report on the seasonality of the wholesale data roaming services in Spain (2016).

Second, even without considering the specific geography of wholesale roaming traffic, it is just untrue that domestic network dimensioning is based only on domestic traffic. Domestic network dimensioning is designed to support the sum of all traffics including of course domestic and wholesale roaming traffic, which by no mean can be considered as a free rider using capacities let idle by domestic traffic. Mobile network do not serve differently roaming and domestic users. All users contribute with their respective traffic to network dimensioning and costs, each with its specific peaks, usage and geographies.

The vision of Recital (15) is not only untrue but also operates a cost allocation between roaming and domestic traffic, which fully contradicts the Roaming Regulation which requires that roaming should cover all costs including those related to seasonality as well as joint and common costs. Even in case of a high growth rate of domestic data traffic, and even when roaming traffic represents only a small proportion of the total traffic, the specific seasonality of roaming traffic leads to higher unit cost allocated to roaming traffic than to domestic traffic when costs are normally allocated in compliance with the provision of the “TSM” Regulation, contrary to Recital (15). A thorough demonstration of this point is given in Annex 1 of this paper.

We use Orange data in France to estimate the seasonality effects as we do not have data for the French generic operator or at EU level. As there are more tourists in France than in most other European countries, roaming traffic is probably more balanced between seasons in France than in other countries where tourism season is probably more concentrated over the year. The seasonality effect is so probably lower in France than in other countries. This is a first reason why our calculations can thus be considered as conservative. This subsection presents the methodology used.

Networks are dimensioned in function of the traffic during busy periods (busy month and busy hour). Thus, network costs are allocated between services in proportion of the cost driver which is the traffic during busy period. For each service (domestic, RIN and other services), we calculate the weight the traffic during busy period represents in annual traffic and we compare the service weights to obtain a unit network cost per volume of production. Services for which the ratio between the traffic during busy period and the yearly volume of production is high have a higher unit network costs than service for which this ratio is lower.

The ratio “traffic at network busy period on yearly volume of production” is higher for roaming in traffic than for domestic traffic. In this subsection, we make a conservative estimate of the impact of the seasonality effect of roaming services upon roaming wholesale costs using data from Orange in France.

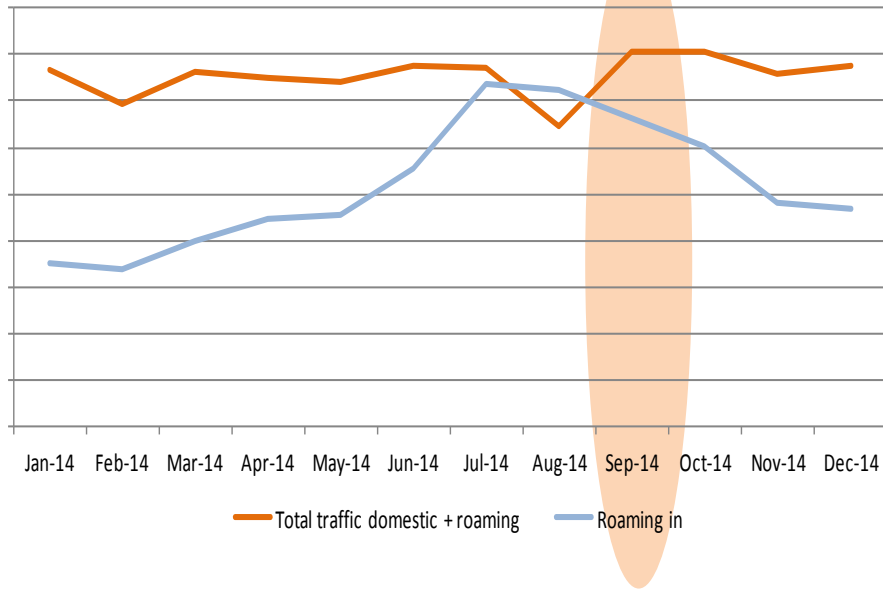
### *Voice*

The engineering rule generally used in France is to dimension the network for the traffic of the second highest month in the year. To estimate the additional costs for voice generated by the seasonality of “Roaming in” traffic, we thus take into account the second month in terms of volumes of total minutes carried by the domestic network (domestic traffic + “Roaming in” traffic), which is September for the illustrative year 2014<sup>13</sup> (see Figure 5).

---

<sup>13</sup> We observe for voice that there is no significant traffic growth between January and December 2014 so we choose not to correct from the impact of the average growth over the considered year.

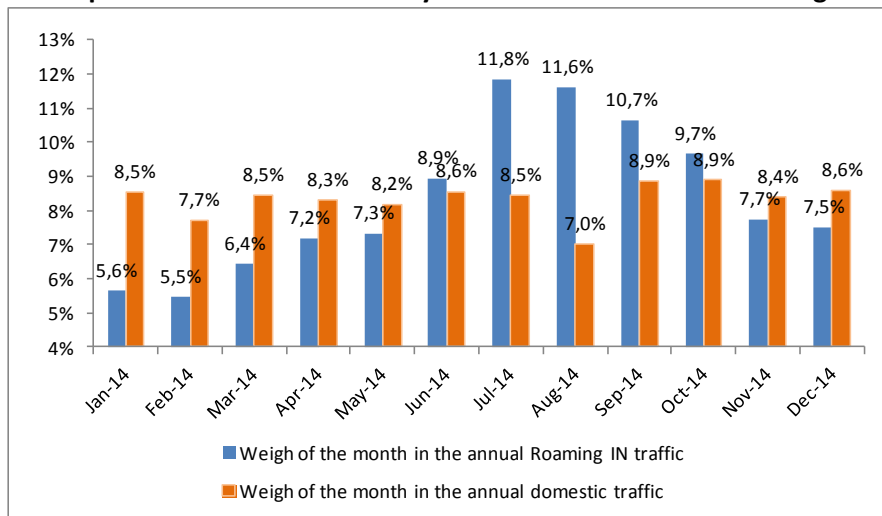
**Figure 5. Seasonality of voice traffic (domestic + “roaming in”)**



Source: Orange data for France

In Figure 6, we determine the weight of domestic and “roaming in” voice traffic of the month September in the annual global traffic.

**Figure 6. Comparison of traffic seasonality between domestic and roaming voice traffic**



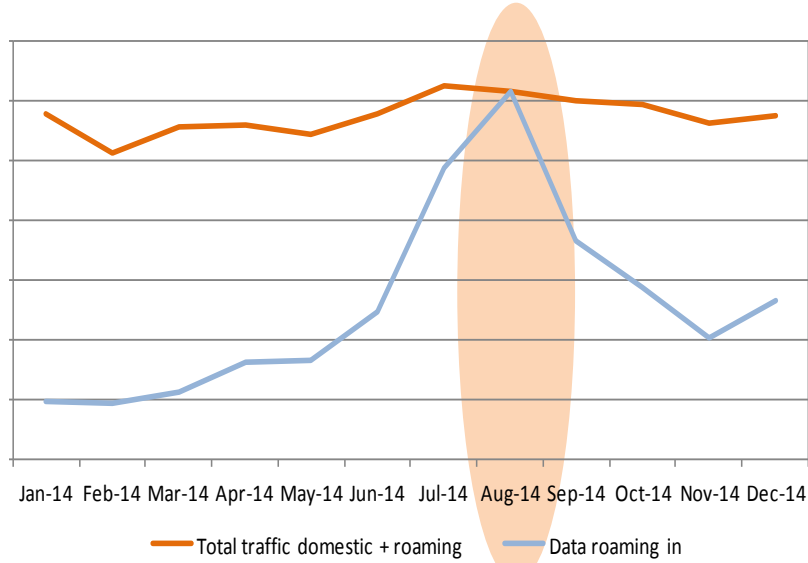
Source: Orange data for France

September represents 8.9% of annual domestic traffic vs. 10.7% for annual “roaming in” traffic. Hence average roaming minutes cost 20% more than average domestic minutes:  $10.7 / 8.9 = 1.20$ .

**Data**

Likewise, to estimate the additional costs generated by the seasonality of roaming traffic for data, we take into account the second month in terms of volumes of Mbytes, August for the illustrative year 2014. To distinguish the seasonality effects from the growth effects, the domestic and the “Roaming in” mobile data traffics per month presented in Figure 7 have been corrected from the impact of the average growth over the considered year.

**Figure 7. Seasonality of data total traffic (domestic + roaming) – growth effect excluded**

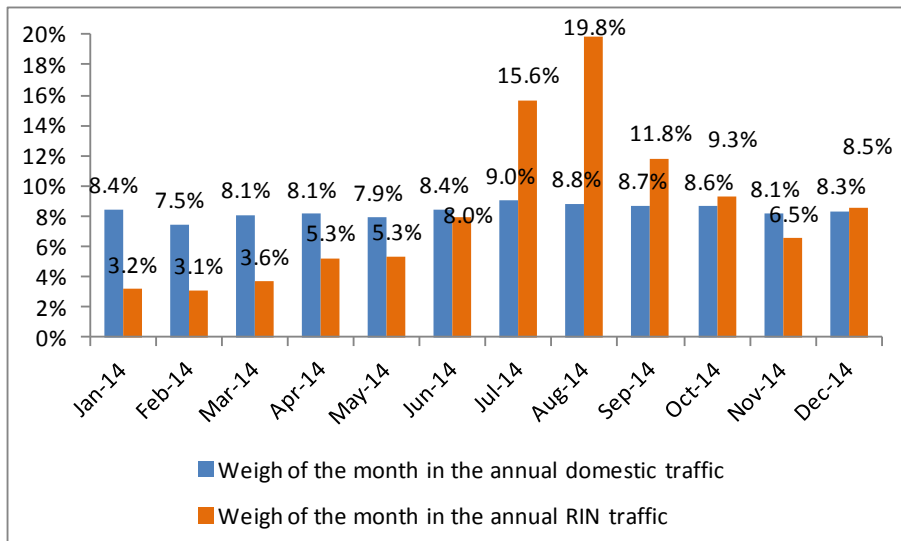


Source: Orange data for France

It has to be reminded that the growth of “roaming in” data traffic is larger than the growth of domestic data traffic. As a large growth implies a low average utilization of capacity, due to anticipation constraints, data “Roaming in” traffic contributes more to this lower utilization of capacity due to its higher growth than the growth of domestic data traffic. However, this has not been accounted for in the calculation.

We determine the weight of domestic and roaming data traffics of the month August in the annual traffic. The month of August represents 8.8% of the annual domestic traffic versus 19.8% for the annual roaming traffic (see figure 8). Therefore average “roaming in” Mbyte unit cost is around 124% higher than the average domestic Mbyte ( $19.8 / 8.2 = 224$ ).

**Figure 8. Comparison of traffic seasonality between domestic and roaming data traffic**



Source: Orange data for France

In order to evaluate globally the impact of seasonality of average roaming usage over average domestic usage, we need to combine the seasonality effect on voice (+20%) and on data (+124%). We have neglected SMS specific seasonality for which we have not searched specific data but which should have a similar profile than voice. We have considered that complex considerations of cost

allocation between services in the context of this simple general study would be irrelevant. So, for the needs of this simple study, we just use in the arithmetic average of voice and data seasonality effects: +72% which is the average of +20% and of +124%. In the future, data services will dominate network costs and the global seasonality effect will become aligned on the data seasonality effect.

It should be underlined that this way of calculating the effects of seasonality minimizes its impact, because it is done at a global network level. An accurate calculation would require taking into account the heterogeneity of the location of roaming peaks depending on the seasons. De facto, the corresponding loss of economy of scale between domestic and roaming traffic has more impact on the smaller roaming traffic than on the larger domestic traffic, as can easily be shown on a toy model<sup>14</sup>.

The results are presented in table 6.

**Table 6. Estimation of the roaming inbound network costs for a basket of EU average usages taking into account seasonality effects**

	2013	2014	2015e
Network costs for a basket of EU average consumptions in euros	7,6	7,4	7,4
Network costs of wholesale roaming inbound activity (including +72% seasonality effects) for a basket of EU average consumptions in euros	13,0	12,7	12,8

Source: Orange calculations

We obtain a network cost, including the seasonality effect of roaming activity, of 12.8 euros for a basket of EU usages in 2015.

3.2.3. Estimation of the full costs of a service sold in the wholesale market

To cover the full costs of a wholesale service, network costs should typically be increased by around 20% to take into account wholesale roaming commercial and specific costs and a fair contribution to the company common costs (see table 7).

<sup>14</sup> The fact that taking roaming seasonality at a local rather than at a global level would increase roaming overcosts can be shown in the following toy example. Let us consider a network with domestic traffic during busy period of 10 and roaming traffic during busy period of 1. The annual domestic production is 100 for domestic and 5 for roaming (roaming is twice more peaky than domestic. There is some economy of scale in the dimensioning function: network capacity = 1+busy period traffic. We suppose network cost as strictly proportional to network capacity: cost = network capacity.  
 In a first scenario, domestic and roaming traffics are spatially homogenous. The roaming and domestic traffic during the busy period, respectively 1 and 10, generate 11 of total traffic during busy traffic which dimension the network capacity = 1 + 11 = 12 which is also the cost. This cost is allocated to domestic and roaming traffics proportionally to their respective contribution to the total traffic during busy period: (10/11) for domestic and (1/11) for roaming. Applying these coefficients to the 12 of total cost, we find = 12 \* (10/11) = 10,91 allocated to domestic traffic and = 12 \* (1/11) = 1,09 allocated to roaming traffic. To find the unit cost we then have to divide it by the yearly volume of production, 100 for domestic and 5 for roaming. Hence the unit cost of domestic is 10,91/100 = 0,1091 and the unit cost of roaming is 1,09 / 5 = 0,2182, twice the unit domestic cost.  
 In a second scenario, domestic and roaming traffics are located in different places. We then have the cost and capacity of the domestic network = 1+10 = 11. The cost and capacity of the roaming network is 1+1 = 2. The unit domestic cost is 11/100 = 1,1 and the unit roaming cost is 2/5 = 0,4 which is (0,4/1,1)=3,64 times more expensive. Hence the overcost of roaming is higher when roaming and domestic traffic have different locations. More the traffic peaks are in different places or time, greater are the ratio of unit costs between roaming and domestic activities.

**Table 7. Wholesale full costs for EU average basket**

	2013	2014	2015e
Network costs for a basket of EU average consumptions in euros	7,6	7,4	7,4
Network costs of wholesale roaming inbound activity (including +72% seasonality effects) for a basket of EU average domestic consumptions (€)	13,0	12,7	12,8
Full costs of wholesale roaming inbound activity (including +20% specific and common costs) for a basket of EU average domestic consumptions (€)	15,6	15,3	15,3

Source: Orange calculations

Full wholesale costs represent around 15.3 euros for a basket of EU average usages in 2015.

### 3.3. Comparison between wholesale inbound roaming prices per client and wholesale inbound full costs per client

Comparing the wholesale inbound roaming average prices (§3.1 Table 4) to wholesale inbound roaming full costs (§3.2 Table 7), we find that wholesale inbound roaming costs represent 98% of wholesale inbound average price for an EU average basket if we consider EU average wholesale roaming inbound average price observed in Q3 2015 (see Table 8).

**Table 8. Comparison between EU average wholesale inbound roaming prices and EU average wholesale inbound full costs for an EU average basket**

	2013	2014	Q3 2015
Full costs of wholesale roaming activity (taking into account seasonality effects) for an EU average basket in euros	15,6	15,3	15,3
EU average wholesale price for an EU average basket in euros	34,3	22,5	15,3
Wholesale inbound roaming costs in % of wholesale inbound roaming prices	46%	68%	100%

Source: Orange calculations

The cost estimations may be considered as underestimated notably because the seasonality impact is modeled on the French market rather than on a European level, and at national rather than at local level<sup>15</sup>.

**These results show that there are good reasons to presume that current level of market wholesale price is not higher than wholesale roaming costs.**

**These estimations give a reasonable and conservative first picture of the situation of the wholesale roaming market. It shows that the wholesale roaming market is globally a competitive market regarding to the relation between prices and costs. Therefore the review of the regulation of**

<sup>15</sup> See footnote 14 for more details



**wholesale roaming should not have the objective to modify the general level of wholesale roaming prices resulting from market mechanism. Caps should stay significantly above wholesale roaming market prices and serve as a safeguard against any fraud or non-compliance with the terms of wholesale contracts. They should be kept at a sufficient level to avoid any domestic market distortion.**

#### IV. Conclusion

As RLAH can be achieved under current wholesale regulation and as the objective of wholesale regulation is to prevent the existence of competitive distortions between mobile operators, Roaming Regulation should only address identified competitiveness issues in wholesale roaming market. In this respect, this paper demonstrates that wholesale roaming markets exhibit clear competition mechanisms and competitive level of average market prices, triggered by Roam Like At Home retail regulation.

This result questions the proportionality of the EC draft Regulation reviewing wholesale roaming caps.

## Annex I. High growth of data traffic and small proportion of roaming traffic does not eliminate impact of seasonality of unit cost of roaming traffic

### Introduction

In its Recital (15), the draft Regulation of wholesale roaming caps argues that the existence of high growth of domestic data traffic and the small proportion of roaming traffic in the total traffic eliminates the impact of seasonality on the unit cost of roaming traffic. This note proves that this argument is untrue.

Taking a numerical example specifically designed to model the effects mentioned in Recital (15) and using the cost allocation rules between domestic and roaming traffic imposed by the TSM regulation, we find that roaming unit costs is systematically and significantly larger than domestic traffic due to seasonality effect.

The note is organized as follows:

- the first section recalls the exact references in the draft Regulation and in the TSM Regulation which are concerned by the issue at stake;
- the second section recalls the different cost concepts used to address a cost allocation issue when several services share a common resource. Furthermore, it formalizes the types of cost allocation formulae which are compliant with the requirements of the TSM Regulation;
- the third section describes how the network dimensioning process in function of domestic and roaming traffic trajectories is modelled, fairly translating the dimensioning process considered in Recital (15) of the draft Regulation;
- the fourth and last section presents a numerical example which precisely reflects the situation and the effects of traffic growth considered in Recital (15) of the draft Regulation. This section proves that the outcome of network dimensioning process and of cost calculations is such that the situation leads to much higher unit costs for roaming traffic than for domestic traffic due to seasonality, in contradiction with the argument expressed in Recital (15). Several robustness checks prove that this conclusion holds independently of the specific choices of parameters in the numerical example.

### 1) Conflicting texts

TSM Regulation modifies Article 19 of Roaming III Regulation. The review of this article includes the following requirement:

*“In assessing measures necessary to enable the abolition of retail roaming surcharges, the Commission shall take into account the need to ensure that the visited network operators are able to recover all costs of providing regulated wholesale roaming services, including joint and common costs.”*

The following paragraph of Recital 15 of the draft Regulation of Wholesale Roaming Price *“In considering cost estimates, the potential impact of the seasonal nature of roaming traffic on the overall costs of providing wholesale roaming services at national level was taken into consideration. Such estimates noted the counterbalancing effects that would mitigate any potential increase in costs caused by the seasonality of roaming traffic. In particular for data services, increasing domestic*

*demand means that any seasonal traffic peak in a given year is likely to be exceeded by total domestic demand in the following year(s). Accordingly, since terrestrial mobile communications networks are dimensioned in order to cope with this general upward trend driven by domestic demand, any peak in total network demand caused by seasonal roaming flows is unlikely to drive mobile network dimensioning costs.*” is in contradiction with the provision of the TSM Regulation quoted above, in particular because the reasoning in Recital 15 implicitly but unambiguously only allocates incremental costs and not joint and common costs to roaming traffic in contradiction with the requirement of the TSM Regulation. This assertion will be clearly exemplified in the quantitative example developed in the following sections.

## 2) Allocation of joint and common costs

We consider the two traffics  $T_d$ , domestic traffic, and  $T_r$ , roaming traffic. Their sum is  $T_t = T_d + T_r$  total traffic.

The cost of the network is a function of the total traffic:  $C_t(T_t)$

The stand alone cost of the domestic traffic is the cost of carrying domestic traffic alone:  $C_{sa}(T_d)$

The stand alone cost of the roaming traffic is the cost of carrying roaming traffic alone:  $C_{sa}(T_r)$

The incremental cost of domestic traffic is the cost of carrying domestic traffic in addition to the cost of carrying roaming traffic, in other words the difference between the total cost  $C(T_t)$  and the stand alone cost of roaming traffic  $C_{sa}(T_r)$ . So we can write the equation of the incremental cost of domestic traffic  $C_i(T_d) = C(T_t) - C_{sa}(T_r)$ .

The incremental cost of roaming traffic is the cost of carrying roaming traffic in addition to the cost of carrying domestic traffic, in other words the difference between the total cost  $C(T_t)$  and the stand alone cost of domestic traffic  $C_{sa}(T_d)$ . So we can write the equation of the incremental cost of domestic traffic  $C_i(T_r) = C(T_t) - C_{sa}(T_d)$ .

By definition, joint costs are residual costs which are not incremental, so here the joint cost is the total cost minus the incremental cost of domestic traffic and the incremental cost of roaming traffic:

$$C_j(T_d, T_r) = C(T_t) - C_i(T_d) - C_i(T_r)$$

The average cost of domestic traffic, including a fair share of joint cost, is equal to the incremental cost of domestic traffic plus a proportion of joint cost. The average cost of roaming traffic, including a fair share of joint cost, is equal to the incremental cost of roaming traffic plus a proportion of joint cost.

In general, apportioning joint costs between different traffics may be the object of endless controversies. However in the present case, the TSM Regulation has provided that roaming traffic should receive what can be called a fair proportion of joint costs when compared to the share of joint costs allocated to domestic traffic. As incremental costs and stand-alone costs are the minimum and the maximum ways to allocate costs, a “fair proportion” of joint cost should in any case be in between allocating joint costs proportionally to incremental costs, and allocating joint costs proportionally to stand alone costs.

We call fully allocated cost 1 of domestic traffic,  $C_{f1}(T_d)$ , the full cost of domestic traffic including the incremental cost of domestic traffic plus a share of joint cost apportioned proportionally to incremental costs.

$$C_{f1}(T_d) = C_i(T_d) + C_j(T_d, T_r) * C_i(T_d) / (C_i(T_d) + C_i(T_r))$$

We call fully allocated cost 1 of roaming traffic,  $Cf1(Tr)$ , the full cost of roaming traffic including the incremental cost of roaming traffic plus a share of joint cost apportioned proportionally to incremental costs.

$$Cf1(Tr) = Ci(Tr) + Cj(Td,Tr) * Ci(Tr) / (Ci(Td) + Ci(Tr))$$

Of course it can be easily verified that the sum of the two full costs is equal to the total cost:

$$Cf1(Td)+Cf1(Tr) = C(T)$$

We call fully allocated cost 2 of domestic traffic,  $Cf2(Td)$ , the full cost of domestic traffic including the incremental cost of domestic traffic plus a share of joint cost apportioned proportionally to stand alone costs.

$$Cf2(Td) = Ci(Td) + Cj(Td,Tr) * Csa(Td) / (Csa(Td) + Csa(Tr))$$

We call fully allocated cost 1 of roaming traffic,  $Cf1(Tr)$  the full cost of roaming traffic including the incremental cost of roaming traffic plus a share of joint cost apportioned proportionally to incremental costs.

$$Cf2(Tr) = Ci(Tr) + Cj(Td,Tr) * Csa(Tr) / (Csa(Td) + Ci(Tr))$$

Of course it can also be easily verified that the sum of the two full costs is equal to the total cost:

$$Cf2(Td)+Cf2(Tr) = C(T)$$

In particular, to be compliant with the Article 19 of RIII as modified by the TSM Regulation, the cost allocated to roaming traffic should in any case be between  $Cf1(Tr)$  and  $Cf2(Tr)$ .

### 3) Network dimensioning as a function of traffic

As mentioned in Recital (15) network operators dimension the capacity of their network anticipating future growth and in order also to cope with any variations of traffic within a year.

To translate this reality in a simplified way, however relevant for the purpose of the present analysis, we will consider that for any month  $i$ , network capacity installed that month is able to cope with the traffic of that month  $i$  plus the maximum level of traffic planned one year ahead including the current month. In other word, if traffic  $Tj$  is the total traffic on month  $j$ , then network capacity on month  $I$  should be able to carry  $\text{Max}(Tj)$  for  $j = i$  to  $i+11$ , that is for one rolling year.

This simplified modeling of network dimensioning is fully consistent with the general process described in Recital (15) of the draft Regulation.

To keep things simple, we will consider that network capacity on month  $i$  is equal to the traffic it is designed for that: network capacity for month  $i = \text{Max}(Tj)$  for  $j = i$  to  $i+11$ .

Again to keep things simple, but still relevant for our purpose, the network cost on month  $i$ ,  $Ci$ , is equal to network capacity. Cost for month  $I = Ci = \text{Max}(Tj)$  for  $j = i$  to  $i+11$

This unique dimensioning and costing function depending on traffic trajectories can and will be applied in the following section to the different traffic categories in order to calculate the different concepts of costs introduced in the preceding paragraph: total cost, stand alone costs, incremental costs, joint costs, fully allocated costs.

A utilization coefficient could have to be introduced to convert Maximum traffic in the coming year into monthly capacity. A unit cost coefficient could have to be introduced to convert monthly capacity into monthly cost. However, it would only have added parameters with no impact on the reasoning and the outcome.

Using here the hypothesis of a linear relation between traffic, capacity and cost, instead of a non-linear relation exhibiting economies of scale, is fully consistent with the principle of non-discriminatory joint cost allocation between all traffic using the network, required by the TSM Regulation. Even if the real dimensioning and cost function includes economies of scale, the principle of non-discriminatory allocation of joint costs impose to consider the cost function as a linear cost function for the purpose of cost allocation.

#### 4) Numerical example

The numerical example is very simplified because it is designed to capture specifically the effects mentioned in the Recital (15) on the draft Regulation:

- High growth of domestic traffic and of roaming traffic;
- Absence of seasonality of domestic traffic and high seasonality of roaming traffic;
- Small proportion of roaming traffic.

The numerical example captures only these effects, but captures all these effects. It is therefore relevant in order to assess whether the statement included in Recital (15) holds when the cost allocation methodology follows the rules described in the §2 of the present note in order to comply with the new Article 19 of RIII Regulation as modified by the TSM Regulation.

The total traffic  $T_t$  is the sum of domestic traffic  $T_d$  and of roaming traffic  $T_r$  for any month  $j$  :

$$T_t j = T_d j + T_r j$$

Domestic traffic grows every month without exhibiting any seasonality:

$$T_d j = \alpha * T_d(j-1)$$

In the numerical example,  $\alpha$  is chosen large enough at 1.05 strong to lead to an annual growth of +80%, and  $T_0$  will be normalized at 100.

Roaming traffic is assumed to have high seasonality. To keep things simple,  $T_r j$  is assumed to be zero 11 months out of 12:

$$T_r j = 0 \text{ if } j \neq n * 12$$

and different from zero only one month per year, but growth fast at rate  $\beta$  from one year to the other

$$T_r n * 12 = \beta * T_r (n-1) * 12$$

To focus on a single effect without introduce more parameters in the analysis, we consider here that over one year, the growth of roaming traffic is equal to the growth of domestic traffic so:

$$\beta = \alpha^{12}$$

$T_{r0}$  is normalized at 10, 10 times smaller than domestic traffic for the month where roaming is maximal. Over one year this choice of parameters leads to a total roaming traffic around 1,3% of the total domestic traffic which is a reasonable order of magnitude.

These hypotheses allow us first to derive the calculations of domestic traffic, of roaming traffic and of total traffic every month from 0 to infinity.

Using the dimensioning and costing formula provided in §3, we can calculate the different costs concepts (total cost, stand alone costs of domestic and roaming traffics, incremental costs of domestic and roaming traffics, joint costs, full costs 1 and full costs 2 of domestic and roaming traffics) every month  $i$ .

For each cost concept, a total cost per year can be obtained by adding the cost per month of 12 consecutive months.

Then the full costs per year 1 and 2 can be calculated both for domestic and for roaming traffic :  $Cf1d$ ,  $Cf1r$ ,  $Cf2d$  and  $Cf2r$ . Then the total domestic and roaming traffics per year can also be calculated by adding the domestic and roaming traffics per month of 12 consecutive months :  $T_d$  and  $T_r$ .

Dividing the full cost per year 1 and 2 per the total traffic per year, one obtains the unit cost 1 and 2 for each year, for domestic and for roaming traffics: cu1d, cu1r, cu2d and cu2r.

The numerical simulation has included several consecutive years but for the chosen parameters and for the purpose of comparing unit costs between domestic and roaming traffics, the result are identical in the different years, due to constant dynamic and to identical growth rate between domestic and roaming traffic. So the following table only provides the outcome of the simulation for the first year.

However the conclusions for our purpose derived from the results for the following years 2, 3, 4 etc...would be the same as with this set of parameters, the values of unit costs stays constant one year after the other.

Annual total cost:	2810
Annual stand alone cost Domestic	2722
Annual stand alone cost Roaming	415
Annual incremental cost Domestic	2395
Annual incremental cost Roaming	88
Annual Joint Cost	327
Annual full cost Domestic 1 (joint cost allocation proportional to incremental costs)	2711
Annual full cost Roaming 1 (joint cost allocation proportional to incremental costs)	100
Annual full cost Domestic 2 (joint cost allocation proportional to stand alone costs)	2679
Annual full cost Roaming 2 (joint cost allocation proportional to stand alone costs)	131
Annual total traffic Domestic	1592
Annual total traffic Roaming	2
Unit full cost Domestic 1	1,7
Unit full cost Roaming 1	4,98
Unit full cost Domestic 2	1,68
Unit full cost Roaming 2	6,56

These numerical results show that whatever the method of cost allocation of joint cost chosen, the unit cost of roaming will be much higher than the unit cost of domestic traffic, even though domestic traffic is growing fast and even though roaming represents a small proportion of total traffic, contrary to what states Recital (15) of the draft regulation.

Even without allocating joint cost to roaming traffic, in the present example, the unit incremental cost of roaming traffic would be of 88 / 20 that is 4,4 much higher than than the unit cost of domestic traffic.

**Robustness checks**

Change in the month of roaming traffic: if roaming traffic is different from zero on month 12 instead of month 1, the results become:

Unit full cost Domestic 1	1,71
Unit full cost Roaming 1	1,83
Unit full cost Domestic 2	1,7
Unit full cost Roaming 2	2,53

Even in this unfavorable case, the unit cost of roaming traffic is still significantly higher than the unit cost of domestic traffic.

In order to have a robust estimation of the difference between domestic and roaming traffic, independent of the respective positions of the month for which the annual calculation is done, and of the month when roaming traffic is active (in the model), the calculation should be done averaging the result over the 12 possible respective positions. Such average calculation is not difficult but is cumbersome and the outcome is more than likely to fall in the middle of the two extreme cases presented above. So in average:

Averaged Unit full cost Domestic 1:  $(1,71+1,70)/2 = 1,71$

Averaged Unit full cost Roaming 1:  $(1,83+4,98)/2 = 3,40$

Averaged Unit full cost Domestic 2:  $(1,70+1,68)/2 = 1,69$

Averaged Unit full cost Roaming 2:  $(2,53+6,56)/2 = 4,55$

Unit cost of roaming traffic is several times higher than unit cost of domestic traffic in a case which exactly corresponds to the case depicted in Recital (15) which proves that the conclusion of Recital (15) is untrue.

Higher growth of roaming traffic when compared to domestic traffic: today, data roaming traffic is growing faster than domestic roaming traffic first because of retail roaming regulation and second because roamers may have less opportunities to offload their traffic on fixed accesses than domestic users. If the annual growth rate of roaming traffic is assumed to be higher than the annual growth of domestic traffic, than the difference between roaming unit cost and domestic unit cost is even higher than in the baseline scenario and moreover increases over time.

## Conclusion

The high seasonality of roaming traffic has an important impact on the calculation of the unit cost of roaming traffic when compared to domestic traffic, even when traffics are growing fast and when roaming traffic represents a small proportion of the total traffic.

Therefore seasonality effects must be included in the evaluation of unit cost of roaming data traffic. In that respect the current wording of Recital (15) of the draft Regulation is untrue and should be changed.

## References

ARCEP, Generic operator mobile model, <http://www.arcep.fr/?id=8080#9574>

BEREC report, “International Roaming; Analysis of the impacts of “Roam Like at Home” (RLAH)”, BoR(14) 209.

[http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah](http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/4826-international-roaming-analysis-of-the-impacts-of-8220roam-like-at-home8221-rlah)

BEREC report on the wholesale roaming market BoR (16) 33  
[http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/5745-berec-report-on-the-wholesale-roaming-market](http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5745-berec-report-on-the-wholesale-roaming-market)

BEREC report, “International Roaming BEREC Benchmark Data Report April – September 2015” , BoR (16) 28-1, [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015](http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5760-international-roaming-berec-benchmark-data-report-april-8211-september-2015)

CNMC (2016), Report on the seasonality of wholesale data roaming services in Spain.  
[http://www.cnmc.es/Portals/0/Ficheros/Telecomunicaciones/Resoluciones/2016/1607-Julio/160707-Informe%20INF-DTSA-088-16\\_eng.pdf](http://www.cnmc.es/Portals/0/Ficheros/Telecomunicaciones/Resoluciones/2016/1607-Julio/160707-Informe%20INF-DTSA-088-16_eng.pdf)

European Commission draft regulation

[http://ec.europa.eu/newsroom/dae/document.cfm?doc\\_id=16211](http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=16211)

“TSM” REGULATION (EU) 2015/2120 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2015

JAUNAUX L., DENIAU P. & LEBOURGES M. (2016), “Roaming Like at Home: Retail roaming at domestic price does not require new wholesale regulation”, forthcoming in Communications and Strategies.