WORKING PAPER | ISSUE 3 | 2016

Challenging prospects for roam like at home

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ABSTRACT

On 25 November 2015, the European Union enacted new rules for international mobile roaming (IMR) under Regulation 2015/2120, which seeks to implement a Roam Like at Home (RLAH) regime among the member states of the European Union. Questions remain, however, as to whether it is possible to implement RLAH without mandating below-cost pricing and thus introducing significant regulatory and economic distortions.

It is difficult to see how RLAH could be implemented for other than trivial amounts of IMR traffic without significant cross-subsidisation of the IMR service in many different dimensions. Identifying ways to maintain the ubiquity of the IMR service without unduly distorting the economics of European mobile markets and networks would appear to pose serious challenges; the saving grace, however, might well be that IMR revenue now represents a small enough fraction of total mobile revenue (thanks to previous regulation) that the necessary cross-subsidies might be manageable. The European Commission, which is required to assess the situation and to provide legislative proposals by 15 June 2016, faces a daunting task.

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1 Introduction

International mobile roaming (IMR) is a service whereby a subscriber to mobile telecommunications services in one country is able to use his or her mobile device in other countries. For many years, governments around the world have expressed concerns that the prices of IMR services seemed to be unreasonably high compared to the price of domestic telecommunications services. These concerns have led to numerous regulatory initiatives, and to wholesale and retail IMR price controls in the European Union and also between the six countries of the Gulf Cooperation Council[1].

1.1 Motivation: the policy context in Europe today

On 25 November 2015, the European Union enacted new rules for IMR under Regulation 2015/2120, which seeks to implement a *roam like at home (RLAH)* regime for EU member states[2]. In a pure RLAH regime, the price of roaming services would be the same as for equivalent domestic telecommunication services (ie *mobile network operators (MNOs)* would not be permitted to charge a premium for these services).

Regulation 2015/2120 expresses a legitimate political objective; however, no robust means for delivering RLAH have been identified to date.

The primary public policy rationale for RLAH is straightforward. High costs for calls and for internet data while travelling within the European Union, which seeks to function as an integrated free trade area (FTA), are incongruous, and can be viewed as an impediment to the functioning and efficiency of a European single market.

As a secondary but minor rationale, high charges for IMR lead to losses of societal welfare in the form of welfare transfers and *deadweight loss*; however, as we explain in section 3, these losses are small for Europe as a whole. (Indeed, the *incremental* gains to static economic efficiency that could be achieved beyond those already achieved by the 2012 Regulation are miniscule.)

The primary goal of RLAH would thus appear to be legitimate; the question remains, however, whether it is possible to implement RLAH without introducing problematic economic and regulatory distortions. Regulation 2015/2120 calls on the European Commission to report on the wholesale market for roaming, and to make legislative proposals to solve an economic problem that is in fact quite difficult to solve[3]. We return to these questions in section 5.

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1 The European Union issued regulations in 2007, 2009, 2012, and most recently in 2015. The regulations approved by the ministers of Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE) in 2015 implement wholesale and retails controls that are broadly similar to those in effect in Europe in 2012, as explained in J. Scott Marcus, Christin-Isabel Gries and Robert Clarke (2015).

2 See European Union (2015). The Regulation also applies to European Economic Area (EEA) members Norway, Iceland, and Liechtenstein.

3 Per Article 7 of the new Regulation (which amends the previous Roaming Regulation), this report and the accompanying legislative proposals are due by 15 June 2016. Recital 21 of the new Regulation notes that *"… the ultimate aim of eliminating the difference between domestic charges and roaming charges cannot be attained in a sustainable manner with the observed level of wholesale charges. Therefore this Regulation sets out that retail roaming surcharges should be abolished from 15 June 2017, provided that the issues currently observed in the wholesale roaming markets have been addressed. In this respect, the Commission should conduct a review of the wholesale roaming market, and should submit a legislative proposal based on the outcome of that review."*

1.2 A further motivation: the global policy context

Regulation of IMR at regional level is under way in a number of the world's regional groupings. The GCC region has had regulation in place since 2013 for IMR calls made, and is (as previously noted) in an advanced stage of implementation of a new, comprehensive roaming regulation. Initiatives at various stages are ongoing in the Southern Africa Development Community (SADC), the East African Community (EACO), Latin America and the West Balkans.

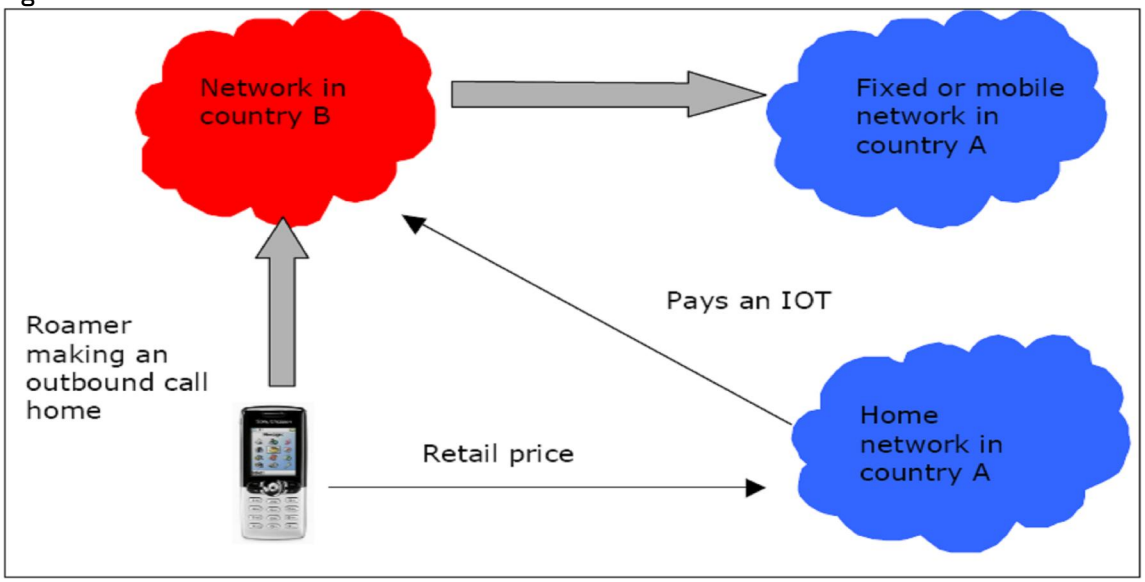
The International Telecommunications Union (ITU) issued a Recommendation on IMR in 2012 (ITU-T, 2012). Possible revisions have been under discussion ever since.

2 IMR data flows and payment flows

The most intensively studied form of IMR, and perhaps the easiest to explain, is the case of a roamer subscribed to home network (HN) A in country A who visits country B and uses MNO B as a visited network (VN) to place a call (Figure 1). The roamer pays his or her home network in Country A. MNO B actually places the call on the roamer's behalf, thus incurring both origination and termination costs, much as if its own subscriber had placed the same call.

MNO B (the VN) receives no retail revenue for this service; however, it receives a payment at wholesale level from MNO A (the HN). This wholesale payment is often referred to in the literature as an inter-operator tariff (IOT)[4].

Figure 1: Cash flows in IMR: calls made



Source: ARCEP (France), 2006.

The same basic principles apply to SMS messages sent while roaming, and to data; however, each service has its own idiosyncrasies.

[4] MNOs sometimes distinguish between the nominal wholesale payment rate versus bilaterally agreed discounted rates, in which case the IOT generally refer to the nominal rate.

SMS messages are subject to the same general payment arrangements as calls made; however, the SMS is sent to from the VN to the HN as a control message (ie not as bearer traffic), and is then sent to its end destination by the HN[5].

Roaming data is subject to similar payment arrangements; however, the data is physically sent from the VN to the HN[6] before being shipped to wherever it is needed by means of IP transit services[7]. This enables the HN to account for the data, and thus to bill for it. It may also enable the HN to apply rules, for instance to block content that is banned in the home country.

For calls received (Figure 2), a significantly differently flow of traffic and payments comes into play. The call is effectively forwarded from the HN to the VN. The VN receives a normal payment of the international *mobile termination rate (MTR)*, but receives no additional IOT payment (which suggests that the incremental cost of providing this IMR service cannot be very great).

For calls received (whether domestic or international), the HN generally receives an MTR payment from the caller's network[8]. The *difference between the MTR received and the MTR paid* is thus crucial in understanding the HN's costs. Among EU member states, this difference is generally not more than 2 eurocents today[9], but internationally it can be much more. In this paper, we treat the MTR paid net of the MTR received as being the cost; one could, alternatively, treat the MTR received as being part of the IMR revenue.

In most countries, the party receiving a call typically does not make a retail payment for it; however, roaming calls have historically been associated with retail charges[10].

5 In most countries, there are no charges for receiving an SMS message while roaming.

6 This data transmission could take place over a dedicated link or over a secure 'tunnel' over the public internet; however, it is more often done using a 'hubbed' solution to a multi-provider exchange point following standards developed by the *GSM Association (GSMA)*. The current GSMA standard is the *IP Exchange (IPX)*.

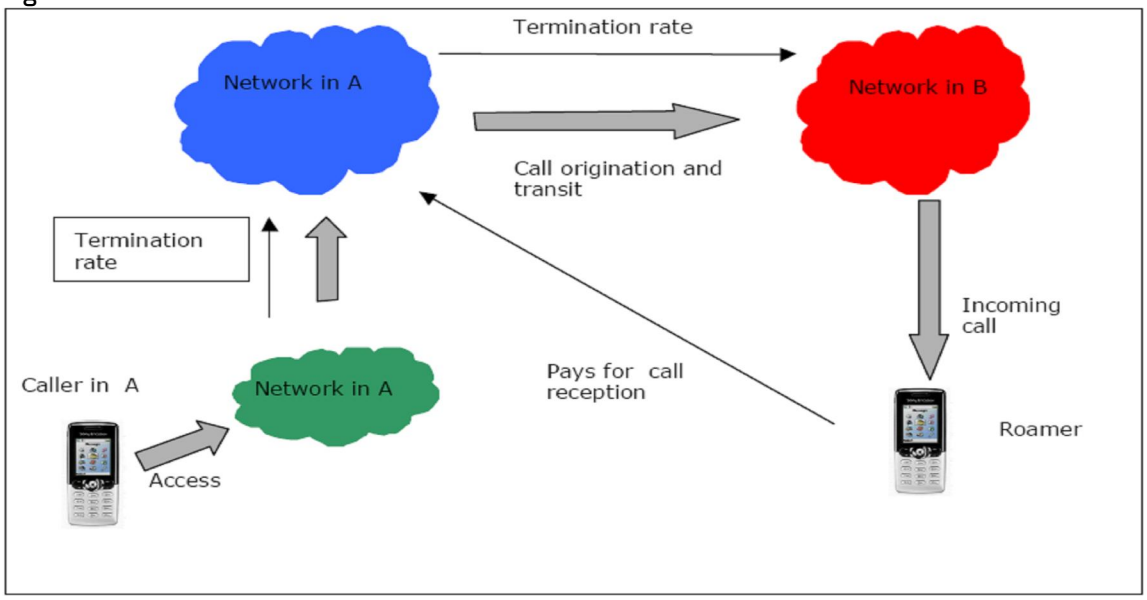
7 In the future, *LTE local break-out services* (a technical capability that is related to but not synonymous with the local break-out (LBO) regulatory option introduced with Europe's Roaming Regulation of 2012) might make it possible for the VN to ship IMR data off directly via IP transit services, without incurring a rather unproductive transit shipment to the HN.

8 If the caller is on-net (ie is also a customer of the called party's MNO), the MNO receives retail revenue instead of an MTR.

9 European Commission, Digital Agenda Scoreboard.

10 Under Regulation 2015/2120, these retail charges are to be prohibited.

Figure 2: Cash flows in IMR: calls received



Source: ARCEP, 2006.

Numerous roaming-specific charges can be relevant. These have been analysed in numerous studies[11], but the results are often less than fully conclusive. Information about these costs is generally known only to the MNOs, if it is known at all. In practice, the MNOs might not have a full understanding of their own 'soft' costs, and also might not wish to report them.

Different costs apply to the HN versus the VN, and not all IMR costs are relevant to each IMR service[12]. Among the costs relevant to the HN are:

- Retail costs (including a proportionate share of the costs of customer acquisition and customer care);
- Wholesale payments (IOTs) from the HN to the VN;
- Roaming overhead costs;
- Signalling;
- International transit (where relevant);
- Taxes (if relevant)[13];
- Origination, termination and other traffic-related costs (where relevant).

It is generally impractical to differentially allocate retail costs to individual services; consequently, they are often assumed to represent either a constant percentage of retail revenue for all services, or else a constant percentage of the cost of generating that retail revenue

Roaming overhead costs consist of a variety of administrative and network-related components that are entailed in maintaining the roaming service. These can include negotiation of agreements, testing, operations and maintenance (including accounting, payments, revenue assurance, fraud prevention,

[11] See for instance Chapter 5 of J. Scott Marcus, Christin-Isabel Gries and Robert Clarke (2015); and Imme Philbeck, Jasper Mikkelsen and Werner Neu (2012).

[12] The discussion in this section closely follows the analysis in the previously cited study for the GCC, J. Scott Marcus *et al* (2015).

[13] Taxes rarely enter into the European IMR discussion, but different tax rates can be a significant consideration in other parts of the world.

dedicated staff costs, software and systems for roaming operations), data clearing, and financial clearing.

The cost of signalling is in principle relevant to all roaming services in both home and visited networks; however, this cost is small.

Some of these costs can be viewed as fixed annual costs, largely independent of traffic volumes. Their impact on unit costs can be greater for MNOs with low IMR traffic volumes.

These costs vary greatly among European member states due to a range of underlying factors, notably including different labour costs. Even within a single member state, they can differ among the MNOs due for instance to the size of the network operator and related scale effects. In addition, the situation is substantially different for member states that are substantial tourist destinations, where MNOs tend to be net recipients of payments, versus for member states that tend to be net payers. These tourism effects can moreover be subject to considerable seasonal variation.

3 Literature review

The general literature on the interconnection of switched telephone networks largely derives from seminal works by Armstrong (1998) and by Laffont, Rey and Tirole (1998a and 1998b) , together with a sequel that generalises the work to deal with Internet interconnection (Laffont *et al*, 2003) We do not summarise the work here, since the Laffont, Rey and Tirole work permeates the rest of this paper[14].

Armstrong and Wright (2007) model fixed interconnection (with fixed termination rates (TRs) that are presumably always subject to regulation) and mobile interconnection (with mobile termination rates (MTRs) that are not necessarily subject to regulation), thus refining the earlier work[15].

Several subsequent studies have analysed the impacts of the regulation of IMR in the European Economic Area (EEA)/EU, and have explored alternative approaches to address over-pricing of IMR services[16]. Particularly noteworthy in this group is the Commission's impact assessment in preparation for the 2012 Roaming Regulation[17], which includes a thoughtful analysis derived from a study to which Steffen Hörnig contributed. Hörnig and his colleagues found the own price elasticity of demand[18] for IMR calls made, calls received and SMS to all be in the -0.24 to -0.27 range, which is to say that demand for the services is relatively inelastic; however, the own price elasticity of demand for IMR roaming data was in the -1.23 range, which is to say that consumer demand for roaming data is relatively elastic[19].

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[14] We generally cite their book, which concisely summarises the results of multiple papers; Jean-Jacques Laffont and Jean Tirole (2000).

[15] An annotated bibliography of the pre-2008 literature on network interconnection in telecommunications appears as an annex in J. Scott Marcus *et al* (2008).

[16] Among these are a study for the European Commission, J. Scott Marcus and Imme Philbeck (2010); and a short study for the European Parliament: J. Scott Marcus, Pieter Nooren and Imme Philbeck (2012).

[17] See European Commission (2011).

[18] The *price elasticity of demand (PED)* reflects the way in which demand for a product or service and corresponding consumption responds to changes in price. It is generally negative, because an increase in price results in a decrease in demand (and vice versa). A PED between zero and -1.0 indicates that demand is relatively *inelastic* (ie the response to changes in price is small); a PED that is greater in magnitude than -1.0 indicates an *elastic* demand, with a stronger response to changes in price.

[19] The mathematical specification of this work appears on pages 101 through 104 of the document.

It is possible that the price elasticity of demand for roaming voice services is higher today. In the past, even with regulation, the price was perceived as being too high – most Europeans placed calls while roaming only when unavoidable, both before and after the regulations came into force. We have argued, however, that when the price of calls made while roaming approached that of domestic calls, the price elasticity of demand for placing roaming calls could also be expected to be similar[20].

The same impact assessment[21] also assesses the impact on societal welfare (in terms of static economic effects) of the changes already put in place up to that time. It compares a business-as-usual scenario, in which the price reductions already put in place by the 2009 Roaming Regulation continue without change, to an alternative (counterfactual) scenario in which the Roaming Regulation would have been discontinued, and prices would have returned to the previous unregulated levels. Compared to the counterfactual scenario, the continuation of regulation from 2012 to 2014 was calculated as increasing consumer surplus by €18.6 billion, while reducing industry profits (producer surplus) by €5 billion. The difference of € 13.6 billion represents a net gain in societal welfare (ie a reduction in deadweight loss), and reflects increased consumption of IMR services[22].

As previously noted, a number of studies have attempted to quantify the actual wholesale and retail costs of providing IMR services. Two of our own studies featured prominently in section 2.

For the current situation in Europe, BEREC (2014) can also be viewed as a significant contribution to the literature. We make reference to these BEREC findings in several places in this paper. BEREC (2014) starts from the obvious but sometimes overlooked proposition that (1) wholesale revenues to the VN should be at least as great as the associated costs, and that (2) retail revenues should be at least as great as the payments that the HN makes to the VN. As previously noted, including all these desirable elements under an RLAH regime seems doubtful at best. BEREC (2014) therefore attempts to systematically explore ways to mitigate the economic imbalances that flow from a pure RLAH regime, primarily by (1) reducing wholesale payments to levels that are low but still in excess of marginal cost; or (2) imposing fair-use limits (FULs) that limit the losses being imposed on MNOs, or by means of a combination of the two.

4 Insights from the interconnection literature

Relatively little has been published on the economics of international mobile roaming. This is perhaps a result of the complexity of the operation – as we saw in section 2, there are at least four distinct services of interest, with significantly different considerations at the VN level versus the HN level.

A great deal of energy has been invested, by contrast, in understanding interconnection issues. For the comparatively simple points we would like to make in this paper, the core results and basic formulations that were already visible in the original work by Laffont, Rey and Tirole would appear to be sufficient.

Numerous observations flow directly from the structure of payments between the HN and the VN, and from a comparison with the literature on network interconnection.

[20] See J. Scott Marcus and Imme Philbeck (2010).

[21] European Commission (2011). This is again the work of Hörnig and his colleagues.

[22] The application of welfare economics to international mobile roaming is explained at some length in section 8.4 of the previously cited report for the six GCC countries, J. Scott Marcus, Christin-Isabel Gries and Robert Clarke (2015). See also European Commission (2011).

4.1 High prices can be expected with IMR, and are challenging to remedy

The first is that a tendency to *dual marginalisation* is to be expected, leading to prices to end-users that are even higher than those that a vertically integrated profit-seeking monopolist would choose[23]. Consider international calls between two countries, each with a monopoly operator (and thus no competition for the same end-users, which corresponds to the typical roaming situation between the VN and the HN)[24]. As Laffont and Tirole (2000) note, *"a noncooperative setting of access charges would necessarily result in the well-known double marginalization, each country adding its monopoly [mark-up] to its perceived marginal cost"*[25].

We emphasise that if the HN and VN were competing for the same end-users, one would not expect double marginalisation to emerge. This assumption is crucial.

Dual marginalisation leads to end-user prices that exceed even the monopoly price, and are thus above the economically optimal price for the network operators. The problem is not easy to correct, even for the network operators in question (which probably explains why high IMR pricing has been difficult to correct in general). Dual marginalisation can be ameliorated somewhat if one of the monopolists acquires the other, or if they are permitted to set prices cooperatively – in that case, the end-user pays 'only' the monopoly price. Otherwise, regulation would appear to be the most practical alternative to high prices.

With voice interconnection, even small network operators have market power over termination to the extent that typically there is no other network operator that can complete calls to their end-user's telephone number. In fact, smaller network operators tend to have greater ability to exercise their market power than large network operators, because the termination rates charged by small operators tend to have less impact on the prices that consumers pay than the termination rates charged by large operators (assuming that retail prices are affected by average wholesale payments rather than network-specific termination payments)[26]. High prices tend to reduce traffic volumes because of the price elasticity of demand; however, to the extent that a small network has only a small impact on the price paid by end-users who wish to reach its end-users, a small network tends to be less economically constrained than a large one in the access price that it can charge.

These considerations also apply to IMR, albeit imperfectly. The VNs typically do not have perfect monopoly control over visitors; nonetheless, they probably possess considerable pricing power. In Europe (and in most countries), it is rare to have more than four MNOs. Each HN could in principle choose one (or more) of these four for each visited country to which its roamers travel. One might therefore well imagine that prices charged to the HN would reflect oligopoly prices with up to four market participants, which would not necessarily differ greatly from competitive prices. In practice, however, it is often the case that one or more MNOs (1) have only limited geographic coverage, or (2) do not support all of the mobile connectivity options desired by the HN's customers (for instance, support only 2G and 3G but not 4G mobile connectivity); or (3) possess networks that do not offer the quality or speed that the HN desires. The number of realistic choices is therefore more likely to reflect an oligopoly situation rather than perfect competition.

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[23] See Laffont and Tirole (2000), section 5.3 (in a chapter written with Patrick Rey). They refer to this form of over-pricing as the *chain of monopolies* or *pancaking* problem.

[24] As we explain shortly, this condition is not fully met, but competition for roaming services is weak.

[25] Laffont and Tirole (2000), page 184. They explain the underlying drivers, and reference an extensive literature addressing this point.

[26] See again Laffont and Tirole (2000), page 186.

The practical reality might be considerably worse. Roaming can be thought of as a multi-stage game, in which the HN initially chooses its VN partner(s) in a given visited country, then the roamer effectively chooses a VN from among those supported by its HN in the visited country (in most cases, the handset makes this choice automatically based on steering preferences downloaded from the HN to the handset), and only then does the end-user choose how much use to make of the service. Beyond this, the HN's ability to steer traffic to its preferred VN is limited by numerous practical considerations, and especially by any gaps in coverage of a particular VN. Under these circumstances, the flow through of wholesale competition into end-user retail prices might well be attenuated.

The effectiveness of wholesale bargaining is in any case not altogether clear. Market players claim that there is intense negotiation over wholesale prices, sometimes leading to prices discounted as much as 40 percent below regulated European wholesale price caps[27]. The negotiations between MNO multi-country groups could be complex, since each could offer to steer roamers to the other in one country or another.

At the same time, assuming that the prices are symmetric (as appears to often be the case), then the prices for voice roaming services only matter for *unpaired minutes.* If MNO A is both an HN and a VN in country A, and MNO B an HN and VN in country B, and each steers some or all of its roamers to the other, then the only minutes that result in a net payment are those to which roaming minutes consumed by MNO A roamers in country B exceed those consumed by MNO B roamers in country A (or vice versa) – since the other minutes net to a zero payment, the rate charged for them is irrelevant. For purposes of the quarterly statistics that BEREC generates (see for instance BEREC, 2016), the MNOs generally report the paired minutes at a high rate (in Europe, typically the wholesale price cap rate), thus making the average wholesale payments for all minutes appear higher than the unit prices for unpaired minutes (BEREC, 2016). In other words, wholesale negotiations may possibly be somewhat more effective than most experts have assumed based on the BEREC statistics.

It is also important to note that wholesale prices for *data roaming* have consistently been significantly below the regulated cap (BEREC, 2016). This voluntary decision of network operators may possibly represent a response to market forces, and especially to the higher price elasticity of demand for roaming data services compared to other roaming services (ie calls and SMS).

For any given pair of MNOs and countries, one MNO will tend to be a net payer, the other a net receiver. Their negotiating interests are not aligned. The net payer will prefer a low wholesale price, the net receiver a high price.

Taking all of this together, it is not surprising that both wholesale and retail prices are high in practice in the absence of regulation. This is clear in the statistics published by BEREC where regulated wholesale and retail prices tend to be just below the price caps (except to some degree in the case of data roaming), and where unregulated 'bargain' prices are actually on average above the caps. Competitive forces appear to be weak. As BEREC notes *"… [f]or voice roaming services, average EEA prices are close to the regulated caps. This suggests that providers see little attraction in competing on Eurotariff rates, despite the fact that there is a significant margin between typical wholesale prices and retail caps"*.

[27] This emerged in multiple interviews, as reported in J. Scott Marcus and Imme Philbeck (2010).

4.2 Wholesale payments influence the retail price

If both (1) wholesale unit charges for IMR and (2) the volume of roaming traffic between MNOs A and B in countries A and B were symmetric, one might well imagine that the wholesale charges would be totally irrelevant to retail pricing, since they would net to zero; in practice, however, they are highly relevant to retail pricing. Suppose, for instance, that MNO A were to choose to lower its roaming prices in order to win more business from country A roamers who travel in country B (ie to attract them when they choose to make a subscription). To HN MNO A, the wholesale payment to VN MNO B is a real cost (assuming that the MNOs are not affiliated). MNO A will therefore tend to view its payment to MNO B as a key component of its real marginal cost, and is unlikely to set its retail price below its real marginal cost.

In the case of voice roaming and where the MNOs distinguish between paired and unpaired minutes (see section 4.1), *it is the wholesale charge for the unpaired minutes that influences the retail price*.

Assume (without loss of generality) that MNO A does not offer retail services in country B, nor MNO B in country A. Under these circumstances, one can make a straightforward economic argument that the societally optimal wholesale rate is equal to marginal cost (ignoring network effects)[28]. If, however, one assumes that both fixed and marginal costs must be recovered, including joint and common costs associated with operating the network as a whole, then there is an argument to be made that higher mark-ups are needed to recover those costs.

The question of whether joint and common costs should be recovered in general is largely an open question in the literature, but the European institutions have resolved the matter in the case of the RLAH provisions of Regulation 2015/2120. Article 6d(3)(a) of the regulation explicitly states that *"... the determination of the overall actual and projected costs of providing regulated retail roaming services by reference to the effective wholesale roaming charges for unbalanced traffic* ***and a reasonable share of the joint and common costs necessary to provide regulated retail roaming services"*** (emphasis added).

If the two MNOs happen to operate in the same country, and thus to compete for the same end-user customers, then they tend to have an additional incentive to maintain high wholesale rates. For reasons just noted, the retail price is unlikely to be less than the wholesale payment; thus, high wholesale payments effectively raise a rival's costs, and weaken competition between them for the same end-user consumers[29]. Under suitable assumptions, both benefit.

4.3 Social welfare implications

As noted in section 3, a credible estimate of the welfare effects of continuing the Roaming Regulation as it was versus eliminating it altogether between 2012 and 2014 found that elimination would have increased industry profits by €5 billion at the expense of consumers, and also would have increased deadweight loss (thereby reducing societal welfare) by an additional €13.6 billion based on reduced consumption of IMR services resulting from the higher price (European Commission, 2011).

[28] See Laffont and Tirole (2000), page 197. When one takes network effects into account, the societally the optimal price (disregarding any dynamic impact on investment) is arguably below marginal cost. See also Armstrong and Wright (2007).

[29] See for instance Laffont and Tirole (2000), page 190-195.

These may sound like large numbers, but it is important to bear in mind that in a European Union of some 508 million inhabitants, this works out to about €9 per person per year. Moreover, this was a comparison based on the prices of the 2009 regulation versus previous unregulated prices. The prices in place in early 2016 were much lower, and have just become lower still under the new rates that came into effect on 30 April 2016 as a result of Regulation 2015/2120. The societal welfare difference between RLAH versus the new regulated rates is probably less than €1 per year per inhabitant.

As a related matter, the societal welfare impact of RLAH will be more important for some services than for others. Societal welfare gains come mainly from increased consumption thanks to the price elasticity of demand. SMS is, however, a service that is in global decline, possibly because of competition from over-the-top services[30]. The logic of promising increased usage is thus questionable. For calls made and calls received (and also for SMS), the impact of lower prices is limited because of the fairly low price elasticity of demand (see section 3). For roaming data, however, there is the opportunity to facilitate use of a growing service, arguably the service of the future; moreover, the impact of price reductions is likely to be significant in light of a relatively high price elasticity of demand (again, see section 3).

5 Challenges in implementing Roam Like at Home

As noted in section 1.1, it is by no means clear whether it is possible to implement RLAH without introducing problematic economic and regulatory distortions. The discussion throughout this paper, reflecting both practical considerations concerning the costs of providing the service and theoretical insights from the economic literature, should make clear why this is so. It has always been clear that the provision of IMR services entailed costs beyond those associated with domestic services. Some of these costs fall to the *Home Network* (the *HN*, i.e. the MNO that serves the subscribed end-user in the Home Country), while others fall to the *Visited Network* (the *VN*, i.e. the MNO that serves the subscribed end-user in the *Visited Country*). These costs have widely been assumed to be small relative to the total cost of providing the IMR service, but they are not well understood.[31] There is in our judgment substantial risk that the implementation of the new Regulation might introduce distortions and inconsistencies between the *price* and the *cost* of IMR services. Indeed, a 2014 study by the *Board of European Regulators of Electronic Communications (BEREC)* questioned whether RLAH could ever be "sustainable or feasible in practice".[32]

The regulations of 2007, 2009, and 2012 took great pains to ensure adherence to the principle that, in the words of BEREC (2014), *"wholesale roaming caps should at least be at the level of the cost of providing domestic services (which costs vary between Member States)"* (BEREC, 2014). Retail prices for the HN were always set at levels sufficiently in excess of the wholesale payment to the VN (frequently referred to as the *Inter-Operator Tariff* or *IOT*) to enable the HN to achieve a reasonable

[30] An over-the-top (OTT) service is an online service that can be regarded as potentially substituting for traditional telecommunications and audiovisual services such as voice telephony, SMS, video on demand and television. See J. Scott Marcus (2016, forthcoming).

[31] See for instance J. Scott Marcus, Christin-Isabel Gries and Robert Clarke (2015). See also J. Scott Marcus, Imme Philbeck, Jasper Mikkelsen, and Werner Neu (2012). The European Commission has tasked a group of outside experts with the job of estimating these costs. They appear to be taking a generally sensible approach, but this is a difficult problem – whether they can obtain solid results in the end remains to be seen. In any event, even a rigorous knowledge of the costs would not in and of itself provide a means of bringing prices in line with costs.

[32] *"BEREC's analysis of the risks and impacts of the European Parliament's RLAH proposals demonstrates that the removal of retail roaming surcharges across Europe is not currently sustainable or feasible in practice, given the significant variations in a number of important parameters across Member States, including (but not limited to) the levels of retail tariffs, costs, and travelling and consumption patterns"* (BEREC, 2014).

profit. Even in the first Roaming Regulation in 2007, policymakers were worried that if prices were regulated to levels below cost, the IMR service would no longer be widely offered. It was possible to simultaneously satisfy these objectives as long as it was permissible to maintain retail IMR prices somewhat in excess of typical domestic prices. Now that Regulation 2015/2120 seeks to prohibit any premium at all from being charged, it is doubtful that these goals can still be fully met.

Finding a solution is not easy. As BEREC (2016) noted, (1) roaming challenges cannot be solved solely by adjustments to roaming wholesale and retail prices, but need to also reflect call termination rates; and (2) it seems unlikely that any single set of wholesale roaming rates under an RLAH regime can simultaneously be low enough and high enough to prevent various kinds of harm[33].

The exact consequences of a failure to find a robust solution are difficult to predict, but many possibilities are conceivable:

- If wholesale prices are capped at levels below the marginal cost of providing the IMR service, some MNOs might no longer offer the service as VNs.
- If domestic retail prices are effectively capped at levels below the IOT payment to the VN (plus a minimally adequate profit), some MNOs might no longer offer the IMR service (perhaps selectively to high price or off-net VNs).
- There will be a tendency for MNOs to increase their domestic mobile prices because of so-called *waterbed effects* (where a network operator seeks to compensate for mandated reductions in the price of one component of its service by means of increases in other components). The loss on roaming services is included in their overall costs, and is reflected in the prices that they charge. This has the fringe benefit that it enables them to charge slightly higher prices for IMR services.
- Costs and prices of mobile services vary greatly in different member states. Many MNOs have expressed valid concerns about 'permanent roaming', where an end-user obtains a mobile service in a member state where mobile prices are low and uses it without limit in a member state where mobile prices are high. These concerns could be mitigated by means of fair-use limits (or *FULs*, see for instance BEREC, 2014), but it is unclear whether a limit can be found that is simultaneously large enough to be useful to roaming consumers and small enough to prevent arbitrage that might be harmful to the MNOs.
- To date, the objective of European policy has been simultaneously to reduce IMR prices and to maintain consistent IMR price caps across the member states. Whether this is possible in a regime in which prices are fully reduced to domestic levels remains to be seen.
- Taking all of this into account, it is difficult to see how RLAH could be implemented for other than trivial amounts of IMR traffic without significant cross-subsidisation of the IMR service. Identifying ways to maintain the ubiquity of the IMR service without unduly distorting the economics of European mobile networks would appear to pose challenges; the saving grace, however, might well be that IMR revenue now represents a small enough fraction of total mobile revenue that the necessary cross-subsidies might possibly be manageable today.

[33] BEREC (2016). *"A range of measures suggested by some MNOs and MVNOs (such as converging mobile termination rates (MTRs) and lower wholesale caps) are needed to ensure that their domestic tariffs schemes are sustainable in a RLAH environment. … The challenge is finding a balance between wholesale charges that are sufficiently low to allow for a sustainable suppression of retail roaming surcharges, protect competition and avoid significant retail price increases in the home country, and sufficiently high to allow efficient cost recovery and return on investments to visited network operators to avoid retail price increases in the visited network and avoid a negative impact on MVNO competition in the visited markets. As there is no uniform wholesale tariff that would satisfy those conditions in every Member State, this is likely to involve a trade-off …".*

6 Concluding observations

Relative to global considerations, the lessons that can be drawn from the related literature on interconnection seem to be sufficiently straightforward:

- That IMR prices tend to be high in the absence of regulation is not an aberration, but rather an expected economic consequence of the nature of the service.
- Initiatives to reduce IMR costs at regional level appear to offer promise in terms of regional integration and economic gains in societal welfare.
- Policy needs to reflect the reality that wholesale and retail prices are linked.
- Successful implementations to date have ensured (1) that the VN is permitted to earn wholesale revenues in excess of its corresponding costs, and (2) that the HN is permitted to earn retail revenues in excess of its corresponding costs (ie its wholesale payments to the VN.

Relative to the implications for Europe, what is clear to date is that it is difficult if not impossible to fulfil the last point (avoiding making the IMR service unprofitable) while fully implementing an RLAH regime. The European institutions face substantial challenges.

Taking all of this into account, it is difficult to see how RLAH could be implemented for other than trivial amounts of IMR traffic without significant cross-subsidisation of the IMR service. Identifying ways to maintain the ubiquity of the IMR service without unduly distorting the economics of European mobile networks would appear to pose challenges; the saving grace, however, might well be that IMR revenue now represents a small enough fraction of total mobile revenue that the necessary cross-subsidies may be manageable.

Our intent here has not been to identify a solution, but rather to clarify the boundaries of the problem to be addressed.

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