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Philipp Herrmann, Dennis Kundisch, Vlad Nicolau, and Steffen Zimmermann, 2014, "COMPETITION AT LAST? AN ECONOMIC ANALYSIS OF CURRENT MOBILE DATA ROAMING REGULATIONS IN EUROPE", Proceedings of the European Conference on Information Systems (ECIS) 2014, Tel Aviv, Israel, June 9-11, 2014, ISBN 978-0-9915567-0-0 <http://aisel.aisnet.org/ecis2014/proceedings/track16/5>

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Research in Progress

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Abstract

The mobile data roaming market in the European Union is characterized by a lack of competition which is one of the main reasons for wholesale and retail prices being well above cost-based prices. In 2012, the European Commission has enacted new regulatory measures such as allowing for more players competing in the wholesale data roaming market and forcing mobile network operators to unbundle roaming services from domestic offers by 2014. Moreover, the European Commission recently proposed the elimination of roaming charges by 2016. Nevertheless, it remains unclear whether these measures will ultimately result in more competition and, thus, in increased social welfare. Drawing on existing research from IS, telecommunications and regulation domains, we propose the development of an analytical model to evaluate the economic implications of these regulatory measures.

Keywords: Mobile Data Roaming, Bundling, Regulation, Internet Economics.

1 Introduction

There is a long tradition of normative research on economic regulation. This stream of research either focuses on identifying “market failures” or seeks to develop “optimal” policies for correcting market imperfections (Jaskow and Rose, 1989). The widely accepted principles that should govern optimal policies can be characterized as follows: “economic efficiency calls for prices equated to marginal social opportunity costs; and that, whenever it is technologically feasible, competition is the best institutional mechanism for achieving that result [...]” (Kahn, 1979) Adopting this normative view, we analyze recent European regulation concerning the mobile data roaming market in this paper.

Global mobile data traffic is expected to increase 18-fold between 2011 and 2016, with the European market accounting for 29% of the overall traffic by 2016 (Cisco, 2013). Amongst the causes for this increase is the substitution of traditional mobile voice and text message services by data driven

communication applications build on top of the mobile network operators' networks (so-called "over-the-top communication services" (GSMA, 2012a)) such as Whatsapp for online messaging or Viber for Voice over IP (VoIP) services. Other reasons for the predicted increase in data traffic include the emergence of new business models such as new machine-to-machine technologies where mobile devices communicate across borders.¹

As the European Union (EU) is composed of relatively small countries that have undergone an intense process of political and economic integration (Infante and Vallejo, 2012), there is a substantially higher demand for international roaming compared to, say, North and South America (Paltridge et al., 2009). In 2009, the total EU roaming revenues were 6.04 billion €. Mobile data roaming accounted for about 16% of these revenues and has experienced the highest growth in traffic volume in recent years (EC, 2011).² However, a more elastic demand of data roaming services (-1.23 compared to -0.27 for outgoing voice roaming services; EC, 2011) and wholesale and retail data roaming prices³ that are well above cost-based prices (Falch, 2012) seem to entail a substantial social cost. For instance, travelling and tourism as well as the development of cross-border business across Europe are negatively affected by these high prices (BEUC, 2011; EC, 2010; EC, 2012a). To eliminate this deficiency, the EC (EC) set the target that "the difference between roaming and national tariffs should approach zero by 2015" (EC, 2010). To reach this, policy makers enacted the regulation 531/2012 (EC, 2012a). At its core, it has two major measures that may have a substantial impact on the market structure (which we call "structural measures" in the following) and shall bring wholesale and retail prices closer to competitive levels. First, it allows more players to enter and compete in the wholesale roaming market (*direct access measure*). Second, it will force operators to unbundle roaming services from domestic offers by 2014 (*separate sale measure*). Moreover, the EC (2013) recently proposed an additional structural measure in terms of the elimination of roaming charges by 2016 (*single market measure*). According to Kroes (2013), this measure aims to bring down the borders and reduce unnecessary fragmentation to unlock economies of scale in the European mobile telecommunication market. This represents a further step towards the creation of a single telecommunications services market, one of the main objectives of the Digital Agenda for Europe initiative of the EC, part of the Europe 2020 Strategy (EC, 2010). Nevertheless, it remains unclear whether these three structural measures will ultimately result in more competition and, thus, in increased social welfare.

Analytical approaches that analyze the impact of regulatory measures in the mobile communication market on competition or welfare are surprisingly rare in academic literature. Just Lupi and Manenti (2009) and Ambjørnsen et al. (2011) analyze price-cap regulation and found that this measure is not sufficient to achieve a competitive international roaming market. A thorough analytical analysis of the three structural measures proposed by the EC is missing so far and is considered as an underexplored area of research (Jakopin 2008). Accordingly, our research aims to answer the following question: *What are the economic effects to be expected from the structural measures that were introduced by the EC on the data roaming market?*

¹ For instance, automotive manufacturers use mobile networks to receive performance data and data about driving behavior from their sold cars. These data are used to deliver innovative value added services (Levine, 2013).

² Compared to voice roaming services, mobile data roaming services are independent from the mobile phone number (Black and Lewin, 2011), have more substitutes (e.g., WiFi or local prepaid cards), and are often less sensitive to delays (e.g., emails, messaging, apps).

³ Wholesale prices are the negotiated prices per megabyte between the mobile network operator seeking roaming access (access seeker) and the mobile network operator providing international roaming access (roaming provider). The access seeker charges its customers by the retail price when they use the network of the roaming provider. The retail price is based on the wholesale price plus the margin of the access seeker.

For our analysis we draw on existing research from IS, telecommunications and regulation domains and propose the development of an analytical model in this research-in-progress paper. With this analytical model we aim to rigorously evaluate the three structural measures proposed by the EC in terms of their impact on competition, wholesale and retail prices, mobile network operators' investments in network infrastructure, and ultimately social welfare. We start with an analysis of the separate sale measure building on the profit maximization model for two bundled products of McAfee et al. (1989).

With this research, we aim to make recommendations for policy makers as early as possible if it turns out that there is still some need for action beyond the already proposed regulatory measures. Moreover, we aim to contribute to the general understanding of market imperfections caused by bundled goods as well as by collusion.

2 Status Quo in Data Roaming

In the following section, we describe the structure of the European data roaming market and the reasons for low competition before regulation 531/2012 as well as the structural measures proposed by the EC. Based on this information, we discuss the existing analytical work that approaches the competition within the mobile roaming market.

2.1 Structure of the EU Data Roaming Market before Regulation 531/2012

Mobile data services can be provided either by mobile network operators (MNOs), i.e., operators that own the network (infrastructure and radio spectrum) and provide the full range of mobile services (voice, text, and data) to their customers, or mobile virtual network operators (MVNOs) that “provide mobile communications services without having their own radio spectrum” (Dewenter and Haucap, 2006). MVNOs usually contract mobile services from MNOs and resell them on niches (BEUC, 2011) under various offers (e.g., targeting specific client groups, such as young or older people with discounted offers).

Mobile data roaming refers to a situation where private or business customers use mobile data services while they are outside the geographical coverage area provided by their home telecommunication service provider (home MNO or home MVNO) (GSMA, 2012b). In this case, they cannot use the infrastructure of their home M(V)NO but must make use of the infrastructure of the visited MNO. To use this infrastructure, customers pay the mobile data roaming retail price to their home M(V)NO.

On the wholesale level of the data roaming market, home MNOs interact and collaborate with visited MNOs. If customers of the home MNO aim to use data roaming services on the network of a visited MNO, the data traffic produced is passed by the visited MNO via international data transit to and from their home MNO, which in turn connects the customers to the Internet (GSMA, 2012b). In order to offer roaming services, home MNOs have to negotiate international roaming agreements with visited MNOs from every country where they want to offer their mobile roaming services. An international roaming agreement includes negotiating the wholesale price per megabyte of data traffic charged by the visited MNO. This price is based on the inter operator tariff that is unilateral and nondiscriminatory and is set by the MNO and charged to all of its international roaming partners. Based on specific situations, e.g., traffic balancing between the MNOs, visited MNOs may offer discount rates on the inter operator tariff. MVNOs are not allowed to negotiate international roaming agreements directly with the visited MNOs. Thus, they can offer roaming services only through the home MNO. Therefore, they have to negotiate a domestic roaming agreement including a price to have access to the home MNOs' international roaming agreements. Consequently, the total wholesale price of an MVNO for data roaming is the sum of the access price negotiated in the domestic wholesale agreement and the wholesale price negotiated in the international roaming agreement. Figure 1 shows the structure of the mobile roaming market and the interactions between customers,

roaming providers (visited MNOs) and access seekers (home MNOs or home MVNOs) before the regulation 531/2012 came into effect.

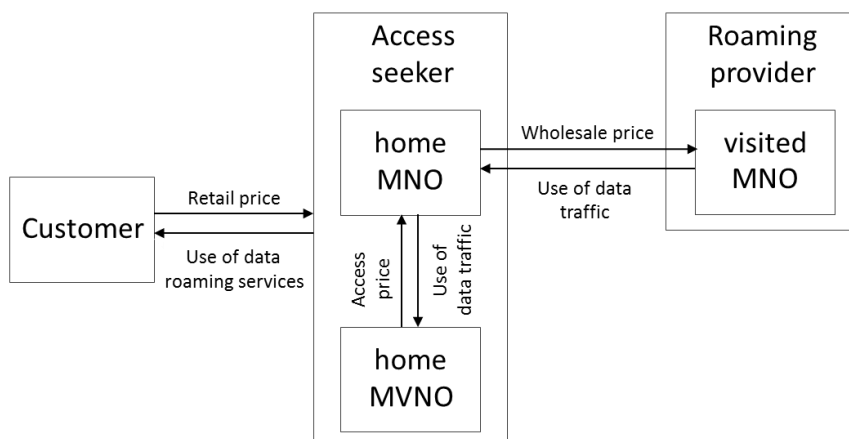


Figure 1. Data roaming market structure before the 2012 regulation

2.2 Competition in the EU Data Roaming Market before Regulation 531/2012

The roaming market in Europe is characterized by low competition (OECD, 2010, 2011; WTO, 2011; EC, 2011, 2012; Infante and Vallejo, 2012; Kroes, 2012) and data roaming prices on the wholesale and retail level that are well above cost-based prices (Falch, 2012). The reasons for this situation can be summarized as follows (cf. Infante and Vallejo, 2012):

First, home MNOs cannot perfectly steer their traffic to the visited MNO that provides the lowest wholesale price. Although the evolution of steering techniques has enabled home MNOs to direct a high share of traffic to their preferred visited MNO (cf. Salsas and Koboldt, 2004) the customer can still be automatically directed to a non-preferred visited network in regions with no network coverage of the preferred visited MNO and users can still manually change the visited network. Thus, better steering techniques do not necessarily translate into more price competition on the wholesale level as long as there is no perfect control on traffic flow (cf. Lupi and Manenti, 2009). Second, MNOs tend to internalize traffic inside groups such as Vodafone, Orange, or T-Mobile that provide mobile services in multiple European countries. For example, the data roaming traffic that was managed by visited MNOs that are part of the same group as the home MNO was 58% in 2009 (BEREC, 2010). Moreover, MNOs are actively balancing roaming in and roaming out traffic with other players. Thus, home MNOs make their roaming agreements not only based on price, coverage, and quality of service, but also based on the revenues to be obtained from their counterparts. As a consequence, the wholesale price for intra-group and balanced traffic is notional and does not necessarily reflect real costs. This creates important incentives for large MNOs to collude and hold the wholesale prices high and make international roaming agreements based on reciprocal price conditions, instead of opting for lower prices offered by small MNOs, which can only offer low volumes of outbound traffic (Shortall, 2010). Third, home MVNOs have to provide their roaming services via the network of the home MNOs. As the access prices negotiated in domestic roaming agreements have not yet been regulated by the EC it is hard for the home MVNOs to compete with home MNOs on the retail level.

One of the most important issues in international roaming regulation remains the question of whether wholesale regulation alone would be enough to let market actors efficiently compete at the retail level. This does not seem to hold true for the data roaming market, as it cannot be solely imputed to the imperfect functioning of wholesale roaming markets. Relevant competition problems remain at the retail level itself, and there is no evidence that the evolution of the wholesale market per se, in the absence of retail regulation, will result in an increase of competition at this level (Infante and Vallejo,

2012). It is supposed that one of the main reasons for low competition and high data roaming prices on the retail level is the fact that roaming services are bundled with domestic services (e.g. EC, 2011). As customers base their choice of their M(V)NO on domestic prices but seldom on roaming prices (Falch, 2012), there is little incentive for retail roaming price competition. Thus, M(V)NOs set monopolistic retail roaming prices as they have no incentive to compete on them (Lupi and Manenti, 2009). Based on this situation, the EC introduced different measures to regulate the wholesale and the retail market.

2.3 Regulation on the EU Data Roaming Market

The need for regulating the mobile roaming market in Europe was triggered in 2006 when alarming results emerged regarding the existing high prices for roaming services (EC, 2006). The EC reacted by introducing the first roaming regulation in 2007 with new price caps being applied to voice roaming services (EC, 2007). After the results were reviewed in 2008, the second roaming regulation was enacted in 2009. Besides further lowering price caps for retail and wholesale voice roaming services as well as for text messages, the new regulation introduced the first cap for the wholesale data roaming price with planned annual adjustments until the next revision, in 2012 (EC, 2009). The third regulation came into force on July 1st, 2012. The reasoning behind the new regulation was the fact that there was still a large difference between domestic and roaming prices (Regulation 531/2012; EC, 2012a). The regulation 531/2012 adopts a series of measures in terms of further adjusted price caps (including retail data roaming), new transparency and safeguard mechanisms for data roaming consumption, together with two new structural measures allowing more players to enter the market (article 3: *direct access measure*) and unbundling roaming services from domestic services (article 4: *separate sale measure*) that equally affect both voice and data roaming services. As the implementation of the price cap as well as the transparency and safeguard regulation have no substantial structural impact on the data roaming market, we focus on the two structural measures.

The direct access measure implies that MNOs will have to meet all reasonable requests for wholesale roaming access. This means that, aside from home MNOs, home MVNOs are also allowed to negotiate direct international roaming agreements with visited MNOs (direct wholesale roaming access; EC, 2012b) and home MNOs have to give access to their network to all MVNOs and other alternative roaming providers through domestic roaming agreements (wholesale roaming resale access; EC, 2012b). However, existing technology prevents a home MVNO to have a domestic roaming agreement with a home MNO and at the same time international roaming agreements with visited MNOs. This is due to the fact that given an existing domestic roaming agreement between home MVNO and home MNO, the home MVNO cannot steer the roaming traffic to a visited network of its preference as the traffic is already steered by the host MNO to its preferred visited network (BEREC, 2012). Hence, a MVNO has to decide whether it uses direct wholesale roaming access or wholesale roaming resale access.

The separate sale measure refers to the separation of domestic services and roaming services from the mobile services bundle. Hence, customers can choose a different provider (a so-called “Alternative Roaming Provider” (ARP)) for their roaming services besides their domestic mobile service provider. Based on the analysis of (BEREC, 2012), the EC enacted guidelines on how to implement this measure to unbundle domestic and roaming services (EC, 2012b). Specifically, it suggests two technical modalities that both may be implemented for the separation of roaming services from domestic services:

- **Single IMSI.** Under this modality, both the home MNO as well as the ARP share the same International Mobile Subscriber Identity (IMSI) code stored on the SIM card. The home MNO offers roaming services to the ARP based on a wholesale resale agreement. The ARP in turn resells the services at the retail level to its customers. This ensures that the traditional communications flow for international roaming between home MNO and visited MNO is maintained, while allowing to resale the retail roaming service by the ARP (BEREC, 2012). This situation is similar

to the relationship between the home MNO and home MVNO described in figure 1 except that roaming services can be offered separately. This modality is a pure resale solution (BEREC, 2012) where the home MNO is reselling all its wholesale roaming agreements in a package to the ARP.

- **Local Break Out (LBO).** LBO only refers to data roaming services that can be offered by visited MNOs and visited MVNOs (as voice roaming services are still dependent on the home M(V)NO). This is subject to commercial agreements between visited MNOs supporting LBO and visited MVNOs (BEREC, 2012). LBO consists of local data provision by the visited network, while maintaining provision of voice and text by the domestic provider (BEREC, 2012). When customers enter a visited country, their phone will automatically choose the visited MNO preferred by the home MNO (with whom the home MNO has an international roaming agreement). However, with LBO in force, customers can additionally – and regardless of existing international roaming agreements under the Single IMSI modality (see above) – choose a different LBO provider for their data roaming services. In this case, customers will be directly charged by the LBO provider. However, voice and text roaming services can only be used in the LBO network if an international roaming agreement with the home MNO already exists. LBO data roaming services can be offered temporarily or on a permanent basis.

These two structural measures were enacted to increase competition in the mobile roaming market both on the wholesale level (*direct access measure*) and retail level (*separate sale measure*). Moreover, the EC published a new proposal in September 2013 (EC, 2013a) that seeks to facilitate the market entry, incentivize investments, and eliminate the roaming charges by 2016 across Europe (*single market measure*). Specifically, the EC enables the operators to get a single authorization for operating in all EU member countries instead of individual authorizations for each country. With this measure the EC aims to “ensure that access seekers have truly equivalent access to (visited) networks” (EC, 2013b) and argues that the wholesale prices will be driven by the market rather than by the regulation (supports the direct access measure). If the access seeker is capable of reaching a roaming agreement with at least one visited MNO in each EU member country, then access seekers can offer domestic rates across the EU and the customers can “roam like a local” in the visited countries. In this case the access seeker is not forced to decouple its domestic services and roaming services. Otherwise, the access seeker has to allow its customers to choose another roaming provider (*separate sale measure*). The EC rounds up the proposal by harmonizing the consumer rights and proposing a more coordinated way of assigning spectrum rights across the EU.

2.4 Relevant Literature

There is a huge body of literature on the mobile telecommunication market in general. For instance, Niculescu and Whang (2012) empirically explore the parallel market evolution of mobile voice and data services on the Japanese mobile telecommunication market. Fuentelsaz et al. (2012) address the European mobile telecommunication market and empirically analyze the joint effect of switching costs and network effects in determining the level of competition. Valletti (2003) analyzes the incentives for domestic roaming in general where an operator wants roaming rights on a domestic rival’s network. Fabrizi and Wertlen (2008) and Stuehmeier (2012) also address the domestic roaming market but focus on data roaming in terms of network sharing where MVNOs use the 3G and 4G network of MNOs. They take the perspective of MNOs and present models to study their incentives to invest in their mobile network facilities under various regimes of domestic data roaming price regulation. International roaming of mobile services is primarily addressed in the academic literature in a descriptive way (see, e.g., Jakopin, 2008 for an overview) where mainly a qualitative description of the market structure and regulatory measures is provided (e.g., Sutherland, 2001; Sutherland, 2008; Falch et al., 2009; Shortall, 2010; Falch, 2012; Infante and Vallejo, 2012). Formal analyses on the market performance are surprisingly rare but – at the same time – considered as an underexplored area

of research (Jakopin 2008) and highly important in order to evaluate the new regulatory obligations (Ambjørnsen et al. 2011).

To the best of our knowledge, the first scholars to study the international mobile roaming market with an analytical model were Salsas and Koboldt (2004). They analyze wholesale international roaming within a duopoly framework in two countries. The main focus is on the economic effects of cross-border mergers and the ability to steer roaming traffic. They find that cross-border mergers do not necessarily increase competitive pressure on roaming prices but their model predicts that traffic steering will introduce price competition between visited MNOs. Lupi and Manenti (2009) extend the model of Salsas and Koboldt (2004) as they could not observe more competition at the wholesale level although traffic steering techniques were advanced substantially. They show that, unless these techniques do not allow for perfect control of traffic flows, traffic steering does not substantially improve the efficiency of the market. Moreover, they find that a simple price-cap mechanism adopted by the EC may restore partial efficiency of the wholesale market. Ambjørnsen et al. (2011) also analyze the impact of price-cap regulation on retail and wholesale price structures and rent-seeking behavior. They find that price-cap regulation may increase unconstrained wholesale prices and rent-seeking incentives. Another analytical model is proposed by Hoernig (2011). He presents a setup of a generic roaming market model for the determination of unregulated retail and wholesale roaming prices.

Summing up, few formal economic analyses of the mobile roaming market exist in the literature. Lupi and Manenti (2009) and Ambjørnsen et al. (2011) already analyzed price-cap regulation and found that this measure is not sufficient to achieve a competitive international roaming market. Moreover, the existing literature mostly addresses roaming in general not focusing on specifics of the data roaming market (e.g. LBO is just relevant for data roaming). A thorough analytical analysis of the three structural measures (separate sale, direct access, and single market) in terms of their impact on the data roaming market (competition, wholesale and retail prices, mobile network operators' investments in network infrastructure, and ultimately social welfare) is missing so far.

3 Research Plan and Conclusion

Our research aims to contribute to the existing literature on the regulation of mobile telecommunication markets by formally analyzing the effects of the three structural measures (separate sale, direct access, and single market) on the mobile data roaming market. As a basis for this formal analysis, we plan to develop analytical models to address each of the structural measures. In a first step and extending this research in progress contribution, we plan to build the model for the retail level (separate sale measure).

Apparently, the retail level is characterized by high retail prices for data roaming services caused by the virtually non-existent competition due to the bundling of domestic and roaming services and efforts made by MNOs to hide roaming prices. Here, we want to analyze how the separate sale measure (single IMSI and LBO) to unbundle mobile roaming services from domestic services (article 4 of regulation 531/2012) affects retail prices for both services. Our model for the retail level will be based on the earlier work done by Hoernig (2011). In his model, operators sell domestic and roaming services in a bundle. When consumers choose their operator for domestic services, they weight their surplus related to roaming services with a scale factor $\gamma \in [0,1]$, which could be interpreted as their ex-ante relative importance of these prices or as the probability that customers are aware of retail roaming prices. Obviously, if consumers are not aware of these prices, they do not fully incorporate them in their decision when deciding for a contract – comprising both domestic and roaming services – offered by a specific MNO. This may ultimately limit price competition for data roaming services. To analyze how MNOs set their prices before regulation 531/2012 for (bundled) domestic and roaming services, we assume that the market for domestic services is competitive and, due to the bundling and the limited customer awareness for roaming prices, the market for roaming services offers the potential to

set monopoly prices. In this setting, MNOs have the opportunity to subsidize one service using the potential profits made with the other service. Consequently, the optimal prices for roaming and domestic services as well as the potential price subsidy result from a profit maximization calculus of an MNO providing two products (see, e.g., McAfee et al. 1989 for a bundling model with two products without subsidy). In a second step, we incorporate the separate sale measure in our model assuming a competitive market for roaming services. Using profit maximization calculus based on this modified assumption, we again determine the optimal prices and the optimal price subsidy. We expect that this analysis results in lower prices for data roaming services (due to intensified competition). In addition, it may turn out that domestic prices increase in case there was a subsidy of domestic services that is now discontinued. Hence, it is unclear whether the separate sale measure truly contributes to an increase in social welfare.

Subsequent work will address the direct access measure. The wholesale level is characterized by a relatively small number of MNOs (2-5 per EU country; Infante and Vallejo, 2012) and substantial collusion opportunities caused by traffic balancing between operators and traffic internalization within operator groups. Thus, we plan to analyze the effect of the direct access measure (article 3 of regulation 531/2012) on collusion opportunities and competition among operators and, thereby, on the wholesale price level. Therefore, we take the wholesale level as an oligopolistic market with price collusion (cf., e.g., Tirole, 1992) among operators considering the fact that an MNO can take both roles of access seeker and of roaming provider. Furthermore, we aim to analyze the welfare effects of the single market measure on both, the retail and the wholesale level. The intention of this measure is first and foremost to increase consumer surplus by adjusting retail prices for data roaming to the domestic prices, which are substantially lower (EC, 2011; GSMA, 2011; ITU, 2013). However, it remains unclear whether the implementation of this measure increases consumer surplus. While it is apparent that, *ceteris paribus*, lower roaming prices positively affect consumer welfare, for instance, the BITKOM argues that the elimination of roaming charges leads to an increase of domestic prices and a decrease of subsidies for smartphones and tablets (BITKOM, 2013). Moreover, this measure could have a negative effect on investment in mobile networks (Fontanella-Khan and Thomas, 2013).

With this research, we hope to be able to provide a rigorous assessment of the structural measures proposed by the EC and valuable indications for potential further regulations on the mobile data roaming market. We also aim to contribute to the general understanding of market imperfections caused by bundled goods as well as market imperfections caused by collusion in settings where transaction partners act as provider and consumer at the same time. The analytical models – proposed in this paper – to analyze regulatory measures that have already been imposed is just a first step of a more comprehensive research plan. First, we aim to empirically validate our results based on the prices as well as the market structure that can be observed on the data roaming market in the upcoming years. Moreover, we plan to take the normative view of economic regulation in further research and propose policies for correcting potentially remaining market imperfections on the data roaming market after the structural measures come into effect.

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