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TELECOMMUNICATION SECTOR REGULATORY CHALLENGES IN BOSNIA AND HERZEGOVINA

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Abstract

Much anticipated privatization of the two remaining incumbent telecom operators in Bosnia will create a new dynamic and changing environment for all participants in this sector, especially for potential investors that are trying to find the right approach and a competitive market niche. The intention of this paper is to provide an overview of regulatory developments in the telecommunication sector over the past two decades, major challenges, accomplishments, and the role played by State Communication Regulatory Agency (CRA). The research includes the analyses of adopted Sector Policies, the Telecommunication Law itself, as well as the rules and major decisions issued by CRA. Through a countrywide survey and multinomial logit estimation of consumer's selection between the two largest mobile carriers, as well as in-depth interviews with the sector participants and CRA – we provided consumers' and participants' opinions of the sector development, achievements, challenging issues, and major stepping stones. Asserting its role as an independent regulatory authority and despite unprecedented political difficulties, the CRA has managed to complete the overall process of sector liberalization. It has done so mostly by utilizing an ex-ante form of regulation and proactively addressing critical areas for the sector development. But, market conditions are constantly changing and the demand for ex-post regulation will bring new challenges for regulatory authorities. The privatization of remaining incumbent carriers, making the maximum use of local-loop unbundling and open network provision, is only one of them. Also, securing the balanced infrastructure development and ensuring that the overall social welfare gains are equally distributed throughout the country will present new and evermore challenging questions for country telecommunication regulatory authorities.

***Keywords**: Telecommunications, regulatory authorities, multinomial logit, Bosnia.*

***JEL Codes:** L11, L51, L96.*

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1. **INTRODUCTION**

Information technologies have become an essential part of how economies function, while the telecommunication sector has become an unprecedented source of opportunities for economic growth and development. In recent years, exponential growth of mobile data services, as well as the overwhelming role of the Internet in everyday life, has placed additional pressure and difficult challenges for the sector overall regulation. With increased consumer expectations and additional pressure on telecom operators to provide a wide range of services at diminishing prices, the regulatory bodies are struggling to understand best ways forward in securing optimal social welfare output, while maintaining sector competitiveness and overall development (Krämer and Schnurr, 2015). Making this process more difficult is the fact that telecommunication as such is indisputably a network industry, i.e. it is a market that functions in a different manner than conventional commodity or service markets. The economic characteristics of network industries inherently have an inevitable danger of market domination of one or several companies – with all resulting in negative effects. This, in turn, provides a strong justification for different forms of sector regulation directly targeting and preventing market dominance. The information asymmetry between the operators and the regulatory bodies greatly prevents establishing optimal prices and fair market conditions, and the regulator has the difficult task to establish a balance between stimulating the operators' to reduce cost and the concerns regarding the distribution of profit gained from cutting costs (Basaran et al., 2014; Confraria et al., 2016), or ultimately, relying on the market to regulate itself over time.

Moreover, the regulation of network markets as such faces a number of challenging issues. Economies of scale are just one of them. The regulator must make sure that all operators are able to achieve economic volume necessary to minimize cost. In other words, a newcomer to the market will not be able to estimate all effects of its entry, which could result in an increase in average cost and ultimately increase in prices for consumers. Also, one of the key characteristics of network industries is the existence of network effects whereas the greater the number of people are using product or service it becomes more valuable for all the consumer using it (Rohlfs, 1974; 2003; Katz and Shapiro, 1994; Arthur, 1990, 1996; Economides, 1996; Birke, 2009). Often, the success of certain products/services in network industries cannot be attributed to superior technology or better solutions, but to compatibility with other products and/or the overall size of their networks. Clearly, this involves new market dynamics, both for the network users (consumers) deciding to join a network and for companies/providers (Goolsbee and Klenow, 2002; Banerji and Dutta, 2005; Duan and Chen, 2007; Birke and Swan, 2006; Karacuka et al., 2011; Srinuan et al., 2012a; Zaimovic, 2015). In deciding to join a network, consumers will often consider network future size, which provides companies with a motivation to invest in growing their network first and to maximize profit later – substituting short-term profits for long-term success and in some cases *de facto* monopoly (Economides, 1994; Garud *et al.*, 2003). Also, in recent years we have seen a trend that in network selection consumers often place more emphases on social network ties, like family, friend or colleagues, than on service-price or overall size of the operator (Suarez, 2005; Karacuka et al., 2013; Basaran et al., 2014). Once the network has been established, markets favor the leading product at the expense of others, with what is often a strong lock-in effect, as well as giving rise to significant problems of standardization and interoperability (Farrell and Saloner, 1985, 1986, 1992; Katz and Shapiro, 1994, Gruber and Verboven 2001).

In the developing countries like Bosnia and Herzegovina (henceforth, B&H), all this is further perplexed by overall weakness of government' regulatory authority and the lack of coherent sectoral strategy. As the rapid growth of a variety of telecommunication services and products becomes an indispensable part of our everyday life and evermore influencing role of mobile devices and the Internet technology in changing the way how we live/work; the sector regulation becomes that much more important (Barth and Heimeshoff, 2014). But, different regulatory practices have a different impact on consumers. For example, asymmetric access price regulation can increase consumer surplus (Peitz,

2005), or regulatory practices that stimulate/force effective sector competition will lead to consumers gains (Boylaud and Nicoletti, 2001). Furthermore, government' misunderstanding of different and often conflicting issues related to the regulation of state-owned telecommunication operators and their role in sector liberalization, can result in partial and(or) uneven service development (mobile/Internet vs. landline, bundled services, etc.), weak overall social welfare effects, as well as hindered overall sector development. In all, the role of independent sector regulator becomes essential as telecommunication industry is often a critical element in the overall national economic development (Yang et al., 2013; Kaur & Malhotra, 2014; Zaimovic & Avdic, 2014).

In this paper we will look at the at overall telecommunication regulatory framework, effects of mandatory interconnection, local-loop unbundling, regulatory practices (*ex-ante* vs. *ex-post*), as well as the introduction of number portability[1] – as some of the critical aspects of the telecommunication sector development from the establishment of the independent Communication Regulatory Agency (henceforth, CRA). Also, we will be looking at how different regulatory practices, their timing, content, implementation mechanism, etc. have impacted consumers' benefits as well as the market position of the sector participants. Furthermore, through the assessment of public opinion survey we will be looking at the influence of contemporary network effects in consumer's selection of mobile carriers and through in-depth interviews with key sector participants the status and challenges of Bosnia telecommunication sector.

In presented results, although we do find some of the contemporary network effect to be significant in the mobile carrier market, the values associated with the variable that codes ethnicity underscores the importance of ethnic identification in the choice of carrier and overwhelms standard networking effects in terms of magnitude. Control for ethnic diversity, as well as some other post-conflict determinants (e.g. the war (e)migrant status, international migration experience, including some interaction effects), is extremely important in today's ever-changing world. Understanding the ethnic, national or racial dimension in service/product selection in today's social context should receive more attention. In the last decade, we have seen a number of incumbent telecom operators in EU making investments in rebranding and market re-profiling, shifting away from their initial image and names to more "generic one". Assessing possible changes in consumers' carrier choice provided that they are familiarized with operator history and pre-rebranding title might provide an interesting new perspective on consumers' carrier decisions and on regulatory bodies position and practices overall. Although limited to BiH context, the presented findings provide an additional contribution to this important research area.

2. NETWORK EXTERNALITIES IN TELECOMMUNICATION

A major characteristic of telecommunication is the existence of network externalities for consumers. Network externalities, as such, have a significant impact on competition among telecommunication networks and represent the basis for a series of regulatory provisions that, among other, prescribe mandatory network interconnection as a licensing requirement (Brennan, 2009; Gasmi and Virto, 2010). Consumers prefer subscribing to a large, rather than a small network, since the former offers a higher value in the sense of the number of people they could reach, resulting in large network becoming even bigger and more attractive to future consumers in comparison to smaller networks (Kim and Kwon, 2003). The dominance of a single network due to market externalities represents a serious threat to the overall competitiveness of the sector (Blonski, 2002; Shy, 2003; Trifunovic et al, 2015) because the dominant network is able to sustain much higher prices of its services without the fear of losing its market share. To avert this, mandatory interconnection ensures that a consumer subscribing to any network will have access to consumers from all other networks, thus eliminating to a certain degree the

[1] Number portability is defined as the ability to keep the same phone number while changing service providers/carriers.

potentially negative role of network externalities. Still, ensuring mandatory network interconnection is no guarantee of fair competition, and often presents a major issue for the regulator. In a system of interconnected telecommunication networks, it is assumed that the ratio of calls to subscribers of a network is comparable to the network's market share. The fact that the majority of calls from small networks (small private telecom operators) are directed towards the dominant network enables the dominant network to affect the call quality and prices of small networks through its interconnection strategy (Basaran et al., 2014). The dominant company may raise the average call price for small networks by charging high prices for calls termination towards their subscribers (Sobolewski and Czajkowsi, 2012). Or, the dominant operator may increase the cost of interconnection by requiring that the small operators invest in expensive equipment to ensure "technical compatibility", they may also degrade the quality of interconnection thus degrading the quality of calls made from small networks. Increasing call prices and decreasing quality will lead to subscribers shifting to the dominant network rather than to smaller/alternative[2] networks because of lower prices, which in turn will strengthen market domination (Hrivnak and Križanova, 2006; Srinuan et al., 2012).

There are, however, real differences between the cost of call termination price within a network and to other networks. This difference allows operators to charge subscribers with a different retail price for calls to other subscribers within their networks and for calls to subscribers of other networks. The price difference may be a benefit of the dominant operator's position, just as the discriminatory interconnection pricing. If the new user expects to have a balanced calling pattern, they will then prefer the dominant operator, considering that the majority of calls will be directed at other subscribers of the dominant provider, i.e. the majority of calls will remain within the same network (Birke and Swann, 2010; Srinuan et al., 2014). Non-market interconnection pricing, however, leads to poor social welfare effects (Economides and White, 1995; Vogelsang, 2003), as well as to a universal increase of call price substantially above cost in the event that all operators apply the same strategy. In turn, the sector liberalization and regulation greatly remove the possibility for the dominant operator to charge exaggerated traffic rates.

Furthermore, in the context of full market liberalization and development, local loop unbundling becomes crucial milestone (Kongaut and Bohlin, 2014; Garrone and Zaccagnino 2015). The ability to access existing infrastructure of incumbent operators in providing service is prerequisites for competition in the area of broadband communication and is one of the most complex issues of telecommunication sector liberalization. Local loop unbundling surely represents a decisive step towards sector competitiveness carried out by the regulator and it is difficult to expect comprehensive results and complete effectuation of network externalities within the telecommunication sector without a strong role of the regulator in the process (Economides, 2003; Krämer and Schnurr, 2015).

Finally, from costumers' perspective, the lock-in effect and the switching cost are the two most prominent issues related to network effects in telecommunications. The telephone number represents a basic identification in terms of telecommunication networks. For the majority of users, and especially for business users/companies, the telephone number is a major identification mechanism and losing it may present a serious blow to their overall competitive position – this, in combination with established social network ties, often lead to users reluctantly to change operator (Weitzel et al., 2006; Huang 2010; Karacuka *et al.*, 2013; Basaran et al., 2014; Zaimovic, 2015). Hodge and Weeks (2006) find the number change to be highest switching cost for a company in the telecom industry, and as a common cause for users to be locked in a network. The other reason for high switching cost can be found in complex and often expensive administrative procedures, followed by an additional

[2] Term "alternative" refers to small privately owned emerging telecom operators.

cost of call termination, as well as the inability to use a device (e.g. a precoded mobile phone) in the competitive carrier network.

3. ECONOMICS OF TELECOMMUNICATION REGULATION

Economic characteristics of the telecommunication sector are construed by operators powerful enough to change the market equilibrium. One of the principal goals of independent regulation is to prevent the dominant operator to abuse its market power in order to protect the overall social welfare (Bauer, 2010). Example of this practice is retail price-cap regulation, aimed at preventing the monopolist company/operator from increasing its prices to a level that would be harmful to consumers. Economides (2006) notes that positive network effect will lead to the creation of *de facto* "natural monopolies" and emphasizes the need for a proper regulation of network industries in general.

Price regulation in the area of tariffs and interconnection fees should be preventive. The regulator should apply an *ex-ante* set of rules the intent of which is to limit the power of the monopolist company/dominant operator in setting prices in order to provide for socially optimal results. As opposed to *ex-ante* regulation, the regulatory body can intervene only after the abuse occurred, and such an intervention is usually carried only with sufficient evidence to prove abuse. There has been a lot of discussion about the suitability of *ex-post* as opposed to *ex-ante* regulation in the sector of telecommunication, as well as discussion about who should be in charge of regulating competition in the sector (Bergman et al., 1998; Coen and Thatcher, 2008). Still *ex-ante* regulatory approach leads to wider roll-out and less frequent duplication of investments (Inderst and Peitz, 2012). Determining the optimal combination of *ex-ante* and *ex-post* regulation represents a major challenge in managing the sector liberalization process. This requires a significant shift in the overall relationship of policy-makers, the sector regulator and the existing operators (Zaimovic et al., 2015). In most transition countries, the process of liberalization began with the regulation and establishing the control over the existing monopolist structure, continuing with improving and maintaining effective competition, i.e. regulating the existing disproportion between the dominant and alternative operators (Parker and Kirkpatrick, 2005; Bauer 2010). In one of the early papers, Bergman et al. (1998) state that the deregulation of telecom sector should follow three successive phases: (i) monopoly regulation, followed by (ii) monopoly and competition, and (iii) possibility/room for competition. Today, and especial since 2008 economic crises, many countries have reconsidered proactive state intervention even in highly liberalized and competitive markets (Huigen and Cave, 2008).

The successful mix of *ex-ante* and *ex-post* regulatory approach is to a great extent determined by the ever-present asymmetry between the regulator and sector participants. If the regulator has perfect information on the structure of service cost as well as service demand, then the price regulation of any kind could be defined is such a way to ensure the increase social welfare (Gaudin and Saavedra, 2014). At the same time, the regulator should set access prices, contingent on demand, which to some extent penalize the inefficient entrant (Vareda, 2010). Hodge and Weeks (2006) iterate several basic mechanisms and areas of *ex-ante* regulation: retail price regulation, the rate of return regulation, price cap regulation, profit-sharing regulation, and the regulation of interconnection price and access.

Retail price regulation includes a direct intervention in the amount of fees to be paid by users for a certain service and has been practically been abandoned (Sanderson, 2005). The price cap regulation is the most widely used form of the telecom sector regulation; here, the average yearly price increase is limited by the inflation rate (measured by the CPI) subtracted by the productivity factor, which is determined by the regulator itself in this form of regulation (Sappington, 2006). This means that the higher the productivity factor, the lower the average price increase. Vogelsang (2003) states that this

form of regulation, combined with the ECPR[3] regulation of interconnection prices, is to be applied solely in the markets with natural monopolies present; otherwise, the use of this form of regulation may damage the overall competitiveness of the telecommunication sector. Furthermore, profit-sharing regulation is a form of regulation ware the price cap is set to a level that will enable the operator to turn a certain, defined profit. In the event that the profit exceeds the set limit, the extra profit becomes the basis for the calculation and lowering of the price cap for the subsequent calculation period and vice versa.

A dynamic governance of interconnection price and access is also often used and form of sector regulation, and independently from the previously mentioned generic models of regulation, here the regulator can separately treat and employ a form of regulation of interconnection price and access to network infrastructure. There are several widespread forms of regulation of interconnection price and network access, namely: (i) backward-looking cost-based pricing, (ii) Long-run Incremental Costs – LRIC, and (iii) efficient component pricing. FL-LRIC (Forward looking long-run) represents one of the most widely-used models[4], and it is based on long-run monitoring of incremental costs of the operator (Neumann and Vogelsang, 2013). The LRIC methodology should include only those costs that are directly caused by the defined output increment. Increments should be defined in such a manner that the resulting data on incremental costs can serve their intended use, i.e. that results can be used in a manner that will show that the interconnection fee is cost-oriented. Therefore, it is necessary to define small enough increments, or sub-increments to provide for the calculation of LRIC data at the lowest level (such as basic network components, for example). Hodge and Weeks (2006) state that determining adequate increments represents the biggest constraint of the LRIC model, due to its technical demands, becomes too big a burden for the regulator. Furthermore, it carries with it the risk that, if not properly used, it can lead to rendering the operator unable to gain profit from interconnections (price-squeeze problem), which in turn brings another set of issues and difficulties for the dominant operator (Briglauer and Vogelsang, 2011).

Finally, the most complex model for interconnection pricing is the Efficient Component Pricing Rule (ECPR), which determines interconnection prices on the profit lost by the dominant operator for failing to provide the service, and enabling alternative operators – *de facto* competitors, to do so (Cave, 2013). Different authors have different approaches to the realistic interpretation and calculation of the ECPR. Armstrong (2006) for example notes that access price should include the cost of service provision plus loss of profit by the dominant operator caused by providing interconnection service. Many different analyses and sub-models of ERCP have been created for almost every telecom service, especially in the pricing of interconnection and access, international traffic termination and mobile traffic termination within an unbundled local loop (Economides, 1994; Vogelsang, 2003; Tardif and Taylor, 2003; Sanderson, 2005; Armstrong, 2006; Brennan, 2009, Gaudin and Saavedra, 2014; and many other). In all, regardless of the model selected, any price regulation needs to meet two requirements of the competition: (i) to enable both dominant and

[3] Efficient Component Pricing Rule

[4] In a series of directives and rules, the European Commission recommended that the LRIC model be employed by national regulators. It is especially important to emphasize the following: Directive 97/33/EC represents the legal and regulatory framework for the interconnection of telecommunication networks in the area of the European Union, based on the principles of providing universal services and interoperability by applying the principles of Open Network Provision – ONP. The Recommendation of the European Commission 98/195/EC on interconnection in a liberalized telecommunications market represents detailed instructions to national regulatory authorities (NRA) for the application of cost-oriented interconnection pricing. Directly related to the above-mentioned Recommendation is the Recommendation 98/195/EC on interconnection in a liberalized market. Two more recommendations followed that represent amendments to the above-mentioned recommendations on interconnection in a liberalized market, i.e. Recommendation 00/263/EC and Recommendation 02/175/EC. Furthermore, it is also important to mention the directives of the European Parliament and Council 2002/19/EC, 2002/20/EC, 2002/21/EC, and 2002/22/EC that directly treat the area of interconnection, electronic communication networks, and pertinent infrastructure.

alternative (newcomer) operators to compete for retail users under equal terms, and (ii) to ensure that both dominant and alternative operators may turn a profit.

4. TELECOMMUNICATION SECTOR REGULATORY FRAMEWORK IN BOSNIA: EVOLUTION AND STATUS

Bosnia war resulted in a divided society, largely institutionalized by the Dayton constitution (Efendic et al., 2011), and consequently influenced the telecommunication sector as well. As a consequence, the incumbent operators were initially organized following the ethnic lines established during the war. In 2001, the state-level Communication Regulatory Agency was established and thus far we have seen dramatic changes in both the dynamics and structure of sector development.

The telecommunications sector is regulated by the Law on Communications of Bosnia and Herzegovina[5] adopted in 2002, but also through Government defined Sector Policies and Communications Regulatory Agency Rules and Decisions[6]. In the context of defining a regulatory body, the existing Law in Chapter IX defines the mandate and responsibilities of the *Communications Regulatory Agency* as independent institution governing the telecommunication and electronic media. The Law defines that the communication within the framework of this Law includes telecommunications, radio, broadcasting (including cable television), and the services and resources in this regard. The Law specifies a mechanism of providing telecommunications services, obligations of operators in the field of operation and maintenance, the obligations of telecom operators that provide voice telephony services, as well as parameters and mechanism of issuing permits for different types of operators. The CRA is set as independent agency, dual or convergent type, and as a body responsible for broadcasting and telecommunications sector. Article 39 establishes also the Agency Council responsible for monitoring work of the CRA and to act as an appellate body for the Director General's decisions. Although the Agency reports to the Council of Ministers of BiH, in reality, their work is independent of the Council of Ministers, creating a rather unusual situation for the sector participants since they can only voice their objection on the regulatory decision to Agencies council and not to any other government body.

From 2000 to date, the Council of Ministers adopted four telecommunication Sector Policies (in 2000, 2002, 2006 and 2008). The first of the policies adopted in 2000 focused mainly on the "express" privatization of the sector with an aggressive approach to liberalization of landline services. This policy planned full liberalization of international services by 2005 and the issuance of licenses for four mobile operators by the end of 2002 without special fees for a license and only symbolic fee for the use of the frequency spectrum. Since the implementation of this policy ended in debacle, the Council of Ministers in March 2002 adopted a new one. Among other things, this second policy considered Universal Services and brought deadlines for *the liberalization of non-voice services (data transmission and Internet services) - 2002, domestic voice telephone service - 2002, and by the end of 2005 - international voice services*. This policy defined a reduction in the number of mobile operators from four to three and after a lengthy court process, the third GSM license was awarded to the company HT Mostar – the Croatian Telecom Mostar.

The third Telecommunications Policy (adopted in 2006) is perhaps the most interesting and certainly the most controversial. It was adopted after the elections by the out-going Council of Ministers in the form of amendments to the Policy and was intended to be a simple one-year extension of the 2002 Policy. This Policy mandated the CRA to determine the incumbent operators, define their relationship to other market participants, and set deadlines for perhaps the most important question

[5] Official Gazette of BiH No. 31/03 from 2003 and the amendments No. 75/06 from 2006
[6] All Rules, Decisions, as well as current Sector Policy and the Law on Communications of Bosnia and Herzegovina are available at State Communications Regulatory Agency website at: www.rak.ba

of sector liberalization – the Local Loop Unbundling. In addition, this Policy defined the method and schedule for number portability, the introduction of VoIP as the standard offer, and allowed (to the certain extent ordered) the CRA the overall tariff rebalancing. Perhaps the most important element of this Policy is the introduction of UMTS services with "arbitrarily" defined provision that the UMTS licenses will be automatically assigned to the existing operators without competition. This resulted with the Council of Ministers' decision in 2009 to award 3G/UMTS licenses to existing operators at a cost of 15 million euros for a period of 15 years, with the possibility of payments over a period of seven years and with two years grace period. Also, it required the introduction of cost-based accounting, but although this section mentions the need of harmonization with international regulations it does not mention any of EU directives relating to the calculation of interconnection services, nor any other parameters of landline telephony services.

The fourth and currently valid policy, adopted in 2008[7] was mostly focused at securing full competition in the telecommunications market, mostly through the continuation of regulated interconnection offers and local loop unbundling. In the domain of infrastructure and services Policy further defines the conditions for local loop unbundling specifying that *unbundling should be gradual in order to create conditions for increasing the use of broadband services and that the loop unbundling does not apply to newly built capacity in a two-year period*. In addition to the focus on LLU, the current sector Policy specifies that the price of interconnection must be *".... based on actual costs and reasonable gain ..."* which to some extent suggests the application of LRIC model, although it is not clearly specified. Furthermore, in the segment of service provision, it brings three novelties: *(i) ... all new services ... free of ex-ante regulation (ii) … stimulate the process of reselling services ... and obligations for incumbent operators to provide public offer for service wholesale; and (iii) allows bundling of services with the aim of an enriched offer and creating favorable service arrangements.* Finally, the Policy provides clear provisions for price rebalance and tasks' CRA to create a program of tariff rebalancing in landline services for the next three years as well as the establishment of cost-oriented prices (subsequent, Rule 40/2009[8] as well as Rule 67/2012[9]). By following guidelines set forward in Sector Policies and the Law, the CRA has defined steps/rules/decisions towards market liberalization which ware ultimately aligned with scope and timeframe of specific policy (Chapter V. Competition in the telecommunications market). Below is a short look at appropriate Rules/Decisions crucial for overall sector transformation.

The Law in the Article 15 defines perhaps the most important provision of the liberalization process; non-discriminatory access under comparable circumstances, i.e. *the same conditions and the same level of quality of services provided for new entrants as those provided for their own use or for the needs of associated companies*. Section of the Law concerning the minimum provision of leased lines is extremely weak and even today, despite a series of decisions by CRA, it is one of the most common areas of abuse by incumbent operators. On the other hand, Article 18, which defines the access and interconnection of public telecommunications networks, quite clearly establishes deadlines, the role of the Agency, the way and point of access to the network. Article 19 quite clearly and in detail defines the scope of the interconnection and access of alternative (small private) operators to the network of incumbent operator's allowing full and non-discriminatory access. To further ensure the development of this market segment, Agency adopted Rule 16/2002 which defines the content of reference interconnection offers and mandates that interconnection charges should be based on costs. Unfortunately, until today, the CRA has not selected the system of cost-based calculation of interconnection prices recommended by the EU in its directives. The Rule 16/2002[10] was created based on the Law from 1999 and needed to be revised after the new changes to the Law were adopted in 2010. The currently valid Rule that regulated interconnection

[7] Official Gazette of BiH No. 08/09 from 2009
[8] Official Gazette of BiH No. 22/09 from 2009
[9] Official Gazette of BiH No. 94/12 from 2012
[10] Official Gazette of BiH No. 36/02 from 2002

offers is Rule 51/2010[11]. By the end of 2016, the total number of interconnection agreements between service providers and incumbent operators was 13 (CRA, B&H Telecommunication Indicators for 2016).

The regulation of price-cap, i.e. business conditions and prices, is defined in Article 20 of the Law and since its establishment, the CRA, in rather traditional *ex-ante* manner, has intervened with a number of rulings and decisions. In 2002, the CRA regulated the question of internal roaming tariffing between incumbent operators in Bosnia and Herzegovina, and in 2007 gave a short supplement to this decision. Through the Rule 20/2003[12] the CRA for the first time established the upper price limit for certain services by incumbent operators. The decision was first revised in 2004, twice in 2005 with instructions for more favorable calculation of the Internet, then in 2006, and finally in 2009 when it provided tariff rebalancing and the upper limit of the price of particular services until 2012. The final decision provided a significant increase in the price of landline telephony, their alignment between household and enterprise tariffs, and at the same time decrease in prices of connection fee. In addition, it is important to note that section 20 of the Law clearly provides a different relationship of CRA with incumbent and alternative operators. Articles 21 and 22 provide a separate calculation of costs, regulate issues of subsidies, as well as the accounting for costs, and provide the Agency the right to access this information only for the incumbent operators. Currently valid Rule 67/2012[13] on Tariff Rebalance of voice telephone services brings a continuation of *ex-ante* regulation of the sector and direct intervention of the CRA in the domain of market and marginal prices – in some segments limiting marketing and services offered by incumbent operator.

Furthermore, by following guidelines of this one as well as earlier Polices, CRA prepared Rule 35/2008[14] on access to unbundled loops, and actively facilitated making Referent Unbundling Offer by incumbent operators. The rule defines in detail the ways to create a mechanism of negotiation and the obligation for the availability of technical capacity of incumbent operators. Additionally, this rule introduces the obligation of making a referent offers to access to unbundled local loops, standard provisions on equal access and transparency. Although the rule made these opportunities available in 2009, till today there have not been significant attempts by small operators to take advantage of LLU and the access to the infrastructure of incumbent operators was mostly used on few locations in major cities and large office buildings.

Chapter VI of the Law defines the parameters of addressing and numbering, and Article 27 defines the issue of number portability, operator selection, and pre-selection. In 2006 Agency introduced Decision on amendments to the Rules on Management of Numbering Plan of telephone services, enabling a choice of prefix for alternative operators. With the Rule 32/2008[15] and its amendment in December 2009, the number portability between operators is defined. This Rule is quite complicated with an externally established administrative database or repository of ported numbers. Revised Rule 62/2012[16], and its amendments[17], fully accessed problems of number portability (preserving same/existing phone number while changing operators) between different operators not depending on whether it is incumbent or alternative, as well as termination and tariffing methods. Following provisions of the Telecommunications Sector Policy, in 2012 CRA issued first licenses for operators of Mobile Virtual Network Operator (MVNO) with the accompanying Rule 73/2014[18] which regulated this area and defined the relationships between MVNO and the incumbent operators. To date, only two MVNO are providing various forms of assembly services and international traffic at very

[11] Official Gazette of BiH No. 109/10 from 2010
[12] Official Gazette of BiH No. 41/03 from 2003
[13] Official Gazette of BiH No. 94/12 from 2012
[14] Official Gazette of BiH No. 54/08 from 2008
[15] Official Gazette of BiH No. 20/08 from 2008 and No. 102/09 from 2009
[16] Official Gazette of BiH No. 85/12 from 2012
[17] Official Gazette of BiH No. 39/13 from 2013 and No. 94/15 from 2015
[18] Official Gazette of BiH No. 68/14 from 2014

favorable terms, and unlimited free calls within the network. Finally, it is important to mention that the CRA in 2013 adopted the Rule 69/2013[19] on the protection of end-users, which covered the provisions of Directive 2002/22/EC on universal service and users' rights in relation to electronic communications networks and services and amended Directive 2009/136/ EC.

Since its founding in 2001, the CRA enacted 80 Rules and 26 individual Decisions mostly ex-ante in their nature, and by following the frameworks set out by the sector policies, progressively liberalized and regulated the telecom sector. In the end, the local-loop is unbundled, both landline and mobile service are liberalized with three incumbent operators and number of alternative providers (most of them providing landline, cable TV and Internet service countrywide; and 4 providing limited mobile service), number portability is available, Internet Service Provision with all of its services as well as independent international interconnections is completely liberalized and services are provided by private ISPs, UTMS is licensed, and ex-ante price regulation is slowly fading out. Most of the consumer's services and bundled services are offered by most of the operators, and market competition has shifted away from core service provision to added-value services and overall customer relationship management.

5. METHODOLOGY AND DATA USED

Analysing the impact of the regulatory framework in any telecommunication market is always difficult. The methods of regulation are different, and each country has to be assessed individually. Although it is important to investigate individual regulatory practice and status within the country, the perception of sector participants – both operators and consumers should not be neglected. Different regulatory decisions and practices, their timing, content, implementation mechanism, etc. – have different impacts on consumers' benefits, as well as on profits and market share of sector participants. In order to have a more comprehensive look at regulatory framework impact, as well as key challenging areas, we have conducted twofold multiyear comprehensive research assessments closely looking at the market effects of mandatory interconnection, incumbent privatization, local-loop unbundling, regulatory practices *ex-ante* vs. *ex-post*, as well as the introduction of number portability.

On one side we conducted public opinion survey and analysed the determinants which affect the consumer's selection of mobile carriers in Bosnia and Herzegovina. Our choice of *"mobile carrier selection"* is predominantly based on the fact that mobile services have been liberalized since the introduction of CRA and mandatory services provision and coverage is part of license agreements for all incumbent operators. The research data relates to consumers' decision in selecting one of the three incumbent mobile operators. The survey sample was 2,500 individuals covering proportionally entities, regions, municipalities, ethnic groups, genders, as well as urban/rural areas in Bosnia and Herzegovina. We estimated our model using the multiple regression model applied to a binary dependent variable (Logit and Multinomial Logit). The dependent variable was the mobile carrier choice itself, while for control variables we used the 15-question survey[20]. However, as the most useful outcomes are obtained by calculating marginal changes in the model, the presented results are values of marginal effects after Multinomial Logit for the two direct market competitors (BH Telecom and Telecom Srpske).

In addition, with the intention of fully understanding market conditions and overall practical effects of regulatory activities, we conducted comprehensive semi-structured interviews with top managers of telecommunication operators in the country; including carriers with significant market

[19] Official Gazette of BiH No. 28/13 from 2013

[20] Initial model specification gender, age, education, region, etc. As none of these variables is significant at conventional levels and since the model diagnostics proved to be better when we exclude these variables from the model they are not used in the final specification (obtained results remain fully consistent in terms of statistical significance, estimated signs and even magnitudes).

power in telephony services (the 3 incumbent operators in accordance CRA decision) and existing licensed public telephone operators (i.e. alternative, small private operators). In 2014, there were 13 operators licensed to provide telephony services in country[21]. Furthermore, we also interviewed the representative of Telecommunications Section of the State Communications Regulatory Agency as the most relevant representative of the sector regulator[22]. All the interviews followed a set of pre-defined questions[23] and the findings presented are selected outlines of comprehensive research.

We estimate our model using binary Logit and Multinomial logit[24], and the dependent variable representing the selection of mobile carrier in BiH. Since our dependent variable has more than two values, our final estimation was done in Multinomial Logit Model. By calculating marginal changes, we avoided the problem of "over-interpretation" and provided more practical information. For the Multinomial Logit Model, the marginal change calculation is rather complicated (Wooldridge, 2006), and can be obtained through the following equation (Long and Freese, 2006).

$$MC = \frac{\partial \Pr(y = m|x)}{\partial x_k} = \Pr(y = m|x)\left\{ \hat{\beta}_{k,m|J} - \sum_{j=1}^{J} \hat{\beta}_{k,j|J} \Pr(y = j|x) \right\}$$

As our baseline results ware from the binary Logit estimates, and as part of the robustness analysis, we have also estimated models using binary Probit estimation, but the results did not differ with respect to the sign or significance of the estimated coefficients. Finally, by understanding the practical limitations, we will only present the focus findings for two largest mobile carriers and direct market competitors – BH Telecom and Telecom Srpske. The Multinomial Logit model estimations allow us to look at their mutual relationships and we begin by observing that the control variables associated with network effects in consumers' carrier selection.

Table 1: Model Diagnostic

	BH Telecom (*bhtel*)	Telekom Srpske (*ts*)
Number of obs.	= 1,519	= 1,519
Likelihood ratio test	chi2(17) = 1006.21 Prob > chi2 = 0.0000	chi2(17) = 1025.92 Prob > chi2 = 0.0000
Wald test	chi2(17) = 458.28 Prob > chi2 = 0.0000	chi2(17) = 480.10 Prob > chi2 = 0.0000
Hosmer-Lemeshow test	chi2(8) = 10.17 Prob > chi2 = 0.2531	chi2(8) = 9.80 Prob > chi2 = 0.2795

The model diagnostics, both the Likelihood ratio, as well as the Wald test, for all the models, reject the null hypothesis at the highest level of significance (p=0.000). We also performed the Hosmer-Lemeshow test which compares predicted probabilities from the model with the observed data (Long and Freese, 2006; Bierens, 2008) providing the simple measure of fit. The results do not reject the null hypothesis at any conventional level of significance, and the estimated models for all carriers do fit well. In the initial specification, we included standard demographic/individual variables, namely, variables controlling for gender, age, education, region, and urban/rural area. However, none of these variables is significant at conventional levels of statistical significance. Since

[21] CRA 2014 Annual Report. The interviews did not include companies that had been providing services for less than a year.
[22] Pre-defined questions that the CRA representative was asked were adapted adequately to ensure the neutrality of the regulator's position.
[23] The comprehensive semi-structured interview questionnaire had 25 discussion topics/questions.
[24] Logit and Multinomial logit baseline estimations are available on request.

the model diagnostics proved to be better when we exclude these variables from the model, they are not used in the final specification. It is important to note that the obtained results remain fully consistent in terms of statistical significance, estimated signs and even magnitudes.

6. RESEARCH FINDINGS

The following table provides a summary of the baseline results for the estimated models.

Table 2: The Baseline Multinomial Logit Model Results for Two Largest Mobile Carriers (Marginal Effects)

	BH Telecom (*bhtel*) y= .33466307		Telecom Srpske (*ts*) y= .49316423	
	dy/dx	P>|z|	dy/dx	P>|z|
price[25]	.0442027	0.586	-.0728978	0.397
freemin	.1024797	0.164	-.0924985	0.268
bundle	**-.1921439**	**0.002**	**.2346648**	**0.000**
family	.0399524	0.549	.0256129	0.731
colleagu	**.1167402**	**0.043**	**-.148841**	**0.015**
size	.0442618	0.316	-.0594259	0.205
residenc	-.0769178	0.380	.0066954	0.936
landline	**.1431478**	**0.001**	**-.0926455**	**0.049**
no_porta	**-.0926442**	**0.034**	**.1060856**	**0.024**
vas	**-.1171952**	**0.021**	**.1695419**	**0.001**
alt_oper	-.0509601	0.267	.0556614	0.264
quality	-.0929469	0.282	.0646659	0.466
new_tech	-.0795876	0.123	.0219989	0.684
crm	-.1089621	0.165	.1341904	0.102
Bosniacs	**.4624595**	**0.000**	**-.1542506**	**0.027**
Serbs	**-.4776173**	**0.000**	**.6835062**	**0.000**

Our findings identify several contemporary network effects as significant variables in estimated models, and the direct relations between the two competitors in immediately noticed. We start our discussion with the variable *bundle* which looks at the value of a service-package customization. Consumers are less likely (-19%) to select BH Telecom and more likely (23%) to opt for Telecom Srpske as their mobile carrier if they value a service-package customization.

On the other hand, the significance of variable *colleague* reveals consumers preferences of social ties in carrier selection. Contrary to previous findings, consumers are more likely (11%) to select BH Telecom as their carrier if they value social networking with colleagues from work, while for the case of Telecom Srpske this variable is significant but negative in sign (-15%) attributing lack of importance of social ties in the selection in the selection of Telecom Srpske. This to some extent suggests BH Telecoms' biggest competitor business strategy is directed toward aggressively pursuing users from the biggest carrier in the market. At the same time, a carrier with large user-base relies on the established network and existing consumers as a foundation of marketing and business activates.

We notice a similar difference in the variable *landline*. Assuming no change in the other parameters, there is 14% higher probability over competitor in selecting BiH Telecom as carrier if consumers value the link between mobile and landline. This actually could indicate the positions

[25] While some authors (e.g. Karacuka et al., 2013; Basaran et al., 2014) use minute-price in standard tariff plan or weighted prices according to respondent's call distribution, due to differences in exiting tariff plans offered by the carriers in BiH, as well as lack of data from CRA, we estimate the importance of price on consumer's carrier selection based on survey data.

where mobile carrier exploits the link with fixed telephony and to some extent locking-in customers to affordable and integrated service packages. It comes as no surprise that variable *no_porta* is also significant for two direct market competitors, but here with different signs. Consumers are less likely to select BH Telecom as their mobile carrier, if they value the ability to switch carrier without additional cost (*no_port*, -9%) while keeping their phone number. Contrary to BH Telecom, the obtained coefficient on the *no_porta* variable indicates that number portability and switching costs. Finally, we find higher probability (16%) for the consumers who value complementary products and value-added services to opt for Telecom Srpske as their carrier as opposed to BH Telecom (-11%).

Finally, understanding the Bosnia recent history we find it important to investigate dose ethnicity plays a role in consumes carrier selection. Although to some extent expected, the results suggest that ethnicity still plays an important role in consumers' decision making. In our models, the influence of respondent ethnicity[26] is significant at the highest level. It has very high marginal effects and negative signs for carriers considered to belong to "other ethnicity'" (i.e. not the respondent's ethnicity). In 48% cases, the Serbs are less likely to select BH Telecom as their mobile carrier (dominant in the majority Bosniak areas), similar to a 15% smaller probability that Bosniaks are likely to select Telecom Srpske as their carrier (dominant in majority Serb areas). Consequently, 46% of the Bosniaks and 68% of the Serbs will favor BH Telecom or Telecom Srpske respectively.

It is quite clear that there is a difference between customers choice for two largest mobile carriers in the country (according to CRA 2016 report their combined market share is 85.2%). It is less likely that the customers will choose BH Telecom is there base their choice on the mobile packages being offered, or on the ability to transfer their number, or value-added services. Although we can speculate to different reasons for these results, we have to take into account the fact is that BH Telecom covers predominantly urban areas; its customers have the highest educational profile; and as largest and more advanced carrier, customer expectations are more critical.

Looking at presented findings, we have seen the influence of a number of traditional variables for telecommunication sector in the Bosnia and Herzegovina market. Among important regulatory challenges mentioned in earlier sections, we have seen social networks, "landline link" locking-in customers to affordable and integrated service packages, and number portability beaning significant in Bosnia telecom market.

At the same time, despite the fact that mobile carriers have been providing countrywide service ethnic self-assessment and choice of the carrier are still closely linked. The majority of respondents still view the carriers as a manifestation of "ethnic categories" and are more inclined to choose or to stay with a mobile carrier perceived as "their own" while at the same time not ignoring more conventional network effects. This should be especially important for the country regulatory authorities – predominantly Communication Regulatory Agency, in future activities in promoting of the countrywide market and envisaged *ex-post* regulatory approach on telecommunication market.

Furthermore, to complement above presented research findings and to have more in-depth understating of telecommunication sector regulatory impact over the past decades, we have conducted comprehensive semi-structured interviews with top managers of telecommunication operators and in presenting results we have focused on five most challenging issues in regulating telecommunication market: (i) interconnection, (ii) the local loop unbundling, (iii) number portability, (iv) regulatory practices, *ex-ante* vs. *ex-post*, and finally (v) the overall role of regulatory authority.

In looking at interconnection conditions, referent interconnection offers (RIO), RIO pricing as well as call termination conditions and prices, as expected – the incumbent and alternative operators have different opinions. The overall position of managers was that the general provisions of RIO are

[26] The variable that codes ethnicity represents consumers' self-reported ethnicity.

satisfactory and only voiced complaint was related to a series of unnecessary and demanding equipment testing and requested level of "technical conditions". Unanimously, managers of small/alternative operators concluded that although RIO general provisions are cogent and provide sufficient space for overall liberalization process, at the same time, the restrictive application prevents the development of proper competition. In their view, the incumbent operators' see RIO as the mechanism to *"control"* and *"balance"* overall sector liberalization, and not as the framework which provides equal access and drives mutual development. The area in which opinions differ significantly is related to an unusual RIO provision defining that the contractual relation between dominant and alternative operators "on a commercial basis", leaving room for different interpretation and abuse. Often cited are the cases where incumbent operators unilaterally change or disregard RIO provisions. Although mandatory and voiced, there was no decisive reaction from the CRA. Finally, it's worth noting that there had been no true discussion or dialogue between different operators in the process of defining the RIO, and that the entire process was conducted solely by CRA.

Pursuing the discussion about network access the interviews ware continued with the group of questions dedicated to perhaps the most complex issue of sector liberalization – the local loop unbundling (LLU). Although only a few alternative operators have requested access to unbundled loop and did so for a relatively limited (targeted) capacity, the position of the majority of managers is that the contents and structure of the Rules 35/2008 that regulate the Referent Unbundling Offer (RUO) needs correction. Subtle barriers included in RUO; e.g. maximum daily connection set by the incumbent operator represents a typical impediment to service provision and a direct constraint in developing a viable business case. Also, the RUO provisions conditioning the access to LLU infrastructure only to offer the services already offered by the incumbent is directly contradicting main role and purpose of regulatory bodies in the development of the more competitive sector. This directly undermines the overall sector competitiveness, as well as scope and content of services offered by operators. By looking at our public opinion survey and estimated carrier selection model, we found that customer’s decision to select certain service provider is affected by the quality of service-package offered, as well as value-added services and complementary products. This additionally confirms that managers of alternative operators have justifiably recognized that "price-squeeze" and "subtle administrative barriers" defined by RIO and RUO represent a major competitiveness obstacle since they only serve in preventing service development and consumers needs alignment – as we have seen the two elements Bosnia consumer s' value in service provider selection. Additionally, important and rather restrictive provision of the RUO has to do with the inability to use newly set up incumbent operators' infrastructure for a three-year period. As a result, alternative operator manages by large agree that "strategically positioned" and often unnecessary infrastructure activates by incumbent operator serve as "hidden prevention" of LLU access in critical areas. In conclusion, although the local loop unbundling took place, it's difficult to see what effects will have on the development of the entire sector. In assessing respondents' answers, we can conclude that RUO prepared by CRA are to some extent viewed as obstacle than the framework for further sector development. In our discussions with the CRA representative, the prevalent position was that both RIO and RUO are the "best possible" arrangement at this time.

Shifting the discussion from infrastructure issues to number portability, we found rather antipode opinions. On one side we have managers who consider that number portability, combined with access to infrastructure, is the most important factor for the successful development of the sector. While on the other side, for some number portability will not influence the sector development and see this as more added service to be offered. The prevailing opinion is that the number portability will have the greatest effect in mobile telephony, considering that the competition in that sector is strongest and the sector is liberalized for a number of years. Furthermore, incumbent operators see the number portability, especially in mobile telephony, as equally a chance and a danger, placing only privately-owned incumbent operator (Telekom Srpske) in much more favourable position. Here too, our public opinion survey and carrier selection model confirmed that consumers are more likely to

select Telecom Srpske (as oppose to BH Telecom) as their carrier if they value the ability to switch carrier without additional cost while keeping their phone number. Although not in major percentages and not on the same level as other countries in the regional, this to some extent is complemented by core sector data published by State Communication Regulatory Agency (CRA, 2017) showing a steady rising trend over the years with 7% ported numbers in the landline telephony and 1.2% in mobile telephony in 2016.

In assessing *ex-ante* regulatory practices, we especially looked at "price cap" and overall price regulation. Answers here vary, and surprisingly the majority of alternative operators agree that set price cap did not have a significant effect on their development. Furthermore, for those operators that were among the first to be licensed it even had a reverse effect making it difficult to implement initial business cases. For most, the business case was focused mostly on value-added services and bundled service packages; their market niche was better "customer relationship". To some extent, the changing price-cap in combination with existing "price-squeeze" crated rather non-competitive environment for the small/alternative operators' making it difficult to implement setout business plan. Surely, the lowering of interconnection prices was welcome to alternative operators, but the majority agrees that CRA price regulation should have been done sooner and still leaves extremely narrow price margins. All managers commented pricing of mobile call termination as an example of narrow price margin. For most, the regulatory agency did a satisfactory job rebalancing the voice service prices, as well as setting the price cap for conduit lease. The *ex-ante* interventions directly contributed to the overall competitiveness and development of the sector. Also, a majority of managers pointed out that *ex-ante* decisions of CRA worked quite well in the initial process of network expanding, providing “protection” from total "domination" of incumbent operators. Still, today, preponderance believes that CRA decision should be aimed at the creation of competitive and development-driven market environment and more *ex-post* in nature. It is also worth noting that the CRA attempted to resolve the issue of "call termination pricing" by the incumbent with a series of *ex-ante* decisions, and to some degree, managed to find a middle ground in securing valid business case for alternative operators. Nevertheless, despite measures implemented by the CRA the alternative operators undisputedly remain in "price-squeeze" situation failing to secure sufficient funds to expand service-offered and further develop their businesses. This, in turn, forces the operators only towards the price competition – which our public opinion survey as well as estimated carrier selection model did, not find to be significant at any level. On the contrary, as we have presented, we have found that customer’s decision to select certain service provider is not affected by service-price nor free minutes offered by the carriers.

Finally, in summing up regulatory challenges, managers believe that the CRA, as a largely independent state agency, played a crucial role in sector standardization and organization. Still, an often-voiced critique by heads of alternative operators was that the liberalization could have been more expedient. Furthermore, the fact that CRA is still understaffed relying mostly on ad-hoc and international expertise, invokes concussion of conscious limiting of its role to the formal harmonization of activities with specific rules, failing to consider the essential effects those activities have on the market in general. Finally, the majority of managers agree that the CRA was mostly focused on finding a way to ensure that alternative operators can cohabitate with a moderate growth in the presence of incumbent operators, i.e. it seems that CRA acknowledges corporate oligopoly as optimal sector structure for now. Our analysis especially treated the questions relating to the relationship between incumbent operators and the CRA, and here we found that all interviewees (both small and the incumbent ones) agree that the CRA objectively favors incumbent operators. However, the majority also agree that, nowadays, the CRA is, for the most part, trying to balance in the treatment of operators, possessing a much better understanding of issues related to the development of alternative/small operators and aiming to stimulate more comprehensive sector development.

7. CONCLUSION

In this paper, we analysed some of the most challenging issues in telecommunication market regulation, as well as achieved results. The different regulatory approaches – Law vs Policies and *ex-ante* vs *ex-post*, or the dynamics and the effects of liberalization and privatization processes, different game-changers like local loop unbundling or number portability, the role of regulatory authorities etc. – all have impacted Bosnian telecom market creating to some extent, the unique market conditions. Although methods of regulation are different and have to be looked individually, some key decisions and processes are comparable.

In summing up the overall sector regulation in Bosnia and Herzegovina, we can conclude that, as expected, the process of liberalization – after the initial problems and the "liberalization shock", slowly entered the phase of stabilization. Despite a series of reviews and to some extent enabling sector development, the interconnection offer failed to contribute greatly to the improvement of the position of alternative operators, thus limiting the overall sector competitiveness. The incumbent operators were able to take advantage of their "dominant" position, and though pricing, infrastructure investment, and call termination, control both the development and the “market” share of alternative operators. The local loop unbundling, welcomed step in the overall sector development process, still has to produce a significant effect on the market, notwithstanding the fact that it has been available to alternative operators for some time. For a great part, this is due to the objective faults of the unbundled loop reference and the week role the CRA played in drafting referent offers as well as their implementation. Consequently, the overall growth and competitiveness of the sector have been hindered to some extent, and the upcoming privatization of the remaining incumbent operators will increase complexity and bring stronger competition among operators. In turn, this could result in the concentration of alternative operators, and to some extent end-users collateral damage; especially dose in underdeveloped communities and rural areas. But in recent years we see a rather worrying trend of concentration among small private alternative operates further limiting competition in both services and geographical areas. Something that needs to be further explored assessing overall effects on service availability, price, and overall market conditions.

Looking at the CRA role in the overall process of regulation and development of the telecommunications market in Bosnia and Herzegovina, we can conclude that the Agency has been quite successful in the application of the *ex-ante* regulation in regulating and controlling the existing monopoly structure. Still, the CRA had difficulty in dealing with the information asymmetry between the regulator and sector participants, resulting in price cap regulation frequently failing to provide intended purpose; mostly visible in interconnection disputes. The need for better regulation of various aspects of network effects in the telecommunication market is obvious – as well as the need for a more active role of the CRA in making room for all sector participants in exploiting positive network effects. In the end, with over hundred enacted decisions relating to the telecommunications sector and despite the ever-present political difficulties, CRA has managed to regulate telecommunication sectors and to secure, although limited, development of small/alternative operators. Today, licensing arrangements are established; interconnection referent offers are common particle; LLU has been implemented; number portability is available; UTMS network is up and running, EU monitoring mechanics have been established and *ex-ante* regulation is slowly fading out, and in 2013 the wholesale of services and virtual mobile operators were introduced. By following the frameworks set out by the Sector policies the CRA has gradually liberalized and regulated the telecom sector. Despite the series of Policies adopted by the government, a number of EU directives and rules have failed to be implemented. Understanding of next-generation technologies has yet to come, and although defined in both EU Directives and government policies, the use of LRIC model has not seen its manifestation, thus making a business case for small/alternative operators much more difficult.

Furthermore, the presented research results indicate that although we do find some of the contemporary network effect to be significant in the mobile carrier market, the values associated with the variable that codes ethnicity lead us to conclude that the choice of carrier is still largely based on the ethnic identification of the individual carriers as "ours". Ethnicity remains an important determinant in this market and trumps standard networking effects in terms of magnitude. Nevertheless, our study identified a number of contemporary network effect significant for Bosnia mobile users like the link between landline and mobile service, quality of service packages being offered, or number portability. At the same time, some traditional network effects have not been perceived as important by the users.

Noticeably, the Bosnia market dynamics rely on a different set of pertinent issues, to some extent confirming the findings of Grajek (2010) as well as Sobolewski and Czajkowsi (2012). Also, our findings have confirmed the importance of social ties like family or friends in carrier selection rather than the overall size of the operator or price (Karacuka et al., 2013), and clearly show that social networks, compared to price or the installed base, have more significant influence on operator choice, confirming the findings of Birke (2009) and Basaran et al. (2014).

Finally, despite unprecedented political difficulties, in its 15 years of existence the State CRA, through asserting its role as independent regulatory authority, has managed to complete the overall process of transition from "government controlled natural monopolies" to competitive and liberalized telecom market. It has done so mostly by utilizing *ex-ante* form of regulation and proactively addressing critical areas for sector development. But with the upcoming privatization of two remaining incumbent telecom operators in Bosnia, the market conditions will change, creating new dynamic and changing sector environment for all participants. The *ex-ante* will have to be replaced by an *ex-post* form of regulation, placing new challenges in front of CRA. The current Telecommunication Sector Policy has to be updated and it has to focus on post-privatization market conditions. Sector overall competitiveness has to be at a centre of this new policy, making maximum use of Open Network Provision in infrastructure access. Also, a special attention has to be placed on the Universal service provision as well as balanced infrastructure and overall service sector development – making sure that overall social welfare gains are equally distributed throughout the country.

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