Theoretical and Applied Economics
Volume XXII (2015), No. 2(603), Summer, pp. 303-310

The effects of competition regulations on mobile telecommunication markets

Ioan Lucian ALEXA
Bucharest University of Economic Studies, Romania
alexa.luci@gmail.com

Abstract. *This paper is based on the classic economics hypothesis that the presence of a reduced number of suppliers on a market can provide them a larger negotiation power towards consumers, thus being able to abuse this power in the disadvantage of consumers. Because the telecommunications market is characterized by a reduced number of operators due to its specific features, the present paper wants to analyze what are the implications on consumers, for the perspective of the costs they endure and what effects have the regulations on this market for the consumers from Romania.*
The paper analyzes how the reduction of interconnection tariffs affects the price structure of mobile communications, penetration rate of mobile communications, the degree of usage of these services and the evolution of the number of operators in the market, comparing the evolution of these variables before and after the 2009 European Commission proposals.
Also the paper aims to determine the demand equation for mobile communications services through a panel model that analyzes 21 of the member states of the European Union, to identify the main factors that have influence on the demand and also to determine the price elasticity of demand.

Keywords: competition regulation, panel model, demand equation, consumer surplus, telecommunication.

JEL Classification: C23, D12, D22, D43, L96.

1. Introduction

This paper is based on the classic economics hypothesis that the presence of a reduced number of suppliers on a market can provide them a larger negotiation power towards consumers, thus being able to abuse this power in the disadvantage of consumers. Because the telecommunications market is characterized by a reduced number of operators due to its specific features, the present paper wants to analyze what are the implications on consumers, for the perspective of the costs they endure and what effects have the regulations on this market for the consumers from Romania.

To measure this effects a panel model was used to determine the demand function for voice services at European level. Also more panel models were used for determining the average European price so that it can be compared to the price levels from Romania and afterwards to be used in determining the consumer surplus.

2. Literature review

This approach was used by several authors that wanted to analyze the competition on certain telecommunication markets. Hausman (1997a) estimated an income elasticity of demand of 0.193 for the first thirty mobile communications markets in U.S.A. Lee and Lee (2006) obtained values between 0.625 and 0.655 for income elasticity of demand for mobile telecommunication market in South Korea. Waverman et al. (2005) estimated a value of 1.95 for the income elasticity of demand for a sample of high income countries.

Also these papers have estimations for the price elasticity of demand. Hausman (1997b) found a value of -0.506, Lee and Lee (2006) estimated values between -0.482 and -0.643. Waverman et al. (2005) estimated a price elasticity of -1.50. Also Hausman (2013) estimated price elasticity of demand of -0.27 for fixed-line services and of -0.524 for mobile communications.

3. Research context

Competition in mobile communications can be manifested in two ways: access and services. Access is based on the infrastructure of the operators, while services refer to the services offered by the operators. When this industry first started to develop, to ensure proper competition, the regulators usually offered licenses for at least two operators, but as the industry progressed and were identified more spectrums, the competition gained new aspects. Thus the regulations under these circumstances must assure an optimal level of competition in this sector, and too many regulations can lead to the mitigation of innovation, raising of costs and can affect the consumers' welfare due to the risk of inefficient allocation of resources, especially of spectrum.

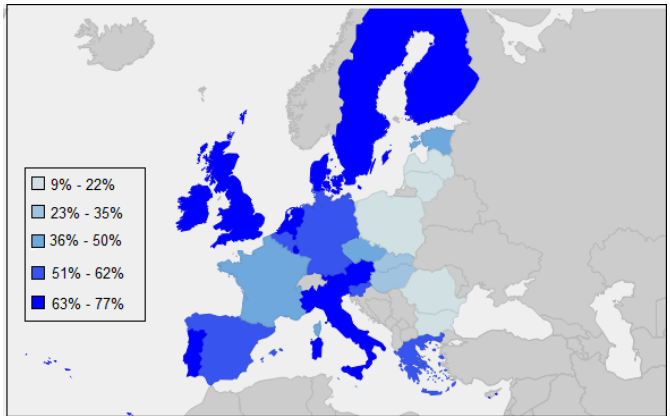
The regulation of interconnection tariffs still draws much attention from the specialized institutions, both in developing and developed countries, thus the regulation raising problems on establishing the optimal level of such tariffs.

In most of the cases, the regulators considered these tariffs the result of a monopoly power since every operator set them individually, independently of the other. Thus the regulations tried to orient the level of these tariffs accordingly to the costs that are generated by these services.

The interconnection tariffs are regulated in many countries, and often these are set according to an annual calendar so that the investors have a better predictability of the business environment. Under these circumstances, the regulation of the interconnection tariffs is better to be realized at national level, according to the specific of each country.

Figure 1 shows the penetration rate of mobile telecommunication in year 2000. The countries were divided in 5 intervals according to their level of penetration. It can be observed that Romania has a penetration rate similar to other Central and Eastern European countries (between 9% and 22%) while the entire Western and Nordic countries have a penetration rate above 30%.

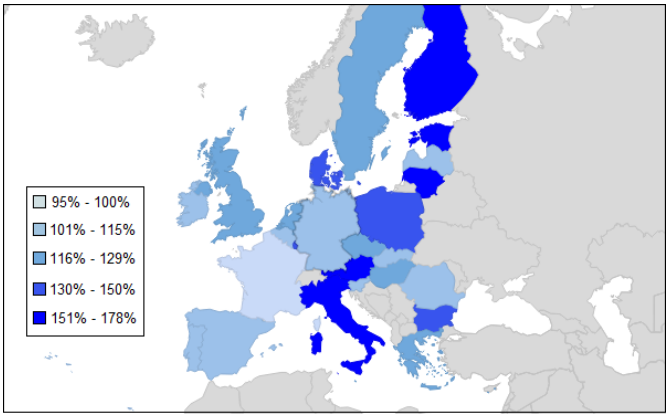
Figure 1. *European Union mobile penetration rate in 2000*



Source: own processing based on International Telecommunications Union data.

In 2012 it can be observed a significant change at European level in mobile penetration rates. It can be observed that only two countries have a level under 100% for this indicator (France and Cyprus). Also it is noticeable that western countries are not on the first category of penetration, most of them now spread in the first three categories of penetration rate grouping, having values between 97% and 130%.

Figure 2. *European Union mobile penetration rate in 2012*



Source: own processing based on International Telecommunications Union data.

Due to the chosen indicator (the number of active SIM cards to a hundred inhabitants), the modifications surprised by the two figures may suggest two aspects of the evolution of mobile telecommunication market at European level between 2000 and 2012: mobile communication market has reached a certain level of "maturity" (1) and that consumers start to orient to other services provided by mobile operators (especially mobile internet) (2).

4. Methodological aspects

Although mobile telecommunications appeared at different periods in the EU member states and evolved differently, the development of new technologies allowed reaching a certain "maturity" at national level. More than that, even though there are differences between the groups of countries (Western Europe and Central and Eastern Europe), the telecommunication sector faces a series of regulations that all operators from EU members states must respect. Since the regulations affect all operators, an analysis of the entire EU level will generate comparable results.

The variables used in the model are GDP per capita as a proxy for income, the level costs with mobile services (approximated by the Average Revenue Per Minute – ARPM hereafter), and penetration rate of mobile communication (measured as active SIM card on 100 inhabitants) as a proxy for demand.

For GDP per capita it was used the exchange rate approach because the infrastructure and the equipment in the telecom industry is produced in other country than the selected sample, thus they are traded in other markets and this equipment has a significant impact on the costs' structure. The data was extracted from Eurostat database, for the 2002 -2011 interval, with an annual frequency.

For the cost analysis, the best proxy used in the literature is the ARPM registered by the mobile telecommunication companies. The data series for informational society, implicitly the series for telecommunications, in Eurostat database have a structural inconsistency due to the fact that in 2010 a part of the indicators monitored by Eurostat changed, so that some of them are measured until 2009 and some of them start from 2010. ARPM series has values only for 2010 and 2011. Hence, in order to fill the series for the rest of the period was elaborated a methodology for calculating this indicator based on the other available data: total revenues were reported to the total number of minutes, weighting for the value that the voice services in the total services provided by operators (voice, SMS, MMS), taking account for each country's specific.

Penetration rate indicator also presented structural incoherencies in Eurostat database because of the methodology change in 2010, hence was preferred the series from International Telecommunication Union whose methodology was the same in the selected period.

The reason for which were included only 21 countries is because for the excluded countries (Italy, Poland, Latvia, Malta, Luxembourg, Croatia and United Kingdom) one or more indicators were not in the aforementioned databases and they could not be calculated from other data sets.

Regarding the number of mobile operators in each country, the series covers only 2002 - 2009 interval, but taking account for the national evolutions we can assume that their number has not changed in 2010-2011 because the markets already reached certain level

of stability and saturation. However, assuming that the number of operators has not changed during 2010-2011 can lead to erroneous conclusions, thus this variable must be treated with certain doubt. Also the data available for the number of mobile operator does not present o consistency over the selected period, which means that the Eurostat has centralized values based on different national methodologies.

For elaborating the model was used the approach proposed by Hausman (2013). In the first step was estimated the demand equation for mobile services in order to obtain values for both the price elasticity and the income elasticity of demand. In this equation the penetration rate is the dependent variable, thus the equation shows how the penetration rate changes when the other variables change. In the second step three models were estimated to determine the price of the mobile communications in each country as a response to the influence of the average European price and income. Based on the values estimated for price and for price elasticity was calculated the consumer surplus for 2011 for Romania.

Due to the lack of data, the newest available data cover only the year 2011.

5. Econometric analysis

Because there are significant differences between the penetration rate in the countries within the sample and most of them have values over 100% for estimating the equation was used fixed effects in order to isolate the country specific factors. To test if the fixed effects are preferred to the random ones the Hausman test was used. The test had a values of 142.209, confirming the accuracy of using fixed effects.

To estimate the fixed effects model, the generalized method of moments (GMM) was used because the estimators are consistent and eliminate the influence of fixed effects. The exogenous variables from the model are GDP per capita and ARPM registered by the operators (in the existing literature ARPM is considered by researchers a better approximation of the costs bore by consumers than the cost of a hypothetical call at a certain distance – assuming that costs are correlated with the distance). To specify the instruments for GMM it was used the GDP per capita. Also as a price instrument it was used the approached developed by Hausman and Taylor (which was used in a series of academic papers and has come to be known as “Hausman instruments”). The main idea behind this approach is that the best instrument for price is given by the variable costs. However, most of the time, such data are not available for researchers in order to elaborate a quantitative analysis. In this case the prices from other countries should be correlated with the price from the studied country due to similar costs structures, and these prices are independent of the stochastic error since there are no correlations between the demand shocks. The price instrument for each country was the average of the other 20 countries. All the countries have a similar behavior from the point of view of the costs, due to the highly competitive industry telecommunication equipment and the new technologies that are rapidly implemented by all the operators.

Table 1 presents the results for estimating the demand equation. The dependent variable is the penetration rate of mobile communication. To obtain robust errors and to isolate the heterogeneous effects from each country’s level, it was used for estimation the White cross-section weighting. The dependent variables are the GDP per capita to reflect income and the ARPM used to reflect price. Because the equation was estimated using

logarithm values, the coefficients represent price elasticity. The coefficient's value is -0.24 estimated with a high probability (t statistic -6.48). Also the GDP per capita coefficient, 0.847, is estimated with a high probability (t statistic 7.17), which means that the income elasticity of demand is 0.847

Table 1. *Parameters' values for the demand equation*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.058008	1.177813	-2.596344	0.0102
LOG(GDP)	0.847429	0.118083	7.176584	0.0000
LOG(ARPM)	-0.240973	0.037152	-6.486224	0.0000

Source: Own calculation.

In the next step, in order to determine the price equation for the 2002 – 2011 period, was elaborated another model. The dependent variable is the ARPM and is the same variable used in the previous model. Also to isolate the heterogeneous components from national level was used the fixed effects. The exogenous variables used were GDP per capita, the average of the ARPM in the other countries and the number of mobile operators (both as absolute value and also as difference to emphasize on the evolution). The results are presented in Table 2.

Table 2. *The results for the three models for price equation*

Endogenous variable: LOG(ARPM)			
Exogenous variables	Model 1	Model 2	Model 3
C	5,632* (1,59)	5,279* (1,73)	4,948* (1,518)
LOG(ARPMMED)	0,727* (0,064)	0,783* (0,064)	0,766* (0,053)
LOG(GDP)	-0,543* (0,153)	-0,494* (0,162)	-0,456* (0,144)
OP	0,066* (0,017)	-------	----------
D(OP)	------	0,011** (0,016)	----------

* Statistically significant for 1%. ** Statistically not significant.

Source: Own calculation.

The model estimated without accounting for the number of operators generated statistically valid results. The coefficient for the average price in the other countries has a high value of 0.766 and has a high significance (t statistic 14.21) which means that a decrease of the average price in the other countries by 1% leads to decrease in the analyzed country by 0.766%

All the three models generated significant coefficients, but the model that uses the difference for the number of mobile operators to estimate the impact price has not generated a statistically significantly coefficient for this variable. Also due to the close results obtained for the other two models and because of the structural inconsistencies of the number of operators' data set, the number of operators was not used to estimate the price equation, thus the chosen model in model 3.

For calculating the consumer surplus were used the coefficients determined with the aforementioned models for price elasticity and the price estimated by the price equation.

The formula to calculate consumer surplus using a logarithmic model (according to the approach proposed by Hausman, 2013) for the demand equation is:

$$\Delta CS = \frac{p_{2\times}q_2 - p_1 \times q_1}{1-\varepsilon} \quad (1)$$

Where ε represents the price elasticity of demand (expressed in absolute terms), p_1 and q_1 are the actual price and actual quantity from the considered period (2011 in this case), whereas p_2 and q_2 are referring to the forecasted values using the model. For the forecasted quantity was used the following substitution:

$$q_2 = q_1 \times \left(\frac{p_2}{p_1}\right)^{-\varepsilon} \quad (2)$$

Replacing equation (2) in equation (1) and rearranging the expression, the modification on consumer surplus can be written as follows:

$$\Delta CS = \left(\frac{p_1 \times q_1}{1-\varepsilon}\right)\left[\left(\frac{p_2}{p_1}\right)^{1-\varepsilon} - 1\right] \quad (3)$$

For the forecasted value of the price I used the inferior limit of the approximation (calculated value – one standard error), and for the price elasticity of demand was used the value of the coefficient estimated in the demand equation of -0.24 (in absolute terms). For q1 were used data from National Authority for Management and Regulation in Communication of Romania (ANCOM) regarding the total voice traffic in 2011. From the calculations, due to the reduced level of prices for mobile communication in Romania compared to the other member states, the consumers registered a consumers surplus of approximately 68 million Euros.

6. Conclusions

The mobile communication market in Romania, although it is characterized by a small number of operators, it does not affect the consumers, due to the existence of several factors, such as technological progress that impacts massively the dynamic of the industry, maintaining a high degree of competition. In this case, it is difficult to identify the effects experienced by the consumers between regulation of the telecommunications market and its natural dynamics. As it concerns the cost of the services, Romania was ranked second in the European market, being exceeded only by Lithuania.

Likewise, the rapid evolution of mobile communication penetration in the last 10 years and its stabilization around 110% in recent years and the strong decrease of costs show that the market for voice services has reached a certain "maturity", consumers turning to other services that operators provide, such as data packets.

Under these conditions, the reduced costs brought to mobile consumers (strictly for voice services) from Romania, in 2011, generated a consumer's surplus of over 68 million Euros. But the low level of costs is not entirely due to the regulations in the field of telecommunications. Although the level of utilization of the communication services has increased and the price has decreased, the correlation between these variables and the reduction of interconnection tariffs is poor. The acceleration of costs reduction has not

determined acceleration of the utilization level or of the price reduction. These conclusions are supported by empirical analysis in the member states studied.

The explanation of this phenomenon lies at the basis of this industry's structure. Price regulation affects in a small amount the structure of operators' costs because they diffuse much of the costs incurred by consumers to other services (the "water bed" effect). Moreover, another factor that can contribute to this explanation, that is not included in the data presented, is the implementation of new technologies that allow more efficient use of network and radio spectrum, thus contributing to a large extent of cost reduction. Another element that cannot be neglected is the diversification of the services offered by the operators, especially services based on Internet protocol, services that have a greater price elasticity compared to voice services. Therefore the indicators analyzed (average revenue per minute) tend to decrease in relevance to performance analysis of mobile communications industry as a whole. A better indicator of this is the average revenue per active user.

In conclusion, the regulations in mobile communications have led in part to a decrease in costs supported by consumers and an increase in use, but these effects are not due to regulation (lowering the cost of interconnection), only to a little extent. These regulations should rather aim the structural aspects, those related to the specific industry, degree of concentration and the ability of operators to achieve economies of scale so that the limited resources (radio spectrum) to be efficiently used, generating beneficial effects for both consumers and operators.

References

Baltagi, B., 2008. *Econometric analysis of panel data.* 4th ed. Chichester: Wiley.

Baltagi, B., 2011. *Econometrics.* 5th ed. Springer. Berlin.

Cowan, S., 2012. Third degree price discrimination and consumer surplus. *The Journal of Industrial Economics.* Vol. 60. Issue 2. pp. 333-346

Hausman, J., 1978. Specification tests in econometrics. *Econometrica.* 46. pp. 1251. 1262-63. 1273.

Hausman, J., 1997a. Valuation of new goods under perfect and imperfect competition". In T. Bresnahan and R. Gordon (Eds.). *The economics of new goods*. Chicago: University of Chicago Press.

Hausman, J., 1997b. Valuing the effect of regulation on new services in telecommunications". Brookings papers on economic activity. *Microeconomics*, pp. 1-38.

Hausman, J. and Ros, A., 2013. An econometric assessment of telecommunications prices and consumer surplus in Mexico using panel data. *Journal of Regulatory Economics.* Vol. 43. Issue 3. pp. 284-304

Lee, D. and Lee, D., 2006. Estimating consumer surplus in the mobile telecommunications market: The case of Korea. *Telecommunications Policy.* 30. pp. 424-444.

Schlee, E., 2008. Expected consumer's surplus as an approximate welfare measure. *Economic Theory*. Issue 2. pp. 127-155

Waverman, L., Meschi, M., and Fuss, M., 2005. The impact of telecoms on economic growth in developing countries. *The Policy Paper Series Vodafone Public Policy.* Series No. 2.

Eurostat, http://epp.eurostat.ec.europa.eu

International Telecommunications Union, http://www.itu.int/

National Authority for Management and Regulation in Communication of Romania, www.ancom.org.ro