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Two-sided Market Effect in Lithuanian Mobile Communications Market

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The paper deals with the activity of Lithuanian mobile communications operators in the context of two-sided market. One knows that value of goods and services grows with an increasing number of people using them. There are products that are used in conjunction with other products at the same time. The latter, when used alone, are almost worthless. Buyers who use these products make up networks. In these networks user utility grows logging in new users. The market characterized by this feature is called a network market and its positive effect of consumption is network externality.
Network externality is the situation when consumer utility by good consumption increases with the number of other agents consuming the good or in other words network externality is the increase of net value of action resulting from the growth of the same number of users performing that action. In economic literature generally considered products where network externality can occur are: fax machines, telecommunication networks, credit cards, computer hardware and software, etc. There are two types of network externality: direct and indirect. The direct network externality is generated by the consumption of the same product. The indirect network externality occurs when product value is added by a growing number of substitutions. A good example of this kind is computers and their software. This effect is often called a hardware-software paradigm.
The indirect network externality is related to minimum two markets. One, that is exposed to influence and the other (or others) that exposes. In economic literature it is possible to find the term cross-network externality.
It is argued that this externality occurs between mobile calls and cellphone sales in the context of two-sided market. One side is cellphone calls and the other is cellphones. It is argued that the profit decline on the cost of subsidizing cellphones is offsetted by an increase in profits from sales of calls. So, this method helps to increase the demand for cellphone calls. This article presents the theoretical model of a two-sided market in a mobile communications area. The conditions of subsidization that is used in order to increase net profit are determined.
The research of Lithuanian mobile calls demand is made. The main data sources of the study are reports on the electronic communications sector released by The Communications Regulatory Authority of the Republic of Lithuania (data concerning subscribers, calls' prices and quantities) and United States Department of commerce Bureau of Economic Analysis (relates to price index of computers and peripherals). The main results of this estimation are introduced. The study shows that mobile calls' demand does not depend on the sales of cellphones and that subsidization of cellphones does not stimulate the sales of mobile calls. Lithuanian operators use this subsidization only as a marketing tool in order to acquire bigger market share.

Keywords: *two-sided market, network externality, cellphone subsidies, mobile communications market, Pareto efficiency.*

Introduction

It is observed, that in many countries mobile network operators sell cellphones with a considerable discount. This phenomenon is also observed in Lithuania. Here are three large and several smaller operators. The larger ones apply the subsidization. The paper examines the hypothesis that it is possible to overcome the loss of discount sale of cellphones by increasing the revenues from sales of calls. In this case the network externalities occur then the decisions made by some agents in one market influence the other ones. So, it is possible to adapt the economic model of two-sided markets.

The aim of the paper is to determine the occurrence of a two-sided market in the Lithuanian mobile communications network, which leads to the subsidization of cellphones in order to achieve revenue increase from sales of calls. Herein the statistical *methods* are used. One of them is Least squares and the other Two-stage least squares. The analysis may be relevant to the politics of antitrust. That is because of the fact, that the occurrence of network externality not always leads to efficiency by Pareto even in perfect competition circumstances.

This paper consists of three parts. The first part reveals examples of the similar researches in the field of two-sided markets and network externalities, they are briefly discussed and a theoretical model is presented. The second part deals with research data and achieved results. The third part presents the main conclusions.

Theoretical model of two sided market

Due to the rapid development of information technologies and the growth of social networks, the concepts of network externalities, network economy, and network effects are often analyzed in the economic studies. First significant works in this area are made by Katz and Shapiro (1985), Farrell and Saloner (1985). Their research

was extended later by Economides and Himmelberg (1995), Liebowitz and Margolis (1994). In the case of two-sided markets so called cross network effect (Eisenmann & Alstyne, 2006) is functioning. Its feature is that this occurs in two inter-related markets. For example, credit cards. In this case first market consists of clients which dispose credit cards. The second one consists of merchandises which accept payments by using these credit cards (Rochet & Tirole, 2003). Information technology market from the point of view of the two-sided markets consists of service platform and reception platform (Parker & Alstyne, 2005). The case of Adobe is similar to this. The company did not succeed until it decided to price portable document format (PDF) viewers at zero. After this step the sales of PDF writers increased significantly. A lot of researches (Gabszewicz, Laussel, & Sonnac, 2004; Kind, Nilssen, & Sorgard, Competition for viewers and advertisers in a TV oligopoly, 2007; Anderson & Coate, 2005; Wilbur, 2007) are made in the area of television industry where one side consists of content viewers and the other - content advertisers. Both groups exert externalities on each other. Recent analysis on television as two-sided market is made by Kind and et. (2010). Rysman (2004) investigated yellow pages market in the same context. His estimation showed that advertisers value consumer usage and that consumers value advertising, implying a network effect. Rysman argued that the internalization of network effects would significantly increase surplus.

There are a lot of researches of two-sided market in other areas, such as newspapers (Argentesi & Filistrucch, 2007), competing matchmakers, such as dating agencies, real estate agents, and internet "business-to-business" websites (Caillaud & Jullien, 2003). The impact of subsidization, its consequences and public policy were analyzed by Heald (1997). He discussed monopoly structures. The models of oligopoly were analyzed by Leahy and Neary (1997). Antitrust issues in two-sided markets were examined by Evans (2002). Armstrong (2006) surveyed the literature of two-sided markets and provided a synthesis.

Lithuanian mobile telecommunications sector was analyzed by identifying the most important aspects of company orientation towards the market and the suggestion of the ways to anticipate changing customer needs (Kurtinaitiene & Gaizutis, 2008). Stanikunas (2009) examined Lithuanian fixed communication sector and Stanikunas with Burinskas (2011) made competition analyses in cellular mobile telephone markets in various European countries. However the activity of the Lithuanian mobile communications operators has not been studied in two-sided market approach. As already mentioned, there are three main operators. The market may be studied as oligopoly. One of the possible models is price leadership, where "Omnitel" Ltd. chooses the price of the calls, and others ("Bitė" Ltd. and "Tele2" Ltd.) are the followers. All of them sell cellphones with great discount. It can be assumed that marginal costs of calls are equal to zero. Practically there is no difference for the operator whether client speaks one or two minutes. Because of this it is possible to model the situation as a monopolistic two-sided market.

Similar to Parker and Alstyne (2005), Economides and Katsamakas (2006) or to Economides and Joacim (2009) let us assume, that the demand for the mobile calls is described by this equation:

$$q_{pok} = Q_{pok} + e_{tel} q_{tel} - \frac{Q_{pok}}{V_{pok}} p_{pok} \qquad (1)$$

where q_{pok} – demand for calls, Q_{pok} – maximum demand of the calls, V_{pok} – maximal reservation price of calls (or maximal price which leads to zero demand), e_{tel} – coefficient that describes the influence of cellphones to the demand of calls[1], q_{tel} – the demand for the cellphones. The demand dependence on price is expressed as follows:

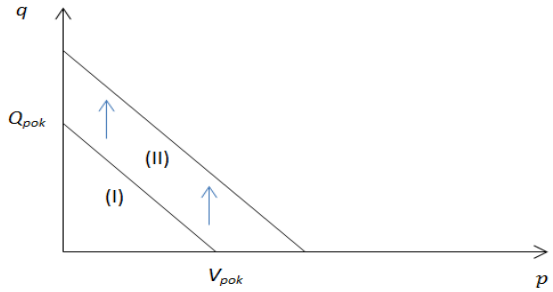

Figure 1. Calls demand dependence on the sales of cellphones

This figure shows two demand curves: (I) $q_{pok} = Q_{pok} - \frac{Qpok}{Vpok} p_{pok}$

$q_{pok} = Q_{POK} - \frac{Q_{pok}}{V_{pok}} p_{pok}$ when demand of the calls is not influenced by the sales of the cellphones $(e_{tel} = 0)$ and (II) $q_{pok} = Q_{pok} + e_{tel} q_{tel} - \frac{Q_{pok}}{V_{pok}} p_{pok}$, when the demand is evidently influenced.

Unquestionably, the mobile communications operators in Lithuania are the main suppliers of the cellphones to the market. So, the two-sided market occurs. The demand for the cellphones is described by this equation:

$$q_{tel} = Q_{tel} + e_{pok} q_{pok} - \frac{Q_{tel}}{V_{tel}} p_{tel} \qquad (2)$$

where q_{tel} – demand of the cellphones, Q_{tel} – maximum demand of the cellphones, V_{tel} – maximal reservation price of the cellphones (or maximal price which leads to zero demand), e_{pok} – coefficient that describes the influence of the calls to the demand of the cellphones, q_{pok} – demand of the calls. Let us assume $e_{pok} = 0$. This means that calls do not stimulate the sales of the cellphones. On the contrary, only cellphones stimulate demand for the calls. In this case the profit of the monopolist $\pi_{pok+tel}$ is as follows:

$$\pi_{pok+tel} = p_{pok} q_{pok} + p_{tel} q_{tel} - c \qquad (3)$$

where C means costs. It is assumed that $\frac{\partial c}{\partial q_{pok}} = 0, \frac{\partial c}{\partial q_{tel}} = 0$. The first assumption is quite realistic. The second one is followed for simplicity. In this case, the profit maximization problem is as follows:

[1] $e_{tel} = \frac{\partial q_{pok}}{\partial q_{tel}}$

$$\max_{p_{pak},p_{tel}} \pi_{pok+tel}, \quad \pi_{pok+tel} \qquad (4)$$

From (1) and (2) equations it is possible to solve:

$q_{pok} = f_1(p_{pok})$ and $q_{tel} = f_2(p_{tel})$ and get:

$$q_{pok} = \frac{Q_{pok}V_{pok}V_{tel}+e_{tel}V_{pok}V_{tel}Q_{tel}}{V_{tel}V_{pok}(1-e_{tel}e_{pok})} - \frac{e_{tel}V_{pok}Q_{tel}p_{tel}+Q_{pok}V_{tel}P_{pok}}{V_{tel}V_{pok}(1-e_{tel}e_{pok})} \qquad (5)$$

$$q_{tel} = \frac{Q_{tel}V_{pok}V_{tel}+e_{pok}V_{tel}V_{pok}Q_{pok}}{V_{tel}V_{pok}(1-e_{tel}e_{pok})} - \frac{e_{pok}V_{tel}Q_{pok}p_{pok}+Q_{tel}V_{pok}P_{tel}}{V_{tel}V_{pok}(1-e_{tel}e_{pok})} \qquad (6)$$

By putting in the result from equations (5) and (6) in equation (4) and then differentiating them according to p_{pok} and p_{tel} we get two equations. Using these results the profit is equal to:

$$\pi^*_{pok+tel} = \frac{Q_{pok}V_{tel}(Q_{pok}V_{tel}+Q_{tel}V_{tel}+e_{tel}Q_{tel}V_{pok}}{4V_{tel}Q_{pok}-Q_{tel}V_{pok}e^2_{tel}} \qquad (7)$$

Accordingly, the equilibrium prices and quantities are as follows:

$$p^*_{pok} = \frac{V_{pok}V_{tel}(2Q_{pok}+e_{tel}Q_{tel})}{4V_{tel}Q_{tel}V_{pok}e^2_{tel}} \qquad (8)$$

$$p^*_{tel} = \frac{V_{tel}(2V_{tel}Q_{pok}-e_{tel}Q_{pok}V_{pok}-Q_{tel}V_{pok}e^2_{tel})}{4V_{tel}Q_{pok}-Q_{tel}V_{pok}e^2_{tel}} \qquad (9)$$

$$q^*_{pok} = \frac{Q_{pok}V_{tel}(2Q_{pok}+e_{tel}Q_{tel})}{4V_{tel}Q_{pok}-Q_{tel}V_{pok}e^2_{tel}} \qquad (10)$$

$$q^*_{pok} = \frac{Q_{tel}V_{pok}(2V_{tel}+V_{pok}e_{tel})}{4V_{tel}Q_{pok}-Q_{tel}V_{pok}e^2_{tel}} \qquad (11)$$

If demand for the calls is not influenced by the cellphones $e_{tel} = 0$, then the price is:

$$p^*_{tel}(e_{tel} \to 0) = \frac{V_{tel}}{2} \qquad (12)$$

Subsidizing (denoted Δp) is equal to the difference of (12)and (9) equations:

$$\Delta p = \frac{1}{2}\frac{V_{tel}e_{tel}V_{pok}(Q_{tel}e_{tel}Q_{tel}+2Q_{pok})}{4V_{tel}Q_{pok}-Q_{tel}V_{pok}e^2_{tel}} \qquad (13)$$

So, subsidization is possible then $\Delta p > 0$ or:

$$e_{tel} < 2\sqrt{\frac{Q_{pok}V_{tel}}{Q_{tel}V_{pok}}} \qquad (14)$$

Inequality (14) shows the conditions for the occurrence of the subsidization or in other words the occurrence of two-sided market. This means that by reducing prices for the cellphones operators can increase the overall profit. It should be mentioned, that there are some researches that even justify the negative pricing (Shapiro, Varian, 1999).

Empirical research of Lithuanian mobile and cell phones markets

This research is based on two data sources. The first one is "Reports on the electronic communications sector" released by The Communications Regulatory Authority of the Republic of Lithuania and covering the time-period from 2003 and 2010[2] (data concerning subscribers, calls' prices and quantities). And the second one is information (relates to price index of computers and peripherals[3]) collected by US Department of commerce Bureau of Economic Analysis.

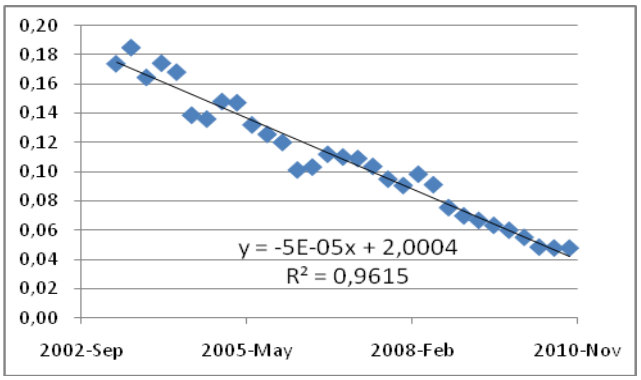

Figure 2. One minute call's price change over time[4]

In this figure (2) the vertical axis' unit is Litas per minute. The straight line shows the trend by date. Next to the trend the formula is placed where y means minute call's price, x - date and R^2 is determination coefficient. It is obvious that in the investigated range the price declines linearly. In the same period variation of the active subscribers was as follows:

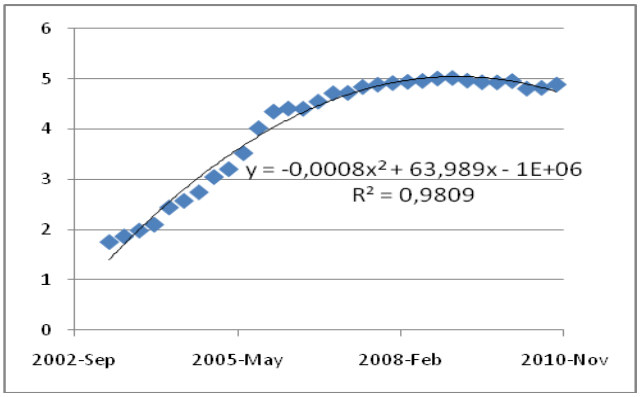

Figure 3. Variation of mobile communications market's active subscribers over time[5]

[2] http://www.rrt.lt/lt/apzvalgos-ir-ataskaitos/elektroniniu-rysiu-sektoriaus-mzkm.html

[3] http://www.frbsf.org/csip/data/charts/chart28.cfm

[4] Based on data from The Communications Regulatory Authority of the Republic of Lithuania

[5] Based on data from The Communications Regulatory Authority of the Republic of Lithuania

In this figure (3) the vertical axis unit is millions of subscribers. The curve shows the trend by date. Next to the trend the formula is placed where y means subscribers' quantity, x - date and R^2 is a determination coefficient. At the beginning of 2008 the saturation of the market is observed. In mid-2009 we may see decline, which was possibly caused by emigration.

Since the equation (15) is a demand equation, the use of ordinary least squares method produces biased and inconsistent estimators because of the correlation between p^t_{pok} and ε^t. This problem can be solved implementing two-stage least squares method. However, it is necessary to choose right information variables. In this analysis as the information variable is chosen the world price index of computers ant its peripherals. This choice is motivated by the fact that the majority of the mobile operators' costs depend on electronic equipment. So the price index of computers and its peripherals is a perfect indicator that influences the supply.

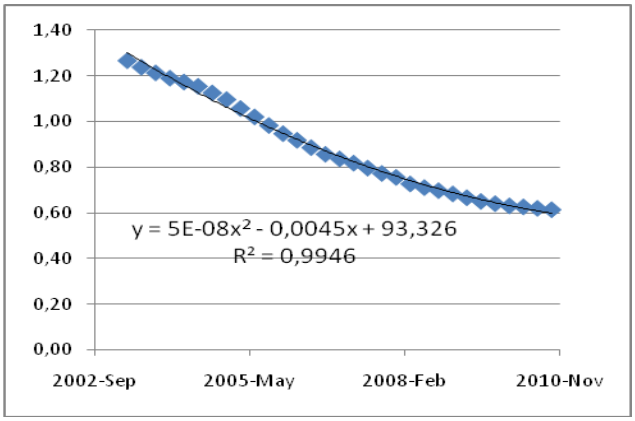

Figure 4. Price index of computers and its peripherals[6]

In this figure (4) the vertical axis's unit is index. The curve shows the trend by date. Next to the trend the formula is placed where y means price index, x is date and R^2 is the determination coefficient. It is quite clear that the price index declines exponentially. Next figure presents the analysis of correlation between computer price index and the price of the minute call:

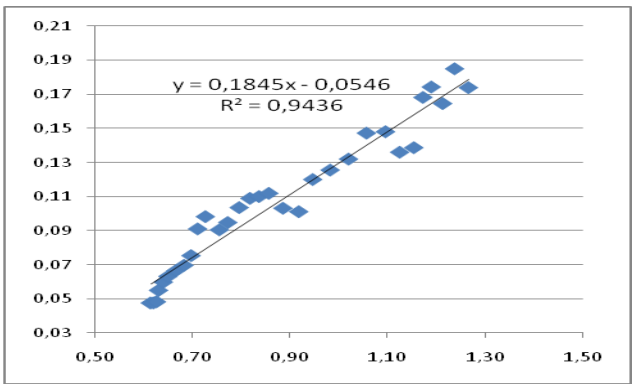

Figure 5. Correlation between computer price index and price of minute call

In this figure (5) the vertical axis's unit is the price of minute call and horizontal axis's unit is index. The curve shows relation between the call price (y) and computer price (x). Next to the trend the formula is placed with the determination coefficient R^2. The correlation is quite strong because of the high determination coefficient (R^2=0.9436).

Moving closer to the primary purpose of the paper it should be analyzed the stochastic equation which is based on structure equation (1)

$$q^t_{pok} = c^t_1 + c^t_2 q^t_{tel} - c^t_3 p^t_{pok} + \varepsilon^t \qquad (15)$$

Here q^t_{pok} means minutes talked by subscribers in date interval *t*, q^t_{tel} – number of subscribers in date interval *t*, p^t_{pok} – average price of minute call in date interval *t*, c^t_1, c^t_2, c^t_3 are regression coefficients and ε^t – an unobserved random variable. The leading purpose of this study is to determine coefficient's c_2 estimator. The main results are displayed in this table 1.

The table (1) presents four estimations. The two-stage least squares method was used in the first attempt. The prices index of the computers and its peripherals and the price of minute call in previous period were used as information variables. In the second attempt simple least squares method was used but equation (15) is supplemented with the price index of computer and its peripherals as variable. The third estimation differs from the first one that is: price of minute call in previous period variable is replaced by date trend. In the fourth attempt the assumption was used that calls' price does not depend on the number of cellphones.

The results that are listed in table (1) show that c_2 estimator is not statistically significant for the following reasons. Firstly, c_2 estimator value (attempt 1) is less than its standard error (0,078). Secondly, estimations 2 and 3 show negative values of coefficient c_2. Thirdly, the attempt 4 (where assumption $c_{\downarrow}2 = 0$ displays greater determination coefficient (0,96) than in estimation 3 (0,958). On the basis of these results it reasonable to reject the hypothesis that operators of Lithuanian mobile communications market are using cellphone subsidization in order to increase the demand for calls.

[6] Based on data from US Department of commerce Bureau of economic analysis

Table 1

The results of estimations

Method	Instrumental variables	Equation	Coefficients' estimators and standard errors	R^2
1. Two-stage least squares	Computer price index, calls minute price in previous period	$q^t_{pok} = c^t_1 + c^t_2 q^t_{tel} - c^t_3 q^t_{pok} + \varepsilon^t$	C_1= 1592,17 (548) C_2= 0,07318 (0,078) C_3= 7978,67 (2167)	0,950
2. Least squares	-	$q^t_{pok} = c^t_1 + c^t_2 q^t_{tel} - c^t_3 q^t_{pok} + c^t_4 p^t_{komp} + \varepsilon^t$	C_1= 3831,4 (276) C_2= -0,1632 (0,029) C_3= 4282,5 (1052) C_4= -1899,3 (283)	0,985
3. Two-stage least squares	Computer price index, date	$q^t_{pok} = c^t_1 + c^t_2 q^t_{tel} - c^t_3 q^t_{pok} + \varepsilon^t$	C_1= 2466,4 (245) C_2= -0,048 (0,035) C_3= -11458,4 (990)	0,958
4. Two-stage least squares	Computer price index, date	$q^t_{pok} = c^t_1 - c^t_3 p^t_{pok} + \varepsilon^t$	C_1= 2137 (44,4) C_2= 10222 (385)	0,960

Conclusions

The paper presents the theoretical model of Lithuanian mobile communications market as a two-sided market. It is demonstrated that there is a theoretical possibility for the subsidization of mobile calls by selling cellphones with great discount. Using this subsidization it is possible to increase profit. This is because of the influence of network externality when revenue loss in one market (because of the discount) is less than revenue growth in another (demand increase because of subsidization).

The research is based on the data from 2003 till 2010 and it shows that the above mentioned subsidization does not influence the Lithuanian mobile calls' market. The Lithuanian mobile communication operators use subsidization to gain a bigger market share, but not to increase revenue from calls. They use it as a marketing instrument, but not as the direct usage of market power. This means that there are no losses in Pareto efficiency. Thus, research reveals that indications of two-sided market do not exist in Lithuanian mobile communications and cellphone's markets.

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Dvipusės rinkos reiškimasis Lietuvos mobiliųjų komunikacijų rinkoje

Santrauka

Kai kurių prekių ir paslaugų vertė padidėja, kai padaugėja jas vartojančių žmonių. Yra produktų, kurie vartojami kartu su kitais produktais tuo pačiu metu. Šie, jei naudojami atskirai, yra beveik beverčiai. Pirkėjai, naudojantys šiuos produktus, sudaro tam tikrus tinklus, kuriems būdinga tai, jog naudingumas, gaunamas naudojant produktą, didėja prisijungiant naujiems vartotojams. Rinka, pasižyminti šia savybe, vadinama tinklo rinka, o jos pagrindinis požymis teigiamas vartojimo efektas – tinklo išoriniu poveikiu. Tinklo išorinis poveikis – tai toks poveikis, kada vartotojo naudingumas, gaunamas naudojant produktą, didėja daugėjant jį vartojančių individų. Kitais žodžiais tariant, tinklo išorinis poveikis yra veiksmo grynosios vertės prieaugis, atsirandantis, daugėjant tą patį veiksmą atliekančių agentų. Ekonominėje literatūroje dažniausiai nagrinėjami produktai, patiriantys tinklo išorinį poveikį: fakso aparatai, telekomunikaciniai tinklai, kreditinių kortelių tinklai, kompiuterių aparatinė ir programinė įranga ir kt.

Skiriami du tinklo išorinio poveikio tipai: tiesioginis ir netiesioginis. Tiesioginis tinklo išorinis poveikis sukuriamas tiesiog to paties produkto naudojimu. Telekomunikaciniai tinklai – internetas, telefoninis ryšys – yra tipiniai tiesioginio tinklo išorinio poveikio produktų ar paslaugų pavyzdžiai.

Netiesioginių tinklo poveikių atsiranda tuomet, kada produkto vertė didėja daugėjant papildiniams. Geriausias pavyzdys – kompiuteriai ir jų programinė įranga. Šis netiesioginis tinklo poveikis dažnai vadinamas aparatine-programine paradigma. Galima pastebėti, jog dažnai rinkoje operacinės sistemos, skirtos asmeniniam kompiuteriui, paklausa priklauso ne tik nuo technologinių pranašumų (kokybinis rodiklis), bet ir nuo tai sistemai sukurtų taikomųjų programų kiekio. Pastarasis kiekybinis rodiklis dažnai turi didesnę įtaką tinklo poveikiui. Panašūs dėsningumai reiškiasi tarp mobiliųjų telefonų aparatų ir mobiliųjų pokalbių rinkų.

Daugelyje šalių mobiliųjų tinklų operatoriai parduoda telefonų aparatus su didele nuolaida. Toks reiškinys pastebimas ir Lietuvoje. Čia veikia trys stambūs operatoriai ir keletas smulkesnių. Visi didieji taiko minėtą subsidijavimą. Straipsnyje keliama hipotezė, kad taikant mobiliųjų telefono aparatų (toliau – telefonų) pardavimo nuolaidas, galima padidinti pajamas iš mobiliųjų pokalbių (toliau – pokalbių) pardavimo. Šiuo atveju reiškiasi išorinis tinklo poveikis, tiksliau – išorinis tarptinklinis poveikis. Taigi galima taikyti dvipusės rinkos ekonominį modelį.

Tyrimo tikslas – nustatyti, ar Lietuvos mobiliojo ryšio rinkoje yra dvipusė rinka tarp pokalbių ir telefonų, kas sąlygoja telefonų subsidijavimą siekiant padidinti pajamas iš pokalbių pardavimo. Taigi tyrimo objektas – dvi rinkos: Lietuvos mobiliųjų pokalbių ir Lietuvos mobiliųjų telefonų aparatų rinkos. Atliekant analizę taikomi statistiniai metodai: mažiausių kvadratų metodas ir dviejų lygių mažiausių kvadratų metodas. Tyrimas aktualus konkurencijos politikos įgyvendinimo požiūriu, nes, veikiant tinklo išoriniam poveikiui, ne visada pasiekiamas efektyvumas pagal Pareto taisyklę, net ir esant sąlygoms, artimoms tobulos konkurencijos modeliui.

Lietuvoje mobiliojo ryšio operatorių veikla nebuvo tirta dvipusės rinkos požiūriu. Kaip jau buvo minėta, čia veikia trys pagrindiniai operatoriai. Analizuoti pradedama nuo teorinio modelio.

Mobiliųjų komunikacijų rinką galima analizuoti tiek kaip oligopolinį, tiek kaip monopolinį (tariant, kad operatoriai veikia kaip vienas) darinį. Dėl modelyje padarytų prielaidų abiem atvejais rezultatas bus tas pats, todėl tyrime pateiktas paprastesnis modelis – monopolinis. Analizėje nustatytos dvi

mobiliųjų pokalbių pardavimo pusiausvyros kainos. Pirmoji, kai rinkoje reiškiasi tinklo išorinis poveikis, kada telefonų aparatų pardavimai skatina pokalbių paklausą (dvipusė rinka):

$$p^*_{pok} = \frac{V_{pok}V_{tel}(2Q_{pok}+e_{tel}Q_{tel})}{4V_{tel}Q_{tel}V_{pok}e^2_{tel}}$$

Antroji, kai telefonų aparatai nedaro tiesioginės įtakos pokalbiui paklausai:

$$p^*_{tel}(e_{tel} \to 0) = \frac{V_{tel}}{2}$$

Šių kainų skirtumas rodo subsidijavimą. Kadangi šis yra teigiamas skaičius, tai iš čia surandama sąlyga:

$$e_{tel} < 2\sqrt{\frac{Q_{pok}V_{tel}}{Q_{tel}V_{pok}}}$$

čia e_{tel} – koeficientas, apibrėžiantis telefonų įtaką pokalbių paklausai $\left(e_{tel} = \frac{\partial q_{pok}}{\partial q_{tel}}\right)$; Q_{pok} – maksimalus pokalbių skaičius; V_{tel} – maksimali telefonų rezervacijos kaina (arba minimali kaina, kuriai esant telefonų paklausa lygi nuliui); Q_{tel} – maksimalus telefonų skaičius; V_{pok} – maksimali pokalbių rezervacijos kaina (arba minimali kaina, kuriai esant pokalbių paklausa lygi nuliui). Kadangi šių dydžių tiesiogiai negalime stebėti, todėl subsidijavimą galima nustatyti atliekant šios lygties regresinę analizę:

$$q^t_{pok} = c^t_1 + c^t_2 q^t_{tel} - c^t_3 q^t_{pok} + \varepsilon^t$$

čia q^t_{pok} – pokalbių ryšiu minučių kiekis laiko momentu, *t*; q^t_{tel} – mobiliųjų telefonų skaičius laiko momentu, *t*; p^t_{pok} – pokalbio mobiliuoju ryšiu minutės kaina laiko momentu, *t*; c^t_1, c^t_2, c^t_3 – regresijos koeficientai; ε^t – atsitiktinis dydis, apibrėžiantis matavimo paklaidas laiko momentu, *t*. Pagrindinis tyrimo tikslas – nustatyti c_2 koeficiento įvertį. Kadangi ši lygtis atspindi paklausą, tai taikant mažiausių kvadratų metodą koeficientų įverčiai bus paslinkti ir nesuderinti, nes p^t_{pok} ir ε^t yra koreliuoti. Todėl naudojamas dviejų lygių mažiausių kvadratų metodas. Kaip informacinis kintamasis pasirinktas kompiuterių ir jų periferijos pasaulinis kainų indeksas. Šis pasirinkimas motyvuojamas tuo, jog mobiliųjų operatorių didžiąją dalį sąnaudų sudaro elektroninė įranga. Šios įrangos kaina glaudžiai susijusi su kompiuterių ir jų periferijos kaina, todėl šis kainų indeksas puikiai atspindi sąnaudas, darančias įtaką pokalbių rinkos pasiūlai.

Atliekant tyrimą, naudotasi dviem duomenų šaltiniais: 2003 – 2010 m. Lietuvos Respublikos ryšių reguliavimo tarnybos ketvirtinėmis „Elektroninių ryšių sektoriaus periodinėmis ataskaitomis“ (duomenys apie abonentus, pokalbių kainas ir pakalbių kiekius) ir Jungtinių Amerikos Valstijų komercijos departamento ekonominės analizės biuro duomenimis (kompiuterių ir jų periferijos kainų indeksas).

Regresinė analizė atlikta keturiais skirtingais būdais. Pirmuoju būdu buvo tirti koeficientai taikant dviejų lygių mažiausių kvadratų metodą, kur naudotasi dviem informaciniais kintamaisiais – kompiuterių ir jų periferijos kainų indeksu ir praėjusio laikotarpio pokalbio kaina. Antruoju būdu buvo taikytas tiesioginis mažiausių kvadratų metodas papildomai įtraukiant kompiuterių kainų indeksą į tiriamąją lygtį. Trečiuoju būdu pakeistas (palyginti su pirmuoju) vienas informacinis kintamasis, t. y. įvestas trendas (data). Ketvirtuoju būdu pritaikyta hipotezė, jog pokalbių kaina nepriklauso nuo telefonų kiekio, t. y. $(c_z =)$.

Apibendrinus tyrimo rezultatus, matyti, jog koeficiento c^t įvertis nėra statistiškai reikšmingas, nes, pirma, pirmuoju būdu gauta reikšmė (0,07318) yra mažesnė nei standartinis nuokrypis (0,078), antra, antruoju ir trečiuoju matavimu nustatytos netgi neigiamos koeficiento reikšmės, trečia, ketvirtuoju būdu (čia prielaida $c_z =$) gautas didesnis determinacijos koeficientas (0,96) nei trečiuoju būdu (0,958), čia $c_z \neq 0$. Apibendrinus tyrimo rezultatus, matyti, kad koeficiento c_z įvertis nėra statistiškai reikšmingas. Taigi, remiantis tyrimo rezultatu, galima atmesti hipotezę, kad Lietuvos mobiliojo ryšio operatoriai subsidijuoja telefonų aparatus siekdami padidinti pokalbių paklausą.

Analizuojant Lietuvos mobiliųjų pokalbių rinką dvipusės rinkos kontekste, pateiktas modelis, kuris parodo, kad teoriškai galima subsidijuoti pokalbius pigesniais telefono aparatais. Taigi toks subsidijavimas plačiai taikomas. Subsidijuojant galima padidinti bendrąjį pelną, kada vienoje rinkoje pajamų praradimas dėl telefonų mažesnės kainos yra kompensuojamas pajamų prieaugiu kitoje dėl padidėjusios pokalbių paklausos. Atliktas tyrimas, kuris remiasi 2003-2010 m. duomenimis, rodo, jog Lietuvos mobiliojo ryšio rinkos pokalbių paklausos šis subsidijavimas visiškai neveikia, t. y. pajamų prarandama daugiau vienoje rinkoje (telefonų), nei padidėja pardavimų kitoje rinkoje (pokalbių). Operatoriai subsidijuojant nepakeičia rinkos paklausos, o tik konkuruoja tarpusavyje dėl rinkos dalies. Tai teisinga konkurencija (efektyvumo pagal Pareto taisyklę požiūriu), nes nesinaudojama tinklo išoriniu poveikiu. Taigi dvipusės rinkos požymių tarp Lietuvos mobiliojo ryšio pokalbių ir mobiliųjų telefono aparatų nėra.

Raktažodžiai: *dvipusė rinka, išorinis tinklo poveikis, mobiliųjų telefonų subsidijavimas, mobiliųjų komunikacijų rinka, efektyvumas pagal Pareto taisyklę.*

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