Network effect – a key element for switching the provider of mobile communications in the Republic of Macedonia

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Abstract — This paper presents the analysis of mobile market’s competition developments in the Republic of Macedonia for period from 2005 to 2015 from the consumer’s perspective. The calculated results, based on the previously developed empirical model, are compared with the outputs from an administered questionnaire, which was distributed to consumers of all existing mobile operators. The research focuses on the impact of the so-called „Network effect“ on switching costs, but also, on switching at all and its relation to the market competition. The analysis locates switching barriers, and points out switching procedures’ weak points. The results impact appropriate regulatory activities.

Keywords — Competition, Network effect, Switching costs, Consumer behavior, Regulation

I. INTRODUCTION

Telecommunication market, especially mobile, experiences a significant development in the past decade. The entrance of the new players on the market is the evidence of an industry paradigm change and a market transition. Mobile communication services are shifting from voice-centered communication to a combination of high-speed data communication and multimedia. The introduction of 4G/LTE and the growth of the wireless Internet services emphasize the start of a market’s transition period.

The ability and willingness of consumers to switch the service provider is very important. The effective competition delivers the increased choices and lower prices to consumers. In order to benefit from the competition, the consumers must have confidence to make the choice and get benefit from that. When moving to the product or service offered by a competing company, consumers face significant costs, the so called switching costs. The network effect is another hot issue that attracts the regulators’ attention during the last decades. It is a phenomenon whereby a product or a service becomes more valuable when more people use it. Network effect increases the value of customer’s subscription as the number of existing customers grows.

Many authors have studied switching costs and network effects on mobile market in different countries, using adjusted customer surveys, with no measurement of switching costs directly. This paper relies on the empirical research developed by Shy [1] that offers a model to precisely calculate the switching costs only through the observed prices and market share. The empirical model is presented in Section II. It is then tested on the actual data for the mobile market in Republic of Macedonia for period 2005-2015, when different stages on the market are easily recognized. Section III presents the results. Calculated consumer switching costs for the existing mobile operators in the mentioned period were analyzed from customer behavior perspective with respect to Lock-in [2]. This paper identifies the rationale behind the numerical values and the particular calculated switching costs and highlights the relation to the network effects. Finally, section IV compares the computed switching costs with the estimates based on a survey and provides some appropriate recommendations for activities in the future locating some switching barriers. Section V concludes the paper.

II. EMPIRICAL MODEL

Direct measurement of the switching costs is a complex procedure. The implemented Shy’s model offers a quick and easy methodology for calculation based only on the observed variables, such as prices/fees and market share [1].

The methodology assumes that the companies involved in the price competition recognize the switching cost for the consumers and therefore maximize their prices. These prices are subject to the restriction that no other company
will decide it is profitable to lower the prices in order to subsidize the switching cost of its consumers.

The model initially assumes that the prices of each company satisfy the Undercut-proof Property [1], so no company can increase its revenues by undercutting the rival company and no company can increase its price without being profitably undercut by the competing company.

If we define $S_i$ to be a switching cost of a $i$-company consumer and assume that all $S_i (i=1,...,I$ and denotes the order of appearance of the company on the market) are known to all companies and consumers, then each company $i \neq I$ takes the price charged by $i$-company $p_i$ as known and sets maximal $p_i$ to satisfy

$$\pi_i = p_i N_i \geq (p_i - S_i)(N_i + N_I)$$

where

- $\pi_i$ stands for the revenues of $i$-company
- $p_i$ stands for the revenues of $I$-company
- $S_i$ is a cost of $i$-company’s customer to switch into $I$-company
- $p_i$ is a price charged by $i$-company
- $p_I$ is a price charged by $I$-company
- $N_i$ denotes the number of $i$-company’s customers
- $N_I$ denotes the number of $I$-company’s customers.

Therefore, every $i$-company maximizes its price $p_i$ so that $I$-company will not find undercutting as profitable. Because all prices are observed, unobserved switching costs of the consumers of each company can be calculated. Taking equation (1) as equality, $S_i$ becomes

$$S_i = p_i - \frac{N_I p_I}{N_i + N_I} \quad i \in \{1,...,I-1\}$$

Equation (2) represents the switching cost for $i$-company’s consumers as a function of the prices set by $i$-company and $I$-company and the size of the market share of each company. This determines the switching costs of $I$-company’s consumers. The company with the lowest market share (the $I$-company) assumes that it is the target of company 1, who first appeared on the market. Therefore, the $I$-company sets the price $p_I$ that would make undercutting its price by company 1 unprofitable:

$$\pi_I = p_I N_I \geq (p_I - S_I)(N_I + N_I)$$

Since the price $p_I$ is observed, the unobserved switching cost $S_I$ is calculated from (3) in the case of equality as:

$$S_I = p_I - \frac{N_I p_I}{N_I + N_I}$$

In reality consumers may not have the same switching costs. If the switching costs reflex the training or learning by doing, then the switching costs will be higher for those customers who have high value of time (i.e. they use the same brand for longer time).

### III. Fitting the Model into Actual Market Conditions

In this section, we use the model presented in the previous section to calculate the switching costs for the mobile market in the Republic of Macedonia. Different phases on the mobile market development are identified during the research period.

#### III.1 The Period of Monopoly

Mobile telephony as a service in the Republic of Macedonia was introduced in September 1996 by organizational unit ”Center for mobile telephony” which functioned within the Public Enterprise ”PTT Macedonia”.

The mobile activity center was transferred to JSC ”Mobimak” on June 4, 2001, which in 2006 was rebranded into ”T-Mobile Macedonia” and became part of the international ”T-Mobile” group.

#### III.2 Entry of a Second Mobile Operator

The period of monopoly was terminated on November 22, 2001 when the Minister of Transport and Communications of the Republic of Macedonia grant a concession for the provision of public mobile telecommunications services and networks to ”MTS” Mobile Telecommunications Services Inc., which was wholly owned by the Greek Telecommunications Company SA ”OTE”.

The commercial launch of the mobile services was in June 2003 under the brand ”Cosmofon”. Since November 11, 2009, the company started to provide also fixed telephony services and digital broadcasting DVB-T under the brand ”ONE.”

#### III.2.1 Switching Costs in a Period of Duopoly

The presented empirical model in section II is used to calculate the switching costs for each of the two mobile operators ”Mobimak” and ”Cosmofon”. Table I presents the calculated results based on data taken from [3]. The calculated price $p$ set by each company and the switching cost $S$ are presented in Euros.


<table>
<thead>
<tr>
<th>Company</th>
<th>$N$</th>
<th>$a$</th>
<th>$p$</th>
<th>$S$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobimak</td>
<td>877.142</td>
<td>70,443,528.45</td>
<td>80,31</td>
<td>64,45</td>
</tr>
<tr>
<td>Cosmofon</td>
<td>384.186</td>
<td>20,007,406.50</td>
<td>52,07</td>
<td>-3,77</td>
</tr>
</tbody>
</table>

The estimated switching costs for the operator ”Mobimak” consumers are higher than the switching costs for the
operator "Cosmofon" consumers, since the former already uses network effects of its realized subscriber base, as presented in Fig. 1.

In order to check the validity of the estimated switching costs, it is necessary to identify the costs a subscriber faces when he/she replaces operator "Mobimak" with operator "Cosmofon" and vice versa. In the observed period, the subscriber had the following costs:
- amount of one-time fee for service usage and
- lost time due to the change of subscriber’s phone number.

Considering the pricelist of the operators, the calculated value of the switching costs is within the applicable prices and market conditions.

The negative value of the switching cost for the operator "Cosmofon" subscribers only confirms that in the observed period the number of the pre-paid subscribers is dominant in the total number of the subscribers. It is a consequence of the operator’s business model and policies and resulted in low costs for switching from this operator. In the observed period, the older mobile operator "Mobimak" started to conclude post-paid subscribers’ agreements on indefinite period of validity.

### III.3 Market with Three Mobile Operators

The Agency for Electronic Communications in March 2007 issued an approval to “Mobilkom Austria” for usage of radio frequencies for mobile telephony for a period of 10 years with a possible extension of the approval at the least once for a period of 10 years. The third mobile operator in Macedonia began its commercial operation in September 2007 under the brand "VIP operator".

All three mobile operators began their commercial launch on the GSM (2G) technology platform. By decision of the Agency for Electronic Communications from 01.12.2013, all three mobile operators have gained approval for radio frequencies for LTE valid for 20 years and an obligation for commercial launch of 4G technology services within 9 months of authorization receipt.

#### III.3.1 Switching Costs After the Start of the 3rd Operator

The switching costs for each of the three mobile operators "T-Mobile", "ONE" and "VIP", only 3 months after the commercial launch of the third operator on the market and the relevant network parameters are presented in Table II.

<table>
<thead>
<tr>
<th>OPERATOR</th>
<th>N</th>
<th>p</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;T-Mobile&quot;</td>
<td>1,212,610</td>
<td>592,970</td>
<td>1,463,232.93</td>
</tr>
<tr>
<td>&quot;Cosmofon&quot;</td>
<td>152,876,032.14</td>
<td>57,641,066.36</td>
<td>1,845,232,93</td>
</tr>
<tr>
<td>&quot;VIP&quot;</td>
<td>126,00</td>
<td>0</td>
<td>10,36</td>
</tr>
</tbody>
</table>

The market share observations are based on [4]. The price \( p \) set by each company and the switching cost \( S \) for the customers of each company, are calculated using the empirical model from section II and are presented in Euros. The results show that the customers of each company have different values of switching costs when moving to other operator.

It is obvious that immediately after the entrance of a new operator on the market, the highest switching costs have subscribers who choose to leave operators "T-Mobile" and "Cosmofon" and switch to the new operator "VIP", as shown in Fig. 2. This is confirmed by the results of the empirical model. So, the cost of the second appeared operator’s subscriber on the market (i.e. "Cosmofon") to switch into the new operator "VIP" is lower than the cost of the oldest operator’s subscriber ("T-Mobile") to switch into the same new operator. This explicitly shows the impact of the network effect.

During the observation period, both operators that previously existed on the market have started to conclude post-paid subscribers’ agreements with their consumers for definite commitment period. That included subsidies for mobile handsets. The value of the calculated switching cost is increased compared to the value from 31.12.2005 due to the following costs:
- amount of one-time fee for service usage,
- lost time due to the change of subscriber’s calling phone number, and
- difference to the full value of the purchased mobile handset.

In the observed period, the "number portability", as a subscriber’s right to keep the existing number when changing operator, has not been implemented, so we have
considered the cost related to the time lost due to subscriber’s number change.

Figure 2 – Switching costs on the beginning of the work of the 3rd operator

III.3.2 SWITCHING COSTS WITH THREE OPERATORS

The market parameters for three mobile operators “T-Mobile”, “ONE” (ex “Cosmofon”) and “VIP” are shown in Table III. The analysis was based on the observations of the market share and relevant data from [5]. The price \( p \) set by each company and the switching cost \( S \) for the customers of each company, are calculated using the empirical model from section II and are presented in Euros.

### TABLE III: STATUS ON MOBILE MARKET (31.12.2011)

<table>
<thead>
<tr>
<th></th>
<th>T-Mobile</th>
<th>ONE</th>
<th>VIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N )</td>
<td>1,151,361</td>
<td>494,877</td>
<td>568,585</td>
</tr>
<tr>
<td>( \sigma )</td>
<td>143,941,153.97</td>
<td>34,855,651.76</td>
<td>34,145,071.25</td>
</tr>
<tr>
<td>( \mu )</td>
<td>124.90</td>
<td>70.00</td>
<td>60.26</td>
</tr>
<tr>
<td>( \delta )</td>
<td>(T&gt;V) 96.90</td>
<td>(T&gt;V) -37.84</td>
<td>(V&gt;T) -58.78</td>
</tr>
<tr>
<td></td>
<td>(T&gt;O) 103.90</td>
<td>(T&gt;O) -17.36</td>
<td>(O&gt;T) 27.63</td>
</tr>
</tbody>
</table>

Four years after the entrance on the market of the third mobile operator in the country, a decrease in the switching cost is noticed for the subscribers of all three existing mobile operators, as presented in Fig. 3. It is evident that network effect has a strong impact on the switching costs.

Namely, with increasing of the subscriber base of the operator "VIP" closer to the number of subscribers of the operator "ONE", the costs for “T-Mobile” subscriber (when switching into one of other two operators) are almost equal (96.90 Vs 103.90 Euros, respectively). Switching costs for the subscribers of the oldest operator on the market of mobile communications, "T-Mobile", remain highest again due to the impact of the network effect, since it keeps the biggest subscriber base.

During the observed period, the operators in the country begun to offer loyalty contract with duration of two or three years in return to favorable offer of service packages (benefits with included call minutes, SMSs and volume of internet traffic into the monthly subscription) and favorable offers for mobile handsets. The "number portability" started from 01.09.2008, as subscriber’s right to keep the existing number when changing the operator. The Agency for electronic communications, with its decision from June 2009, calculated the highest value of one-time fee for number portability as 200.00 Denars (3.25 Euros, excluding VAT).

Having these conditions, subscribers are faced with the following costs when switching the operator:
- amount of one-time fee for services usage;
- amount of one-time fee for service number portability;
- the difference to the full value of the purchased mobile handset, and
- penalties for early termination of a subscriber agreement.

III.4 MARKET DEVELOPMENTS IN 2015

The shareholders of the companies "Makedonski telekom" and "T-Mobile" have agreed to merge "T-Mobile" with "Makedonski telekom". So, starting from July 1st 2015, "Makedonski telekom" and "T-mobile" became officially one company called "Makedonski telekom" AD, which also provides mobile communication services.

The group "Telekom Austria" - owner of the "VIP operator" and the group "Telekom Slovenia" - owner of the operator "ONE" concluded an agreement to merge their daughter companies. The new created company called "one.Vip" has started October 1st 2015, providing mobile communications services in the country.
TABLE IV: STATUS ON MOBILE MARKET (31.12.2015)

<table>
<thead>
<tr>
<th>Operator</th>
<th>N</th>
<th>s</th>
<th>p</th>
<th>s(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Makedonski telekom&quot;</td>
<td>1,001,578</td>
<td>46,291,596.00</td>
<td>46.22</td>
<td>13.88</td>
</tr>
<tr>
<td>&quot;one.Vip&quot;</td>
<td>1,082,005</td>
<td>67,403,023.00</td>
<td>62.29</td>
<td>40.07</td>
</tr>
</tbody>
</table>

At the end of 2015, only two mobile operators, "Makedonski telekom" and "one.Vip", were on the market. Table IV presents the relevant market parameters based on data in [6].

The fact that even after the merging, the operator “one.Vip” impacts the market (as two separate operators versus its competitive operator), reflects in significantly higher switching costs with relatively small differences in the subscriber base size. Therefore, the merging of the operators has a negative effect on the development and encouragement of the competition. From regulatory aspect, the case is an evidence for market failure.

III.5 ANALYSIS OF SWITCHING COSTS FOR “T-MOBILE”

Since mobile operator “T-Mobile” is present on Macedonian mobile market for almost 20 years, it was interesting to analyze the behavior of the switching costs for its subscribers in relation to its subscribers’ base over the studied period. The trends are shown in Fig. 4.

![Figure 4 – Network effect Vs Switching costs for customers of “T-Mobile”](image)

It is evident that the network effect has a great impact over the switching costs for consumers of “T-Mobile”. Also, the graph clearly presents a distinction between those costs which may arise from legitimate commercial customer retention strategies (period 2005-2014) and those that may arise due to the market failure, as it happened in the middle of 2015.

IV. SWITCHING COSTS AND NETWORK EFFECT

Performed calculations for realistic scenarios for presented market characteristics define the dependence between the network effects and the switching costs and barriers. Novel and interesting methodological research may arise when computations based on the model are compared with the estimates based on a survey.

IV.1 MATERIALS AND METHODS

We have used a survey with a structured questionnaire to test the relation between the switching costs and the network effect. Customers of all three mobile operators were sampled for the study. The study was performed during the distortion market period. The implemented research instrument was a structured questionnaire. The design of the questionnaire benefited from the extant literature dealing with the effects of switching costs and barrier on consumer retention.

The questionnaire was divided into three main sections: the first section deals with the general demographic data, the second with the consumer behavior and satisfaction and the third with the switching of an operator. The second section has used a 5-points Likert’s scale ranging from “strongly agree” to “strongly disagree”. The received data were analyzed using the SPSS (Statistical Package for the Social Sciences) software package.

IV.2 RESULTS AND DISCUSSION

The questionnaire analysis leads to some conclusions and observations:

- All respondents use mobile communication services of all three mobile operators more than three years: 50% of the respondents are consumers of the oldest operator, 30% of the respondents are consumers of the second appeared operator on the market, and 20% of the respondents are the last appeared operator consumers.
- Mobile communication services are used more for business (66.66% of the respondents) than for private purposes (31.67% of the respondents), which is in line with the dominance of Post-paid respondents to the Pre-paid ones.
- The number of Post-paid customers prevail the number of Pre-paid consumers (ratio 95:5 (%)), which is in line with the research about legal commercial customer retention strategies that operators use.
- The first legal commercial policy is the usage of loyalty agreements with duration of 1 or 2 years in return for favorable offer of service packages (benefits in included call minutes, included SMSs and included volume of Internet traffic into the monthly subscription) and favorable offers for products, such as mobile handsets, TV-sets, IT equipment, etc.
- The second legal commercial strategy which all three mobile operators use is the special favorable offers for closed user groups, such as family, company, etc.

- The number of consumers of all three mobile operators who didn’t switch their operator in the last two years is higher than the ones who did switched their mobile operator in the last two years. The ratio of statistical frequencies of not switched compared to switched is 41:18 (68,3% : 30,0%).

- The largest number of respondents who didn’t tried to change their mobile operator in the last two years use mobile communication services of the same mobile operator as the members of their family. Consumers respond positively to their mobile operator with a recommendation the same mobile operator and thus increase the number of users of that mobile operator.

- Substantial number of the respondents believes that the benefits that they would have with the operator change are insignificant, pointing to the fact that operators use similar strategies in attracting and retaining the customers.

Because of the located weak points for operator change, we propose following directions where the regulation should be focused, such as:

- Promotion of media (web-site) where consumers can compare the operator’s offers, prices, quality of services, etc.

- Revision of the regulation for number portability procedure from the aspect of the whole switching process duration, which entered into force in 2006 and it was amended many times, last in February/2015;

- Revision of the regulation for end user rights protection and retail offers and prices, with focus on minimization of any barriers into subscribers’ agreements that affect the user's right to switch: determining the minimum duration of the mandatory period, elimination the possibilities for automatic extension into a new commitment period, educating consumers about their rights; and

- Hard upcoming work to fix the market failure which happened in the middle of 2015.

The major contribution of this analysis is the conclusion that the switching costs have negative impact on the customer’s decision to switch the mobile provider and that the network effect has positive effects on the customer retention.

V. CONCLUSIONS

The level and complexity of changing provider is a key indicator for the welfare and prosperity of customers and a significant factor influencing the overall development of competition on the retail markets. The network effect reduces the consumer’s confidence in switching the mobile operator that can negatively influence the competition.

The paper shows the relation between the level of the competition, and the switching costs on the mobile market in the country within the period of 10 years and the impact of the network effect. Also, it stresses some weak points in the switching procedures and suggests appropriate regulatory activities in the near future.

REFERENCES


