

The choice of mobile operator in Slovenia

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1. Introduction

Mobile telephony has been characterised by changes in technology and in the market structure. All these changes have been accompanied by legislative and regulatory developments. The mobile telephony market is also one of the first telecommunications market segments where competition has been introduced. New companies have entered the Slovenian 2G mobile market gradually. Currently, there are four mobile operators; two network operators and two virtual network operators. Despite new companies entering the mobile market in Slovenia, a comparison with the EU shows that the Slovenian mobile market is highly concentrated.

By using a conditional model the aim of this paper is to empirically examine the factors users take into account when choosing their mobile operator in Slovenia. Directly related to our research are studies by Kim and Kwon (2003) and Birke and Swann (2006) in which a similar research question was examined for the Korean and UK mobile markets, respectively.

In analysing the subscription behaviour of mobile users a special emphasis was put on network effects. The network effect operating at the firm level leads to more intense competition in the market. However, network effects also represent a disadvantage for small operators and have a tendency towards a higher market concentration. In fact, this has happened in the Slovenian mobile market. The 'battle' for new customers was then causing a continuous fall in prices in conjunction with the continuous growth of penetration, which has constantly exceeded the EU average. On the other hand, the Slovenian mobile market remains highly concentrated.

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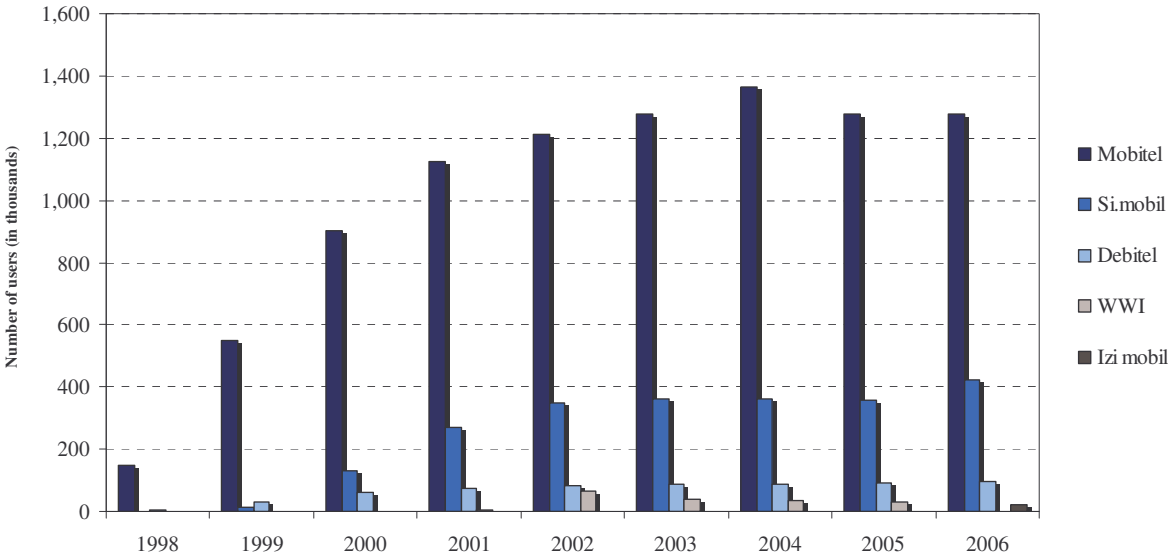
The paper is structured as follows: In Section 2 we present a brief overview of the Slovenian mobile market. In Sections 3 and 4 we describe the model and the data used. Section 5 contains our empirical results. Finally, in Section 6 we make some concluding remarks.

2. Overview of the Slovenian mobile telephony market

In this section we present a brief overview of the Slovenian mobile market². While the survey data used in the paper corresponds to the period from April 1999 to March 2004, we also present updated market developments till the end of 2006.

New companies have entered the 2G market sequentially following the delay of granting additional 2G licences to new operators. In 1996 Mobitel started to offer 2G mobile services. In this period – preceding the entry of the competition – Mobitel reduced its prices, offered subsidised handsets and differentiated users by introducing new packages. It also introduced pre-paid packages which were, like in other countries, the main driver of further mobile penetration. Mobitel also attracted a virtual network operator Debitel to offer an ‘option of choice’ to new users. All these actions resulted in more than 170,000 GSM users in March 1999 when the second mobile operator entered the market (Figure 1).

Figure 1: Number of users by mobile operators in Slovenia

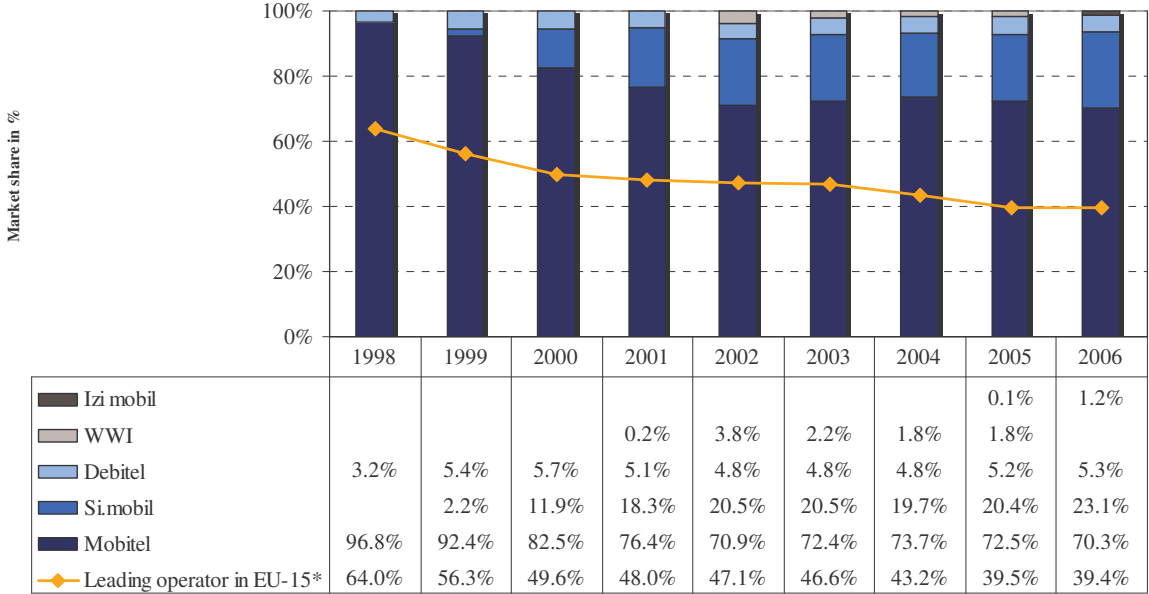


Sources: Stergar 2004 and APEK 2007.

² For details, see Hrovatin et al. (2006).

With the entry of the second operator (Si.mobil) competition in the Slovenian market actually began. After some drawbacks in the launch phase, the competitor was quickly adding new subscribers but at a slower rate than the incumbent operator. The competitor had been gaining in market share but became stuck at around 20% and could not grow further till 2006 (Figure 2).

Figure 2: Market shares by mobile operators in Slovenia



Sources: Stergar 2004, APEK, 2007 and EC 2007.

There are several reasons Si.mobil could not gain any larger market share. The first reason is that it lagged behind Mobitel by more than a year in launching its pre-paid packages.³ The second reason was that when Si.mobil entered the market its network coverage was significantly inferior to that of the incumbent. This difference in coverage lasted for an extended period of time and was one of the main differentiating factors. Further, Mobitel was a well-known and established brand name. Another important reason was that Si.mobil and Mobitel differentiated highly between on-net and off-net call prices, which was a consequence of the high mobile termination prices. The large differential between on-net and off-net prices has caused so-called tariff mediated network externalities. This means that the network (operator) with the most users holds greatest value for a new user. In Slovenia Mobitel had already acquired a large subscription base when the new operators entered the market. If Si.mobil wanted to gain a larger market share through prices, its off-net prices would have needed to be lower than Mobitel’s on-net prices. Mobitel was charging for a mobile termination almost the same price as it was charging its own users for on-net calls in several

³ When Si.mobil introduced its pre-paid packages Mobitel already had more than 240,000 pre-paid users.

packages. As a result, Si.mobil could not offer to its users lower off-net prices than Mobitel's on-net prices (Hrovatin et al., 2006).

On the other hand, the entry of Si.mobil triggered further price cuts in the mobile market. Falling prices, subsidised handsets and the introduction of pre-paid packages led to the growth of mobile users in Slovenia to more than one million at the end of 2000.

In December 2001, a third operator, WWI, entered the market. In spite of its low on-net call prices and large-scale promotions, WWI could not gain a significant market share (see Figure 2). It seems that WWI underestimated Slovenian customers in terms of their preferences for the range of services as WWI only offered voice telephony and SMS services. In addition, the basic conditions for WWI were poor as the 'battle' for new customers has been causing a continuous fall in prices and the termination-based network externalities created by the on-net/off-net differential has represented a disadvantage for small operators (Hrovatin et al., 2006a).

In November 2005 a second mobile virtual network operator, Izi mobil, entered the market with pre-paid packages. Like Debitel, Izi mobil also uses Mobitel's network. In one year it gained a 1.2% market share.

To sum up, in 2006 Mobitel held a market share of 70.3%, followed by Si.mobil with a 20% market share. Debitel had 5.3% and Izi mobil just a 1.2% market share of the Slovenian mobile market (Figure 2). The penetration rate at the end of 2006 was 90.2%, while in the EU it was 103.2%.

Despite new companies entering the mobile market in Slovenia, a comparison with the EU shows that the Slovenian mobile market is still highly concentrated. In 2006 the leading operator (Mobitel) had a market share of 70%, while the leading operators in the EU had on average a 39% market share (Figure 2). As seen above, there are several reasons for the concentrated market structure but this can also be attributed to the ineffectiveness of the regulator in the past⁴.

⁴ For details of regulatory issues, see (Hrovatin et al., 2006).

3. Model specifications

In order to analyse the decisions of consumers when they choose mobile operators, the appropriate econometric model is a multiple discrete choice model with an unordered choice set. Discrete choice models are usually derived on the assumption of utility-maximising behaviour by the decision-maker (Train, 2003).

The dependant variable in our model is the choice of mobile operator and has three different unordered outcomes (Mobitel, Si.mobil and Debitel). Since we need to include both the attributes of the alternatives-mobile operators (Model I) as well as the characteristics of individuals (Model II) in the model, the appropriate model is a conditional logit model which is motivated by a random utility model. The model was derived from McFadden (1973). Below we briefly describe the model.⁵

Model I

For the n -th consumer faced with J choices the utility of choice j is:

$$U_{nj} = \beta' X_{nj} + \alpha_j + \varepsilon_{nj} . \quad (1)$$

X_{nj} is a vector of explanatory variables which describe the attributes of alternative j as faced by decision-maker n . α_j is a constant that is specific to the alternative j . The alternative – a specific constant for an alternative captures the average effect of all factors that are not included in the model on utility. However, since only differences in utility matter just the difference in the alternative specific constant is relevant. The standard procedure is to normalise one of the constants to zero. In our case, we normalise the constant for the Debitel alternative to zero.

Let Y_n be a random variable that indicates the choice made. In the conditional logit model the probability that a decision-maker n chooses alternative (mobile operator) j is:

$$P(Y_n = j) = \frac{e^{\beta' X_{nj} + \alpha_j}}{\sum_{k=1}^J e^{\beta' X_{nk} + \alpha_k}} . \quad (2)$$

⁵ For details of the conditional logit model and discrete choice models, see Green (2003), Train (2003) and Maddala (1983).

In Model I we use the following explanatory variables which describe the attributes of the mobile operators: NR_j , MS_j , AD_j , PON_j and $POFF_j$.

- NR_j is the average cumulative number of subscribers of a mobile operator in the observed period⁶. Slovenian mobile operators have differentiated highly between on-net and off-net call prices. The large difference between the low on-net and high off-net prices has caused so-called tariff mediated network externalities (Laffont, Rey and Tirole, 1998). This means that the network operator with the highest number of users holds the greatest value for new users compared to the mobile operator with a smaller number of subscribers. On the other hand, mobile operators with a large user base can induce a bandwagon effect, which was first described by Leibensten (1950). It is therefore expected that variable NR_j has a positive influence on the probability of choosing a mobile operator.
- MS_j is the average market share of a mobile operator in the observed period. Based on Katz and Shapiro (1995) and Caminal and Vives (1996) market share can signal quality. The higher market share of a mobile operator can be interpreted by prospective users as a signal of its higher relative quality mobile services. Therefore it is expected that variable MS_j has a positive influence on the probability of choosing a mobile operator.
- AD_j is the gross value of advertising expenditure of a mobile operator in the observed period. All mobile operators' advertisements published in daily newspapers, magazines, TV stations, billboards and cinemas are monitored daily by a special advertising agency. Each advertisement is then rated by the official monthly list price for the specific media, whereby reductions and discounts are not taken into account. This variable thus only indicates the costs of a mobile operator's advertising since the actual costs are not publicly available. Advertising influences the preferences of consumers and it is therefore expected that variable AD_j has a positive influence on the probability of choosing a mobile operator.
- PON_j and $POFF_j$ are the average on-net and off-net prices of a mobile operator in the observed period, respectively. Their calculation is explained in Section 4. We expected that both variables PON_j and $POFF_j$ would have a negative influence on the probability of choosing a mobile operator.

⁶ In the survey a consumer could choose among 10 periods between April 1999 and March 2004 in which they subscribed to a mobile operator, therefore the values of the explanatory variables correspond to those periods.

Model II

In Model II we also added as explanatory variables some variables that describe the characteristics of users (Z_n). Therefore, for the n -th consumer faced with J choices the utility of choice j is:

$$U_{nj} = \beta' X_{nj} + \gamma' Z_n + \alpha_j + \varepsilon_{nj}. \quad (3)$$

In the conditional logit model the probability that a decision-maker n chooses alternative (mobile operator) j is:

$$P(Y_n = j) = \frac{e^{\beta' X_{nj} + \gamma' Z_n + \alpha_j}}{\sum_{k=1}^J e^{\beta' X_{nk} + \gamma' Z_n + \alpha_k}}. \quad (4)$$

However, the characteristics of a decision-maker (Z_n) do not vary over the alternatives and so they fall out of the probability, hence the model must be modified. Consequently, we create a set of dummy variables for the choices and multiply each of them by the individual characteristic. However, a complete set of interaction terms creates a singularity (the dummy variable trap) so one of them must be dropped (in our case Debitel).

As variables that describe the characteristics of users (Z_n) average monthly income (INC_n), age (AGE_n) and average monthly expenditure for mobile services (EXP_n) are used in Model II.

4. Data source and descriptive statistics

Data on mobile operators were gathered from several sources for 10 mainly half-yearly periods between April 1999 and March 2004 (see the Appendix, Table 3). This allows us to consider in the models the attributes of the mobile operators at the time new users actually chose their operator. The number of subscribers was gathered directly from the mobile operators, while data on the gross value of advertising expenditure of mobile operators was obtained from Mediana, the Institute for Market and Media Research. Data on prices were taken from Gabrovšek (2004). Since he calculated the average prices only till October 2003, we calculated the missing price levels using the same methodology by ourselves. In the calculation of prices the most important post- and pre-paid packages of mobile operators were taken into account. The costs of handsets and rental charges were excluded from the calculation. In the calculation only the prices of calls were taken into account. Descriptive

statistics for the variables that describe the attributes of the mobile operators are presented in the Appendix (Table 3).

On the other hand, data on mobile users are based on a telephone survey conducted in March 2004⁷. The survey is based on 1,200 respondents who were between 15 and 80 years old. Excluding those who did not fit the sample restrictions (do not use mobile services, received their mobile phone as a present, use their company's mobile telephone, subscribed to an operator before April 1999 or did not report the period when they subscribed to an operator), 577 observations remained in the sample for analysis in Model I⁸. Out of 577 respondents 56 did not report their average monthly income or age, therefore for the analysis in Model II 521 observations were left in the sample. Descriptive statistics for the socio-demographic variables are presented in Table 1.

Table 1: Descriptive statistics (means)

Variables	Mobitel	Si.mobil	Debitel
AGE (in years)	38.5	40.8	42.7
INC (in SIT)	81,419	88,849	128,226
EXP (in SIT)	5,211	5,232	9,097

5. Results

The estimation results of Model I and Model II are presented in Table 2. We use the maximum likelihood method of estimation. Based on the likelihood ratio test (*LR*) we can reject the null hypothesis that all parameters are zero at a 0.01 level of significance in both models. We can also reject the null hypothesis that all parameters other than the alternative-specific constant are zero at a 0.05 level of significance in both models (see *LR_c* in Table 2).

⁷ Based on our questionnaire the survey and sampling was conducted by a professional agency, Ninamedia, which used the CATI method.

⁸ Since there were only 10 WWI users in the sample and the company has not been present in the market since April 1999, WWI was excluded from the analysis.

Table 2: Determinants of choosing mobile operators

Variables	Model I		Model II	
	Coefficient	Standard error	Coefficient	Standard error
<i>NR</i>	0.0018 **	0.0007	0.0020 ***	0.0008
<i>MS</i>	4.0355 ***	1.2923	3.8188 ***	1.3622
<i>AD</i>	0.0002	0.0003	0.0000	0.0004
<i>PON</i>	-0.0870 *	0.0486	-0.0749	0.0530
<i>POFF</i>	0.0002	0.0197	0.0054	0.0211
α^D_m	-1.9287	1.4081	-1.0449	1.5581
<i>INC_m</i>			-0.0066 ***	0.0024
<i>EXP_m</i>			0.0000	0.0000
<i>AGE_m</i>			-0.0024	0.0131
α^D_s	0.5749	0.4446	1.3143 *	0.7242
<i>INC_s</i>			-0.0060 **	0.0026
<i>EXP_s</i>			0.0000	0.0000
<i>AGE_s</i>			0.0042	0.0138
Nr. of observations	577		521	
$\bar{\rho}^2$	0.2920		0.2950	
$LL(\hat{\beta})$	-446.0828		-398.4926	
<i>LR</i>	375.6330 ***		347.7688 ***	
<i>LR_c</i>	11.2502 **		22.5434 **	

* Significant at $\alpha=0.10$, ** significant at $\alpha=0.05$, *** significant at $\alpha=0.01$.

In Model I we only use variables that describe the attributes of the mobile operators. The results of Model I show that the coefficients of *NR*, *MS* and *PON* are all statistically significant and have the predicted signs. This means that the number of subscribers and market share have a significant positive impact on the probability of choosing a mobile operator, while the on-net call prices have a negative impact. On the other hand, the statistically insignificant coefficients of *AD* and *POFF* show that neither the cost of advertising nor the off-net price prove to have a significant impact on the probability of choosing a mobile operator. Besides that, the coefficient of *POFF* has a positive sign, which was not expected.

Similarly as in Model I, the results of Model II show that the coefficients of *NR* and *MS* are statistically significant and have the predicted signs. Among the variables that describe the characteristics of users coefficients are only statistically significant for the variables *INC_m* and *INC_s*. The negative sign of the coefficients of the variables *INC_m* and *INC_s* means that a user with a higher income is less likely to choose Mobitel or Si.mobil compared to Debitel. These results are in accordance with the market strategy of Debitel which, at that time, did not offer any pre-paid packages. The users of pre-paid packages commonly come from lower income groups.

However, when variables that describe the characteristics of users are included the coefficient of *PON* loses its statistical significance, while the coefficients of *AD* and *POFF* remain insignificant.

The result that the number of subscribers and market share have a positive impact on the probability of choosing a mobile operator in both models indicates that network effects are present in the Slovenian mobile market. These results are in line with the market situation in the observed period. As described in Section 2, the ‘battle’ for new customers was causing a continuous fall in prices in conjunction with the continuous growth of penetration. On the other hand, the leading incumbent operator’s market share still exceeds 70% while the smallest operator has exited the market. Such market circumstances are typical of a market characterised by network effects.

Unfortunately, the model does not allow us to explore the source of these network effects which could be a consequence of the difference between the on-net and off net prices, the bandwagon effect or quality signalling effects.

6. Conclusion

In the paper we empirically examine factors that users took into account when choosing their mobile operator in Slovenia. We estimate several variations of conditional logit model specifications. In the model where we only use variables that describe the attributes of the mobile operators the result shows that the number of subscribers, market share and on-net call prices have a statistically significant impact on the probability of choosing a mobile operator.

However, when the variables that describe the characteristics of users are included in the model the on-net call prices lose their statistical significance. Among the characteristics of users only monthly income has a significant impact on the choice of a mobile operator. On the

other hand, in none of the different variations of the model specifications did the cost of advertising nor the off-net price prove to have a significant impact on the probability of choosing a mobile operator.

The empirical results indicate that network effects can be found in the Slovenian mobile market. These results are in accordance with the market situation in the observed period, when the 'battle' for new customers was causing a continuous fall in prices while on the other hand the Slovenian mobile market remained highly concentrated.

Unfortunately, the model does not allow us to explore the source of these network effects. For this a more detailed survey data on consumer behaviour when choosing a mobile operator is needed. On the other hand, in mature mobile markets competition is shifting from acquiring new subscribers to retaining existing subscribers and luring customers away from rival mobile operators. Accordingly, survey data on churning behaviour will be of great interest in further research.

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APPENDIX

Table 3: Descriptive statistics for the variables NR, MS, AD, PON and POFF (means)

Period	NR (in thousands)		MS (in %)		AD (in mio SIT)		PON (in SIT/min)		POFF (in SIT/min)		
	Mobitel	Si.mobil	Mobitel	Si.mobil	Mobitel	Si.mobil	Mobitel	Si.mobil	Mobitel	Si.mobil	Debitel
01.04.1999 - 31.12.1999	365	7	89.2%	1.7%	549	360	33.02	22.18	63.24	54.50	49.14
01.01.2000 - 30.06.2000	657	37	89.8%	5.1%	545	925	26.48	20.93	47.05	41.30	41.06
01.07.2000 - 31.12.2000	833	96	84.7%	9.8%	555	708	25.10	19.65	40.40	29.89	38.08
01.01.2001 - 30.06.2001	959	163	80.7%	13.7%	522	680	25.03	19.00	40.40	28.60	38.08
01.07.2001 - 30.11.2001	1061	233	77.7%	17.1%	1,254	549	24.95	19.25	40.40	28.60	38.08
01.12.2001 - 30.06.2002	1138	285	75.1%	18.8%	1,367	1,033	24.95	19.50	40.40	28.60	38.08
01.07.2002 - 31.12.2002	1190	325	72.5%	19.8%	864	1,137	26.29	21.75	41.39	39.19	40.04
01.01.2003 - 30.06.2003	1223	350	71.6%	20.5%	1,082	1,116	30.47	25.00	45.46	49.78	41.70
01.07.2003 - 31.12.2003	1255	356	72.3%	20.5%	1,207	1,337	33.30	26.00	48.55	49.78	41.40
01.01.2004 - 29.02.2004	1287	362	72.6%	20.4%	814	373	33.30	26.00	48.55	49.78	41.40