

Mobile Telephony Price Benchmarking in Croatia

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Abstract— To extend the understanding of which operator provides the lowest price we have conducted mobile telephony price benchmarking in Croatia for 2014. During this period we have collected data for 21 residential tariffs of the three largest Croatian mobile network operators. Five pre-defined usage baskets were used to simulate various usage patterns. Analytical tool was developed to calculate the cost. Results suggest that, in overall, the most cost-effective operator is Tele2, followed by Hrvatski telekom and Vipnet. These results can be used for operators' strategic positioning on the market, and by end-users and experts alike in decision making about mobile tariffs.

Keywords— Mobile tariff, Benchmark, Mobile operators

I. INTRODUCTION

A. Mobile telephony market

Telecommunications services have been a major driver of the global economy in the last 10 years ([1] GSMA, 2013). To be successful, mobile operators need to respond to various, sometimes conflicting, factors such as new technologies, regulatory pressures, and economic crises ([2] Harno et al. 2009). In addition, every operator is puts effort to retain existing users and to attract new users with various offers and tariffs. They often contain myriad characteristics such as free minutes, messages, megabytes (MB), price of calls and messages, etc. Consequently, they could create difficulties and biases when choosing mobile tariff.

On the other hand, unsatisfied users can change an operator very easily with the ongoing market liberalization. In that case, an operator must analyze the benefits that user gains from switching operator and see how it affects its revenue. In addition, it may be useful for operator to perform benchmarking of mobile telephony price through different usage scenarios.

B. Croatian context

Mobile market in Croatia is currently comprised of the three mobile network operators (MNO): Hrvatski telekom (HT) Vipnet (Vip) and Tele2. According to [3] HAKOM (2014a), in June 2014 HT had largest market share (46.61%), followed by Vip (35.57%) and Tele2 (17.82%).

Mobile user behavior varies for different users in Croatia. For example, users choose Tele2 primarily because of the financial reasons ([4] Tvornica istraživanja, 2013a). According to the same research, users select HT because their friends and

relatives are on the same network. Vip is selected by users who want quality user support.

An average Croatian mobile user spends \$232 per year on mobile services ([5] HAKOM, 2013). The likelihood that Croatian user is considering a switch of operator depends to some extent on how much he or she pays per month. Among users who spend \$9-13 per month, 48% think about switching, as well as 45% of those who spend \$14-17 per month ([4] Tvornica istraživanja, 2013a). These data suggest that these users may be particularly likely to benefit from the results of mobile telephony price benchmarking.

Despite the increase of voice minutes in 2014, compared to 2013, mobile revenues have fallen 27% in the second quarter of 2014, compared to the second quarter of 2013 ([6] (HAKOM, 2014b). This may be because of the proliferation of flat tariffs which include unlimited promotions (free minutes, messages, and MB). It could also be argued that this is a result of the ongoing economic crises.

C. Mobile telephony price benchmarking

When users want to determine the most cost-effective tariff, they need to consider myriad factors. For example, the amount of monthly subscription, amount of free minutes, a billing unit, and connection fee are only several cost-drivers. Quantification of all cost drivers might be a problem for an average user. Therefore, it's necessary to implement a mathematical model which includes all variables to determine the cost.

Benchmarking of mobile telephony price may prove useful when user wants to compare various tariffs on the market. User has a chance to find out what will change if he or she changes tariff or even an operator. Furthermore, it's possible to compare previous and current tariffs on the market, thus getting insight how certain changes in tariff structures reflect on cost.

II. DATA AND METHODOLOGY

A. Data description

Data were collected for 21 residential tariff plans available on the market. The monthly subscription doesn't include any upfront fee for mobile devices. Therefore, we assume that a user gets mobile phone for free while cost estimation is performed for a period of 1 month.

TABLE I. MOBILE TARIFFS' CHARACTERISTICS

Operator (Tariff's name)	Monthly subscription ^d	Free minutes	Free SMS	Free data	Conne - ction fee
HT (S)	55 Kn	150 ^a min	100 ^a	-	0.29 Kn
HT (M)	75 Kn	200 ^a min	200 ^a	Unlimited	0.29 Kn
HT (L)	135 Kn	Unlimited, 200 ^c min	200 ^a	Unlimited	-
HT (XL)	190 Kn	Unlimited, 500 ^c min	500 ^a	Unlimited	-
HT (XXL)	350 Kn	Unlimited, 5000 ^c min	Unlimited ^a	Unlimited	-
HT (Do 28 god.)	100 Kn	Unlimited, 200 ^c min	200 ^a	Unlimited	-
Vip (Bez granica S)	75 Kn	Unlimited ^b	Unlimited ^b	Unlimited	-
Vip (Bez granica M)	125 Kn	Unlimited ^b	Unlimited ^b	Unlimited	-
Vip (Bez granica L)	220 Kn	Unlimited ^a	Unlimited ^a	Unlimited	-
Vip (Bez granica XL)	400 Kn	Unlimited ^a	Unlimited ^a	Unlimited	-
Vip (Bez granica XXL)	600 Kn	Unlimited ^a	Unlimited ^a	Unlimited	-
Tele2 (Revolucija)	150 Kn	Unlimited ^b 1500 ^c min	Unlimited ^a	3 GB	-
Tele2 (Mix tarifa 50)	50 Kn	150 ^a min	100 ^a	250 MB	0.29
Tele2 (Mix tarifa 75)	75 Kn	250 ^a min	250 ^a	500 MB	-
Tele2 (Mix tarifa 100)	100 Kn	500 ^a min	500 ^a	1 GB	-
Tele2 (Mix tarifa 125)	125 Kn	750 ^a min	750 ^a	1.5 GB	-
Tele2 (Mix tarifa 150)	150 Kn	1000 ^a min	1000 ^a	2 GB	-
Tele2 (Mix tarifa 175)	175 Kn	1500 ^a min	1500 ^a	2.5 GB	-
Tele2 (Mix tarifa 200)	200 Kn	2000 ^a min	Unlimited ^a	3 GB	-
Tele2 (Mix tarifa 300)	300 Kn	3000 ^a min	Unlimited ^a	4 GB	-
Tele2 (Mix tarifa 400)	400 Kn	Unlimited ^a	Unlimited ^a	5 MB	-

^aValid towards all networks (operators)

^bValid within network (on-net calls)

^cValid towards other networks (off-net calls)

^d1 Kn ≈ \$0.17 in September 2014

This paper doesn't consider group and business tariffs, special promotions and additional services such as cloud music services, mobile TV and cloud storage service. In order to obtain more credible results we assumed that price of mobile device could significantly affect cost, thus causing certain noise in the results. Therefore, price of mobile device was not taken into consideration.

Table 1 contains list of tariffs in the sample and their characteristics.

B. Calculating total cost

We used predefined OECD mobile baskets to simulate different usage scenarios of mobile services. Table 2 contains mobile baskets used in this paper. Each basket is comprised of different number of calls, SMS messages, total voice minutes and data traffic, thus representing different usage patterns.

Before calculation, following assumptions were made:

- We assume that a user spends 91% of total outgoing minutes to on-net calls, according to [7] Croatian Bureau of Statistics (2014).

- If tariff includes only free minutes for calls within network, the remaining 9% of total minutes will be distributed according to the ratio of their relative customer base.
- We assume that SMS messages are sent to each network in proportion to their relative customer base.
- We assume that the average call duration is a quotient of total minutes and total calls.
- MMS messages were not included. This is because of the small amount of total MMS messages sent in the second quarter of 2014. In fact, it was only 0.001 MMS per user ([7] Croatian Bureau of Statistics, 2014).
- Total cost includes surcharges for airtime excise (5 Kn), charge for network access (10 Kn) and Value Added Tax (VAT) of 25%.

Total cost of calls, messages and data is calculated by subtracting the total amount defined in the baskets from free promotions in the tariff. After spending free promotions, services are charged according to the official price list of the operators ([8] Hrvatski telekom (2014), [9] Vipnet (2014), [10] Tele2 (2014)). In order to account for different billing unit duration, OECD (Organisation for Economic Cooperation and Development) methodology was used ([11] OECD, 2010).

We're going to test mobile tariff plans using mobile baskets (Table 2) across HT, Vip and Tele2 end-user cost perspective. This cross-sectional analysis will enable insights of how a change to new tariffs affects cost. For example, if HT user spends 91% of total minutes on calls within network, would it be potentially more cost-effective to switch tariff or even an operator.

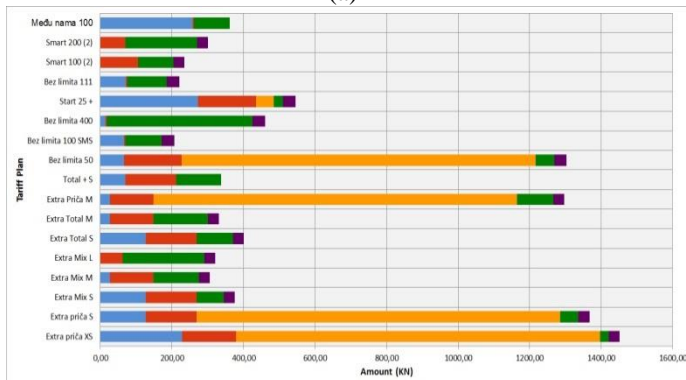
The cheapest operator in overall will be determined by generating "TOP 3 cheapest tariff" list. Consequently, first place will be weighted by 3 points, second place by 2 points, and third place by 1 point. The cheapest operator will be the one with the highest total weighted score.

TABLE II. OECD MOBILE PRICE BASKETS (VOICE/SMS + DATA)

Name	Call volume	SMS	Total minutes	Data
PB 1	30 calls	100	50	100 MB
PB 2	100 calls	140	188	500 MB
PB 3	300 calls	225	569	1 GB
PB 4	900 calls	350	1787	2 GB
PB 5	100 calls	140	188	2 GB

COST BREAKDOWN					
Total cost (calls)	Total cost (messages)	Total cost (data)	Monthly subscription	Connection fee	Overall cost
83,83	27,29	9305,55	24,41	20,00	9461,08
0,00	17,29	9305,55	50,82	20,00	9393,66
0,00	6,09	9305,55	101,63	20,00	9433,27
0,00	17,29	6763,05	76,22	20,00	6876,56
0,00	6,09	6763,05	127,04	20,00	6916,18
0,00	6,09	4098,51	228,66	20,00	4353,26
0,00	6,09	4098,51	330,29	20,00	4454,89
0,00	17,29	0,00	101,63	20,00	138,92
0,00	6,09	0,00	152,44	20,00	178,53
0,00	6,09	0,00	254,07	20,00	280,16
0,00	6,09	0,00	355,70	20,00	381,79
0,00	6,09	0,00	508,14	20,00	534,23
83,83	27,29	9305,55	25,41	20,00	9462,08

(a)



(b)

Figure 1. Cost breakdown by different cost driver in Tariff calculator

C. Tariff calculator

For implementation of mathematical calculations, analytical spreadsheet tool “Tariff calculator” was developed. It’s regularly updated system with new tariff plans. Currently, it contains 68 tariff models (previous and existing). This tool enables quantification of all cost drivers, such as cost of calls, messaging, and data transfer, including various fees and taxes. As a result, user can test new tariffs against previous ones, and see what may occur when switching operator.

In the *Tariff calculator* user enters amount and distribution of the traffic among operators (number of minutes, messages and data, billing unit etc.). It enables to analyze all tariffs or just the ones selected by user.

Tariff calculator enables easier way to analyze the results of benchmark test. Moreover, all results (e.g. costs) are broken down and graphically displayed. It’s possible to view the overall or customized results according to the cheapest/most expensive tariffs for calls, messaging or data transfer. This tool can be used by experts and end-users alike as a decision support when choosing tariff. Figure 1 shows partial view of the results and quantification of cost drivers in Tariff calculator.

III. RESULTS

TABLE III. BENCHMARK RESULTS FROM HT USERS’ PERSPECTIVE

Operator (Tariff’s name)	Hrvatski telekom				
	Total cost for mobile services ^a				
	PB 1	PB 2	PB 3	PB 4	PB 5
HT (S)	78.70	203.04	779.17	2531.30	203.04
HT (M)	98.70	119.00	187.00	411.00	119.00
HT (L)	150.00	150.00	160.00	210.66	150.00
HT (XL)	205.00	205.00	205.00	205.00	205.00
HT (XXL)	365.00	365.00	365.00	365.00	365.00
HT (Do 28 god.)	115.00	115.00	125.00	175.66	115.00
Vip (Bez granica S)	176.35	347.46	816.24	2259.28	347.46
Vip (Bez granica M)	226.35	397.46	866.24	2309.28	397.46
Vip (Bez granica L)	235.00	235.00	235.00	235.00	235.00
Vip (Bez granica XL)	415.00	415.00	415.00	415.00	415.00
Vip (Bez granica XXL)	615.00	615.00	615.00	615.00	615.00
Tele2 (Revolucija)	165.00	165.00	165.00	522.46	165.00
Tele2 (Mix tarifa 50)	73.70	305.30	1114.09	3329.71	1055.30
Tele2 (Mix tarifa 75)	90.00	90.00	801.84	2834.71	840.00
Tele2 (Mix tarifa 100)	115.00	115.00	329.34	2327.21	615.00
Tele2 (Mix tarifa 125)	140.00	140.00	140.00	1854.71	390.00
Tele2 (Mix tarifa 150)	165.00	165.00	165.00	1382.21	165.00
Tele2 (Mix tarifa 175)	190.00	190.00	190.00	912.21	190.00
Tele2 (Mix tarifa 200)	215.00	215.00	215.00	442.21	215.00
Tele2 (Mix tarifa 300)	315.00	315.00	315.00	315.00	315.00
Tele2 (Mix tarifa 400)	415.00	415.00	415.00	415.00	415.00

^a All amounts are in Croatian Kunas (1 Kn ≈ \$0.17 in September 2014)

The Tables 3-5 contain the results of benchmark tests from cost-perspective of HT, Vip and Tele2 end-user. The top three cheapest tariffs are highlighted in each column, which represents mobile price baskets.

HT users (Table 3) do not necessarily have to switch an operator for mobile price baskets PB 3, PB 4 and PB5. It could be argued that, for PB 1 and PB 2, the user would be better off if he or she switched to Tele2.

TABLE IV. BENCHMARK RESULTS FROM VIPNET USERS' PERSPECTIVE

Operator (Tariff's name)	Vipnet				
	Total cost for mobile services ^a				
	PB 1	PB 2	PB 3	PB 4	PB 5
HT (S)	78.70	203.04	779.17	2531.30	203.04
HT (M)	98.70	119.00	187.00	411.00	119.00
HT (L)	150.00	165.98	616.54	2057.13	165.98
HT (XL)	205.00	205.00	358.54	1749.13	205.00
HT (XXL)	365.00	365.00	365.00	365.00	365.00
HT (Do 28 god.)	115.00	130.98	581.54	2022.13	130.98
Vip (Bez granica S)	121.77	147.53	212.24	379.85	147.53
Vip (Bez granica M)	171.77	197.53	262.24	429.85	197.53
Vip (Bez granica L)	235.00	235.00	235.00	235.00	235.00
Vip (Bez granica XL)	415.00	415.00	415.00	415.00	415.00
Vip (Bez granica XXL)	615.00	615.00	615.00	615.00	615.00
Tele2 (Revolucija)	165.00	165.00	165.00	522.46	165.00
Tele2 (Mix tarifa 50)	73.70	305.30	1114.09	3329.71	1055.30
Tele2 (Mix tarifa 75)	90.00	90.00	801.84	2834.71	840.00
Tele2 (Mix tarifa 100)	115.00	115.00	329.34	2327.21	615.00
Tele2 (Mix tarifa 125)	140.00	140.00	140.00	1854.71	390.00
Tele2 (Mix tarifa 150)	165.00	165.00	165.00	1382.21	165.00
Tele2 (Mix tarifa 175)	190.00	190.00	190.00	912.21	190.00
Tele2 (Mix tarifa 200)	215.00	215.00	215.00	442.21	215.00
Tele2 (Mix tarifa 300)	315.00	315.00	315.00	315.00	315.00
Tele2 (Mix tarifa 400)	415.00	415.00	415.00	415.00	415.00

^a All amounts are in Croatian Kunas (1 Kn ≈ \$0.17 in September 2014)

For Vip users there's a slightly different situation. In fact, in four cases it may be better for a user to switch operator, primarily Tele2. The most cost-effective Vip's tariff is for basket PB 4, which includes highest volume of traffic. Vip doesn't enter in TOP3 for the first three mobile baskets with lower traffic volume.

At Tele2 users, similar picture emerges as with HT users. For baskets PB 1 – PB 4 it may be better for user not to switch operator. In contrast to PB 2 and 500 MB, PB 5 includes 2 GB of data traffic. Because of that, a user might consider to switch to HT.

TABLE V. BENCHMARK RESULTS FROM TELE2 USERS' PERSPECTIVE

Operator (Tariff's name)	Tele2				
	Total cost for mobile services ^a				
	PB 1	PB 2	PB 3	PB 4	PB 5
HT (S)	78.70	203.04	779.17	2531.30	203.04
HT (M)	98.70	119.00	187.00	411.00	119.00
HT (L)	150.00	187.54	681.67	2259.80	187.54
HT (XL)	205.00	205.00	423.67	1951.80	205.00
HT (XXL)	365.00	365.00	365.00	365.00	365.00
HT (Do 28 god.)	115.00	152.54	646.67	2224.80	152.54
Vip (Bez granica S)	177.62	352.11	830.28	2275.21	352.11
Vip (Bez granica M)	227.62	402.11	880.28	2325.21	402.11
Vip (Bez granica L)	235.00	235.00	235.00	235.00	235.00
Vip (Bez granica XL)	415.00	415.00	415.00	415.00	415.00
Vip (Bez granica XXL)	615.00	615.00	615.00	615.00	615.00
Tele2 (Revolucija)	165.00	165.00	165.00	165.00	165.00
Tele2 (Mix tarifa 50)	73.70	305.30	1114.09	3329.71	1055.30
Tele2 (Mix tarifa 75)	90.00	90.00	801.84	2834.71	840.00
Tele2 (Mix tarifa 100)	115.00	115.00	329.34	2327.21	615.00
Tele2 (Mix tarifa 125)	140.00	140.00	140.00	1854.71	390.00
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Tele2 (Mix tarifa 200)	215.00	215.00	215.00	442.21	215.00
Tele2 (Mix tarifa 300)	315.00	315.00	315.00	315.00	315.00
Tele2 (Mix tarifa 400)	415.00	415.00	415.00	415.00	415.00

^a All amounts are in Croatian Kunas (1 Kn ≈ \$0.17 in September 2014)

TABLE VI. WEIGHTED SCORES

	Hrvatski telekom	Vip	Tele2
No. of 1 st places x 3	15	3	27
No. of 2 nd places x 2	14	4	14
No. of 3 rd places x 1	9	0	7
TOTAL	38	7	48

Table 6 shows weighted scores for each operator. There is a substantial difference in score between HT and Tele2 on one side and Vip on the other side. The highest number of first places has Tele2. When talking about being No. 2, Tele2 and HT are equal. HT is the operator that has been third most frequently. On the other hand, Tele2 has the highest total weighted score.

IV. DISCUSSION AND CONCLUSION

The main purpose of this article was to perform mobile telephony price benchmarking of residential tariffs in Croatia. To conduct the test, OECD methodology was used. According

to our results, the most cost-effective operator in overall is Tele2, followed by HT and Vip. These results suggest that, in some scenarios, it may prove useful to switch tariff or even an operator.

The fact that users choose Tele2 because of the financial reasons ([12] Tvornica istraživanja, 2013b), is consistent with our results which suggest Tele2 is indeed the cheapest operator. According to the same analysis, results also align with the fact that users choose HT because their relatives and friends are on the same network. This is because in the three situations (Table 3) it doesn't pay off for a HT user who spends 91% on on-net minutes to switch operator. Vip is selected by business users and those who require certain level of quality of service ([12] Tvornica istraživanja, 2013b). Therefore, it could be argued that Vip should change his offer because its results in this benchmark test are not like Tele2's and HT's.

HT, despite having significantly larger market share, is not the most expensive operator. On the other hand, it's possible that Tele2, the operator with smallest market share, is trying to attract new user by lowering its prices. As a result, Tele2's market share rose to 17.82% (June 2014) from 11.60% in 2011 ([3] HAKOM, 2014a). Vip's market share, slightly fell to 35.57% (June 2014) from 39.24% in 2011.

Further improvements of presented methodology are related to distribution of average call duration. It is necessary to distribute the duration of average call more detailed with respect to operators. For example, it can be assumed there is a difference between an average on-net and off-net call duration. In fact, it is consistent, with the data from [7] Croatian Bureau of Statistics (2014), that an average user spends 91% of total voice minutes on on-net calls. The same applies to SMS messages. Developing such a function would require more detailed information and a certain level of cooperation with telecom operators.

After Croatian accession to the European Union (EU), price of roaming calls has fallen. Consequently, there is a proliferation of tariffs which includes free promotions towards mobile operators in EU. Therefore, it's also necessary to investigate how international calls reflect on cost.

Mobile operators need to simplify their mobile tariffs, thus reducing the users' effort to understand their offer. Confusion about tariffs, their characteristics and various offers on telecommunication market may cause bias toward decision about choosing the tariff. Our results and analytical tool *Tariff calculator* may provide users with additional information when comparing tariffs, thus reducing possible bias. In addition, *Tariff calculator* can be developed as a web service in a form of price comparison site. Such site may prove useful as a

consumer empowerment measure on the emerging markets like Croatian where, to our best knowledge, there is currently no such a service.

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