MOBILE VIRTUAL OPERATORS: THE CASE OF THE CZECH REPUBLIC

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Abstract

Mobile virtual network operators (MVNOs) offer mobile telecommunication services by purchasing capacity from mobile network operators (MNOs) and competing with each other at the retail market. The purpose of this study is to examine national data in order to identify possible impact mobile virtual operators (MVNOs) on the mobile market and consumers. While the opening of the wholesale market for MVNOs is relatively widespread in European countries, evidence of its impact on end consumers is limited due to a lack of previous research. For this purpose, the market entry of MVNOs in the Czech Republic in 2013 is analysed to estimate the impact on consumers. The results, based on standard difference-in-differences, suggest that the market entry of MVNOs leads to a decrease in the price of calls and a decrease in the monthly ARPU of operators relative to the control countries. This results also imply an appropriate policy to promote MVNO diffusion.

Key words: MVNO, regulation, telecommunication

JEL Code: L51, L96

Introduction

In general, there is a relatively small number of theoretical and empirical studies on the impact of MVNOs on mobile markets. It is worth mentioning that the studies have concluded that there are two types of MVNOs: Telecommunications-oriented players have telecommunications as their main business activity, while for business-oriented players telecommunications is only one of their many business activities (Sarraf, 2002).

OECD researchers, Boylaud and Nicoletti (2001), showed a significant relationship between regulation, market structure, and telecommunications performance. They examined the empirical links between regulatory regimes, the market environment, and performance in fixed and mobile networks. Using data from the OECD countries in the 1990s, they provided empirical evidence showing that the liberalization of market entry and the development of

effective competition in telecommunications services generally lead to higher productivity, lower prices, and a higher quality of services.

Peppard and Rylander (2006) found that the introduction of MVNOs had motivated more companies in the market to provide both telecommunications and content services, which has increased the use of mobile devices by users. Kalmus and Wiethaus (2010) expanded on the value chain theory by stating that MNOs will host MVNOs only if MVNOs do not present a competitive pressure to generate MNO profits. Such a situation will only occur if MVNOs and MNOs provide different services, meaning these players do not compete directly and retail prices thus remain stable. Banerjee and Dippon (2009) assumed the existence of product differentiation, allowing MNOs and guest MVNOs to remain profitable, but found that competition at the wholesale level had not yet emerged. In contrast, Garrido and Whalley (2013) used a sample of five countries to illustrate that the number of MVNOs has increased over time, while concentration on the wholesale market has decreased. Furthermore, for example, Sung (2014) examined the relationship between market concentration, prices, and profits in the mobile market of 24 selected OECD countries and concluded that the entry of MVNOs together with the introduction of mobile phone portability to the mobile market can have a positive effect on price competition.

Shin (2010) concluded that factors such as social impact, perceived quality, and ease of use influence consumers' intent to switch to MVNO services. On the other hand, the costs of changing operators negatively affect the willingness of consumers to switch and then use the services of MVNO.

Most studies come to two conclusions as to why the total number of MVNOs is still growing, although in terms of transaction costs, the number of price based MVNOs should decrease. The first is the role of the regulator, which can stimulate a competitive environment where MNOs have no motivation to host MVNOs. Banerjee and Dippon (2009) found that the regulator should enforce access for MVNOs only if the MNOs engage in discriminatory behaviour or abuse their dominant position. In other cases, the role of the regulator should be limited to promoting voluntary commercial cooperation between MVNOs and MNOs. Song (2010) suggested that when conditions effective competition for MVNOs are upheld, regulatory intervention is not necessary, as MNOs will voluntarily host MVNOs. Kim and Seol (2007) studied the expected economic impacts of the introduction of MVNOs depending on the type of MVNO and regulation in Korea. Unlike previous studies, they found that active regulation grants access to wholesale prices and regulation is generally desirable when it comes to generating a consumer surplus. Dewenter and Haucap, (2007) showed that MVNOs operate

successfully in places where regulation has limited the dominant position of MNOs, such as Germany and Spain. Riccardi et al. (2009) suggested that MVNOs have succeeded in countries where regulation has been able to prevent the introduction of MNO measures that would discourage MVNOs from entering the market.

The second reason studies agree on is that the market entries of MVNOs are motivated by permanent opportunities resulting from the developments of the telecommunications industry, both on the part of MVNOs and MNOs. The advantages associated with hosting an MVNO can outweigh the disadvantages that result from it. Although an increased number of competitors in the mobile market may lead to a price war, MVNOs also offer an alternative sales channel for overcapacity of the MNO networks. This hosting can be advantageous for MNOs for two reasons. Firstly, higher revenues can reduce financial entitlements from obtaining new spectrum licenses by increasing the use of each operator's radio spectrum (Kuo & Yu, 2006). Second, the revenues could be higher than the loss of customers, when MVNOs focus on market segments that are not the main target market of MNOs, such as the elderly, adolescents, or immigrant minorities (Banerjee & Dippon, 2009). At present, network operators often see MVNOs as an effective indirect sales channel, or an alternative distribution channel that allows MNOs to strengthen their financial situation, especially in the cases where MVNOs focus on different segments and have well-known brands that exclude price-based competition.

As for the impact of MVNOs on the mobile market itself, Kim and Seol (2007) concluded that the market entry of MVNOs has resulted in a reduction in the retail price of the mobile services provided. In contrast, Höffler and Schmidt (2008) pointed out that even if prices do not fall, consumers are not necessarily harmed by the entry of MVNOs, as mobile operators can engage in non-price competition. Due to that, consumers can benefit from a wider and richer range of services, more flexible tariffs, and value-added services.

In general, previous studies have analysed in particular the theoretical determinants of MVNOs' growth, their relationship to MNOs, and the role of regulators in supporting the expansion of MVNOs.

1 Data and methodology

Dataset includes telecommunications data from BMI Research, Body of European Regulators for Electronic Communications and the Group of Independent Regulators. Geographical and GDP indicators were obtained from the OECD and World Bank database. The value of the Herfindahl-Hirschman index was calculated using data from operators or regulatory authorities

of member countries. The time period is based on the availability of data from each source. There are 11 quarters before and 11 quarters after the market entry of MVNOs in the Czech Republic in 2013. The time period therefore begins with the 3rd quarter of 2010 and ends with the 4th quarter of 2015.

The impact of MVNOs market entry is identified by comparing the actual results after market entry with a hypothetical result that would occur in the absence of market entry. Given that for the Czech Republic, where the MVNOs entered, only the real impact on the market can be observed, it is necessary to estimate the counterfactual result without the market entry of MVNOs using the difference-in-differences (DiD) method.

As the MVNOs market entry itself may not explain the difference in outcome variables in individual countries, other country-specific control variables were included in the model in order to measure the impact of changes in costs and demand on the price of mobile services. Other control variables may explain these differences to some extent. Therefore, the estimation equation takes the following form:

$$\begin{aligned} log\ (Y)_{it} = \beta_0 + \beta_1 DiD\_1_{it} + \beta_2 DiD\_2_{it} + \beta_3 log\ (GDP_{it}) \\ + \beta_4 log\ (MTR)_{it} + \beta_5 HHI_{it} + \beta_6 Area_{it} \\ + \beta_7 Density_{it} + u_{it} \end{aligned} \quad (1)$$

where log $(Y)_{i, t}$ is the logarithm of the outcome variable (price /ARPU/minutes). *Price* is the price for 1 minute of outgoing call in the mobile network. The market entry of MVNOs itself could have an impact not only on the price of the call, but also on other prices such as the price of SMS and the price of data and thus on the revenues of operators. Another outcome variable is the monthly *ARPU* (Average Revenue per user). This variable shows how the market entry of MVNOs affected the profitability of network operators and what happened to the average monthly sum that end consumers pay to operators for all mobile services consumed. As the third outcome variable, I also included the operating variable – *Minutes*, which represents the average number of outgoing minutes per SIM card. This makes it possible to find out what effect the entry of MVNOs had on the consumption of telecommunications services itself. If the price decreases together with the ARPU and the average number of outgoing minutes increases, this would mean an increase in the consumer surplus, as end-users consume more telecommunications services at lower prices and vice versa.

DiD_1 and *DiD_2* are dummy variables amount to 1 for the first year after the entry of MVNO, resp. for the second year in the treatment country. These variables were included in the model

to determine the short- and medium-term impact of MVNO market entry. These two variables can be replaced by the *DiD* variable in order to determine the overall effect of the MVNOs market entry. The variable *GDP* denotes real gross domestic product per capita, which can be considered a proxy variable related to change in demand for mobile services, and *MTR*[1] refers to a mobile termination rate, which can be considered a proxy variable with a marginal cost of calls to other mobile networks. The Herfindahl-Hirschman Index (*HHI*) has also been included. It captures the concentration in the mobile market. In a market with a high HHI, we can expect the price to be higher as there is less competition. Furthermore, the variables *Area* and *Density* represent the investment intensity for building a mobile network. It can be expected that with a larger land area, but above all with a higher population density, operators have to build more capacity networks and have to reckon with higher operating costs for such a network. On the other hand, this could lead to a return to scale.

Furthermore, finding a suitable control group (country or group of countries) is also necessary. Slovakia can be such a country for several reasons. There are no MVNO operating on the Slovak mobile market in the given period, only 3 MNOs, just like in the Czech Republic. Slovakia has undergone a similar development in telecommunications as the Czech Republic and has a similar regulatory policy, due to the common European regulatory framework. To make the results as robust as possible, I decided to include the second control group, namely selected countries of the European Union (EU). In these countries, the market has not undergone any fundamental changes – no new network operator entered the market, no existing ones left, and there were no new mergers or acquisitions or new MVNO entry. A total of 13 EU countries were included in this control group: (1) Belgium, (2) Denmark, (3) Estonia, (4) Finland, (5) Italy, (6) Germany, (7) the Netherlands, (8) Poland, (9) Portugal, (10) Austria, (11) Slovakia, (12) Spain, and (13) Sweden.

2 Results

a) Price

Table 1 presents the results for price per 1 minute of outgoing call (*Price*) for both control groups (Slovakia and selected EU countries). Model (1) presents the results for the overall impact of the market entry of MVNOs. It can be noted that after the entry of MVNOs, the price decreased on average by 7.6 to 17.5%. The second model (2) examines the impact of market

[1] This is the rate that an MNO has to pay for calls that end up in the network of the subscribers of another MNO so that they can offset the cost of the incoming call of the other MNO. MTRs are often regulated and cost oriented.

entry from a short-term perspective (first year) as well as a medium-term perspective (second year). In the short term, the market entry of MVNOs reduced the price by an average of 3.4 to 11.9%, but this variable is not statistically significant. In the medium term, the market entry of MVNOs has resulted in reducing the average price of 1 minute of call by 11.9 to 15%.

Tab. 1: Results for the price of 1 minute of an outgoing call

Variables	(1)				(2)			
Dependent variable (ln_price)	Slovakia		EU		Slovakia		EU	
cons	392,1659		20.46788	***	145.1128		20.63722	**
	[346.143]		[7.265498]		[441.6151]		[0.0341709]	
DiD	-0.1752933	*	-0.0756568	***	-		-	
	[0.0299733]		[0.0222384]		-		-	
DiD_1	-		-		-0,1185022		-0.0335754	
	-		-		[0.0329618]		[0.0341709]	
DiD_2	-		-		-0.1496658	**	-0.1192986	***
	-		-		[0.0115953]		[0.0178907]	
ln_GDP	-0.6115342		-1.58512	**	-1.34438		-1.60964	**
	[0.3557686]		[0.6558067]		[0.3116865]		[0.6759712]	
ln_MTR	0.3086106	***	0.4284732	***	0.29084	**	0.4297638	***
	[0.0005367]		[0.0239032]		[0.0152203]		[0.024382]	
ln_HHI	0.3878953		0.3229089		-0.13684		0.3164136	
	[0.4278504]		[0.2939118]		[0.4870355]		[0.2935245]	
Area	-0.0052125		-0.000015		0,00		-0.0000147	
	[0.00542427]		[0.0000113]		[0.0065655]		[0.0000116]	
Density	-0.4864924		-0.012146		-0.46		-0.0120071	
	[0.1163455]		[0.137025]		[0.2734519]		[0.0137678]	
Observations	44		308		44		308	
R^2 – within	0.97		0.87		0.97		0.87	
Test – common trend	Passed		Passed		Passed		Passed	

Note: Standard errors (in parentheses) are clustered at the country level, ***p<0.01, **p<0.05, *p<0.1.

b) ARPU

Table 2 summarizes the results for *ARPU*. Model (3) examines the overall effect of MVNO market entry. Only the impact of MVNOs is statistically significant in the EU control group: the market entry reduced operators' ARPU by 9%. This would indicate that the customer paid less for all telecommunication mobile services (not only voice services), but only if the consumption of mobile services had increased. For the Czech Republic, as well as for most countries, the consumption of telecommunications services (voice services, data services, and SMS) has been growing.

As for model (4), no variable is statistically significant. The negative impact of MVNO market entry can be seen in the short and medium term, but both variables are insignificant. One of the reasons for this may be that ARPU includes not only revenues from voice services, but also SMS, and especially revenues from mobile data services. These have been growing for a long

time, at the expense of conventional mobile services such as voice and SMS services. From a long-term perspective, ARPU is in decline, but provides are trying to compensate for this decline by increasing revenues from data services. It can therefore be concluded that MVNOs are able to offer competitive offers on traditional mobile services (voice, SMS) but not on data services.

Tab. 2: Results for ARPU

Variable	(3)			(4)		
Dependent variable (ln_ARPU)	Slovakia		EU	Slovakia		EU
cons	297.1199		4.093465	121.5512		4.081776
	[151.5351]		[4.252169	[200.8829]		[4.207007]
DiD	-0.1060657		-0.09 ***	-		-
	[0.0597237]		[0.0252735]	-		-
DiD_1	-		-	-0.0687619		-0.0179679
	-		-	[0.0457092]		[0.02047]
DiD_2	-		-	-0.1022021		-0.1075925
	-		-	[0.0263014]		[0.0180626]
ln_GDP	-0.7333852		-0.19832	0.29675	*	-0.1831102
	[0.271058]		[0.3563046]	[0.0310719]		[0.3552056]
ln_MTR	0.1473267		0.22607 ***	0.13495		0.2291962 *
	[0.328966]		[0.0180895]	[0.039636]		[0.3552056]
ln_HHI	-0.0584775		-0.03154	-0.28649		0.2291962
	[0.2278398]		[0.2082723]	[0.0982769]		[0.17607]
Area	-0.0039694		-0.00002 *	-0.00116		-0.0464782
	[0.00226]		[0.00001]	[0.0028753]		[0.2088474]
Density	-0.4241289	*	0.00983	-0,39669		0.0102444
	[0.0565517]		[0.0096599]	[0.1661587]		[0.0096101]
Observation	44		308	44		308
R^2 – within	0.96		0.76	0.97		0.76
Test – common trend	Passed		Passed	Passed		Passed

Note: Standard errors (in parentheses) are clustered at the country level, ***p<0.01, **p<0.05, *p<0.1. For better clarity, columns are numbered starting from 3.

c) Minutes

Table 3 shows the resulting values for the number of outgoing minutes (*Minutes*). For the first model (5), only the variables GDP and MTR are statistically significant. While GDP has a positive effect – the number of outgoing minutes increases with increasing GDP per capita, the MTR has a negative effect – as the price of termination rates increases, the number of outgoing minutes decreases. Similar values can be found in the last model (6), with the difference that in both control groups, the values for the variable DiD_1 are significant. Thus, MVNO market entry has resulted in an increase in the number of outgoing minutes in the mobile network by 6.3 to 6.8%.

However, these two models (5) and (6) did not pass the common trend test. This may be due to the difference in the introduction of flat voice tariffs, where after purchasing this tariff, the

customer can make unlimited calls – there is no limit on the number of call minutes per month. These flat tariffs were introduced at a different time in each country, and not all operators took this step at the same time, and this seems to be the main reason why the common trend test is not based on both Slovakia and the selected EU countries. An alternative explanation may be the rise of OTT services such as Skype, WhatsApp, or Viber.

Tab. 3: Results for minutes

Variable	(5)			(6)		
Dependent variable (ln_minutes)	Slovakia	EU		Slovakia		EU	
cons	-137.1565 [249.704]	-10.81774 [0.0279599]	**	-91.11095 [329.8374]		-11.31568 [4.152962]	***
DiD	-0.0093883 [0.0566069]	0.043989 [0.0279599]		- -		- -	
DiD_1	- -	- -		0.0630069 [0.0023159]	***	0.0679562 [0.0285375]	**
DiD_2	- -	- -		0.0436722 [0.0226524]		0.0549316 [0.0218864]	**
ln_GDP	1.047179 [0.9228212]	1.22302 [0.3679431]	***	1.49151 [0.7677042]		1.27211 [0.3818482]	***
ln_MTR	-0.116803 [0.0518355]	-0.06433 [0.223505]	**	-0.0835315 [0.0460284]		-0.0635908 [0.0219905]	**
ln_HHI	-0.093174 [1.352575]	-0.29049 [0.2925072		-0155443 [1.112347]		-0.2961748 [0.2864825]	
Area	0.0020773 [0.0038328]	0.00004 [0.000651]		0.0012652 [0.0051094]		0.0000388 [0.0000679]	
Density	0.0060953 [0.0110147]	0.01160 [0.0066002]	*	0.0089348 [0.0229544]		0.0117935 [0.0066317]	*
Observation	44	308		44		308	
R^2 – within	0.89	0.57		0.9		0.57	
Test – common trend	Failed	Failed		Failed		Failed	

Note: Standard errors (in parentheses) are clustered at the country level, ***p<0.01, **p<0.05, *p<0.1. For better clarity, columns are numbered starting from 5.

Conclusion

This study addressed the question of whether the very market entry of MVNOs in the first half of 2013 in the Czech Republic had any impact on consumer utility. I focused on three outcomes: the price of 1 minute of outgoing call, the average monthly revenue of the operator per 1 user, and the average monthly number of outgoing call minutes. The results clearly prove that the market entry of MVNOs and thus the increase in competition in this market had a positive effect on end consumers.

The added value of this study is undoubtedly the analysis of the entry of new players into the mobile market and their impact on consumer utility. So far, no other study has addressed the impact of MVNO market entry. The findings of this study may have an impact on national

regulatory policies. The state has limited opportunities to increase competition in the mobile market – mainly due to the limited radio spectrum usable by mobile operators. However, this study proves that a wholesale market for MVNOs mobile services has a positive effect on market competition, and in particular on the market price of services, despite the fact that MVNOs are fully dependent on network operators' offers.

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