A Close Look on Mobile Number Portability in Turkey

Yavuz GÖKTAYLAR[[1]](#footnote-1) and Mehmet Bilal ÜNVER[[2]](#footnote-2)

Abstract

In Turkey, mobile number portability has been implemented since late 2008. The implementation has been accepted generally as a successful regulation. After the implementation of mobile number portability since November 2008, there is slightly decline in mobile penetration rate in Turkey which is attributed to effect of mobile number portability. In this paper, we test this hypothesis by using the Chow test to determine whether there is a regime change after introduction of mobile number portability. We use time series data, number of mobile number subscriptions, spanning period between 2002 and 2014 at monthly basis. The data is obtained from Information and Communication Technologies Authority, regulatory body in Turkey. The evidence seems to support the hypothesis.

Introduction

Turkish mobile telecommunications market, liberalized in 1998, having undergone many developments since then. One of the landmark developments for this sector was the introduction of mobile number portability (MNP) in November 9, 2008, which allows porting of one number from one mobile operator to another without any charge to be paid by the subscribers. This development, along with other regulatory acts (e.g., highly reduced interconnection rates, additional pricing rules applied to Turkcell, leading mobile operator), seem to have made a significant effect over mobile telecommunications industry in Turkey, which is expressed by many (Kulali and Bilir, 2012; Tözer and Güngör, 2012).

The four largest telecommunications firms in the Turkish telecom sector (three mobile firms and Türk Telekom, fixed incumbent) have recorded 26 billion TL net sales volume in 2013, and almost 71% of this volume is realized by the mobile services, namely by the three mobile operators (ICTA, Market Data, 2013 Q4). The average growth rate of gross revenue in Turkish mobile telecommunications for the last five years is 41%, marking a contrast with the stagnant growth of the fixed telecommunications sector. However, though with a lessening degree, Turkish mobile market has a remarkable concentration rate with three players, Turkcell, Telsim, and Avea that have market shares of 46,2%, 32,55%, and 21,25%, respectively (ICTA, Market Data, 2014 Q2). Notwithstanding this issue, calling prices decrease in a day-by-day speed, being followed by a very remarkable MoU level (364 minutes per capita) (ICTA, Market Data, 2014 Q2), the highest EU rate, represent another aspect of Turkish mobile market. Such determinants, having appeared over the last five years, drove Turkish mobile market to a more balanced and fair playing field for which MNP does seem to have an important stake.

Traditionally, MNP has become one of the regulatory instruments towards consumer welfare and a more competitive marketplace, and Turkey’s experience proves this fact with note-worthy results. First, there arouse a variety of new and competitive tariffs, especially those of flat rates which enable calling to all directions (off-net and on-net) with a certain fixed price. This trend has intensified in 2009 and afterwards, being fed with the continued reduction of interconnection fees as well as an exponentially growing MNP. In a short period after implementation, by January 2010, ported mobile phone numbers have reached 11.251.030 (Güngör and Evren, 2010), corresponding to 17.9% of the whole mobile subscribers, and now exceeded 75 million.

Second remarkable aspect of Turkish MNP experience is the distribution of mobile calls among on-net and off-net calls (Başaran, Çetinkaya and Bağdadioğlu, 2014). Flat rate tariffs and growing price competition in the market has significantly changed the so-called distribution in favor of on-net traffic, which occupies 41.6% of the total mobile traffic now, comparing to 9% in 2008. This seems quite related to introduction of extra reduced tariffs exclusive for the newcomers preferring to port his or her number from another operator. Such subscribers are and have been invited by each mobile operator with more attractive prices comparing to those open to everyone. As a conclusion of these resultant effects, Turkey has been recorded as the leading EU country in terms of ported numbers from the beginning (European Commission, 2013; Güngör and Evren).

Last but not least, after an enormous diffusion path, mobile penetration has reduced after the MNP experience, which appears to have affected the increase of mobile subscriber number. While the mobile penetration rate has been 92% at the end of 2008 after a continuous increase from the beginning, it became 90.9% by the end of 2013, following a fluctuation dropping to and rising from 83.8%. This point also refers to the research question being underlined here in this paper, which aims to analyze whether there is any structural break after implementation of MNP. It is questioned whether and to what extent MNP regulation in Turkey was successful, focusing on the degree of cancellation of excess simcards resulted with the reduced number of mobile telephony subscribers following MNP.

In sum, with this study, the interrelationship between MNP and mobile penetration rate is examined. It has been verified using Chow test, which demonstrated that there is a regime change after introduction of MNP. We used time series data, number of mobile number subscriptions, spanning period between 2002 and 2014 at monthly basis. The data is obtained from Information and Communication Technologies Authority (ICTA), regulatory body in Turkey.

Method and Data

In general, a rather simple approach is followed throughout the paper although it is acknowledged that some questions may have been left unaddressed. Essentially, several ARMA models are estimated and they are used for the Chow Test to check whether there exists a structural break or not (Enders, 2010 and Chow, 1960). Initially, popular unit root tests will be employed, namely Augmented Dickey Fuller (ADF), DF-GLS and Philips-Perron, in order to determine whether lnmpen is stationary or not. However, it should be noted that there is a vast literature on the unit root tests and the structural breaks such that without considering possible structural break at unit root tests may lead to bias that reduces the ability to reject a false unit root null hypothesis (Perron, 1989 and Hansen, 2001). For the time being, in order to keep it simple that issue is shelved.

In this study, Chow test for structural break has been deployed based on several ARMA models. Since there is a suspicion of structural break when MNP was introduced in late 2008, whole sample has been separated into two sub-samples in order to estimate residual sum of squares of each sub-sample. Test statistic following F-distribution for the Chow test is as follows:

$$\frac{(SSR-SSR\_{1}-SSR\_{2})/n}{{(SSR\_{1}+SSR\_{2})}/{(T-2n)}}$$

In this test statistic; SSR shows sum of the squared residuals of whole sample, whereas SSR1 and SSR2 show sum of the squared residuals of each sub-sample. Furthermore, n shows number of parameters estimated and T is total number of observations. The idea is that if there is no structural change then estimated parameters for each subsample become equal. In other words, if there is no structural change then it may be expected that test statistics get close to zero. Finally, the null hypothesis to be tested is that there is no structural change.

Data, monthly based number of mobile telephony subscriptions in millions, has been obtained from ICTA. It spans between the period of January, 2002 and September, 2014. Although, mobile telephony service in Turkey has been started to be offered in 1994, the sample does not include observations before 2002 since we could not access more data at the time being. Clearly, it would have been better had more observations been available.

There is another issue such that the data is consisted of both human subscriptions and machine to machine subscriptions. Machine to machine subscriptions have become important in Turkey only recently. Nevertheless, it implies a different data generation process since our aim is to assess the MNP on mobile penetration and prior data has been generated by mainly human subscription process. In other words, if mobile number portability is effective then one may expect elimination of excess individual subscriptions in the short run. In the long run, however, mobile number portability may have positive effect on mobile telephony penetration. Therefore, we have excluded the machine to machine subscriptions in millions from aggregate subscription data. Machine to machine subscription data has also been obtained from ICTA as monthly basis span the period between January 2012 and September 2014. The data have been linearly extrapolated backward implying positive machine to machine subscriptions from late 2007.

In order to calculate the mobile penetration rate per 100 population (mpen), adjusted mobile telephony subscription variable has been divided by population variable. Then natural logarithm of that variable has been calculated. Data for Turkey’s population has been obtained by Turkish Statistical Agency at yearly basis. Then it has been transformed to monthly basis by using linear extrapolation. Table 1 shows the summary statistics of the sample data consisted of 153 observations.

Table 1: Summary statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Number of observations | Mean | Standard Deviation | Minimum | Maximum |
| mtel | 153 | 52.287 | 16.701 | 18.593 | 71.909 |
| mpen | 153 | 71.767 | 20.233 | 28.483 | 91.636 |
| lnmpen | 153 | 4.223 | 0.344 | 3.349 | 4.518 |

Graph 1 shows the change in mobile penetration rate in time. As it is clearly seen that until November 2008 mobile penetration rate increases steadily. The dashed line at graph 1 shows the date of introduction of MNP, that is November 2008. After then there is a declining trend for a while so that the pattern is contrasted with prior period.

Graph 1: Mobile Telephony Penetration Rate

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Since the graph of lnmpen implies a deterministic trend, it may not be surprising if the lnmpen is non-stationary. Indeed, ADF test with 12 lags with drift and trend parameters shows that the null hypothesis that there is a unit root cannot be rejected at 5% and 10% significance levels. DF-GLS and Philips-Perron tests for unit root are resulted with the same conclusion, either. Since the data seems to have quadratic deterministic trend, the lnmpen is de-trended by fitting a quadratic time trend and keeping residuals which are graphed at the below in order to make the data stationary. When ADF test with 12 lags with drift and trend parameters have been applied to new de-trended serie (lnmpen\*), absolute value of test statistics (3.567) is slightly larger than Dickey-Fuller critical value (3.445) at 5% significance level. Therefore, we may reject the null hypothesis. On the other hand, DF-GLS test confirms that result, while Philips-Perron test does not.

Graph 2: De-trended Serie of lnmpen (lnmpen\*)

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Results

At implementation stage, ARMA models with good fit have been looked for by experimenting different autoregressive and moving average lag components based on the Akaike and the Bayesian information criterions. End results show that several combinations of ARMA models with lags of autoregressive components (1 2 3) and moving average components (1 2 3) may be potential candidates. More formal expressions are as followed:

Model 1:

$$lnmpen\*\_{t} =α\_{0}+ β\_{1}lnmpen\*\_{t-1}+β\_{2}lnmpen\*\_{t-2}+ε\_{t} $$

Model 2:

$$lnmpen\*\_{t} =α\_{0}+ β\_{1}lnmpen\*\_{t-1}+β\_{2}lnmpen\*\_{t-2}+β\_{3}lnmpen\*\_{t-3}+ϵ\_{t} $$

Model 3:

$$lnmpen\*\_{t} =α\_{0}+ β\_{1}lnmpen\*\_{t-1}+β\_{2}lnmpen\*\_{t-2}+γ\_{1}ε\_{t-1}+ε\_{t} $$

Model 4:

$$lnmpen\*\_{t} =α\_{0}+ β\_{1}lnmpen\*\_{t-1}+γ\_{1}ε\_{t-1}+γ\_{t-2}ε\_{t-2}+γ\_{t-3}ε\_{t-3}+ε\_{t} $$

Table 1 shows the estimation results of those models. It should also be noted that results of the Portmanteau Test supports that residuals are white noise at 5% significance level.

Table 2: Estimation Results for Models

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Model 1AR = 1 2 | Model 2AR = 1 2 3  | Model 3AR = 1 2 MA = 1 | Model 4AR = 1MA = 1 2 3 |
| Intercept | 0.0198(0.5) | 0.0156(0.46) | 0.0135(0.45) | 0.02559(0.51) |
| Coef\_ar1 | 1.5734\*(22.97) | 1.46\*(17.59) | 1.7812\*(27.7) | 0.9768\*(43.02) |
| Coef\_ar2 | -0.5876\*(-8.61) | -0.2862\*\*(-2.1) | -0.7937\*(-12.67) |  |
| Coef\_ar3 |  | -0.1907\*(-2.62) |  |  |
| Coef\_ma1 |  |  | -0.3331\*(-3.97) | 0.48\*(5.61) |
| Coef\_ma2 |  |  |  | 0.3443\*(3.65) |
| Coef\_ma3 |  |  |  | 0.1588\*\*(1.99) |
| SSR | 0.0090256 | 0.0092918 | 0.009517 | 0.0085673 |
| AIC | -1106.526 | -1110.153 | -1110.625 | -1098.136 |
| BIC | -1094.404 | -1095.001 | -1095.473 | -1080.753 |

Note: \* shows 1% significance level and \*\* shows 5% significance level. The values in parenthesis show the Z-values.

All four models above are used for Chow test. It is assumed that the break date is known as introduction of MNP. First sub-sample includes first 86 observations and second sub-sample is consisted of remaining 67 observations. Table 3 shows the results of test statistics and relevant critical values for different models. According to these results, the null hypothesis that there is no structural break is rejected for 1% significant level for all four models. Therefore, it can be claimed that there is a structural break at the period of introduction of MNP.

Table 3: Results of Chow Test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Model 1 | Model 2 | Model 3 | Model 4 |
| Test Statistics | 8.806 | 6.011 | 5.560 | 4.262 |
| F critical value (1%) | 3.917 | 3.451 | 3.451 | 3.147 |
| F critical value (5%) | 2.666 | 2.434 | 2.434 | 2.277 |
| F critical value (10%) | 2.121 | 1.984 | 1.984 | 1.887 |
|  | Reject H0 | Reject H0 | Reject H0 | Reject H0 |

Nevertheless, some caution may be needed. First of all, it is assumed that there is only one known structural break. However, there may be more endogenous breaks. Secondly, the sample size is limited while it may be more interesting to examine larger samples consisting of prior data of 2002. Thirdly, there was a recession in 2009 due to effect of global financial crises. Besides, since new innovations like mobile telephony follows s-shaped diffusion pattern, there occurs a saturation point. Then it could be assumed that if the penetration rate was very close to saturation point at introduction date of MNP, it may have been actual source of structural break, too. Therefore, even we have some evidence in favor of structural break, the source of structural break may still be questioned due to those issues. It may be possible that by using data of longer periods which necessarily includes severe economic crises and potentially more than one structural break, the effects of economic crises on mobile penetration in Turkey may be more clearly understood. There are also different approaches to consider structural break question such as particularly designed unit root tests and recursive methods. The study may be extended towards this direction to confirm the results.

Conclusion

In Turkey, MNP has been accepted generally as a successful regulation that has started to be implemented in late 2008. After the introduction of MNP, there is slightly decline in mobile penetration rate in Turkey which is attributed to effect of MNP. In this paper, we have tested this hypothesis by using the Chow test to determine whether there is a regime change after introduction of MNP. Our results provide some evidence in favor of it. However, some further study is still be needed on this issue.

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1. Senior ICT Expert at Information Communications and Technologies Authority of Republic of Turkey (ICTA) (since 2011), ICT Expert at ICTA (since 2005); Telecommunications Assistant Expert at Telecommunications Authority (ex-ICTA) (2001-2005); MA in Economics at Boston University (2008); MSc in Science and Technology Policy Studies at Middle East Technical University (METU) (2007); BS in Economics at METU (2000). The author is interested in regulation policies, price regulation, collecting and assessing market data. E-mail address: ygoktaylar@btk.gov.tr [↑](#footnote-ref-1)
2. Head of Sectoral Competition Department in ICTA (since 2011), ICT Expert in ICTA (since 2005); Telecommunications Assistant Expert in Telecommunications Authority (ex-ICTA) (2001-2005); PhD Candidate in Private Law at Selcuk University; LLM in Information Technologies, Media and E-Commerce, University of Essex (2007); MSc in European Studies, Middle East Technical University (2004); LLB, Ankara University, Faculty of Law (2000). The author deals with the devising and implementing access and pricing regimes in electronic communications markets with particular regard to their legal dimensions. E-mail address: bunver@btk.gov.tr

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