Subscribers` mobility as a potential factor of the cellular services consumption

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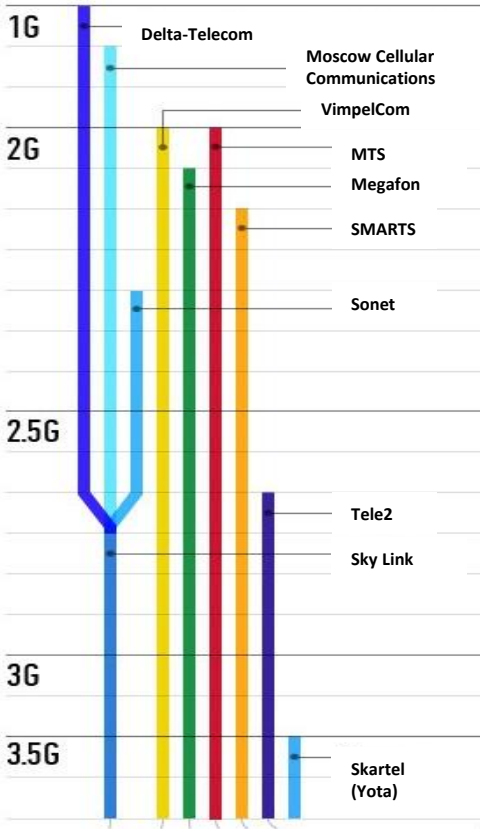
Structure

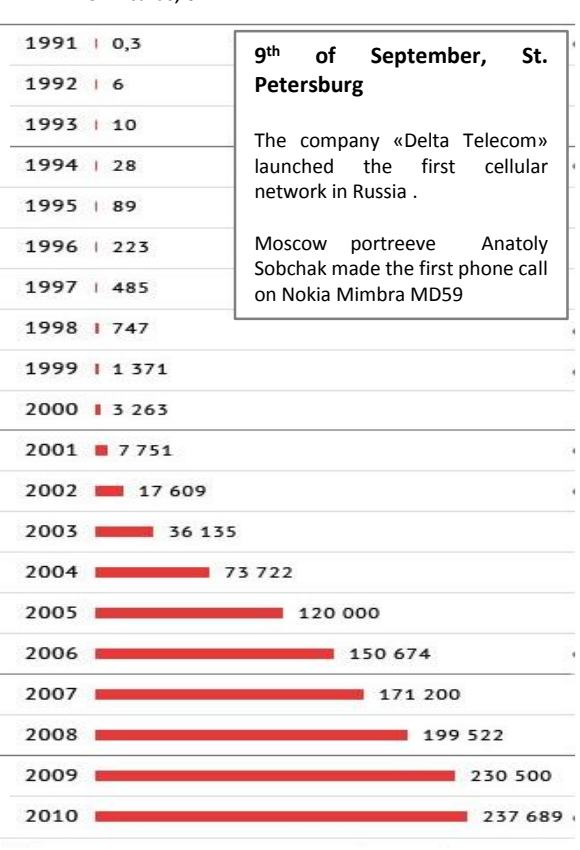
- Introduction
- Main objectives
- Related literature
- Data
- Methodology
- Calculating clients` mobility
- Model design
- Predicted outcomes
- Potential problems

Russian cellular market

The largest cellular providers and standards` evolution



Number of active SIM cards in Russia



9th of September, St. Petersburg

The company «Delta Telecom» launched the first cellular network in Russia .

Moscow portreeve Anatoly Sobchak made the first phone call on Nokia Mimbra MD59

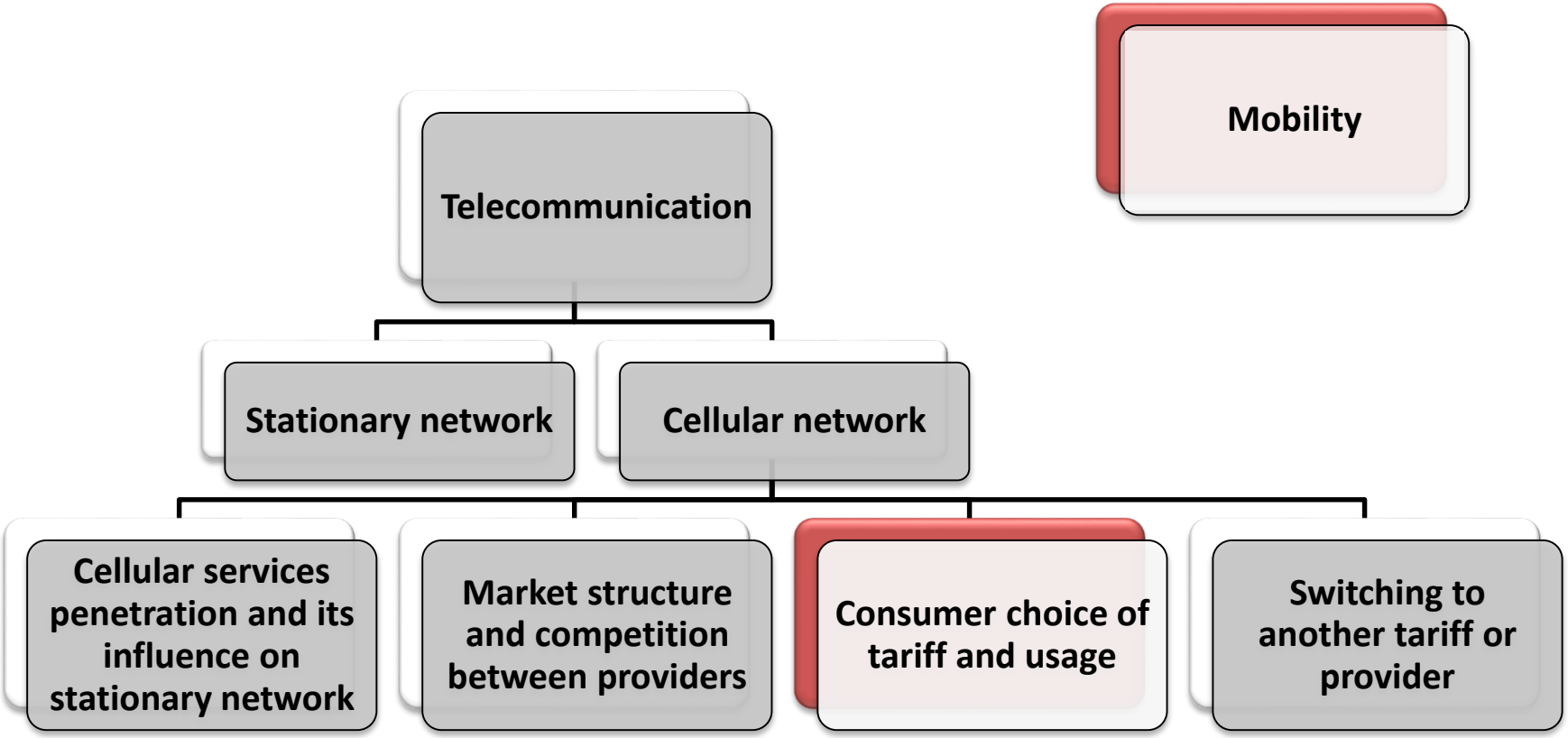
Purpose and objectives

- Purpose:

  Investigate a mobility effect on the demand

- Objectives:
  - Study basic demand models in the industry
  - Analyze subscribers` mobility and find the best way to measure it
  - Estimate a model

Literature review



Literature review

Paper	Idea
Rhee, I., Shin, M., Hong, S., Lee, K., Chong, S. (2008) On the Levy-walk nature of human mobility // *Proc. IEEE Infocom.*	Estimation of human trajectories.
Hoteit S., Secci S., Sobolevsky S., Ratti C., Pujolle G. Estimating human trajectories and hotspots through mobile phone data// *Computer Networks 64* (2014) 296–307	Estimation of human trajectories, compare them with real ones. Use of mobile GPS data. Mobility measure – index of gyration. Defined as the deviation of user positions from the corresponding centroid position. $$r_g = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\vec{p}_i - \vec{p}_{centroid})^2}$$

Literature review

Paper	Idea	Results
Miravete, E. J. (2002). Estimating demand for local telephone service with asymmetric information and optional calling plans. *Rev. Econom. Stud*. 69, 943–971.	Two cities, two pricing schiemes. 2 staged Heckman model.	Evidence for asymmetry of information. Uncertainty about future consumption.
Miravete, E. J. (2003). Choosing the wrong calling plan? Ignorance and learning. *American Economic Review*, 93, 297–310.	Tariff choice mistakes and learning. Voice service, flat and two-part tariffs. Logit model	Support to the rationality of consumers.
Miravete E. J., Narayanan S., Chintagupta P. K. (2007). The role of self selection, usage uncertainty and learning in the demand for local telephone service. Quant Market Econ, 5:1–34.	Self-selection of subscribers. Uncertainty about future usage. Learning mechanism through the information about mean usage.	Heterogeneity in mean usage levels. Learning with measured tariff is faster than fixed one.
Kim, Y., Telang, R., Vogt, B. W., Krishnan, R. (2010) An empirical analysis of mobile voice service and SMS: a structural model. *Management science*, Vol. 56, No. 2, pp. 234–252.	Tariff choice modeling with the respect to voice and SMS consumption under three-part tariffs.	Voice and SMS are substitutes. Heterogeneity according to preferences of voice and SMS consumption.
Lambreht, A., Seim, K., Skiera, B. (2007) Does uncertainty matter? Consumer behavior under three-part tariffs. *Marketing science*, 26 (5), pp. 698-710.	Internet consumption. Three-part tariffs. Uncertainty about future consumption. Discrete continuous choice model.	Significant heterogeneous uncertainty about future consumption.

The data

- Provider: Perm cellular services provider “Rostelecom”.
- Period: November 2011 – November 2012 every day.

- Individual consumption→ panel data:
  - Services: voice, SMS, Internet etc.;
  - Tariff regimes;
  - Costs, date, duration, opponent;
  - **Cell of each connection→** frequency of changing cells, distance between cells.

Methodology

1. Introduce indexes for mobility measurement.
2. Divide subscribers according to characteristics: mobility, address, tariffs, costs etc.
3. Estimate discrete/continuous model.

Calculating mobility

- **Movements during the day:**
  - Distance;
  - Frequency of changing cells;
  - Number of connections;
  - Time lag between different cells.

- **Measurement approaches:**

1. Sum of changing cells and total distance
2. Weighted average of distance. Weights are number of calls in the cell or its inverse value.
3. Index of concentration of calls in the cells.
4. Index of gyration.
5. Movement speed.

Grouping

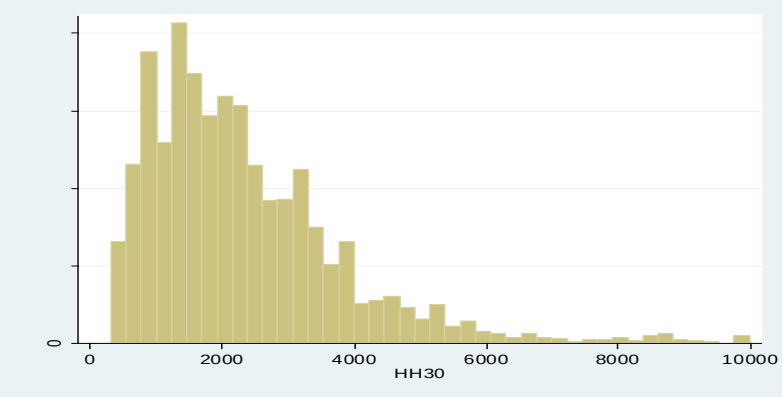
- Tariff
- Location
- Consumption

Set of tariffs

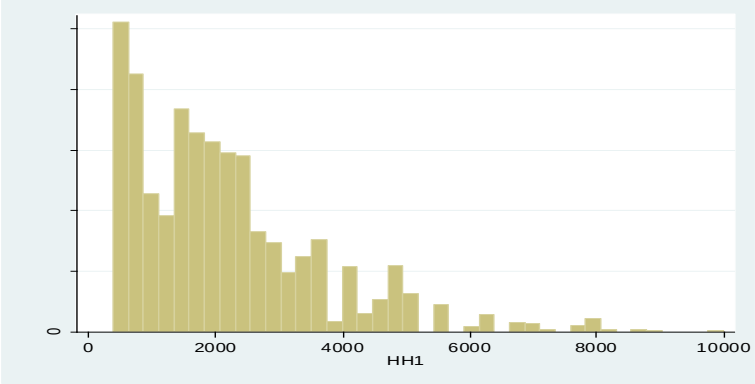
Tariff	Subscribers` share
Радуга Фристайл (ПО)	0,128
Пять звезд (ПО)	0,117
Пионер (ПО)	0,116
Капитал Platinum (ПО)	0,109
Радуга Фристайл + (ПО)	0,086
Молодежный (ПО)	0,069
Капитал Platinum Star (ПО)	0,064
Союз (ПО)	0,055
Радуга Фрилайт (ПО)	0,053
5 копеек (ПО)	0,045

Concentration index (HH)

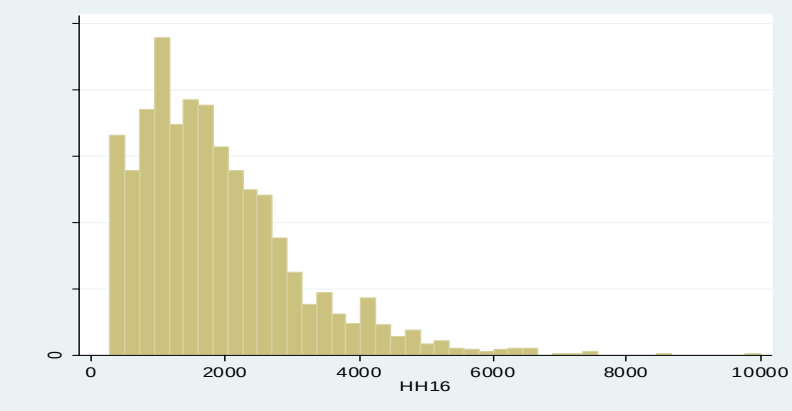
Радуга фристайл



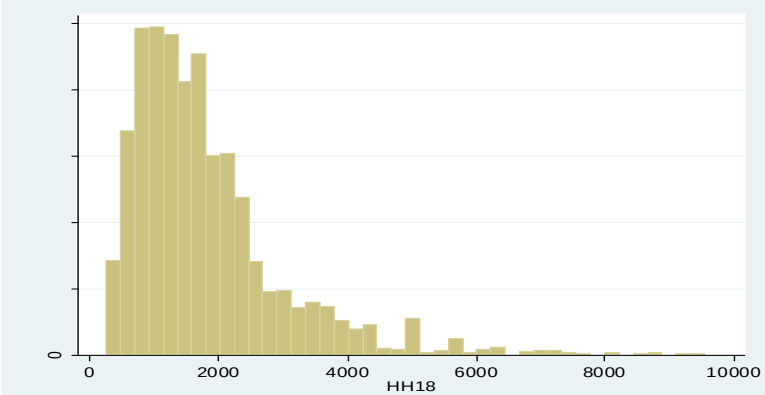
5 копеек



Капитал Platinum

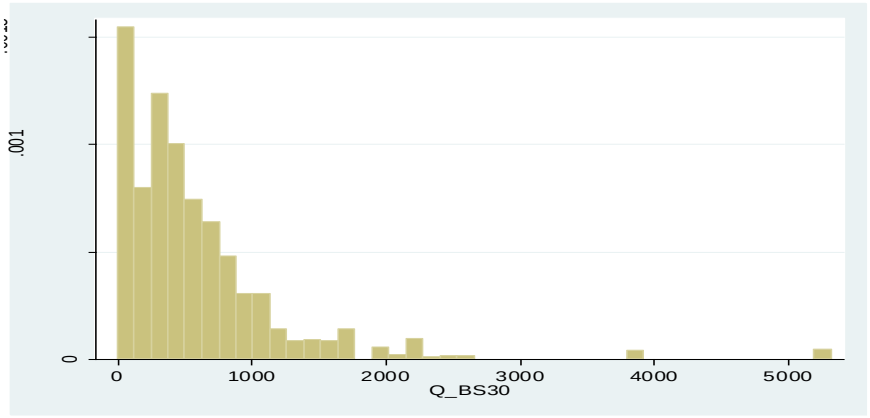


Капитал Platinum Star

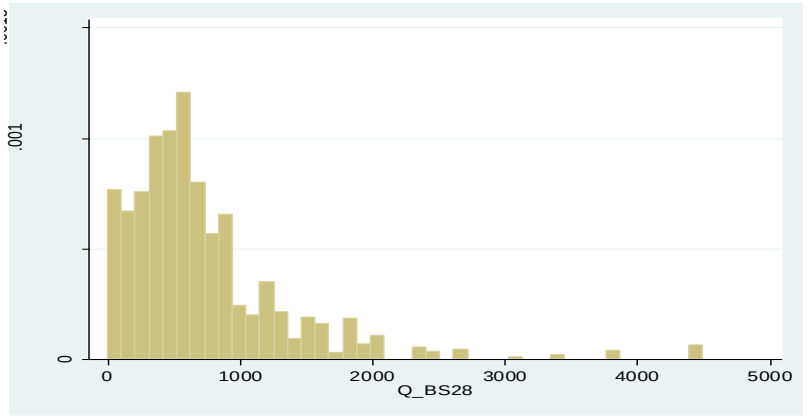


Frequency of changing cells

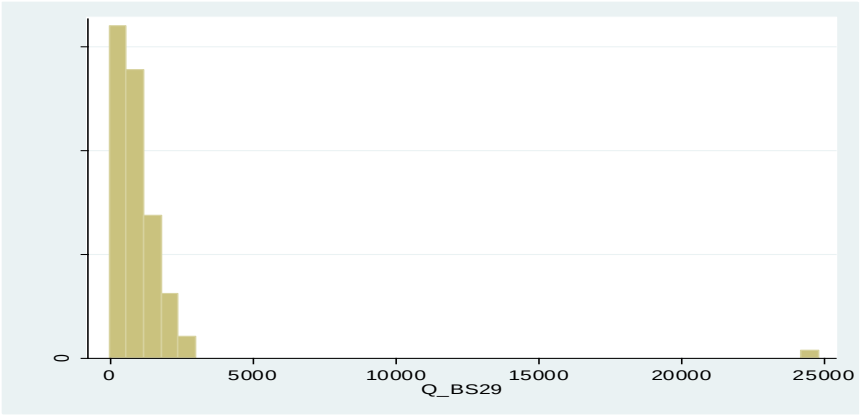
Радуга фристайл



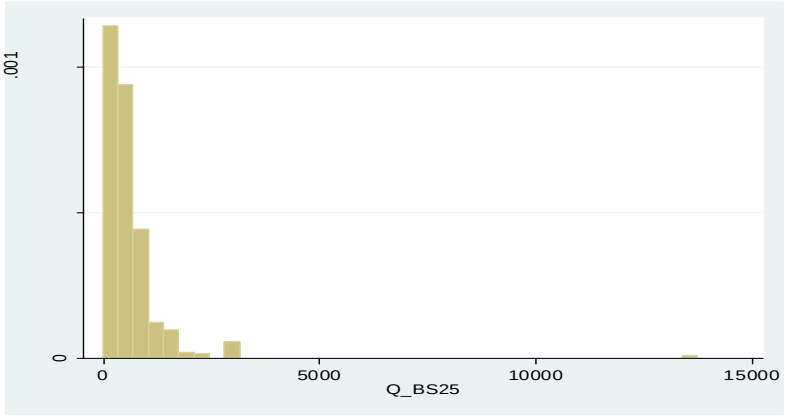
Пионер



Радуга фрилайт



Молодежный



Modeling

- Discrete/continuous choice model:

$$U_{ikt}^{*} = U_{ikt}^{*}(Y_{it}, q_{ikt}, s_{ikt} \mid F_{ikt}, m_{ikt}, p_{ikt}^{q}, p_{ikt}^{s}, M_{ikt}, e_{ikt}^{q})$$

- q_{ikt} - duration of calls
- s_{ikt} - SMS quantity
- m_{ikt} - monthly payment
- p_{ikt}^{q} - marginal fee of calls
- p_{ikt}^{s} - marginal fee of SMS
- M_{it} - mobility
- $i = \overline{1,n}$ - number of individuals
- $k = \overline{1,J}$ - number of tariffs
- $t = \overline{1,T}$ - number of time periods

$$Y_{it} = \begin{cases} k, U_{ikt}^{*} \geq U_{ijt}^{*}, k \neq j, \forall j \in J \\ 0, U_{ikt}^{*} < 0 \end{cases}$$

Predicted outcomes

- Mobility can indicate different behavior of subscribers.
- Mobility increases voice and SMS usage.
- Subscribers with high mobility level are less sensitive to price changes.

Potential problems

- Measurement of mobility
- Calculating distance
- Extreme interesting cases: intersection of cells → frequent changing of 2-3 cells every time
- Group and types identification

Thank you for your attention!