

GEOGRAPHIC INFORMATION SYSTEM IN MODELING OF EDUCATIONAL MIGRATION: GRAVITY MODEL OF THE UNIVERSITY

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ABSTRACT

The Higher Education and universities have high impact for regional development and youth migration. We suggest what the migration of people with a high level of knowledge (called “brain drain”) is detrimental for the region of emigration. High level universities attract the best students and growth the brain drain. There are close relationships between neighboring regions. Distance can be understood as a barrier of human capital growth. Geographical distance between parental home and college poses a potential barrier to higher education entry, and could be a deciding factor when choosing between institutions. Similar issues potentially arise when considering who goes to which universities, because students with different backgrounds and abilities choose different types and qualities of universities, and the spatial distribution of both university types and student characteristics is not uniform. But at the same time there are the researches which don't find the impact of distance to accessibility of higher education. The distance a pupil lives from their nearest university has little effect on the likelihood that they go to university. There are many articles describe the social Neighborhood Effects of universities. But the question about geography and place is too often overlooked. The paper of Cullinan and Duggan presents a gravity model of student migration flows to HEIs in Ireland. Their analysis suggests that while geography plays a very important role in explaining student flows. Available studies about student migration cover the territory of England, Ireland, Romania, Poland, US, Canada etc. But we don't have the works which explain the spatial effect of Russian universities to youth migration. In this article we observe the example of Kazan federal university and her spatial effect to educational migration. The case of Kazan federal university is very important. It's a one of ten federal university of Russia. More of 30.000 students study in university, 80% of them is from Volga Federal district. The study allowed to find the neighbors of the first and second order, who are influenced by a strong neighbor.

Keywords: Educational migration, spatial effect, university, gravity model, geography, GIS

INTRODUCTION

There are a lot of articles describe the process of migration. Few of its focus on youth migration, because on student migration focuses on the role of tuition and financial aid policies in the student migration process, and most of this work focuses upon interstate student migration. Youth migration is an independent area of research, primarily because it is related to education [5]. Researchers have been progressively shifting their focus to the youngest age cohorts associated with the very first education and migration

decisions [5]. Competing for the most talented students becomes an important factor of development for the regions. Western researchers identify the category of the college-bound [2], who demonstrate a clear age-specific migration pattern with peaks in the late teens, when most young people move for educational purposes. Student migration flows are directed towards not only large cities but also university centers that are sometimes far from metropolitan areas. The quality and reputation of a university plays the critical role in the complex process of shaping high school graduate migration flows. Researchers in many Western countries study migration of specific age groups by drawing on the comprehensive statistics which includes both census and register data [4] which allows them to trace the migration trajectories and the structural characteristics of different types of migrants.

In Russia, the research on youth and particularly student migration has been mostly based on sample surveys among high school graduates and university students (asking them about their migration experience and intentions) [1]. Some studies focus on specific regional universities [3], and there has also been some post-educational migration research [6]. A special niche belongs to the works by Nadezhda Zamyatina, who explores youth migration in a broader, non-educational context, paying particular attention to the perception of migration, the choice of destinations and the attitude of youth to their “small motherland” and the host city as a complex system of orientations [7]. However, although this field of research is quite well developed, there are still some major information constraints in studying youth migration in Russia. The existing demographic statistics can only be used on certain conditions due to the data collection techniques used and the temporal-conditional nature of student migration (student migrants have a temporary registration in the city of studies, which was not included in Russian statistics until recently). In this paper, we analyze migration of student-age youth by using the gravity model of migration.

The Higher Education and universities have high impact for regional development and youth migration. We suggest what the migration of people with a high level of knowledge (called “brain drain”) is detrimental for the region of emigration. High level universities attract the best students and growth the brain drain. Distance can be understood as a barrier of human capital growth. Geographical distance between parental home and college poses a potential barrier to higher education entry, and could be a deciding factor when choosing between institutions. Similar issues potentially arise when considering who goes to which universities, because students with different backgrounds and abilities choose different types and qualities of universities, and the spatial distribution of both university types and student characteristics is not uniform. But at the same time there are the researches which don’t find the impact of distance to accessibility of higher education. The distance a pupil lives from their nearest university has little effect on the likelihood that they go to university.

In these article we observe the example of Kazan federal university and her spatial effect to educational migration. The case of Kazan federal university is very important. It’s a one of ten federal university of Russia. More of 30.000 students study in university, 30% of them is from Volga Federal district. The study allowed to find the neighbors of the first and second order, who are influenced by a strong neighbor.

METHODS AND DATA

We decided to use gravity model to find the spatial effect of university to young people around the region. We can use the analogy with Newton's law of Gravitation, which reads that the gravitation force between two objects is proportional of their masses and inversely proportional to the square of the distance between their centers:

$$F = \frac{G * M_i * M_j}{D_{ij}^2}$$

In 1954, V.Izard, on its basis, proposed a similar model for calculating the volume of trade between the two countries. We guess that we can use the similar model for evaluation the gravity effect of university:

$$F_{ij} = \frac{N_i * N_j}{D^2}$$

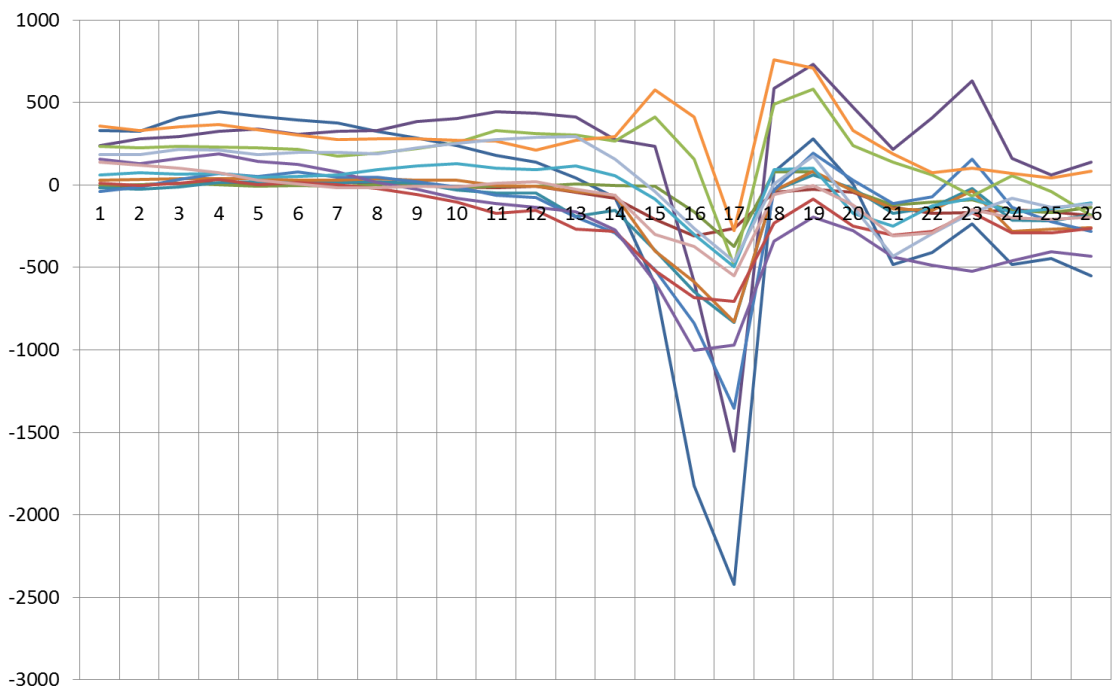
Where F_{ij} is the gravitation force of I (university/region...) to students from j (university/regions...). N_i - number of students from I (university/regions...), N_j – number of students, which attracted from j region to i. D - distance between I and j regions.

$$F_{ij} = \frac{N_i * N_j}{D^2}$$

In this study we use the example of Kazan federal university. The case of Kazan federal university is very important. It's a one of ten federal university of Russia. More of 30.000 students study in university, 80% of them is from Volga Federal district. The study allowed to find the neighbors of the first and second order, who are influenced by a strong neighbor.

RESULTS

To find the population balance we used Lexis diagramme. It helps us to find the «demographic collapse» in ages 16-17 (Pic.1). The geography of students shows that around 90% are from Volga federal district (68% from Republic of Tatarstan plus 22% from other region of Volga federal district) (Pic.2, Tab.1). For this reason we decided to estimate the gravity of Kazan federal university in Volga federal district.



Pic.1. Dynamics of the number of age groups of the Volga federal district (born from 1989 to 1998)



Pic.2 The geography of students of Kazan Federal University, 2015-2017 years

Tab.1 The geography of students of Kazan Federal University, 2015-2017 years

Country/region/city	Quantity (2015 year)	Quantity (2016 year)	Quantity (2017 year)	%
Russia	7086	7681	10269	86,3%
Tatarstan	5180	5303	7494	68%
Kazan	2393	2507	2641	29%
Volga Federal district (without Tatarstan)	1547	1778	1900	22%
Other regions from Russia	357	600	915	10%
Foreign students	867	1078	1634	13.7 %
Total	7953	8759	11903	100%

Last free year, the geography of student is characterized by stability. We can state that the number of students from different region and their proportion are the same.

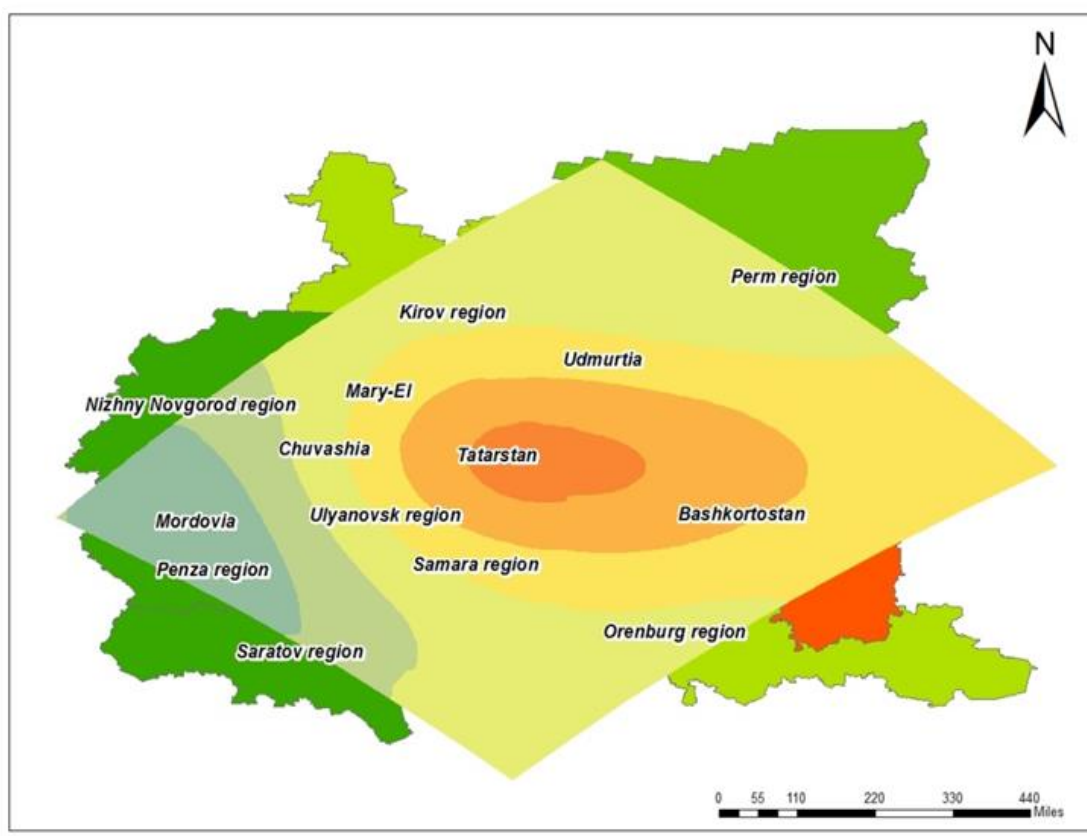
Table 2. The gravity model of Kazan federal university in Volga federal district

Region	Number of students	Distance by road (km.)	F
Tatarstan	5303	0	-
Bashkortostan	640	528	12,17401
Chuvashia	211	151	49,07386
Ulyanovsk region	182	218	20,3086
Udmurtia	178	390	6,206009
Samara region	160	359	6,583437
Mary-El	128	141	34,14235
Kirov region	91	372	3,487202
Orenburg region	88	769	0,789136
Perm region	54	588	0,828249
Nizhny Novgorod region	25	378	0,927851
Saratov region	20	633	0,264694
Penza region	13	478	0,301724
Mordovia	8	373	0,304926

CONCLUSION

Universities influence to regional development and youth migration [8]. We found the neighborhood effect, is a different effect on the nearest neighbors. The university has high impact on young people and their distribution in space. We can imagine the university as an attractor of young people from the nearest regions. Our study confirm the first geographer's law: «Everything is related to everything else, but near places are more related than far places». We can highlight first and second order neighbors. The higher impact Kazan federal university has an effect on Tatarstan Republic and first order neighbors: Bashkortostan, Chuvashia, Ulyanovsk region, Udmurtia, Samara region, Mary-El, Kirov region. Less influence it has an effect on second order neighbors: Orenburg region, Perm region, Nizhny Novgorod region, Saratov region, Penza region, Mordovia (Pic.2, Table 2).

Our study confirmed the possibility to assess the gravitational force of the university and the scale of the impact in space using the analogy of Newton's law of the world.



Pic.3 The gravity model of Kazan federal university in Volga federal district

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