Ilya Kashnitsky and
Nikita Mkrtchyan

Russian periphery is dying in movement: A cohort assessment of Russian internal youth migration based on census data
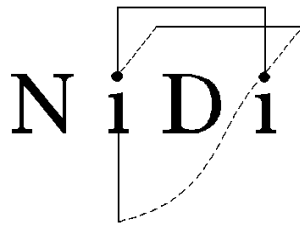
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Russian periphery is dying in movement

Ilya Kashnitsky[1,2] and Nikita Mkrtchyan[1,3]
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Netherlands Interdisciplinary Demographic Institute (NIDI)
P.O. Box 11650
2502 AR The Hague
Phone: 070 - 3565214
E-mail: ilya.kashnitsky@gmail.com for all correspondence

[1] National Research University Higher School of Economics, Moscow, Russia
[2.] Netherlands Interdisciplinary Demographic Institute / KNAW / UG, The Hague, Netherlands
[3] Russian Presidential Academy of National Economy and Public Administration, Moscow, Russia

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ABSTRACT

In this paper we study youth migration in Russia at the sub-regional level of administrative division. The aim of the research is to assess the volume of internal youth migration. The task is only doable with the use of census data, which not only allows us to research at the sub-regional level, but also provides much more accurate information on youth migration than the current migration record does. We used the survival method to study sub-regional population dynamics. As mortality is quite insignificant at young ages, most of the change in cohort size is caused by migration. Our estimates show that during the last intercensus period (2003-2010) up to 70 percent of youth cohorts have left the regional periphery for good after graduating from school, and there was no significant return to the demographically depleted periphery in the young working ages.

RESEARCH PLACEMENT

In this research we are studying the impact of migration on demographic structures at the sub-regional level of administrative division using census data. We focus primarily on migration of the youth because their relocation determines the biggest change in the demographic structure. The age selectiveness of migration was already noted in Ravenstein's "Laws of migration" (Ravenstein 1885), and the term "differential mobility" was firstly introduced by Thomas (1938). Empirical support for age selectiveness has been provided by Castro and Rogers (1983), Bailey (1993), Millington (2000) and Rogers et al. (2002).

Migration of the youth really matters because young people change the basis of the demographic structure determining the mode of the demographic development for the future generations. The role of migration in fertility and population replacement (Filipov and Schuster 2010; Ediev et al. 2013; Wilson et al. 2013) and in slowing down the aging of the population (Alho 2008) is widely debated and acknowledged. Usually the role of migration as a factor of immense importance is noticed at the level of countries, i.e. for international migration (Coleman 2006). The main focus on international migration is caused by the quality of data, which is usually better for the national level than for the sub-national level. Although, the population redistribution at the sub-national level may lead to much greater demographic consequences (Rees et al. 2013).

Our analysis of migration patterns of the youth at the sub-regional level of administrative division allows us to draw some conclusions about the present-day and future demographic development of Russian periphery.

METHOD & DATA

The main method used for the estimation of the volume of youth internal migration is the *survival method* (Wunsch and Termote 1978; Bogue 1982) also known in Russia as *method of age shift* (Zayonchkovskaya 1991; Moiseenko 2004). The idea of the method is quite simple. People can survive, die or move, not vanish. So we can evaluate the migration balance of a certain cohort during the intercensus period by the comparison of the corresponding age groups at the time of the censuses. Once we have considered mortality, the rest of the change in the cohort size stands for migration.

The prime data source is Russian Census 2002 and 2010 data. We also use the current mortality records to assess the impact of mortality on the cohort size and the current migration record to compare it with our migration evaluations based on Census data.

Why do we use Census data in this research? The first and the main reason for such a choice is that only Census data allows us to analyze spatial mobility of the population at the sub-regional level of administrative division. Other demographic data on population movement with detailed age distribution is not available for the sub-regional level (see Appendix 1). And we are interested in revealing some core-peripheral patterns of internal youth migration.

The second very important reason is associated with the problems with current migration record that follow the fall of the Soviet Union. The liberalization of the rules of tabulation by the place of residence in Russia caused huge inaccuracy in the migration statistics (Choudinovskikh 2004). Naturally, the most problematic group proved to be the youth, especially the so called "student ages" (usually at the age of 17-19). Some positive changes in migration record happened only in 2011 which leave the intercensus period internal migration to be verified.

STATISTICS DISCREPANCY: CENSUS DATA VS CURRENT MIGRATION RECORD

Linking the data of two adjacent censuses at the sub-regional level is quite a challenging task due to the changes in administrative division (see Appendix 2). Thus, we limited the area of our sub-regional research within the 18 regions of the Central Federal District of Russia (Figure 1).
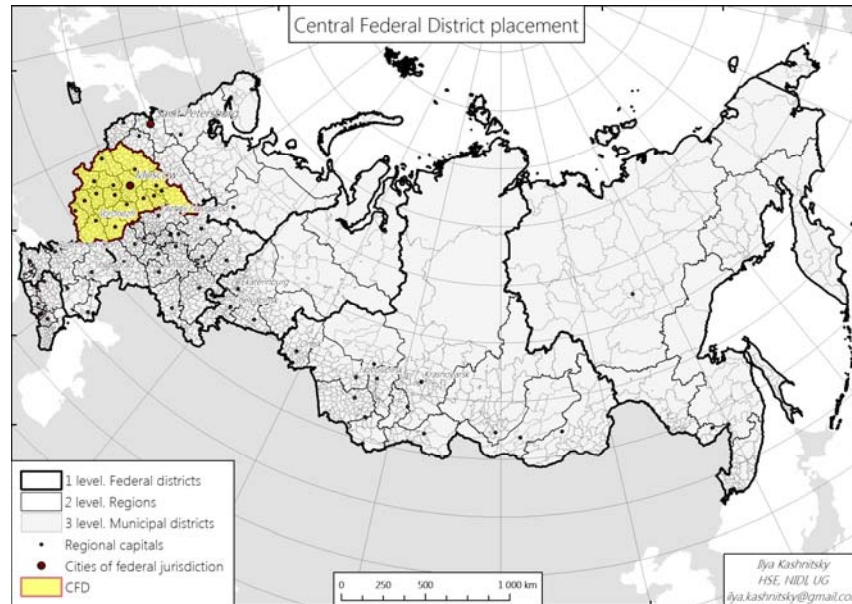
Figure 1. The location of the Central Federal District in Russia.

For the selected set of regions we compared the two main sources of migration statistics, the censuses and the current migration record using the survival method. Our previous research (Kashnitsky 2013) and some indications from the literature review (Choudinovskikh 2008, 2010) formed the hypothesis about the exceptionally big error of the current migration record in dealing with the "student ages". Our comparable analysis presented here is aimed to check the hypothesis.

The survival method was applied to two generations, each consisting of 5 birth cohorts. The first one is the present-day cohort of "student ages", born in 1988-1992, who were in the ages of 18-22 at the time of the 2010 Census (see results in the Table 1). The second generation we considered was born in 1980-1984, and its representatives were in "student ages" at the time of the 2002 Census (Table 2).

Table 1. Survival method applied for the birth cohort 1988-1992 during the intercensus period 2003-2010.

Birth cohort 1988-1992	Population in 2002, thd	Population in 2010, thd	Change by the Census, thd	Registered deaths in 2003-2010, thd	Registered migration in 2003-2010, thd	Change by the current record, thd	Discrepancy, thd	Unexplained change	Change by Census, %	Change by the current record, %	Unaccounted cohort change, %
Belgorod region	106.8	112.1	5.4	0.7	5.2	4.6	0.8	0.15	5.0	4.3	0.8
Brynsk region	99.8	91.0	-8.7	0.7	-2.1	-2.8	-6.0	0.68	-8.7	-2.8	-6.0
Vladimir region	99.5	101.7	2.2	0.9	-0.7	-1.6	3.9	1.73	2.2	-1.6	3.9
Voronezh region	156.4	174.2	17.8	1.2	5.3	4.0	13.8	0.77	11.4	2.6	8.8
Ivanovo region	74.0	79.7	5.7	0.6	0.6	0.0	5.7	1.00	7.7	0.0	7.7
Tver' region	97.3	91.9	-5.5	0.9	-0.8	-1.7	-3.8	0.70	-5.6	-1.7	-3.9
Kaluga region	70.3	71.3	1.0	0.6	-1.3	-1.9	2.9	2.82	1.5	-2.7	4.1
Kostroma region	51.4	44.4	-7.0	0.4	-1.4	-1.9	-5.1	0.73	-13.6	-3.6	-10.0
Kursk region	84.4	74.4	-10.0	0.6	-0.6	-1.2	-8.8	0.88	-11.9	-1.4	-10.5
Lipetsk region	82.3	77.8	-4.5	0.6	-1.6	-2.3	-2.2	0.50	-5.5	-2.8	-2.7
MOSCOW	521.5	829.8	308.3	3.3	63.0	59.6	248.7	0.81	59.1	11.4	47.7
Moscow region	401.8	512.7	110.9	3.5	33.9	30.4	80.5	0.73	27.6	7.6	20.0
Orel region	58.0	56.1	-1.8	0.4	-0.2	-0.6	-1.3	0.69	-3.2	-1.0	-2.2
Ryazan region	79.3	82.6	3.3	0.7	0.2	-0.6	3.9	1.17	4.2	-0.7	4.9
Smolensk region	70.5	71.7	1.2	0.6	-1.2	-1.8	3.0	2.56	1.7	-2.6	4.3
Tambov region	80.0	75.8	-4.2	0.5	-1.2	-1.8	-2.5	0.59	-5.3	-2.2	-3.1
Tula region	100.6	102.1	1.5	0.8	-0.7	-1.5	3.1	2.00	1.5	-1.5	3.0
Yaroslavl region	86.4	86.7	0.2	0.6	2.5	1.9	-1.7	-7.02	0.3	2.2	-1.9
CFD	**2320.3**	**2736.0**	**415.7**	**17.8**	**98.8**	**81.1**	**334.6**	**0.80**	**17.9**	**3.5**	**14.4**

Source: Censuses of 2002 and 2010, current record of migration and mortality.

Table 2. Survival method applied for the birth cohort 1980-1984 during the intercensus period 2003-2010.

Birth cohort 1980-1984	Population in 2002, thd	Population in 2010, thd	Change by the Census, thd	Registered deaths in 2003-2010, thd	Registered migration in 2003-2010, thd	Change by the current record, thd	Discrepancy, thd	Unexplained change	Change by Census, %	Change by the current record, %	Unaccounted cohort change, %
Belgorod region	115.2	121.1	6.0	1.6	7.4	5.7	0.3	0.04	5.2	5.0	0.2
Brynsk region	100.0	98.1	-1.9	2.2	-2.6	-4.8	2.9	-1.52	-1.9	-4.8	2.9
Vladimir region	118.9	112.1	-6.8	3.0	-0.7	-3.8	-3.0	0.44	-5.7	-3.2	2.5
Voronezh region	178.9	178.8	-0.1	3.6	-1.1	-4.7	4.6	-68.10	0.0	-2.6	2.6
Ivanovo region	90.1	80.9	-9.2	2.2	-1.1	-3.3	-5.9	0.64	-10.2	-3.7	6.6
Tver' region	104.6	103.5	-1.1	3.2	1.1	-2.1	1.1	-1.00	-1.0	-2.1	1.0
Kaluga region	79.4	80.5	1.1	1.7	0.6	-1.1	2.2	2.02	1.3	-1.4	2.7
Kostroma region	56.4	52.2	-4.2	1.3	-1.5	-2.8	-1.4	0.34	-7.5	-5.0	2.5
Kursk region	86.5	82.3	-4.2	1.7	-2.8	-4.5	0.2	-0.06	-4.9	-5.2	0.3
Lipetsk region	83.9	89.7	5.8	1.8	0.8	-1.0	6.8	1.18	6.9	-1.2	8.1
MOSCOW	852.7	1044.0	191.3	13.9	74.6	60.7	130.6	0.68	22.4	7.1	15.3
Moscow region	550.2	603.8	53.6	13.2	84.4	71.2	-17.6	-0.33	9.7	12.9	3.2
Orel region	63.2	57.7	-5.5	1.2	-1.7	-3.0	-2.6	0.47	-8.8	-4.7	4.1
Ryazan region	90.8	84.9	-6.0	2.3	-0.5	-2.9	-3.1	0.52	-6.5	-3.1	3.4
Smolensk region	80.8	78.2	-2.6	2.1	-2.3	-4.4	1.8	-0.69	-3.2	-5.4	2.2
Tambov region	79.8	77.2	-2.5	1.6	-4.9	-6.5	3.9	-1.55	-3.2	-8.1	4.9
Tula region	119.9	118.3	-1.6	3.3	0.2	-3.1	1.5	-0.90	-1.4	-2.6	1.2
Yaroslavl region	106.7	98.8	-7.9	2.1	2.8	0.7	-8.6	1.09	-7.4	0.7	8.1
CFD	**2958.2**	**3162.2**	**204.0**	**62.0**	**152.5**	**90.5**	**113.6**	**0.56**	**6.9**	**3.1**	**3.8**

Source: Censuses of 2002 and 2010, current record of migration and mortality.

The discrepancy (red color in the Tables 1 and 2) between the censuses (green) and the current statistical record (blue) is striking. If we take census data as the main source, and we have good reasons for such a move, the change that is unaccounted by the current statistical records of change in the 1988-1992 birth cohort for the CFD is 14.4 percent, compared with a change of 17.9 percent according to the censuses. That means that 80 percent of all the change in the cohort size came unnoticed by the current statistical record (the unexplained change column in the Tables 1 and 2). In some regions even the direction of change is missed. For example, in Vladimir region the current statistics recorded a decrease of 1.6 percent in the 1988-1992 birth cohort, while the censuses saw an increase of 2.2 percent. The case of Vladimir region is not unique; the similar paradoxes are present for Kaluga, Ryazan, Smolensk and Tula regions (Figure 2).
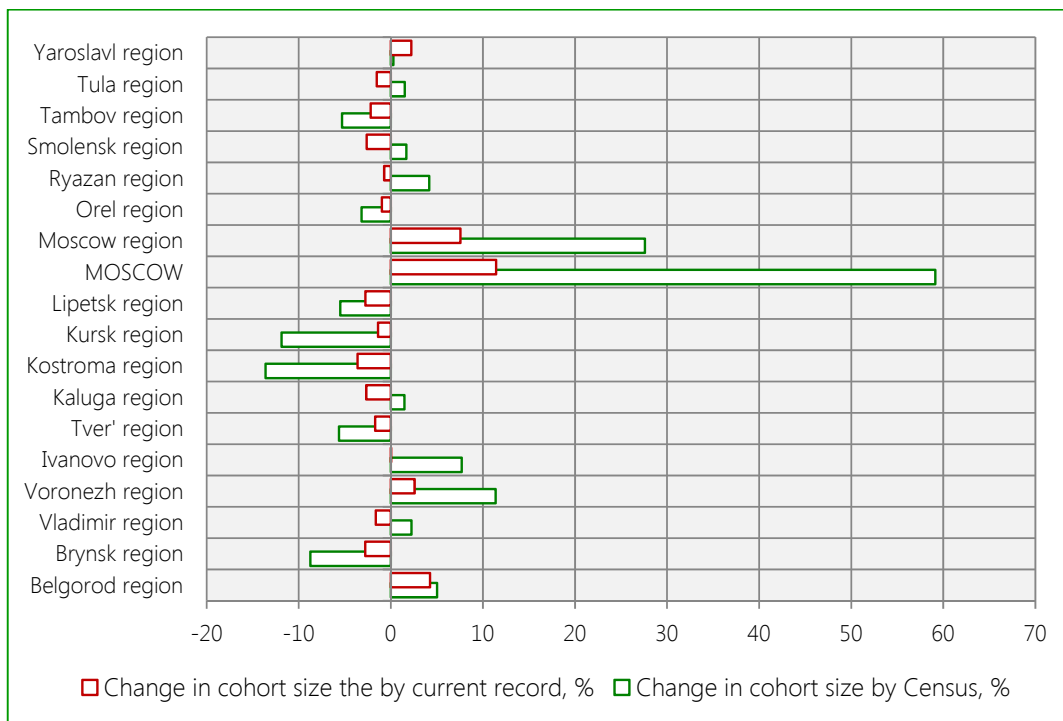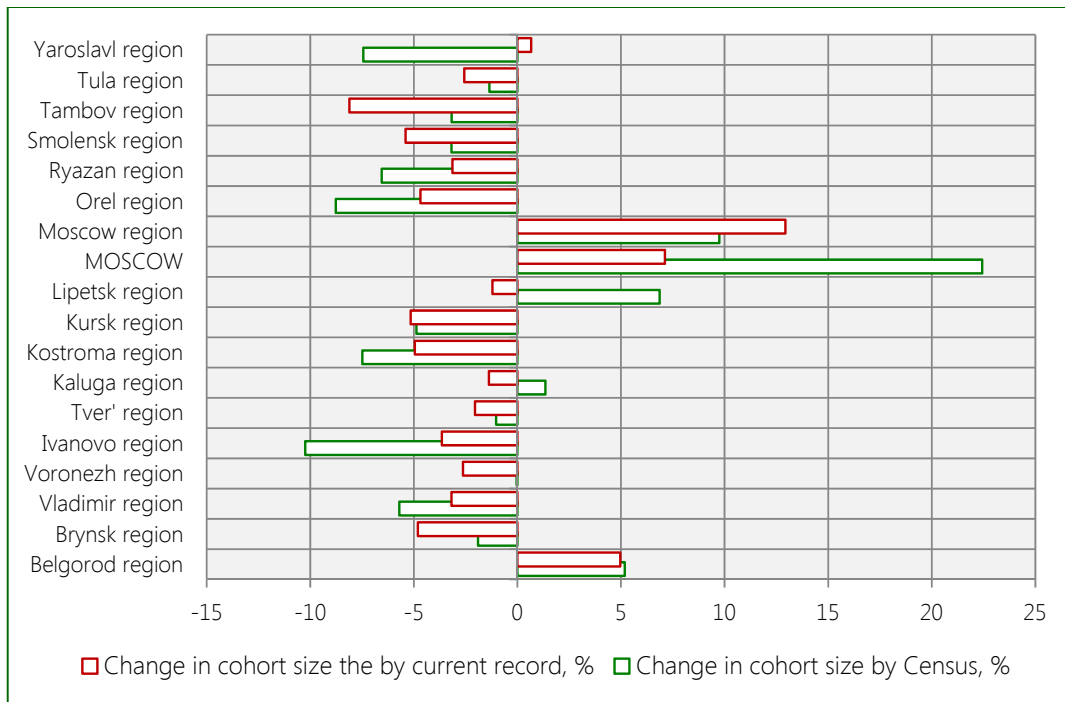

Figure 2. CFD regions, the change in the 1988-1992 birth cohort size during the period of 2003-2010. Source: Censuses of 2002 and 2010, current record of migration and mortality.

It is natural that the most problematic region proves to be the one most attractive for young migrants – city of Moscow. The change that is unaccounted by the current

statistical record was 47.7 percent of the initial cohort size in 2002. About 30 percent (47.7/159.1) of Moscow's "student age" population consist of the youths who moved to the capital unnoticed by the official migration statistics!

The deviation of the current statistical record estimates for the "post-student ages", the young working ages, is slightly less striking. Still the average unaccounted cohort change across the regions of the CFD is 56 percent. The intensity of migration seems to be smaller than at the "student ages", but the results are harder to explain (Figure 3).

Figure 3. CFD regions, the change in the 1980-1984 birth cohort size during the period of 2003-2010. Source: Censuses of 2002 and 2010, current record of migration and mortality.

Summing up, the current statistical record was unable to provide the reliable estimate of the cohorts' size during the intercensus period of 2003-2010. The official migration statistics are not suitable for researching on youth migration. Of course, census data is not perfect and has its limitations (Andreev 2012), but for the purpose of migration study of youths it is definitely the most reliable source of data available; the comparison with the current statistical record proves the point.

ESTIMATION OF YOUTH INTERNAL MIGRATION

To assess the volume of youth intra-regional migration, we used data for 18 regions of the Central Federal District (CFD) of Russia and applied the survival method for 5 one-year birth cohorts (1988-1992). Each of these cohorts has experienced the 18-years peak of migration activity during the period between the 2002 and 2010 Censuses. At the time of the 2002 Census they were 10-14. Naturally, during the intercensus period, they grew older and reached the "student" ages of 18-22 by the 2010 Census (Figure 4).

Our data allows us to look at the intercensus cohort losses of regional periphery by every municipality. Here we want to note that these losses are almost entirely due to migration. The change in cohort size due to mortality at the ages 10-22 is less than one percent (Figure 5). The mortality at the young age is so low that there is almost no risk in interpreting the intercensus changes of the cohorts' size as the migration balance.

Figure 4. The schematic view of the survival method application.
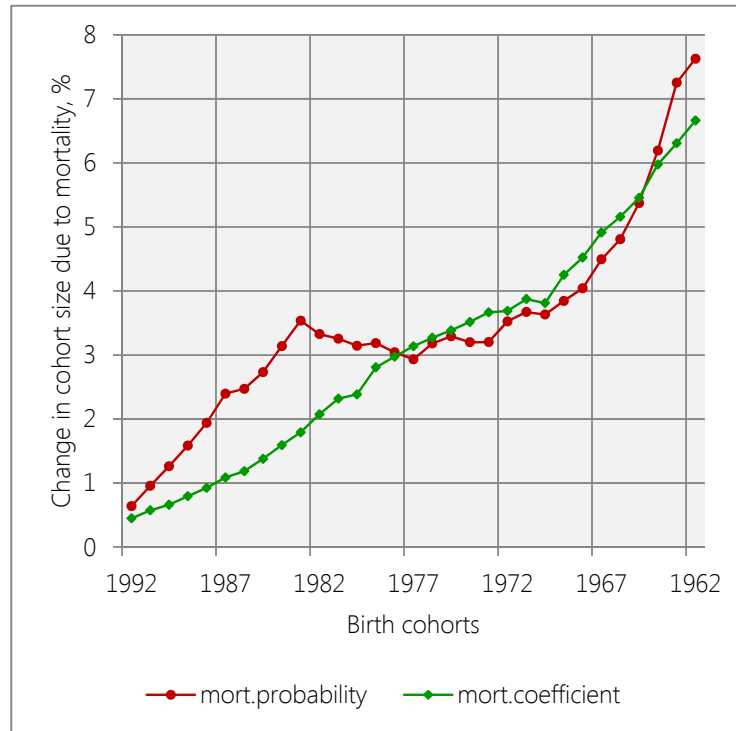
Figure 5. Mortality impact on the cohorts' size during the 2003-2010 intercensus period, Central Federal District. Source: 2002 and 2010 Censuses, current statistical record of mortality (2003-2010).

The significant difference between the *mortality probability* and *mortality coefficient* for the young cohorts is a clear indicator of migration attractiveness of the CFD. The positive migration balance of the CFD at the young ages changed the denominator we used for the calculation of the mortality coefficient comparing to the denominator used for mortality probability, the initial cohorts' size at 2002 Census. The total population of the CFD has grown only by 1.1 percent during the intercensus period, while the growth in the 1988-1992 birth cohort was 17.9 percent. Summing up, we may conclude that the impact of mortality is negligible for the cohorts under consideration.

The pattern of internal youth migration in CFD is really striking (Figure 6b). Up to 70 percent of the youths (the 1988-1992 birth cohort) leave the periphery after the school graduation! Compare it to the much more moderate change in the size of the whole population of districts and cities (Figure 6a). The urbanization in Central Russia is still occurring rapidly. The cities with populations of more than 100 thousand gained 6.1 percent while the rest of the territorial units, the inner periphery, lost on average 5.0 percent of their populations.

Only big cities tend to attract the young movers. In the majority of regions only the regional center is attractive enough for the young, as all other cities are relatively small. We can only imagine the future of the population where just 30 percent of the youth are willing to stay. The demographic development of hinterland doesn't seem to be sustainable.

The research for the previous period between two censuses in Russia (1989-2002) showed that up to 40 percent of school graduates leave regional periphery in the search of better opportunities (Mkrtchyan 2013; Mkrtchyan and Kashnitsky 2013). Our research demonstrates that the migration situation in Russian hinterland is becoming more and more negative.
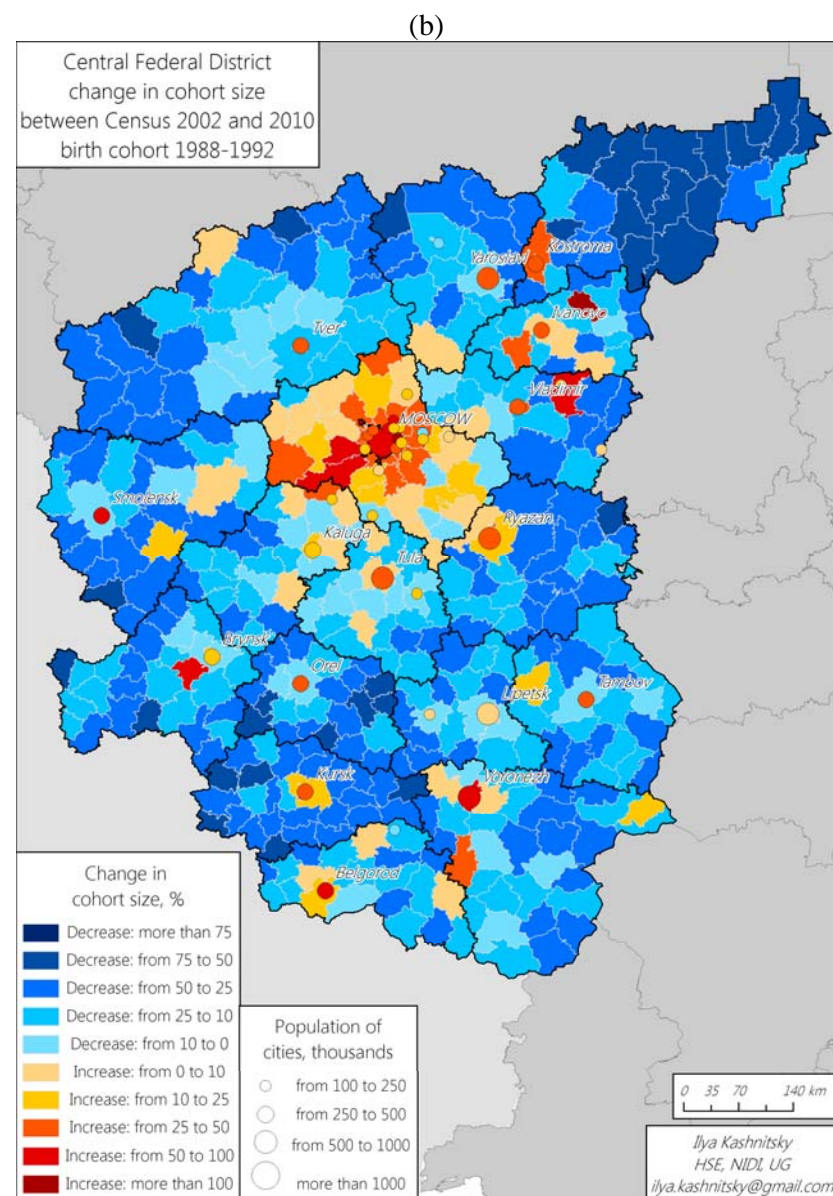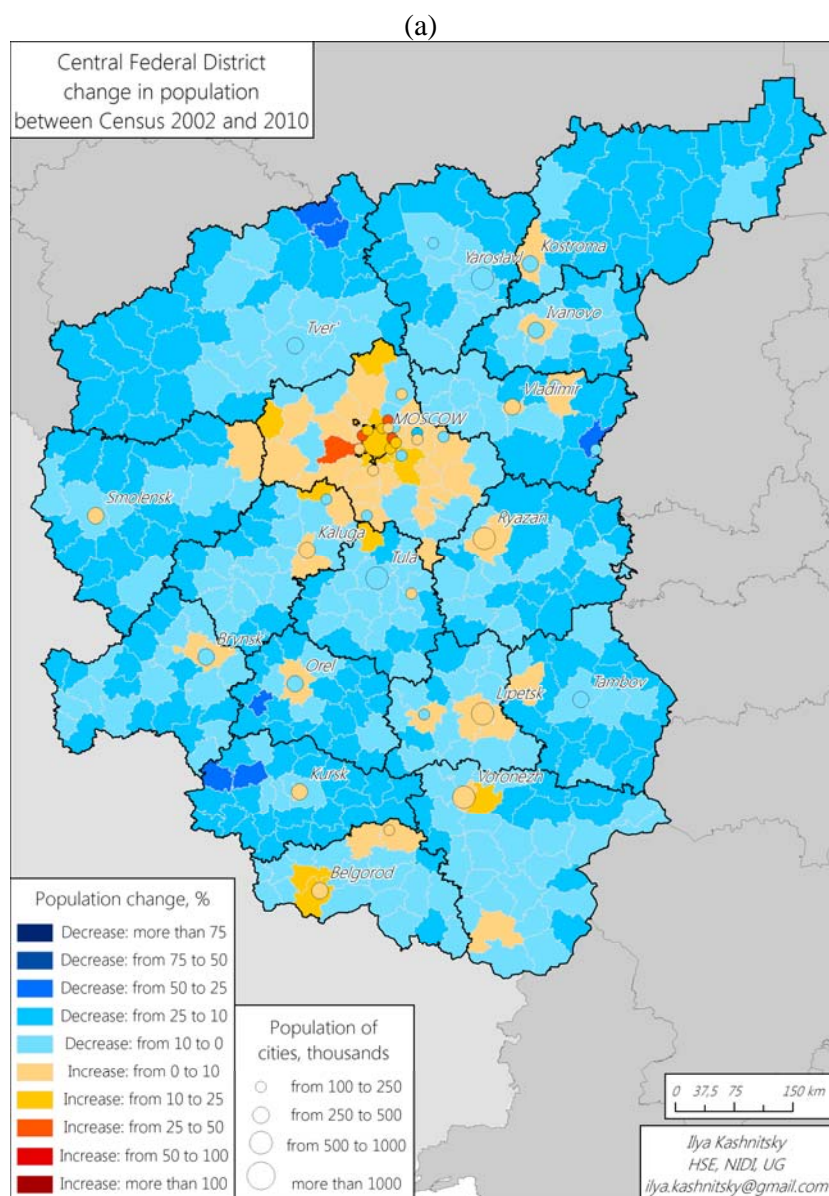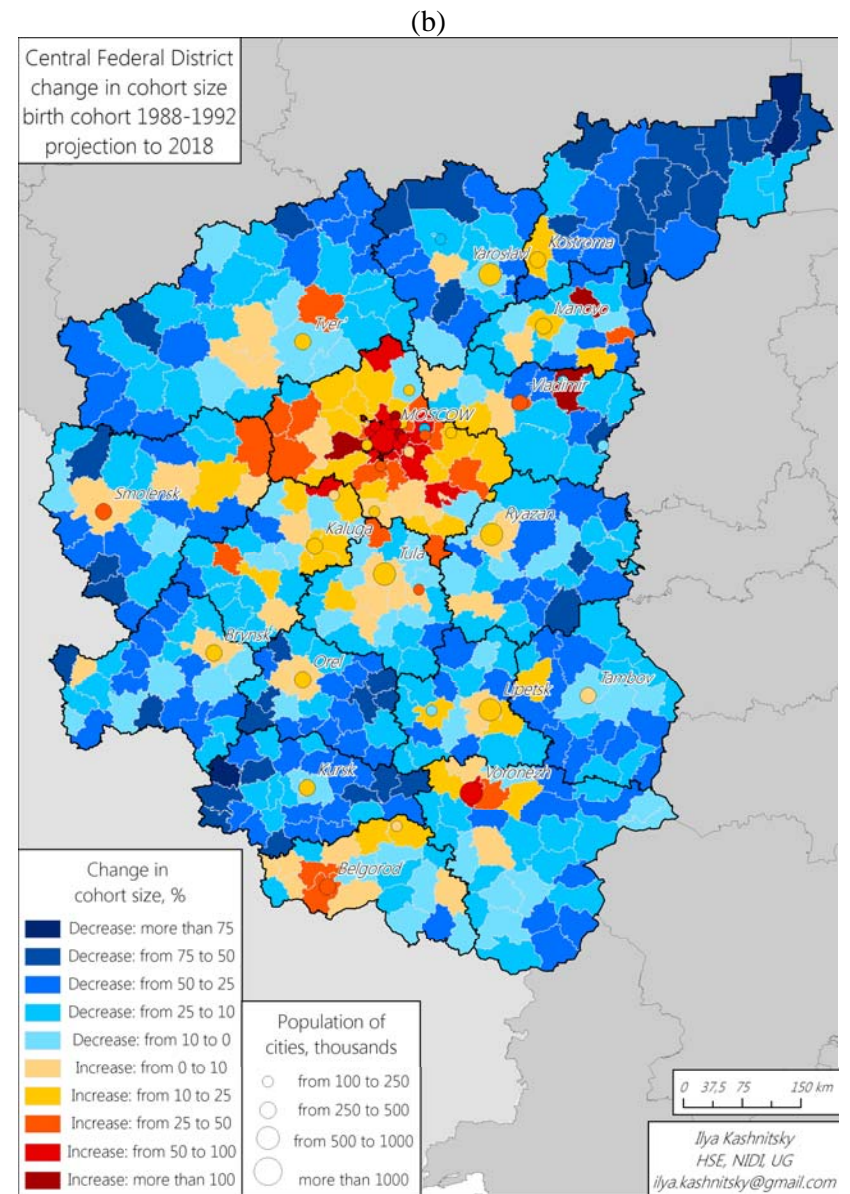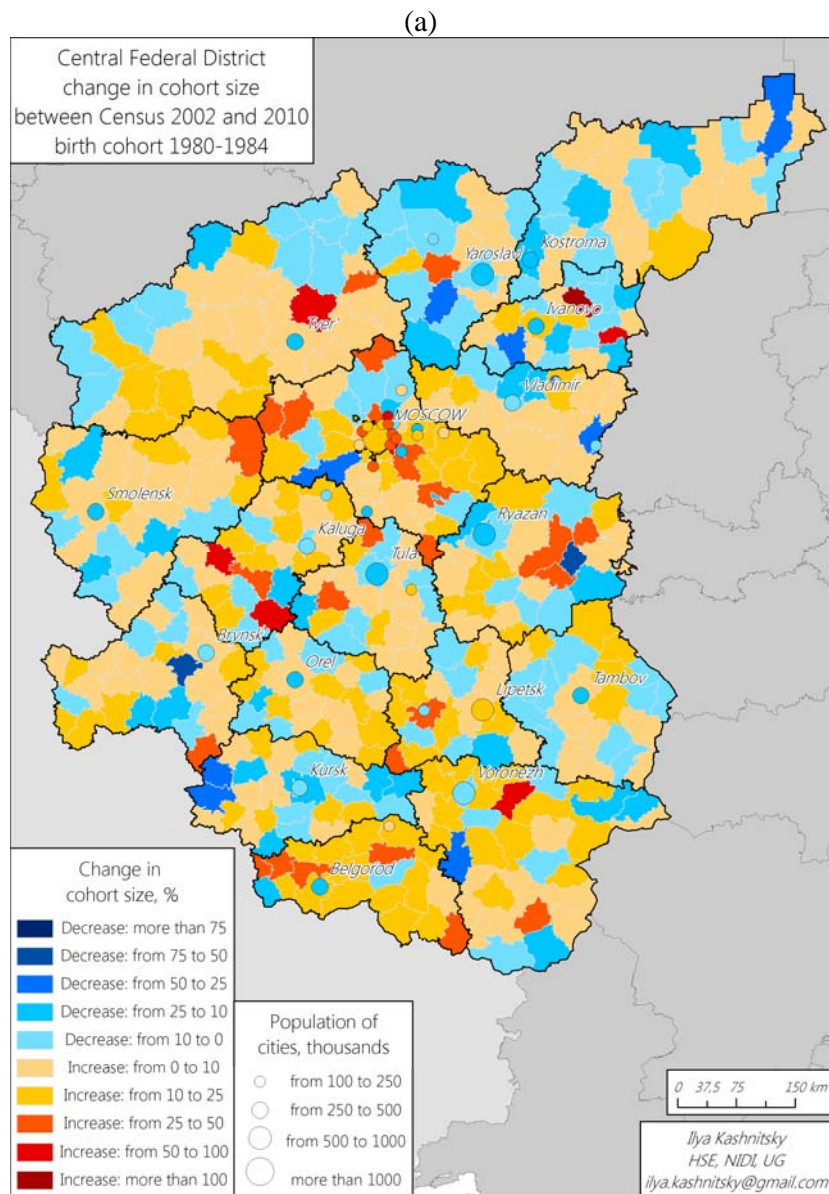
Figure 6. Central Federal District of Russia, change during 2003-2010, percent: (a) – total population change; (b) – change in the 1988-1992 birth cohort size. Source: 2002 and 2010 Censuses.

DO THE YOUNG MOVERS COME BACK LATER?

It is natural for the young to move from the periphery in search for education and better life opportunities. But the crucial question is whether the young movers return to the periphery. The demographic situation is not so miserable if there is a compensating return migration to the periphery. There are several conceptions of life-cycle migration describing the balance of migration between periphery and center though the lifespan of cohorts. We would like to note the *escalator region* concept by Fielding (1989, 1993), which was persuasively supported with evidence from some developed countries. A key factor here is the stage of urbanization. The migration balance between core and periphery is quite similar to the urbanization/suburbanization balance, but in Russia urbanization has not finished yet. Apart from the usual lag in demographic development, we may also see the result of deep agricultural crisis in rural areas after the fall of the Soviet Union. The only analogue of escalator region migration in Russia is the life-cycle population exchange between Far North and Southern regions, when young workers migrate to the North in search of higher income, and the retirees move to the South fulfilling the long-lasting dream of living in warm climate. But this phenomenon is beyond the scope of our research. The whole concept of life-cycle migration does not work at the inter-regional level in modern Russia. Hence, we expect to see no significant return of the "post-student" aged population to the inner periphery.

In order to assess the volume of the return movement of the youths to the periphery, we decided to study the intraregional migration of the 1980-1984 birth cohort (Figure 7a), who were in the "student ages" at the time of the 2002 Census and grew into young working ages by the 2010 Census. As we do not have long time series to trace the real cohorts through the "student ages" and on to the young working ages, we are forced to make some synthetic cohort assumptions due to the data limitations. Thus, we apply survival ratios of the 1980-1984 birth cohort in the 2003-2010 intercensus period to our current "students" – the 1988-1992 birth cohort. In other words, we are projecting the size of the 1988-1992 birth cohort for the next 8 years, till 2018, assuming that their migration rate would be the same as for the 1980-1984 cohort in the 2003-2010 period. This is quite a rough assumption, but it gives us the only opportunity to understand the possible return migration pattern for the contemporary young generations.

Figure 7. Central Federal District of Russia, change in the cohort size, percent: (a) – change in the 1980-1984 birth cohort size during 2003-2010; (b) – projected change in the size of the 1988-1992 birth cohort during 2011-2018. Source: 2002 and 2010 Censuses.

Figure 7b gives us the idea about the possible return rate of the young movers from periphery. We can see no massive return. True, some peripheral districts experience a slight influx of young migrants. But let us not forget that this inflow of migrants follows a huge out-migration earlier. The most depressed municipalities continue to sustain serious losses of young population. It seems like the regional centers in the CFD face a surplus of "high school graduates". They suffer a slight loss of young population in the "post-student ages" (Figure 7a).

The projection for the 1988-1992 birth cohort (Figure 7b) shows that the summary impact of youth interregional migration is fatal for the inner periphery. The most depressed municipalities lose young population not only in the "student ages" but also in the "post-student ages". In the end, the size of the original youth cohorts shrinks by more than 70 percent, which is much bigger than the estimated 2.8 percent decrease in the size of the cohort during the period of 2003-2018 due to the influence of mortality.

We would also like to note that our research showed the increase in the intensity of centripetal migration at the "student ages" comparing with the previous intercensus period. It is likely that the intensity of intraregional centripetal movement in "post-student ages" would also increase in the nearest future. In other words the real cohort depletion of the periphery could turn out to be even worse than our projection for the synthetic cohort.

THE RESULTING EFFECT OF THE YOUTH MIGRATION ON THE
DEMOGRAPHIC STRUCTURE

Census data provide information on the demographic structure of the population, which shows the result of long-lasting influence of demographic processes. The demographic history of population is imprinted in the population structure. Of course, there is some diversity in the levels of fertility and mortality, which result in quite a diverse picture across the regions of Russia, but they cannot explain the differences between municipalities within regions. Usually there is no significant difference in fertility and mortality levels across neighboring municipalities. Thus, most of the spatial variance of demographic structures at the sub-regional level is caused by intensive migration at the sub-regional level, which is, of course, age selective. So the relatively young population moves to the regional centers accelerating the aging of the periphery. The long-term effect of migration is clearly visible in some characteristics of the demographic structure, such as median age of the population (Figure 8), share of young population (Figure 9) and the dependency ratio (Figure 10). Regional centers tend to be younger than the surrounding periphery, the share of young population in their demographic structure, and the dependency ratio is very low.

Geographers (Treivish and Nefedova 2010) noticed that every big center of migration attraction forms a depressed ring around, the radius of the ring is proportional to the attractive power of the center. The depressed ring consists of the municipalities most affected by the intensive migration to the center. We can easily find such rings on the maps of Russia (Figures 8, 9 and 10) around major destinations of migration. The municipalities located in the sphere of big center's influence are weakened by the long-lasting centripetal migration and have distinctive characteristics of population composition caused be the selectivity of migration. Naturally, the most obvious depressed ring is formed around Moscow and has a radius of approximately 500 km. We can also find the similar semi-ring around St. Petersburg (radius ca. 200-250 km). Smaller depressed rings are visible around Barnaul (100-120 km), Ekaterinburg (150 km), Kazan (80-100 km). The spatial pattern found here with the use of basic visual analysis is supported by our previous results (Mkrtchyan and Kashnitsky 2013).

Naturally, the must depressed municipalities are located the sphere of influence of several centers of migration attraction. For example, such municipalities could be seen at the border of Tver' and Novgorod regions. They suffer from a combined migration gravitation of Moscow and St. Petersburg apart from the influence of their own regional centers. The other example is the extremely depressed municipalities at the border of Kursk and Orel regions, whose population is attracted by seven neighbor regional centers: Belgorod, Kursk, Orel, Tula, Ryazan, Lipetsk and Voronezh, and let us not forget about the far-spreading influence of Moscow.
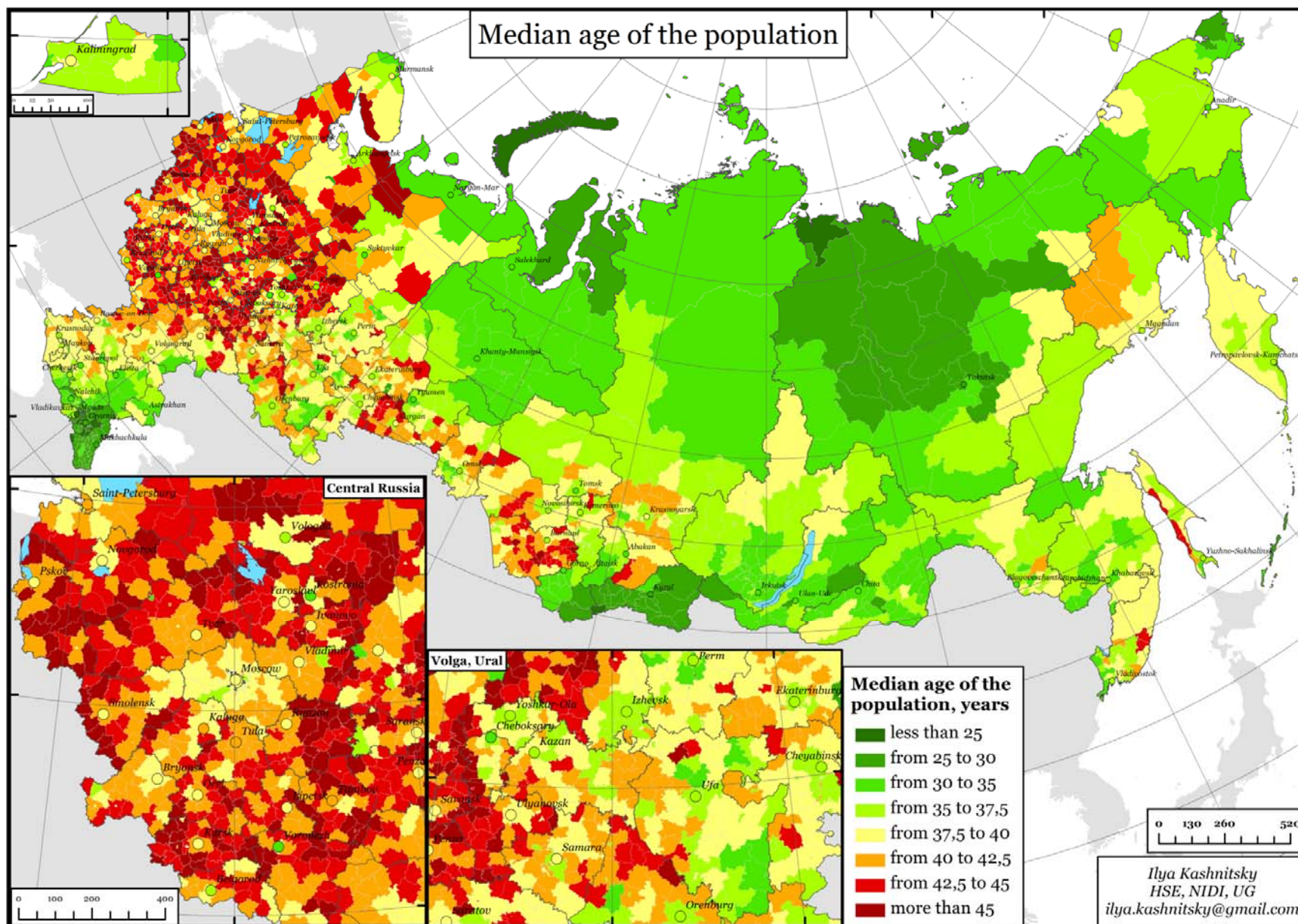
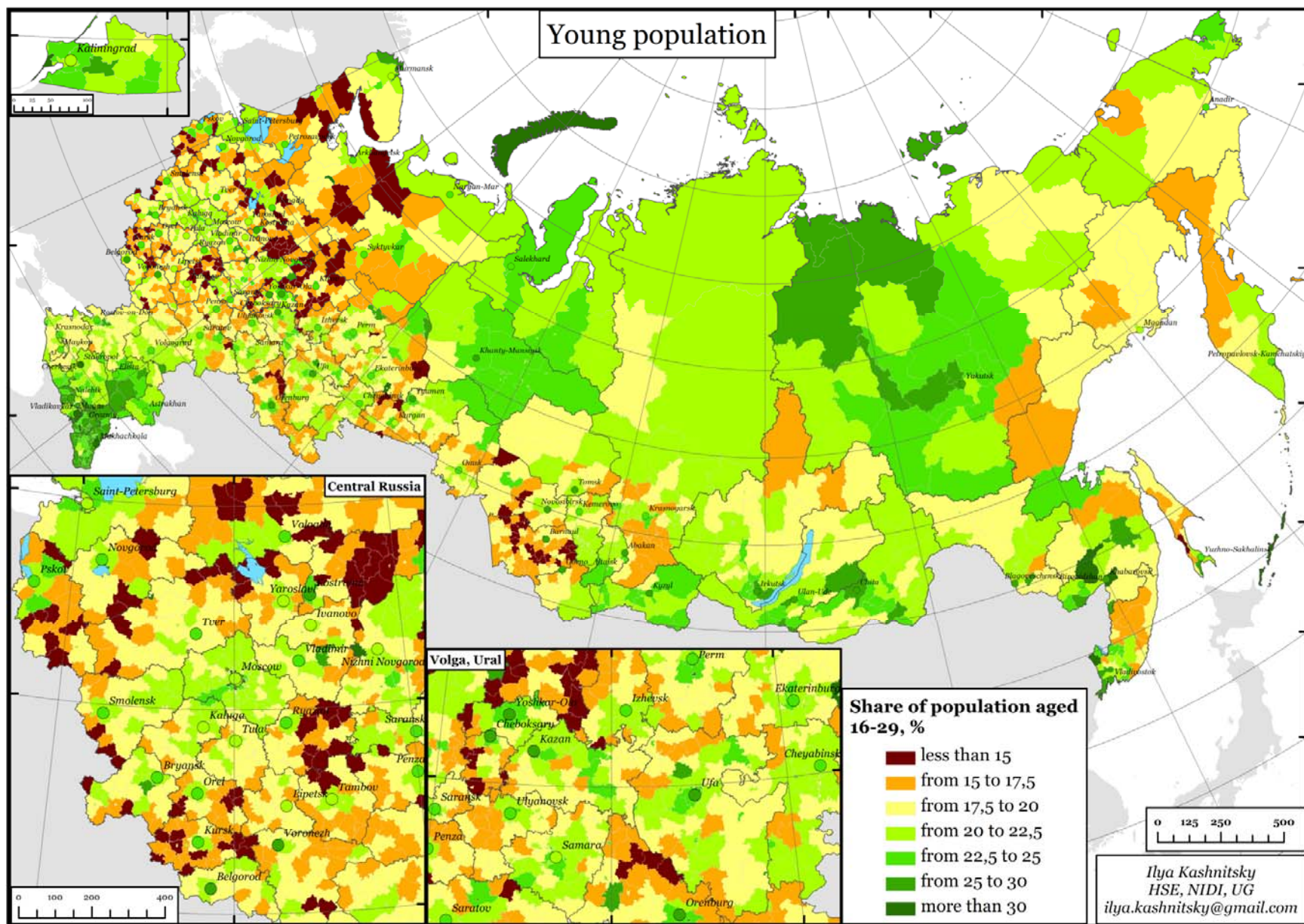**Figure 8. Median age of the population. Source: Census 2010.**

Young population

Central Russia

Volga, Ural

Share of population aged 16-29, %

- less than 15
- from 15 to 17,5
- from 17,5 to 20
- from 20 to 22,5
- from 22,5 to 25
- from 25 to 30
- more than 30

Ilya Kashnitsky
HSE, NIDI, UG
ilya.kashnitsky@gmail.com

Figure 9. Share of the population aged 16-29. Source: Census 2010.
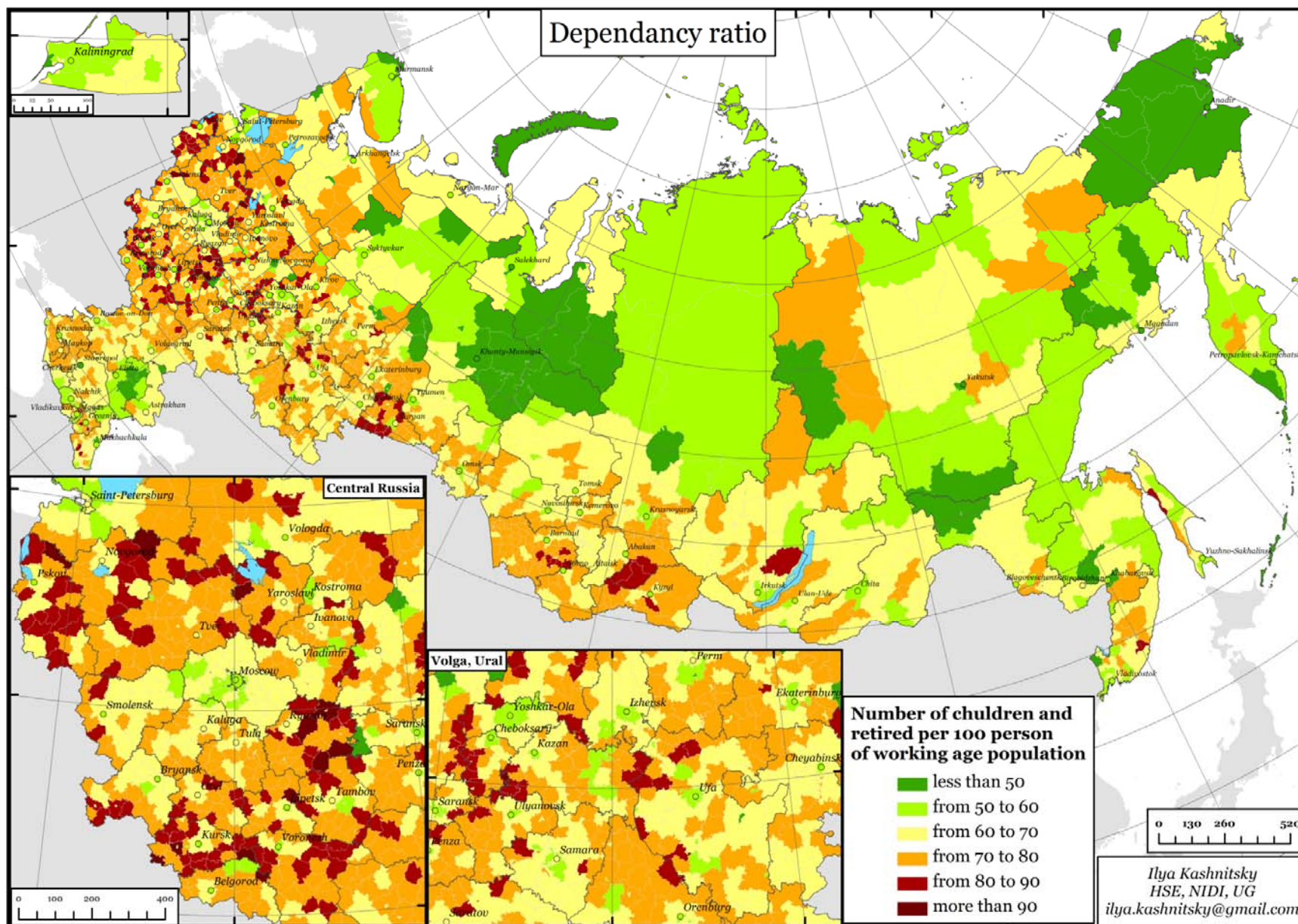
Figure 10. Dependancy ratio. Source: Census 2010.

CONCLUSION

In this paper we study the internal youth migration as a factor of population dynamics at the sub-regional level of administrative division. The main part of the research is conducted at the level of municipalities, which allow us to analyze intraregional migration dynamics.

The current statistical record proves to be an inconvenient data source for the research on youth internal migration. On average, it recorded only about one fifth of the youth migration stream in the CFD during the last intercensus period. Our preliminary idea that the official migration statistics was unable to register correctly *only* the "student ages" has found no empirical support.

Cohort research on youth migration at sub-regional level revealed the increase in the intensity of the centripetal movement in the last intercensus period compared to the previous one. The pace of the depopulation in the hinterland is accelerating. The most depressed municipalities have lost up to 70 percent of school graduates during the last intercensus period. Migration proves to be the main factor of changes in the demographic structures of municipalities.

Relatively small regional centers face a surplus of young adults in the "post-student ages" whom they are unable to hold, so they see an outflow of population in young working ages.

There is no compensating return migration of young adults to the periphery. In contrast, the most depressed peripheral municipalities continue to lose population in the young working ages right after the massive outflow of school graduates. If the current rate of depopulation due to internal youth migration persists, there could be no sustainable demographic development for the periphery.

The impact of long-lasting migration is clearly visible in the demographic structure of the population. The remoteness of the peripheral municipality together with the attractiveness of the regional center determines the level of the peripheral depression. Every big center of migration attraction forms a depressive ring around itself. This is the result of "migration exhaustion".

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APPENDIX 1. Russian administrative division system

There are basically 4 levels of administrative division in Russia (Table A1). The first three of them are shown on the Figure A1.

Table A1. Levels of administrative division in Russia.

#	Name	Name – transliteration from Russian	Quantity*
1	federal district	federalnij okrug	8
2	region	oblast (46) / respublika (21) / krai (9) / avtonomnij okrug (4) / avtonomnaja oblast (1) / gorod federalnogo podchineniya (2 – Moscow, StPeterburg)	83
3	municipality	municipalnij rajon (municipal district) / gorodskoj okrug (urban district) **	2343**
4	settlement / district of city	selskij naselennij punkt / rajion goroda	154737

NOTES: * The number of units at the time of the 2010 Census. **See Appendix 2.

Federal districts (#1) are only used for better government of the huge Russian territory. Statistical data is easily available for federal districts, but the size of units is too big for a proper research on spatial diversity. Usually demographic research addressing the issues of spatial diversity is held at the level *regions* (#2). The majority of official statistics is available for the level of regions.

Region is the basic unit of federal administrative division. Every region has limited self-government which could be roughly compared with the legal status of *states* in the US or the *bundeslands* of Germany. There are 6 names for different types of Russian regions depending on the degree of freedom in self-government. For our purpose there is no point in distinguishing between them, so we just call them regions. The principle behind region definition in Russia is more historical than statistical, i.e. the territory and population distribution across the regions is extremely uneven (Figure A2). Thus, it's quite difficult to compare Russian regions with the European administrative division system. Depending on the population or the area size, Russian regions could be placed between 1 and 2 on the NUTS scale (Table A2). The biggest Russian region (Yakutia) is more than 5 times bigger than France. And the most populated (Moscow) is bigger than Belgium, Portugal or Greece.

The most suitable level of administrative division for researching on core-peripheral issues is the level of *municipalities* (#3). On average region in Russia consists of 28 municipalities which give a proper distinction between regional center and the inner periphery. There are two main problems in working with the data at the level of municipalities. First, very limited data is available for this level; the proper age structure of the population could only be retrieved from Census data. Second, the definition of municipality is not very stable. Lots of changes in administrative division happen during every intercensus period which makes it extremely difficult to link the data of adjacent census for comparison (see more on the matter in the Appendix 2).

Table A2. Comparison of Russian regions (#2) and municipal districts (#3) with European NUTS.

Territory	Level of administrative division	Mean area size (thd sq. km)	Mean population size (mln pers.)
RUSSIA	region (#2)	206.33	1.72
	municipality (#3)	7.31	0.06
Central Federal District of Russia	region (#2)	36.12	2.13
	municipality (#3)	1.27	0.07
EUROPE	NUTS 0 (countries)	177.59	16.90
	NUTS 1	53.58	5.10
	NUTS 2	19.67	1.87
	NUTS 3	4.28	0.41

Source: Russian Census 2010, Eurostat 2010.

On average, Russian region is bigger than European country (NUTS 0) whereas its population size is compareable with NUTS 2 level. If we look only at historically populated Central Federal District, regions could be placed between 1 and 2 on the NUTS scale. Municipalities are on average smaller than NUTS 3 level.
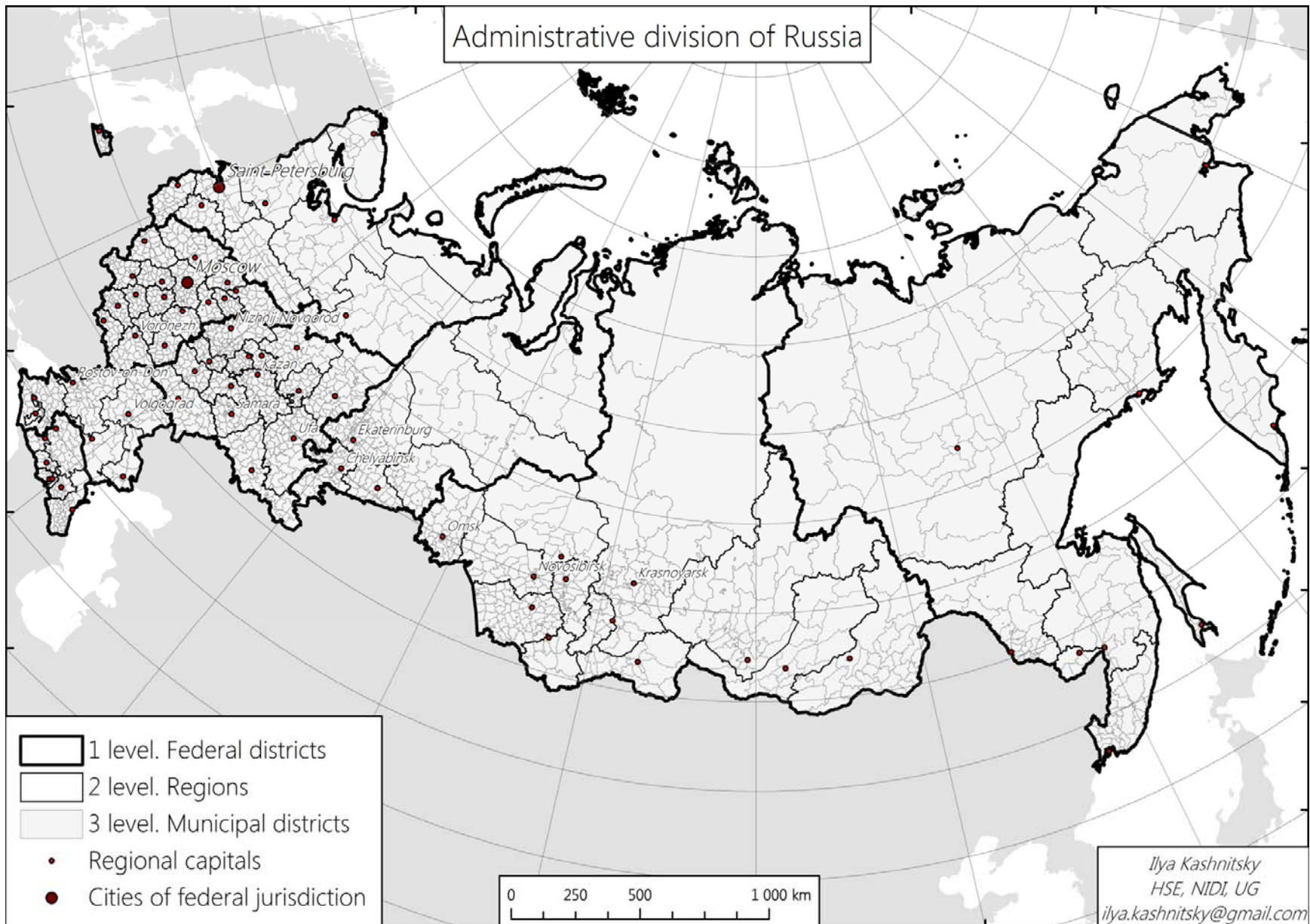
Figure A1. Administrative division of Russia at the time of the 2010 Census.
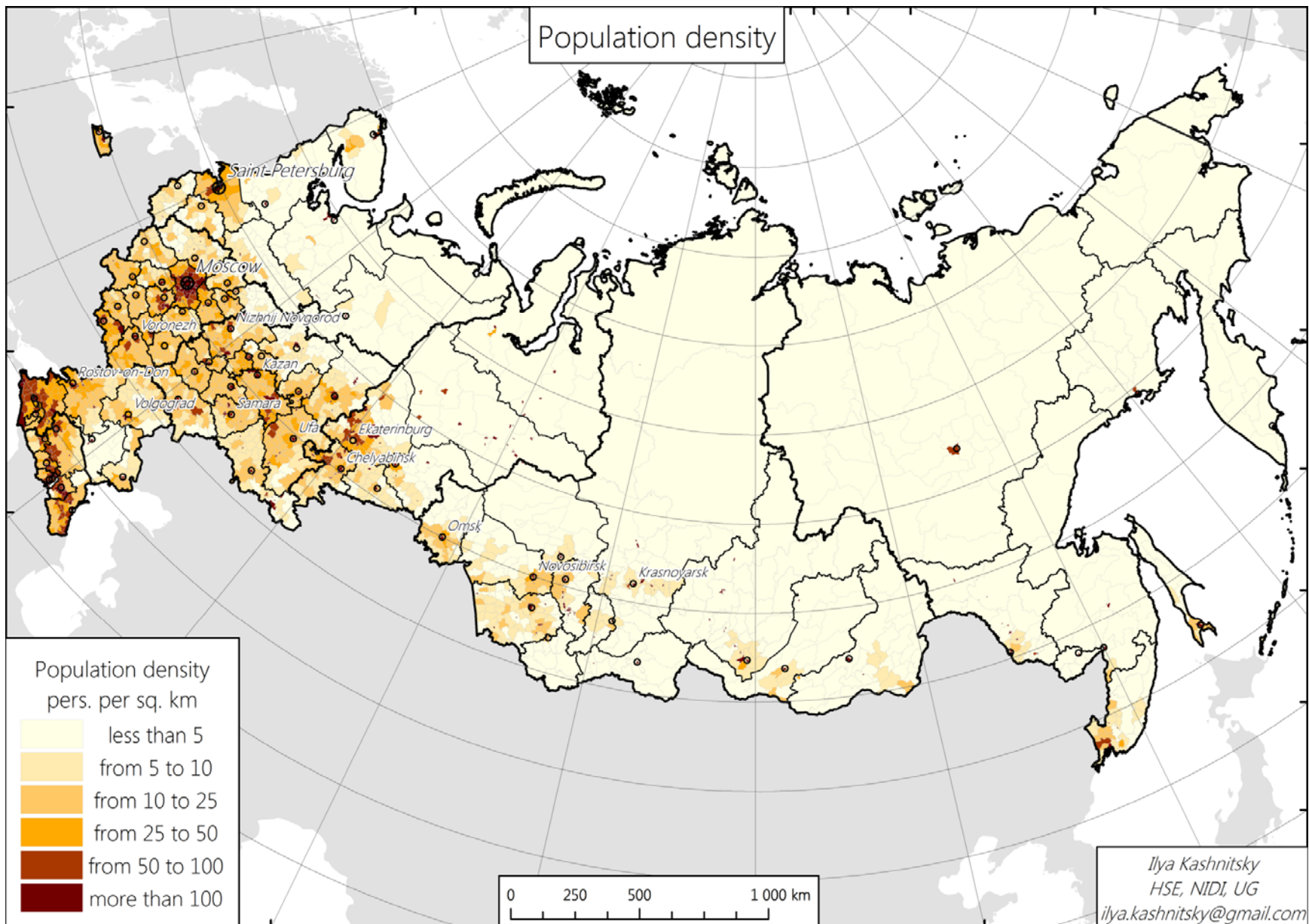
Figure A2. Population density by Russian municipalities. Source: Census 2010.

APPENDIX 2. A typology of the changes in administrative division (CADs) at the level of municipalities

The administrative division is unstable in time. Whereas the reshaping of *regions* is quite a rare and well noticeable phenomenon, the CADs at the level *of municipalities* could be a huge problem for a researcher. Here we provide the typology of the CADs at the level of municipalities based on their difficulty for the research.

There are two types of municipalities: *municipal districts* and *urban districts*. Small cities are usually included in the municipality surrounding them, while regional capitals and other big cities in a region could be allocated into separate units. The criteria for distinguishing between municipal districts and urban districts vary both in time and across Russian regions.

The first type of CAD brings no difference apart from the change in the unit name and code. There is no change in the number or shape of the units, no population recount is needed.

      1a. Municipal district becomes an urban district.
      1b. (reverse of 1a) Urban district becomes a municipal district.

The second type of CAD is a bit harder to overcome. It happens when a city changes its status. The status of local cities is the most common reason for the changes in municipalities' network.

      2a. A city, usually it's a center of municipal district, allocates from the surrounding municipal district and becomes a separate urban district.
      2b. (reverse of 2a) An urban district unites with the surrounding municipal district becoming either municipal district or urban district.
      2c. Bordering units group together.

The third type of CAD is the trickiest one. It happens when a part of municipality (usually certain *settlements*, see #4 in Table A1 in Appendix 1) changes its jurisdiction and becomes a part of the neighboring municipality. Luckily, the case is quite rare. At least it is rare for our prime area of study, Central Federal District, where the administrative division is relatively mature due to the long history of inhabitance.

3a. An urban district takes some settlements from the surrounding municipal district under its jurisdiction.

3b. A settlement moves from the jurisdiction of one municipality to the jurisdiction of the other municipality.

There is also a specific Russian phenomenon of new administrative units "appearance" (Karachurina 2012, 2014). In the Soviet Union there were quite a lot of closed cities and areas. Usually the cities were closed because of the location of various secret objects (military objects, army factories, scientific laboratories). After the fall of the USSR such cities started to appear out of nowhere in the official statistics and on the maps. Not all the former closed areas were opened at the same time. Mainly their disclosure happened during the first intercensus period (1990-2002) after the fall of the USSR. The latest former closed areas were disclosed in 2004. But there were no new openings in the Central Federal District during the last intercensus period (2003-2010). So we didn't face this particular problem working on the paper.

*APPENDIX 3. Institutional populations in Russia, a case of Kaliningrad region*

A closer look at Russian 2010 Census maps (Figures 8, 9, 10) shows that not only regional centers are relatively young but also, quite unexpectedly, some peripheral municipalities. It is very unlikely that these peripheral municipalities are somehow desirable for the young migrants. The key for this paradox is the huge institutional population in Russia, i.e. soldiers, prisoners, shift workers of the North and special hospitals' patients. A young age profile is also typical for such migration streams. Sometimes, when military servants are involved in migration, the age distribution is concentrated at certain ages even stronger than in the case of age selectivity of "normal" migration. These "institutional migrants" move involuntarily skewing sex-age structures dramatically in the destination areas. Further we investigate the effect of institutional population locations using the example of Kaliningrad region, which is a known location for significant contingents of army forces.
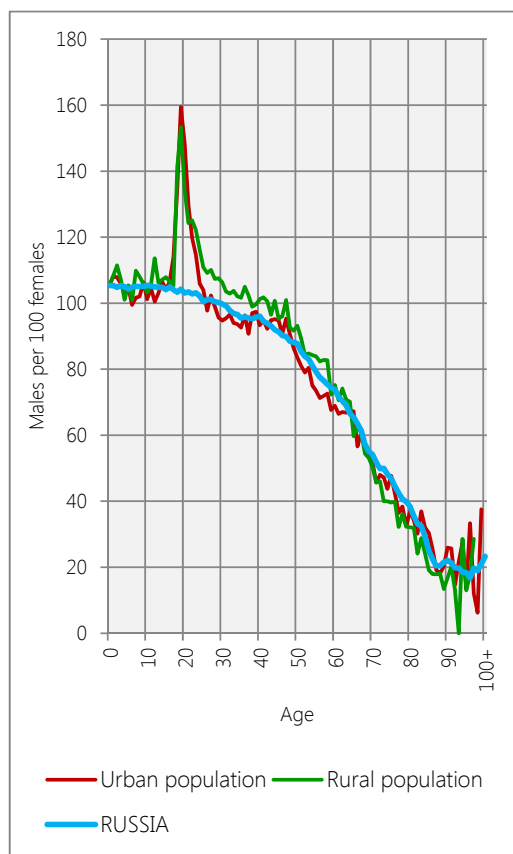
Figure A3. Sex ratio for Kaliningrad region. Source: Census 2010.
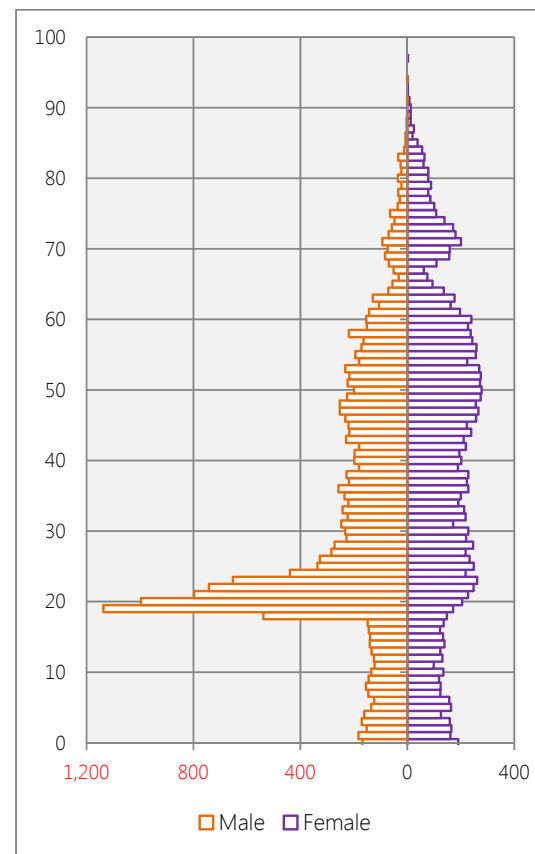
Figure A4. Demographic structure of Baltiysk, a town in Kaliningrad region. Source: Census 2010.
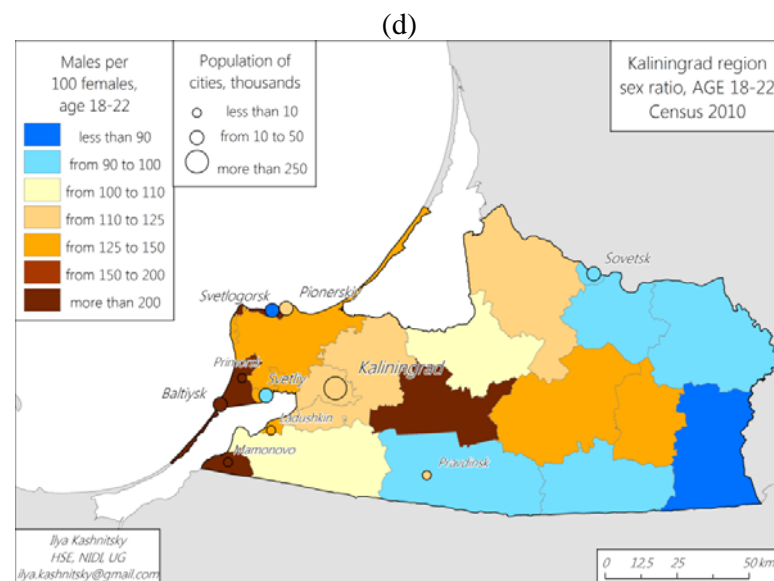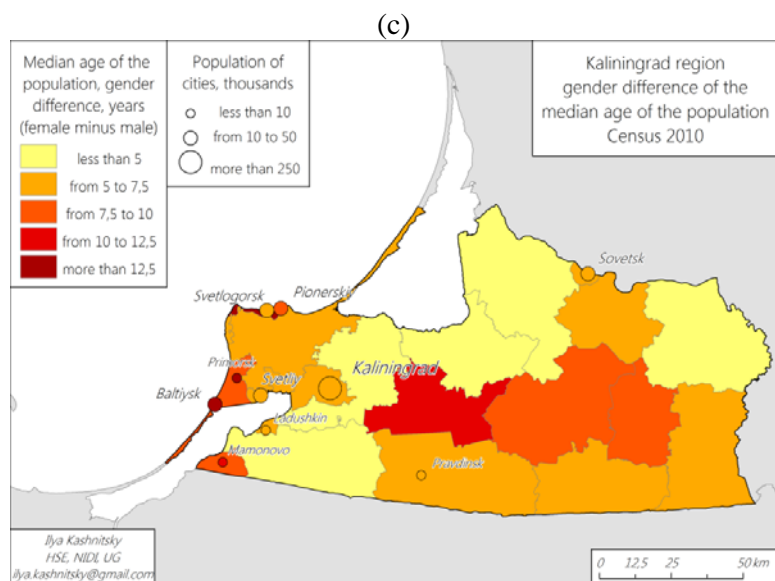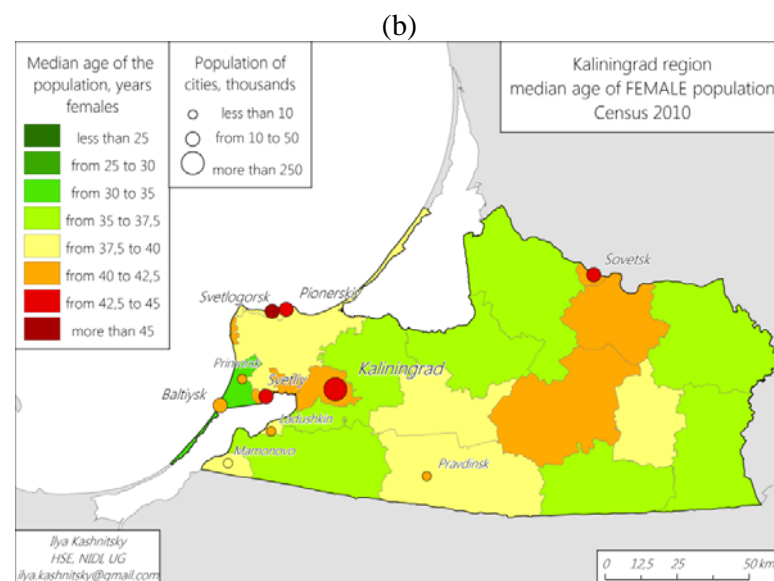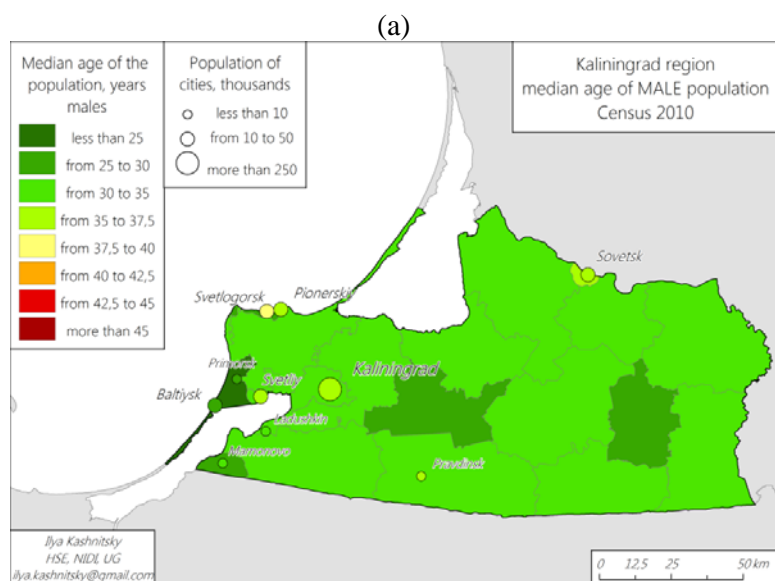
Figure A5. Kaliningrad region: (a) - median age of male population, (b) - median age of female population, (c) - gender difference in the median age of the population, (d) – sex ratio. Source: Census 2010.

The excess of the males over the females in the young ages is clearly visible for the whole population of Kaliningrad region (Figure A3). At the age of 20 there are 60% more males than females in the population. The large share of young males aged 18-25 reveals the impact of young male migration on population composition, which definitely is caused by the relocation of army servants. The domination of young males in the population is even more obvious if we look at the demographic structure of a certain city where the military forces are located (Figure A4). The sex ratio at the ages of 18-22 reaches as high as 421 males per 100 females in Baltiysk, a typical military town.

We can easily detect the municipalities and cities of the possible location of the institutional populations at the 4 maps of Kaliningrad region (Figure A5). There are several territory units with relatively younger male population (a). At the same time the median age of the female population (b) is not relatively young. Naturally, the difference between the median age of the females and the median age the males is biggest in the same territorial units (c). This big difference is the mark of disproportionally big share of young males. Finally, the last map (d) proves that the same municipalities and cities have noticeable surplus of young males aged 18-22, which could only be the result of massive relocation of military forces.

Military objects are not necessarily located in the cities. Therefore, the location of institutional populations brings the systematic disturbance to our concept of cities' migration attractiveness formed earlier. When the presence of big share of young male population is caused by the migration of institutional populations, we cannot claim that this is the result of migration attractiveness of the territory. The phenomenon of institutional populations could be a theme for separate research; this is actually happening now (Averkieva 2014). In this paper we have to consider the movement and the resulting demographic structures caused by institutional populations as a biasing factor in our research.

In this paper we study the youth migration in Russia at the sub-regional level of administrative division. The aim of the research is to assess the volume of internal youth migration. The task is only doable with the use of census data, which not only allows us to research at the sub-regional level, but also provides much more accurate information on the youth migration than the current migration record does. We used the survival method to study sub-regional population dynamics. As mortality is quite insignificant at young ages, most of the change in cohort size is caused by migration. Our estimates show that during the last intercensus period (2003-2010) up to 70 percent of youth cohorts have left the regional periphery for good after graduating from school, and there was no significant return to the demographically depleted periphery in the young working ages.