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Spatial patterns of age-specific sex ratios in Russian intraregional migration

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Abstract: *Migration is one of the key processes that shape the age and sex structure of a population. Intraregional migration, which accounted for 39% of migration turnover in Russia in 2016-2020 and follows the centripetal trend, has a significant impact on the population of many territories. The study of sex disparities in migration deepens the understanding of its impact on the age-sex population structure, fertility and marriage patterns, and local labor markets. This article aims to identify the differences in the participation in intraregional migration between men and women, using data on the age-sex population distribution and the number of arrivals and departures by age and sex in 2016-2021 in Russian municipalities. Based on these primary data, the coefficients of arrivals and departures per 1000 residents for individual age and sex groups for 2016-2020 were calculated. Also, the corresponding standardized coefficients were calculated for the ages of 15-29 and 40+ years. The case of Central Russia was considered in detail. The results revealed that women show higher migration activity at the age of up to 40 years, while men do so at the age of over 40 years and in all types of territories. The higher migration activity of women at young ages is associated with their greater involvement in educational migration and fewer employment opportunities in peripheral territories, as well as with a potentially more frequent change of registration when getting married, having children, and enrolling them in preschool institutions and schools. As for men, their higher migration activity at older ages is probably due to the fact that they less often than women take care of children alone after a divorce or of elderly relatives, which makes them less restrained in terms of migration.*

Keywords: *intraregional migration, migration structure by sex and age, core, periphery, municipal data.*

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Introduction

The sex ratio is regarded as one of the most crucial indicators of the demographic situation (Zayonchkovskaya, 1991). Migration plays a pivotal role in shaping this ratio in numerous territories. Gender imbalance in migration alters the population composition in areas of both departure and arrival, consequently influencing birth rates, marriage rates, and local labor markets. An analysis of migration structure by gender is imperative to gain a comprehensive understanding of population dynamics and demographic processes.

The study of gender-specific migration patterns dates back to the pioneer of migration research, E. Ravenstein (Ravenstein, 1885). He observed that women exhibit higher migration activity over short distances, while men tend to do so over longer distances. In the context of Russian statistical publications, intraregional migration refers to moves over short distances, while interregional and international migration encompasses long-distance moves. Recent statistics from Rosstat (2021) confirm the prevalence of women in intraregional migration, especially among the youngest and most mobile age groups.

Intraregional migration holds particular interest not only due to its greater gender disproportions compared to other migration flows but also because it largely adheres to a center-peripheral hierarchy of territories. Accounting for 39% of migration turnover in Russia between 2016 and 2020 (Rosstat, 2021), intraregional migration significantly influences the age-sex population structure throughout vast areas of the country.

This article aims to identify differences in the migration activity of men and women regarding intraregional moves. The data were analyzed based on individual age groups within a spatial context.

Previous research

Intraregional migration in Russia

In Russian statistical publications, intraregional migration refers to moves between municipalities of a region. Such moves are recorded when individuals change their place of residence registration or when a temporary registration is obtained or has expired. The classification of moves adheres to the grid of administrative and municipal territorial divisions, following all of their peculiarities. For instance, migration spanning hundreds of kilometers within large Siberian regions is categorized as intraregional, whereas a move to the opposite side of the street in Moscow and St. Petersburg metropolitan areas, if the regional border follows it, is considered interregional migration.

Changes in migration between urban cores and the periphery are influenced by the stages of urbanization (Nefedova, Treyvish 2002), which result in varying degrees of centripetal and centrifugal flows. In Russia, in contrast to other European countries, there is a pronounced trend towards spatial concentration (Karachurina, Mkrtchyan 2016). This trend is not driven solely by internal migration, but also by a gradual increase in natural population decline observed when moving from cores to the periphery. However, this gradient is somewhat disrupted by local secondary and tertiary centers (Karachurina, Mkrtchyan 2013).

Intraregional migration leads to the concentration of population in regional cores and their adjacent municipalities (Karachurina, Mkrtchyan, Petrosyan 2021), although there are

several examples of noticeable alternative centers (Cherepovets in Vologda Oblast, Surgut and Nizhnevartovsk in KhMAO, and Sochi in Krasnodar Krai).

Migration selectivity by gender

The characteristics of migration based on gender remain less explored than age-based migration studies (Mkrtchyan, 2021). Nevertheless, differences in migration patterns between men and women are evident across various aspects, including the reasons and consequences of migration, its intensity, and its spatial and temporal features.

Gender-based differentiation in migration patterns is increasingly influenced by economic causes. In developed countries, a connection has been shown between higher female mobility and gender imbalances in the labor market, such as variations in employment structures and wage levels (Faggian, McCann, Sheppard, 2007). In East Germany, where the gender ratio spatial patterns resemble those in Russia (with a disproportionately higher number of men in rural areas and women in cities), women's higher migration activity is also driven by labor market inequalities (Leibert, 2016).

Other studies also show the presence of gender selectivity of migration at certain spatial levels in developed countries. For example, in Sweden, women living in rural areas are more actively involved in educational migration than men, which enhances their chances of moving to pursue education and subsequently entering the labor market or getting married (Johansson, 2016; Karpestam, Håkansson, 2021). Indirectly, Russian data (Bessudnov, Malik, 2016) also suggest that females are more likely to enter the 10th grade (high school), thereby increasing their opportunities to access universities primarily located in regional centers.

On the contrary, at older ages, the relatively higher migration activity of men may be associated with the consequences of divorce (Clark, 2013; Mkrtchyan, 2021). In Russia, children typically stay with their mothers after divorce, which can hinder their mobility. In addition, in most cases, women are responsible for taking care of their elderly parents.

Core-peripheral spatial relations in Russia

The Russian space exhibits considerable polarization, with stark socio-economic contrasts between large cities, small towns, and rural areas (Nefedova, 2009). This spatial heterogeneity results in varying living standards, decreasing hierarchically from centers to the remote periphery (Zubarevich, 2013). Centripetal migration, which has been ongoing for decades, plays a vital role in this dynamic and includes intraregional moves (Karachurina, Mkrtchyan 2016).

Centripetal migration, along with its consequences, alters the age-sex structure of the population in the territories involved. Regional cores tend to have a younger population compared to the periphery, with a sex ratio disproportionately favoring women due to the gender selectivity of centripetal migration (Kashnitsky, 2014; Gerasimov, 2022). The most notable core-peripheral differences are observed in the Center and the North-West regions, as well as in Siberia.

Educational institutions and the availability of more diverse services, leisure activities, and labor markets attract migrants from peripheral territories to large centers. However, the scale of the increasing concentration of the country's population in major urban cores and their metropolitan areas may be underestimated. Many migrants who have left peripheral areas and have been residing elsewhere for an extended period may still be registered at their former place

of residence, thus inflating the population figures for rural areas and small towns (Fomkina, 2017; Alekseev, Vorobyov, 2018). Consequently, the actual rate of out-migration from the periphery may be even higher than indicated in statistical data.

Study limitations

This study faces several limitations due to the migration registration rules in Russia and the quality and nature of the available data:

- Russian migration statistics exhibit significant distortions that complicate analysis. Migration registration practices affect data on moves differently for men and women. Events like childbirth and marriage often prompt changes in registration for women (Mkrtchyan, 2021), usually following an extended period of residence at a place different from the registered address.
- Migration registration in Russia creates the statistical artifact of "pseudo-return" migration (Mkrtchyan, 2020). This refers to the automatic "return" of migrants with expired registration from their current place of stay to their original place of residence. Consequently, the number of arrivals in donor municipalities and departures in recipient ones is inflated.
- Men's higher involvement in circular labor migration, predominantly interregional (Mkrtchyan, Florinskaya, 2019), which is not reflected in migration statistics (Mkrtchyan, 2021), leads to the underrepresentation of men in intraregional migration in peripheral municipalities where circular labor migration is most common.
- The institutional population, including the armed forces and prisoners, is registered at their place of stay (Pyankova, 2014), but their moves are recorded in migration statistics only on rare occasions[1]. As institutional groups are predominantly male, this leads to an underestimation of male migration activity indicators in their location municipalities.
- Evasion of military service by draft-age men may further hinder the analysis of statistical data, as some men, after moving, may not be registered at their actual address. This general limitation arises from the assumption that Russian migration statistics record changes in registration, not actual moves.
- The study excludes federal cities and adjacent regions due to the consideration of migration between them as interregional rather than intraregional, making comparisons with other regions problematic. Moreover, intraregional migration in federal cities consists of moves between city districts, which are not comparable to municipalities in other regions. In addition, due to missing data for 49 municipalities across the country, they also were excluded from the calculations, either entirely or in part.
- To achieve a more accurate spatial picture, longer statistical series are required to eliminate random fluctuations caused by a small number of observations. Using earlier data is challenging due to the short time series in the Municipal Indicators Database (BDPMO) and the data's incomparability resulting from changes in the statistical recording of migration in 2011. After this, migration flow volumes stabilized only by 2015-2016 (Mkrtchyan, 2020).

[1] According to Rosstat instructions, migration statistics take into account the moves of military personnel serving under contract. Conscripts and prisoners are counted only if they changed their place of residence after completing their service or serving their sentence respectively.

Data and methods

The primary data source used in this study is the Municipal Indicators Database (Rosstat, 2022a). Territorial cells consist of the first-level municipal entities, including municipal districts and urban and municipal okrugs. We utilized data on the population of municipalities by sex and age at the beginning of each year for the period 2016–2021, along with data on the annual number of arrivals and departures by sex and age from 2016 to 2020.

The indicators for the five-year period were averaged, and the focus of this study was not on analyzing dynamics. The fluctuating sizes of age cohorts among residents and migrants in sparsely populated municipalities and the limited time series of data made it impractical to analyze the time series of indicators . Averaging the indicators over a five-year period enabled us to observe a relatively stable picture of migratory flows. Notably, significant changes in migration activity in Russia in 2020 due to the COVID-19 pandemic did not impact the sex ratio in migration flows (Mkrtchyan, 2021), allowing us to include the data for that year on equal terms with the rest.

The analysis was conducted for 2,164 municipal entities (MEs) within their boundaries for 2016. Some municipalities underwent administrative transformations during the study period, such as transforming from municipal districts into urban okrugs. In such cases, statistical series for transformed municipalities were combined. For calculations concerning unified or divided MEs, series before their conversion were used if their length was sufficient (at least three years).

The original database contained a significant number of gaps. To address population data them, we filled them with mean values when data were available for the previous and following years. For migration data, gaps were categorized as "systemic," affecting municipalities in all age groups for specific years, and "other", concerning sparsely populated municipalities and/or older age groups (i.e., the least mobile). We replaced these gaps with zeros to enable calculations, as described below.

For the municipalities analyzed, we calculated coefficients of arrivals and departures per 1000 inhabitants of the respective sex in the following age groups: 0–14, 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, and 70+ years old. The age group boundaries align with the grouping of age cohorts in the population data source. We first calculated the average population for 2016–2020 as the mean between the figures for January 1 of the subsequent two years. Then, we calculated the coefficients for each year; if there was a gap in the series for at least one of the indicators, the year was excluded. The obtained indicators were averaged over a five-year period. However, if there were more than two gaps in the coefficients' series, we did not make the calculation.

For cartographic analysis, we selected two enlarged age groups of particular interest: 15–29 years old, representing the age with the highest migration activity, and 40+ years old, the age range with higher migration activity of men. To account for differences in the age composition of men and women within these age groups, we standardized the indicators using the average weight for the period under review of the initial age groups in the Russian population.

For a more detailed examination of spatial differences in migration activity, we focused on Central Russia, where well-established and pronounced center-peripheral relations of territories are observed. The municipalities were categorized into four groups based on calculations by A. Raysikh (Raysikh, 2019), who identified gravity zones of large settlements in

Russia using the gravitational method. The four groups included regional centers with suburban areas (28 MEs), large cities with a population of over 100 thousand people and their suburban areas (10 MEs), local centers with a population of less than 100 thousand and their adjacent areas (58 MEs), and other municipalities (251 MEs). The analysis excluded municipalities belonging to the Moscow agglomeration, as well as territories where institutions of the Federal Penitentiary Service and large contingents of the armed forces are located[2] (except for large cities, where their influence on the age and sex structure of the population is insignificant). Population sizes and the number of arrivals and departures were aggregated for the aforementioned four groups, enabling us to obtain coefficients of arrivals and departures similar to calculations for individual municipalities.

Results

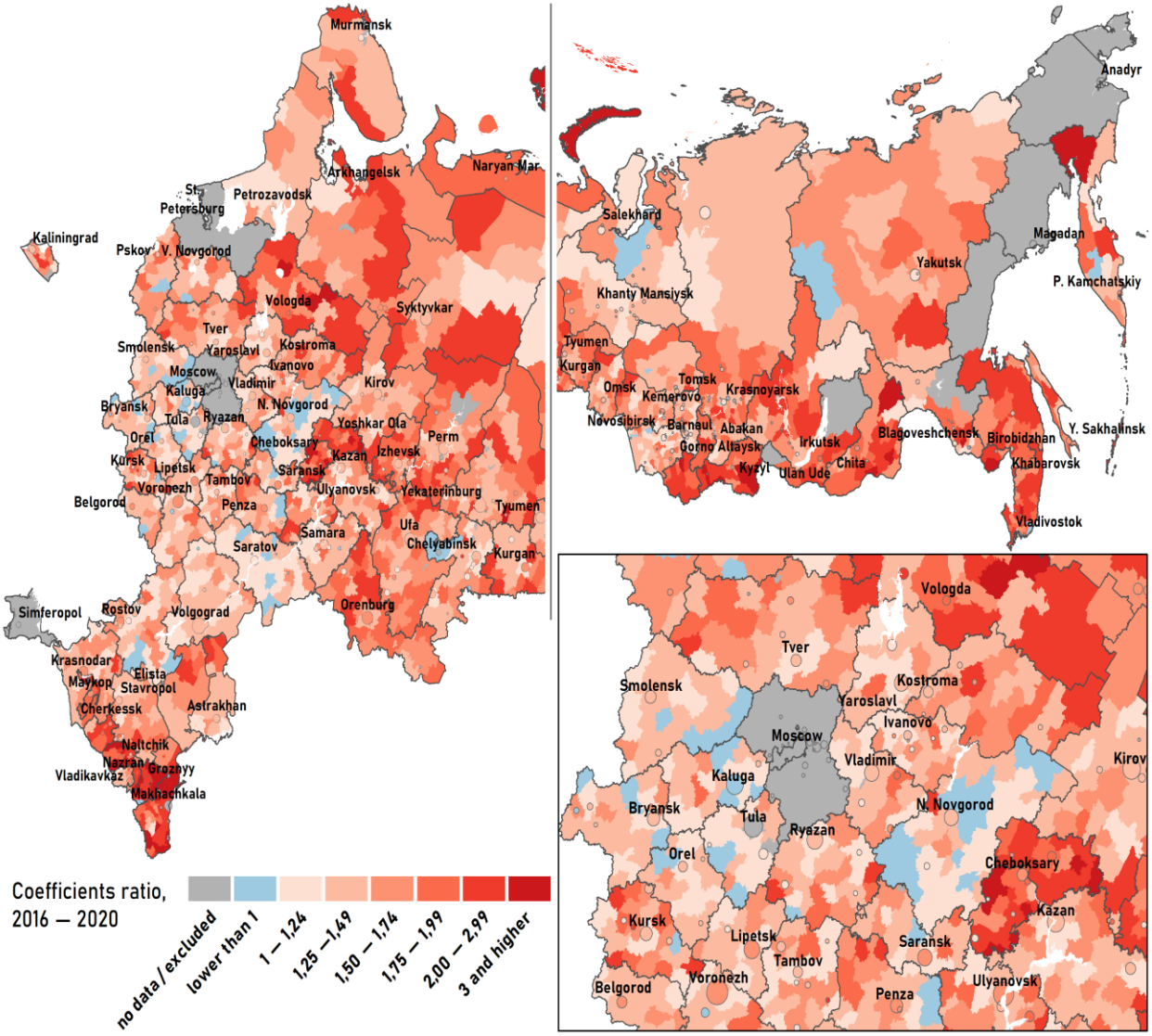
By dividing the age coefficients of female arrivals and departures by the corresponding coefficients for men, we were able to compare the migration activity by municipalities and obtain the following results.

Arrivals aged 15–29. Figure 1 displays the coefficient ratios for arrivals aged 15–29, revealing a higher migration activity of women in the majority of municipalities. In numerous peripheral territories, arrivals in this age group are a "reflection" of departures associated with educational migration, influenced by migration registration peculiarities. Large cities, attracting centripetal flows, exhibit a more intensive arrival of women. These findings align with studies on individual regions. For example, G. Leonidova and N. Vyacheslavov (2016), using data from Vologda Oblast, found that women account for up to two-thirds of all intraregional moves at young ages.

The largest disproportions in favor of women are observed in the North, Far East, and North Caucasus regions. In the first two macro-regions, and some municipalities in other parts of the country, the higher migration activity of women is linked to the presence of military contingents, artificially lowering the migration activity of local men due to the registration of the institutional population at the place of stay without recording its moves in migration statistics. For the North Caucasus, limitations arise from noted problems with demographic statistics (Kazenin, 2014; Mkrtchyan, 2019).

[2] Lists of penal colonies and open prisons are provided on the websites of the regional departments of the Federal Penitentiary Service. The location of large military units was determined according to open data, checked with municipal statistics.

Figure 1. Coefficient ratios of arrivals for persons aged 15–29 per 1,000 residents of the corresponding sex (female/male)[3]



Source: based on the author's calculations

Noteworthy are the two Volga republics, Chuvashia, and Mari El. In most municipalities within both regions, there is significantly higher migration activity of women compared to men, visible not only in arrivals but also in departures (Figure 2). Calculations for five-year age groups indicated that women's peak migration activity in most municipalities occurs in the 25–29 years age group, while for men, it is in the 15–19 years age group. Data for municipalities with the most significant disparities are presented in Table 1.

[3] Here and below, on the maps, urban okrugs are presented with generalized boundaries for better representation at scale.

Table 1. Population and arrivals per year in the age group 25-29 in several districts of Mari El and Chuvashia republics

	District	Population at start of year						Arrivals over year				
		2016	2017	2018	2019	2020	2021	2016	2017	2018	2019	2020
Women	Kuzhenerskiy [4]	283	208	126	87	91	143	35	35	29	27	25
	Alikovskiy	260	134	53	25	81	157	42	33	23	27	19
	Krasnochetayskiy	195	76	27	19	31	82	24	28	41	21	25
	Shemurshinskiy	188	99	13	30	82	142	25	20	24	16	17
	Shumerlinskiy	103	90	31	17	41	69	21	15	11	10	9
	Yal'chikskiy	79	17		42	95	205	40	34	39	39	39
Men	Kuzhenerskiy	492	405	351	308	286	306	15	11	7	8	13
	Alikovskiy	575	485	338	314	319	392	22	16	28	20	10
	Krasnochetayskiy	538	462	376	314	277	336	32	22	12	21	12
	Shemurshinskiy	425	359	245	185	183	180	13	10	12	8	6
	Shumerlinskiy	278	199	185	169	179	215	8	8	3	8	
	Yal'chikskiy	382	321	220	244	291	389	27	22	25	12	10
Sex ratio, men per 100 women	Kuzhenerskiy	174	195	279	354	314	214	43	31	24	30	52
	Alikovskiy	221	362	638	1256	394	250	52	48	122	74	53
	Krasnochetayskiy	276	608	1393	1653	894	410	133	79	29	100	48
	Shemurshinskiy	226	363	1885	617	223	127	52	50	50	50	35
	Shumerlinskiy	270	221	597	994	437	312	38	53	27	80	
	Yal'chikskiy	484	1888		581	306	190	68	65	64	31	26

Source: Compilation based on BDPMO data (Rosstat 2022a).

In the districts presented in the table, as well as in other municipalities of the two republics, there is a significant disproportion in the sex ratio in favor of men, exceeding the values found in peripheral municipalities of Central Russia (120–130 men per 100 women (Gerasimov, 2022)). The reason for this anomaly is unclear, but its clear localization within the regions suggests problems with the statistical recording of migration events at the municipal level.

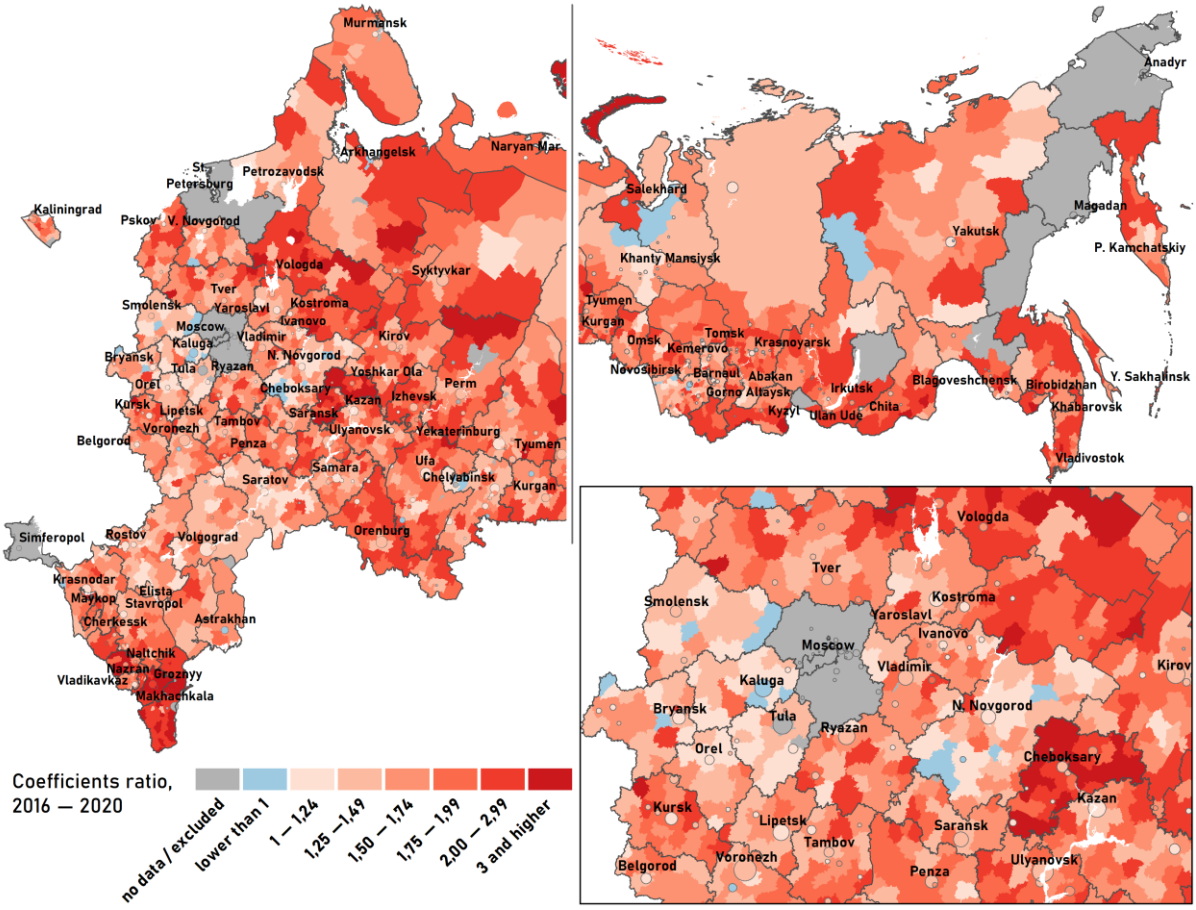
Departures aged 15–29. Compared to arrivals throughout the country, there is an even higher migration activity of women in out-migration (Figure 2). For certain regions (the Republics of Altai, Tyva, and Buryatia), the intensity of migration at young ages may also be influenced by the popularity of contract service in the armed forces, which involves interregional migration of some men. Service in the armed forces acts as a social lift and one of the few reliable sources of income for many peripheral territories.

Arrivals aged 40 and over. For both arrivals (Figure 3) and departures (Figure 4), there is a more mosaic spatial pattern compared to ages 15–29. This is due to lower migration activity at older ages and, consequently, the influence of small numbers on the results, despite attempts to mitigate it in the calculations described above (averaging indicators over 5 years and aggregating

[4] The Kuzhenerskiy municipal district is located in the Republic of Mari El, while the rest are in the Chuvash Republic.

age groups). As a result, more intensive arrivals among women of these ages, as well as a significant disproportion in favor of men, are typically found in sparsely populated municipalities.

Figure 2. Coefficient ratios of departures aged 15–29 per 1,000 residents of the corresponding sex(female/male)



Source: based on the author's calculations

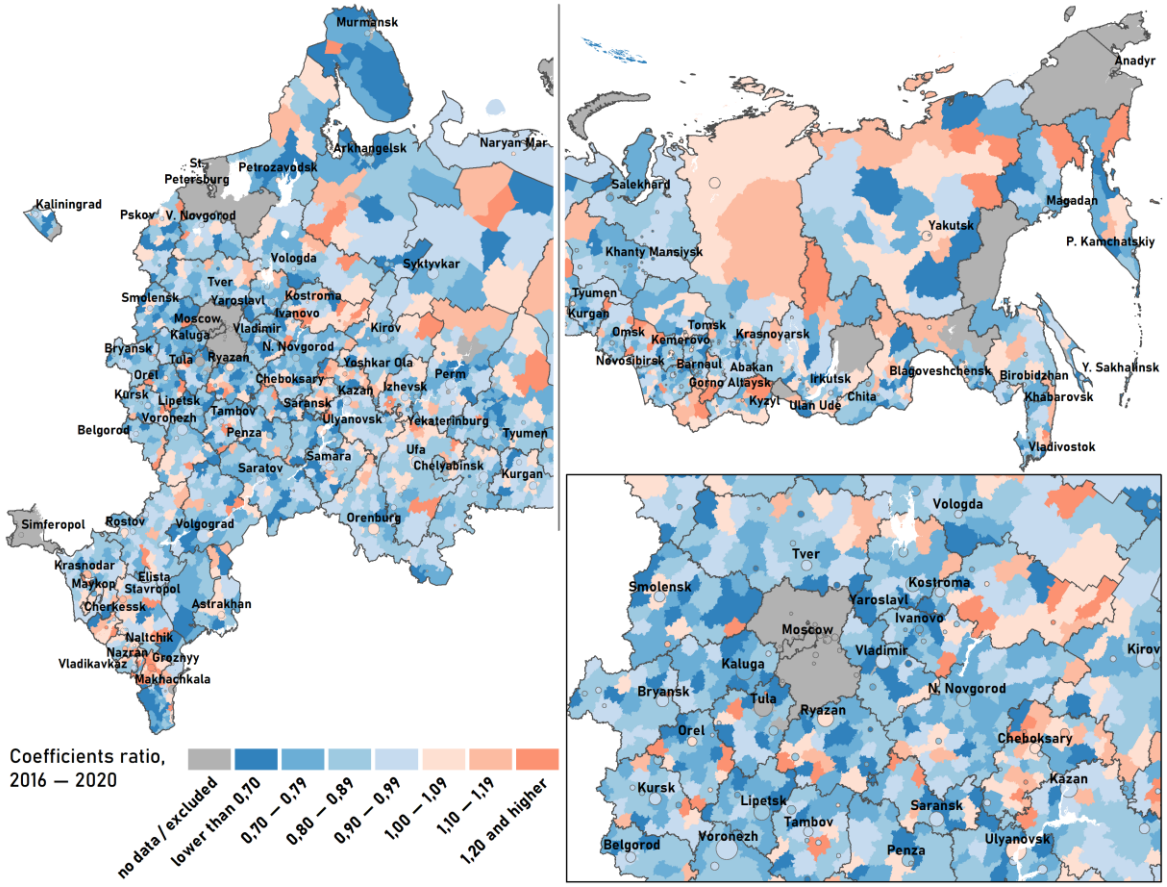
In most municipalities, men exhibit higher migration activity, both in large cities and peripheral territories. However, in some cases, the migration activity of men is distorted by the predominantly male contingents of the Federal Penitentiary Service, particularly in the north of the Perm Krai, northeast of the Kirov Oblast, and north of the Nizhny Novgorod Oblast.

Departures aged 40 and over. A higher intensity of departures is observed among men, but this phenomenon is less common across municipalities. Nevertheless, where women show higher migration activity, it tends to occur in sparsely populated municipalities. Large cities, on the other hand, consistently exhibit an imbalance in departures, favoring men.

Younger ages display a higher migration activity of women throughout the country, both in urban centers and peripheral regions. Significant sex disparities in favor of women are noted in macro-regions with a substantial institutional population, such as the North and the Far East, as well as regions where military service is more popular among men.

At older ages, the spatial picture is less clear due to the influence of small numbers. However, densely populated municipalities, especially large cities, tend to have a higher migration activity of men.

Figure 3. Coefficient ratios of arrivals aged 40 and over per 1,000 residents of the corresponding sex(female/male)

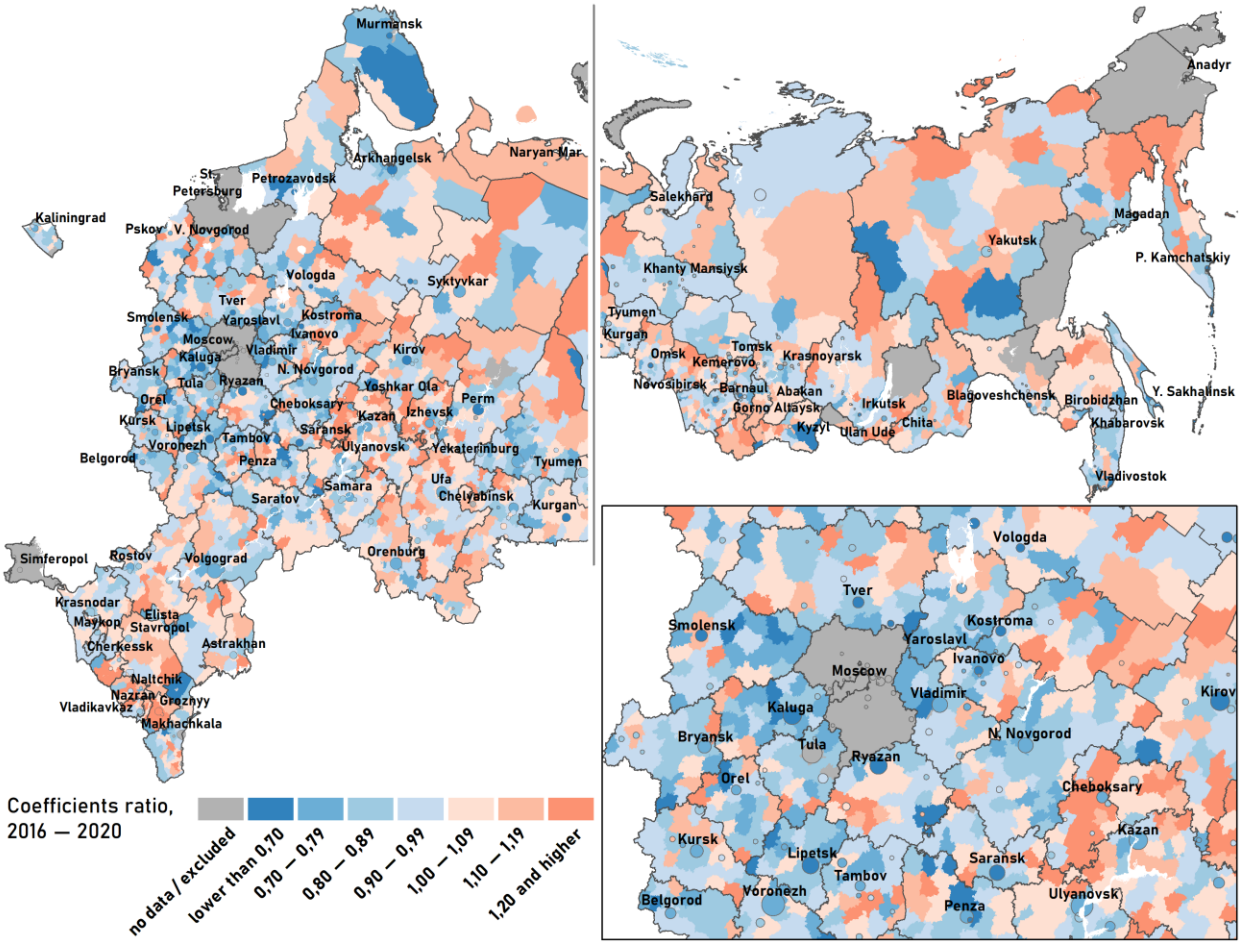


Source: based on the author's calculations

Intraregional migration in Central Russia. Detailed calculations for Central Russia confirmed the results of the cartographic analysis. Up to the age of 40, women display higher migration activity across all territorial types, while over 40, men become more active migrants (Figures 5-8). In this case, we managed to get rid of the influence of small numbers. Large cities receiving migrants show a peak disproportion of 1.5 times in favor of women at the age of 20–29 years, while men aged 40 and above tend to have 10–30% higher migration activity compared to women. Similar disproportion profiles are observed in medium and small towns with peripheral areas, with the peak disproportion by 2 times in favor of women occurring at the age of 20–29 years, and differences at ages 40+ being similar to those in large cities.

Graphs for all types of territories indicate that women are more active in migration flows directed toward large cities (arrivals in regional centers and departures from the periphery) compared to "pseudo-return" flows (departure from large cities and arrival in the periphery). Events such as childbirth, admission of children in kindergartens or schools, and marriage may lead women to change their registration to their actual residence, contributing to their higher migration activity, as pointed out by N. Mkrtchyan (2021). For large cities that are not regional centers, arrivals and departures show similar values, likely due to their smaller role as recipients of migrants at the regional level compared to regional centers.

Figure 4. Coefficient ratios of departures aged 40 and over per 1,000 residents of the corresponding sex(female/male)



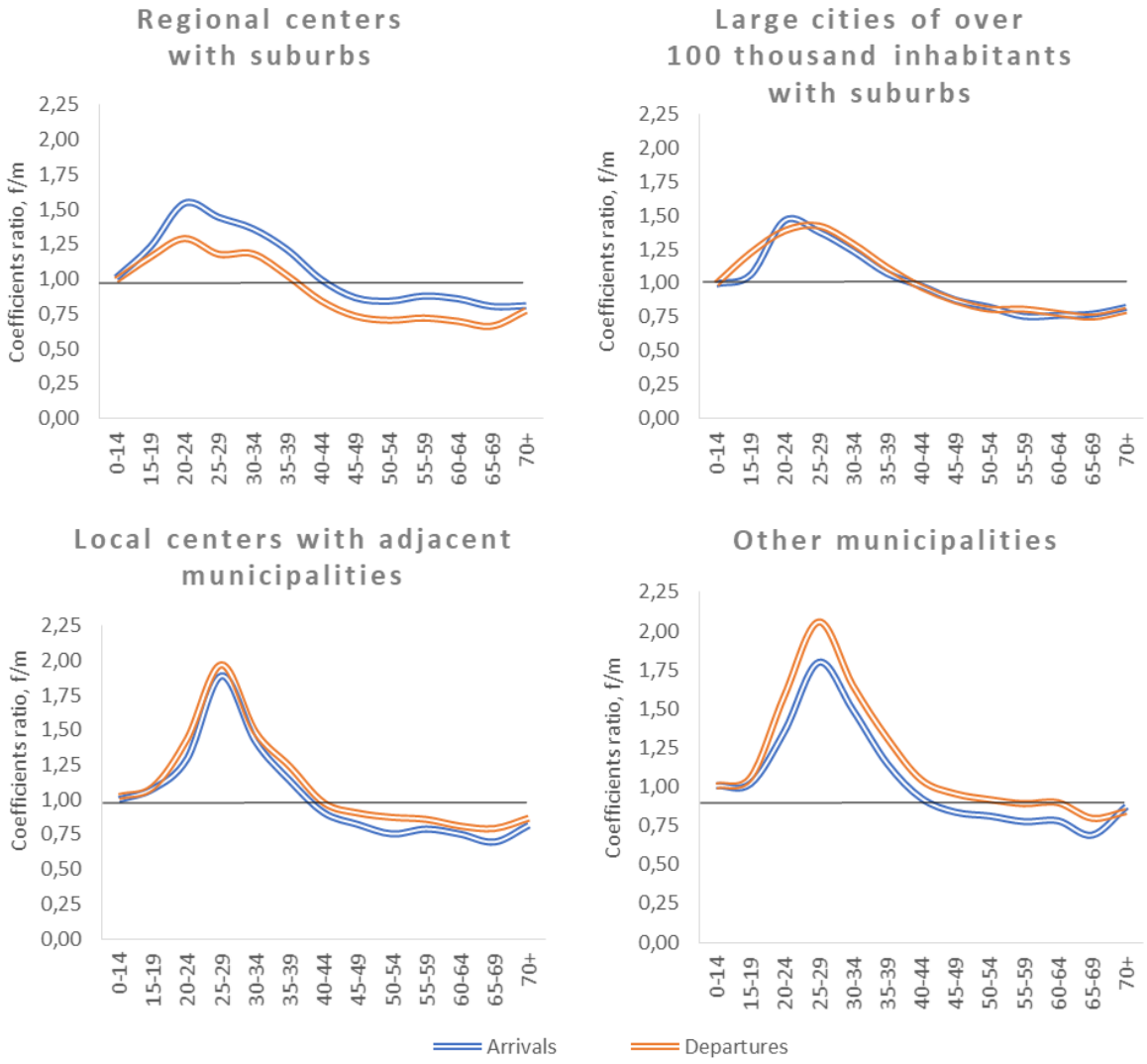
Source: based on the author's calculations

In large cities, in contrast to local centers and peripheries, the largest gender disparities in favor of women occur in the age group of 20–29 years, while disparities tend to be smaller due to larger population cohorts. At ages 40 and over, differences in migration intensity between men and women are similar for all types of municipalities, with a disproportion in favor of men.

The age profiles of local centers and peripheral municipalities are similar, primarily because small towns have lost their attractiveness to young residents and those from surrounding territories (Mkrtchyan 2017). Consequently, the characteristics of migration flows in local centers have become similar to "peripheral" ones. The sharp peak of the disproportion in favor of women in these areas occurs in the 25-29 years age group, which corresponds to the period of high birth (Rosstat 2022b) and marriage rates[5], likely contributing to the greater migration activity of women.

[5] The second highest age-specific marriage rate after the age group of 20-24 years. Own elaboration for five-year age groups according to data from the Demographic Yearbook of Rosstat (Rosstat 2022b).

Figure 5-8. Coefficient ratios of arrivals and departures (female/male) in municipalities of Central Russia of different types



Source: based on the author's calculations

Conclusion

At young ages, intraregional migration is more intense among women, with variations depending on the type of area. Factors such as higher school performance leading to better university opportunities in regional centers and limited employment prospects in peripheral territories contribute to this trend. The peak disproportion in favor of women at 25–29 years is likely influenced by changes in registration due to marriage, childbirth, or enrolling children in preschool or school.

However, the migration activity of men is potentially underestimated due to the way military personnel and contingents of the Federal Penitentiary Service in demographic statistics are recorded. Service in the armed forces, involving men in interregional migration, is more widespread in some regions, which entails an artificial underestimation of the intensity of intraregional moves of men. Moreover, the presence of institutional populations artificially increases the "denominator" and, thus, underestimates the migration activity of "local" men.

Men over the age of 40 exhibit higher migration activity in all types of territories, possibly due to fewer responsibilities for childcare after divorce and elderly care, making them more mobile compared to women.

As a result of intraregional migration at young ages, an imbalance in the sex ratio arises in the population of large cities, with a higher proportion of women, and in peripheral territories, with a higher proportion of men. Despite the higher intensity of moves of men relative to women in older age groups, it has a much smaller impact on the age-sex structure of the population due to the low overall level of migration mobility at these ages.

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