

# The Dynamics of the Population Structure of the South of Central Russia over a 130-Year Period: Migration Processes

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**Abstract**—This article assesses the dynamics of indicators characterizing marriage and migration parameters among the population of the south of Central Russia from 1890 to 2018. In the structure of marriages over the 130-year period, there was a significant decrease (1.6–2.2 times) in the share of isolocal marriages and a significant increase in the share of heterolocal marriages (by almost 11 times), while the size of the elementary population increased from the village level to the district/region level. From 1890 to 2018 the dynamics of isolocal marriages was more pronounced among the urban population and the dynamics of heterolocal marriages was more pronounced among rural residents. Over the 130-year period positive marital assortativity by place of birth of spouses decreased by 1.5 times without significant differences in the level and dynamics of marriage selectivity by place of birth of spouses between the urban and rural populations (except for the period of 1951–1953). A strong direct correlation was established between the level of marital assortativeness and the share of marriages concluded within one region and one district ( $r = 0.90$ ,  $p < 0.05$ ) and a negative one, on the share of heterolocal marriages (concluded between immigrants from different regions) ( $r = -0.90$ ,  $p < 0.05$ ).

**Keywords:** marriage structure, migration, assortativity of marriages

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## INTRODUCTION

The modern population is actively migrating and a trend toward an increasing intensity of migration processes among the population in recent decades continues to be significant. According to WHO data, by 2022 about one billion people worldwide were migrants, i.e., approximately one of eight individuals [1]. Migration processes are also significant for Russia, where they have contributed to the expansion of the borders for many centuries due to the development and settlement of novel territories. A contemporary allocation of the population of the Russian Federation is a result of migration processes that occurred in the Russian Empire, the Soviet Union, and at the post-Soviet stage of the development of the Russian Federation. Over the past 50 years, the population of Russia in general persistently increased due to migration influx [2, 3].

Intense migrations of the population have a significant impact on the population-genetic structure, including changes in population size, ethnicity, sex and age content, genetic diversity, outbreeding conditions, an effect on the frequency and prevalence of pathologies, etc. According to a study by O.L. Kurbatova and N.K. Yankovsky [2], the example of the urban population of Russia demonstrated that almost

complete substitution of the gene pool of the indigenous population of Russia is possible in ten generations under the condition of migration intensity at the level of 1990s.

For several decades different scientific groups have been studying genetically significant migration parameters in the population, mainly that residing in the European part of Russia [4–9]. At the same time, the problem of the gene pool dynamics caused by migration processes is of particular relevance for the indigenous Russian population at the southern borders of Central Russia. The regional populations in the south of Central Russia, which are characterized by heterogeneity due to their geographical location and historical past, remain insufficiently examined [10–15].

This research presents the results of a study of marital and migration parameters of the population of south of Central Russia (Belgorod region) in dynamics over a 130-year period (from the 1890 to 2018).

This study starts a series of studies devoted to the analysis of the dynamics of a number of population and demographic indicators (parameters of migration, distance isolation, age, and ethnic content) among the population of the south of Central Russia (Belgorod region) over a 130-year period.

## MATERIALS AND METHODS

The object of the present study is the population of the Belgorod region. Geographically, the region is located on the southwestern and southern slopes of the Central Russian Upland, in the basins of the Dnieper and Don Rivers. Within the present borders, the Belgorod region was formed in the postwar period, on January 6, 1954 due to the fusion of a number of districts of the Kursk and Voronezh regions [16]. The Belgorod, Borisovsky, Grayvoronsky, Valuysky, Volokonovsky, Novooskolsky, Gubkinsky, Ivnyansky, Korochansky, Krasnoyarusky, Prokhorovsky, Rakiyansky, Starooskolsky, Chernyansky, Shebekinsky, and Yakovlevsky districts were isolated from the Kursk region. The Alekseevsky, Krasnensky, Krasnogvardyevsky, Veidelevsky, and Rovensky districts were selected from the Voronezh region. The Belgorod region includes 21 districts. A significant impact on the formation of the population structure of present Belgorod is caused by migration processes, which resulted in the observed increase in population size. The population of the region gradually increased; however, the causes of such growth differed within various time periods: (1) at the end of the 19th to early 20th centuries, the development of infrastructure, agriculture, and industry (the Kursk–Kharkov–Azov Railway passed through Belgorod in 1869, which expanded relations with industrial centers and other countries; in 1871, water supply was established through the first water pipeline; chalk mining, etc.); (2) post-war migrations; (3) natural population growth in the 1960s; (4) the influx of people to the region in the 1970s, which was caused by formation of a territorial and natural complex based on the mineral resources of the Kursk Magnetic Anomaly (KMA); and (5) an active influx of migrants from countries of the Union of Independent States (Central Asia, Transcaucasia, the Baltic Republics, etc.) in the 1990s [16, 17]. It should be noted that in the 1990s, the influx of migrants from the UIS countries was significantly accompanied by return migration to their historical homeland, which included return of immigrants and their descendants to the territories where their ancestors had previously lived. In all time periods, the influx of migrants was also favored by the natural and climatic conditions of the region, which attracted residents of the northern regions of Russia. According to Rosstat, the population of the region was 1 514 527 by January 1, 2023, while the urban population was 66.25%.

Eight districts of the region were selected for the study: Belgorod, Starooskolsky, Novooskolsky, Korochansky, Grayvoronsky, Valuysky, Alekseevsky, and Krasnogvardeysky (Fig. 1). The criteria for selecting district populations were the following:

(1) historical peculiarities of region formation from the counties (districts) of the Kursk and Voronezh provinces (regions). Belgorod, Grayvoronsky, Korochansky, Novooskolsky, and Starooskolsky districts (counties) were included, which were initially comprising the Kursk province, then the Kursk region, and were transferred to the Belgorod region after 1954. Other districts such as the Biryuchansky (later Krasnogvardeysky and partially Alekseevsky) and Valuysky districts (counties) comprised the Voronezh province and the Voronezh region until 1954, while they belong to the Belgorod region after 1954;

(2) the urbanization level of the population. The analysis included districts with a high level of urbanization such as Belgorod and Starooskolsky, which consist of two large cities of regional significance—Belgorod and Sary Oskol, which concentrate two-thirds of the urban population [18]; districts with an average level of urbanization with small towns being the regional center (Alekseevsky, Valuysky, and Novooskolsky districts); regions with a low level of urbanization of the population with small towns with population below 10 000 people being the regional center (Krasnogvardeysky, Korochansky, and Grayvoronsky districts);

(3) the geographical location of the districts in different parts of the region. The Grayvoronsky district is the most western part of the region, the Krasnogvardeysky and Alekseevsky districts (included in the analysis since 1951) (previously both districts were a part of the Biryuchansky district) are located at the east of the region, The Starooskolsky district is the most northern part, while the Valuysky district is the most southern of the Belgorod region. The Korochansky and Novooskolsky districts belong to the central part of the region, while the Belgorod district as the regional center represents the southwestern part of the region;

(4) The national content of the district populations. During two centuries (the 16th and 17th), the region was practically diethnic (Russian-Ukrainian) due to the settlement by immigrants from the Central Russia and the Right-Bank Ukraine. Only starting from the beginning of the 20th century did significant ethnic-territorial transformations begin. In the examined districts (counties) of the Belgorod region Russians and Ukrainians lived dispersed: the Russian population prevailed in the northern and central parts, while there was a high proportion of Ukrainians in the western, southern, and eastern regions. Thus, by the end of the 19th century the proportion of Russians was the highest in Starooskolsky, Belgorod, and Korochansky counties (districts). Ukrainians prevailed in four of seven counties of the Kursk and Voronezh provinces (these territories now are the part of the Belgorod region), including Biryuchansky, Grayvoronsky, Valuysky, and Novooskolsky counties [19].

The study of the dynamics of the population and demographic structure of the population of the Belgorod region over the past 130 years was carried out based on the materials of marriage records of church parish registers of the Archive Registry Office of the



**Fig. 1.** The territorial location of the districts of the Belgorod region (examined areas are highlighted; the bold line indicates a border between the Kursk and Voronezh regions before 1954, the year of the formation of the Belgorod region).

Belgorod region from the late 19th to early 20th centuries (4925 records within 1890–1910), and the registers of civil status of the regional Registry Office Archive for 1951–1953 (5128 records), 1978–1980 (14819 records), 1991–1993 (6128 records) and 2016–2018 (8130 records). Information on the spouses' places of birth was obtained from the civil status acts. The total sample size is 39 130 civil status records. Statistical analysis was carried out using Excel (10) and Statistica (v10).

The analysis of the marital structure was performed based on information about the places of birth of the spouses; marriages, according to O.L. Kurbatova and E.Y. Pobedonostseva [20], were divided into isolocal and heterolocal. Isolocal marriages included marriages between residents of the same region (province), including marriages between residents of the same district (county) and one village (town). Heterolocal marriages included marriages between residents from different regions (provinces). In order to estimate the value of marital assortativity based on the “place of birth” the polychoric correlation coefficient  $K$  was used [20–22].

A quantitative assessment of the degree of local isolation of populations, the endogamy index, was used, which was calculated based on data of marital migrations as the proportion of grooms and brides born in

this population [23]. The elementary population, which receives no more than 50% of the gametes, explains this [23].

## RESULTS

### *Migration Parameters of the Population of the South of Central Russia*

1. **1890–1910.** The study of marital structure in the counties of the Kursk and Voronezh provinces demonstrated that in 1890–1910 96.38% of all marriages on average were within the provinces (Table 1), including 92.43% of them within the same county and 54.80% within the same village. Accordingly, the village was the elementary population in the later 19th to early 20th centuries. In general, the variability of the proportion of marriages within the same village (43.86–67.54%) was higher compared to the variability of the proportion of marriages within the same county (85.16–97.71%) or province (93.17–98.22%). The proportion of marriages between residents from different counties was 3.62% (1.78–6.83%) in general (Table 1).

In general, marriages between the residents of different provinces occurred more frequently (1.7 times) in the Voronezh province than in the Kursk province and more rarely between the residents from the same

**Table 1.** The structure of marriages among the populations of the Kursk and Voronezh provinces in 1890—1910

Population	N	Proportion of marriages (%) between immigrants from												K
		different regions (provinces)		same region (province)		including one district (county)		including one village (town)		including one district (county)		including one village (town)		
		n	%	n	%	n	%	n	%	n	%	n	%	
Counties of the Kursk province	Belgorod county (in general)	844	3.68	813	96.32	770	91.23	454	53.79	0.450				
	urban	253	7.51	234	92.49	223	88.14	175	69.17	0.403				
	rural	591	2.03	579	97.97	547	92.56	279	47.21	0.298				
	Starooskolsky county (in general)	795	4.02	763	95.98	677	85.16	394	49.56	0.358				
	urban	167	10.18	150	89.82	144	86.23	92	55.09	0.260				
	rural	628	2.39	613	97.61	533	84.87	302	48.09	0.277				
	Novooskolsky county (in general)	727	2.06	712	97.94	690	94.91	491	67.54	0.448				
	urban	302	3.64	291	96.36	279	92.38	237	78.47	0.376				
	rural	425	0.95	421	99.05	411	96.70	254	59.76	0.327				
	Korochoansky county (in general)	364	3.57	351	96.43	340	93.41	218	59.89	0.435				
	urban	162	7.41	150	92.59	146	90.12	124	76.54	0.387				
	rural	202	0.50	201	99.50	194	96.03	94	46.53	0.321				
	Grayvoronsky county (in general)	789	1.78	775	98.22	771	97.71	474	60.07	0.469				
	urban	320	1.24	316	98.76	314	98.13	199	62.19	0.381				
rural	469	2.12	459	97.88	457	97.45	275	58.64	0.328					
<i>On average for the county</i>	<b>704</b>	<b>3.02</b>	<b>683</b>	<b>96.98</b>	<b>650</b>	<b>92.48</b>	<b>406</b>	<b>58.17</b>	<b>0.432</b>					
<i>urban</i>	<b>241</b>	<b>6.00</b>	<b>228</b>	<b>94.00</b>	<b>221</b>	<b>91.00</b>	<b>165</b>	<b>68.29</b>	<b>0.361</b>					
<i>rural</i>	<b>463</b>	<b>1.60</b>	<b>455</b>	<b>98.40</b>	<b>428</b>	<b>93.52</b>	<b>241</b>	<b>52.05</b>	<b>0.310</b>					
Counties of the Voronezh province	Valuysky county (in general)	820	6.83	764	93.17	740	90.24	401	48.90	0.390				
	urban	190	15.26	161	84.74	153	80.53	87	45.79	0.326				
	rural	630	4.29	603	95.71	587	93.17	314	49.84	0.501				
	Biryuchensky county (in general)	586	3.41	566	96.59	553	94.37	257	43.86	0.323				
	urban	259	1.93	254	98.07	250	96.53	108	41.70	0.276				
	rural	327	4.59	312	95.41	303	92.66	149	45.57	0.227				
	<i>On average for the county</i>	<b>703</b>	<b>5.12</b>	<b>665</b>	<b>94.88</b>	<b>647</b>	<b>92.31</b>	<b>329</b>	<b>46.38</b>	<b>0.357</b>				
	<i>urban</i>	<b>224</b>	<b>8.60</b>	<b>208</b>	<b>91.41</b>	<b>202</b>	<b>88.53</b>	<b>98</b>	<b>43.75</b>	<b>0.301</b>				
	<i>rural</i>	<b>479</b>	<b>4.44</b>	<b>458</b>	<b>95.56</b>	<b>445</b>	<b>92.92</b>	<b>232</b>	<b>47.71</b>	<b>0.364</b>				
	<i>On average for the region</i>	<b>704</b>	<b>3.62</b>	<b>678</b>	<b>96.38</b>	<b>649</b>	<b>92.43</b>	<b>384</b>	<b>54.80</b>	<b>0.394</b>				
	<i>urban</i>	<b>236</b>	<b>6.74</b>	<b>222</b>	<b>93.26</b>	<b>216</b>	<b>90.29</b>	<b>146</b>	<b>61.28</b>	<b>0.331</b>				
	<i>rural</i>	<b>468</b>	<b>2.41</b>	<b>455</b>	<b>97.59</b>	<b>433</b>	<b>93.35</b>	<b>238</b>	<b>50.81</b>	<b>0.337</b>				

village (1.3 times). Among the urban population, the proportion of marriages between the residents of the same village (town) (61.28%) was 1.2 times higher, while the proportion of marriages between the residents from different provinces (6.74%) was 2.8 times higher compared to the rural population (50.81 and 2.41%, respectively) (Table 1).

Marital assortativity by place of birth of spouses was observed in all counties of the Kursk and Voronezh provinces (on average,  $K = 0.394$ ) without pronounced differences between the urban ( $K = 0.331$ ) and rural population ( $K = 0.337$ ) (Table 1).

2. *1951–1953*. During administrative and territorial reorganizations conducted in the middle of 20th century, the Kursk and Voronezh provinces were transformed in corresponding regions, while counties, in districts, and the borders of previous counties did not completely coincide with the borders of formed districts. Namely, the Biryuchansky county of the Voronezh province in 1918 was abolished accompanied by a transfer of the county center to Alekseevka village and was renamed Alekseevsky county from April 1, 1918 [24]; therefore, within this time period (1951–1953) the analysis included the Alekseevsky district instead of the Biryuchansky district. In 1951–1953 87.72% of marriages on average were within the same region, including 85.50% of them within the same district and 62.90% within the same village (Table 2). Therefore, both in the late 19th century and in 1951–1953 the village was the elementary population. By the middle of the 20th century a 3.4 times increase in the proportion of marriages between residents of different regions (up to 12.28%) was observed.

In general, a 1.5 times increase in the frequency of marriages was observed between the residents from different regions in the Voronezh region compared to the Kursk region (16.32 and 10.67%, respectively). Among urban population the proportion of marriages between residents from the same village (town) (76.19%) was 1.3 times higher, while the proportion of marriages between residents from different regions (13.19%) was 1.2 times higher compared with the rural population (59.19 and 11.32%, respectively) (Table 2). Marital assortativity by spouses' place of birth was detected in all the examined districts of the Kursk and Voronezh regions (on average,  $K = 0.381$ ) and was more pronounced among the rural population ( $K = 0.342$ ) than in urban citizens ( $K = 0.252$ ).

3. *1978–1980*. The present borders of the Belgorod region (the 21st district) were formed in 1954 by a fusion of several districts of the Kursk and Voronezh regions. With administrative transformations several regions were subjected to territorial changes. Namely, from March, 1964, the Krasnogvardeysky district (with a center in Biryuch) was isolated from a part of the Alekseevsky district and, therefore, within a selected time period (1978–1980) we examined the Krasnogvardeysky and Alekseevsky districts sepa-

rately, which were formed from the Alekseevsky district. Due to the small sample size of rural populations and absent archive data for several districts, a subsequent analysis of population-demographic structure was carried out by districts in general (without their subdivision into rural and urban population). The Belgorod and Starooskolsky districts were exceptions, since the significant sample size and the presence of a large city made it possible to continue the analysis of marital and migration parameters among both urban and rural populations.

In 1978–1980, in the marital structure, 64.12% of all marriages on average were within the region, including 48.14% of them within the same district and 23.45% within the same village (Table 3). Therefore, the size of the elementary population in 1980s corresponded to the territorial borders of the district or slightly exceeded it in the majority of examined populations. By the second half of the 20th century, the proportion of marriages between the residents from different regions increased by 2.9 times (up to 35.88%). The analysis of urban and rural population of the Belgorod region demonstrated that on average the proportion of marriages within the same town (village) almost did not differ between the urban (21.31%) and rural parts (20.8%). Moreover, the proportion of urban marriages between the residents of the same region (45.81%), including the same district (28.56%), was lower (by 1.3 and 1.5 times, respectively) than in the rural population (58.14 and 42.95%, respectively). At the same time, the proportion of marriages between the residents of different regions in towns (54.20%) was 1.3 times higher compared to villages (41.86%). A positive marital assortativity by spouses place of birth was observed in all examined districts of the Belgorod region (on average,  $K = 0.272$ ) without pronounced differences between the urban ( $K = 0.263$ ) and rural populations ( $K = 0.255$ ) (Table 3).

4. *1991–1993*. In 1991–1993, 61.73% of all marriages on average were within the Belgorod region, including 46.69% of them within one district and 25.16% within one village. The size of the elementary population in the 1990s corresponded to the territorial borders of the district (Table 4). The proportion of marriages within the same town (village) was 1.9 times higher for urban citizens (34.19%) compared to rural ones (18.21%). In the 1990s in all the examined districts of the region a positive marital assortativity by spouses' place of birth was determined (on average,  $K = 0.284$ ) without differences between the urban ( $K = 0.250$ ) and rural populations ( $K = 0.246$ ).

5. *2016–2018*. In 2016–2018, 59.48% of all marriages on average were within the same region, including 43.35% within one district and 25.80% within one village (Table 5). By the beginning of the 21st century, the size of the elementary population in one-third of examined district populations (37.5%) corresponded

**Table 2.** The structure of marriages among the population of the Kursk and Voronezh regions in 1951–1953

Population	N	Proportion of marriages (%) between immigrants from										K
		different regions (country)		same region (province)		same district (county)		same village (town)		n	%	
		n	%	n	%	n	%	n	%			
Districts of the Kursk region	Belgorod region (in general)	1170	141	12.05	1029	87.95	1012	86.50	859	73.42	0.447	
	urban	404	64	15.83	340	84.17	338	83.67	334	82.68	0.219	
	rural	766	77	10.05	689	89.95	674	87.99	525	68.54	0.534	
	Starooskolsky region (in general)	675	42	6.22	633	93.78	627	92.89	539	79.85	0.383	
	urban	197	13	6.80	184	93.20	184	93.40	171	86.80	0.187	
	rural	478	29	6.06	449	93.94	443	92.68	368	76.99	0.281	
	Novooskolsky region (in general)	645	117	18.14	528	81.86	512	79.38	401	62.17	0.394	
	urban	102	11	10.79	91	89.21	91	89.21	84	82.35	0.066	
	rural	543	106	19.53	437	80.47	421	77.52	317	58.37	0.367	
	Korochovsky region (in general)	633	54	8.53	579	91.47	570	90.05	297	46.92	0.375	
	urban	156	16	10.25	140	89.75	140	89.75	122	78.21	0.490	
	rural	477	38	7.97	439	92.03	430	93.15	175	36.69	0.249	
	Grayvoronsky region (in general)	643	54	8.40	589	91.60	584	90.82	402	62.52	0.286	
	urban	112	16	14.29	96	85.71	94	83.93	86	76.79	0.142	
	rural	531	38	7.16	493	92.84	490	92.28	316	59.51	0.259	
<i>On average for the region</i>	<b>753</b>	<b>82</b>	<b>10.67</b>	<b>672</b>	<b>89.33</b>	<b>661</b>	<b>87.93</b>	<b>500</b>	<b>64.98</b>	<b>0.377</b>		
<i>urban</i>	<b>194</b>	<b>24</b>	<b>11.59</b>	<b>170</b>	<b>88.41</b>	<b>169</b>	<b>87.99</b>	<b>159</b>	<b>81.37</b>	<b>0.221</b>		
<i>rural</i>	<b>559</b>	<b>58</b>	<b>10.15</b>	<b>501</b>	<b>89.85</b>	<b>492</b>	<b>88.72</b>	<b>340</b>	<b>60.02</b>	<b>0.338</b>		
Valuysky region (in general)	724	91	12.57	633	87.43	609	84.12	426	58.84	0.407		
urban	193	14	7.25	179	92.75	177	91.71	146	75.65	0.314		
rural	531	77	14.50	454	85.50	432	81.36	280	52.73	0.341		
Alekseevsky region (in general)	638	128	20.06	510	79.94	477	74.76	361	56.58	0.361		
urban	295	80	27.12	215	72.88	190	64.41	150	50.85	0.253		
rural	343	48	13.99	295	86.01	287	83.67	211	61.52	0.349		
<i>On average for the region</i>	<b>681</b>	<b>110</b>	<b>16.32</b>	<b>572</b>	<b>83.69</b>	<b>543</b>	<b>79.44</b>	<b>394</b>	<b>57.71</b>	<b>0.384</b>		
<i>urban</i>	<b>244</b>	<b>47</b>	<b>17.19</b>	<b>197</b>	<b>82.82</b>	<b>184</b>	<b>78.06</b>	<b>148</b>	<b>63.25</b>	<b>0.284</b>		
<i>rural</i>	<b>437</b>	<b>63</b>	<b>14.25</b>	<b>375</b>	<b>85.76</b>	<b>360</b>	<b>82.52</b>	<b>246</b>	<b>57.13</b>	<b>0.345</b>		
<i>On average for the region</i>	<b>733</b>	<b>90</b>	<b>12.28</b>	<b>643</b>	<b>87.72</b>	<b>627</b>	<b>85.50</b>	<b>469</b>	<b>62.90</b>	<b>0.381</b>		
<i>urban</i>	<b>208</b>	<b>31</b>	<b>13.19</b>	<b>178</b>	<b>86.81</b>	<b>173</b>	<b>85.15</b>	<b>156</b>	<b>76.19</b>	<b>0.252</b>		
<i>rural</i>	<b>524</b>	<b>59</b>	<b>11.32</b>	<b>465</b>	<b>88.68</b>	<b>454</b>	<b>86.95</b>	<b>313</b>	<b>59.19</b>	<b>0.342</b>		
Districts of Voronezh region												

**Table 3.** The structure of marriages among the population of the Belgorod region in 1978–1980

Population	N	Proportion of marriages (%) between immigrants from								K
		different regions (country)		same region (Belgorod region)		same district		same village (town)		
		n	%	n	%	n	%	n	%	
Belgorod district	4737	2230	47.08	2507	52.92	1383	29.19	940	19.84	0.270
urban	3378	1577	46.68	1801	53.32	951	28.15	769	22.76	0.259
rural	1359	653	48.05	706	51.95	432	31.79	171	12.58	0.252
Starooskolsky district	3320	1748	52.65	1572	47.35	1252	37.71	760	22.89	0.276
urban	2165	1336	61.71	829	38.29	627	28.96	430	19.86	0.267
rural	1155	412	35.67	743	64.33	625	54.11	330	28.57	0.258
Novooskolsky district	1120	334	29.82	786	70.18	581	51.88	248	22.15	0.267
Korochansky district	1034	302	29.20	732	70.80	487	47.10	193	18.67	0.267
Grayvoronsky district	613	260	42.42	353	57.58	264	43.06	145	23.65	0.271
Valuysky district	1837	610	33.20	1227	66.80	986	53.68	470	25.59	0.277
Krasnogvardeisky district	1145	282	24.63	863	75.37	696	60.78	328	28.64	0.270
Alekseevsky district	1013	284	28.03	729	71.97	625	61.70	265	26.16	0.278
<i>On average for the region</i>	<b>1852</b>	<b>756</b>	<b>35.88</b>	<b>1096</b>	<b>64.12</b>	<b>784</b>	<b>48.14</b>	<b>419</b>	<b>23.45</b>	<b>0.272</b>
<i>urban</i>	<b>2772</b>	<b>1457</b>	<b>54.20</b>	<b>1315</b>	<b>45.81</b>	<b>789</b>	<b>28.56</b>	<b>600</b>	<b>21.31</b>	<b>0.263</b>
<i>rural</i>	<b>1257</b>	<b>533</b>	<b>41.86</b>	<b>725</b>	<b>58.14</b>	<b>529</b>	<b>42.95</b>	<b>251</b>	<b>20.58</b>	<b>0.255</b>

**Table 4.** The structure of marriages among the population of the Belgorod region in 1991–1993

Population	N	Proportion of marriages (%) between immigrants from								K
		different regions (country)		same region (Belgorod region)		same district		same village (town)		
		n	%	n	%	n	%	n	%	
Belgorod district	1654	604	36.52	1050	63.48	700	42.32	538	32.53	0.264
urban	1350	444	32.89	906	67.11	608	45.04	509	37.70	0.255
rural	304	160	52.63	144	47.37	92	30.26	29	9.54	0.245
Starooskolsky district	1052	492	46.77	560	53.23	459	43.63	308	29.28	0.260
urban	665	351	52.78	314	47.22	248	37.29	204	30.68	0.245
rural	387	141	36.43	246	63.57	211	54.52	104	26.87	0.247
Novooskolsky district	408	133	32.60	275	67.40	209	51.22	95	23.28	0.281
Korochansky district	479	171	35.69	308	64.31	215	44.89	87	18.17	0.274
Grayvoronsky district	310	138	44.52	172	55.48	132	42.58	75	24.19	0.303
Valuysky district	893	322	36.07	571	63.93	420	47.02	187	20.93	0.287
Krasnogvardeisky district	620	263	42.42	357	57.58	270	43.55	147	23.71	0.296
Alekseevsky district	712	225	31.61	487	68.39	415	58.28	208	29.21	0.307
<i>On average for the region</i>	<b>766</b>	<b>294</b>	<b>38.28</b>	<b>473</b>	<b>61.73</b>	<b>353</b>	<b>46.69</b>	<b>206</b>	<b>25.16</b>	<b>0.284</b>
<i>urban</i>	<b>1008</b>	<b>398</b>	<b>42.84</b>	<b>610</b>	<b>57.17</b>	<b>428</b>	<b>41.17</b>	<b>357</b>	<b>34.19</b>	<b>0.250</b>
<i>rural</i>	<b>346</b>	<b>151</b>	<b>44.53</b>	<b>195</b>	<b>55.47</b>	<b>152</b>	<b>42.39</b>	<b>67</b>	<b>18.21</b>	<b>0.246</b>

**Table 5.** The structure of marriages among the population of the Belgorod region in 2016–2018

Population	N	Proportion of marriages (%) between immigrants from								K
		different regions (country)		same region (Belgorod region)		same district		same village (town)		
		n	%	n	%	n	%	n	%	
Belgorod district	2001	901	45.03	1100	54.97	795	39.73	640	31.98	0.277
urban	1010	510	50.50	500	49.50	352	34.85	299	29.60	0.272
rural	991	391	39.46	600	60.54	443	44.70	341	34.41	0.276
Starooskolsky district	1959	630	32.16	1329	67.84	1203	61.41	1032	52.68	0.265
Novooskolsky district	519	218	42.00	301	58.00	179	34.49	87	16.76	0.254
Korochansky district	448	213	47.54	235	52.46	155	34.60	63	14.06	0.262
Grayvoronsky district	411	194	47.21	217	52.79	134	32.60	79	19.22	0.253
Valuysky district	1225	563	45.96	662	54.04	493	40.25	240	19.59	0.266
Krasnogvardeisky district	656	225	34.30	431	65.70	311	47.41	132	20.12	0.276
Alekseevsky district	911	273	29.96	638	70.04	513	56.32	291	31.95	0.258
<i>On average for the region</i>	<b>1016</b>	<b>402</b>	<b>40.52</b>	<b>614.13</b>	<b>59.48</b>	<b>473</b>	<b>43.35</b>	<b>321</b>	<b>25.80</b>	<b>0.264</b>

to the district level (Alekseevsky, Krasnogvardeysky, and Starooskolsky districts), while in the majority (62.50%) of examined populations (Belgorod, Novooskolsky, Korochansky, Grayvoronsky, and Valuysky districts) it coincided to almost the regional level (52.46–58.00% of marriages within these districts were within the Belgorod region). Among the urban population of the Belgorod region the proportion of marriages between the residents of the same region (49.50%), including the same district (34.85%) and the same village (29.60%) decreased by 1.2–1.3 times compared to the rural population (60.54, 44.70, and 34.41%, respectively), while the proportion of marriages between the residents from different regions was 1.3 times higher in urban territories compared to rural ones (Table 5).

In 2016–2018 a positive marital assortativity by spouses' place of residence was observed in all the examined districts of the Belgorod region (in general,  $K = 0.264$ ) without differences between the urban ( $K = 0.272$ ) and rural populations ( $K = 0.276$ ) of the Belgorod region.

#### *Trends in the Dynamics of Migration Parameters Among the Population of the South of Central Russia*

At the final stage of our study, the analysis of the main trends in the dynamics of the marital structure of the population of south of Central Russia (the Belgorod region) over 130 years (from 1890 to 2018) was carried out within the framework of five time periods (data are presented in Figs. 2–5). The following trends were determined.

First, the size of the elementary population changed over 130 years from the level limited by the territory of the village to the territorial boundaries of

the district (37.5% of the examined districts) and the region (62.5% of the examined districts) (Fig. 2).

Secondly, from the end of the 19th century to the beginning of the 21st century, a significant decrease in the proportion of marriages between residents of one province (region) (by 1.6 times), one county (district) (2 times) and one village (2.2 times) was observed, while the proportion of marriages between the residents of different regions increased by 10.6 times (Fig. 2). A strong direct correlation was established between the proportions of isocal marriages ( $r = 1.00$ ,  $p < 0.05$ ), which negatively correlated with the proportion of heterocal marriages ( $r = -1.00$ ,  $p < 0.05$ ).

Thirdly, the dynamics of marital and migration parameters characterizing isocal marriages was more pronounced among the urban population (Fig. 3) compared to rural residents (Fig. 4) from 1890 to 2018 of the south of Central Russia: the proportion of intra-regional (intra-provincial) marriages decreased by 2 times in the towns and 1.6 times in the villages, intra-district (intra-county) marriages decreased by 2.6 and 2 times, respectively; marriages between fellow villagers were reduced by 2 and 1.5 times, respectively. At the same time, the proportion of marriages between the residents of different regions increased by 7.5 times in urban territories and by 16.4 times in the villages with the maximum dynamics during the period from 1951–1953 to 1978–1980 (Fig. 3, 4).

Fourthly, over a 130-year period, positive marital assortativity by spouses' place of birth decreased by 1.5 times (from 0.394 to 0.264) (Fig. 5) without significant differences in the level and dynamics between urban and rural populations except for 1951–1953, which saw a 1.4 times increase in the marital assortativity index in urban compared to rural territories (Fig. 5, Table 2).



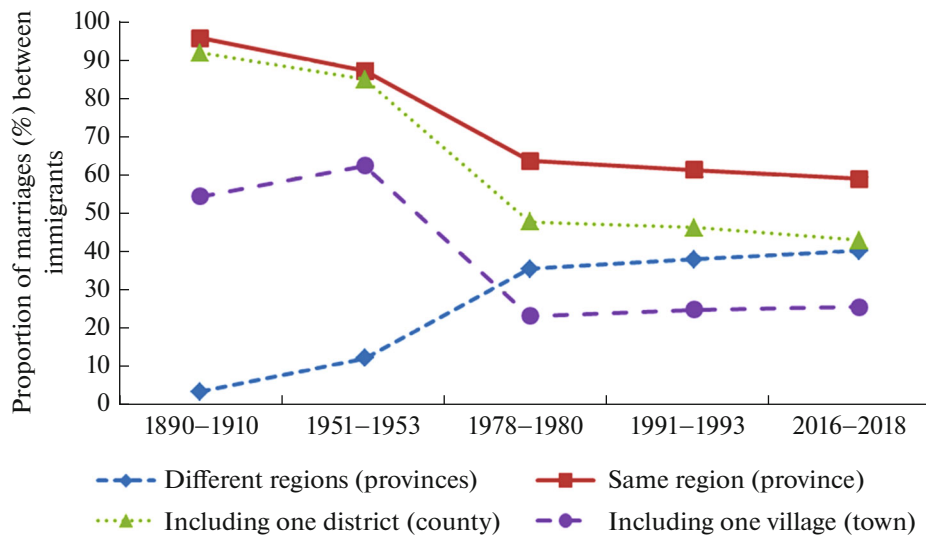


Fig. 2. The dynamics of the structure of marriages by the place of birth of spouses.

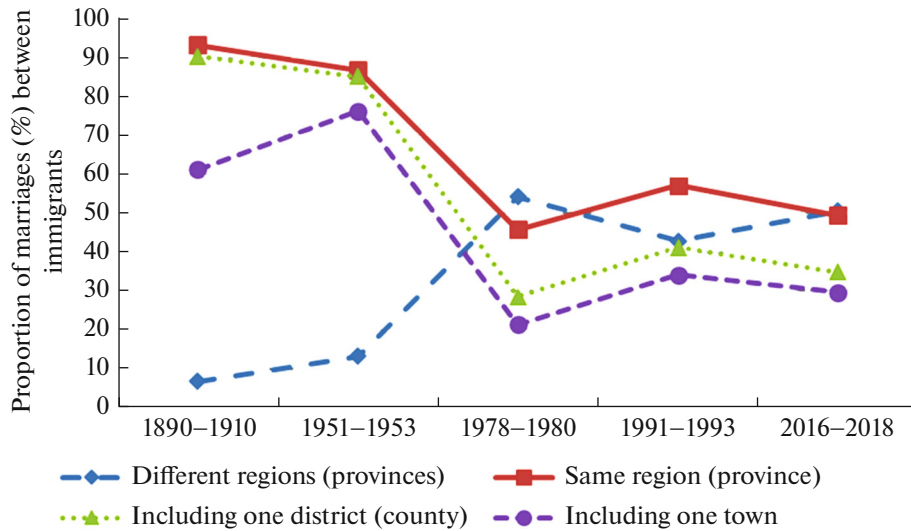


Fig. 3. The dynamics of the structure of marriages by the place of birth of spouses among the urban population.

Fifthly, a pronounced strong direct correlation was observed between the level of marital assortativity and the proportion of marriages within the same region and the same district ( $r = 0.90, p < 0.05$ ), while a negative one is observed for the proportion of heterolocal marriages (between residents from different regions ( $r = -0.90, p < 0.05$ )).

### DISCUSSION

Over a 130-year period (from 1890 to 2018), there was a significant decrease (by 1.6–2.2 times) in the proportion of isolocal marriages and a significant increase (by almost 11 times) in the proportion of heterolocal marriages in the Belgorod region, on average.

As an example, from the end of the 19th century (1890–1910) to the middle of the 20th century (1951–1953), more than half of the marriages were between residents of one village. The remaining marriages were between residents of different localities of the same county or province and these marriages (isolocal) exceeded 95% in total. Heterolocal marriages were less than 5%. The population in the late 19th to early 20th century was relatively conservative in their social bonds and preferred to marry within kindred clan groups. From the one side, this was caused by the “priority of economic reasons for marriage” and resulted in “a limited choice of a marriage partner and social isolation” [25]. Therefore, brides and grooms were preferentially chosen within the same village. How-

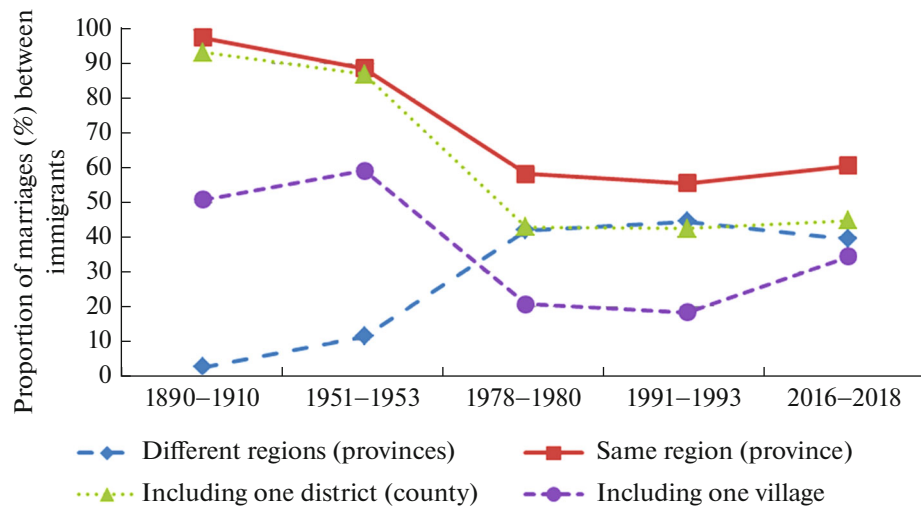


Fig. 4. The dynamics of the structure of marriages by the place of birth of spouses among the rural population.

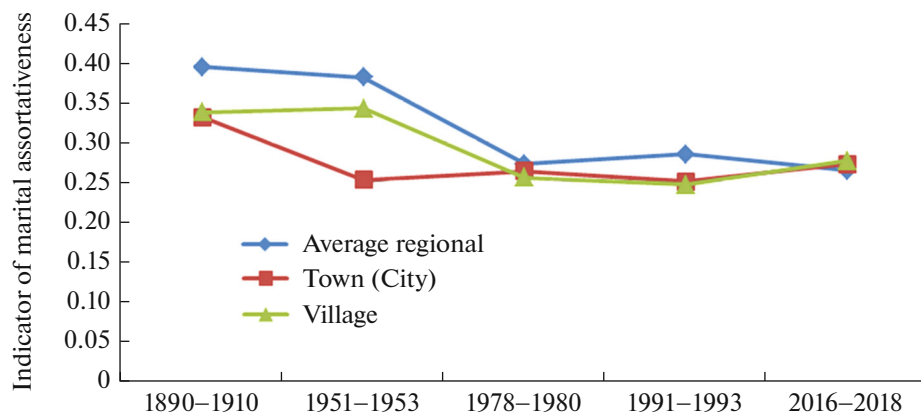


Fig. 5. The dynamics of marital assortativity by the place of birth of spouses.

ever, “in the case of absence of the bride’s choice in the same village, Ukrainians went to matchmaking in Ukrainian villages independent of their distant location, while Russians went to villages with Russian residents,” writes L.N. Chizhikova [26]. On the other hand, for many decades up to 1917 in Russia marriage conditions were regulated by church marriage legislation (a church marriage existed). This determined the conditions for the search for marriage partners and marriages. After the revolution, the church form of marriage was abolished. Within a short time period several marriage and family codes were introduced, which fixed the separation of marriage from the church [27], and marriage registration was introduced into the state civil registry offices. Therefore, the conditions of marriage registration from the late 19th to early 20th centuries promoted a prevalence of isolocal marriages at all levels of the population structure (intra-regional including intra-district and between

villagers) until the middle of the 20th century. Significant changes in the marital structure of the Belgorod region from 1951–1953 to 1978–1980 were the consequences of large loss of the male population during the war and subsequent imbalance in the sex ratio. During the war years, the number of registered marriages decreased by more than two times [27]. Only by the late 1950s to early 1960s did the proportion of the male population begin to increase, when the grooms represented the novel generation of men who did not participate in the war. However, demographic waves among male and female populations and the imbalance between the sexes continued to play a significant role in the formation of the marriage and migration structure subsequently in the 1960s and 1980s. As an example, the number of women of marriageable age was determined by the generation born during the war, when the birth rate sharply diminished, which caused a deficiency in young brides on the marriage market.

By 1964, the girls born during the post-war compensatory birth increase had reached adulthood [27]; however, an imbalance in the sex ratio (at its maximum in 1956: 641 men per 1000 women) was detected. Fluctuations in the birth rate affected the formation of the marital structure of the Belgorod region until the 1980s. Only by 1979 a trend toward a reduced imbalance between the sexes was achieved: 784 men per 1000 women [28]. It can be proposed that labor migration, which could result in population decrease (predominantly, men) was another reason for sex imbalance in this period. It should be noted that from the 1940s to 1950s up to the 1970s, the region remained as an economically underdeveloped agrarian region, which caused an outflow of labor. The endogamy index decreased by 21% over the 130-year period, and population outflow from the region increased by 19.6% from the end of the 19th century to 1978–1980. Moreover, the maximum population outflow at all levels of the organization of the population structure (more pronounced at village and district levels) occurred within the period from 1951–1953 to 1978–1980. Starting from 1980 to 2018, a stabilization of the marital and migration structure of the region's population was observed. On the one hand, it was facilitated by an increased birth rate and restored proportions between the sexes, while on the other hand, by active migration of the population to the Belgorod Region (especially in the 1990s) from other regions of Russia, which resulted in an increased number of heterolocal marriages.

The analysis of the dynamics of the marital structure of the urban and rural populations of the Belgorod region revealed that from the late 19th to early 20th centuries more than 50% of rural marriages and more than 60% of urban marriages were between residents from the same population. The remaining marriages, both among the urban population and among the rural population, were mainly between the residents of the same province (more than 90%), including one county. The proportion of marriages between the residents of different provinces in this period was less than 7% and it was slightly higher among the urban population (6.74%) than among the rural one (2.41%). As described above, rural regions were more "closed" compared to urban populations. However, if we consider that the proportion of the urban population in the present territory of Belgorod region was only 7.0% in 1897, this can explain a predominance of isolocal marriages until the middle of the 20th century [19]. The political, socio-economic, and administrative-territorial transformations from the early to middle of 20th century also caused changes in the marital structures of both rural and urban (most expressed) populations of the Belgorod region. From 1951–1953 to 1978–1980, an exponential decrease in the proportion of intra-regional marriages, including intra-dis-

trict ones, was detected and a significant increase in heterolocal marriages was observed. During the following decades, the insignificant decrease in the proportion of isolocal marriages among urban residents (at all levels of the population structure) and an increase in heterolocal marriages continued. Oppositely, the rural population saw an increased proportion of marriages between residents from the same region, while the proportion of intra-district marriages was almost unchanged and the proportion of marriages between fellow villagers increased compared to the reduced proportion of heterolocal marriages.

Our findings are congruent with data obtained for the neighboring Kursk region: 97–98% of marriage registrations carried out within one province, including within one county and one village (50%) in the 19th century [12]. The same high level of local marriages was characteristic for small towns in the Kursk region except for Kursk. By the second half of the 20th century a significant decrease in the proportion of isolocal marriages was observed in populations at all levels: marriages between residents of the same (Kursk) region were at the level of 74% among the rural population (including 16% among fellow villagers) and 55% in urban territories (4% between urban residents). A trend to a decrease in all types of isolocal marriages was maintained only in rural populations of the Kursk region, whereas in urban areas the proportion of intra-district marriages and marriages between the residents of the Kursk region increased. Starting from 1865–1873 to 1993–1995, the number of isolocal marriages decreased several times at the territory of the Kursk region (by one-third in all populations) [10–12].

It should be noted that over the 130-year period, the endogamy of marriages significantly decreased (by two times on average). The size of the elementary population in the Belgorod region changed from the level limited by the village territory to the territorial boundaries of a district and a region. A similar variability in the endogamy index was previously established in the neighboring Kursk region, which was characterized by a decrease (by two times) of this parameter from 1865 to 1995. The authors of [10–12] demonstrated that within 1987–1990 the endogamy index was 0.460 in rural district populations of the Kursk region, while in 1995 it was 0.419 in towns and 0.440 in villages. These results completely coincide with our data on the regional populations of the Belgorod region characterized by an endogamy level of 0.467 (0.412 urban and 0.424 rural) by 1993. The data on the endogamy level in the Central Chernozem region are congruent with the results of population-demographic studies carried out in the Kostroma region with changes in the endogamy index from 0.48 to 0.64 based on districts of the region [29].

A population-genetic analysis of the population of the Rostov region resulted in different findings [30–33]. The weighted average value of the endogamy index was 0.34 among the rural population of the Rostov region. At the same time, from 41 to 69% of marriages were within the Rostov region, and from 78 to 85% within Russia. These data allowed the authors [30–32] to conclude that the level of the elementary population for the rural population of the Rostov region was limited to the territory of almost the entire region at the beginning of the 21st century.

It should be mentioned that the marital and migration characteristics of populations have an important medical-genetic value since they affect the distribution of both monogenic congenital pathologies and other inherited diseases among the population [14, 32–40]. In this regard, these indicators have to be considered while planning population-genetic and medical-genetic studies [2, 5, 14, 34].

Among the population of the south of Central Russia, the positive marital assortativity by the place of birth of spouses decreased by 1.5 times (from 0.394 to 0.264) over the 130-year period without significant differences in the level and dynamics between the urban and rural populations (except for the 1951–1953 period, when the index of urban marital assortativity was 1.4 times higher than the rural one ( $K = 0.252$ )).

It can be mentioned that our results on the analysis of marital assortativity dynamics by the place of birth of spouses are consistent with similar data obtained for the neighboring Kursk region for 1865 to 1995. The author of [12] demonstrated that the positive marital assortativity among the population was at its maximum by the end of the 19th century and decreased by 1995. Together with the Belgorod population, the marital assortativity by place of birth was more significant in rural residents (0.491) than in urban residents (0.443) in the Kursk region in 1895–1900, while these differences became less pronounced a century later.

The analysis of the marital structure of the Moscow population [41] revealed that assortativity based on the “place of birth” was especially high in the late 19th to early 20th centuries (0.71). As mentioned by the authors, increased indices of marital selectivity during this period occurred for indigenous Muscovites and residents of the majority of central and Belarusian provinces, and the Caucasus [41, 42]. By the end of the 20th century, this indicator significantly decreased and was 0.12 in the Moscow region [41].

A decrease in the assortativity index by place of birth of spouses within two generations was also recorded in the Kemerovo region (among the Shorians of the Tashtagol district): from 79.63% in 1970–1975 to 70.64% in 2000–2005 [38].

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## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This work does not contain any studies involving human and animal subjects.

## CONFLICT OF INTEREST

The authors of this work declare that they have no conflicts of interest.

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