Differentiation of dependency ratio in Irkutsk oblast

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Abstract. The article determines the dependency ratio among municipalities of Irkutsk oblast. We designed scales with ratio gradation for mapping the results for different types of dependency burdens. We revealed that the youth population less than 400 per 1,000 people is typical for northern peripheral districts of the region and for the well-developed industrial and multifunctional central cities. The connection between the long-term mean birthrate within the main settlement zone in the region and mean indices of youth dependency burden from 400 to 600 is determined. Minimal old dependency burden (less than 400) have been revealed in the regional center Irkutsk and the Irkutsk district with higher working-age population, in most other districts the old dependency burden has mean values 400 to 500 per 1,000. Maximal value of the old dependency ratio is typical for the north of the region and they are determined by migration outflow, low birthrate and aging population. We have summarized the values of youth dependency ratio and the old dependency ratio and revealed a significant differentiation of indicators of the total dependency load in the region within the values up to 800 and more than 1,000. The northern regions with a considerable proportion of pensioners in the total population and the regions of the main settlement zone with mean values of both ratios and the regions of Ust’-Orda Buryat okrug with traditionally high birthrates experience the greatest dependency load on the workforce.

1. Introduction
Irkutsk oblast is one of Siberian regions with unfavorable demographic situation. Decrease of total population, long-term migration outflow from the region, extremely uneven distribution of population and aging processes in peripheral northern districts specified dramatic differentiation of interregional demographic indices.

The structure of the population in relation to working capacity is an important indicator of the socio-economic state. The paper determines one of the structural coefficients of demography – the dependency ratio. This is a generalized characteristic of the age structure, expressed by the ratio of individual groups (parts) of the population, which assess the "workload" of some groups of people by the others. The dependency ratio shows the number of unemployables per 1,000 people of the working-age population, that is, the load of the unproductive population on society [1].

The total population of Irkutsk oblast in 2000 was 2,644,000 people in absolute terms. The youth population was 609,000 (or 23% in the total structure), working-age population – 1,592,000 (60%) and elderly population – 443,000 people (17%). By 2020, the total population decreased to 2,398,000 people, the number of youth population was 526,000 (22%), working-age population – 1,316,000 (55%) and pensioners – 555,000 people (23%). Between 2010 and 2019, the elderly population
increased by 61,000, and the youth population by 55,000. Thus, the share of the working-age population has decreased by 136,000.

The uprend in the structure of the unemployables in Irkutsk oblast is currently continuing to increase the economic dependency burden on the workforce.

The message of Irkutsk oblast considering the demographic indicators in the rating of Russian regions, assessment of demographic distress and security of demographic development are highlighted in the works by A.V. Korolenko [2], L.L. Rybakovskii [3] and O.N. Kalachikova [4]. Demographic problems were studied by the authors at the regional level in various directions: such as the reserve and potential for the territorial development [5] with a detailed analysis of demographic processes, structures and identification of social problems in the region [6-8], as well as taking into account the impact of standard of living at the local level [9].

2. Materials and methods
In this study we used data from the statistical base of the Federal State Statistics Service for urban and municipal districts of Irkutsk oblast. In the calculation of the demographic ratio we considered the population of Irkutsk oblast in three age groups: young (up to 15 years), working-age (men – from 16 to 59, women from 16 to 54 years) and older than working age [10]. According to the formulas accepted in demography the article calculates three types of demographic loads on the working-age population: potential (youth), pension (elderly) and total per 1,000. Potential dependency burden (youth) is the young dependency ratio (under 15 years) to the working-age population (per 1,000 people). Pension dependency burden is the elderly dependency ratio (women over 55 and men over 60) to the number of working-age people (per 1,000). The total demographic load is the sum of the potential and elderly burdens [11-12].

Being guided by the cartographic method, we propose to group the territories of municipal and urban districts of Irkutsk oblast using a scale with a step of the load factor of 100 per 1,000 people. Thus, potential and pension dependency burdens are displayed on schematic maps with a gradation of the scale of demographic dependency ratio in the range from less than 400 to more than 600. As a result, the sum of these two dependency burdens gave the values of the dependency ratio of the total demographic load with a scale ranging from less than 800 to more than 1,000.

We calculated the positive and negative values of the total demographic load to assess the demographic potential of the territory of municipalities: a positive value means the percentage excess of the potential dependency burden over the pension; negative value – excess of the pension dependency burden over the potential.

3. Results and discussion
The study of the dynamics of mean dependency ratios over the past twenty years in Irkutsk oblast reflects the general demographic processes characteristic of the region and country. Between 2000 and 2008 there was a gradual decrease in the potential dependency ratio in all municipalities of the Irkutsk region. On average, the burden of children has decreased from 383 to 291 per 1,000 of working-age population; the main reason for this is the decline in the overall birthrate. The increase in the youth dependency burden came after 2008. Meanwhile numerous groups of mothers born in the 1980s entered the fertile age. The growth in the number of births was also influenced by the state program “maternity capital”. Currently, the dependency ratio in the region is 400 per 1,000.

Over the twenty-year period the pension dependency burden has also changed significantly. In contrast to the potential burden, pension burden ratios increased by 34%, from 278 (in 2000) to 422 (in 2019). This dynamics was influenced by several socio-demographic factors: there was a change in the age structure of the population. Since 2000, the cohorts born in the postwar years has been entering their own retirement years; the share of the workforce, which included the cohort of 16 to 25 year old, has decreased; as a result of the migration outflow in the region, the number of working-age population has also decreased; life expectancy has increased, contributing to aging population. The
migration movement of the population changed the demographic structure and between 2010 and 2019 Irkutsk oblast lost about 50,000 people as a result of migration.

Nowadays the total demographic burden in Irkutsk oblast averaged 822 per 1,000, having increased by 19.5% since 2000 as a result of natural dynamic changes in the youth and old dependency ratios. In 2000, the value of the total demographic load was positive: the youth dependency ratio was 27% higher than the old dependency: 383 to 378. In 2009, the value of the positive total demographic load changed to negative: the ratio of the potential load (295) corresponded to the pension (296) per 1,000. At present, the difference between the ratios continues to grow and today is 400 to 422.

The analysis of the calculated ratio indices of the three demographic burdens showed a significant differentiation of these indicators on the territory of Irkutsk oblast.

The potential dependency burden (youth) varies in the towns from 344 per 1,000 (Bratsk) to 514 (Svirsk), in districts from 369 (Ust'-Ilimsk district) to 610 (Bayandai district), which is 1.5 and 1.7 times. The minimum youth dependency ratio (less than 400) is typical for the northern districts of the oblast: the Bodaibo district (390), Ust'-Ilimsk district (369), Nizhneilimsk district (389) and towns: Ust'-Ilimsk (379) and Bratsk (344), where industrial enterprises are located. This group also includes the southern districts of the region: the Irkutsk district (377), Usol’ district (397) and the towns: Irkutsk (350) and Angarsk (349). The given territories are attractive multifunctional centers for the labor forces. The largest group includes districts with mean values of potential dependency ratio from 400 to 500 per 1,000 people.

The population of these districts has been declining as a result of migratory outflow, and low birthrate. The territories with high values of youth dependency burden (from 500 to 600) were identified within the main settlement zone of the region, with mean values of fertility, mortality and migratory outflow in the region. The districts of Ust'-Orda Buryat okrug (UOBO) with long-term high birthrates are an exception in the group of these districts.

The old dependency ratio varies: in towns from 356 per 1,000 people (Irkutsk) to 555 (Svirsk), in municipal districts from 328 (Osa district) to 623 (Mamsko-Chuiskii district), that composes 1.6 and 1.9 times. Minimum old dependency ratio (less than 400 per 1,000) was revealed in the town of Irkutsk, the Irkutsk district, and in four districts of UOBO: the Bokhan district – 376, Nukuty district – 347, Osa district – 328 and Ekhirit-Bulagatskii district – 371. The causes of these ratios are as follows: large number of working-age population (Irkutsk and the Irkutsk district) and peculiar counterbalance of youth share in the districts of UOBO. The most of districts of oblast composes the second group of territories with ratios from 400 to 500: Bratsk, Zima, Kazachensko-Lenskii, Nizhnevudinsk, Olkhon, Taishet, Tulun, Ust'-Kut, Chuna and Shelykhov.

We revealed the highest dependency ratio from 500 to 600 in the periphery northern districts of oblast: Katanga (532), Kirensk (530), Ust'-Ilimsk (541), Nizhneilimsk (511); and more than 600 in the Mamsko-Chuiskii (623) district. For these territories aging of population is typical.

The total dependency ratio in the region varies in the towns – from 707 per 1,000 (Irkutsk) to 1069 (Svirsk), in the municipal districts – from 719 (Irkutsk district) to 1,114 (Kachug district), that composes 1.5 times. Minimal total dependency ratio – less than 800 per 1,000 people was revealed in the Irkutsk district and two towns: Irkutsk and Bratsk.

The highest share of the working-age population in the region is 56% (Bratsk) and 59% (Irkutsk). In most districts of Irkutsk oblast the total dependency ratio is in the range from 800 to 1,000, in which the dependency burden of youth and pensioners also correspond to the mean values. The share of the working-age population is already lower here and amounts to 50-55%.

Maximum loads with a ratio of more than 1,000 were found in 7 districts. These are the northern districts with a high old dependency burden: Mamsko-Chuiskii (1,109), Kirensk (1,013), and more southern districts with a high youth dependency burden: Zhigalovo (1,023), Zalari (1,013), Kachug (1,144), Ust'-Uda (1,025) and Bayandai (1,055). The share of children in the districts is from 27 to 30% and of the working-age population – 47 to 49%. Considering the two parameters of the total dependency burden (total dependency ratio per 1,000 people, and a positive or negative values of the load), we assessed the favorable development of the demographic situation at the level of municipal
districts and urban districts. A positive demographic load was registered in 3 urban districts and 19 municipal districts. Minimum excess of the youth dependency burden over the old dependency burden is in Tulun (5%), and the municipal districts in Irkutsk (1%), Nizhneudinsk (3%), Kachug (3%) and Taishet (4%) districts. The maximum excess of youth over pensioners is in the Zima urban district (by 13%) and in several districts of UOBO.

While investigating other municipalities, having negative values of the demographic load, we noted the districts and urban districts in which the total load is minimal, and the excess of the pension load over the youth is insignificant, namely the Irkutsk, Usol’e, Bodaibo, Ust’-Kut and Shelekhov districts. The excess of the pensioner load over the youth in them ranges from 1 to 6%. The group with an average excess of pensioners over youth from 10 to 20% included: the town of Usoly’e-Sibirskoe (by 16%), Chuna district (by 10%), Bratsk (by 15%), Katanga (by 16 %) and Slyudyanka (by 17%).

The percentage ratio within the total population has its own characteristics, given the extremely uneven distribution of the population on the territory of Irkutsk oblast and the concentration of the population in the main settlement zone. The group with a minimum demographic load of less than 800 includes two towns (Irkutsk and Bratsk) and one district (Irkutsk district), but they are home to 42% of the region’s population. In the group with a total load from 800 to 900 – 33%. 19% of the population already lives in the largest group in terms of the number of municipal districts with a total workload of 900 to 1,000. The distribution of the population according to the positive and negative values of the demographic load also happened naturally. According to this criterion, the territories were distributed almost equally, with the distribution of the population, a positive value is typical for 29% of the population, negative for 71%. A significant role in this ratio is played by the concentration of the population in several urban districts with a negative demographic load: Irkutsk, Angarsk, Usol’e-Sibirskoe, Bratsk and Ust-Ilimsk. By 2036, according to the forecast of the demographic situation in Irkutsk oblast, the total population of the region will decrease by 82,000 people. There will be a decrease in the youth population by 25,000 due to the drop in the birthrate. Aging processes and an increase in life expectancy contribute to an increase in the number of the youthful population by 19,000. The migration outflow to other regions of Russia contributes to the decline in the working-age population by almost 76,000. In municipalities, there will also be a change in demographic indicators, age structure and demographic load factors.

4. Conclusion
Irkutsk oblast is characterized by a significant differentiation of the dependency ratios. Mean values of total loads are typical for 50% of the population. The maximum demographic load was revealed in the northern regions (due to the high old dependency burden) and in the regions of the middle settlement zone with high indicators of the potential load (youth). Geographically, most regions have a positive demographic load, but due to the uneven distribution 71% of the population lives in urban districts and areas with a negative demographic load. The regional center (Irkutsk), in which 26% of the region's population is domiciled, has a significant impact on the indicators of demographic load in the regional average.

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