Comparative estimate of the population movement intensity in the regions of the Russian Arctic

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Abstract. The article is devoted to the estimation of population movements intensity in the regions of the Russian arctic. The study is based on the methodology of the balance of population and labor resources movement. For calculations the Rosstat data is used. The analysis showed that during the post-Soviet period, the intensity of population attrition was quite high throughout the country. The population dropped out most quickly at the initial stage of reforms due to an increase in mortality and a significant migration outflow from the regions of the Arctic. The share of intraregional relocations was about a quarter of all withdrawals. Most of the attritions were due to migration outside the region or death. The share of those who hadn’t changed their permanent place residence differs significantly among the regions of Russian arctic. Withdrawal of the population from a permanent place of residence in the Arctic regions is one of the main threats to Russia's security.

1. Introduction
The dominant influence of the migratory movements of the population has always been a characteristic feature of the process of the development of the Arctic. If before the revolution of 1917 the Arctic was not among the main development priorities, then in the USSR it became a zone of wide economic development. In the 1930s it was already noted that the issue of the developing the North was in direct connection with the development of the national economy of the entire USSR [1]. This required the attraction of significant material and human resources [2].

The migratory inflow to the Arctic was large. The outflow of the population was also significant, however, it was lesser than the incoming flow of the population. It was associated not only with the climate but also with both dissatisfaction with expectations and unsettled life [3], [4], although involvement in the heroic events partially alleviated everyday problems in the minds of people [5]. Wherein, the propaganda component of the migratory policy was gradually supplemented by the creation of a system of state social guarantees, which made it possible to compensate to a great extent for adverse living conditions.

In the 1990s, the state significantly reduced its presence in this macro-region, which is of significant importance for the Russian economy and security. As a result, the standards of living of the population have noticeably decreased. Because of the ill-conceived socio-economic transformations, the economic situation has worsened, the state support system has largely ceased to fulfill its functions, and demographic processes have become uncontrollable. Against this background, many negative demographic changes have occurred including mortality increase with a decrease in the birth rates, the population has been aging rapidly there are still a significant migration outflows and others.
As the state’s presence in the Arctic has been growing, geopolitical threats against these territories from foreign countries have become less likely, but global trends indicate that they persist. This is to a large extent connected notably with the prospects for the demographic development of the Russian Arctic. It will be difficult to manage and maintain control over it without a sufficient resident population.

The demographic policy that is currently being implemented in Russia is primarily aimed at the birth rates increase and mortality reducing. Slightly less attention is given to the optimization of migration. However, migration has a very large impact on the dynamics of demographic rates for the Arctic regions. In order to understand the existing demographic trends and the prospects for their changing it is necessary to comprehend the experience of the development of the Arctic zone of Russia in the post-Soviet period.

2. Research methodology
The study is based on the methodology of the balance of population and labor resources movement and the corresponding forecasting and analytical tools [6], [7]. Based on the Rosstat data, the paper considers the dynamics of the population attrition in the Arctic regions in 1991-2017 including population transfer to a new permanent place of residence or as a result of a death. To do this, we consider a matrix, which allows us to estimate how much of the population have not been displaced at the end of the period compared to the initial amount of the population. We take into account all arrivals into this region including migration within a region. That means we consider the proportion of those who have never changed their permanent place residence for any period. This matrix is one of the simplest methods to estimate the intensity of population displacement, but it is of a significant analytical potential. It is described as follows:

\[
q_i(t) = \frac{n_i}{a_i} = \frac{n_i}{n_i(t - 1) + \sum_{j}^{n} b_{ji}(t)}
\]

где \(n_i\) – the population size of a region \(i\) at the end of the period,
\(n_i(t-1)\) – the population size of a region \(i\) at the beginning of the period,
\(\sum_{j}^{n} b_{ji}(t)\) – the sum of all incomes to the population in a region \(i\) from a state \(j\) (as a result of a migratory inflow or birth).

The division of the Russian Arctic into the European and Asian parts by demographic grounds is justified in our works [8], [9]. We include Arkhangelsk and Murmansk regions, the Komi Republic and Nenets Autonomous Okrug to the European part of the Arctic zone of Russia. The Asian part consists of the Republic of Sakha (Yakutia), Krasnoyarsk Territory, Chukotka and Yamalo-Nenets Autonomous Okrugs. Some researchers divide the Asian part into the Middle and Eastern regions [10]. The first one is comprised of the Siberian regions of the Arctic zone of Russia, the second one incorporates the Far Eastern regions of the Arctic zone of Russia.

The classification of the factors of migration and their role in demographic development has been developed in sufficient detail [11], [13]. In relation to the regions of the Arctic, it can be expected that the most important factors are geographical proximity and the economic ones. The main economic factors include the levels of wages, prices, and employment [14], [15].

Migration in the Arctic regions of Russia and its features are considered in sufficient detail. Particular emphasis is placed on the 1990s since during this period of time the migration outflows from these regions were the most significant [16], [17], [18], [19]. Huge migration outflows were observed in Chukotka, that’s why it is the most interesting example to study among all the regions of the Arctic zone of Russia [20]. The city of Norilsk is an economically successful one though it is also remote from the rest of the country. For that reason, it is the second most interesting example [21]. Researchers focus mainly on one region, but they have access to local statistics, so they analyze migration trends in details [22], [23]. Most often they consider short periods of time and only sometimes quite long ones [24].
3. Analysis and results

Figure 1 allows assessing the extent to which the incoming of the population due to in-migration or births compensates for the losses due to outmigration and death. The dynamics is presented for a period of one year.

Throughout the entire period under review, the population dropped out of the Arctic regions to a greater extent comparing to the country as a whole. In the initial period of economic reforms, the dynamics of the population withdrawal from the Arctic regions showed a rather high intensity. Chukotka Autonomous Okrug showed up strongly. In the first half of the 1990s, approximately every seventh inhabitant withdrew annually from this region. More than one in ten of residents dropped out annually even in the second half of the 1990s. This led to a rapid three-fold decrease in the population. In the remaining regions, the figures were close. Every year 4-8% of the population dropped out from the place of permanent residence for all reasons. The indicator value was slightly above the average only in Yamalo-Nenets Autonomous Okrug in 1993-1995. From 1995 onwards, the figures began to converge as most of those who wanted and could leave the Arctic realized their intentions or died, but by the end of the decade, the indicator values were still different.

![Figure 1](image.png)

**Figure 1.** The share of those who hadn’t changed their permanent place residence in regions the Arctic zone of Russia for the period 1991-2017.

By 2005, Chukotka Autonomous Okrug moved closer to the rest of the regions and the intensity of the process of population withdrawal both in the Arctic and the country as a whole decreased. But in 2009, it began to differ from other regions again. After 2011, Yamalo-Nenets Autonomous Okrug also began to demonstrate a higher rates of population attrition. The dynamics of the figures in Chukotka and Yamalo-Nenets Autonomous Okrugs differed markedly from the rest of the Arctic regions. Nevertheless, the rates of the population dropping out from the permanent place of residence have increased both in all the Arctic regions and throughout the country as a whole. This can be attributed to a change in the methodology for the recording of migrants, which has led to an increase in the intensity of migration movement according to statistics. It should be borne in mind that population
attrition includes not only interregional migration but also intraregional migration, which accounts for the bulk of spatial movements. Therefore, a population withdrawal does not necessarily mean the physical disappearance of people from the region.

There are two sharp bursts in the figure, for which we can assume that the real figures were still in line with the trends. In the first case, we can assume the impact of changes in the methodology for the recording of migrants and revaluations after the population census. In the second case, the incorporation of Crimea probably played a role.

The differences between the regions have been small, and Chukotka Autonomous Okrug have not had a noticeable effect due to the small size of its population. Murmansk region had a larger population, but the figures were not as different from the average as for Chukotka Autonomous District ones. As a result, the intensity of population withdrawal in the European and Asian parts of the Russian Federation Arctic zone differed only in the third decimal place. The differences between the Arctic and the rest of the country were more noticeable, although also quite small. They amounted to 0.01-0.02.

What are the features of population attrition when longer periods of time are considered? The corresponding estimates are presented in the table 1.

### Table 1. The share of those who hadn’t changed their permanent place residence in regions of Russian arctic and in the Russian Federation for the various periods of time

|                         | 1991- | 1996- | 2001- | 2006- | 2011- | 1991- | 2001- | 2011- |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                         | 1995  | 2000  | 2005  | 2010  | 2015  | 2000  | 2010  | 2015  |
| Komi Republic           | 0.756 | 0.790 | 0.833 | 0.805 | 0.751 | 0.619 | 0.684 | 0.389 |
| Arkhangelsk region      | 0.805 | 0.830 | 0.854 | 0.862 | 0.775 | 0.682 | 0.746 | 0.456 |
| Nenets Autonomous Okrug| 0.771 | 0.819 | 0.883 | 0.871 | 0.743 | 0.652 | 0.781 | 0.473 |
| Murmansk region         | 0.732 | 0.767 | 0.824 | 0.804 | 0.727 | 0.583 | 0.677 | 0.365 |
| Yamalo-Nenets Autonomous Okrug | 0.845 | 0.807 | 0.872 | 0.821 | 0.661 | 0.705 | 0.731 | 0.442 |
| Krasnoyarsk Territory   | 0.802 | 0.824 | 0.838 | 0.845 | 0.778 | 0.681 | 0.725 | 0.467 |
| Republic of Sakha (Yakutia) | 0.738 | 0.784 | 0.836 | 0.853 | 0.775 | 0.605 | 0.732 | 0.433 |
| Chukotka Autonomous Okrug | 0.458 | 0.569 | 0.729 | 0.850 | 0.632 | 0.286 | 0.647 | 0.200 |
| European part of the Arctic zone of Russia | 0.768 | 0.799 | 0.839 | 0.828 | 0.753 | 0.632 | 0.707 | 0.407 |
| Asian part of the Arctic zone of Russia | 0.780 | 0.809 | 0.840 | 0.844 | 0.759 | 0.654 | 0.727 | 0.450 |
| Arctic zone of Russia   | 0.775 | 0.804 | 0.840 | 0.837 | 0.757 | 0.644 | 0.719 | 0.432 |
| Russian Federation      | 0.852 | 0.867 | 0.875 | 0.889 | 0.819 | 0.753 | 0.790 | 0.550 |

Source: authors’ calculations based on Rosstat data, provided by Rosstat on authors request.

In 1991-1995, almost every fourth inhabitant of the Arctic zone of Russia left his permanent place of residence. Withdrawal throughout the country affected only one in seven residents. Less mobility was demonstrated by the populations of Arkhangelsk region, Krasnoyarsk Territory and the Yamalo-Nenets Autonomous Okrug. The economy of the Arkhangelsk region was more diversified in comparison with other regions of the Arctic zone of Russia. The presence of a developed route network made supplying the population with food and industrial goods a fairly simple matter. Most of Krasnoyarsk Territory is located outside the Arctic zone, which was of positive significance for keeping the population in places of its permanent residence after widespread socio-economic reforms had begun. The economy of Yamalo-Nenets Autonomous Okrug have specialized in economic activities with great export potential, so the authorities were able to maintain a relatively high standards of living. The remote Chukotka Autonomous Okrug suffered economically more severely and faced a very large loss of population. During the period under review, more than every second resident of the population at the beginning of 1991 left the place of permanent residence.
In 1996-2000, the rates of population attrition slowed down and only one in five residents dropped out because a significant part of the population had already left its place of permanent residence. Chukotka Autonomous Okrug remained the leader in population disappearance. Here a little less than every second resident from the population at the beginning of 1996 dropped out. Nenets Autonomous Okrug was added to the group of regions with lower rates of population withdrawal and the remaining population was enough to meet the needs of the economy and to balance labor supply and labor demand. The labor supply shortage was compensated with temporary labor migrants.

In 2001-2005, the rates of population attrition slowed down and became closer to the national average. The withdrawal of the population within the Arctic zone of Russia became more uniform, and the differences between the Arctic and the rest of the country were minimal. Only Chukotka Autonomous Okrug was notable for. In this region about a quarter of all residents from their original number left the place of permanent residence.

In 2006-2010, the differences in population withdrawal between the Arctic and Russia as a whole were slightly greater than in the previous five years, but within the Russian Arctic zone, this period is the most homogeneous. The rates of the population withdrawal remained above the national average, but no more than one in five residents dropped out of the place of permanent residence in all the Arctic regions. During this period, Murmansk region and the Komi Republic faced the highest population attrition. The standards of living determine to a large extent the rates of population attrition. They were heavily influenced in these regions by the prices of mineral resources that are not energy commodities.

A sharp increase in the population withdrawal in 2011-2015 was due to a change in the methodology for the recording of migrants. As a result, we cannot compare this period with the previous ones. We believe that the previous trends persisted and the intensity of population withdrawal was quite low, although it may have become slightly higher. It will be possible to say more precisely only after the end of 2020. The values of the indicator were lower than even the ones of the beginning of the 1990s in Chukotka and Yamalo-Nenets Autonomous Okrugs due to the fact that migrants began to include much more labor migrants who have been working in these regions for a long time.

Between 1991 and 2000, a quarter of the total population left the place of permanent residence throughout the country as a whole. In the regions of the Arctic, the share of the dropout population was just over one third. In Chukotka Autonomous Region, the attrition was the most intense. At the end of 2000, a little less than three out of ten inhabitants available at the beginning of 1991 remained at their original place of permanent residence. On the contrary, in Arkhangelsk Region, Krasnoyarsk Territory, and Yamalo-Nenets Autonomous Okrug, only three out of ten residents left their place of permanent residence.

In 2001-2010, interregional differences in terms of the population attrition in the Arctic regions decreased. The Arctic zone has drawn closer to Russia. The decrease in withdrawal was due to the stabilization of the economy and the fact that most of those who wanted and could leave the Arctic did so back in the 1990s or died. Murmansk region, the Komi Republic, and Chukotka Autonomous Okrug were the leaders in population withdrawal. In Nenets Autonomous Okrug, the intensity of the attrition was the lowest and was at an national average. This confirms our assumption that the labor market was balanced in terms of the labor force quantity.

Between 1991 and 2015, slightly less than half the population of 1991 dropped out across the country as a whole. A little less than six out of ten residents dropped out in the Arctic. The bulk of the population attrition occurred in the 1990s when the state was the weakest. Adverse living conditions in the Arctic lead to higher mortality. At the same time, it should be taken into account that it will not be possible to attract the population in significant numbers to these territories without the implementation of large-scale social programs. After the state withdrew a significant amount of social obligations, a huge migration outflow was added as another reason for population attrition. This led to a rapid and sharp decline in the population in the Arctic regions. Chukotka Autonomous Okrug became the absolute leader in terms of population attrition. For the entire period, only one out of five people in this region was not displaced. This region has been distinguished by the rates of population attrition throughout the reporting period. The Komi Republic and the Murmansk region have also demonstrated
rather significant rates of population withdrawal. More than six out of ten people dropped out there. The differences between the other regions were not so great that it was possible to highlight a particular region.

Within the Arctic zone of Russia, the European and Asian parts were different. In the European part, the rates of population attrition was higher. The population dropped out of economically developed and old-reclaimed regions with a large number of settlements. What played a part in this was that major centers were located nearby: Moscow, St. Petersburg, the cities with a population more than one million people of the Volga and Ural Federal Districts. It was easier to leave these regions and easier to return if necessary.

Although Chukotka Autonomous Okrug is located in the Asian part of the Arctic zone of Russia, its population is small to exert a noticeable influence. A significant part of the territories of the Asian regions does not belong to the Arctic zone. The export potential of mineral resources in these regions is higher, which allows maintaining higher standards of living for the population. These regions are more remote from the rest of the country and transport accessibility is lower therein. As a result, the rates of population attrition in the Asian part of the Arctic zone were slightly lower. Nevertheless, it significantly exceeded the national average.

The economies of all Arctic regions have a large share of the extractive sector. Only in Arkhangelsk region was it noticeably below the Arctic average. Some additional explanations are needed to analyze how economic specialization affects the rates of population attrition. In the Asian part of the Arctic zone, it was easier for regions specializing in the extraction of energy commodities, gold, diamonds, and aluminum production to sell domestically and export minerals and products of their primary processing abroad than to the regions from the European part. However, there were other economic reasons that caused differences between regions. The rates of population attrition were higher in regions that were slower and worse adapted to market conditions. This is supported by the fact that migrants were more actively attracted to more economically active regions, which required additional labor force. Accordingly, the population has left the labor-surplus regions more actively.

From a geographical point of view, population attrition was more intense from the peripheral regions of the Arctic zone of Russia including Murmansk region, the Komi Republic, and Chukotka Autonomous Okrug. There was less population withdrawal from the central regions. These regions attracted a significant number of labor migrants who could stay there for long periods of time, which is due to the peculiarities of their economic development.

We can assume that the higher rates of population attrition in the Arctic regions will continue. To a large extent, this is due to the underdeveloped social infrastructure in these regions. This greatly reduces the standards of living of the population. If the state continues to attract people without creating conditions for comfortable living, they will remain only temporary labor migrants. In this case, the focal development of territories will continue, links between the Arctic regions will weaken, and the successful implementation of important economic projects will greatly depend on the availability of migrants. In addition, it should be remembered that migrants are much less careful about the surrounding area and less interested in its sustainable development since it is not their homeland and is considered only as a temporary place of residence.

4. Conclusions
The analysis showed that during the post-Soviet period, the intensity of population attrition was quite high throughout the country. Over the much part of the XX century, the Arctic zone of Russia was the center of attraction for the population. In the 1990s, state policy changed and without its support, the regions of the Arctic began to lose population rapidly. Poorly implemented social and economic reforms have led to the high intensity of population movement. However, in this case, we talk about population withdrawal.

The population dropped out most quickly at the initial stage of reforms when the state almost completely ceased to perform its social functions. This has led to an increase in mortality and a significant migration outflow from the regions of the Arctic. The 2000s period is characterized by a
slowdown in the rates of population attrition. This is due to the fact that those who wanted and could leave had already realized their plans, and many of the remaining ones died. In 2010s, the rates of population withdrawal could increase slightly, but due to a change in the methodology for the recording of migrants, we cannot say for sure. Nevertheless, it is obvious that the rates of population leaving the place of permanent residence in the Arctic regions was higher compared to the national average.

The share of intraregional relocations was about a quarter of all withdrawals. This means that most of the attritions were due to migration outside the region and death. Such a significant population attrition was due to a change in the role of the state. In Soviet times, the Arctic was, in a sense, a showcase of national achievements, and significant resources were spent to maintain it. In the 1990s, the state greatly reduced aid. Adverse living conditions imply the need to compensate them, which is not done in the post-Soviet period in the right amount. Financial resources have been allocated less than what is needed to maintain infrastructure. As a result, the social infrastructure in these regions is in poor condition, and inhabitants face low transport accessibility therein, which leads to low standards of living of the population. We can assume that this reason will be one of the main reasons for the population attrition in the future as well [25].

Withdrawal of the population from a permanent place of residence in the Arctic regions is one of the main threats to Russia's security. This is due to the fact that it becomes more difficult to control these territories, which are of critical importance for the development of the country. If the state plans to attract an additional population, it needs to increase funding for social projects in the Arctic regions. This is particularly true for the European part of the Russia's Arctic zone, since in it more people drop out and the population is older [4]. However, in addition to infrastructure development, this requires the development of not only the extractive sector of the economy but also the development of other industries. This is the right way to make the national economy more sustainable and to decrease the dependency on prices on global mineral resources markets.

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References
[1] Slavin S V 1987 The regional section of the plan of the Second Five-Year Plan and the concept of development of the North: Pages of memory. About plans, planning and planners (Moscow: Profizdat) 181-195
[2] Zaionchkovskaya Zh A 2000 20th century population migrations in the USSR and Russia: evolution through cataclysms Stud. Russ. Econ. Dev. 11(3) 304-313
[3] Gonina N V 2016 Influence of migratory processes on formation of urban population in Krasnoyarsky krai in 1954-1984 Her. Keverovo State Univ. (4) 28-34
[4] Kelemeneva E A 2017 Mastering the Extreme North: policies and living conditions in Arctic cities under Khrushchev’s time Quaestio Rossica 5(1) 153-170
[5] Agapov M G Klyueva V P 2018 “The North is calling!”: the northern attraction’ motif in the history of the Russia Arctic development Sib. Hist. Res. (4) 6-24
[6] Baranov E F Breev B D 1969 The basic principles of constructing of balances of labor resources (Moscow: TsEMI AN SSSR)
[7] Korovkin A G 2001 Employment and labor market dynamics: issues of macroeconomic analysis and forecasting (Moscow: MAKS Press)
[8] Sinitsa A L 2016 Demographic development of the regions of the Arctic zone of the Russian Federation in 2010-2014 Arctic Ecol. Econ (1) 18-27
[9] Korovkin A G Sinitsa A L 2019 Assessment of the intensity and directions of population
movement in the regions of the Russian Arctic in 1991-2015 Trans. Inst. Natl. Econ. Forecasts RAS 17(1) 323-340

[10] Loginov V G 2015 Middle Arctic region: geographical and social-economic aspects of development Russ. J. Econ. Theory. (3) 108-121

[11] Lee E S 1966 A theory of migration Demogr. 3(1) 47-57

[12] Petersen W 1958 A general typology of migration Am. Soc. Rev. 23(3) 256-266

[13] Shelomentev A G Voronina L V Ukhanova A V Smirennikova E V 2018 Paradox of population migration in the Russia Arctic: factors and barriers Manage. Econ. Sys.: Sci. Electron. J. (11) 4

[14] Andrienko Y Guriev S 2004 Determinants of interregional mobility in Russia Econ. Transit. 12(1) 1-27

[15] Brown A N 1997 The economic determinants of internal migration flows in Russia during transition The Davidson Institute (Working Paper Series Working Paper Number 89)

[16] Gerber T P 2006 Regional economic performance and net migration rates in Russia, 1993-2002 Int. Migr. Rev. 40(3) 661-697

[17] Round J 2005 Rescaling Russia’s geography: the challenge of depopulating the northern periphery Europe-Asia Stud. 57(5) 705-727

[18] Heleniak T 1997 Internal migration in Russia during the economic transition Post-Sov. Geogr. Econ. 38(2) 81-104

[19] Heleniak T 1998 Out-migration and depopulation of the Russian North during the 1990s Post-Sov. Geogr. Econ. 40(3) 155-205

[20] Kumo K Litvinenko T 2019 Post-Soviet population dynamics in the Russian Extreme North: A case of Chukotka Polar Sci. 21 58-67

[21] Zamyatina N Y 2016 Symbolic capital of a territory in the context of Arctic migrations: a view from Norilsk Etnogr. Obozr. (4) 45-59

[22] Druzhinina I V Kurushina E V Kurushina V A 2017 Attractiveness of the Arctic zone and the Northern territories of Russia for migrants Int. J. Ecol. Econ. Stat. 38(4) 152-163

[23] Sukneva S A 2008 Migrational processes in the Republic of Sakha (Yakutia) Spat. Econ. (1) 62-77

[24] Sharova E N 2015 Migration attitudes of young people in the Murmansk oblast Probl. Territ. Dev. (3) 88-103

[25] Fauzer V V Lytkina T S Fauzer G N Smirnov A V 2018 The impact of migration on the number and transformation of socio-demographic structures of the population in the Russian North Trans. Komi Sci. Centr. Ural branch, RAS (4) 111-121