Journal of Infrastructure, Policy and Development 2024, 8(12), 8948.
https://doi.org/10.24294/jipd.v8i12.8948

Article

Regional fertility characteristics of urban population of Kazakhstan at the end of the 20th–first quarter of the 21st centuries

Zhanna Aubakirova[1], Yerkin Nogaibayev[2], Saule Ualiyeva[2], Eleonora Stolyarova[1], Nelli Krasnobayeva[1,*]

[1] D.Serikbayev East Kazakhstan Technical University, Ust-Kamenogorsk 070000, Kazakhstan
[2] Asfendiyarov Kazakh National Medical University, Almaty 050000, Kazakhstan
*** Corresponding author:** Nelli Krasnobayeva, krasn_nelli@mail.ru

CITATION

Aubakirova Z, Nogaibayev Y, Ualiyeva S, et al. (2024). Regional fertility characteristics of urban population of Kazakhstan at the end of the 20th–first quarter of the 21st centuries. Journal of Infrastructure, Policy and Development. 8(12): 8948.
https://doi.org/10.24294/jipd.v8i12.8948

ARTICLE INFO

Received: 31 August 2024
Accepted: 24 September 2024
Available online: 29 October 2024

Abstract: The article examines the current state of fertility processes in Kazakhstan, the diversity of reproductive scenarios, and the reasons for their formation. The authors proceed by analysing the sovereign demographic system formed in Kazakhstan in the first quarter of the 21st century based on the Kazakh ethnic group. Cluster analysis was performed for demographic zones, considering indicators such as the proportion of Kazakhs in the urban population and the total fertility rate in cities. We believe that case technology allows us to demonstrate the differences in the reproductive attitudes and behaviour of urban Kazakhs, ultimately determining the trends in reproductive processes in the country. The focus is given to the socio-cultural and socio-economic differences across the regions of Kazakhstan and their impact on fertility processes in the context of the accelerated urbanisation of Kazakhs. The main variants of adaptation of the reproductive behaviour of Kazakhs to new urban living conditions are described, and an assumption is made about further prospects for maintaining or changing birth rates in Kazakhstan.

Keywords: Kazakhstan; reproductive behavior; fertility; urbanization; cases

1. Introduction

A significant feature of the demographic system of Kazakhstan, which began to acquire a relatively autonomous character at the turn of the 20th and 21st centuries, is the presence of different types of birth rates and models of reproductive behaviour of the urban population that are opposite in their vectors. The authors' previous studies were based on the identification and study of specific features of the demographic development across the regions of Kazakhstan at the end of the 20th century based on the demographic zoning of the territory of the republic for the intercensal periods of 1979–1989 and 1989–1999. This made it possible to determine macroregions, i.e., "ethnodemographic zones" (Aubakirova, 2010).

These zones are territories that differ in the modes of population reproduction and have internal integrity of their constituent elements (ethnic composition, population size natural growth, settlement type, etc.). The authors consider such integrity as an objective condition and a natural result of the demographic development of ethnic groups in these territories over a long historical period, allowing us to conclude about the influence of pronounced ethnic differentiation on regional features of demographic development in Kazakhstan.

It should be noted that an essential feature by the end of the 20th century was the significant potential of specific features of demographic, cultural, and historical development accumulated by large ethnic groups of Kazakhstan. In 1999, the share of

Kazakhs was 53.3%, Russians—30.0% and other ethnic groups—16.7% (Agencies of the Republic of Kazakhstan on Statistics, 2006a; Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, Bureau of National Statistics, 2023).

The accumulation of this potential occurred over a long historical period due to the formed patterns and differences in the processes of natural movement of ethnic groups, as well as under the influence of state regulation on population distribution, its size, migration flows, etc.

Ethnic composition of Kazakhstan is gradually moving towards mono-ethnicity, and Kazakhs are becoming the majority of the population. According to the 2021 census, the share of Kazakhs was 70.4%, Russians—15.5%, and other ethnic groups—14.1%. A single demographic system of Kazakhstan has been formed, which, for the first time in modern history, is determined by Kazakhs. However, the mono-ethnic composition of the population does not refer to homogeneity of demographic processes. Regional specifics has clearly remained based on previously formed different types of fertility, which in its turn arose under the influence of a whole range of socio-economic, socio-cultural and historical characteristics of the regions. Such dynamics attracts our attention to the issues of identifying differences in the reproductive behaviour of the urban Kazakh population.

Today, Kazakhstan is experiencing a completely new period of demographic development. The role of external migrations, which had a considerable impact on changes in the number and ethnic composition of the population during the 20th century, has been currently reducing to a minimum. Demographic dynamics almost entirely depend on reproduction processes, primarily on birth rates, and a sovereign demographic system is being formed that functions on a Kazakh ethnic basis. The strategic task of Kazakhstan's academy is to determine the main trends in demographic development and potential scenarios for the formation of not only quantitative but also qualitative parameters of the country's population.

The transition from the previous demographic system to a sovereign system based mainly on the reproduction standards of Slavic ethnic groups (e.g., Russians, Ukrainians and Belarusians) is close to its end. The tendency for it to function based on the Kazakh and other Turkic (e.g., Uzbeks, Uighurs) ethnic groups is becoming increasingly prominent, and it is already possible to identify the characteristic features of this sovereign demographic system with a high degree of certainty. On the one hand, Kazakhs are actively trying to revive traditional ideas about family, marriage, and the role of women in society. On the other hand, there are clearly expressed aspirations for modernization. In the consciousness and behaviour of Kazakh women from different regions, one can see how a substantial civilizational range manifests itself, containing complex combinations of socio-economic, socio-cultural, and other factors. It is impossible to identify the components of this range using statistical methods alone. The solution to the problem requires a comprehensive approach; therefore, various historical, demographic and sociological sciences methods are widely used. The interdisciplinary approach used by the authors is a choice predetermined by the versatility and diversity of the processes of birth rate modernization in modern Kazakhstan.

The presence of various scenarios of reproductive behaviour suggests that none of them can prevail and be realized in their pure form. Kazakhs not only perceive urban

standards of low birth rate but also bring their traditional attitudes towards having many children to the urban environment. As a result, the reproductive attitudes of Kazakh women in cities reflect the complex and contradictory mutual influence of two oppositely directed vectors: traditional and modernization. The combination of these vectors gives rise to various options for reproductive attitudes and, therefore, makes various scenarios for the socio-demographic development of Kazakhstan possible in the future. The article aims to identify regional features of the birth rate of the Kazakh urban population at the end of the 20th–first quarter of the 21st centuries and to outline various scenarios of reproductive behavior. The latter allows us to determine the processes of demographic development of Kazakhstan. We expect that the historically established features of the socio-cultural development of the urban population of the regions of Kazakhstan lead to different variants of the combination of traditional and modernization vectors, which does not allow us to speak of an established single type of reproductive behaviour.

2. Materials and methods

What are the regional characteristics, which areas are similar in terms of the type of birth rate in cities? How does the total fertility rate correlate with the proportion of the urban Kazakh population, how is this relationship reflected in the polarization of demographic processes in Kazakhstan and manifested in the growing demographic imbalance of the regions? The regions were ranked using the cluster analysis method to answer these research questions.

Cluster analysis in demographic studies allows us to identify similar processes across different territories. A cluster (in English, a group of elements characterized by some common property) or taxon (in English, a systematized group of any category) is a relatively autonomous association of homogeneous objects (including in the logical sense). In fact, a cluster is a super or meta object with characteristics that reflect a result of synthesizing the characteristics of objects that form the cluster. Methods for finding clusters are called cluster analysis or numerical taxonomy.

The Pearson correlation coefficient is used according to the formula to check the presence or absence of a correlation between the dynamics of the urban Kazakh population and birth rates:

$$rxy = \frac{\sum(x_i - \bar{x}) \times (y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \times \sum(y_i - \bar{y})^2}}$$

Here x_i is the value of the variable proportion of Kazakhs in the urban population; y_i is the value of the variable total fertility rate of the urban population; $\bar{x}$ is the arithmetic mean of the variable proportion of Kazakhs in the urban population; $\bar{y}$ is the arithmetic mean of the variable total fertility rate of the urban population. As presented in **Table 1**, the ranking was based on data from the 1999, 2009 and 2021 population censuses.

Table 1. Dynamics of the urban Kazakh population (1999–2021).

Regions	Proportion of urban Kazakh population (%)			2021 by 1999	2021 by 1999
	1999	2009	2021		
Republic of Kazakhstan	43.2	55.9	67.0	155.1	119.9
Akmola region	28.5	42.8	56.0	196.5	130.8
Aktobe region	62.2	75.3	83.8	134.7	111.3
Almaty region	45.7	57.7	66.1	144.6	114.6
Atyrau region	82.3	83.6	88.4	107.4	105.7
West Kazakhstan region	39.6	58.3	71.9	181.6	123.3
Zhambyl region	54.5	64.7	72.7	133.4	112.4
Karaganda region	30.7	39.5	51.5	167.8	130.4
Kostanay region	20.2	31.8	43.0	212.9	135.2
Kyzylorda region	91.3	91.2	93.6	102.5	102.6
Mangistau region	72.9	79.6	83.4	114.4	104.8
Pavlodar region	30.0	41.9	52.6	175.3	125.5
North Kazakhstan region	18.8	24.1	32.9	175.0	136.5
Turkestan region	61.6	69.5	77.4	125.6	111.4
East Kazakhstan region	33.1	46.2	57.2	172.8	123.8
Astana city	41.8	69.4	81.4	194.7	117.3
Almaty city	38.5	53.0	63.4	164.7	119.6
Shymkent city			70.3		

Source: Agencies of the Republic of Kazakhstan on Statistics, 2006b; Agencies of the Republic of Kazakhstan on Statistics, 2010; Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Bureau of National Statistics, 2020.

Calculations have shown that in 1999, the Pearson correlation coefficient between the proportion of the Kazakh population in cities and the value of the total fertility rate of the urban population of the republic was 0.860. Thus, a strong positive relationship was identified and recorded between these two indicators: the higher the values on the scale “Proportion of Kazakhs in the urban population”, the more pronounced the indicators on the scale “Total fertility rate of the urban population”. According to data for 2009, this relationship remains high—0.813. In 2021, the correlation dependence decreased but is still high—0.629. In our opinion, this is explained by new trends in the ethnodemographic development of Kazakhstan. That is to say that the high correlation dependence is a consequence of significant differences in reproductive behaviour already within the Kazakh ethnic group. The factor of ethnic differentiation of population distribution in Kazakhstan has exhausted its potential.

The clustering process begins with the definition of demographic processes, the state of which, firstly, can be calculated and compared, and secondly, whose mutual influence can be statistically confirmed. As the above calculations show, over the past decades, the process of urbanization of the Kazakh ethnic group and the dynamics of the birth rate have been closely correlated. We will describe step by step how the clustering process occurs.

The k-means method is designed to cluster vector space data by dividing it into a predetermined number of clusters, k. The algorithm is an iterative process in which the following steps are performed sequentially:

(1) The number of clusters k is specified;

(2) k observations are randomly selected from the original data set, which becomes the initial cluster centers;

(3) Each observation from the original data set is assigned to a cluster corresponding to the nearest cluster center, measured in the Euclidean metric;

(4) Centroids, the average values of the corresponding features for all records in the cluster, are calculated for each cluster;

(5) Cluster centers are shifted in the direction of the corresponding centroids, after which the centroids become the new cluster centers;

(6) The third and fourth steps are repeated until the cluster boundaries and centroid locations stop changing from iteration to iteration, i.e., at each iteration, the same set of observations remains in each cluster.

When performing these steps, the cluster boundaries change and their centers shift, which minimizes the distances between elements within clusters and increases the distances between clusters. The algorithm is stopped when the cluster boundaries and centroid locations are stable.

The k-means method has the advantages of high speed and ease of implementation. Its disadvantages are the uncertainty of the choice of initial cluster centers and the need to specify the number of clusters initially, which may require some a priori information about the source data.

Today this method is implemented in the form of various computer programs; we use one of them: Flourish.studio. To work with the Flourish.studio program, the following parameters are set: the number of objects, the number of features, and the number of classes, which are entered into the table of source data "objects—features". The algorithm's output is a table of degrees of objects belonging to classes, a matrix of weighted average values of the "centers" of classes, and a set of graphs and diagrams visualizing the results. The features that will form the basis of cluster analysis acquire the main significance in ranking. Of course, these depend on the objectives of the study.

The purpose of this ranking is to identify regions with a similar urban birth rate in Kazakhstan, track the dynamics of this process in the first quarter of the 21st century (in 1999, 2009, 2021), and determine the specifics of each type (cluster) to identify scenarios for Kazakhstan's socio-demographic development.

Features that form the basis of cluster analysis:

- 17 objects (14 regions of Kazakhstan by type of administrative-territorial division until 2022, three cities of republican significance: Astana, Almaty, and Shymkent).
- Two demographic indicators are the proportion of the Kazakh urban population (%) and the total fertility rate of the urban population.
- number of clusters—4.

The first-level demographic processes (in this case, the proportion of Kazakhs in the urban population and the total fertility rate in cities) interact with each other to form a second-level object—a demographic cluster—a territory or group of territories

with similar characteristics of some demographic process, in this case fertility. Typological analysis allows us to identify the specifics of each type (cluster).

As a result, a 4-cluster classification of the fertility of the urban population of Kazakhstan was obtained (a more detailed description is given in the third section on Results).

For the typological analysis of regional features of the reproductive behaviour of the population, the case study technology was used as the most effective tool for studying the differentiation of socio-demographic processes. Since objects with similar types of fertility formed the clusters, the choice of the case was determined by the object that was closest to the center of the cluster, around which other areas similar to it in demographic characteristics were grouped, that is, the object located in the center of the cluster and most fully reflecting its features. Mathematically, the choice was determined by the distance to the cluster center; the smaller it is, the closer the object is to the cluster center (**Table 2**). Then, based on the observed trends in the change of specific quantitative characteristics of the object using the extrapolation method, it is possible to forecast the development of a similar situation in other objects of the cluster under consideration. Thus, the extrapolation method allows us to show what state the object may reach in the future if its development is carried out at the same speed or acceleration as in the past.

Table 2. Cluster centroids and distance to the center of clusters (ranking of urban fertility rate) in 2021.

Cluster	Objects	Distance to the center (Euclidean distance)	Centroid by specific weight of Kazakhurban population (%)	Centroid on TFR of urban population (TFR)
Cluster 1	Pavlodar region	0.098820	50.94	2.25
	Akmola region	0.514935	50.94	2.25
	East Kazakhstan region	0.410240	50.94	2.25
	Almaty city	0.761703	50.94	2.25
	Karaganda region	0.155487	50.94	2.25
	Kostanay region	0.516182	50.94	2.25
	North Kazakhstan region	1.134959	50.94	2.25
Cluster 2	Shymkent city	0.079807	70.25	4.18
	West Kazakhstan region	0.698129	70.25	4.18
	Zhambyl region	0.344738	70.25	4.18
	Almaty region	0.520895	70.25	4.18
Cluster 3	Atyrau region	0.139745	86.12	3.96
	Astana city	0.703242	86.12	3.96
	Aktobe region	0.403215	86.12	3.96
	Kyzylorda region	0.615810	86.12	3.96
	Mangistau region	0.651805	86.12	3.96
Cluster 4	Turkestan region	-	77.4	7.63

Source: Shaimardanov, 2022.

The selected regional examples reflect different dynamics of the transition to mono-ethnicity, the pace of urbanization and, as a result, different options for

demographic development.

In the first cluster, the Pavlodar region is closest to the center of the cluster; in the second cluster—the city of Shymkent; in the third—the Atyrau region; and in the fourth cluster—the Turkestan region. Separate cases are presented by the cities of republican significance, such as Astana and Almaty. Based on the administrative status, two blocks of cases can be distinguished: the "Regions" block, which is the urban population of the Pavlodar, Atyrau, and Turkestan regions. The "Megacities" block—Astana, Almaty and Shymkent. The later cities with a population of over one million, which are centers of attraction for internal migration, have absorbed the reproductive characteristics of the population of all regions of Kazakhstan. To a lesser extent, this applies to Shymkent, which became a megacity only in 2019, which explains the peculiarities of its demographic development.

Mass urbanization of Kazakhs has begun only at the end of the 20th century. It is logical to assume that the socio-cultural inertia of demographic behavior, historically formed in rural areas, continues to influence birth rates in cities to this day. Therefore, demographic indicators significantly depend on the evolution of the ethnic composition of cities in a particular region.

Thus, cluster analysis and case technology were the main tools for studying the diversity of reproductive scenarios in Kazakhstan, which allowed us to obtain the following results.

3. Results

In this section we present the results of the regional ranking for 2021. For the period between 2009 and 2021, the total fertility rate in the republic increased from 2.32 to 3.08 (by 33.8%). The share of the Kazakh urban population from 55.9% to 67.0% (by 19.9%) during the same period increased. The indicators increased in all regions but with varying intensity. The application of the cluster analysis method resulted in the following:

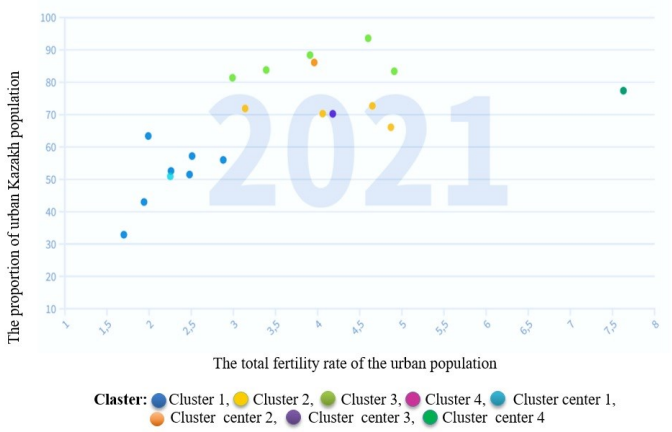

Figure 1. Cluster analysis results for 2021.

Source: Ivlev, 2023b.

Parameters of the center of the first cluster indicates that while the share of the Kazakh urban population is 50.94%, the total fertility rate is 2.25. It includes Karaganda, Kostanay, Pavlodar, North Kazakhstan, Akmola, East Kazakhstan, and

Almaty regions (**Figure 1**). At the same time, the city of Almaty is the largest metropolis in the country, geographically located at a distance from these regions. The population of the former capital of Kazakhstan is likely the bearer of modern urbanized reproductive behavior. Despite its geographical location, demonstrates a "purely urban", i.e., already formed modern type of birth rate.

The second cluster includes Almaty, Zhambyl, West Kazakhstan regions, and the city of Shymkent. The cluster center by the share of the Kazakh urban population is 86.12%, with a total fertility rate of 3.96. It is marked in yellow on the demographic map (**Figure 2**).

The third cluster is represented by one southern region, Kyzylorda, and three western regions: Atyrau, Mangistau and Aktobe. It also includes the current capital of Kazakhstan—Astana. The total fertility rate of the urban population in these regions varies from 2.99 to 4.91; whereas the share of the Kazakh urban population from 81.4% to 93.6%. The cluster center by the share of the Kazakh urban population is 70.25%, with a total fertility rate of 4.18. On the demographic map, it is marked in green (**Figure 2**).

Finally, the fourth cluster is formed by the Turkestan region, which has a proportion of the Kazakh urban population of 77.4% and a total fertility rate of 7.63. On the demographic map, it is shown in red (**Figure 2**).

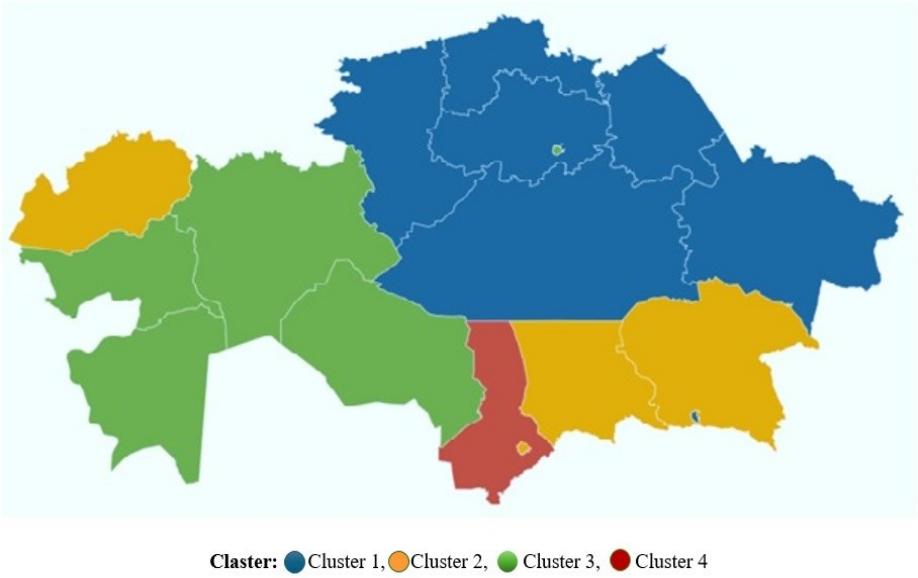

Figure 2. Map of the birth rate of the urban population in 2021 (in accordance with the four-cluster classification).
Source: Ivlev, 2023b.

The birth rates recorded in the Turkestan region allow us to talk about a particular type of reproductive behavior in this region, which is not typical for urban birth rates, due to changes in the administrative-territorial nature and the inclusion of rural areas in cities.

It can be assumed that differences in reproductive behaviour can be largely influenced by factors such as urban birth cycles (Salvati, 2021).

However, it should be noted that Kazakhstani cities, in terms of cyclical development, are not synchronized. They are at different stages of urbanization,

suburbanization, and ruralization. The history of their emergence and formation (pre-industrial and industrial), the population density of the territories adjacent to the cities, and the conditions of modern post-industrial functioning are of great importance.

Currently, various types of urbanization in the Kazakhs have developed. One of these types historically dates back to the Middle Ages, when the city did not play a significant role in the producing sector of the economy of a traditional society but occupied a crucial position in trade, religion, and politics. It was precisely these cities that the Kazakhs in the southwest were well acquainted with. The socio-cultural space of these cities was formed to a significant degree under the influence of the Turkic (including proto-Kazakh) traditional culture. At present, the population of these cities is largely characterized by the preservation of the pre-industrial tradition of having many children.

Another type of urbanization has become widespread in the context of a modern industrial city, which becomes the center of all socially significant processes and, above all, the center of economic development. The socio-cultural space of these cities was formed primarily by Russian-speaking migrants. Here, a new industrial tradition of having few children was formed and consolidated in two or three generations.

Different types of urbanization correspond to different socio-cultural spaces that directly form a system of values and social practices, dictating specific models of demographic behavior, including reproductive behavior.

These reflections are confirmed by the results of the sociological study on reproductive attitudes of urban Kazakh women between 2021 and 2023 (Aubakirova, 2023). As a result, four types of reproductive behavior were identified, conventionally called “modern”, “traditional”, “from modern to traditional” and “from traditional to modern”. It should be borne in mind that the ethnic factor was of great importance for the demographic development of Kazakhstan throughout the 20th century. Socio-cultural features, in turn, affected the indicators of natural and spatial population movement, acquiring a certain specificity in the area of settlement of ethnic groups. However, the ethnic factor has faded into the background, losing its former relevance, vivid expression, and influence on reproductive processes in the country with the beginning of the 21st century. At the same time, the Kazakh ethnic group demonstrates different reproductive behaviors, which led to the formation of different birth rate clusters, reflected in the cases proposed below.

Table 3. Comparative analysis of the cases “South”, “West” and “Regional metropolis”.

Indicators	**Case of the “South” (using the example of the Turkestan region)**	**Case of the “West” (on the example of the Atyrau region)**	**Case of “Regional megapolis” (on the example of the new city of republican significance Shymkent)**
The proportion of urban Kazakh population	High proportion of the Kazakh population (72.3% at the beginning of 2023). Other representatives of the Turkic population (primarily Uzbeks, 23.8%). Similarity of socio-cultural processes, motives and attitudes towards having many children	High proportion of the Kazakh population (89.0% at the beginning of 2023). Mono-ethnicity. a certain homogeneity of socio-cultural processes. Similarity of motives and attitudes towards having many children	High proportion of the Kazakh population (70.9% at the beginning of 2023). Other representatives of the Turkic population (primarily Uzbeks, 15.9%). Similarity of socio-cultural processes, motives and attitudes towards having many children

Table 3. (*Continued*).

Indicators	Case of the "South" (using the example of the Turkestan region)	Case of the "West" (on the example of the Atyrau region)	Case of "Regional megapolis" (on the example of the new city of republican significance Shymkent)
The total fertility rate of the urban population	The highest in Kazakhstan in 2021—7.63, correction at the beginning of 2023—4.75*	Constant growth was 3.91 for 2021	The highest was 4.06 in 2021
Type of reproduction and type of fertility	Extended reproduction, traditional fertility	Extended reproduction, traditional fertility	Extended reproduction, traditional fertility
Social positions of women	Low level of economic activity, focus on having many children and self-realization in the extended family	Low level of economic activity, focus on having many children and self-realization extended family	The low level of economic activity, focus on having many children and self-realization in the extended family circle in recent years has come into conflict with the new status of the city. Women's involvement in socio-economic activity is growing, while the "double burden" remains. At the same time, women are characterized by "double employment" (meaning that traditional responsibilities within the family and new ways of self-realization in the capital's urban space).
Correlation with republican demographic indicators	In 2021, the overall fertility rate was 1.8 times higher than the national average. The natural reproduction rate was 2.5 times higher. Increase in the rate of natural growth over 5 years by 1.1 times (2017–2021)	In 2021, the overall birth rate is 1.2 times higher than the national average, and the natural reproduction rate was 1.5 times higher. However, over 5 years (2017–2021), the natural growth rate had decreased by 1.2 times due to an increase in mortality	In 2021, the overall birth rate is 1.4 times higher than the national average, the natural reproduction rate was 2.0 times higher. Increase in natural growth rates over 5 years is more than 1.1 times (2017–2021)
The main age groups providing fertility	The contribution of the 20–29 age group to the total fertility rate in the region was 57.7% in 2021	The contribution of the 20–29 age group to the total fertility rate in the region was 57.6% in 2021	The contribution of the 20–29 age group to the total fertility rate in the region was 59.6% in 2021
Birth order rates in cities (max/min)	The share of births of the fourth and subsequent child was 38.4%, the second child was 19.2%	The share of births of the fourth and subsequent child was 30.0%, the second child was 22.0%	The share of births of the fourth and subsequent child was 33.3%, the second child was 20.6%
Formation of large families among age groups	Large families were formed in cities already at the age of 25–29 years. Almost every third woman (31.4%) had four or more children. At the age of 30–34 years, this figure was 67.7%, i.e., almost 2/3 of women under 34 were mothers of large families	Having many children was already formed at the age of 25–29 years. Almost every fifth woman (18.9%) had four or more children before reaching the age of 29. At the age of 30–34 years, this figure increased to 45.8%, that is, almost half of women are mothers of many children	Large families were formed already at the age of 25–29 years. Every fourth (23.9%) mother in Shymkent up to 29 years old had 4 or more children. At the age of 35–39 years, 2/3 of mothers (73.9%) had many children
Average age of mothers in cities	The average age of mothers was 28.5 years among cities in 2021	The average age of mothers was 29.7 years among cities in 2021	The average age of mothers was 28.7 years among cities in 2021

Note: Regarding the value of the total fertility rate (TFR) in the Turkestan region—7.63, it should be noted that initially it was considered by us as a statistical error, then as a realistically possible situation explained by a number of socio-cultural and socio-economic features of the region, administrative and territorial transformations, etc. Moreover, this indicator was recorded by official statistics for several years. Along with this, the same official statistics published adjusted data for the beginning of 2023 and a new value of the TFR for the urban population of the Turkestan region appeared—4.75. Whatever the statistical measurement of fertility, this area is distinguished by a special way of demographic development and a high birth rate (in general, it is higher in cities than in rural areas), which is confirmed by the results of empirical data, cluster analysis and materials from a three-year sociological study.

Table 4. Comparative analysis of the cases "Capital", "Ex-capital" and "North. East. Center".

Indicators	Case "Capital" (using the example of Astana)	Case "Ex-Capital" (using the example of Almaty)	Case "North. East. The Center" (using the example of Pavlodar region)
The proportion of urban Kazakh population	High and growing share of the Kazakh population (81.8% at the beginning of 2023). At the same time, the diversity of socio-cultural diversity of migrants from different regions forms differences in demographic behavior	Increase in the number of Kazakhs (63.1% at the beginning of 2023) against the background of the preservation of a high proportion of Russian ethnicity (19.8%) and representatives of other ethnic groups (17.1%). Diversity of socio-cultural attitudes and reproductive scenarios	Average share of the Kazakh population (54.1% at the beginning of 2023) replaced the historical predominance of Russian and other European ethnic groups. Polyethnicity and multiculturalism did not contribute to the preservation of traditional attitudes towards having many children
Total fertility rate of the urban population	Growing; It was 2.99 in 2021	The lowest total fertility rate Kazakhstan; It was 1.99 in 2021	One of the lowest in the republic; It was 2.25 in 2021. However, it shows positive dynamics in the first quarter of the XXI century
Type of reproduction and type of fertility	Extended reproduction, various types of fertility	Does not provide simple reproduction, urban type of fertility	Simple reproduction, modern type of fertility
Social positions women	High involvement of women in social and economic activity—public service, other services, etc.	High involvement of women in socio-economic and social activity, typical for the modern urban population. At the same time, "double employment" often persists	High involvement of women in socio-economic activity
Correlation with republican demographic indicators	In 2021, the overall birth rate was 1.1 times higher than the national average. The natural reproduction rate was 1.6 times higher. Decrease in the rate of natural increase over 5 years by 1.2 times (2017–2021)	In 2021, the overall fertility rate was 1.2 times lower than the national average. The natural reproduction rate was 1.3 times lower. Decrease in the rate of natural increase over 5 years by 1.2 times (2017–2021)	In 2021, the overall fertility rate was 1.5 times lower than the national average, the natural reproduction rate was 9.4 times lower. A catastrophic decline in natural growth rates over 5 years by 4.4 times (2017–2021)
The main age groups that ensure fertility	The contribution of the 25–34 age group to the city's total fertility rate was 56.8% in 2021	The 20–29 age cohort accounts for 55.3% of the city's total fertility rate	The 20–29 age cohort accounts for 51.3% of the total fertility rate in the region.
Birth order rates in cities (max/min)	The share of births of the fourth and subsequent child was 19.7%. The first child was 29.3%	The share of births of the fourth and subsequent child was 14.5%. The first child was 42.7%	The share of births of the fourth and subsequent child was 15.9%. The second child was 31.7%
Formation of large families among age groups	Large families were formed at the age of 30–34 years. Every fourth woman (26.6%) up to the age of 34 had four or more children. At the age of 35–39 years, this figure was 45.2%, i.e., almost half of women up to the age of 39 become mothers of large families	Large families were formed from the age of 30–34. Almost every fifth mother (18.9%) up to the age of 34 had four or more children. At the age of 35–39, this figure was 33.0%, i.e., 1/3 of mothers had large families	Large families in cities were formed from the age of 30–34 (22.4%). Every fifth woman under 34 had four or more children. At the age of 35–39, this figure was 35.8%. More than 1/3 of women under 39 were mothers of large families
Average age of mothers in cities	The average age of mothers was 30.3 years among cities in 2021	The average age of mothers was 30.2 years among cities in 2021	The average age of mothers was 30.0 years among cities in 2021

Source: Shaimardanov, 2022.

Each case reflects the state of the cluster, the center of which is (**Tables 3** and **4**). By extrapolating the findings from the cases to the entire cluster, one can get an idea of the state of birth rate in the regions of Kazakhstan. To analyze the birth rate and

reproductive behaviour of city residents, it is vital to consider the context and implementation of the complex interaction of ethnic, cultural, social and economic factors.

The case of "North. East. West" can be viewed as the one that is in the process of moving from the polyethnicity that has developed in the Soviet period of history to a state of monoethnicity (a pan-Kazakhstan trend). The urban population is formed due to rural residents replacing the emigration losses of representatives of European (mainly Slavic) ethnic groups.

The urban population of the South of Kazakhstan is also polyethnic. Unlike the Pavlodar region, the basis of polyethnicity is formed by ethnic groups with higher birth rates than the Kazakhs (Uzbeks, Uyghurs, etc.). At the same time, urbanization processes are weakly expressed, and the population reproduction rates are determined directly by urban residents.

Kazakhs largely represent the urban population of the West of Kazakhstan. There is a historically established variant of population reproduction on a monoethnic basis.

The demographic development of megacities is outside the regional logic since they are the center of attraction for the population from all regions of Kazakhstan. First of all, this is typical for the capital of the Republic of Kazakhstan. The majority of Astana residents are former migrants, as a result of which the "capital" algorithm of reproduction processes is still in formation.

Shymkent corresponds to a lesser extent to the status of a "republican level" megalopolis. Rather, it is a "regional megalopolis" reflecting the peculiarities of the demographic behavior of residents of southern Kazakhstan.

Almaty is the only large city in the Republic of Kazakhstan. The essence of demographic processes in Almaty is determined by urban Kazakhs that are representatives of the third, fourth, and more urban generations, largely uninfluenced by traditional socio-cultural norms. Almaty's historically established capital status has formed a special, modernized variant of the population's reproductive attitudes.

Table 5. Age-specific fertility rates and total fertility rates of the urban population of the regions of Kazakhstan in 2021 (‰).

Age Groups (years)	Kazakhstan	Across					Almaty	Astana	Shymkent
		South	North	East	Center	West			
15–49	93.0	146.6	63.0	72.3	71.3	114.1	64.8	96.8	128.0
15–19	19.9	28.6	15.7	15.6	17.5	21.3	11.5	12.8	28.0
20–24	165.7	260.2	119.2	141.4	132.2	197.2	102.0	128.2	228.5
25–29	191.3	330.6	135.7	160.8	156.8	244.0	116.8	200.3	256.8
30–34	127.8	234.5	92.4	96.7	106.9	167.0	83.7	137.4	160.8
35–39	86.0	142.5	58.6	70.1	65.3	106.2	62.0	89.9	109.1
40–44	23.6	33.8	16.5	17.2	16.7	29.9	19.5	25.9	28.2
45–49	1.6	1.6	0.9	0.8	0.7	0.7	2.2	3.3	1.4
CKP	3.08	5.16	2.19	2.51	2.48	3.84	1.99	2.99	4.06

Source: Shaimardanov, 2022.

Kazakhstan is characterized by regional diversity of options for reproducing the

urban population. Although the urban lifestyle generally standardizes demographic attitudes in world practice (**Table 5**).

Thus, the presented cases clearly demonstrate the regional diversity of urban fertility types. Such diversity has developed due to significant differences in socio-economic, socio-cultural, and ethno-demographic properties, largely formed in the Soviet past. A uniform "historical foundation", on which a sovereign urban demographic system can be built, is still being formed. At present, Kazakhstan has socio-cultural diversity concentrated in representatives of one ethnic group. Many reproductive options are constantly evolving. In many ways, these options are a consequence of different types of urbanization. The migration flow from the village to the city still significantly impacts the birth rate process. However, the demographic potential of the village will dry up, and the city will begin to produce its socio-cultural dynamics in the long term. Kazakh culture will be reproduced on an urban basis. Moreover, its more active interaction with socio-economic factors can form a new version of the demographic behaviour and reproductive culture of the Kazakhs.

4. Discussion

The impact of urbanization on the processes of family transformation and population reproduction, on the evolution of fertility in cities, the relationship between fertility and socio-economic development are studied by such modern Western scholars as Salvati (2023); Lopez-Gay et al. (2021); Rodrigo-Comino et al. (2021); Egidi et al. (2021); D'Agata et al. (2024); Sateriano (2024); Sun and Zhang (2021); Huang et al. (2023).

Egidi and Salvati (2021) study the influence of the long-term urban cycle (urbanization, suburbanization, counter-urbanization, re-urbanization) and short-term economic downturns on the evolution of fertility rates using a statistical approach that combines global and local indices of Moran's spatial autocorrelation, nonparametric inference and multivariate research methods. The results of the demographers' study are presented in the work "Changes over time in the spatial structure of fertility rates as a dynamic indicator of urban transformations".

The works of Western demographers and urbanists are important in the study of fertility transformations in the context of suburbanization and the role of macro (contextual) and micro (behavioral) factors on population reproduction rates. Researchers such as Caldwell (2001); Halbak-Cotoara-Zamfir et al. (2021); Newsham and Rowe. (2023); Rontos et al. (2024); Rindfuss et al. (2016). (2024); Salvati (2020); Sobotka et al. (2010); Vardopoulos et al.

We believe that studying the demographic situation in Kazakhstan only through the prism of the concept of socio-economic determinism is sometimes able to explain the essence of the ongoing processes in all their diversity. More attention should be paid to the opinion that demographic relations are not only a consequence of economic changes but also largely depend on the socio-cultural past of a particular group of people, enshrined in religion, traditions and customs. Cultural norms are long-lasting, passed down from generation to generation and cannot change quickly in new socio-economic conditions (Vishnevskii, 2015). The study of regional characteristics requires special attention (Kireeva et al., 2023; Rakhmetova et al., 2020; Sadvokasova,

2021; We, 2019).

Along with this, we present for the first time a study of regional characteristics of the birth rate of the urban population using the method of cluster analysis and case technology to identify the socio-cultural and socio-economic impact on the reproductive behavior of urban Kazakhs. Various scenarios of the sociodemographic development of Kazakhstan in the future are discussed for the first time.

Over the past three decades, urbanization in Kazakhstan has been associated with other economic, political and sociocultural processes, namely: state programs to support families (benefits), the rise of national self-awareness of Kazakhs, the revival of ethnicity, traditional values (including the value of family and the social status of having many children), the actualization of clan relations, and the "Islamic renaissance". The interweaving of processes that are diverse in content and degree of influence has led to the concentration in one space and in one time period (i.e., here and now) of representatives of various social groups of the urban Kazakh population, differing in status, economic, cultural characteristics, level of proficiency in the Kazakh and Russian languages, etc. The differentiation of urban Kazakhs is also influenced by the time and place of residence in the city (city district or suburb), as well as the degree of their adaptation and integration into the modern urban space of the republic.

Further scenarios of socio-demographic development of the country's cities depend on the concentration of representatives of certain groups of the Kazakh urban population, similarly on the number and proportion of other ethnic groups.

The first option is the Europeanization of the Kazakh urban population and the dissolution of ethnic identity and language in the urban space (the movement "from traditional to modern"). In various forms of urban communications (services, employment, etc.), Russian is widely used. Nevertheless, young people use more and more borrowings from English and actively study it. In the "from traditional to modern" model, the majority of the population supports the urban lifestyle. It transmits the values and norms of the modern urban (European) subculture or is on the way to this.

Another option for further development of the urban space is the ruralization of the city (the movement "from modern to traditional"), which takes place to a greater extent in the suburbs. Urban consciousness, urban subculture, and lifestyle cannot resist the corporate opportunities of former villagers due to their large numbers, compactness of residence, and representation in certain spheres of the country's economy. Therefore, the city begins to live not according to the established standard and the usual logic of urban development but in a situation in which modern urban thinking increasingly gives way to the generic one.

There is also a third option for the development of urbanization processes. It is based on the previous social structure of the city: the transformation of its individual elements (ethnic, cultural, economic). For that, prerequisites for further development should be also created. In this scenario, a synthesis of mutual coexistence in one urban space of both Russian and Kazakh languages and culture, partly with elements of Westernization, is possible: "... It is already clear that the emerging social stratum is capable of becoming a kind of 'guardian of the functions of the city'", a kind of invariant of urban existence. It restrains the emigration sentiments of Russian-speaking people and rural migrants arriving in the city adapt to the peculiarities of life

in this "space" (Alekseenko, 2016).

Despite the similarity of urbanization processes, the trajectory of their development in each city of Kazakhstan is individual. We believe that the third development scenario is essential for the further evolution of the urban space. As already noted, the groups of Kazakh population represented in the cities demonstrate various attitudes and behavioral models (traditional, modern, intermediate), which are transmitted through the attitude to the observance (non-observance) of national traditions, language preferences, clan ties, family and marriage sphere, interethnic communication, position on the visual ethnicization of the city, onomastic transformations, etc. Another marker of belonging is the reproductive culture of representatives of various groups of urban Kazakhs.

For Kazakhs illustrating the modern type of socio-cultural attitudes, the following features of reproductive behavior are characteristic: later terms of marriage and motherhood, few children. Much attention are paid to the quality of children's education, the practical absence of the influence of traditions and religion on the family and marriage sphere, the priority of professional activity and career growth.

Representatives of the titular urban population, transmitting traditional reproductive attitudes, are characterized by the following features: early marriage and motherhood, having many children or attitudes towards it, the priority of motherhood over professional activity, a significant role of religion, and national traditions in family upbringing.

Intermediate types exhibit both traditional and modern norms of reproductive attitudes to varying degrees.

5. Conclusion

Of all the previously considered types of urban titular ethnic groups, the largest share falls on the traditional (second group). A mount of Kazakhs who moved to the city in the 1990s is also significant. This category of the Kazakh population is characterized, in general, by traditional socio-cultural norms, including demographic ones (early marriage, high birth rate and large families). One of the main reasons for the surge in birth rates in the last few years in the cities of Kazakhstan is the concentration of representatives of traditional groups of the Kazakh ethnic group, producing the corresponding socio-cultural mechanisms and reproductive attitudes. This population category responded the most to state family support programs (benefits for large families, increased maternity leave and other preferences).

Considering the intensity of the Kazakhs' urbanization processes, the large number of traditional groups in the cities, and the large migration potential of the village, it can be assumed that the emerging trend of increasing birth rates will continue in the near future. Most of the things will depend on the socio-economic and political transformations in Kazakhstan and the priorities of its strategic development.

Thus, the modern urbanization of Kazakhs due to the large influx of rural migrants is increasingly deviating from the classical models of urban space development. Today, socio-cultural mechanisms for migrants' adaptation to the city are acquiring an important role.

This is confirmed by the growth of the birth rate among Kazakhs against the background of their active urbanization. This calls into question the universality of classical theories of urbanization. The current situation in Kazakhstan encourages us to rethink and reinterpret the phenomenon of the demographic system as such. It should be viewed as a living organism, a more flexible phenomenon that responds to socio-economic, historical and political changes. When forecasting and developing the socio-economic and political course of Kazakhstan, it is necessary to take into account the transformations in the demographic system, the main mechanisms and factors of its development, as well as the emerging trends in the processes of reproduction, in general, and the modernization of the birth rate, in particular. The high birth rate in cities is largely explained by the fact that Kazakhs very quickly "acquired" a new, urban, status. Over the 30 years of independent post-Soviet development of the country, the number of urban Kazakhs has increased threefold. If, in the late 1980s, the proportion of ethnic representatives in the urban population was 26.6%, then in 2021 it was 67.0% (Shaimardanov, 2022).

The majority of modern urban population of Kazakhstan are former rural residents who have not gone through the long path of urban development. The importance of the urban development is explained by the transformation of traditional views, including in the area of reproductive behavior.

The bearers of the birth traditions that developed in the pre-industrial historical period find themselves in the "urban territory" and cannot change quickly. It is also important that they constitute a significant part of the urban population. They do not experience intense pressure from the fully urbanized majority. Therefore, they have no urgent need to change their reproductive attitudes. On the contrary, they begin to dictate their "rules of the game". The first transitional stage of the demographic development of the urban space is evident. The inertia of traditional views is capable of determining demographic development for some time (Sarsembayeva et al., 2022).

To a large extent, new vectors of demographic development will be determined by representatives of the generation born in the 2000s. This generation, for the most part, has not yet been determined, as they are only beginning to implement its reproductive preferences. It is crucial to consider that most of these young people were born in cities and, from birth, go through all the stages of urban socialization. The current generation of youth is going to form the "Kazakhstani birth model" in the future.

Thus, the examples provided demonstrate the regional diversity of fertility types in cities, which has developed as a result of significant differences in socio-economic, socio-cultural and ethno-demographic characteristics, primarily formed in the Soviet past. At present, Kazakhstan is distinguished by socio-cultural diversity, manifested in various variants of reproductive behavior that are constantly evolving. In many ways, these differences are a consequence of different types of urbanization. The migration flow from rural areas to cities still has a severe impact on fertility processes. However, in the future, the demographic potential of the village is highly likely to dry up. The city is going to develop its socio-cultural dynamics, and Kazakh culture will be reproduced on an urban basis. And its more active interaction with socio-economic factors can form a new version of Kazakh urban reproductive culture.

Author contributions: Conceptualization, ZA; methodology, ZA; software, YN; validation, NK; formal analysis, SU; investigation, SU; resources, NK; data curation, YN; writing—original draft preparation, ES; writing—review and editing, ES; visualization, NK; supervision, ZA; project administration, ZA; funding acquisition, ZA. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan [Grant AP19676895].

Conflict of interest: The authors declare no conflict of interest.

References

Agencies of the Republic of Kazakhstan on Statistics. (2006a). Ethnodemographic Yearbook of Kazakhstan. Statistical Digest. Almaty. pp. 7–8.

Agencies of the Republic of Kazakhstan on Statistics. (2006b). Demographic Yearbook of the Regions of Kazakhstan. Statistical Digest. Almaty. pp. 277.

Agencies of the Republic of Kazakhstan on Statistics. (2010). Demographic Yearbook of the Regions of Kazakhstan. Statistical Digest. Astana. pp. 127–146.

Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, Bureau of National Statistics. (2023). Results of the 2021 National Population Census in the Republic of Kazakhstan. Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, Bureau of National Statistics.

Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Bureau of National Statistics. (2020). Demographic Yearbook of the Regions of Kazakhstan.Statistical Digest. Nur Sultan. pp. 96, 99, 102, 105, 108, 111, 114, 117, 120, 123, 126, 129, 132, 135, 137, 139.

Alekseenko, A. N. (2016). Meeting place Ust-Kamenogorsk: two worlds, two ways of life in search of interaction and cooperation. Astana-Almaty, 144.

Aubakirova, Z. S. (2010). Reproduction of Kazakhstani population (ethnoregional aspect). Ust-Kamenogorsk, 190.

Aubakirova, Z. S., Stolyarova, E. O., Sarsembayeva, G. A., et al. (2023). Regional peculiarities of reproductive behavior of urban Kazakh women. Sociological Science, 435.

Aydapkelov, N. S. (2017). Collection of statistical data. Demographic yearbook of Kazakhstan. pod red. Astana, 183.

Caldwell, J. C. (2001). The Globalization of Fertility Behavior. Population and Development Review, 27, 93–115.

D'Agata, A., Nosova, B., Vardopoulos, I., et al. (2024). Urban decline, economic crisis and fringe landscapes: The mediterranean experience. n book: In A. Sateriano (Ed.), Urban crisis: social and economic implications for southern Europe. Hauppauge, NY, USA: Nova Science Publishers. ISBN: 9798891132429. Chapter: 2

Egidi, G., Salvati, L. (2021). Changes over time in the spatial structure of fertility rates as a dynamic indicator of urban transformations. Quality and Quantity, 55(1), 151–172. https://doi.org/10.1007/s11135-020-00998-4

Halbac-Cotoara-Zamfir, R., Egidi, G., Salvia, R., et al. (2021). Recession, local fertility and urban sustainability: Results of a quasi-experiment in Greece, 1991–2018. Sustainability, 13(3), 1052. https://doi.org/10.3390/su13031052

Huang, Y., Miao, L., Lyu, B. (2023). Urban public health education services, health status, and increased fertility intentions of the rural migrant population. Reproductive Health, 108(2023). https://doi.org/10.1186/s12978-023-01648-2

Ivlev, A. (2023a). Available online: https://public.flourish.studio/visualisation/12638310 (accessed on 12 August 2024).

Ivlev, A. (2023b). Available online: https://public.flourish.studio/visualisation/12712703 (accessed on 12 August 2024).

Kireeva, A. A., Bekturganova, M. S., Ailzhanova, F. G. (2023). Analysis of demographic processes of migration in regions of Kazakhstan. Bulletin of the L.N. Gumilev Eurasian National University, 3, 40–54, 104–106.

López-Gay A., Salvati L. (2021). Polycentric development. and local fertility in metropolitan regions: An empirical analysis for Barcelona. Spain. Population, Space and Place, 27(2), 2402. https://doi.org/10.1002/psp.2402

Meshimbayeva, A. (2008). Collection of statistical data. Demographic yearbook of Kazakhstan. pod red. Astana, 292.

Newsham, N., Rowe, F. (2023). Understanding trajectories of population decline across rural and urban Europe: A sequence analysis. Population, Space and Place, 29(3). https://doi.org/10.1002/psp.2630

Rakhmetova, R. U., Andekina, R. E. (2020). Trends in fertility of ethnic groups in Kazakhstan. Paradigms of Knowledge(Czech), 2, 42–47.

Rindfuss, R. R., Choe, M. K., Brauner-Otto, S. R. (2016). The Emergence of Two Distinct Fertility Regimes in Economically Advanced Countries. Population Research and Policy Review, 35, 287–304.

Rodrigo-Comino, J., Egidi, G., Sateriano, A., et al. (2021). Suburban fertility and metropolitan cycles: Insights from European cities. Sustainability. 13(4), 2181, 1–14. https://doi.org/10.3390/su13042181

Rontos, K., Antonoglou, D., Salvati, L., et al. (2024) Revisiting the Spatial Cycle: Intra-Regional Development Patterns and Future Population Dynamics in Metropolitan Athens, Greece. Economies, 12(8), 202. https://doi.org/10.3390/economies12080202

Sadvokasova, A. K. (2021). Ethnosocial processes and demographic development of Kazakhstan. In: Proceedings of the the International Scientific and Practical Conference; Ust-Kamenogorsk. pp. 148–155.

Salvati, L. (2020). Demographic Dynamics, Urban Cycles and Economic Downturns: A Long-term Investigation of a Metropolitan Region in Europe, 1956–2016. Population Research and Policy Review, 39(3), 549–575.

Salvati, L. (2021). Births and the City: Urban Cycles and Increasing Socio-Spatial Heterogeneity in a Low-Fertility Context. Journal of Economic & Human Geography(Dutch), 112(2), 195–215. https://doi.org/10.1111/tesg.12454

Salvati, L. (2023). A Long Way to Complexity: Nonlinear "Growth Stages" and Spatially Uncoordinated Settlement Expansion in a Compact City (Athens, Greece). Geographical Analysis, 55, 280–99. https://doi.org/10.1111/gean.12327

Sarsembayeva, G. A., Krasnobayeva N. L., Makhmetova N. A. et al. (2022). Historical prerequisites for the formation of the "Kazakhstani model" of fertility: mid-20th–early 21st centuries. Questions of History, 10, 174–186.

Sateriano, A., Ciaschini, L., Rontos, K. (2024). Urban crisis: social and economic implications for southern Europe. Nova Science Publishers. https://doi.org/10.52305/TQJZ2310

Shaimardanov, Z. N. (2022). Demographic yearbook of Kazakhstan. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. pp. 55–292.

Sobotka, T., Billari, F. C., Kohler, H. P. (2011). Economic recession and fertility in the developed world. Population and development review, 37(2), 267–306.

Sun, X., Zhang, Z. (2021). Coupling and coordination level of the population, land, economy, ecology and society in the process of urbanization: Measurement and spatial differentiation. Sustainability, 13(6), 3171. https://doi.org/10.3390/su13063171

Vardopoulos, I., Georgiou, C., Voukkali, I., et al. (2024). Case-based exploration of the nexus between transformative urban megadevelopments and sustainability. Theoretical and Empirical Researches in Urban Management, 19(3), 5–30. https://www.jstor.org/stable/27321372

Vishnevskii, A. G. (2015). The time of demographic change. Moscow, 517.

We, K. (2019). Report—Analysis of the Population Situation in the Republic of Kazakhstan. UNFPA, 153.