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Order of Authors:	mirnajaf mousavi, Professor Hasan Hekmatnia Ali Shamsoddini Ali Bagheri Kashkouli Alireza Jamshidi

Geographical Analysis of Population Aging Trend in Islamic World Countries during 1950-2020

Hasan Hekmatnia, Mir Najaf Mousavi*, Ali Shamsoddini, Ali Bagheri

Kashkouli, Alireza Jamshidi

Department of Geography, Payam Noor University, Yazd, Iran

Department of Geography, Urmia University, Urmia, Iran

Department of Geography, Islamic Azad University, Marvdasht, Iran

Department of Urban Planning, Ministry of Roads & Urban Development, Yazd, Iran

Department of Geography, Urmia University, Urmia, Iran

* Professor of Geography and Urban Planning, Urmia University

E-mail: M.Mousavi@urmia.ac.ir Tell: +989144211702

Geographical Analysis of Population Aging Trend in Islamic World Countries during 1950-2020

In the contemporary world, the population aging and the factors affecting it are among the topics of interest to policymakers and planners in any country, and knowledge of this situation will help to regulate and even advance the substantial programs. The aim of this study was to investigate the trend of the demographic aging index in Islamic countries based on the analysis of survival history. The research method was descriptive-analytical, which was a type of applied research, and methods of collecting documentary information.

The United Nations Population Database (1950 to 2020) was used to collect data. In the present study, 57 countries were grouped and studied in ten geographical areas. The statistical method used is the survival history analysis. Data were analyzed using Stata statistical methods and non-parametric methods of estimating the survival function of Kaplan-Meier, Nelson-Aalen and the semi-parametric model of Cox's proportional risk. Based on the results, it was obtained that, in the ten regions of the Islamic world, the fertility index has a downward trend and the indicators of old age (with low acceleration) and life expectancy have an increasing trend.

Furthermore, the probability of aging has a negative relationship with the total fertility rate and a positive correlation with life expectancy. Estimates of survival function and cumulative risk for the ten geographical regions of the Islamic world in 2020 indicate that the probability of aging in these regions is not significantly different, except for the Southern European region (Albania). It represents that the rate of entry into the aging phase does not differ significantly between the geographical areas of the Islamic world (excluding Albania).

Keywords: aging, fertility, life expectancy, survival history analysis, Islamic world countries.

Introduction

Population aging from the middle of the twentieth century onwards, first in developed countries and then in recent years, is happening in other countries (Darabi & Torabi, 2017: 33), and over the centuries the world is constantly aging (Lutz et al, 2008). In Biological

aspect, it defines as “aging is a process of progressive overall deterioration of different parts of the body that starts after a particular age”. Aging process is a biological reality which has its own dynamic, largely beyond human control, in social and demographic aspect, population aging refers to the process of increase in the proportion of the elderly (older) persons in the total population (Siddhisena, 2016: 3). Nonetheless, population aging is not limited to large numbers of people in the older-age group, but also reducing the proportion of younger people in a population will lead to an aging population (Ofori-Asenso et al, 2018). Considering the positive point of view, Population ageing is a human success story, a reason to celebrate the triumph of public health, medical advancements, and economic and social development over diseases, injuries and early deaths that have limited human life spans throughout history (United Nations, 2019: 3).

Population aging has been a prominent feature around the world, with increasing life expectancy and declining fertility rates, which gradually began in Europe in the first half of the nineteenth century and grew rapidly in the later years. In developed and developing countries, life expectancy has been 60 years and above, as well as nearly 70 years (Bhagat & Unisa, 2006). Indeed, continuous increase in life expectancy has generated a high possibility of an aging population (Véron, 2019: 4). Many countries of the world are grappling with the challenge of population aging (Gietel-Basten et al, 2020), fast aging and its consequences (Yuan & Gao, 2020), notably, in the developed world have been often argued to constitute a serious challenge for economic growth (Cuaresma et al, 2014). On a global scale, population ageing is unprecedented, pervasive, profound and enduring (O'Brien, 2016).

Population aging is recognized as an emerging social challenge in many parts of the world. Some clear evidence of population aging has been observed. For example, the share of the world's population over the age of 60 has increased from 5.1 percent in 1950

to 9.3 percent in 2020, and is projected to be 15.9 percent by 2050 (United Nations, 2019). World life expectancy has also risen from 47 years in 1950 to 72.3 years in 2020, and is expected to increase further to 76.8 years by 2050 (Ibid, 2020). Approximately two billion people will be 60 and older, and 400 million will be 80 or older (United Nations, 2013). This has led to high costs, especially in the healthcare sector. Social support, lack of jobs and social roles, living expenses, or especially staggering health and medical expenses, are some of the cases show the need to give serious consideration to this stratum of society (Mirzaie et al, 2017). Fortunately, the aging problem has drawn considerable attention from international communities (Li et al, 2019).

As individuals age, physical health usually decreases and functional limitations are observed (Østbye et al, 2010). According to Research, disability and long-term health care among older people result in increased cost of social services and medical care (Rahman et al, 2018). Furthermore, population aging and changes in age structure, requires extensive policies and development planning processes (Mai et al, 2013), desired policies are related to social benefits and insurance, as well as health care (Heffner et al, 2019).

Only a few decades ago, the major concern regarding world demography was its rapid growth and increasing pressure on the ecosystem and food security. While population growth will continue sharply in some developing countries, the population aging phenomenon will have profound impacts on various dimensions of society, and this aging trend will be intensified in the coming decades (Kudo et al, 2015: 941).

The average percentage of people over the age of 65 (older countries) in 57 countries of the Islamic world in 2005 was 8.1 percent, which increased to 9.5 percent in 2020. This small increase is due to the fact that the demographic transition in the countries of the Islamic world has started since 2005 and these countries still have a young

population structure. However, by 2050, most countries in the Islamic world are expected to go through the demographic transition and enter the threshold of aging. In this regard, since indicators such as total fertility and life expectancy are effective in connection with the possibility of population aging occurs in Islamic countries, this article has been intended to examine the trend of population aging and its effects.

Methodology

The type of applied research and its review method was "descriptive-analytical". The research data were extracted from the United Nations Population Database (United Nations, 2019), and were analyzed using Stata statistical methods. In this paper, raw data related to three indicators of life expectancy, total fertility and the percentage of people aged 65 and over in the population of 57 countries of the Islamic world were collected, coded and used separately from ten geographical regions during the years 1950 to 2020. In the present study, aging is calculated from the division of the population over 65 years to the population of 0-15 multiplied by 100 (Safarkhanlu & Rezaei Ghahroudy, 2017).

Also, the aging index was estimated by the ratio of people aged 65 and over to the total population (Shryock & Siegel, 1971). The Kaplan-Meier method was also used to analyze the trend of population aging in the Islamic world during 1950 to 2020, and the Cox regression estimation was exerted to predict the independent and dependent variable (ElHafeez et al, 2012; Byberg et al, 2009). The Nelson-Aalen method was applied to estimate the collective risk of population aging (Gavrilova & Gavrilov, 2014).

Research findings

Geographical distribution of aging trend in Islamic countries

The examination of changing trend in the age structure of 57 Islamic world countries in 10 geographical regions has shown that the average percentage of aging was 10.7 in

1950s. Of the 57 countries, 47 had a young population structure, and 10 were in the middle-aged population structure, as Table 1 shows, in the 1950s, no aging occurred in any Islamic world countries. In the same decade, the average total fertility rate in the young countries of the Islamic world was 5.3 and in the middle-aged countries, it was 6.7 children. The average life expectancy in the Islamic world countries was 41.7 years, which in the countries with a young and middle-aged population structure were 51.2 and 39.7 years, respectively.

In the 1970s, the average percentage of aging in Islamic countries moderately declined, meaning that on average about 3.5 percent of people in the Islamic world were over 65 years old, compared to 4.1 percent in 1950. In the aforementioned decade, among 57 countries, 55 had a young population structure and only two had a middle-aged population structure. In the 1990s, compared to the 1970s, there was no such change in the aging and the percentage of people over the age of 65. However, life expectancy had increased by about 10 years due to increased health and medical facilities, from 49.7 years to 59.5 years, while the fertility rate dropped dramatically from 6.6 to 5.6 children. In 2005, the first two countries in the Islamic world, Tunisia and Albania, entered the aging phase. In the same year, 45 countries had a young population structure and 10 had a middle-aged country. During this period, fertility declined significantly from 5.7 children in 1990 to 4.2 children in 2005. The average total fertility rate in the young, middle-aged and elderly countries of the Islamic world was 4.7, 2.3 and 2 children, respectively. Furthermore, the median age was 11.3 percent, with a population over the age of 65 that was 3.8 percent, which was 3.2 percent in young countries, 5.8 percent in middle-aged countries, and 8.1 percent in older countries.

The average life expectancy has increased significantly in all years, reaching 63.3 years in 2005. Turkey has also entered into aging since 2015. Therefore, the number of aging countries reached three, the middle-aged to 14 and the young to 40. The proportion of aging increased to 13 in 2015, with the percentage of people aged 65 and over reaching 4 percent, this figure had risen to 3 percent in 40 countries with a young population structure, and in 14 countries with a middle-aged population structure, it increased to 5.6 percent. Finally, in three older countries, it rose to 9.4 percent. In 2020, two countries, Malaysia and Lebanon, have been added to the list of oldest countries, three countries have been added to the middle-aged, and the number of young countries has been reduced to 35. The average age of 57 countries in the Islamic world was 15.5, while the average age of five countries was 44. These five countries account for about 7.1 percent of the Islamic world's population, while 93 percent of the Islamic world's population has a young population structure (Figure 1).

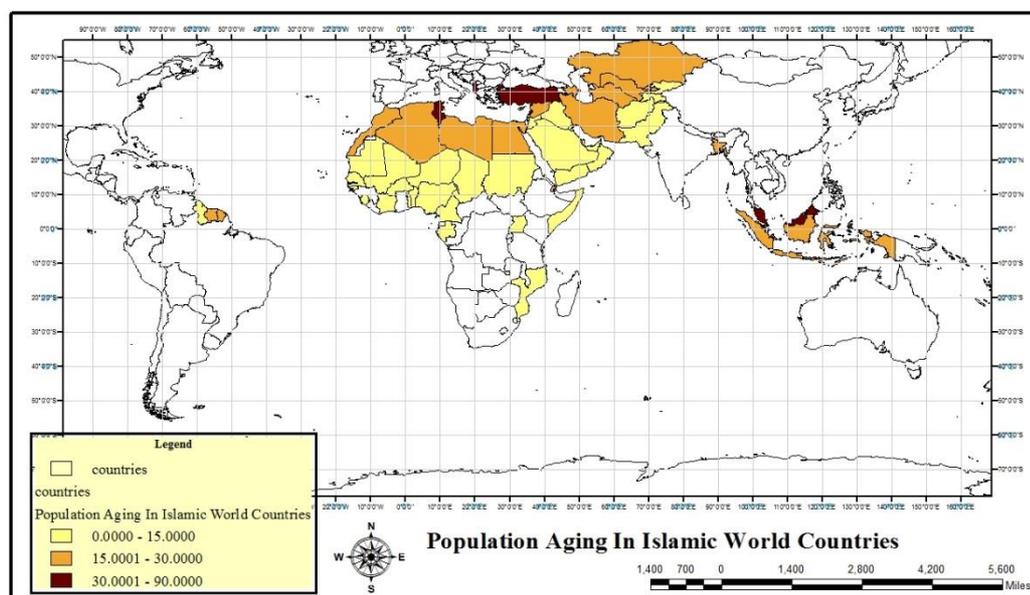


Figure 1. Aging in Islamic world countries

Table 1 shows that in 2020, the average population over the age of 65 was 3 percent in countries with a young population structure, 5.8 percent in middle-aged

countries, and 9.5 percent in older countries. The average total fertility rate has declined in most years, reaching 3.4 in 2020. Of course, this figure has been immensely varied in different countries, so that in young countries, it has decreased to 4.2 children, in middle-aged countries to 2.5 children and in older countries, it has declined to two children. The average life expectancy in the same decade was 68.5 years, which compared to the 1950s it has increased by 17 years.

Table 1. Average percentage of youth, middle age and population aging, total fertility rate and life expectancy in Islamic countries during 1950-2020

Year	1950	1970	1990	2000	2005	2010	2015	2020
Number of young countries	47	55	55	47	45	43	40	35
Number of middle-aged countries	10	2	2	10	10	13	14	17
Number of aging countries	0	0	0	0	2	2	3	5
Average percentage aged 65 years or over(young countries)	6.9	3.4	3.3	3.2	3.2	3	3	3
Average percentage aged 65 years or over(middle-aged countries)	3.5	5.2	5.7	5.9	5.8	5.6	5.6	5.8
Average percentage aged 65 years or over (aging countries)	0	0	0	0	8.1	9.1	9.4	9.5
Average total fertility rate (young countries)	5.3	6.7	5.7	5	4.7	4.5	4.3	4.2
Average total fertility rate (middle-aged countries)	6.7	5.8	3.1	2.6	2.3	2.3	2.4	2.5
Average total fertility rate (aging countries)	0	0	0	0	2	1.8	2	2
Average life expectancy (young countries)	51.2	50	59.1	60.5	61.5	62.8	64.2	65.3
Average life expectancy (middle-aged countries)	39.7	43	69.8	67.9	69.9	71.3	73	72.6
Average life expectancy (aging countries)	0	0	0	0	69.7	75.1	76.2	77.4

Source: UNDP, 2019

In all countries of the Islamic world, the rate of life expectancy has increased significantly, and this rate has become closer in these countries and has created a significant convergence. Therefore, it can be claimed that the demographic transition in the Islamic world countries has started since 2005. However, these countries still have a young population structure and it is predicted that by 2050, most countries in the Islamic world will go through a demographic transition and enter the threshold of aging.

Figure 2 illustrates that in 1950, the average age index in young countries was 8.6, which accounted for about 93.6 percent of the population of Islamic countries.

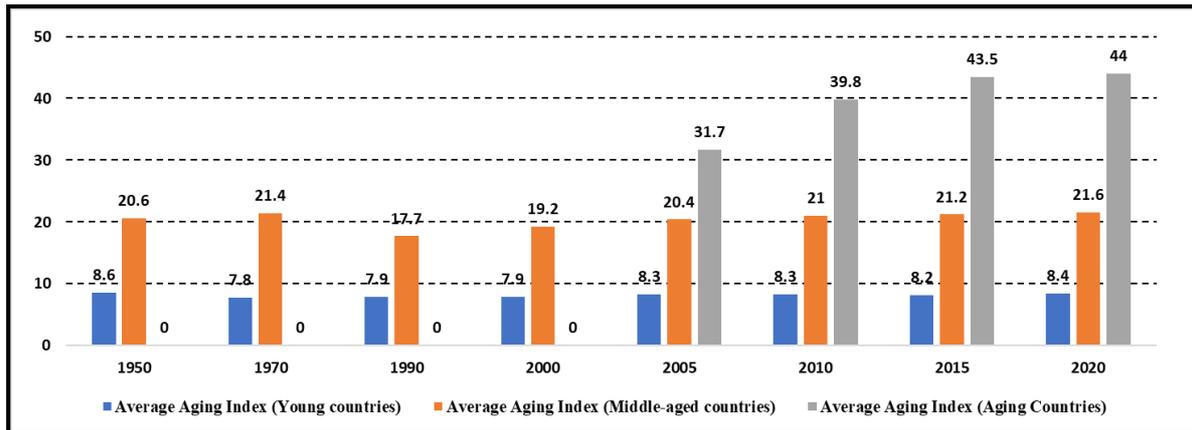


Figure 2. Average aging index with a breakdown of ternary demographic groups among Islamic countries
Source: UNDP, 2019

During the same period, 10 countries included Azerbaijan, Uzbekistan, Turkmenistan, Kyrgyzstan, Kazakhstan, Lebanon, Benin, Gabon, Albania and Suriname had a middle-aged population structure with an aging index of 20.6, which was about 6.4 percent of the population of Islamic countries. In 2005, for the first time, Albania and Kazakhstan experienced a demographic transition and entered the population aging, and with an average aging index of 31.7 percent, they made up about 1.3 percent of the population of Islamic countries. During the same period, 10 countries, including Azerbaijan, Indonesia, Kyrgyzstan, Iran, Lebanon, Algeria, Tunisia, Morocco, Turkey and Suriname, entered the middle-aged population with an average aging index of 20.4, which accounted for about 32.1 percent of the Islamic world's population. Although the number of middle-aged countries has not changed since 1950, their percentage has increased fivefold. In 2010, Kazakhstan pursued a policy of population growth and increased its fertility rate compared to the previous decade, moved out of aging as well as, and gave the way to Tunisia. Therefore, in 2010, Tunisia and Albania accounted for about 0.8 percent of the Islamic world's population at an aging index rate of 39.8 percent. Thirteen countries, including Azerbaijan, Uzbekistan, Indonesia, Kyrgyzstan, Kazakhstan, the Maldives, Malaysia, Iran, Lebanon, Algeria, Morocco, Turkey and Suriname have entered the middle age, which have constituted about 44.5 percent of the

population of Islamic countries. Since 2015, Turkey has been added to the list of aging countries. Generally, three countries with an age index of 43.5, accounted for about 6.8 percent of the population of 57 Islamic countries. During this period, 14 countries included Azerbaijan, Indonesia, Bangladesh, Kazakhstan, the Maldives, Malaysia, Iran, Lebanon, Egypt, Algeria, Brunei, Morocco, Suriname and Guyana accounted for approximately 43% of the world's population. During this period, the young population has been equal to the middle-aged and elderly population.

Finally, in 2020, Lebanon and Malaysia were added to the aging countries, and the number of aging countries has reached five. These countries, with an aging rate of 44, contain about 7.1 percent of the population. During the same period, 17 countries, including Azerbaijan, Uzbekistan, Indonesia, Bangladesh, Turkmenistan, Kazakhstan, Maldives, Iran, Syria, Egypt, Algeria, Brunei, Djibouti, Libya, Morocco, Suriname and Guyana, account for about 43.1 percent of the world's population. During this period, 0.2 percent of the young population was older than the elderly and middle-aged population. These figures show that 7.1 percent of the Islamic world's population has entered the demographic transition, and 43 percent of the population is on the verge of reaching the demographic transition. Although the number of young countries in the Islamic world is much higher than the elderly and middle-aged countries, the percentage of the middle-aged and elderly population is higher, due to the fact that the majority of the elderly and middle-aged countries are the most populous countries in the Islamic world.

Geographical distribution of aging trend in continental regions

As shown in Figure 3, the geographical analysis of the aging population of 57 Islamic countries in 10 geographical regions is relatively different. At the beginning of the study

period, in the 1950s, the average population aging index was as follows: 19.4 in 5 Central Asian countries (Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan and Kazakhstan), 17.9 in Southern Europe (Albanian country), 15.1 in 3 Central African countries (Chad, Cameroon and Gabon), 12.8 in 2 South American countries (Suriname and Guyana), 11.23 in 2 Southeast Asian countries (Malaysia and Indonesia), 10.5 in 15 West Asian countries (Azerbaijan, Jordan, United Arab Emirates, Iran, Bahrain, Syria, Iraq, Saudi Arabia, Oman, Palestine, Qatar, Kuwait, Lebanon, Yemen and Turkey), 9.3 in 6 North African countries (Tunisia, Sudan, Libya, Morocco, Algeria, Egypt), 9.2 in 4 countries of South Asia (Afghanistan, Bangladesh, Pakistan, Maldives), 8.3 in 13 West African countries (Ivory Coast, Senegal, Sierra Leone, Gambia, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Benin, Burkina Faso, Togo), and finally, it was 7.5 in six West African countries (Mozambique, Comoros, Somalia, Bruno, Djibouti and Uganda). It is noteworthy that during this period, 57 countries of the Islamic world have had a youth structure. Southern Europe was the first geographical region, which has entered the aging population since 2005.

Until 2020, no geographical area has reached the population aging stage, with the exception of Southern Europe. However, among the regions, four other countries have entered the aging. The aging difference in Southern European countries has increased in 2010 and 2015, so that in 2020, it reached 85.3, or about 12.9 times that of West Africa (average age 6.6), the youngest geographical area in the Islamic world. According to surveys, Central Africa with 12 times (average age 7.1), East Africa with 7.8 times (average age 11), South Asia with 6.1 times (average age 14.1), Central Asia with 5.12 times (average age 16.6), West Asia with 5.1 times (average age 16.7), North Africa with 4 times (average age 21.35), South America with 3.3 times (average age 26.1), and

Southeast Asia with 3.1 times (average age 27.4), are younger than the countries of Southern Europe.

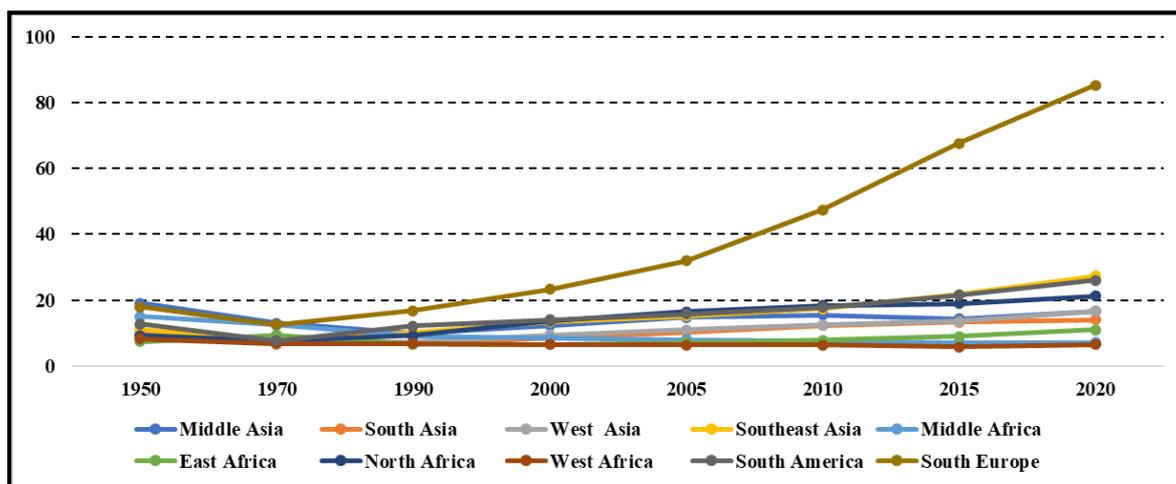


Figure 3. Aging among the countries of the Islamic world with a breakdown of geographical regions from 1950 to 2020

Source: UNDP, 2019

The trend of total fertility rate in Islamic countries

An investigation of the total fertility rate in the countries of the Islamic world shows that since the beginning of the study period to its end, the total fertility rate has dropped by almost half, meaning that it has fallen from 6.4 children to 3.4 in the 1950s. In the 1950s, the highest total fertility rate was in Yemen with 7.8 children and the lowest in Gabon with 4 children. In 2020, Niger with 6.95 children and the United Arab Emirates with 1.4 children had the highest and lowest rates, respectively. The fertility rate gap at the beginning and end of the study is 3.8 and 5.55 for children.

Figure 4 illustrates that the total fertility rate in countries with young, middle-aged, and elderly populations of the Islamic world has been declining from 1950 to 2020. In countries with lower fertility rates, the percentage of population aging is higher, and vice versa.

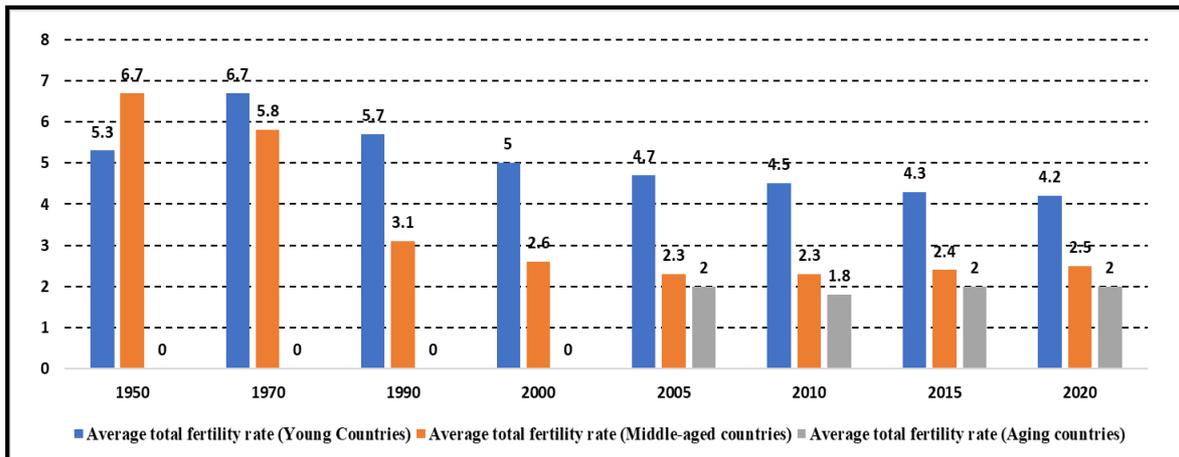


Figure 4. Average total fertility rate with a breakdown of ternary demographic groups among Islamic countries

Source: UNDP, 2019

As Figure 5 shows, the total fertility rate varies from different geographical areas in the Islamic world. The fertility rate gap in the ten geographic regions has risen from two children in 1950 to 3.5 children in 2020. However, from the beginning of the study period to the end, all geographical regions of the Islamic world, except Central Asia in the 1970s and Central Africa in the 1990s, shows a downward trend. On the one hand, the striking differences between 1950 and 2020, and on the other hand, declining trend in most regions, indicate that the overall fertility rate in the countries of the Islamic world is unbalanced. A survey into separate geographical regions of Islamic countries shows that in 2020, West Africa with 5.04, Central Africa with 4.8, East Africa with 4.2, South Asia with 3.01, North Africa with 2.95, West Asia with 2.52, South America with 2.45, Central Asia with 2.43, Southeast Asia with 2.2, and South Europe with 1.62 children, have the highest to the lowest total fertility rates. The difference between the geographical areas is 3.42 children. Thus, it can be concluded that the fertility rate in the countries of the Islamic world seems extremely unbalanced and divergent.

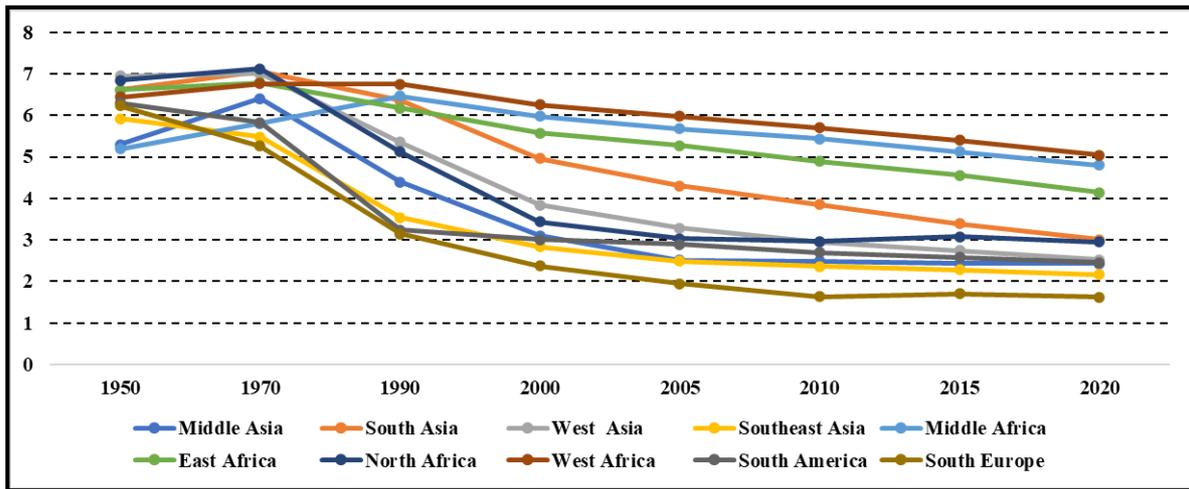


Figure 5. Total Fertility Rates among Islamic World Countries with a breakdown of geographical regions from 1950 to 2020

Source: UNDP, 2019

The trend of life expectancy in Islamic countries

Figure 6 reveals that the trend of increased life expectancy in different countries of the Islamic world has always been rising during 1950 to 2020. In 1950, the average life expectancy in countries with a young population structure was 51.2 years, and in 2020, it increased to 65.3 years, which indicates that it has increased by 14.1 years during the course of the review. This figure has risen from 39.7 years to 72.6 years in middle-aged countries in the same years, indicating an increase of 32.9 years.

In aging countries in 2005, life expectancy rose from 69.7 to 77.4 in 2020. The increased life expectancy rate in aging countries has been 7.7 years. The utmost increase in life expectancy belongs to countries with a middle-aged population structure. Although life expectancy has increased in all countries with different population structures, the life expectancy gap between aging and young countries is about 12.1 years. To sum up, it can be stated life expectancy in the three population structures has been unbalanced.

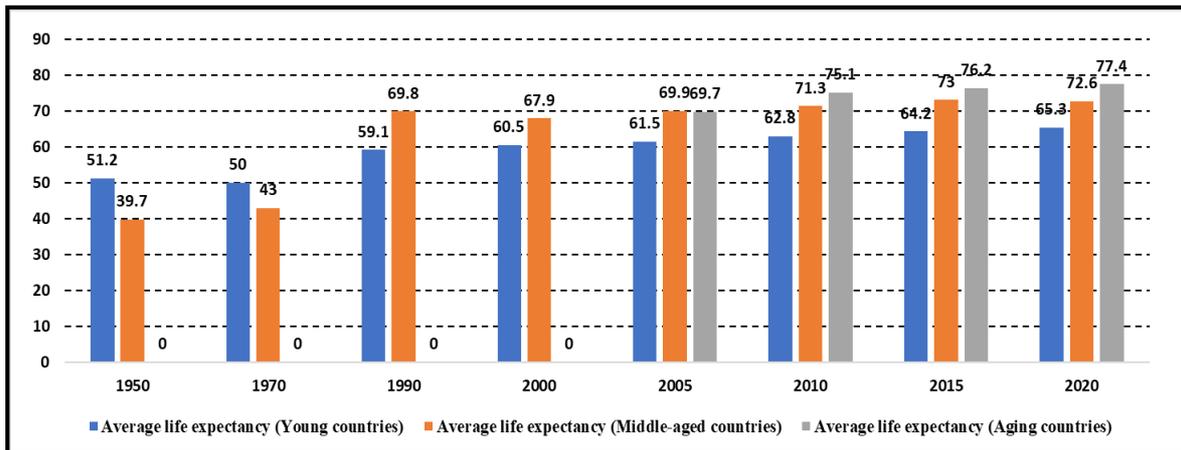


Figure 6. Average life expectancy with a breakdown of ternary demographic groups among Islamic countries

Source: UNDP, 2019

Geographical analysis of this variable has shown that in 1950, the highest life expectancy was related to South American countries with an average of 57.4 years and the lowest rate was belonged to West African countries with the amount of 32.9 years. The life expectancy gap between the 10 regions of the Islamic world has been 24.5 years. In 2020, the average life expectancy in different parts of the Islamic world is 78.4 in Southern Europe, 74.84 in Western Asia, 73.65 in Southeast Asia, 73.11 in North Africa, 71.5 in Central Asia, 70.6 in South America, 70.5 in Southern Asia, 64.3 in East Africa, 60.1 in West Africa, and 59.6 years in Central Africa. Although the gap between the two regions has narrowed since the beginning of the period, there is still a difference of 18.8 years. This indicates that life expectancy is unbalanced not only in countries with different demographic structures in the Islamic world, but also in different geographical areas (Figure 7).

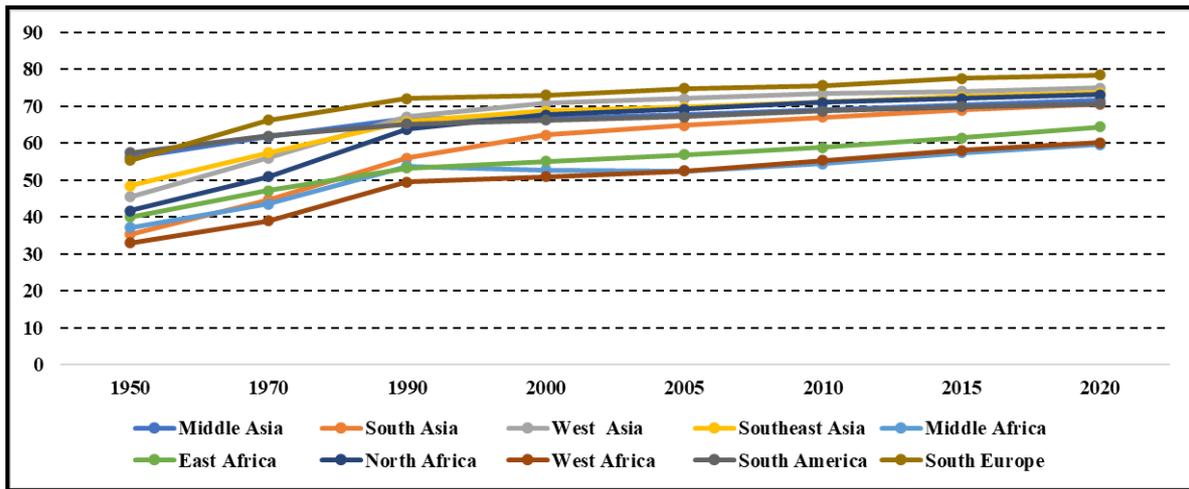


Figure 7. The trend of life expectancy among the countries of the Islamic world with a breakdown of geographical areas from 1950 to 2020
Source: UNDP, 2019

Discussion

This paper examined geographical analysis of population aging trend in the countries of the Islamic world during 7 decades. Discussion should be followed up by two statistical estimation methods. The plot drawn by Kaplan Meier (Figure 8) clearly shows the probability of aging in 10 regions of the Islamic world (the probability of survival in the sample after t_0 time). Whereas Southern Europe, the country of study, has been in aging since 2005, the chart for the Southern European region has moved from probability one to zero probability. Meanwhile, for Southeast Asian countries with a probability of more than 50 percent, the chart is complete, that is, the probability of survival for Asian countries is over 50 percent in 2020. For the North African region, which has been aging since 2015, the chart is complete from probability one to probability 75 percent. In West Asia, the two countries, Turkey and Lebanon, are aged in 2020, with an estimated 90 percent chance of survival (lack of population aging). In other areas, the probability of survival is 100 percent. This shows that, with the exception of five countries, the rest of the Islamic world has not yet entered aging, but with the current trend of life expectancy as well as declining total fertility rate, many of these countries are likely to enter old age in the coming years.

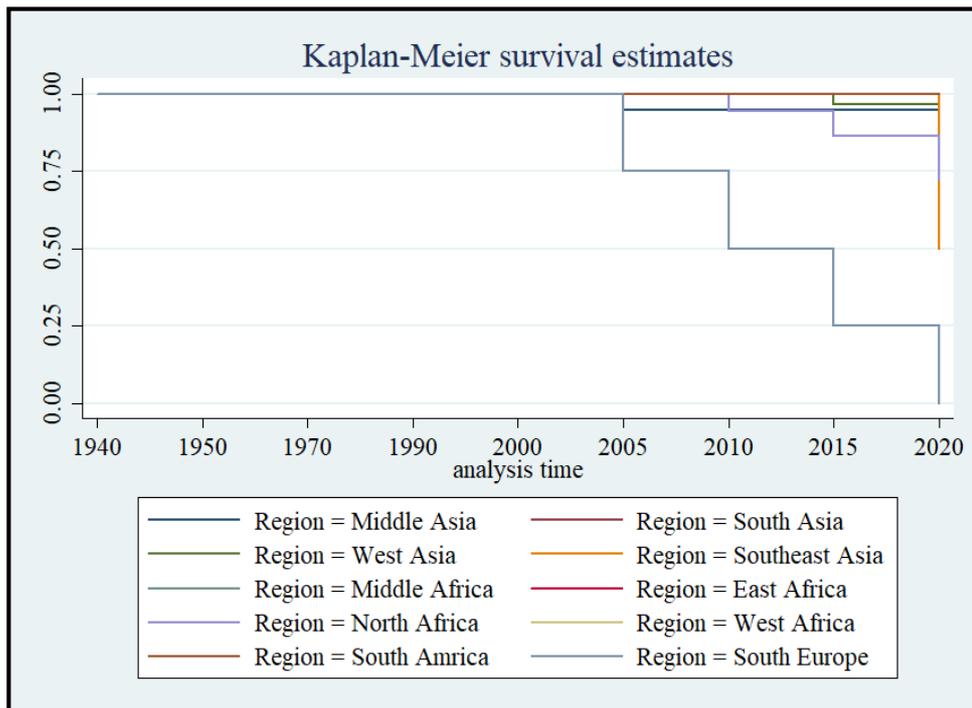


Figure 8. Population aging trend in the countries of the Islamic world during the years 1950 to 2020 using the Kaplan-Meier method
 Source: Authors' Calculations, 2020

The Nelson-Aalen cumulative hazard functions chart in 2020 (Figure 9) for ten regions of the Islamic world shows that in the Southern European region, cumulative hazard estimates has reached above two, due to the prevalence of aging. However, owing to the lower prevalence of this incident in Southeast Asia, estimation of cumulative hazard is 0.5 percent. It is less than 0.2 in North Africa and Southeast Asia. In other areas, it is zero due to the lack of aging prevalence. The Nelson-Aalen's estimate is the opposite of the Kaplan Meier's estimate. In this case, estimation of cumulative hazard is evaluated with the probability of the cumulative event occurrences. As we move forward, the probability of an aging event increases, and as a result, the value of this estimate changes from zero to one.

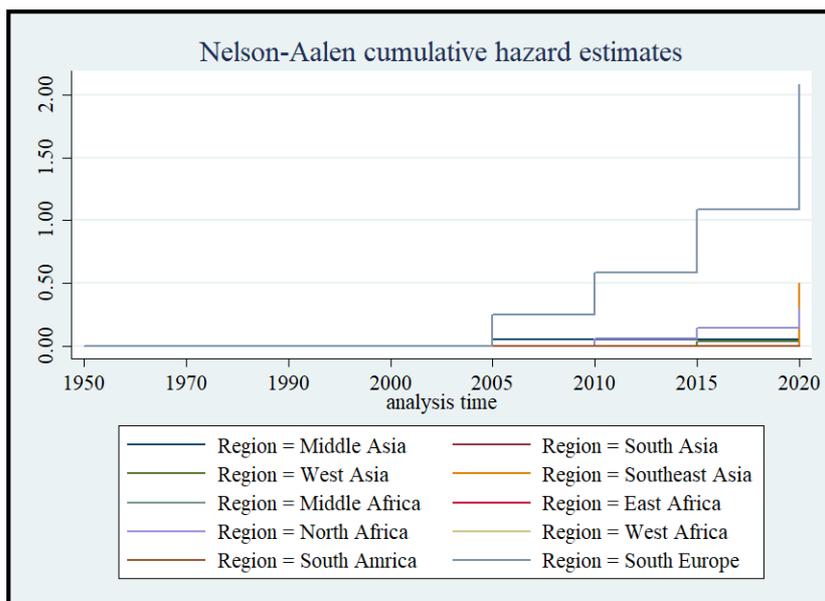


Figure 9. Estimation of the cumulative hazard of

population aging in the countries of the Islamic world during 1950-2020 using the Nelson-Aalen method
 Source: Authors' Calculations, 2020

Table 2 presents the coefficients obtained from Cox's estimation of the effect of total fertility rate and life expectancy on population aging for 57 Islamic countries. The independent variables in this model are the total fertility rate and life expectancy for 57 countries in the Islamic world, which were collected from 1950 to 2020. The variable is a function of the probability of aging, which is obtained by dividing the population over the age of 65 to the population under the age of 15 multiplied by 100. Based on the results obtained from Table 2, the relationship between the probability of an aging event and the total fertility rate is negative, and it has a positive relationship to life expectancy. Coefficient -1.49 for the total fertility variable indicates that, for each unit decrease in total fertility, the probability of aging increases by 1.49, and vice versa. Furthermore, based on the results of Table 1, for each unit increase in life expectancy, the probability of aging increases by 0.947 units. These values reveal that the total fertility rate has a greater impact on population aging trend than the effect on life expectancy.

Table 2. Coefficients related to the effect of total fertility rate and life expectancy on population aging based on Cox's estimation

Variable	Beta Coefficient	Standard Deviation	P
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Life expectancy	0.947	0.0094	0.000
Total fertility rate	1.49	0.115	0.000

Source: Authors' Calculations, 2020

Conclusion

A study of total fertility and life expectancy indicators in the analysis of aging in 57 countries of the Islamic world during the years 1950 to 2020 shows that the number of young countries has decreased from 82.4 percent in 1950 to 61.4 percent in 2020. This indicates that countries are moving towards middle age and aging. The number of aging countries has increased from two in 2005 to five in 2020. Accordingly, in 2005 Albania, in 2010 Tunisia and Albania with an aging index rate of 39.8, in 2015 Turkey, and finally in 2020 Lebanon and Malaysia will be added to the aged countries and the number of older countries reaches into 5. These countries, with an aging rate of 44 consist about 7.1 percent of the population. The main reason has been the decrease in the total fertility and the increase in life expectancy in these countries. Therefore, it can be opined that the demographic transition in the countries of the Islamic world has started since 2005, but these countries still have a young population structure and it is predicted that by 2050 most Islamic countries will go through demographic transition and enter the verge of aging. In this regard, the geographical analysis of the aging trend of the population for 57 Islamic world countries in 10 geographical regions is relatively different.

An examination of the total fertility rate in the Islamic world shows that the total fertility rate in countries with a young, middle-aged and elderly population structure has been declining from 1950 to 2020. In countries with low fertility rates, the aging population has increased, and vice versa. It should be noted that the geographical analysis of the general total fertility rate has been different in various geographical areas of the Islamic world, so that the fertility rate in the countries of the Islamic world is extremely unbalanced and divergent.

Studies have shown that the average life expectancy has increased by 17 years compared to the 1950s. In all the countries of the Islamic world, the life expectancy has increased significantly, and the life expectancy of these countries has become closer and has created a significant convergence. Life expectancy is highest in countries with a middle-aged population structure. Although life expectancy has increased in all countries with different demographic structures, the life expectancy gap between old and young countries is about 12.1 years. As a result, life expectancy in the three population structures has been unbalanced. The geographical study of this variable shows that the gap between the geographical areas has decreased compared to the beginning of the period, but there is still a difference of 18.8 years. This indicates that life expectancy is unbalanced not only in countries with different demographic structures in the Islamic world, but also in different geographical areas.

The interpretation of aforementioned Kaplan Meier's method shows that, except for five old countries of the Islamic world, the rest of the countries have not yet entered aging, but with the current trend of life expectancy and also the reduction of the total fertility, many of these countries are likely to enter aging in the coming years. In this regard, the Nelson-Aalen cumulative hazard functions chart clearly demonstrates the general concept that as we move forward, the probability of an aging event in these countries increases, because according to the coefficients obtained from Cox's estimation, the relationship between the probability of an aging event and the total fertility rate is negative, and it has a positive correlation with life expectancy. Considering the realm of the context, the coefficient of -1.49 for the total fertility variable clearly shows that for each unit decrease in total fertility rate, the probability of aging increases by 1.49, and vice versa.

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