

Estimation of Trends of Ageing Index of Iran from 1966 to 2016 and Prediction of these indices in 2026

Habib Allah Shahriyari

Shahrekord University of Medical Science

Morteza Sedehi

Shahrekord University of Medical Science

Soleiman Kheiri

Shahrekord University of Medical Science

Mohammad Javad Mohammadi

Ahvaz Jundishapur University of Medical Sciences: Ahvaz Jondishapour University of Medical Sciences

Masoud Amiri (✉ sahar.g.m1234@gmail.com)

Shahrekord University of Medical Science

Research article

Keywords: Health Indicators, Aging Index, Elderly, Trend, Prediction, Iran

Posted Date: February 17th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-243912/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: In the recent years, one of the most important issues of the demographic day that has attracted a lot of attention and will intensify is the aging population and the consequences of trend population growth. This study was aimed to estimate the Ageing Index (AI) of Iran from 1966 to 2016 and prediction of these indices in 2026.

Methods: This quantitative cross-sectional study included Ageing Index of Iran from 1966 to 2016 was investigated and then, using Minitab16 software and time series models, the prediction of these indicators for the next 10 years (2026) was studied. The library and documentary methods have been used to collect information and raw data from the General Population and Housing Census in 2016. The statistical population includes the total population of the elderly (65 years and above) of urban and rural areas of Iran.

Results: According to our findings, the index of aging will reach 6.36% in 1966 to 37.36% in 2016, and is expected to increase to 10.2% in 2026. The life expectancy of women and men in 2016 was 76.7 and 74.5, respectively, and expected to reach 78.3 and 76 years in 2026, respectively. The Human Development Index has risen from 52.0% in 1355 to 0.77% in 2016 and is expected to reach 80.8% by 2026. Based on result this study the evaluation of demographic indices such as sex ratio, the proportion, average annual growth rate, dependency ratio and ageing index for the Iranian elderly population at 2006 were 108,7.3%, 2.5%, 43.4% and 29, respectively.

Conclusion: According to the results, the aging indicator has a rising trend that requires proper planning for proper welfare. Based on trend population growth in the next decades Iran will going to experience an increasing proportion of elder population. Attention to needs and quality of life in elderly is very important because of improving living condition in this population could lead to improved quality of life. Also, policy makers should pay more attention to the health demands of the elderly.

Background

Aging is one of the important stage in human life. Nowadays world society regards that matter as an important problem (1). Although aging population is a positive result of development, many negative consequences may occur if policy makers are not prepared for the related changes (2). Nowadays, one of the most anxiety in the world is the incidence of non-communicable diseases (3). Considering the increasing population of the elderly in different societies, it is important to pay attention to their basic physical and mental needs and Quality of Life (QOL) (4). The process of optimizing opportunities for health, participation and security of the elderly in order to enhance their quality of life is define Active ageing (5, 6). Many developed countries demographic structure have become aged decades ago, and also some developing countries are on the verge of entering the aging population due to reduced mortality and fertility rates (7). Recent advances in medical and health sciences have dramatically increased the average life span of the community, on the other hand, the implementation of family

planning programs and, consequently, the reduction of fertility are two important factors in the occurrence of aging phenomena in societies (7). Along with them, the third factor in population changes, that is, immigration, can also contribute to aggravating or reducing the aging population trend (7, 8). The fundamental changes in the structure of individual and social life during old age and the lack of planning for this stage of life, the elderly and the community have faced a more problematic situation that requires a thorough assessment and evaluation. Elders have their own physiological, psychological and social needs that are due to aging. Most of the elderly, despite the confrontation with these limitations, are managing themselves very well and their capabilities are still widespread and, if placed in the right environment, they are able to maximize their capabilities (8). Nowadays, one of the countries in the world that undergoing a population transformation from a young age structure to an old age is Iran (8).

Measuring and monitoring health is one of the most important and basic principles of public health science. Moreover, in order to identify and measure the health problems of people that are becoming more complex every day, information and figures from different dimensions of health need to be collected and from they will be used at different stages of health planning and policymaking. The important thing is collecting information and indicators and then reviewing the trends of indicators. The review of the indicator process allows for a review of the health evaluation system and practices during specific times (1).

The purpose of this study was to assess of trends of ageing index of Iran from 1966 to 2016 and Prediction of these indices in 2026.

Methods

The present study is a study investigate the trends of ageing index of Iran from 1966 to 2016 and Prediction of these indices in 2026 and using the time series analysis. The study was carried out by three-source capture-recapture method using data obtained from three sources including statistical center, ministry of health and central bank. The total population of Iran registered by the three sources were enrolled in the study.

The time series analysis, using MINITAB ver. 16 statistical software packages were used in this ecological and retrospective study. As we mentioned, the time series data consist of the sequential data points taken at equal increments over the time.

According to some indicators, the total population of Iran during the years 1966 to 2016 is considered. The trend and changes in sex ratio, average annual growth rate, ageing index and dependency ratio of the elderly population by documentary method during the period 1966 to 2016 were assessment by using Iranchr('39')s Population and housing census data that collected by Statistical Centre of Iran. The search and literature from 1966 to 2016 based on various databases: Google Scholar, Science Direct, Web of Science, Springer, PubMed, NCBI and BMJ and prediction of ageing index of Iran in 2026. Also, with regard to we needed the country's health data annually for predict the ageing index in 2026, must use the valid registered information of the country that the Ministry of Health (MH), Central Bank (CB) and the

Iranian Statistics Center (Iranian SC). In addition, in this study we used to information the health, social and economic indicators for a large number of covered countries that extract by world health organization (WHO) and World Bank. First, the data from each source were separately entered into Excel (Office 2010), and then repeated cases of each source were identified and deleted.

Determine the ageing index of data over the time in a specific statistical model framework and compare through intended one to implement to make time series models in Iran, during 2026. Time series and case–crossover analyses are the most common methods which have been used to

estimate the different index and parameters (9, 10). There have been numerous community time series studies about the population index (11–13). Time series analysis is a useful tool for better understanding of cause and effect relationship population index (14). The main aim of time series analysis is to describe the movement history of a particular variable in time. Many authors have tried to detect changing behavior of indexes through time, using different techniques (15). Many others have tried to relate trend of population index through time series analysis (16, 17). Time series models have two advantages in compare with other methods such as regression and polynomial regression. Firstly, each value is a model about the past events or past stochastic terms (chocks), so interpretations and monitoring of air characteristics are so easy through these models. the second is forecasting or estimation of values in future; means to predict the future values based on the past values and stochastic structure governed on data.

Aging Index

the aging index as well as one of the main elderly index defined the growth of the elderly population refers to the number of people 60 years and older per 100 people less than 15 years old (18). Based on reported different study, the aging dependency ratio index has reached from 7.44% in 2007 to 8.06% in 2012, representing the increasing number of the elderly compared to the active population aged from 15 to 65 years (18, 19)

Description Of Study Area

Islamic Republic of Iran with 83 million inhabitants approximately, an area of 1,648,195 km², is the second largest country in the Middle East and the 17th largest in the world. Iran is located in in Western Asia. Tehran is the capital and largest city. Islamic Republic of Iran is to the north by the Caspian Sea and to the south by the Persian Gulf and the Gulf of Oman. Iran's neighbors are Armenia and Azerbaijan in the northwest, Turkmenistan in the northeast, Turkey and Iraq in the west, Afghanistan in the east and Pakistan in the southeast (20–23). Location of the Islamic Republic of Iran is presented in Fig. 1.

Data Gathering

The library and documentary methods have been used to collect information and raw data from the General Population and Housing Census in 2016. The statistical population includes the total population of the elderly (65 years and above) of urban and rural areas of Iran.

Ethical approval

Ethics License of the present study was acquired from the Shahrekord University of Medical Sciences (M.S of thesis No: 2603). According to the national guidelines, studies such as this do not require individual consent.

Results

The results indicated that the number of aged people in urban areas increased from 598,834 in 1966 to about 4,431,083 people in 2011 (Table 1). **Table 1** showed that the elderly population has become approximately 7.4-fold.

Based on result of figure 2 the elderly trend in Iran during 1966 to 2016 had many ups and downs and from 1996 to 1982 was a downward trend from 6.75 percent to 5.55 percent. Figure 2 indicates during 1982 to 1997, the trend was upward and The rate reached 6.99 percent, then during the years 1998, 1999 and 2000 had a short downward trend and decreased from 6.97 percent to 6.92 percent. Then, from 1997 to 2002, there was an upward trend and from 6.92 to 7.14 percent, for the years 2002 to 2011, a downward trend and from 7.14 to 6.94 percent, and for the years 2012 and 2013, an upward trend and It has reached 7.36 percent (**Figure 2**).

Table 2 presents the values of aging index in Iran during the years 2017 to 2026 with a 95% confidence interval. It is expected that the trend of this index in the Islamic Republic of Iran is upward and from the aging ratio of 7.62 percent in 2017 to the aging ratio, 10.2 percent for 2026. According to the result figure 3 and 4, in the Normal probability plot section, considering that most of the points are located along a straight line and in the Histogram diagram, it can be seen that the data are in a normal shape, so we can accept the assumption that the remainder is normal (Figure 3 and 4). The Versus fits diagram also shows that the residual variance is assumed to be constant, given that the diagram does not show a specific structure. The Versus order section also shows that this chart shows a purely random process with a mean of one and a constant variance (**Figure 3 and 4**).

Figure 5 shows that the population aging index has been gradually decreasing until 1986 and has reached below 8 this year. This trend has been mainly due to the decrease in child and infant mortality and in part to the increase in births, which has caused the annual growth rate of children and adolescents in this period to be higher than the growth rate of the elderly population. The trend has been reversed, and the population of Iran has not been young since the early 1980s, reaching about 50 in the early years of the next century, and it will take only 25 years for the 2050 aging index to reach around 170.

Discussion

In this study, we estimation of trends of Ageing Index of Iran from 1966 to 2016 and Prediction of these indices in 2026 by using the time series analysis. Table 1 showed that the ratio of the elderly in the rural areas is higher than in urban areas. The main reason for the higher proportion of elderly is the migration of the rural population to the urban areas and the migration of the young is far more than that of the elderly. According to the result figure 3 and 4, it can be concluded that the model used has a good fit with the data of the aging index in Iran. Figure 5 represents the middle of the 21st century, the country's elderly population will be 1.7 times that of children and adolescents

Increasing care needs for the elderly are an important concern in different countries, especially those with an aging population. It is important to understand the factors that influence the use of health services in the elderly for health policy making in identifying potential problems and developing appropriate interventions to improve their better utilization and increase access. With regard to one of the countries in the world is Iran, because of which might have an impact on their health related Quality of Life (QOL) consider older adults' needs is essential.

Movahed and Majidi studied active aging index (AAI) and related factors among aged people in Shiraz in 2018 (1). They reported that mean of AAI was 51.01 ± 15.2 (from 100). Social support was the most effective factor on AAI and then education, spiritual health, self-efficacy, mental health, age and income be effected respectively. Consequently, those factors explained over 70% of Active Aging variation (1).

In another study, Nikpour and Hasanakizadeh Analysis of Elderly Indices in Urban and Rural Areas of Iran (7). They showed that the proportion of the elderly population of the country has increased more than 1.5 times during the period from 1956 to 2016, and it is projected that the proportion of the elderly will reach from about 6 percent in 2016 to more than 20.4 percent in 2061, this will determine the need for planning to respond better to the growing needs of the growing elderly in Iran (7).

Davari et al in 2016, evaluation of health indices among the elderly in Isfahan (2). Result their study showed that 78.5% of the subjects had a chronic disease; 62.8%, 44.1%, and 43.6% sleep disorders, hypertension, and forgetfulness, respectively. With mean scores of 143.5 and 58 in healthy lifestyle and quality of life (QOL), respectively, men had a better health status compared with women (2).

Careful plans to deal with the problems of this elderly population (60 years and over) is vital and necessary with regards to increasing of this age group growth compared to that of total population during the coming decades (8).

Therefore, in order to deal with the elderly population, the policy should be accompanied by the increase in the number of births and fertility that is currently desirable for policy makers in the country, consideration should be given to issues such as policies to realize population profits, increase labor productivity, reform of retirement rules and flexibility at retirement age and increase the rates of economic participation, in particular the rates of economic participation of women and the elderly. The results of the present study, like the above studies, show that the trend of population aging after 1982 is an upward trend and is consistent with other studies. This has been confirmed in the explanations provided above.

Findings of this study, the aging population index until 1982 is a downward trend and then fertility and mortality decreased from high to low levels and consequently the phenomenon of aging occurred in the population of Iran and the number of elderly increased year by year.

Conclusions

Iranian older people, particularly women, are experiencing relatively inactive lives. The prediction results of this study for the years 2016 to 2026 also show an increase in the elderly population, which is expected to reach 10.2% of the population in 2026.

Considering the high rate of population aging in Iran, providing a safe environment for an active life for the elderly, particularly for the groups found to have a less active life, is a top priority. Iran population is increasing rapidly. We have to work on this problem more and more. Attention to social support, education and awareness can be very effective in this situation.

Abbreviations

AI
Ageing Index
MH
Ministry of Health
CB
Central Bank
Iranian SC
Iranian Statistics Center
WHO
World Health Organization
QOL
Quality of Life
AAI
Active Aging Index

Declarations

Ethics approval and consent to participate

Considering the fact that the data collection method was observation and there were no human participants in the current study, obtaining informed consent is deemed unnecessary according to regulations; the Ethics License of the present study was acquired from the Shahrekord University of Medical Sciences (M.S of thesis No: 2603). According to the national guidelines, studies such as this do not require individual consent.

Consent for publication

Not applicable.

Availability of data and materials

Upon request, we can offer onsite access to external researchers to the data analyzed at Shahrekord University of Medical Sciences, Shahrekord, Iran. To do so, Dr. Masoud Amiri should be contacted.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was financially supported by grant: (Grant No: 2603) from Shahrekord University of Medical Sciences.

Authors' Contributions

HA-SH, MS and M-JM were principal investigators of the study and drafted the manuscript. HA-SH, MS, SK and MA were advisors of the study. HA-SH and MA performed the statistical analysis. All authors contributed to the design and data analysis and assisted in the preparation of the final version of the manuscript. All authors read and approved the final version of the manuscript.

Acknowledgments

We appreciate all the observers who helped us to conduct this project.

References

1. movahed m, majidi m. Active Aging Index and Related Factors Among Aged People in Shiraz in 1397. *Journal of Fasa University of Medical Sciences*. 2019;9(4):1819-28.
2. Davari S, Aghdak P, Babak A. Evaluation of Health Indices among the Elderly in Isfahan Province, Iran, during 2012–2014. *Journal of Health System Research*. 2016;12(3):329–34.
3. WHO. Global Status Report on noncommunicable diseases 2014. 2014:vii.
4. Kazemi N, Sajjadi H, Bahrami G. Quality of Life in Iranian Elderly. *Salmand: Iranian Journal of Ageing*. 2019;13(5):518–33. doi:10.32598/SIJA.13.Special-Issue.518.
5. Tajvar M, Yaseri M, Mahmoudi R, Karami B. Active Aging Index and Its Individual Determinants in Tehran, Iran. *Journal of School of Public Health Institute of Public Health Research*. 2020;18(2):139–58.
6. Rajabi M, Jahanshiri S, Movahhed BK, Hosein Rezaei hoseinabadi, Mostafa hoseini shafiabadi, Afshan Mohammad Qashqaei, et al. Quality of life in and its correlates in elderly in Tehran, Iran.

- Health Monitor Journal of the Iranian Institute for Health Sciences Research*. 2017;**16**(4):531 – 41.
7. Nikpour A, Hasanakizadeh M. Spatial Analysis of Elderly Indices in Urban and Rural Areas of Iran. *Human Geography Research*. 2020;**52**(3):921–37. doi:10.22059/jhgr.2019.256357.1007696.
 8. Mirzaei M, Shams Ghahfarokhi M. Demography of Elder Population in Iran Over the Period 1956 To 2006. *Salmand: Iranian Journal of Ageing*. 2007;**2**(3):326–31.
 9. Fung KY, Krewski D, Chen Y, Burnett R, Cakmak S. Comparison of time series and case-crossover analyses of air pollution and hospital admission data. *Int J Epidemiol*. 2003;**32**(6):1064–70. doi:10.1093/ije/dyg246.
 10. Schwartz J. The effects of particulate air pollution on daily deaths: a multi-city case crossover analysis. *Occup Environ Med*. 2004;**61**(12):956–61.
 11. Dominici F, McDermott A, Zeger SL, Samet JM. On the Use of Generalized Additive Models in Time-Series Studies of Air Pollution and Health. *Am J Epidemiol*. 2002;**156**(3):193–203. doi:10.1093/aje/kwf062.
 12. Schwartz J, Zanobetti A. Using Meta-Smoothing to Estimate Dose-Response Trends across Multiple Studies, with Application to Air Pollution and Daily Death. *Epidemiology*. 2000;**11**(6):666–72.
 13. Smith RL. Extreme value analysis of environmental time series: an application to trend detection in ground-level ozone. *Statistical Science*. 1989:367–77.
 14. MARCUS A. MORTALITY AND AIR POLLUTION J LONDON: SCHWARTZJ. A TIME SERIES ANALYSIS. *Am J Epidemiol*. 1990;**131**(1):185–94.
 15. Hies T, Treffeisen R, Sebald L, Reimer E. Spectral analysis of air pollutants. Part 1: elemental carbon time series. *Atmos Environ*. 2000;**34**(21):3495–502.
 16. Gouveia N, Fletcher T. Time series analysis of air pollution and mortality: effects by cause, age and socioeconomic status. *J Epidemiol Community Health*. 2000;**54**(10):750–5. doi:10.1136/jech.54.10.750.
 17. Saffarinia G, Odat S. Time Series Analysis of Air Pollution in Al-Hashimeya Town Zarqa, Jordan. *Jordan Journal of Earth Environmental Sciences*. 2008;**1**(2):63–72.
 18. Afshar PF, Asgari P, Shiri M, Bahramnezhad F. A review of the Iran's elderly status according to the census records. *Galen Medical Journal*. 2016;**5**(1):1–6.
 19. Mirfallah Nassiri N. Demographic Determinants of Population Ageing and Related Indicators in Iran. *Iranian Journal of Official Statistics Studies*. 2008;**18**(2):1–14.
 20. Hiro D *Neighbors, not friends: Iraq and Iran after the Gulf Wars*. Routledge; 2003.
 21. Lamberg-Karlovsky CC. Iran and its neighbors. *The Sumerian World Routledge London-New York*. 2013:559–79.
 22. Kamrava M Iran and its Persian Gulf neighbors. *Iranian Foreign Policy Since 2001*: Routledge; 2013. p. 118 – 33.
 23. RadFard M, Biglari H, Soleimani H, Akbari H, Akbari H, Faraji H, et al. Microbiological dataset of rural drinking water supplies in Zahedan, Iran. *Data in brief*. 2018;**20**:609–13.

Tables

Table 1: Country in Terms of Population Aged 60 and Over in the Years 1966 to 2011

Explanation	Total population					
	1966	1976	1986	1996	2006	2011
Urban	598834	791126	1388361	2254211	3279937	4431083
Rural	1039198	979488	1297989	1723916	18441106	1774915
Total	1638022	1771614	2686350	2978127	5121043	6205998
Source: Statistical center of Iran (Statistical Centre of Iran 2012) (18)						

Table 2: Prediction of elderly in Iran

Year	Prediction of Index	Low limit (95% confidence)	High limit (95% confidence)
2017	7.62	7.53	7.72
2018	7.91	7.75	8.07
2019	8.20	7.96	8.43
2020	8.48	8.17	8.79
2021	8.77	8.39	9.15
2022	9.05	8.60	9.51
2023	9.34	8.81	9.87
2024	9.63	9.02	10.23
2025	9.91	9.24	10.59
2026	10.20	9.45	10.95

Figures

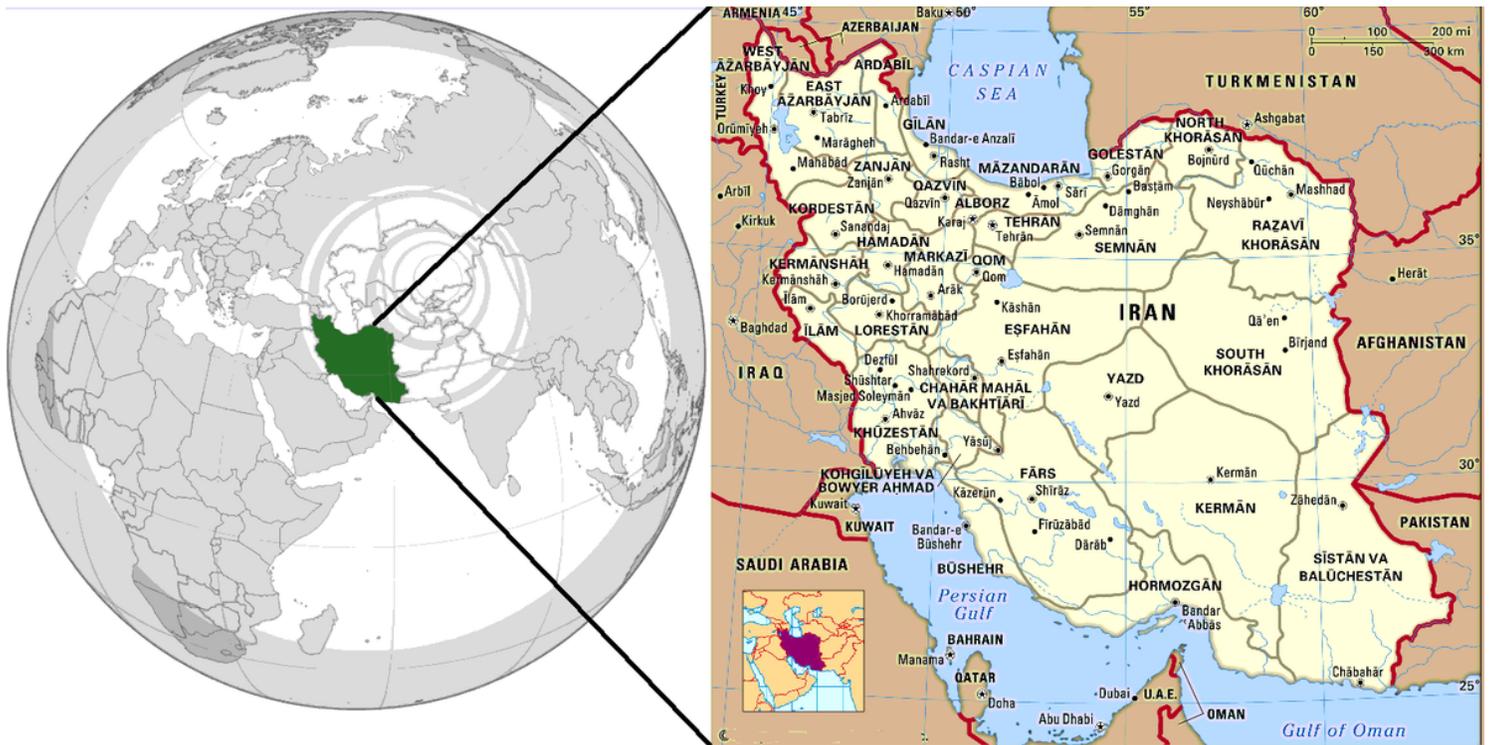


Figure 1

Geographical map of the site study (Islamic Republic of Iran) Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

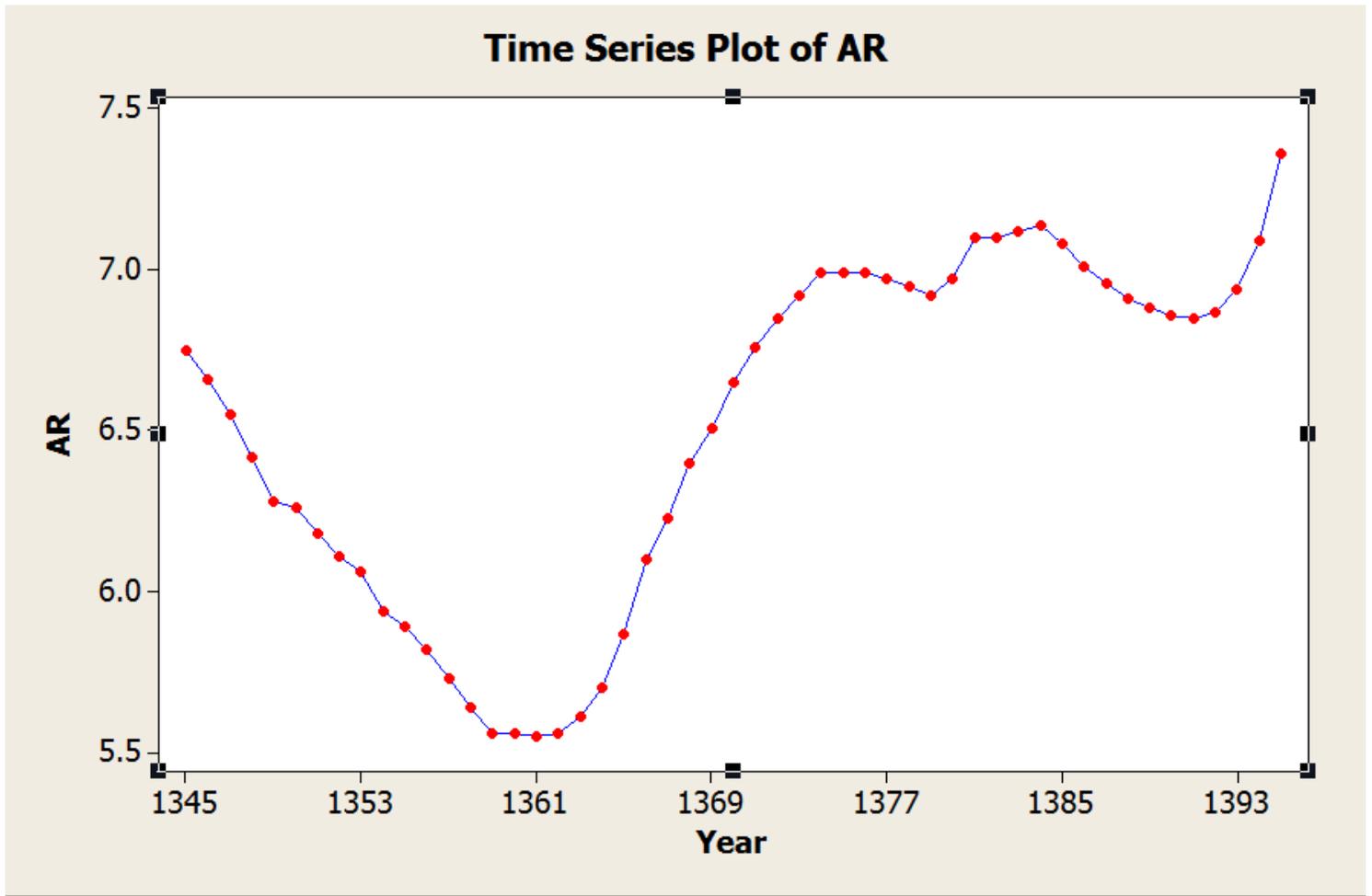


Figure 2

Time series of elderly of Iran during the years 1996 to 2016

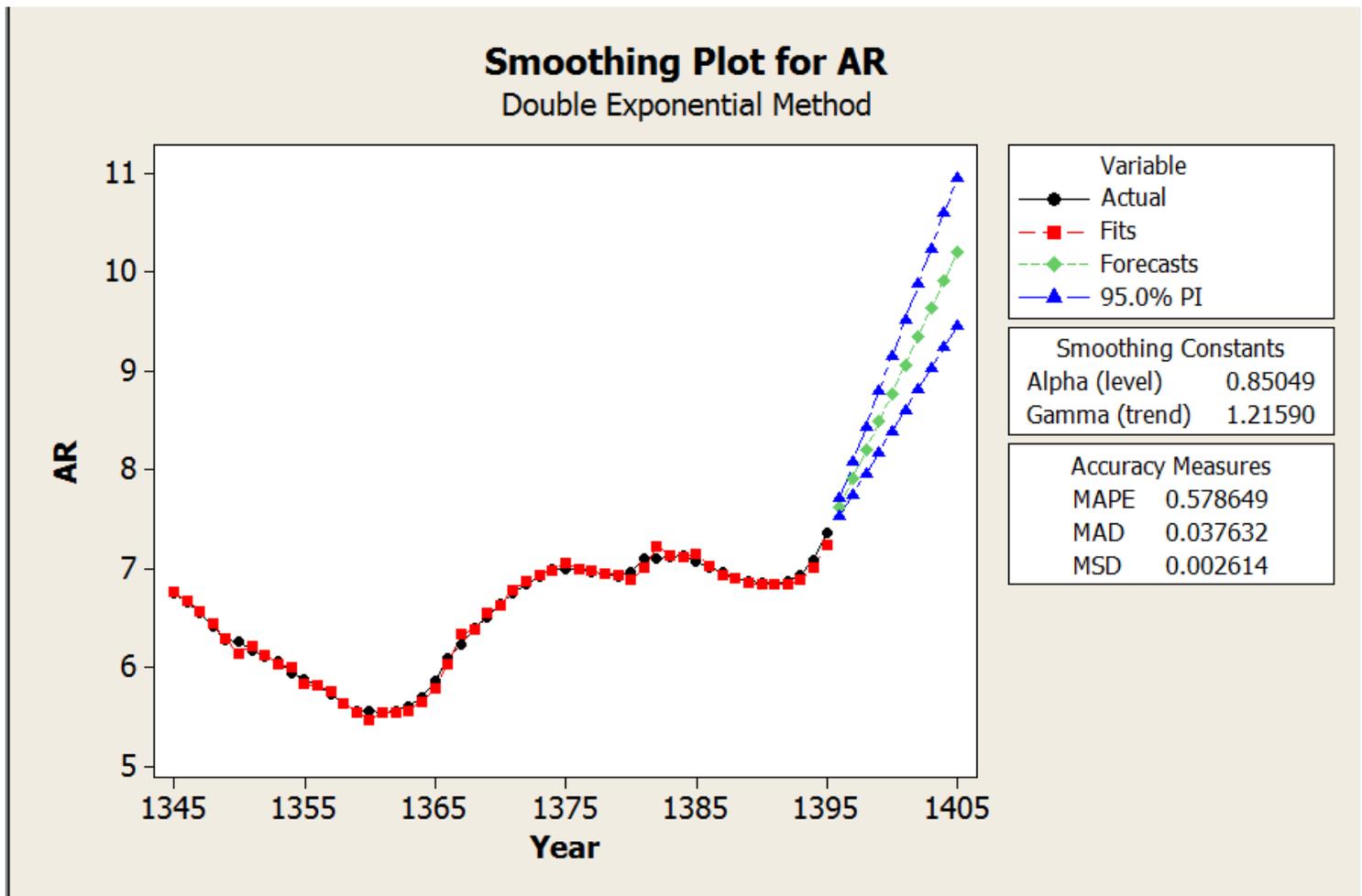


Figure 3

Scheduled prediction of ageing index of Iran during the years 1996 to 2026

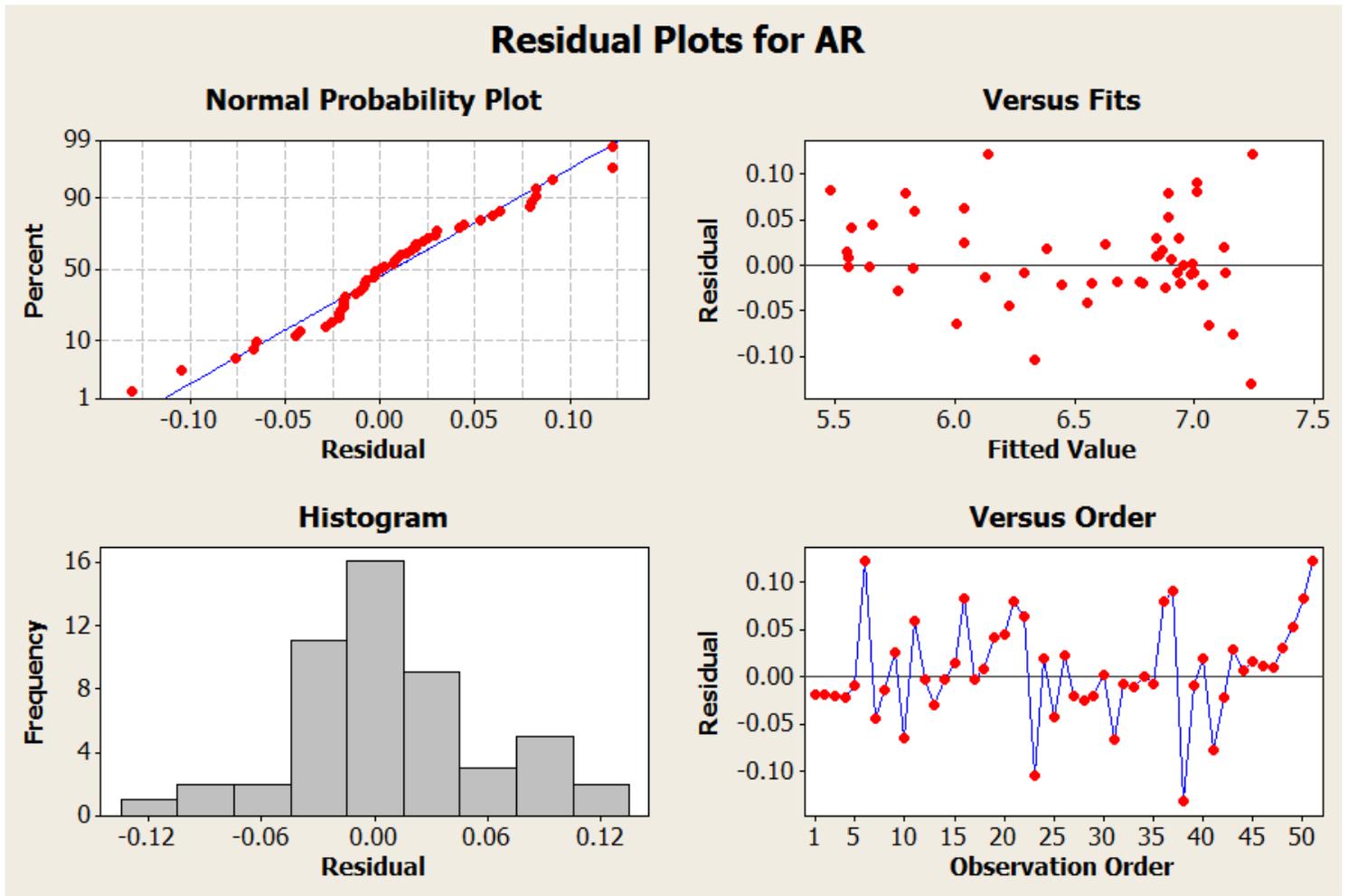


Figure 4

Evaluation of the goodness of fit of the aging index model

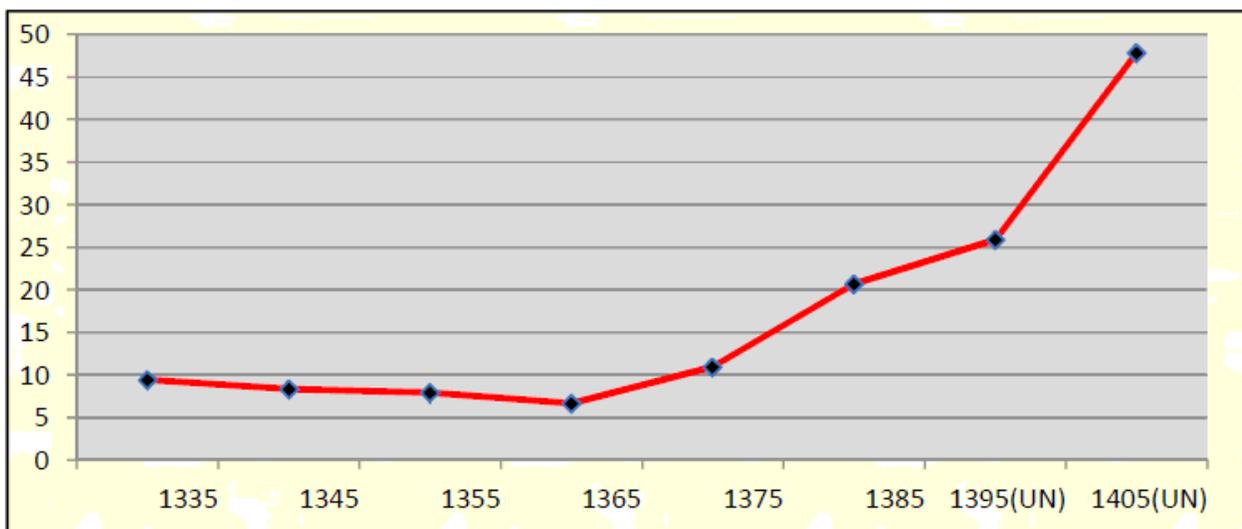


Figure 5

The trend of changes in the aging index during the censuses and estimates until 2026