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Research Article

Future Population Scenario In India And China – An Econometric Approach

Dr. S. Chandra Chud[1*], Dr. S. Saravanan[2], Dr.A.Vinayagam[3]

[1*]Professor & Head, Department of Economics, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai-600 117.
[2]Assistant Professor, Department of Economics, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai-600 117.
[3]Assistant Professor, Department of Economics, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai-600 117.

***Corresponding Author:** Dr. S. Chandra Chud
*Professor & Head, Department of Economics, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai-600 117.

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ARTICLE INFO	ABSTRACT

A population model is a type of mathematical model that is applied to the study of population dynamics. Modelsallow a better understanding of how complex interactions and processes work. Modeling of dynamic interactions in nature can provide a manageable way of understanding how numbers change over time or in relation to each other. Many, if not all, of Earth's processes affect human life. The Earth's processes are greatly stochastic and seem chaotic to the naked eye. However, a plethora of patterns can be noticed and are brought forth by using population modeling as a tool. There are various methods to develop a population model. A simple exponential model gives sufficient approximation in estimation of population but does not defines a saturation point. Hence the population estimated increases exponentially without any upper limit giving an unrealistic figure for longer time period. This is because it does not considers the environmental factors and hence suitable for very short period of time. Logistic model tells that the population growth rate decreases as the population reaches the carrying capacity or saturation point of the environment.

Keywords: Population, Projection, Forecasting and Rural and Urban

Introduction

A population model is a type of mathematical model that is applied to the study of population dynamics. Modelsallow a better understanding of how complex interactions and processes work. Modeling of dynamic interactions in nature can provide a manageable way of understanding how numbers change over time or in relation to each other. Many, if not all, of Earth's processes affect human life. The Earth's processes are greatly stochastic and seem chaotic to the naked eye. However, a plethora of patterns can be noticed and are brought forth by using population modeling as a tool. There are various methods to develop a population model. A simple exponential model gives sufficient approximation in estimation of population but does not defines a saturation point. Hence the population estimated increases exponentially without any upper limit giving an unrealistic figure for longer time period. This is because it does not considers the environmental factors and hence suitable for very short period of time. Logistic model tells that the population growth rate decreases as the population reaches the carrying capacity or saturation point of the environment. The logistic model is more accurate than the exponential model. Much work has been done to further develop these models so as to predict population growth accurately. In this paper we propose to estimate the country's population for the years 2000 and onwards till 2050.

Objectives of the study

1. To study the growth of population in India and China.
2. To experiment the forecasting analysis for population in India and china.
3. To give the expectation picture of population trend and challenges in India and China

Forecasting method

Stochastic population forecasts are calculated by using cohort-component bookkeeping under a linear (Leslie) growth model, with a deterministic jump-off population and probabilistically varying values for age-specific fertility, age-sex-specific mortality, and net migration flows by sex and age. The scaled model for error was applied to specify uncertainty (Alho and Spencer 2005: 280-283). It assumes that the demographic rate for age j at forecast year t (t>0) can be expressed as follows:
R(j,t) = F(j,t) exp(X (j,t)) , ...(1)
where F(j,t) is the point forecast and X(j,t) is the error process which is modeled by a random walk with a drift (in t). The error process is of the form
X (j,t) = ε (j)1, + ...+ ε (,tj , where the error increments are given by
(j,t) S(j,t)((j ,t)) ε = η j + δ . ...(2)
Here, S(j,t) is always positive and can be seen as a weight or scale on the error term ε (j,t). If an appropriate S(j,t) is chosen, a random walk with a drift will replicate the errors in the future well. η j represents the error in the forecasted trends, and) δ (,tj describes the random fluctuations around these trends. It is assumed that for each j, the variables) δ (,tj are independent over time. Additionally, the variables) δ (,tj are assumed independent of the variablesη j with both following a normal distribution: ( ) ~ ,0( )j η j N k ; (,) ~ 1,0( )j δ tj N − k , where 0 < k j < 1 are known. In addition, autoregressive (AR(1)) correlation structures on η j and) δ (,tj across age (fertility and mortality) and sex (mortality and net migration) are assumed: | | (( ), ( )) (,( ), (,)) i j Corri j Corrtitj − η η = δ δ = ρ for some 1 0 ≤ ρ ≤ . Since the increments are scaled by the S(j,t), the model is called the scaled model for error. The function of the correlation parameters in terms of age is to represent the phenomenon that forecast errors of vital rates in close ages tend to be similar, but in distant ages they may be quite different.

Normally in time series data successive values trend to be fairly close. Modeling of such behavior is called Auto- regression. The simplest Auto- regressive scheme is AR (1).

$Y_t = \infty + \beta Y_{t-1} + \varepsilon_t$

The Pthorder scheme, denoted by AR (p), may be written as

$Y_t = \infty + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + ... + \beta_p Y_{t-p} + \varepsilon_t$
Where,
∞ = the constant term
β = the (auto) regressive co- efficient
ε_t = the error term
the properties of ε t are ε t given as:
$E(\varepsilon_t) = 0$,
$Var(\varepsilon_t) = \sigma^2$
$Cov(\varepsilon_t, \varepsilon_{t-k}) = 0, K \neq 0$
$Cov(\varepsilon_t, Y_{t-k}) = 0, K > 0$

The condition that $Cov(\varepsilon_t, Y_{t-k}) = 0, K< 0$
States that the new error is independent of past values of the process.

Moving Average Schemes

The moving average scheme is adopted to model the persistence of random effects over time. Independent from the AR process, each element in the series can be influenced by the past error (or random shock) that cannot be accounted for by the AR components. The model and be written as:
$Y_t = \mu + \varepsilon - \Theta \varepsilon_{t-1}$
Where, the term ε_{t-1} reflects the carry over from one period to the next. This is explained to mean that each observation is made up of a random error part (random shock, ε_{t}) and a linear combination of prior random shocks. The above model represents a first order moving average scheme MA (1). The general q th order moving average schemes, that is, MA (q) may be given as
$Y_t = \mu + \varepsilon - \Theta\varepsilon_{t-1} - .... - \Theta_q\varepsilon_{t-q}$
In a pure MA process, a variable is expressed in terms of the current and previous white noise disturbances.
Where, $E(Y t) = \mu$ since $E(\varepsilon_t) = 0$ and
$Var(Y t) = E(Y t - \mu)^2$
$= \sigma^2 (1 + \Theta_1{}^{2+} \Theta_2{}^{2+} ......+ \Theta_q{}^2)$

ARMA and ARIMA Schemes

The model combining AR (p) and MA (q) components is called ARMA (p, q) schemes and it is expressed as
$Y_t = \infty + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + ...+ \beta_p + Y_{t-p} + \varepsilon_{t-} \Theta_1\varepsilon_{t-1} -...- \Theta_q \varepsilon_{t-q}$

In order to make the given series a stationary one, the differencing technique is necessarily applied. For any series on 'y' the first differencing components is given as $(Y_t\ Y_{t-1})$ and the second differencing components is given as $(Y_t - 2Yt_{-1} + Y_{t-2})$. The second difference of any series is analogues to a second derivative of a continuous function. it measures the " acceleration" or "curvature" of the given function at a given point of time. in this process, for d^{th}order of differencing if the new series is w_t, w_{t-1},
w_{t-2}... w_{t-p}., then the ARIMA (p, d, q) model is given as:
$W_t = \infty^* + \beta^*_1 W_{t-1} + \beta^*_2 W_{t-2} + \ldots + \beta^*_p W_{t-p} + \varepsilon_t - \Theta^*_1 \varepsilon_{t-1} - \ldots - \Theta^*_q \varepsilon_{t-q}$
various dimensions of AR, MA and ARIMA models are tried for forecasting the population in India and China the selection of best fitted model is carried out based on the value of standard error of the model and the significance of the individual co- efficients.

TABLE.1 GROWTH OF POPULATION IN INDIA AND CHINA (in million)

Year	India's Population	Annual Growth	China's Population	Annual Growth
2008	1019	-	1267.4	-
2009	1040	2.06	1276.3	0.70
2010	1056	1.53	1284.5	0.64
2011	1072	1.51	1292.3	0.60
2012	1089	1.58	1299.9	0.58
2013	1106	1.56	1307.6	0.59
2014	1122	1.44	1314.5	0.52
2015	1138	1.42	1321.3	0.51
2016	1154	1.40	1328.0	0.50
2017	1170	1.38	1334.5	0.48
2018	1186	1.36	1340.9	0.47
2019	1220	2.86	1347.4	0.48
2020	1235	1.22	1354.0	0.48
2021	1251	1.29	1360.7	0.49
2022	1267	1.27	1367.8	0.52
2023	1283	1.26	1374.6	0.49

Source: Key indicators of Asia and Pacific,2024

DIAGRAM.1
FORECASTING POPULATION IN INDIA

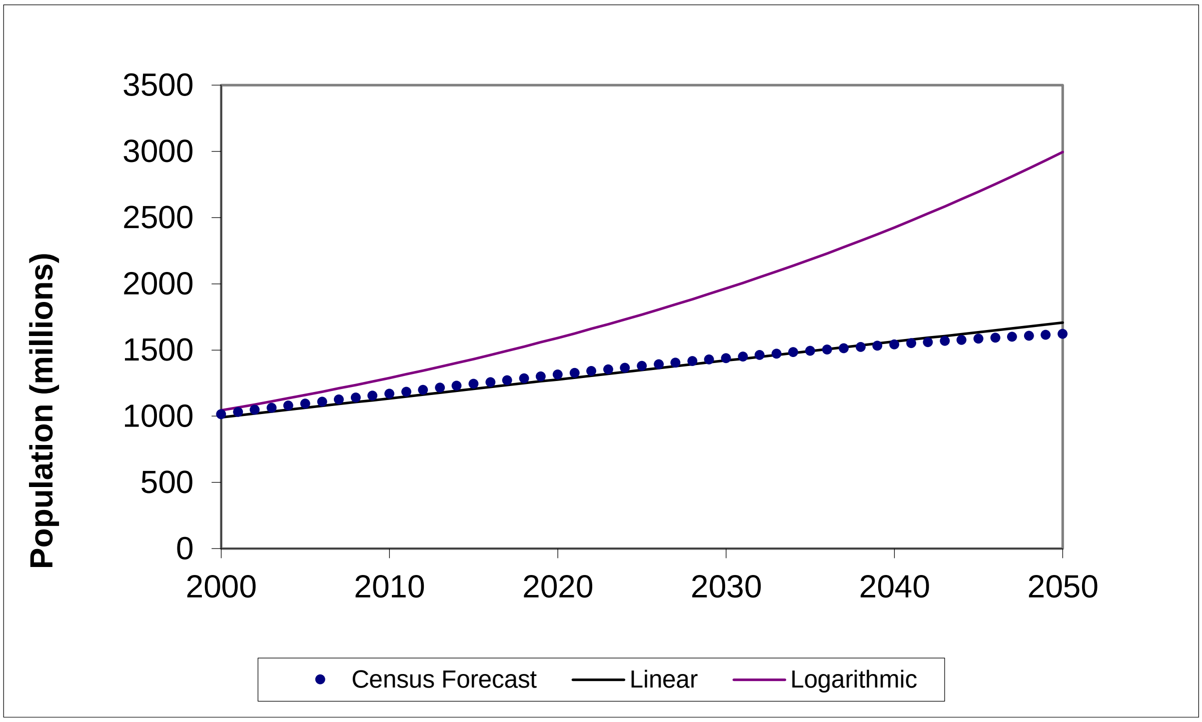

DIAGRAM.2
FORECASTING POPULATION IN CHINA

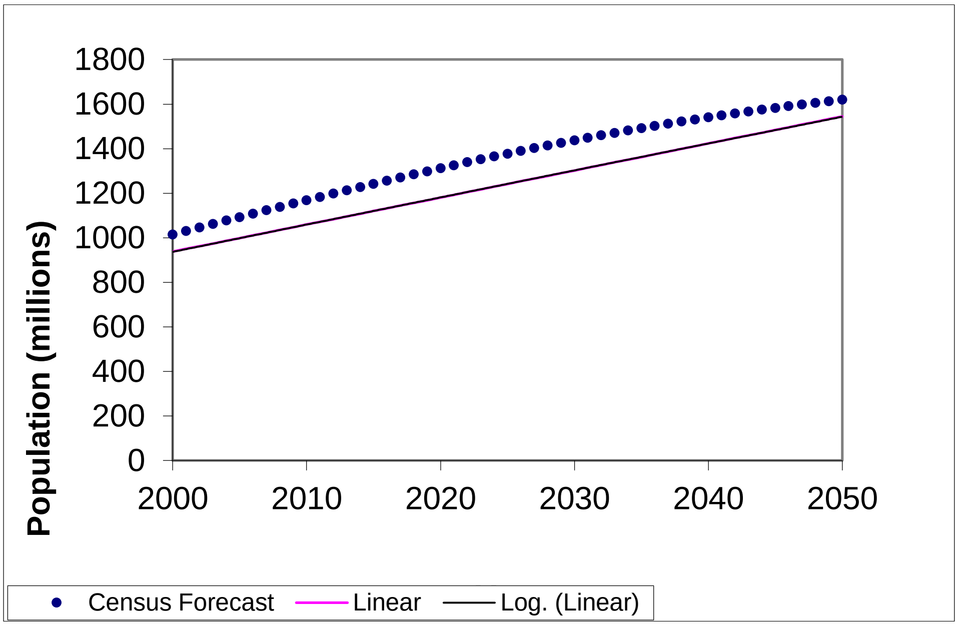

TABLE.2 DENSITY OF POPULATION IN INDIA AND CHINA

Year	India's Population	Annual Growth	China's Population	Annual Growth
2008	309	-	132	-
2009	314	1.61	133	0.75
2010	320	1.91	134	0.75
2011	325	1.56	135	0.74
2012	330	1.53	135	-
2013	335	1.51	136	0.74
2014	340	1.49	137	0.73
2015	345	1.47	138	0.72
2016	350	1.44	138	-
2017	355	1.42	139	0.72
2018	373	5.07	140	0.71
2019	378	1.34	140	-
2020	383	1.32	141	0.71
2021	388	1.30	141	-
2022	393	1.28	142	0.70
2023	398	1.27	143	0.70

Source :Key indicators of Asia and Pacific,2024

FUTURE OF INDIA AND CHINA

India and China has experienced dramatic economic growth and success since moving toward a market economy and opening up to international trade, but the changes have also brought enormous challenges, including growing social and economic inequality, environmental damage, and mass labor migration.

The sharp decline in Chinese fertility, combined with other demographic shifts, has added to the challenges. Limiting population growth may have a positive effect on the environment by reducing the number of people vying for water,land, and air, but because fertility has fallen just as economic growth is rising, most of the positive effects from slower population growth are masked by the enormous impact of new industry on the environment. Family structures have also been affected by changes in fertility, marriage, and life expectancies, leading to another set of complications. People are living longer, and the growing proportion of elderly in China is beginning to strain both national and family resources. The lower fertility levels mean that fewer children—and sometimes only one child—will be available to care for elderly family members. It is often difficult to disentangle the effects of demographic changes on families from the equally powerful—and sometimes contradictory—effects of changing economic and societal conditions. For example, mortality levels are declining for many people, especially those who can buy the better health care available through the private sector, but other people no longer receive even the basic care once provided by the state. People who cannot obtain private health care are more likely to suffer illness and to die earlier than people covered by government health care. China's fertility is expected to remain low, but it is not clear whether the government will continue to enforce a one-child policy or will allow parents to have two children. It is impossible to predict exactly what will happen in China in the next 50 years, but the effects of the dramatic changes on China's fertility, health, and government in the 20th century will doubtless continue to ripple through the society for the foreseeable future. China's recent history shows how population change is an integral part of a country's experience, both affecting and subject to a variety of factors. Given China's enormous political, economic, and demographic importance to the world, the country's demographic future will be of interest to all of us.

Conclusion

Many factors have contributed to the declining delivery rates in China and India, but the respective contributions remain controversial. in the 2d half of the 20th century, both countries made concerted efforts to scale back rapid populace increase via rules geared toward fertility prices. In China, the maximum superb rules have been the "Later, Longer, Fewer" marketing campaign of the Seventies, which advocated later marriage, longer periods among births and fewer kids ordinary, and the stricter "one-toddler" policy that was in location from 1980 to 2015, limiting couples to one or youngsters with some exceptions.

India has additionally taken coverage measures to deter the formation of big families and slow population increase, which include via its countrywide circle of relatives Welfare application, which started out in the Nineteen Fifties. however, because of India's federal structure, kingdom governments have been able to set their own policy priorities, main to unique influences in distinctive components of the u . s .. In Kerala and Tamil Nadu, wherein kingdom governments emphasized socio-financial improvement and ladies's empowerment, fertility declined earlier and faster, falling underneath substitute level a long time before the u . s . a . as a whole. In states that invested less in human capital, particularly for ladies and women, fertility declined extra slowly, despite arguable mass sterilization campaigns and other coercive measures in a few places.

The achievement of world efforts to ensure environmental sustainability will rely critically on tendencies in China and India. As both nations keep to pursue sustained monetary boom and prosperity for their human beings, it's far essential that growing consistent with capita earning do not undermine efforts toward extra sustainable intake and production. To protect and preserve the planet for destiny generations, the economies of the two countries – and of the sector – need to urgently transition far from the current overdependence on fossil-fuel power.

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