URBANIZATION GROWTH DYNAMIC MODEL OF METROPOLITAN CITY KARACHI

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ABSTRACT: The city Karachi has grown from a small fishing village to the enormous metropolis and now becomes the biggest and most industrialized city of Pakistan due to its multi-ethnic character. It population now exceeds 12 million (approximately) and its current growing rate is about 5% per year. This phenomenal, growth of the metropolitan city affects nomads as well as high class society and covers almost all aspect of life such as social, economical, political, sociological, psychological etc. This unchecked increase becomes the origin of the problems of slums, katchi abaadis, and encroachment. It has been estimated that one-third of the total population resides in squatter settlements and slums which results in chronic shortage of dwelling units, water supply, public transport, and civic amenities such as schools, hospitals , parks and playgrounds. This rapid growth of population is a burning issue for developing and governmental agencies. In this study attempts has been made to provide a systematic analysis of the population growth in the metropolitan city Karachi and model have been constructed by using the available demographic data. Finding of this model will serve as a basis for making planning to control rate of population growth in both Urban and Rural areas and develop a strategy to attain higher level of structural change of urbanization.

Keywords: Metropolitan City Karachi, Urbanization, Civic Problem, Systematic Analysis, Population Growth Model

1. INTRODUCTION

The historical background process of urbanization of Karachi has described different phases. First phase is called pre-periodic which is stretch between 1729 to 1843. The second phase has two periods, .in which the first period is of British period from 1843 to 1900, where as second period lies between 1900 to 1946. The third and last periodic is after creation of Pakistan which is from 1947 up till now. The process of urbanization of Karachi started with its occupation by the British in 1839 and with the beginning of second phase the city expanded and absorb the old fringes and form new fringe zones because of becoming an exporting port of south Asia. All port and commercial activities also multiplied the increase in population. After the creation of Pakistan that is in 1947, Karachi was declared its capital and because of that, huge masses of population started migrating to the city and during 1947 to 1950 era at about one million migrants came from different part of India to settle here. In addition to that, large number of people also migrated to Karachi from different parts of Pakistan. This is the phase of abrupt and haphazard rapid population growth. In addition, it progressed with the establishment of industrial estates, transportation networks including roads, highways and suburban railway due to

the only seaport. This urban growth expansion absorbed many old fringes and converted cultivated lands into urban land. Despite the shifting of the capital to Islamabad, the urbanization process continued. After the fall of Dhaka in 1971, once again migrants approached in Karachi in large numbers. Because of the rapid influx and absence of any planned schemes for the settlement of the migrants, an automatic out burst of katchi abadies took place. Latter this trend became a permanent feature and gone out of bounds. The process entered in its second phase as a result of Afghan war and many squatter suburbs appeared influencing the urbanization process. These all issues becomes the source of tribulations of slums, katchi abaadis, encroachment, chronic shortage of dwelling units, water supply, public transport and civic amenities etc.[*KDA and MP& ECD (1961,1963,1972,1974), Doxiadis Associate 1963*]

In this study urbanization, growth model has been developed by utilizing the available demographic data. This model is of great help for managerial authorities for making planning to control unchecked migration of inhabitants to overcome the problem of metropolitan city Karachi.

2. METHODOLOGY

The demographic data is obtained from the published sources, the department concerned, population census organization statistics division government of Pakistan and other relevant statistical agencies [Pakistan Census 200The tool adopted for construction of model has been described in subsection and a digital visual FORTRAN program is used for these.

2.1 Quantitative Approach

a. ***Non-linear regression analysis technique is implemented for establishing the functional association in population growth with time, which provide a mechanism for prediction, or forecasting.*** [*Afifi 1996, Delurgio 1996, Makridakis 1983*]

b. ***Parametric and non-parametric methods are used for checking adequacy of the proposed model.*** [*Box 2003*]

3. URBANIZATION GROWTH DYNAMIC MODEL

To review the fundamental characteristic and associations of sample spaces, and to generalize these for ascertaining the pattern of behaviour, future tendencies and to take coherent decision, we obviously need to resort to a quantitative methodology of investigation of relevant demographic data. The

measure of summary statistics of illustrated demographic data is depicted in Table 1, which provides useful quantitative information.

Table 1. Summary statistics of the demographic sample

Statistics	*Estimated Value*
Mean	*2098330.*
Median	*215466.5*
Maximum	*12500000*
Minimum	*1000.000*
Standard Deviation	*3697792.*
Skewness	*1.884884*
Kurtosis	*5.340671*
Jarque-Bera	*19.68989*
Sum Sq. Dev.	*3.14E+14*

The descriptive statistics show that data sets are not normally distributed which because of migration of inhabitants to the metropolitan city. In order to obtain the quality model, different linear and non-linear regression has been used. The data endow with the non-linear model given by equation(1) i.e.

$$UGDM = e^{\alpha+\beta.t+\gamma.t^2} \quad (1)$$

Where

UGDM = Urbanization growth dynamic model

t = time period

α, β & γ = Regression Variable.

The coefficient of the regression equation (1) with their necessary statistics is depicted in Table 2.

Table 2. Regression coefficients with necessary statistics.

Variable	*Estimated Value with 95% confidence interval*	*Std.Error*	*t-ratio*	*Prob.Value*
α	*-2467.106*±975.0134	*470.135*	*-5.248*	*0.00003*
β	*2.459* ± 0.9799	*0.472*	*5.204*	*0.000029*
γ	*-6.086E-04*± 2.462E-04	*1.1872E-04*	*-5.1260*	*0.00004*

The urbanization growth dynamic model generates the underneath test statistics.

Diverging nonlinear iteration limit =10

Number of nonlinear iterations performed = 37

Residual tolerance = 0.0000000001

Coefficient of Multiple Determination (R^2) = 0.9935

Proportion of Variance Explained = 99.3541%

Adjusted coefficient of multiple determination (Ra^2) = 0.9929

Durbin-Watson statistic = 1.808

3.1 Diagnostic for UGDM Estimates

The reliability of model is evaluated by gone through the following procedural steps.

(i) The R^2 statistics for equation (1) indicates that exogenous variable explain 90% of the variability of endogenous variable.

(ii) The Q-Q plot displayed in Figure 1 confirm that the set of the data come from a particular probability distribution.

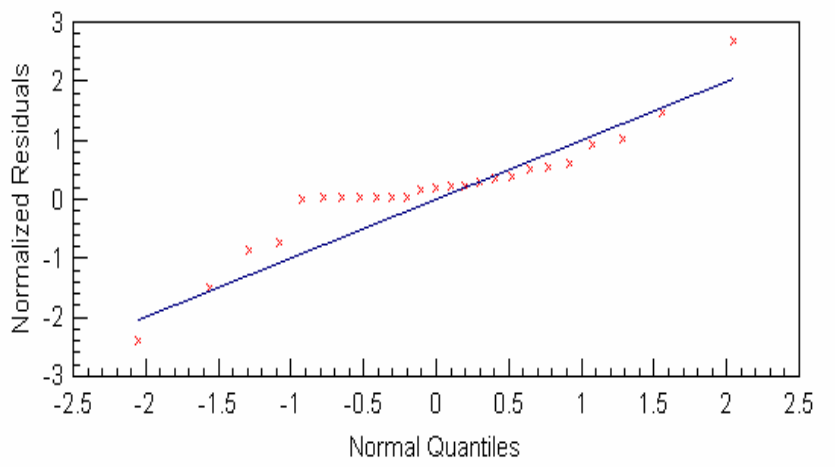

Figure 1: Q-Q representation for urbanization growth dynamic model

(iii) The normality in residual is verified by applying Doornik-Hansen, Shapiro-Wilk, Lilliefors and Jarque-Bera tests. These examinations with their probabilities values in parenthesis yields

Doornik-Hansen test = 14.4914, with p-value 0.000713228

Shapiro-Wilk W = 0.885812, with p-value 0.00912798

Lilliefors test = 0.269225, with p-value ~= 0

Jarque-Bera test = 6.12948, with p-value 0.046666

(iv) Non-parametric runs test also confirm the goodness of fit of the proposed model, which is evident from the test output given below:

Number of runs (R) in the variable Residuals = 4

Under the null hypothesis of independence,
R follows N(7.72, 1.26554)
z-score = -2.93945 (with two-tailed p-value 0.00328797)

(v) Figure 2 shows the autocorrelation function (ACF) and partial autocorrelation function (PACF) for model residuals. The graph indicates the departure of serial dependence in the residual.

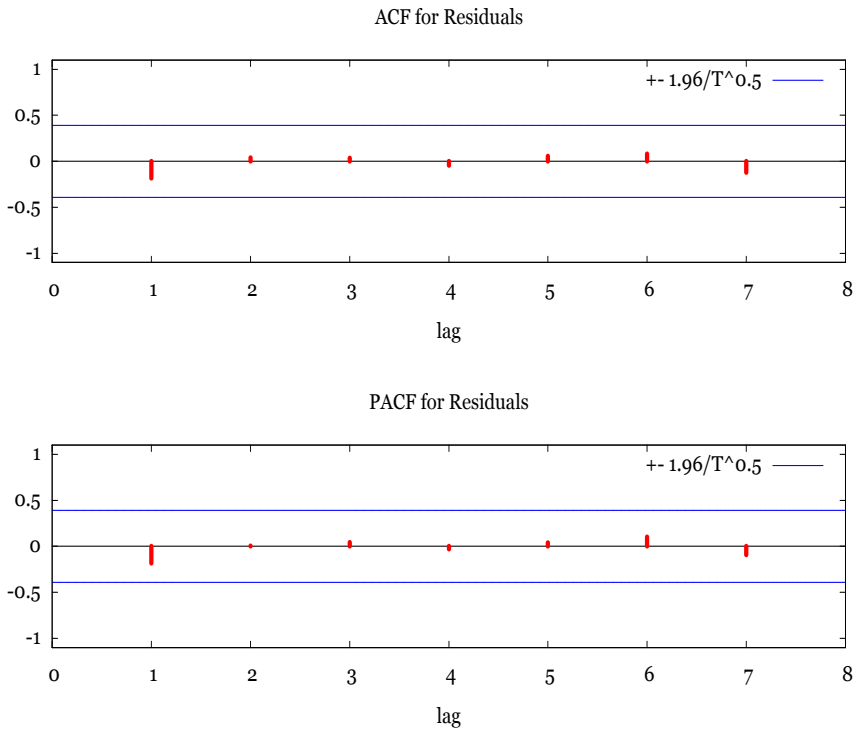

Figure 2: Plot of ACF and PACF of model residual with 95% confidence limit

(vi) The Durban Watson statistics rejects the presence of serial correlation in the residuals.

In view of the above carried out test/ analysis UGDM proposed model appears to be the most adequate for urbanization of the metropolitan city Karachi. This model gives the positive correlation between time and migration, which is an alarming situation for the managerial organization to control this increase in inhabitants.

4. CONCLUSION

In this communication, UGDM is developed by using available demographic data. The procedural steps have also been adopted for accomplishing the adequacy of the projected non-linear regression model. The finding of the model shows that population of metropolitan city Karachi is increasing continuously which is due to inadequate facilities in the rural areas. This model also suggested that proper notice should be taken by the policy maker for focusing on the development of infrastructure of the rural areas on the priority basis.

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