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Impact of Lagged Urbanization on the Process of Urbanization in India

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Abstract The present paper aims to relate the urbanization and Economic development using Computable General Equilibrium (CGE) model proposed by Mills and Becker (1986). The indicators used for the study are Economic, Demographic and Sociological. The data used for the study is collected from census reports of India, Economic Survey of India and Indiastat.com. There is a significant correlation observed between the level of urbanization with density of population, Literacy rate and per capita income. The regression model suggests that Economic indicators are important as compared to Demographic and Sociological indicators. The negatively decrease in the lagged coefficient may be due to the decrease in the urban population growth for last 20 years. The study suggests that the urbanization and economic developments are parallel processes. The policy makers have to give more attention to develop the infrastructural facility for urbanities to strengthen the economic development.

Keywords Lagged Urbanization, Economic Development, Regression Analysis and Equilibrium Urbanization

1. Introduction

In many countries in the South East Asian context including India, urbanization is still in its premature stage. It needs a massive shift of labor and capital from predominantly rural to urban activities and this may require a long time to equate this with any of the developed country. Urbanization as a process of switch from spread out pattern of human settlement to one of concentration in urban centers[1], it is inevitable and universal[2].

The projected World urban population was 3.42 billion in 2009 and is expected to increase by 6.3 billion (84%) in 2050. Most of the urbanized countries among More Developed regions achieved maximum level of urbanization. The future growth of urban population takes place in Less Developed countries, more specifically in South –East Asian Countries. In the case of India, projected urban population is expected to increase from 29.7 per cent to 54.2 per cent during the period of 2009-2050, an increase of 24.5 per cent in 60 years[3]. But in recent years researchers and policy makers, national and international funding agencies have not given much attention to this area of research because their focus is on population control and family planning programmes

There is a strong link between urbanization and economic development when countries are aggregated by income level[4]. According to the modernization school of thought, there cannot be urbanization without economic growth[5].

Urbanization occurs because of massive shift of labour and capital from predominantly rural to urban activities in the course of the economic development[6]. High-income countries have the highest GDPs per capita and urbanization levels; lower income countries are at the other end of the spectrum. The same is true for regions. The only exception in the developing world is sub-Saharan Africa where we observe 36 per cent of urban population, relatively higher urbanization as compared with Southern Asia(29 per cent), having low GDP- US $601[3].

In India, urban contribution to the country's economy is found to be substantially high, i.e. about 2/3 of the country GDP[7]. At present both industrial and service sectors are growing at a faster rate with strong contribution from the private sector[8]. Central Statistical Organization (CSO) indicates that the share of GDP increased from 37.7 per cent in 1970-71 to 52 per cent in 1999-2000. The Mid-Term Appraisal of the Eleventh Five Year Plan puts the urban share of GDP at 62-63 per cent in 2009-10. The document further projects that this share is expected to increase 75 per cent by 2030.

In recent decades, Indian economy has experienced a change from slow to medium growth of economy and a greater change in the urban economy, concentrated in cities of greater size. This is one of the main reasons why urban population is more and more concentrated in cities of larger size. At the initial stage, economic development is generally associated with the growth of urbanization and a shift in labor allocation from primary to the secondary and eventually the expansion of tertiary takes place[9-11]. But in

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India as well as in other developing nations, tertiary sector shows the highest proportion of labour force as compared to secondary[12]. This may be due to the rapid expansion of population size, which requires a large size of labour to serve its basic needs in cities. Besides, improvement in technology leads to shrinking job opportunities in the primary sector, necessitating migration of population to large cities, leading to "false urbanization" with high unemployment and under employment rate[13].

Further, the process of economic development and urbanization are both interlinked, but studies have failed to formulate a comprehensive model to explain what degree of relationship is responsible for achieving a certain level of urbanization along with key variables. For instance, Mills and Becker have formulated a Computable General Equilibrium (CGE) model to study the process of urbanization, city growth and economic development, in several developed and less developed countries including India, and have found a significant effect of lagged urbanization on the process of urbanization. They have estimated equilibrium urban population using a convex function which establishes relationship between present per cent of urban population with lagged and equilibrium urban population through lagged coefficient. But the functional relationship used in their studies is inadequate in the sense, that many of the relevant variables and indicators, that are responsible for the process of urbanization are not included, which reduces the predictive power and importance of the model. Further, the estimated equilibrium urban population using a convex function needs modification in the limits of lagged coefficient λ as -1 to 1 instead of 0 to 1 to account both positive and negative changes in the urban population[14].

Hence in the present paper, a model has been formulated using relevant explanatory variables and indicators to propose a suitable procedure to find the level of equilibrium population for India. In contrast to Mills and Becker, we assume that the level of equilibrium population is not same for all the countries, because they have different levels of urbanization, and experience different patterns of urbanization. For countries having a high level of urban population, level of equilibrium urban population is expected to be higher as compared to those having a low level of urban population at present and past. We also believe, that the level of equilibrium population itself varies with the change in the pace and level of urbanization and shows how the process of urbanization varies with the level of equilibrium urban population.

2. Objectives

1. To study the relationship between urbanization and economic development in India.
2. To identify the important indicators for the growth of urban population in India.
3. To study the impact of lagged urbanization on the current urbanization.
4. To study the comparison between lagged coefficient and equilibrium urbanization.

3. Sources of Data

The present study includes demographic, social as well as economic indicators viz. (1) Per Capita Income (PCI) (2) Labour Force in Industry and Service (LOBIS) (3) Literacy Rate (4) Density of Population (5) Arable land and (6) Lagged Urbanization (U-). The data collected for this study is from Registrar Census of India for 1991, 2001 and 2011, Economic Survey of India 2011-12 and http://www.indiastat .com website[15-19].

4. Methods

4.1. Regression Models

To know the impact of Demographic, Sociological, Economic growth and lagged urbanization on the current urbanization, we have formulated regression models in which the percentage of urban population has been regressed on carefully chosen explanatory variables such as: Density of Population, Literacy rate, Per Capita Income, Labour Force in Industry and Services, Arable land and Urban Population of the previous census as lagged urbanization. To assess the separate impact of chosen variables and lagged urbanization, regression analysis has been carried out without and with lagged urbanization component as specified below in the given models respectively

$$U(t) = A + B(1)\,DEN(t) + B(2)\,PCI(t) + B(3)\,LIT(t) + B(4)\,LOBIS(t) + B(5)\,AL(t) \quad (1)$$

$$U(t) = A + B(1)\,DEN(t) + B(2)\,PCI(t) + B(3)\,LIT(t) + B(4)\,LOBIS(t) + B(5)\,AL(t) + B(6)\,U(t-1) \quad (2)$$

Where, A=Intercept, B(i) =Regression Coefficient, i=1,2,3,4,5,6

Using the chosen variables, a model of urbanization has been specified to identify the factors that link economic and urban development. First, the per cent of urban population U(t) was regressed on chosen variables without its lagged value U(t-1) using Model 1; in the second instance, again we regress U(t) on the same chosen variables by including its lagged variable U(t-1) as one of the independent variable (See Model 2).

4.2. Equilibrium Urbanization

The reason for including lagged urbanization in regression model is well explained in[6], that is, if the equilibrium per cent of urban population, denoted by U^* depends on a set of variables, given by the functional relationship f(.) given by,

$$U^* = f(.) \quad (3)$$

More specifically, the adjustment of the population to changes in variables affecting equilibrium level of urbanization takes time because major migration decisions

are involved and dis-equilibrium adjustment follows a distributed lag, that is

$$U(t) = U(t-1) + \lambda \{U^* - U(t-1)\} \quad (4)$$

Where, U(t) is per cent urban at time t, U(t-1) is its lagged value at time t-1

As per their argument, equation (4) implies that the present level of urban population is a linear function of its lagged value plus a fraction λ of the difference between the equilibrium level and lagged value with $0 < \lambda < 1$. When $\lambda = 0$, $U(t) = U(t-1)$ regardless of U^* ; for $\lambda = 1$, $U(t) = U^*$ regardless of U(t-1). The empirical analysis of the model (4) has shown acceptable performance, but there will be a theoretical limitation arising from imposing partial limits (0, 1) on λ instead of allowing the limits (-1 , 1). This ignores decrease in the growth of urban population, it may be due to stagnation in the urban economy or certain negative factors such as congestion, water and housing problems or polluted atmosphere causing serious health problems and acting negatively on the urban population growth.

The present study reconsiders this problem by allowing λ to vary in between the full limits -1 to 1.This modification helps to interpret the expression (4) more meaningfully than the earlier case because,

$U(t) = 2U(t-1) - U^*$ when $\lambda = -1$, and

$U(t) = U^*$ when $\lambda = 1$ regardless of U(t-1).

In the former case when $\lambda = -1$, lagged urbanization has a greater impact on the present and also on the future growth of urban population, while in the latter case, as the process of urban population is close to the saturation point that is equilibrium level, there will be a decline in growth rate of urban population which tends to be independent of its past growth. So, this important realization is missing in the specified model (4) given by[6].

Now assume, equilibrium per cent of urban population is the maximum value of U, and is denoted by 'a'.

In other words

i.e. $U^* = \text{Max}(U) = a$ is the maximum per cent urban that can be reached when any region attains a complete urbanization. Then the equation (4) can be re-written as ;

$$U_t = U_{t-1} + \lambda (U^* - U_{t-1})$$
$$= U_{t-1} + \lambda (a - U_{t-1})$$
$$U_t = \lambda a + (1-\lambda) U_{t-1}$$
$$U_{t-1} = \lambda a + (1-\lambda) U_{t-2}$$
$$U_{t-2} = \lambda a + (1-\lambda) U_{t-3}$$

$U_{t-3} = \lambda a + (1-\lambda) U_{t-4}$ and so on using the backward substitution method

$$U_t = \lambda a + (1-\lambda) U_{t-1}$$
$$U_t = \lambda a + (1-\lambda)[\lambda a + (1-\lambda)U_{t-2}]$$
$$= \lambda a + \lambda a (1-\lambda) + (1-\lambda)^2 U_{t-2}$$
$$= \lambda a + \lambda a (1-\lambda) + (1-\lambda)^2[\lambda a + (1-\lambda) U_{t-3}]$$
$$= \lambda a + \lambda a (1-\lambda) + \lambda a (1-\lambda)^2 + (1-\lambda)^3 U_{t-3}$$
$$= \lambda a + \lambda a (1-\lambda) + \lambda a (1-\lambda)^2 + \lambda a (1-\lambda)^3 + \lambda a (1-\lambda)^4 + \ldots\ldots\ldots + \lambda a (1-\lambda)^{t-1} U_1 + (1-\lambda)^t U_0 \quad (5)$$

Using the Geometric series the equation (5) can be written as

$$U_t = \frac{a\lambda\left[1-(1-\lambda)^t\right]}{1-(1-\lambda)} + a\lambda(1-\lambda)^t U_0$$
$$= a\left[1-(1-\lambda)^t\right] + a\lambda(1-\lambda)^t U_0 \quad (6)$$

and as time increases infinitely large and the sum of infinite series giving equilibrium per cent urban(U^*)

$$i.e. \quad U^* = U_\infty = \frac{a\lambda}{1-(1-\lambda)} = \frac{a\lambda}{\lambda} = a \quad (7)$$

The equation (6) gives us the equilibrium per cent urban. With this results, the equation (5) can be written as a

$$U_t = c + m\ U_0 \quad (8)$$

Where $c = a[\ 1 - (1-\lambda)^t\ ]$ and $m = a\ \lambda\ (1-\lambda)^t$

The values of m and c are estimated by fitting linear regression equation using the urban per cent for the two decades 2001 and 2011. Using expression for c we have

$$c = a[\ 1 - (1-\lambda)^t\ ]$$

$$\text{i. e. } \frac{c}{a} = [1-(1-1)^t$$

$$\text{i.e. } (1-\lambda)^t = \left[1 - \left(\frac{c}{a}\right)\right]$$

$$\therefore \lambda = \left[1-\left(1-\frac{c}{a}\right)^{1/t}\right] \quad (9)$$

We shall assume the value of equilibrium urban (=a) as 10, 20, ….., 100 and study the behaviour lagged coefficient (λ).

If $c > a$, then there will be a real roots and the value of lagged coefficient is estimated and if $c < a$, then the roots are imaginary and lagged coefficient (λ) cannot be calculated.

4. Result and Discussion

In India, the concentration of urban population in Class-I cities and the number of urban centers continued to increase during 1991 and 2011. From 1981 to 2001, the pace of urban population was rather slow compared to earlier decades. During 1981-91, 1991-2001 and 2001-2011, the average annual exponential growth rate registered 3.09, 2.73 and 1.21 respectively. Urban population is growing at a faster rate than that of rural population. Natural growths of population and relative migration components are prominent factors which are responsible for the increase of urban population in the country.

Both at the global and at the national levels, there is a positive relationship between the level of urbanization and economic development[20-21]. For instance, in the Indian context, some of the economic indicators such as: Per Capita Income, Labour Force in Industry and Services (LOBIS), Literacy Rate, Density of Population and Arable land too have been correlated with the growth of urban population

(See Table 1 and 2).

The correlation coefficient given in Table-2 shows that in the Indian context, urbanization has a 1 per cent significant correlation with population density, Per Capita Income and literacy for all the three decades. This suggests that the urban population growth rate is associated positively with the growth of population, Per Capita Income and literacy rate.

The area of arable land is negatively correlated with per cent urban in all the three decades. This suggests that as the area of arable land decreases the farmers have become workers, business or service people. Hence rural lifestyles have been switching to the urban lifestyle.

The analysis of Tolerance value and Variance Infection Factor (VIF) shows inconsequential co-linearity, that is no VIF value is grater than 10 (Threshold value), and tolerance value is not less than 0.1, which suggest that co-linearity does not explain 10% of any independent variable's variance (See Table 3).

In 2001 census, the percentage of variation is 84 per cent without inclusion of lagged urbanization (i.e. Model 1), when lagged urbanization is included in the model the percentage of variation raised by 13 per cent. For the census period 2001-2011 the percentage of variation is 89 per cent without inclusion of lagged urbanization but when the lagged urbanization is included the percentage of variation is increased by 8 per cent, this change is smaller than earlier census period.

Further, the model explains about the important indicators which are responsible for the growth of urban population. Table 4 explains the density, literacy rate and Per Capita Income are important components in both the censuses of model 1 and arable land is important only in 2011 census, which is without inclusion of lagged urban population. When lagged urban population is included in the model (model 2) the literacy and Labour force in Industry and Services are significant components at 5 per cent level of significance for census 2001 but in 2011 the Per Capita Income and Arable land is significant components at 5 per cent. The lagged urbanization is important component for all the census periods and it is significant at 1 per cent level of significance (See table 4). This is because lagged urbanization includes all the factors Viz. Demographic Social and Economic factors.

The equilibrium per cent urban (U*) and the effect of lagged coefficient on urbanization for India for 2001 and 2011 are presented in the Table 5. The results of the model shows that as the level of equilibrium per cent urban increases over a period of time, the effect of lagged coefficients decreases negatively, when the difference between equilibrium per cent urban population (U*) and level attained (U(t-1)) reduces over a period of time resulting absolute increase in the urban population (Fig. 1). The negative decrease in the lagged coefficient may be due to the decreases in the urban population growth for the last 20 years.

Table 1. Trends in Urbanization and other selected variables for India

Sl.N.	Name of Variable	Census year		
		1991	2001	2011
1	Urban Population (%) (PU)	25.72	27.81	31.16
2	Density of population (DEN)	267	325	382
3	Literacy Rate (LIT)	52.21	64.8	74
4	Per Capita Income (PCI)	7690	10068	11942
5	Labour force in Urban area (%) (LOB)	61	59.7	55.6
6	Arable land (AL)	185127.2	183545	182385

Sources: 1. Census of India, 1991, 2001 and 2011. 2. www.indiastat.com

Table 2. The Correlation Coefficient of Different selected variables of the India for 1991, 2001 and 2011

Urbanization	Selected Variables				
	DEN	PCI	LIT	LOB	AL
PU 1991	0.856**	0.772**	0.591**	0.067	-0.214
PU 2001	0.808**	0.838**	0.576**	0.107	-0.146
PU 2011	0.798**	0.808**	0.591**	0.25	-0.199

Sources: As table 1

Table 3. Test for Multi-colinearity for 2001 and 2011

Sl. No.	Name of Variable	Tolerance		VIF	
		2001	2011	2001	2011
1	Urban Population (%)	0.145	0.196	6.905	5.108
1.	Density of population	0.238	0.287	4.205	3.483
2	Literacy Rate	0.457	0.448	2.187	2.232
3	Per Capita Income	0.265	0.382	3.773	2.621
4	Labour force in Urban area	0.908	0.422	1.101	1.919
5	Arable land	0.771	0.606	1.296	2.336

Source: As table 1.

Table 4. Regression Coefficients and t-values of different selected variable for India 2001 and 2011

Sl. No.	Name of Variable	Regression Coefficients (b) for 2001		Regression Coefficients (b) for 2011	
		Without lagged U	With lagged U	Without lagged U	With lagged U
1	Urban Population (%)	-	0.975**	-	0.739**
1.	Density of population	0.007**	0	0.04**	0.001
2	Literacy Rate	0.506**	0.069	0.002*	0.331*
3	Per Capita Income	0.002**	0.001*	0.549**	0
4	Labour force in Urban area	-0.237	-0.051	0.434	0.4*
5	Arable land	0.001**	0*	0	0
	R Square	0.848	0.973	0.891	0.973
	F	29.026**	147.788**	42.327**	150.303**

Sources: As table 1

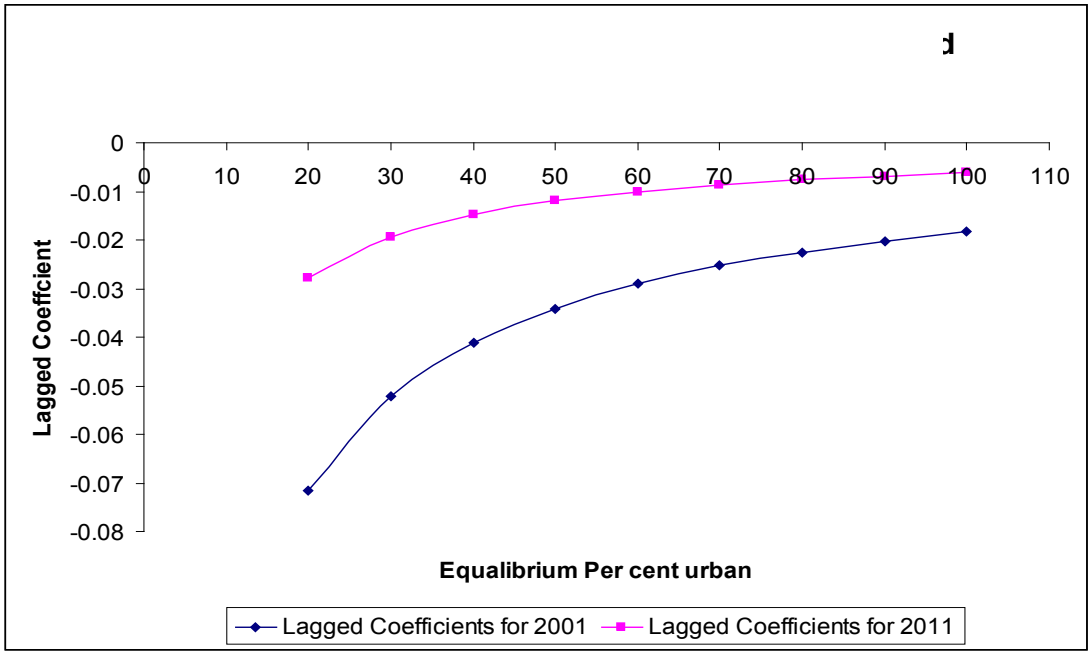

Figure 1. Comparison of lagged coefficients for 2001 and 2011 of India

Table 5. Comparative study lagged coefficient for India in 2001 and 2011

Per cent Urban (U*)	India	
	2001	2011
20	-0.07153	-0.0279
30	-0.05222	-0.01935
40	-0.04122	-0.01481
50	-0.03409	-0.012
60	-0.02907	-0.01009
70	-0.02535	-0.0087
80	-0.02247	-0.00765
90	-0.02019	-0.00683
100	-0.01832	-0.00616

Source : See Table 1

5. Conclusions

The pattern of urbanization in India is shaped to a greater extent by the demographic forces even today. The increased population pressure and a consequent decline in land - man ratio in the rural area have pushed many entrants into the labour force and led towards urban centres. The failure of the rural non-form sectors to grow sufficiently and absorb the increasing labour force has added to the rural- urban migration. Further, improvement in literacy too has made the youth seek non-agriculture work in the urban areas. Thus, natural increases in urban population and migration from rural areas, owing to a variety of factors have contributed more to the per cent urban in India. The regression model also suggests that urbanization and economic development accompany each other.

The observation made on equilibrium urban population is this. As lagged coefficient tends to zero, the difference between equilibrium urban population and urbanization attained also decreases indicating an absolute increase in urban population. The negative effect of lagged coefficient shows decreases in the urban population growth rate of India.

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