Study on Identification of factors influencing population explosion using Stochastic Frontier Analysis

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Abstract

The present study identifies the determinants of population explosion in India. The major determinants were poverty, birth rate, child marriage, area available for inhabitation and illiteracy. Based on the secondary data of all Indian states considered, the results were calculated using descriptive and inferential statistics. The result Cobb-Douglas Stochastic Frontier Model showed that an average technical efficiency of the factors in producing population explosion was 73.47%. Also, the coefficients of variable - literacy has negative value which implies that when population explosion varies inversely with literacy. Meanwhile, the coefficients of factors like birth rate, poverty, child marriage and land area are positive. It suggests that population explosion varies proportionally with quantity of these variables or inputs. Also, birthrate has 1% significance; child marriage has 5% significance; while poverty, literacy and area have 10% significance in influencing population explosion meaning that birth rate stands top in triggering population explosion.

Keywords: Technical Efficiency, Cobb – Douglas Stochastic Frontier Production Function,population explosion;

INTRODUCTION

Population explosion is the rapid increase in number of individuals in an area or territory. It is the first and foremost reason of many social, economical and environmental problems. Thus to improve the quality of life, our awareness level of population explosion , its factors, causes and effects must increase. Checking population explosion definitely has a positive impact on the health as well as other sectors. Hence, the study was made to analyze the efficiency of the mentioned factors in inducing population explosion using stochastic frontier production function. And also, suggestions to check population explosion are also given which are offered by finding key elements boosting the phenomenon by stochastic frontier production (Porcelli, F. (2009)).

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METHODOLOGY:

Analytical tools used in the present study are descriptive statistics and inferential statistics. Descriptive statistics involve the standard deviation, mean, percentage analysis and frequency that describe the variables. Inferential statistics involves stochastic frontier production function. This production function examines the relationship and proportionality between the dependent (population) and independent variables (all input factors) and also finds the technical efficiency of each factor influencing the output.

Technical efficiency refers to ability to produce maximum possible output with given sets of input factors. This function involves two random components; one is associated with technical inefficiency while the other is traditional random error components. Stochastic frontier(Aigner, et al.,1977) production function brings out the technical efficiency and analyses the determinants of efficiency. Frontier 4.1 was the computer software that was used to estimate the stochastic frontier production function and estimate factors affecting efficiency.(Greene W, (2010))

In the present study, in measuring technical efficiency, it is assumed that the population is dependent on birth rate, child marriage, and area available for inhabiting, poverty and literacy. The stochastic frontier production function thus becomes:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + (v_i - u_i)$$

where

Y_i = population of any state, X_1 – birth rate

X_2 - poverty

X_3 - literacy

X_4 – area available for inhabiting

X_5 – child marriage

β_0 – constant

β_1 - Coefficient of birth rate

β_2 – Coefficient of poverty

β_3 – Coefficient of literacy

β_4 – Coefficient of area available for inhabiting

β_5 – Coefficient of child marriage

v_i = random error term which is assumed to be independent and normally distributed

u_i = technical inefficiency assumed to be independent and a truncated normal distribution at zero

DATA

Secondary data was obtained for all factors for all states of India from various sources like Office of the Registrar General and Census Commissioner (India), District level household survey (DLHS), National Sample Survey Organization (NSSO), Bureau of Applied Economics and Statistics, Government of India. Poverty, child marriages, birth rate, illiteracy and area are the major factors concerning population explosion. Corresponding data were obtained from National University of Educational Planning and Administration and Government Census (1991, 2001 and 2011).

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ANALYSIS

Maximum Likelihood Estimates (MLE) was used to evaluate the parameters. With the secondary data collected, the output was fixed as population and inputs were poverty, child marriages, birth rate, illiteracy and area. (Inmaculada C. Álvarez, et al.,2014)

Table 1:Estimation of parameters using MLE estimates

variable/inputs	parameter	coefficient	standard error	t ratio
Constant	β_0	1.21	0.93	1.30
birth rate	β_1	2.63	0.87	3.02
Poverty	β_2	0.14	0.54	1.62
Literacy	β_3	-0.14	0.57	-1.62
Area	β_4	0.56	0.36	1.57
child marriage	β_5	0.48	0.27	1.78

	sigma-squared	0.10	0.14	.72

Table 2: Summary Statistics of Efficiency

Parameter	value
Mean	0.73
Median	0.74
Variance	0.025231
Maximum	1.00
Minimum	0.45

The coefficient of literacy is -0.14 stating that literacy has a negative inverse impact upon population. A literate population is aware of their income, increasing civic needs and increasing standard of living. This allows them to be aware of having less number of children and growing those children with all optimum amounts of resources they can provide. Thus, literacy checks population explosion. The coefficient of birth rate, poverty, area and child marriage is positive implying these factors if available in larger quantity increases population. Thus, these factors boost population explosion.

Poverty has a coefficient of 0.14. It can be a cause as well effect of population explosion. Poor beget more children as they feel their children would help in sustaining livelihood when they go to work. But the truth is that employment is not everyone's destiny. Thus, the children have to go to do meager jobs. Their health is also not up to the level expected and so much of population increase is seen. The next factor is birth rate with a coefficient of 2.63. The life expectancy has increased and infant mortality has decreased. Thus increase in birth rates and decreases in birth rates have increased population rapidly.

Areas that each state can offer for its individuals to inhabit are also a positive factor influencing population. The coefficient of area is 0.56. More the area more is the population of the state. The last factor is child marriage with a coefficient of 0.48. Young age has higher fertility and thus there are more births (since as age increases, fertility decreases). Hence, child marriage is directly linked to increasing population.

Also, the absolute values of t ratios for the factors – birth rate, poverty, literacy, and area and child marriage are 3.02, 1.62, 1.62, 1.57 and 1.78. The absolute value of t ratio above 3 states that factor has 1% significance in influencing output. The value of t - ratio in the range 1.75 to 2.99 states that the factor has 5% significance. The value of t - ratio below 1.74 states that factor has 10%. Therefore, birthrate has 1% significance; child marriage has 5% significance; while poverty, literacy and area have 10% significance. Lesser the significance more is the confidence level.

Thus, it means that birth rate stands top in triggering population explosion, followed by child marriage(5%) and then the rest of the factors(10%). Thus, our measures to tackle population explosion must keep this in view.

RESULTS

The top factor affecting population is found to be birth rate. Thus, only when the realization dawns on the common people and they adopt correct reproductive health measures and have optimum number of children, population explosion can be checked in near future. Then, child marriage is the next significant factor. It has so much other disadvantages and boosting population is one among the serious side effects. Poverty is a multifaceted issue and the compelling situation in making livelihood asks poor families to have more children to multiply the money to sustain livelihood. But the serious counter effect is that it considerably increases population. Similarly, is the area that also offers a place for all to stay. Literacy is the only one factor that negatively affects population explosion. A literate population wisely plans to have few children and grow them with all resource and opportunities. They foresee future and plan accordingly. Thus promoting literacy can solve an ample of problems including population explosion.

CONCLUSION

The present study identified some significant factors that affected population explosion in India. These were poverty, birth rate, child marriage, area available for inhabitation and illiteracy. The result found that the Cobb Douglas production model gave an average technical efficiency of the factors in producing population explosion as 73.47%. The average technical efficiency is 0.73 which implies that these factors on whole can increase population by 26.53%. Population explosion varies inversely with literacy while population explosion varies directly with quantity of these variables or inputs. Also, birth rate stands top in triggering population explosion, followed by other factors. Hence, our contribution to reduce population explosion must start from promoting literacy, reducing poverty, abolishing child marriages. We must be educated and also educate people on having a right family structure with fewer yet healthier, smarter children.

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