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Evaluating the impact of demographic transition on economic growth of India

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Abstract
Demographic Transition refers to the nearly pervasive change countries go through from a regime of high fertility and high mortality to one of low fertility and low mortality. Since in this phenomenon death rates declining first followed by the birth rates later, countries like India often experience a transitional period of rapid population growth. As a consequence of baby boom, reduction in infant and child mortality rates, increase in access to better medical aid, improvement in hygiene and better education; the age structure of a country is transformed which reflects the demographic transition. India is the second most populous country of the world, 1210.6 million according to 2011census and its population is increasing continuously; of the total population, the Active Asset/economically productive age group of 15-59 years constitute of 729.9 million people that is 60.3 percentage of the whole population.[1] On the other hand the 60+ age people constitute only 8.6 percentage of the population.[2] Thus India is experiencing her "first demographic dividend".

This paper is an attempt to study the impact of demographic transition on economic growth of India. This research paper evaluates this impact by comparing the over all, pre and post liberalisation scenario of the economy with respect to the demographic transition from the year 1961-2015. This research paper thus, tries to reveal the contribution of the demographic dividend on economic growth.

Keywords: Demographic Transition, Demographic Dividend, Economic Growth, Multiple Regression Analysis

Introduction

Demographic transition due to population aging is an emerging issue throughout the developing world. There has been a great deal of theoretical and empirical research on the relationship between demographic transition with economic growth for developed economies since 1990s when the population aging emerged to influence the economy and society. Generally speaking, the literature indicates that the aging of the population generates negative economy-wide effects that would slow economic growth. As refer to the relationship between demographic transition and economic growth, the empirical results are inconclusive as there is evidence both supporting a positive and a negative relationship. As the issue of population aging began to unfold at the beginning of the 21st century for developing countries, existing studies on the relationship between demographic transitions with economic growth mainly focus on developed countries and only a few studies referred to developing countries. This paper is an attempt to study the impact of demographic transition on economic growth of India.

Theoretical Framework

Demographic Transition refers to the nearly pervasive change countries go through from a regime of high fertility and high mortality to one of low fertility and low mortality. Since in this phenomenon death rates declining first followed by the birth rates later, countries like India often experience a transitional period of rapid population growth. Initial decreases in child mortality result in a baby boom. Subsequent declines in fertility put an end to the boom and create a distinct cohort at the bottom of the age distribution of the population. As this boom cohort passes through time, it influences the economy. When the cohort reaches the working ages, a stimulus to economic growth may be provided. Output may increase simply as a function of the additional number of workers in the economy and the lower wages that may obtain. Households may also save more, because of the reduction in the number of child dependents, which leads to increased investment, rising capital stock, and further increases in economic output. Attendant improvements to the general health of the population may further encourage economic growth. This population-related increase in economic growth is referred to as the first demographic dividend. A second demographic dividend may occur as the baby boom cohort continues to age and increases its savings and investment in anticipation of retirement.

India is one of the largest developing countries in the world and a country of growing economic and political importance not only in Asia, but in the world at large. It is in the midst of a momentous demographic transition. As a consequence of baby boom, reduction in infant and child mortality rates, increase in access to better medical aid, improvement in hygiene and better education the age structure of a country is transformed which reflects the demographic transition. During the twentieth century from around 1960, not only did the world but India too have entered in its demographic transitional stage.

[1] (The Census department of India, 2011)
[2] Ibid

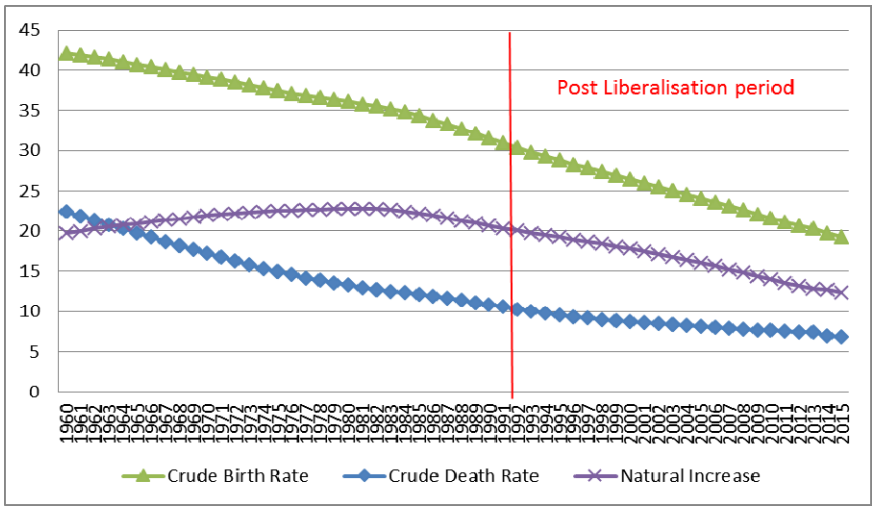

Chart 1: India's demographic transition over 55 years as per World Bank Data

India's demographic transition is reflected in its changing age composition, specifically in the share of the working-age population, which we refer to as the economically productive population or Active Asset also. This economically productive population consists of the young population having age 15-24 and adult population age 18 and above. This "active asset" of our country has the potential to enhance our countries growth prospects. The greater the share of the population in the working –age group; the more will be the savings and investments in the economy.

Though, India is the second most populous country of the world, it is 1210.6 million according to 2011census and its population is increasing continuously; out of the total population, the *Active Asset*/economically productive age group of 15-59 years constitute of 729.9 million people that is 60.3 percentage of the whole population.[3] On the other hand the 60+ age people constitute only 8.6 percentage of the population. [4] Thus we can say that India is experiencing its "first demographic dividend". The figure below clearly reveals the favourable changes in the population's age structure from 1961 to 2015. The population pyramids below are constructed by the authors using World Bank data.

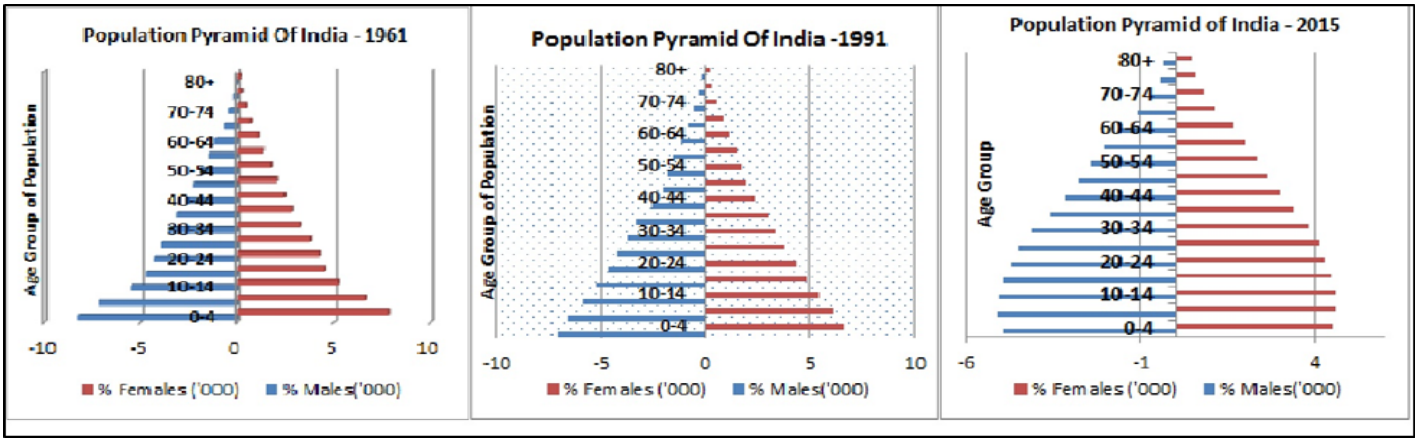

Chart 2: Population Pyramids revealing the Demographic Transition of India

Table-1 and Chart-3 below indicate a comparative view of some important demographic indicators over the different Census years.

Table 1: Comparative view of various growth rates during the census years

Census Year	1961	1991	2001	2011
Population growth rate	1.988	2.0365	1.7321	1.3284
Total Fertility Rate	5.903	3.959	3.243	2.563
G.D.P. per capita growth annual %	1.6809	0.9804	3.0238	5.2311
Crude Death Rate	21.877	10.581	8.553	7.52
Crude Birth Rate	41.865	30.912	26.004	21.116

Source: (World Bank - World Development Indicators, 2015)

[3] (The Census department of India, 2011)
[4] Ibid

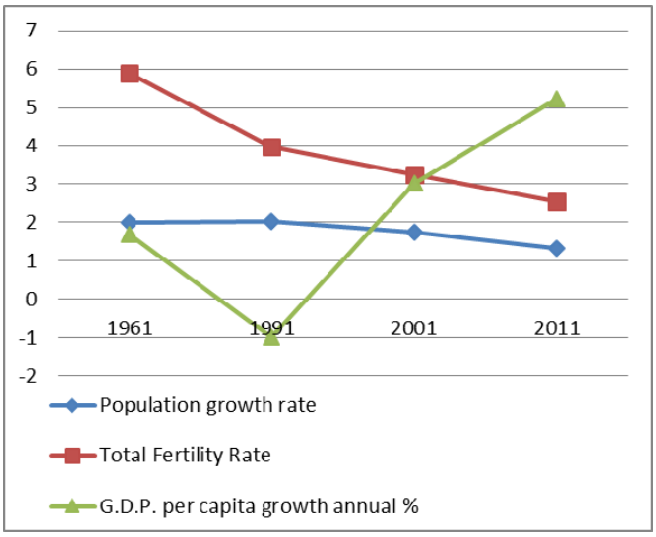

Chart 3: Comparative view of various growth rates during the census years

Rationale of study

One must understand that the country's economy grows only if its population contributes to it. The demographic variables, especially the birth and death rates, the fertility rates and the age-distribution of the population have a great impact on the type of population structure a country has. Though India is the second largest populated country of the world after China, its population age-structure over the years has changed drastically and has become very rich after liberalisation in terms of its potential productive population. Because of the bulging economically productive population, it's experiencing the "first demographic dividend". The Impact of this demographic transition in the age-distribution of India on the economic growth needs to be revealed. This paper is an attempt to study the impact of demographic transition on economic growth of India. This research paper evaluates this impact by comparing the over all, pre and post liberalisation scenario of the economy with respect to the demographic transition from the year 1961-2015. This research paper thus, tries to reveal the contribution of the demographic dividend on economic growth. This research is based on the theoretical set up that, there exists a relationship between demographic transition and economic growth. Throughout the world several studies have been done in this context, but such a research on India that too spanning 55 years is one of its kinds.

Literature Review

Bloom, Canning, & Malane (1999) [6] in their working paper have revealed the link between demographic change and economic growth in Asia, for the period 1965 to 1990. They make known the fact that the overall rate of population growth has a meagre effect on the growth of the economy of countries. It's the change in age-structure, population density and life expectancy that have a significant impact on growth rates. They suggest that demographic transition acts as an accelerator and catalyst for the economic "miracle" in East Asia. The paper thus establishes and reveals a strong linkage between demographic change and economic growth and they suggest the inclusion of growth rates of the working-age population for related studies.

Lindh & Malmberg (1999) [12] has studied the effects of log age group shares (15–29, 30–49,50–64, and 65+) on five-year growth rates in GDP per worker using a sample of OECD countries (1950–1990). They find significant and *positive* coefficients for the age group 50–64 and significant and *negative* coefficients for retirees (65+).

Kelley & Schmidt (1999) [10] in their paper have provided an extensive in-depth comparative review of a wide variety of literature already available in this field of economic-demographic modelling. Building upon a state of the art Core economic and political model of economic growth, they have evaluated the merits of alternative specifications to expose the impacts of demographic change. In their exploratory study, they arrive at a quantified judgement that demography has a very favourable impact on economic growth. Being more specific they reveal that declines in both mortality and in fertility have notably increased the rate of economic growth. For arriving at these conclusions they have studied eight models which include Barro and KS Models.

The research paper by Bloom, Canning, & Sevilla (2001) [8] discusses that the concept of age structure of any country is very important for economic growth since, people of each age groups behaves differently with different economic consequences. They have considered variables like age, income, consumption, labour supply and savings. They say that in countries where the morality and fertility rates are beginning to fall (South- central Asia) the government has the advantage of capitalizing on this demographic transition. Further they reveal that when the number of working age adults grows relatively larger than the dependent population there is a great potential for a major economic outgrowth. Their study discloses that population growth has a large and statistically significant negative effect on per capita income growth but if we consider the economically active population share only over years and PCI growth, then it has a statistically significant positive effect. They have concluded that as the proportion of workers rise or fall, it does affect the prospects of economic growth.

Batini, Callen, & McKibbin (2006) [4] have examined the economic consequences of demographic transition for Japan, the United States, other industrial countries of mainly Europe, and developing regions of the world. They have used a four-country version of the MSG3, a special form of g cube model and dynamic inter-temporal general equilibrium model extended with an OLG (over lapping generations) Blanchard approximation. Their major findings reveal that the population aging in industrial countries will reduce growth, beginning in Japan in the next decade and then the rest of other industrial countries by the middle of the century. Their study reveals that as the relative size of their working-age populations increases, developing countries will enjoy a "demographic dividend" that should result in stronger growth over the next 20–30 years, before aging sets in. Demographic change will thus affect saving, investment, and capital flows, the rapidly aging industrial countries could see large declines in saving and deterioration in their current account positions as the elderly run down their assets in retirement.

Prskawetz, *et al*. (2007) [14] in their report, have reviewed the literary the links between demographic structures to economic growth. They have introduced three empirical growth regressions for the EU-15 countries. Their research data spans from 1950 to 2005. Further they have chosen one of their own empirical estimations to conduct a prospective analysis of the

future implications of demographic change on economic growth for up 2050.

Lewis (2010) [11] has examined the impact of demographic change and urbanization on economic growth in Indonesia for the time period 1960-2007. The analysis shows that economic growth has a positive relation with both, the level and the rate of change of the working age population. Economic growth is also positively associated with the level of urbanization. In the analysis they have used the VEC Model (Vector Error Correction) since it permits the variables of interest to be treated as endogenous. They have also used the Dickey-Fuller test, which is a variety of univariate test to check the stationary properties of variables.

Agrawal (2011) [3] in his report of only nine pages has analysed the demographic trends in key economies like (U.S., U.K., and B.R.I.C.S.) going forward and assess the impact it could have on their economic prospects. He focuses on how demographics pressures could obstruct in the recovery of the advanced economies from the 2007 recessions they faced. This report studies the Impact of Demographics on both developed and developing economies. In their concluding remarks this report they say that**, "**ignoring demographics might not look like a concern over a short-term but could pose serious concerns over long-term. One can still work around to mitigate inflation but with demographics even that cannot be done as it would require huge investments".

Wang, Chen, & Huang (2013) [15] in their research paper have examined the economic and distributional effect of the demographic transition, which is ongoing in China. They have used an integrated recursive dynamic computable general equilibrium (CGE) model with a behavior micro simulation model to measure the income changes due to the demographic changes. For this they divided the labor force into eight different segments and considered the demographic transition from 2010 till 2050. They have used both the FGT index and the Gini coefficient to estimate the poverty and inequality changes due to demographic transition. Further they used regression based inequality decomposition with the Shapley value decomposition method to identify the relative contribution of demographic variable to income inequality. They found that a significant portion of the decrease in poverty and an increase in inequality is expected in the context of the multi- demographic transition.

Research Objectives

1. To study and analyse the impact of demographic transition on the economic growth of India.
2. To compare the impact of demographic transition on economic growth for the following data for: the entire period from 1961-2015, post liberalisation period and pre liberalisation period of India.

Research Methodology

- **The Research Design**
- This research is based upon Descriptive and Causal Research Designs.
- The Population under study is – The population of India

- **Data Sources**

Secondary data was collected from various sources like: The Census Department of India, World Bank, United Nations, N.S.S.O., Socio-Economic Reports of the Government of India, and RBI Bulletin. Demographic Data was available from 1960-2015 and economic growth data was available from 1961-2015. Hence the period under study is 1961-2015.

Data Analysis

Variable Descriptions and Model Specification:

Table 2: Variable Descriptions

Name	Description
Dependent Variable	
GDPPC	G.D.P. per capita annual percentage growth
Independent Variables	
EPP	Ln (Economically Productive Population age 15-59/ total population) % share
OAP	Ln (Old Age Population 60 years and above/ total population) % share
TP	Ln Total Population
PD	Population Density

The Data was analysed using Multiple Regression models to study the relationships between demographic variables and economic growth of India. On the basis of the variables defined above, the Multiple Regression Models applied for the analysis are:

Model 1:

Model for the entire period of study: 1961-2015

$$\mathbf{GDPPC = \alpha_0 + \alpha_1 EPP + \alpha_2 OAP + \alpha_3 TP + \alpha_4 PD + \varepsilon}$$

Sub Model 1a :

Pre-Liberalisation Model: 1961-1991

$$\mathbf{GDPPC = \beta_0 + \beta_1 EPP + \beta_2 OAP + \beta_3 TP + \beta_4 PD + \varepsilon}$$

Sub Model 1b :

Post-Liberalisation Model: 1992-2015

$$\mathbf{GDPPC = \gamma_0 + \gamma_1 EPP + \gamma_2 OAP + \gamma_3 TP + \gamma_4 PD + \varepsilon}$$

Empirical Results

Table 3: The comparative view of the relations and significance between the variables

Independent Variables	Entire period Data 1961-2015 (Model 1)		Pre Liberalisation 1961-1991 (Sub-Model 1a)		Post Liberalisation 1992-2015 (Sub-Model 1b)	
	Coefficient	Sig- p value	Coefficient	Sig- p value	Coefficient	Sig- p value
Constant	-5.533	0.993	-321.247	0.801	-1200.846	0.555
EPP	36.035	0.701	49.362	0.765	326.840	0.394
OAP	-19.493	0.345	-92.563	0.645	-7.111	0.809
TP	-8.671	0.686	21.568	0.796	-2.339	0.981
PD	0.061	0.627	-0.004	0.986	-0.219	0.646
R square		0.309		0.040		0.242
F		5.602		0.270		1.516
Overall Model Sig- p value		0.001		0.895		0.238
Dependent Variable GDPPC = G.D.P. Per Capita Growth Annual Percentage						

From the above table we extract the following estimate models:

MODEL- 1 (Entire Period: 1961-2015)

$$\mathbf{GDPPC = \alpha_0 + \alpha_1 EPP + \alpha_2 OAP + \alpha_3 TP + \alpha_4 PD + \varepsilon}$$

$$\mathbf{GDPPC = -5.533 + 36.035\ EPP - 19.493\ OAP - 8.671\ TP + 0.061\ PD + \varepsilon}$$

The above results indicate that in case of Model-1 EPP is the highest contributing variable to the dependent variable GDPPC, followed by OAP and TP respectively. The positive relation between EPP and GDPPC justifies that an increase in the economically productive population of the country leads to an increase in its economic growth. The inverse relation of OAP and TP with GDPPC indicates that an increase in the old age population or an increase in the total population leads to a decline in GDPPC. The Coefficient of Determination R^2 which evaluates the overall impact of all the independent variables on the dependent variable which indicates that the independent variables can jointly explain 30.9 % of the total variation in the dependent variable which is a moderate relationship. Population Density has a positive but insignificant relation with economic growth. Though all the regression coefficients are insignificant, the p-value of for F-statistic indicates that the model though moderate, it is significant implying thereby a noticeable impact of demographic variables on Economic Growth of India. Thus the transition in the demographic structure of India has a significant impact on its economic growth.

SUB MODEL-1a: Pre-Liberalisation Model: 1961-1991

$$\mathbf{GDPPC = \beta_0 + \beta_1 EPP + \beta_2 OAP + \beta_3 TP + \beta_4 PD + \varepsilon}$$

$$\mathbf{GDPPC = -321.25 + 49.362\ EPP - 92.563\ OAP + 21.568\ TP - 0.004\ PD + \varepsilon}$$

The regression results of SUB MODEL-1a indicate that OAP is the highest contributing variable to GDPPC, followed by EPP and TP respectively. Again it is also observed that OAP is insignificantly inversely related with GDPPC while EPP and TP are insignificantly positively related with GDPPC. This indicates that it an increase in OAP led to a decline in the economic growth of India in Pre-Liberalisation period. The value of R-square indicates that only 4% total variation in GDPPC is being explained by the estimated Pre- Liberalisation Era regression model indicating that demographic variables had a weak relation with the economic growth of the country. Population density has an insignificant inverse relation with economic growth. The overall significance of the estimated model in this period is insignificant. Thus in this period the economic growth was not much affected by its population structure or rather the country did not consider the demographic composition as a serious factor affecting economic growth during pre-liberalisation era.

SUB MODE-1b: Post-Liberalisation Model: 1992-2015

$$\mathbf{GDPPC = \gamma_0 + \gamma_1 EPP + \gamma_2 OAP + \gamma_3 TP + \gamma_4 PD + \varepsilon}$$

$$\mathbf{GDPPC = -1200.8 + 326.84\ EPP - 7.111 OAP - 2.339\ TP - 0.219 PD + \varepsilon}$$

The results of Model-1b indicate that the significance of the estimated model has significantly increased from 4% to 24%, though the overall relation is insignificant in Post Liberalization period. Thus there is a considerable improvement in the strength of the estimated regression model during this period. The results indicate the highest positive impact of EPP on GDPPC. Whereas, OAP is the next highest contributor followed by TP, both having inverse relationship with GDPPC. Population density is also inversely related with GDPPC in this model. Thus an increase in economically productive population leads to a very high increase in economic growth of the country, whereas; an increase in Total population or Old age population leads to a decline in the economic growth of the country. Thus it can be clearly seen that the post liberalization scenario is quite different as compared to pre-liberalization scenario.

Comparative Analysis of all the models

From all the above models, it is apparent that the proportion of economically productive population in the demographic structure significantly affects the economic growth of the country. In post liberalization period, there is a highest contribution of this factor to the economic growth of the country as compared to the pre liberalization period. Further, EPP is found to be the highest contributor to the economic growth of

India in case of the entire period model as well as post liberalization model, while OAP with inverse relationship with economic growth is found to be a highest contributing variable in case of pre-liberalisation era. This indicates that the Demographic transition in India has a noticeable impact on its economic growth.

Conclusion

This research was undertaken to study the impact of demographic transition on economic growth of India. This research paper thus, attempts to reveal the contribution of the demographic dividend on economic growth. The results indicate that it is necessary for the country to consider the impact of the changes in her demographic structure while evaluating her economic growth. In case of India, post liberalisation era has an important asset of increased economically productive population contributing positively to her economic growth. Hence the country should concentrate upon exploiting this strength in favour of the higher economic growth. India should frame her economic policies which will enhance the productivity of this significant section of the population. On the basis of the demographic dividend that India is experiencing in the form of its active asset, India in her post liberalisation era has a huge economic opportunity of growth by using her demographic dividend efficiently, and thereby reaps the benefits of her demographic dividend to achieve higher levels of economic growth. However if appropriate proper policy decisions are not taken and even if taken, if the policies are not well implemented then economic growth will go rancid (stagnate). The country must frame the productive economic policies and adopt the strategies for increased and effective employment opportunities for this productive population category so that they may be able to contribute positively with an increased efficiency which may lead India to achieve higher economic growth and thereby, enhance the wellbeing for her citizens.

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