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Demographic Dividend and Economic Growth: An Empirical Study of Transitional India

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ABSTRACT
Demographic transition results in different age structures of the population. These different age groups have different economic behaviour and because of this, age composition change is important for growth of country and working age group have most positive impact on growth. A 'window of opportunity' is created when growth of working age population is higher than growth of total population. This enhanced working age population share is called as 'demographic dividend.' In this background, this paper tries to examine how demographic dividend of a country impacts its economic growth. Here, we have selected 20 major Indian states as the representative of whole country to see the relationship between two variables demographic dividend and economic growth by using fixed effect model from a time period of 2011 to 2020. The results from the panel data analysis presents that relation between demographic dividend and economic growth is significant and positive.

Keywords
Economic growth, Demographic dividend, Fertility rate, Mortality rate, Working age population.

Introduction

When we talk about population growth in human history, it was stagnant and in fact declining in some areas (Guo & Yu, 2017). Before transition there was slow growth, many births, shorter life span and less young population. But after that population growth first accelerate and got back slower down because of mortality decline first and then fertility decline with older population and longer life span. Around 1800, transition started in Europe with declining mortality. With time it got extended to all parts of the world and was likely to complete in 2100. The process of transition starts with decreasing mortality at first place with declining fertility, then proceeded by lower population growth with population aging. Reason for lower mortality could be reduction in contagious disease and infections caused by air and water. Nutrition was one of the main factors enhancing life expectancy. Better nourishment and organ system helped people to fight against disease (Lee, 2003).

In the year 1929 Warren Thompson developed demographic transition concept via Demographic Transition Model. According to him it is a process of transformation of fertility and mortality rates, which changes population size and distribution. Its phases are higher birth rate and death rate, declining mortality rates and then declining birth rate in response to behavioural and social changes, finally stagnant population growth (Ahmad & Khan, 2018).

Fertility, mortality rate and life expectancy extension are some demographic changes barometer which affect market as well as macroeconomic variables (Rezaei, 2021). However, economic growth is not linked with the mortality rate, whereas fertility rate, particularly the birth rates affect growth negatively (Bloom & Williamson, 1998).

The economic scenario of a country can be changed by its demographic factors (Munir & Shahid, 2020). Like, birth rate, death rate and infant mortality rates are some of the key parameters which determine demographic profile of a country (Krishnan, 1976). And mortality and fertility decline are some of the channels through which economic growth is promoted (Kalemli-Ozcan, 2002). Not only demographic factor affect the growth but they concentrate on better health facilities, controlled population and effective labour and better infrastructure (Munir & Shahid, 2020).

And general result of transition process is population aging. Fertility decrement in initial stages with longer life span also results in different population age structure and people's life major portion captured in old age group (D. S. Reher, 2004). Different age groups have different economic behaviour and because of this, age composition change is important for growth of country and working age group have most positive impact on growth. Like, because of high working age population and reduction in family size women involvement became high and results in higher labour supply. Working age group also provides a saving channel, where a larger share of income is left for child upbringing (Kumar, 2013). Large working age population provides lower dependency ratio and higher labour supply. With higher life expectancy

there are additional working years, which results in productive labour. Age distribution in dependency ratio form can affect economic growth of country via demographic channel. Population surge significance is to convert the population cohort into high-yield labour force for economic growth. However, population is considered as an important factor for social and economic growth, but growth is affected via various channels (Munir & Shahid, 2020).

Population age structure is one of the sources of economic growth of a country (Crombach & Smits, 2021). The link between significant population change and economic growth can be seen through transition process. There is both economic and ethnical impact on the country when population migration occurs simultaneously with transition process along with highly growing population. A combination of large investment in education and health sector with higher life expectancy. The result of longer life span is increased human capital investment return and dilated old age life with decreased labour supply and complete retirement. This longer life duration changes long term decision making. Window of opportunity created by transition process results in economic, social, and familial changes (D. Reher, 2012). And socio-economic development of a country affects the pace of demographic transition too (Mulay, 1999).

Objectives

1. To analyse the relationship between demographic dividend and economic growth.
2. To study the impact of demographic dividend on economic growth of 20 major Indian states from 2011 to 2020.

Literature

In pre industrialization era, transition was the result of time lag between mortality and fertility decline. Whereas, in post era it was due to change from high birth and death rates to lower ones (Ye, 2011). It is a process in which there is change in population growth due to fertility and mortality association's transition and also country's population attributes change with time. It consists of 3-5 stages where each and every country achieve modernity.

However, it is an interim process in which demographic variables may delay or rise the growth. Hence a major part of economic growth is attached to this transition process (Megeri & Manoj Kumar, 2016). Furthermore**,** it is a time related process, in which demographic change is central point of attraction. During this, agricultural society turns into industrial one (Bongaarts, 2009). Which composed of total five phases. Pretransition, declining mortality with enhancing fertility and increasing population, population growth peak, declining population growth and finally post transition. Whereas in this process increment in population is not evenly distributed according to the age. People aged 65 and above than that enlarge more in comparison to other groups (Chesnais, 1990). Although different countries have different phase of transition. Most of the developed countries passed third phase, while many developing economies are still passing through this stage (Jafrin et al., 2021). A large number of developed countries came across demographic transition stage even before achieving demographic dividend. Which results in abrupt change from high fertility and mortality to lower ones. Increasing working age population and decreasing fertility are the two outcomes of this transition (Munir & Shahid, 2020).

Fertility and mortality rates are qualitative and quantitative factors of demographic changes on which socioeconomic development is dependent (Jafrin et al., 2021). Pattern of high fertility and mortality converts to low fertility and mortality in transition (Ranganathan et al., 2015). In the middle years of 20th century mortality was declining in whole world and fertility decline was taking place from last 40 years impacting world's population in larger way (D. S. Reher, 2004). India's current population is growing and very large in numbers. This is due to fertility rate decrement. However, from last 30 years many developing nations have designed policies to mark fertility decline. Current available resources got affected by unavoidable consequences of fertility decline, which impacts socioeconomic development of a country and its political stability (Brinker & Amonker, 2013).

In fact fertility is the most important factor that influence demographic structure, whereas higher life expectancy changes the population age structure by enhancing young population (Munir & Shahid, 2020). However, infant and child mortality are some of the important determinants of fertility rate**.** Also, women education level impacts fertility to larger extend, which affects the child and maternal health. Moreover, low fertility provides more time for mothers (Lockwood, 1995). But there is a complicated relation between mortality and fertility. That is why many economics theories states that there must be definite surviving children instead of birth itself. Child survival rate got enhanced because of better child welfare and health facilities (Lee, 2003).

The triggers affecting demographic transition are uneven effects generated by per capita income on household income and opportunity cost of raising children. Income rise results in fertility decline, since positive income effect was dominated by substitution negative impact developed by opportunity cost of raising children. In spite of rise in income with higher investment portion for each children fertility declines because income elasticity of child quantity is less than

income elasticity of child quality (Galor, 2005)**.** Thus whole household saving rate got affected by demographic alterations (Curtis et al., 2015). However, productive investments are required for economic growth and development of the country. And saving is one of the sources of investment. Total, youth and old age dependency ratio, female participation in the labour force and urbanization are some variables that determine savings of a transition economy. Since, saving plays key role in development. The policy makers should design policies in order to enhance savings (Doker et al., 2016).

In fact, demographic changes can affect economic prosperities of a country. Like growth and savings can be altered by working age population via total number of people who can work. With higher child dependency ratio, families got affected by age structure changes at household level. Reduced child dependency ratio, enhanced per capita GDP growth and reduced poverty are some of the results of policy implications. Human development improvements can reduce poverty and boost per capita income by reducing fertility rates via education attainment and reducing teenage pregnancies (Cruz & Ahmed, 2018)**.** Decrement in child dependency rate was the larger contributor GDP per capita growth rate. There were many other factors too affecting growth rate, working age population and total population had very less but a net positive impact on the growth. Whereas, old age dependency ratio had net negative impact. World's population tripled in last half century and major contributors were developing and emerging nations and main concern for this population growth era was impact on economic growth of country (Choudhry & Elhorst, 2010). Because of cultural reasons or household chores, there were too many members in the families before transition. But in modern days parents started liking better lesser number of children and hence family size changed (D. S. Reher, 2004).

However, transition results in different age structures of the population (Ye, 2011). And there are some implications of population aging on growth. Over the life cycle, parameters like savings, productivity and labour supply vary. Population age structure is consequential for economic growth. Large working age cohorts may enhance growth, while elderly cohorts and large youth may slow its pace (Bloom et al., 2010). A 'window of opportunity' is created when growth of working age population is higher than growth of total population. This enhanced working age population share is called as 'demographic dividend.'(Kumar, 2013).

During demographic transition there are many size and age changes in the population, which may result in economic, social, and demographic opportunities and challenges too. These opportunities are called as 'window of opportunity'**,** and cannot emerge demographic dividend automatically because of its transitional nature. Increased labour force, high investment in education, smaller family size, human capital and a greater number of taxable people are some of the channels through which dividend occur (Islam, 2016). Opportunity window provide less dependent, older, and economically active growing population, which results in smaller age dependency ratio and lower cost pressure on society.

However, this large working age population results in higher per capita output called as demographic dividend. But it is a temporary stage. Moreover, this working age population generates and saves more in comparison to consumption whereas young and older population consume more and have nothing to save. Human capital investment is also affected by transition process, like enhanced life expectancy and health measures (Ahmad & Khan, 2018). Increasing physical, human capital and technological process results in more productive labour. Whereas, women productivity depends on rearing and bearing of child which is her prime responsibility (Lee, 2003). Human capital plays a major role in growth and transition process along with other factors too, like capital accumulation and social classes, which may provide explanation for specific output pattern, fertility rate and wages (Brezis, 2001).

Impact of growing population on growth has always been a point of discussion. Economic growth is slow when the growth of working age population is less than that of whole population growth rate. Whereas, growth is rapid when it exceeds whole population. With this, we can state that economic growth is determined by population dynamics. But, driving force behind economic performance is not whole population. Rather, main reason for economic growth is population age distribution (Bloom & Williamson, 1998).

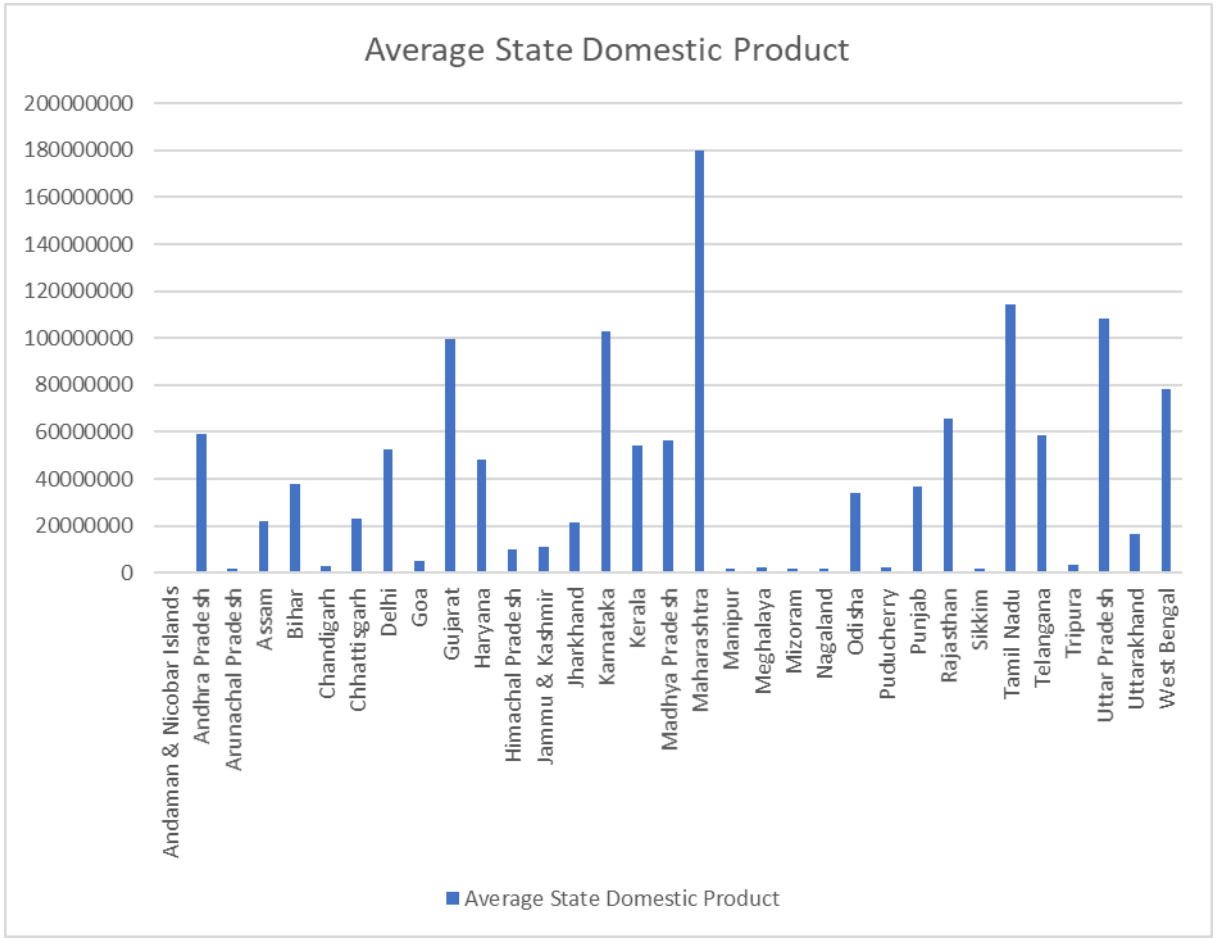
The link between development and population is a concerned topic for researchers, specifically the impact of demographic transition on economic growth of a country. Matter of query was whether population growth has net positive or negative effect on income per capita (Dyson, 2001). There are different views about economic growth, optimistic, pessimistic, and neutral view. According to optimistic view population growth enhances economic development. Whereas, pessimistic view states that population growth restricts development and in neutral view development is indifferent of population growth, where population age composition changes during transition phase in which country moves from high fertility and mortality to lower ones (Kumar, 2013). Similarly, Malthus era believes that population growth restricts economic growth, while according to Simon it helps to enhance economic growth. However, there are some researchers too, who

believes in moderate impact of population growth on economic growth (Mitra & Nagarajan, 2005). And in order to grab advantages from transition opportunities government should design policies for better labour, health, and education. Work participation rate can be enhanced by utilizing full potential of young generation (Megeri & Manoj Kumar, 2016).

Data and Methodology

For this paper, we have collected secondary data from official website of RBI (Handbook of Statistics on Indian States) and Indiastat.com. Annual data is collected for state domestic product and working age population from the years 2011 to 2020 for 20 major Indian states. In this study SDP growth rate is the dependent variable and demographic dividend (working age population, 15-59) is the independent variable. In order to avoid any type of discrepancy in the data, we have collected the data from single source.

Reason for selecting 20 states: In this paper we have selected 20 states: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. The state domestic product (SDP) of these states is higher in comparison to other remaining states, as shown in the bar chart. On the basis of highest individual contribution of these 20 major states in Indian GDP in comparison to other states, we can say that these states impact the Indian economy majorly. However, SDP of Uttarakhand and Telangana state was also considerable but our time period of study is from 2011 to 2020 and Telangana was officially formed in 2014 and no data was available for Uttarakhand for all the targeted years.



Source: *Handbook of Statistics on Indian States/RBI*

Country's growth rate is a function of demographic dividend, in the same manner the state's growth rate can be computed (Misra, 2017).

Based on this fact the estimated model is as follows:

SDP growth rate = *f* (demographic dividend) …… (i)

In mathematical form it can be written as:

SDP growth rate$_{it}$ = $\alpha + \beta_1$ demographic dividend$_{it}$ + e_{it}

Where,
SDP growth $rate_{it}$ is the annual growth rate of state *i* at time *t.*
Demographic dividend is percentage of working age population of the total population of the state i at time t.

Data Analysis
Panel Data Analysis:
The study analyses the impact of selected independent variable (demographic dividend) on the SDP growth rate of each selected state through panel data analysis. This methodology can control unobservable heterogeneity, data multicollinearity problems and decreases estimation bias. It produces more efficiency, variability, and more information (Hsiao et al., 2003)(Dalci, 2018). It gives a strong evidence base via enabling researchers to control for invisible firm specific effects (Baltagi, 2005). However, besides these advantages there is a major problem with panel data analysis. That is autocorrelation, which exists in the data extending for a long time period like 20-30 year (K., 2015). But in our study the time duration is not that long, which make it appropriate for panel data analysis. There are two types of models in this methodology, Random effect methodology (REM) and Fixed effect methodology (FEM). FEM model considers individuality of each cross-sectional unit or firm involved in the sample. It allows the intercept to change for each unit but still presumes that across units the slope coefficients are constant. Whereas, REM is theoretically opposite to FEM. Here the variables are uncorrelated (Dawar, 2014).

Hausman specification test is conducted to choose between FEM and REM (Abdul Kadim & Nardi, 2018) (Nhan, 2019). Specifically, this test differentiates between FEM and REM under null hypothesis, that if individual effects are not correlated with other regressors of the model (Hausman, 1978). This test assesses if the statistical model correlate with data (Misra, 2017). If correlated, then H_o (null hypothesis) is rejected and Fixed effect model is preferred (Misra, 2017)(Gonese et al., 2019)(Roli Mishra 2017).

Pooled OLS is based on limiting assumptions and does not count the unit specific effects. This problem is addressed by REM or FEM (Majeed & Samreen, 2021). However, Wald coefficient test is used to check between Fixed effect method and Pooled method. If there is a significant difference between estimated coefficients then Fixed effect method is suitable(Misra, 2017).

Hypothesis
If demographic dividend is higher, then economic growth will be higher.
In this context, we can suggest:
H_0: Demographic dividend of states does not a have positive impact on their SDP growth rate.
H_1: Demographic dividend of states does have a positive impact on their SDP growth rate.

Interpretation of Results
Descriptive Statistics

	X	Y
Mean	65.2795	11.57736
Median	65.3	11.67741
Maximum	71.6	50.66368
Minimum	55.8	-6.448049
Std. Dev.	3.001228	7.876703
Skewness	-0.471725	1.139339
Kurtosis	3.314329	7.584063
Sum	13055.9	2315.473
Observations	200	200

The overall characteristics of dependent and independent variable is presented by the descriptive statistics in table. Specifically, it provides the mean, median, total number of observations, minimum value, maximum value, standard deviation, skewness, and kurtosis.

In our sample both the variables have 200 observations. The dependent variable, SDP average growth rate is 11.57736 with a maximum and minimum value of 50.66368 and -6.448049 respectively. However, the mid value for SDP is 11.67741 and standard deviation of 7.876703 represents that how much SDP value of all the states is away from mean

value. It is positively skewed with a value of 1.139339 and a high kurtosis with value 7.584063 shows that distribution peak is very sharp, or we can say that all the data points are more clustered around the mean.

Similarly, the independent variable, average working age population percentage is 65.2795% with a maximum and minimum value of 71.6 and 55.8. However, the mid value is 65.3 and standard deviation of 3.001228 represents that how much working age population percentage value of all the states is away from mean value. It is negatively skewed with a value of -0.471725 and a normal kurtosis with value 3.314329 shows that distribution peak is almost equal to normal distribution, or we can say that all the data points are almost distributed normally.

Hausman Specification Test: This test presents the comparison of fixed effects with random effects with a null hypothesis that individual effects are not correlated with other regressors of the model (Hausman, 1978)(Tarazi & Hasan, 2019).

Correlated Random Effects – Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	80.475861	1	0.0000

As the prob value is less than 0.05. Therefore, we will reject the null hypothesis which means that fixed effects are more appropriate in our study. Some other studies show the similar results as that of our study (Abdul Kadim & Nardi, 2018)(Misra, 2017).

Fixed Effect Method

Panel data estimation through Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	28.55250	21.41103	10.67452	0.0000
X	0.546690	0.308930	10.18576	0.0000
D2	2.281670	3.166533	-3.878586	0.0001
D3	4.093160	4.383209	-7.778128	0.9230
D4	6.145470	3.325410	-4.855183	0.0000
D5	2.764604	2.902660	-0.952438	0.0422
D6	10.09513	3.085962	-3.271308	0.0013
D7	11.54636	3.089203	-3.737650	0.0002
D8	9.756448	3.042233	-3.207002	0.0016
D9	-0.280939	2.902660	0.096787	0.0000
D10	1.852640	3.512525	-6.221348	0.0000
D11	0.761896	2.930507	-0.259988	0.0001
D12	12.20528	3.145533	-3.880194	0.7952
D13	7.647660	3.519549	-5.014183	0.0000
D14	12.92133	3.078495	-4.197286	0.0000
D15	12.85694	3.149186	-4.082625	0.0001
D16	6.051403	2.914001	-2.076665	0.0393
D17	9.897370	3.514278	-5.661865	0.0000
D18	3.924236	2.923888	-1.342129	0.0000
D19	2.903320	3.493359	-5.983731	0.1813
D20	5.792043	2.918303	-1.984730	0.0487

R-squared	0.393445	Mean dependent var	11.57736
Adjusted R-squared	0.325674	S.D. dependent var	7.876703

S.E. of regression	6.468142	Akaike info criterion	6.670723
Sum squared resid	7488.797	Schwarz criterion	7.017047
Log likelihood	-646.0723	Hannan-Quinn criter.	6.810875
F-statistic	5.805468	Durbin-Watson stat	2.263193
Prob(F-statistic)	0.000000		

All the estimated coefficients are individually significant, as the p value of estimated coefficients is less than 5%, except for Bihar, Kerala, and Uttar Pradesh.

The results for the regression equation based on the panel data for the period 2011-2022 have been presented in the table. It shows that through Fixed Effect Model with SDP growth rate as dependent variable fits well with the independent variable (demographic dividend) since the value of R^2 is 39.3445%, which is quite high. This indicates that 39.3445 percent variation in SDP growth rate is caused by working age population percentage (demographic dividend) in these 20 states. Or we can say that model's explanatory power is 39.3445 percent. R^2 indicates the model's capability of explaining variations in the dependent variable(Misra, 2017)(Bonsn-Ponte et al., 2008). Many of the previous studies have almost similar R^2, high R^2 value of 50.8% (Misra, 2017), low R^2 value of 7.41% (Upadhyaya et al., 2023), R^2 = 47.2% (Budagaga, 2020), high value of R^2 49.9% (Jafrin et al., 2021), R^2 = 36% (James, 2008), R^2 is 20.03% (Bonsn-Ponte et al., 2008), R^2 = 36.8% (Owusu-Ansah & Leventis, 2006), R^2 = 17.46% (Vuko & Cular, 2014).

The alternate hypothesis is supported by the empirical results, the coefficients attached with independent variable demographic dividend is significant at 5% probability level and positive also. The coefficient of demographic dividend is obtained as 0.546690, which means with 1% change in demographic dividend during the period 2011-2020 there will be 0.54% increase in the SDP growth rate of each state. However, there are some state specific variables which affects the SDP, explained through dummy variables (like culture, infrastructure, health, education etc.). The intercept term of each country is different which highlighted the role of country-specific factors in their contribution to economic growth. In addition to this, the result obtained via panel data analysis also assist the Wald Test for FEM, as coefficient associated with each dummy represent that all the 20 Indian states are significantly different from each other which depict that each state has an individual-specific character which is impacting the SDP growth rate which is represented by dummy variable.

Wald test

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.883097	(19, 179)	0.0000
Chi-square	92.77884	19	0.0000

Null Hypothesis: C(3)= C(4)= C(5)= C(6)= C(7)= C(8)= C(9)= C(10)= C(11)= C(12)= C(13)= C(14)= C(15)= C(16)= C(17)= C(18)= C(19)= C(20)= C(21)=0

Wald coefficient test can be used for checking between fixed effect and pooled method (Misra, 2017). This test also identifies those variables in the model which make significant contributions in the model. The null hypothesis of the test depicts that the value of all dummy variables is equal to 0 or we can say that no fixed effect is present in the model. But the significance level of F statistics indicates that we need to reject the null hypothesis, which confirms the presence of fixed effects in the model (Rajarathin & Tamilselva, 2021).

The value attached with dummy variable in case of Jammu & Kashmir is significant but the coefficient for this state is negative, depicting that all the factors other than demographic dividend does not play a significant role for enhancing economic growth of Jammu & Kashmir. Reason behind this might be the political and other situation prevailing in state. In J&K tourism is vital source for economic growth, but its diversified landscape and challenges of law-and-order hamper communication. Since 2016, violent events discourage Indian and foreign tourism in the valley (Shabir Ahmad Lone & Dr. E.Ravi, 2023).

However, the value attached with Bihar, Kerala, and Uttar Pradesh dummy variables is not significant. This depicts that demographic dividend has not affected economic growth significantly. The demographic window for Bihar, Kerala and Uttar Pradesh is 2026-2036, 1991-2017, 2021-2036 respectively (Adabar, 2022). As we can see that starting point of demographic window for Bihar is too late. This might be the reason that before 2026 Bihar can not utilise the opportunities

created by demographic dividend and hence it can not enhance the economic growth. However, for Kerala the demographic window ends in 2017. In comparison to other states demographic window for Kerala ends too early, which be the reason for its ineffectiveness in improving economic growth. For Uttar Pradesh demographic window starts in 2026, which means it has not encountered any demographic window yet and hence this can be the reason for its ineffectiveness towards economic growth.

Conclusion

The significant but negative coefficient of the dummy variable for Jammu & Kashmir suggests factors beyond the demographic dividend do not significantly boost its economic growth, likely due to political unrest. In contrast, Bihar, Kerala, and Uttar Pradesh show insignificant dummy variable values, indicating limited impact of demographic dividend on their growth. Bihar's late demographic window start may hinder dividend utilization, Kerala's early window end could limit growth, and Uttar Pradesh's yet-to-start window might explain its growth ineffectiveness. Political instability and tourism challenges further hinder growth in Jammu & Kashmir. To sum up the entire discussion, it can be inferred that population growth has shifted from stagnation to acceleration and subsequent slowdowns due to mortality and fertility declines. Developed nations experienced this transition before reaping demographic dividends, altering age structures and economic landscapes. Fertility, mortality, and life expectancy changes profoundly affect socioeconomic development, impacting labour supply, savings, and infrastructure. Population aging and demographic windows of opportunity influence economic growth trajectories. Despite debates over population growth's impact on development, demographic transitions require policy interventions promoting education, health, and labour force utilization for optimal economic outcomes. Success depends on leveraging human capital, technological advancements, and effective governance to navigate demographic shifts and foster sustainable growth.

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