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Demographic Dividend and Economic Growth: Exploring the Case of India

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I. Introduction

India has emerged as the most populous country in 2023, surpassing even China, which was previously known for its high population. India's growing population has generated considerable interest, prompting comparisons with China's demographic landscape. The comparison between India and China holds an inherent interest beyond just their sheer population sizes, as the dynamic of India's population getting younger while China's is getting older contributes significantly to the ongoing contrast between these two nations.

The relationship between population and economic performance has been an ongoing topic of research. Initially, the focus was on the size and growth rate of the population. More recently, however, attention has shifted to understanding how age structure affects economic growth. Developed nations are currently making structural adjustments to address the consequences of declining fertility rates and a growing elderly population. In contrast, many developing nations are experiencing growth in their youth and working-age populations, offering the potential for a demographic dividend. This dividend could fuel short-term economic expansion. When the share of the young working-age group increases, it can have a positive impact on growth due to their higher productivity and greater contribution to the economy. This demographic dividend manifests itself in a higher proportion of economically active individuals within the population, resulting in lower dependency ratios and higher economic growth rates.

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This study looks at India's situation. India's population has been changing, including how many people there are, how fast the population is growing, and how old the people are. The number of people in India has grown quickly, from 446 million in 1960 to about 1.42 billion in 2022.[1] It's projected to reach 1.7 billion by 2060.[2] The age of the population is also changing. India's age groups have been changing for the past 50 years. Currently, about 26% of the people in India are under 15 years old, about 68% are between 15 and 64 years old (working age), and about 7% are 65 or older. By 2050, these figures are expected to change to 18%, 67%, and 15%, respectively.[3] In this context, this paper examines how changes in the population will affect India's economy. Specifically, we examine how shifts in age distribution affect India's economic drivers.

Since 1990, numerous studies have explored the connection between population change and economic growth. The convergence growth model, which incorporates demographic transition, aids in the economic growth analysis.[4] The demographic transition will reshape the labor force, impacting the labor market and industry structure over time. India has a substantial young labor force, with about 67% of the population in the working age category. We examine how the growth of this working age population affects India's economic growth and labor market, using state-level data. Several papers explore India's demographic dividend impact, like Aiyar and Mody (2011), Kumar (2014), and Ladusingh and Narayana (2012), focusing on India's economic benefits. Most importantly, Aiyar and Mody (2011), analyze India's National Sample Survey (NSS) data and find that a 1% increase in population leads to a 0.2 percentage point rise in per capita income. Despite existing research, a gap persists in understanding India's potential demographic dividend. Prior studies, like those mentioned, focused on the opportunities tied to demographic shifts until around 2000. Aiyar and Mody (2011) explored population-economic growth link using 1980-2001 data, and other studies followed suit with early 2000s data. This limitation stems from the scarcity of recent data. The National Sample Survey (NSS) was discontinued after 2011-2012, and the latest census was in 2011, which was delayed to 2020 due to Covid-19. This paper extends the scope of the study to include data up to 2019, achieved by merging two datasets with the most recent information. Furthermore, our analysis encompasses diverse economic dimensions within India. In addition to examining growth in per capita GDP at the state level, we delve into the shifts in employ-

1 World Bank Data Portal (accessed August 15, 2023)
2 UN, World Population Prospects 2022.
3 World Bank Data Portal (accessed August 15, 2023)
4 Bloom and Williamson (1998) demonstrated how it boosted East Asian economies in 1965-1990 via workforce expansion. Bloom and Canning (2004) found the same positive link across countries. Cases like Bloom, Canning, and Malaney (2000) and Mason (2001) attributed the East Asian success to population. Persson (1999) linked age composition to US performance. Feyrer (2007) found a relationship between worker age and productivity using OECD and developing country data, explaining 25% of the OECD-low-income productivity difference and the divergence during the 1960-1990 period. Kögel (2005) linked the youth dependency ratio to low productivity growth.

ment patterns across sectors and the value added by different sectors.

The remainder of the article is organized as follows. Section II outlines data and methodology. Section III estimates the demographic dividend across Indian states during the 1999–2019 period. Section IV concludes.

II. Empirical Strategy

We use the development accounting framework as a tool to explore the relationship between demographic characteristics and per capita output in India. One of the fundamental tenets of the development accounting framework is that the demographic age structure plays a pivotal role in shaping per capita output by influencing both factor accumulation and efficiency (Hall and Jones 1999; Caselli 2005; Hsieh and Klenow 2010). Multiple theoretical pathways demonstrate how the age structure significantly influences per capita output by influencing both factor accumulation and efficiency. First, the age structure impacts aggregate saving rates, driven by heterogeneous saving behavior across age groups in line with the life cycle hypothesis. Second, the employment rate is profoundly affected by the age structure due to the heterogeneity in labor supply observed across distinct age groups. Finally, the heterogeneity in education and experience levels among different age groups is associated with the average human capital of the labor force, thereby further affecting per capita output.

To analyze the interaction between demographic structure and economic growth, we use the following model:

$$log\, y_{it} = D_{it}\beta + \mu_i + \tau_t + \varepsilon_{it} \qquad (1)$$

Here, y_{it} represents the economic status of state i in year t, D_{it} denotes the explanatory variable related to demographic structure, and μ_i, τ_t stand for state and year fixed effects, respectively. The error term is denoted as ε_{it}.

An important consideration in the above analysis is the selection of appropriate demographic variables. Including a large number of age groups in the regression could lead to multicollinearity issues, which could hinder obtaining the desired results. Therefore, it is crucial to meticulously choose the optimal subset of age structure variables to uncover the genuine relationship between demographic structure and economic growth. Following the methodology outlined by Gomez and De Cos (2008) and Zhang, Zhang, and Zhang (2015), we include two crucial variables: the share of the working-age population and the share of prime-age individuals within the working-age group. For the purpose of this study, we define the working-age population as individuals aged 15 to 64, and the prime-age population as those aged 30 to 49.

The regression model combining the two papers is as follows:

$$\begin{aligned} log\, y_{it} = \gamma\, log\, W_{it} + \delta P_{it} + \lambda C_{it} \\ + \theta X_{it} + \mu_i + \tau_t + \varepsilon_{it} \end{aligned} \qquad (2)$$

W_{it} represents the proportion of the working-age population, while P_{it} denotes the share of prime-age individuals within the working-age population. X_{it} incorporates two critical control variables: labor cost, which includes both wage and associated costs, and state-level electricity supply, serving as a proxy for the production capacity. Additionally, C_{it} reflects the proportion of college-educated individuals within the working-age population, capturing the influence of high-educated workers on economic growth. For the dependent variables, we use total state production per capita, sectoral value-added, and sectoral employment rate.

III. Data

1. Population and Labor Market Data

The demographic and employment data at the state level are drawn from a collection of major datasets. Firstly, we use the Employment and Unemployment Surveys (EUS) conducted by the National Sample Surveys (NSS). Initiated in 1950, the NSS is a comprehensive nationwide survey designed to cover various socio-economic aspects of the country's population. The survey aims to provide reliable and up-to-date information on a wide range of topics, including income, employment, education, health, consumption, housing, and more. The Employment and Unemployment surveys are conducted as part of specific rounds, with irregular frequency. In this paper, we utilize data from the 55th (1999) and 66th (2009) rounds of the EUS to examine India's labor market dynamics post-2000. Due to the cessation of the Employment and Unemployment Survey by the NSS Office in 2012, we supplement our dataset with the Consumer Pyramids Household Survey (CPHS) conducted by the Center for Monitoring Indian Economy (CMIE). CPHS is one of the largest household panel surveys in India, following over 170,000 households each year to provide information on consumer spending, income, employment, education, and other socioeconomic indicators. Our analysis focuses on the round conducted in 2019.[5]

The two surveys do not provide weights to precisely estimate the total population. To estimate the count of individuals employed in each sector and state, we derive the sector-wise population distribution within each state using survey data. This share is then multiplied by the state-level (estimated) population for the corresponding year, sourced from the CEIC Global Database. The number of working age (15-64) and prime age (30-49) in each state is also estimated using the share derived from our dataset and the state-level population figures from the CEIC.

India has undergone significant changes in its administrative boundaries since the year 2000.

[5] Other rounds of EUS and CPHS are used to calculate the trends of total population and age structure of India.

Notable instances include the creation of three new states in 2000: Chhattisgarh, Jharkhand, and Uttarakhand, which emerged as distinct entities from Madhya Pradesh, Bihar, and Uttar Pradesh respectively. In 2014, Telangana was established through the bifurcation of Andhra Pradesh. Additionally, in 2019, Jammu and Kashmir underwent a reorganization, leading to the formation of two separate territories: Jammu and Kashmir, and Ladakh. The NSS and CPHS data are aligned with the administrative boundaries in the corresponding years. To ensure data comparability over time, we combine Uttar Pradesh and Uttarakhand, Bihar and Jharkhand, and Madhya Pradesh and Chhattisgarh, based on the administrative boundaries existing in 1999.

It's worth noting that the CPHS does not include certain smaller border states and Union Territories (UTs) located in the northeast, specific islands, and a single small mainland UT. These excluded regions consist of states such as Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, as well as UTs like Andaman and Nicobar Islands, Dadra and Nagar Haveli and Daman and Diu, Ladakh, and Lakshadweep. This exclusion marginally impacts the survey's representativeness because, collectively, these states and UTs account for only 1.5% of the India's total population (Vyas 2020). Notably, Jammu and Kashmir, accounting for 1.01% of the population, is also not included in our sample. As a result, our final sample includes 14 state groups.

Table 1. NSS vs CPHS Comparisons

		NSS				CPHS	
	All	Y=1999	Y=2004	Y=2009	Y=2011	Y=2014	Y=2017
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	27.73	25.53	26.40	27.66	28.08	29.88	31.92
	[18.96]	[18.85]	[18.96]	[19.00]	[19.08]	[18.57]	[18.53]
Male	0.52	0.51	0.51	0.52	0.51	0.53	0.53
	[0.50]	[0.50]	[0.50]	[0.50]	[0.50]	[0.50]	[0.50]
Hindu	0.83	0.82	0.82	0.82	0.81	0.84	0.86
	[0.38]	[0.38]	[0.39]	[0.38]	[0.39]	[0.37]	[0.35]
Muslim	0.12	0.12	0.13	0.13	0.14	0.10	0.11
	[0.33]	[0.33]	[0.33]	[0.33]	[0.35]	[0.30]	[0.31]
SC/ST	0.29	0.29	0.28	0.29	0.28	0.30	0.32
	[0.45]	[0.45]	[0.45]	[0.45]	[0.45]	[0.46]	[0.46]
High School	0.11	0.07	0.09	0.12	0.13	0.14	0.17
	[0.31]	[0.25]	[0.28]	[0.32]	[0.34]	[0.35]	[0.38]
Observation	3,273,902	595,529	602,832	459,784	456,999	633,288	525,470

2. State-level Product and Value-added Data

We employ the total Net State Domestic Product (NSDP) and the sectoral Net State Value-Added provided by the Reserve Bank of India (RBI) to depict both the overall and sectoral economic growth at the state level. These values are presented in real terms; however, it's important to note that the reference year changes from 2004 to 2011. To make the data compatible over different time periods, we standardize the real NSDP and value-added figures in 2011 rupees. We also divide the figures by the state-level total population from CEIC to acquire per-capita values. The economic data at the state level are aggregated into the 14 state groups to match the demographic data.

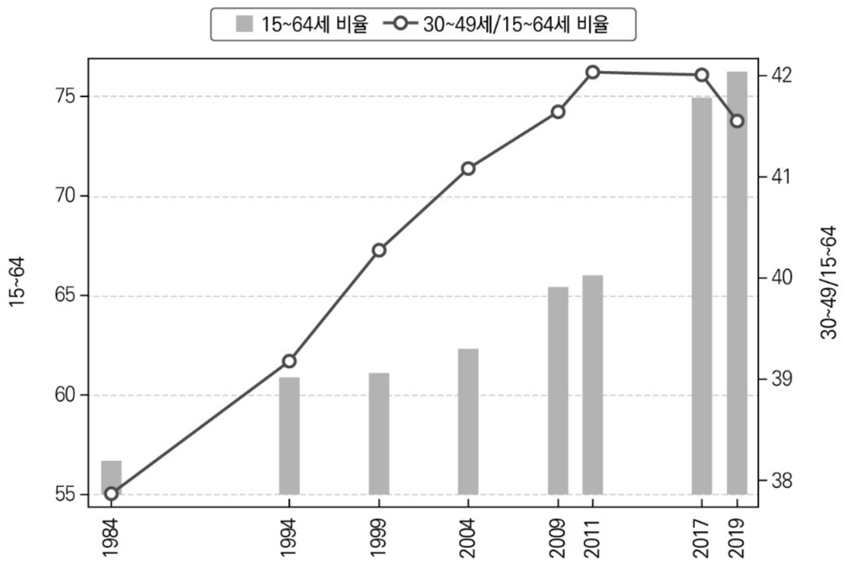
3. Summary Statistics

Figure 1 illustrates the rising proportion of working-age people in the overall population, along with the share of prime-age individuals within the working-age population in our data. The working-age population ratio was 56% in 1984, but it has demonstrated rapid growth, reaching 61% in 1999 and further surging to 65% in 2009. Notably, this ratio has surpassed 75% in both 2017 and 2019, particularly in the years using CPHS data. This deviation is likely attributable to CPHS's inclination to oversample the working-age group in comparison to NSS. Simultaneously, the share of prime-age individuals within the working-age demographic has exhibited consistent growth, expanding from 38% in 1984 to 42% in 2017. When comparing 2011 and 2017, there is no pronounced jump similar to the surge observed in the working-age proportion. This suggests that the CPHS is more compatible when focusing on the working-age population.

Table 2 illustrates changes in working-age and prime-age population proportions across state groups during 1999-2009 and 2009-2019. All states saw positive shifts in working-age populations in columns 1-2, with larger changes in 2009-2019. For 1999-2009, the average change was 4.25 percentage points, with a maximum of 8 points. In contrast, the later period averaged 8.7 points, with a maximum of 17. Changes in prime-age proportions within working-age populations varied more across states than those in columns 1-2. For 1999-2009, the average change was 2 points; for 2009-2019, the average change was 0.06 points.

The table highlights two main insights. Firstly, while the working-age population is growing in all countries, different changes in the prime age share lead to variations in age structure, potentially affecting the demographic dividend. Secondly, an increase in the prime-age population doesn't necessarily translate into a corresponding rise in working-age population. For instance, in Rajasthan and Uttar Pradesh, where there were significant shifts in working-age shares during 2009-2019, the prime-age share of the working age proportion actually declined.

Figure 1. The Proportion of Working Age and Prime Age Population



Source: Ro et al. (2022).

Table 2. Change in Working-Age Population

	Change in Working Age Population (p.p)		Change in Prime Age Population within Working Age Population (p.p)	
	1999~2009 (1)	2009~2019 (2)	1999~2009 (3)	2009~2019 (4)
Punjab	6.15	11.99	-0.29	-1.28
Delhi	4.89	3.98	2.80	-3.49
Rajasthan	4.57	17.47	0.84	-0.27
Uttar Pradesh, Uttarakhand	4.66	14.47	1.17	-1.38
Bihar, Jharkhand	3.26	12.58	1.83	-0.62
West Bengal	5.68	5.25	1.11	-1.26
Odisha	5.42	6.97	2.81	0.28
Madhya Pradesh, Chhattisgarh	5.59	13.81	1.68	0.83
Gujarat	2.51	8.49	1.10	-0.72
Maharashtra	4.93	8.03	-0.24	0.27
Andhra Pradesh	5.20	11.15	1.89	5.25
Karnataka	4.72	12.44	0.69	5.04
Kerala	0.79	6.86	1.51	-0.48
Tamil Nadu	1.89	7.08	3.26	-3.16

IV. Results

Table 3 presents analysis results on India's demographic impact on state domestic product per capita. The analysis includes household and year fixed effects. Columns (2) and (3) detail results with state characteristics and college graduate ratio as explanatory variables. Control variables comprise labor costs identifying state labor markets and power supply capacity representing production environment. The proportion of state college graduates is included to control high-skilled impact. In the comprehensive analysis shown in column (3), findings indicate no effect of increased productive and core working population proportions on per capita economic growth. Conversely, a rise in high-skilled worker proportion positively affects per capita output.

Previous studies have found that India's increase in the proportion of the working-age population has a "demographic dividend effect" that promotes economic growth, but this study has shown that such effect does not exist. There is a reason why the results of this study differ from Aiyar and Mody (2011), who calculated the increase in the proportion of the working-age population every decade from 1980 to 2001 using India's NSS data. India's population growth rate began to decline after the 1980s. India's average annual population growth rate has fallen from 2.3% to less than 2% since the 1990s. When calculating the 10-year population growth rate by state, it can be seen that the growth rate has declined significantly since the 1990s. Therefore, it can be interpreted that the demographic dividend effect had not been found in this study using relatively recent data, compared to the analysis of data from the period when the existing explosive population growth rate occurred.

Table 3. Population Change and Economic Output

	(1)	(2)	(3)
W	-0.124	0.0882	-0.189
	(0.692)	(0.828)	(0.696)
P	0.709	0.0133	0.286
	(1.197)	(1.335)	(1.023)
C			3.498***
			(0.995)
Observations	79	79	79
R-squared	0.976	0.978	0.982
Control		YES	YES

Table 4. Population Change and Sectoral Value Added

	(1) Agriculture	(2) Manufacturing	(3) Construction	(4) Services
W	0.282	-0.283	-0.805	-0.567
	(0.931)	(1.451)	(0.752)	(0.462)
P	5.559**	-2.472*	1.931	4.455***
	(2.165)	(1.338)	(1.351)	(1.153)
C	-0.382	5.821***	1.949	3.551***
	(2.513)	(2.079)	(1.581)	(1.154)
Observations	79	79	79	79
R-squared	0.904	0.970	0.954	0.983
Control	YES	YES	YES	YES

The analysis examined how changes in India's demographic structure impacted output in the industry sector. Demographic shifts had no influence on per capita output, but significant sectoral results emerged. Consistent with previous findings, an increase in the productive population didn't significantly alter industry value-added. However, an increase in the core age share enhanced value added in agricultural and services. A 1%p increase in the productive population transitioning to the core age increased agricultural and service added value per person by 5.60% and 4.46%, respectively. Moreover, a higher proportion of college graduates was correlated with higher per capita value added in manufacturing and services.

Due to the expected impact of changes in demographic structure on industries in terms of employment, an additional empirical investigation was conducted on the proportion of industry-wise employment in the total economy. This employment ratio per industry is the number of employees in a given industry divided by the total number of employees within a state. As shown in Table 5, it was found that the increase in the ratio of the core age population had a positive effect on the employment of the service sector. Specifically, if there is a 1 percentage point increase in the proportion of the working-age population transitioning from a non-core age to a core age, the employment within the service industry grows by 5.18% Analyzing the results of the previous change in the value-added ratio, it can be seen that the increase in the core age ratio tends to increase the value-added per capita of agriculture, while the employment ratio (although not statistically significant) in agriculture tends to decrease. This can be interpreted as a result of the increase in per capita production due to the development of agricultural technology and the increase in the skills of agricultural workers.

Table 5. Population Change and Sectoral Employment

	(1) Agriculture	(2) Manufacturing	(3) Construction	(4) Services
W	2.489	-1.047	-0.306	1.354
	(2.417)	(2.312)	(1.476)	(1.266)
P	-4.443	0.271	-1.820	5.181**
	(4.549)	(3.436)	(2.729)	(1.989)
cs_N2	-7.199	2.980	0.826	0.790
	(6.208)	(5.163)	(6.094)	(2.608)
Observations	78	79	79	79
R-squared	0.470	0.593	0.687	0.535
Control	YES	YES	YES	YES

V. Conclusions

In conclusion, this paper has examined the potential for India's growing youth and working-age population to stimulate short-term economic expansion. By analyzing state-level data from 1999-2019, we have found evidence of a demographic dividend in India, with a growing working-age population contributing to increased economic output. This demographic dividend comes primarily from the prime age population, which is defined as those aged 30-49 years old, and is concentrated in certain sectors such as agriculture and services. The findings of this study are consistent with prior research on India's demographic dividend and suggest that the country is well positioned to benefit from its youthful population. However, it is important to note that sustaining this growth will require continued investment in education and infrastructure, as well as policies that promote inclusive growth and address issues of inequality and social exclusion. Overall, the potential for a demographic dividend in India is an exciting development, and one that policymakers should take more seriously. By investing in education and infrastructure, and promoting inclusive growth, India can continue to build on its economic successes and become a major player in the global economy. KIEP

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