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The Demographic Dividend: Evidence from the Indian States*

ABSTRACT Large cohorts of young adults are poised to add to the working-age population of developing economies. Despite much interest in the consequent growth dividend, the size and circumstances of the potential gains remain under-explored. This study makes progress by focusing on India, which will be the largest individual contributor to the global demographic transition ahead. It exploits the variation in the age structure of the population across Indian states to identify the demographic dividend. The main finding is that there is a large and significant growth impact of both the level and growth rate of the working-age ratio. This result is robust to a variety of empirical strategies, including a correction for interstate migration. The results imply that a substantial fraction of the growth acceleration that India has experienced since the 1980s—sometimes ascribed exclusively to economic reforms—is attributable to changes in the country's age structure. Moreover, relative to the age structure at the turn of the millennium, the demographic dividend could add about 2 percentage points per annum to India's per-capita Gross Domestic Product (GDP) growth over the next two decades. With the future expansion of the working-age ratio concentrated in some of India's poorest states, income convergence may well speed up, a theme likely to recur on the global stage.

Keywords: *Demographic Dividend, Indian States, Age-structure, Migration, Convergence*

JEL Classification: *O47, O15, O53, J11*

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1. Introduction

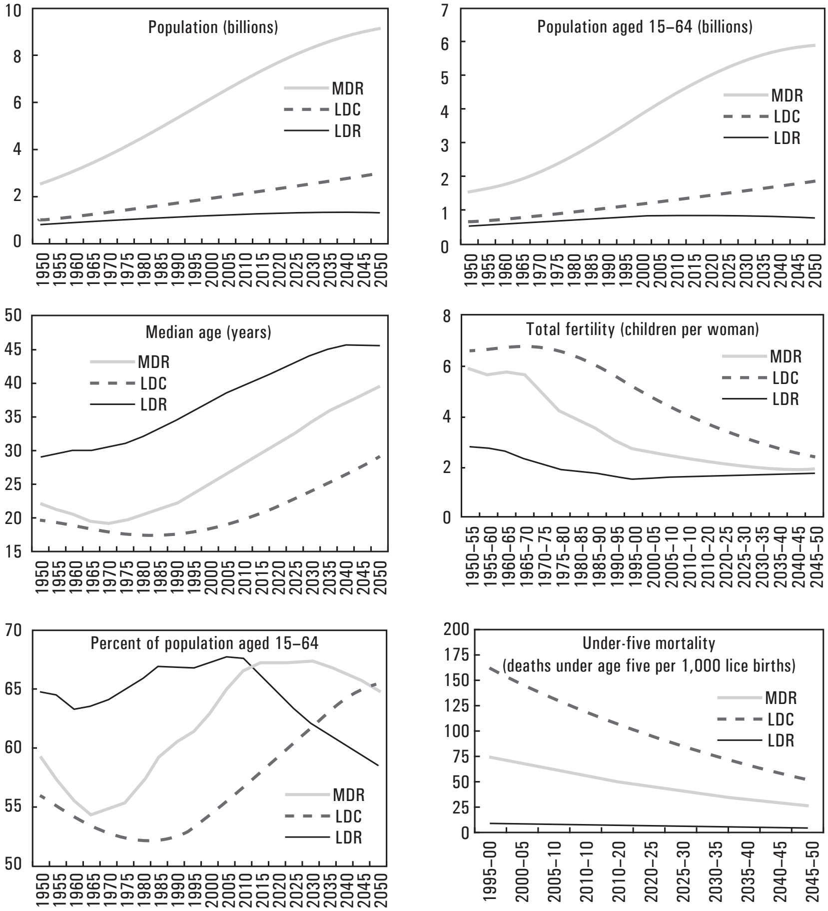
In the next 40 years, the world's population will increase by about 2.4 billion people, with almost all of the increase occurring in developing countries (Figure 1). More importantly, the numbers of those between the ages of 15 and 64—the so-called working-age population—will swell. This boost in potential workers is the outcome of the "demographic transition": declining infant mortality rates that are being followed by falling fertility rates. Thus, with children more likely to survive into productive adulthood and fewer children being produced, the share of working-age populations will increase. For the least developed countries, this share will continue to increase through 2050; for other less developed countries, the share has been steadily increasing and will peak in the coming two decades.[1]

An increase in the working-age ratio can raise the rate of economic growth, and hence confer a "demographic dividend." This can occur through several channels. First, there is the labor-input effect, whereby a greater proportion of workers in a fixed population produces more output per capita. Second, in general, workers save while dependants do not, and even if the correspondence between savers and the working-age population is not exact, the overlap is likely to be considerable. Therefore a bulge in the working-age ratio contributes to higher savings rates, increasing the domestic resources available for productive investment. Finally, the fertility decline that is the source of the changed age structure may induce higher productivity through associated attention to primary education and health, and may also encourage greater female labor supply (Bailey 2006).

While there is a sizeable literature on demographic trends and their economic ramifications, the econometric evidence for the growth impact of the working-age ratio is more limited. Bloom and Canning (2004) is a landmark contribution. For a panel of countries from 1965 to 1995, the authors find a sizeable impact of the working-age ratio on economic growth but only if the economy is "open." Thus, they conclude that the potential for a dividend exists but that it is realized mainly when incentives are in place to exploit that potential. Several papers find that national savings rates are strongly connected to demographic structure (Fry and Mason [1982], Higgins [1998], and Kelley and Schmidt [1996]). Other papers focus on particular countries

1. While the proximate cause of the bulge in working-age populations is the sequence of falling infant mortality rates followed by declining fertility rates, there is much debate about ultimate causes, especially with respect to fertility patterns. See Galor (2011) for a comprehensive review of the theoretical and empirical literature.

FIGURE 1. The Demographic Transition



Source: UN, World Population Prospects.
MDR = More developed regions
LDC = Least developed countries
LDR = Less developed regions, excluding least developed countries

or regions. Persson (2002) and Feyrer (2007) document the relationship in the US between demographic structure and, respectively, output and productivity. Bloom, Canning, and Malaney (2000) and Mason (2001) conclude that East Asia's "economic miracle" was associated with a major transition in age structure, while Bloom, Canning, and Sevilla (2002) find that much of Africa's relatively poor economic performance can be accounted for by the lack of such a transition.

Given the importance of the demographic transition, this paper seeks to deepen our understanding of the size and circumstances of the demographic dividend. In doing so, we focus on India. This focus is motivated by several factors. First, India is in the midst of a major demographic transition that started about 40 years ago and will likely last another 30 years. As a simple quantitative matter, about a quarter of the projected increase in the global population aged 15–64 years between 2010 and 2040 will occur in India.[2] The working-age ratio in the country is set to rise from about 64 percent currently to 69 percent in 2040, reflecting the addition of just over 300 million working-age adults. This would make India—by an order of magnitude—the largest single positive contributor to the global workforce over the next three decades.

Second, recent research on economic growth emphasizes the difficulties of controlling for widely differing economic and noneconomic conditions across countries. An advantage of focusing on India is that we can exploit the variations across Indian states, which are more homogenous than the typical cross section of countries. For our purpose, Indian states have historically exhibited large differences in age structure, both in the level and growth rate of the working-age ratio. And the correlation between states' demographic trends and economic performance appears striking. The paper provides a more careful estimate of the impact of the working-age ratio on economic growth.

Third, for those engaged in the sport of India–China comparisons, the demographic dividend offers the single biggest hope for India to catch up (Kelkar 2004). China saw its population pyramid shift from the bottom-heavy distribution typical of a young and growing population in the early 1980s to a mature population structure by 2000. Over the coming decades, as the working-age population of China declines, that of India will rise rapidly.

In this paper, we describe how a standard conditional convergence framework can be adapted to derive a panel specification in which both the level and the growth rate of the working-age ratio help determine economic growth. The framework is applied to data on the Indian states. In principle, the specification captures all the channels through which a rise in the working-age ratio confers a growth dividend. Thus, this exercise may be viewed as an effort to quantify the aggregate economic impact of India's evolving age structure.

We reach three principal conclusions. First, the demographic dividend in the Indian context has been substantial. This result is robust to adjustments

2. United Nations (2009).

for interstate migration that may be stimulated by growth differentials and to a two-stage procedure in which lagged fertility decisions are used to instrument the growth in working-age population. Our econometric estimates imply that relative to the age structure in 1960, between 40 to 50 percent of the per capita income growth over the next four decades was attributable to the ongoing demographic dividend. While policy reforms had an important role to play in the growth acceleration starting in the 1980s, the results caution that their contribution was less than commonly perceived once the concurrent rise in working-age ratios is taken into account. Second, unlike Bloom and Canning (2004), we do not find the demographic dividend to be conditional on specific policies or social environments. We read the evidence to say that the very features that lead to a demographic transition—mortality decreases followed by fertility decline—also reflect broader health and educational achievements that are conducive to the exploitation of the demographic dividend. Finally, going forward, it is the poorest Indian states that stand to gain the most from the forthcoming demographic transition, since they are the ones that have so far lagged behind in both the transition and in income growth. The prospect of such gains is a source of hope beyond India, where the potential benefits of the demographic dividend are also most on tap for the least developed economies.

The rest of this paper is organized as follows. Section 2 reports on state-specific trends in the age structure of the population and its correlations with income growth. Section 3 describes an econometric framework that is used in Sections 4 and 5 to estimate the demographic dividend, paying attention to various robustness considerations. In Section 6, we use the regression coefficients to quantify the contribution of the demographic dividend in the past four decades and in the decades beyond. The final section offers some concluding remarks.

2. Data and Summary Statistics

We create a database of the age distribution of population, per capita income, and numerous social and economic indicators across Indian states by decade. Data on the age distribution are from successive rounds of the Census of India (COI).[3] Unfortunately, the age groups reported in successive COIs are not uniform. Hence, instead of defining the working-age ratio as the share

3. The Indian census is conducted every 10 years and published in the first year of the decade; thus the ones used in this study are for the years 1961, 1971, 1981, 1991, and 2001.

of population aged 15–64 years, as is conventional, we define it instead as the share of population aged 15–59 years, a group for which we do have a consistent panel.

Two adjustments are made to the population data to account for the creation of new states during the sample period. First, the 2001 data is adjusted to take account of the creation of Jharkhand, Chhattisgarh, and Uttaranchal. These states were carved out of the existing territory of the states of Bihar, Madhya Pradesh, and Uttar Pradesh in 2000. The COI 2001 reports age distributions for these states separately. Since we have the complete age distribution for both the new states as well as the rest of the old states, we consolidate Bihar with Jharkhand, Madhya Pradesh with Chhattisgarh, and Uttar Pradesh with Uttaranchal so that the time series for each state remains consistent with the old geographical divisions. Second, a more complicated adjustment is made to account for the creation of Haryana from the territory of Punjab in 1966.[4]

Real per capita net state domestic product (NSDP) is sourced from the Central Statistical Organization (CSO).[5] With that, for income and age distribution, we have a largely balanced panel of 22 states, with data at 10-year intervals from 1961 to 2001.[6] Data sources for the other variables used will be described as they are introduced, in Sections 4 and 5.

4. The 1966 redesignation also created the Union Territory of Chandigarh, originally a city in Punjab, to serve as the joint capital of Punjab and Haryana. From the COI 1971, we calculate Punjab's population as a ratio of the combined population of Punjab, Haryana and Chandigarh. We do this separately for each age group. We then apply this ratio to the COI 1961 population data on (the old) Punjab, to get a time series that is consistent with the new geographical area. We repeat the procedure for Haryana.

5. The data we actually employ is the Economic and Political Weekly Research Foundation (EPWFR) panel of NSDP (from 1961 through 2004), available on CD-ROM, and sourced from the CSO and Directorates of Economics and Statistics of respective state governments. The data for 1961–71, however, covers only four states. Hence for that decade, we use data from Indiastat (http://www.indiastat.com), a Web site that agglomerates Indian national and state-level data from diverse sources. The CSO data series on real per-capita NSDP have been periodically rebased. To construct a consistent constant price time series we use the base year 1993–94. For any of the previous years, we employ growth rates from differently based series to back out levels corresponding to the 1993–94 base year. For example, growth rates from 1981–82 to 1992–93 are taken from the CSO's base 1980–81 series, and the levels backed out from the fixed point of the per-capita real NSDP in 1993–94.

6. The states are: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Kerala, Karnataka, Maharashtra, Manipur, Madhya Pradesh, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal. Data are missing on income and age distribution for Arunachal Pradesh 1961; income data are missing for Nagaland 1961, Meghalaya 1971 and Nagaland 1971; and age distribution data are unavailable for Assam 1981 and Jammu and Kashmir 1991. Age

Table 1 reports summary statistics for the key variables of interest: the growth in per capita income, the working-age ratio, and the growth rate of the working-age ratio. The first three rows show summary statistics treating each state-time period combination as a separate observation, while the next three rows show summary statistics across states (averaged over time). Both panels attest to the enormous diversity across Indian states.

TABLE 1. Summary Statistics

		Mean	*S.D.*	*Minimum*	*Maximum*
Across states and time periods	Per capita income growth (percent)	2.13	1.67	–1.83 Rajasthan (1971–81)	6.26 Tripura (1991–2001)
	Working age ratio (percent)	54.93	3.37	47.98 Haryana (1971)	64.4 Tamil Nadu (2001)
	Working age ratio growth (percent)	0.22	0.38	–0.68 Madhya Pradesh (1961–71)	0.85 Tripura (1971–81)
Across states	Per capita income growth (percent)	2.18	0.79	0.87 Madhya Pradesh	3.8 Arunachal Pradesh
	Working age ratio (percent)	54.9	1.89	52.2 Bihar	59.7 Tamil Nadu
	Working age ratio growth (percent)	0.21	0.19	–0.09 Jammu & Kashmir	0.55 Haryana

Source: Census of India; CSO; and authors' calculations.

Table 2 reports the evolution of our variables of interest for six selected states. The states have been chosen as representative of two groups: "Leaders" or high-growth states, typically from the south and west of the country, and "Laggards" or low-growth states, largely concentrated in a broad swath of territory running across central and northern India where Hindi and associated dialects are spoken (hence the term "Hindi Heartland"). The divergence in per capita income growth between Leaders and Laggards is well known, with the divergence being highest for the most recent period 1991–2001. What may be less well known is that these trends in income growth are mirrored in the demographic data. A large and widening gap has opened up between the working-age ratios in Leaders and Laggards over the 40-year period. In the decade 1991–2001, the gap reached 8.6 percentage points or 2.6 standard deviations (across state-time observations).

distribution data for Jammu and Kashmir in 1991 are unavailable because there was no census carried out in Jammu and Kashmir in that year.

TABLE 2. Demographic Evolution and Income Growth in Selected States

		1961	1971	1981	1991	2001
Working Age Ratio	Leaders (South and West)					
	Tamil Nadu	56.8	56.5	58.6	62.4	64.4
	Karnataka	52.1	51.5	53.9	57.8	60.4
	Gujarat	52.2	51.7	55.3	58.8	60.3
	Simple Average	*53.7*	*53.2*	*55.9*	*59.7*	*61.7*
	Laggards (Heartland)					
	Bihar	52.1	51.5	51.5	53.6	52.1
	Madhya Pradesh	54.0	50.5	52.3	55.3	54.8
	Uttar Pradesh	53.2	51.4	51.5	53.7	52.3
	Simple Average	*53.1*	*51.1*	*51.8*	*54.2*	*53.1*
		1961–71	*1971–81*	*1981–91*	*1991–2001*	
Working Age Ratio Average Annual Growth Rate (%)	Leaders (South and West)					
	Tamil Nadu	–0.06	0.36	0.64	0.31	
	Karnataka	–0.13	0.45	0.71	0.44	
	Gujarat	–0.10	0.67	0.61	0.26	
	Simple Average	*–0.09*	*0.50*	*0.65*	*0.34*	
	Laggards (Heartland)					
	Bihar	–0.11	0.00	0.40	–0.29	
	Madhya Pradesh	–0.68	0.35	0.54	–0.09	
	Uttar Pradesh	–0.35	0.02	0.41	–0.26	
	Simple Average	*–0.38*	*0.13*	*0.45*	*–0.21*	
		1961–71	*1971–81*	*1981–91*	*1991–2001*	
Per Capita Income Average Annual Growth Rate (%)	Leaders (South and West)					
	Tamil Nadu	0.4	0.1	4.1	5.1	
	Karnataka	2.0	0.7	3.0	6.0	
	Gujarat	1.9	0.9	3.1	3.6	
	Simple Average	*1.4*	*0.5*	*3.4*	*4.9*	
	Laggards (Heartland)					
	Bihar	0.3	0.6	2.7	–0.1	
	Madhya Pradesh	–0.5	0.6	2.2	1.1	
	Uttar Pradesh	0.7	0.7	2.6	0.8	
	Simple Average	*0.2*	*0.6*	*2.5*	*0.6*	

Source: Census of India; Central Statistical Organization; and authors' calculations.

3. Estimation

Following Bloom and Canning (2004), we use a standard conditional convergence equation to derive a relationship between per capita income growth and demographic trends.

$$g_z = \lambda(z^* - z_0)$$

The equation above is a staple of the growth literature, derived and extensively discussed in Barro and Sala-i-Martin (1995). Log income per worker is denoted by z, and growth in income per worker by g_z. The equation states that, over any given time period, growth in per worker income is related to the gap between the steady state level of income per worker and the level of income per worker at the beginning of the period. λ parameterizes the speed of adjustment to the steady state. In turn, the steady state income per worker is a function of several variables that impact potential labor productivity. These include measures of health and education, which determine the quality of the labor stock, or time-invariant factors such as climate, geography, and culture. Denoting these determinants of labor productivity by the vector X and the associated vector of parameters by β, the equation can be rewritten as:

$$g_z = \lambda(X\beta - z_0) \tag{1}$$

To relate this to demographic variables, consider the following simple identity:

$$\frac{Y}{N} = \frac{Y}{L}\frac{L}{WA}\frac{WA}{N}$$

where N denotes population, L the labor force and WA the working-age population. The identity states that income per capita equals labor productivity times the participation rate times the working-age ratio. Let lowercase letters represent the log of these ratios,

$$y = \ln(\frac{Y}{N}); z = \ln(\frac{Y}{L}); p = \ln(\frac{L}{WA}); w = \ln(\frac{WA}{N})$$

It follows that:

$$z = y - p - w \tag{2}$$

And, assuming that participation rates remain constant within each state,

$$g_y = g_z + g_w \tag{3}$$

where g_y is the growth in income per capita and g_w the growth in the working-age ratio. Substituting (2) and (3) into (1) yields:

$$g_y = \lambda(X\beta + p + w_0 - y_0) + g_w \tag{4}$$

Equation (4) is the basis for our empirical estimation. It says that over a given time period, both the initial working-age ratio and the growth rate of the working-age ratio should be positively related to per capita income growth. This is in addition to the impact of any other factors that may affect steady state labor productivity. Note that the vector *X* could also contain time-invariant variables.

Equation (4) imposes strict parameter restrictions on the coefficients for the working-age ratio and the growth rate of the working-age ratio. But the restrictions will not be valid if behavior changes in response to the changes in the working-age population ratio. As argued by a large literature, this is unlikely to be the case. The life cycle hypothesis posits that workers have positive savings while the young and the old consume more than they earn. Thus an expansion in the working-age ratio—the converse of the dependency ratio—is likely to be associated with increased aggregate savings and hence the potential stock of capital. Being born into a large cohort—so called "generational crowding"—could also impact behavior, influencing individual labor supply and relative wages (Easterlin 1980; Bloom, Korenman, and Freeman 1987; Korenman and Neumark 2000). Changes in the working-age ratio could also influence fertility decisions and participation rates. Moreover, to the extent that workers are healthier than the old, an expansion in the working-age ratio could also be accompanied by improvement in the stock of human capital stock, which may not be captured by "input" indicators of health. For these reasons, no restrictions are imposed on the coefficients of demographic variables, allowing the data to speak to their effect.

We estimate various specifications of the form:

$$g\_y_{i,t} = \rho \ln y_{i,t} + \beta_1 \ln w_{i,t} + \beta_2 g\_w_{i,t} + \gamma' X_{i,t} + f_i + \eta_t + \varepsilon_{i,t} \qquad (5)$$

where the dependant variable $g\_y_{i,t}$ is the annual average growth rate of per capita income in state *i* over the decade beginning in year *t*. The main regressors are the log of initial per capita income, the log of the initial working-age ratio, and the average annual growth rate of the working-age ratio over the decade. $X_{i,t}$ is a vector of explanatory variables that might impact steady state labor productivity. f_i is a time-invariant fixed effect, capturing state-specific effects, while η_t is a time dummy, capturing effects unique to the decade beginning in year *t* (in our case, the national policy environment and international growth impulses). Thus the framework comprises a standard application of the within estimator.

All regressions are estimated with heteroskedasticity-robust standard errors. All control variables are measured at time *t*, and, like the initial working-age ratio, should be predetermined with respect to income growth over the following decade. The growth rate of the working-age population, being contemporaneous with the dependant variable, is potentially more problematic. The main determinant of this growth rate should be fertility decisions in the previous decade or earlier. However, other contemporaneous influences on the growth rate of the working-age population may include feedback effects from income growth. This endogeneity concern is taken up at some length in the next section.[7]

4. The Demographic Dividend

Column 1 in Table 3 presents the results from a regression using our two demographic variables—initial working-age ratio and the growth rate thereof—together with state-specific fixed effects and time period dummies. Both variables have the expected sign and are significant. Moreover, their magnitude is large, implying a very substantial impact on income growth. An increase of 0.01 in the log of the initial working-age ratio (i.e., a 1 percent increase in the working-age ratio) is associated with a 0.2 percentage points

7. The specification in equation (5) is technically equivalent to a dynamic panel with a lagged dependent variable, raising the usual issue of upward bias in the lagged dependant variable, in this case the log of initial per-capita income. It has become customary to address this bias using one of two variants of GMM, the difference estimator and the system estimator (Arellano and Bond [1991], Blundell and Bond [1998]). We do not follow this approach here. The difference and system estimators suffer from econometric issues of their own, which in this application are larger than the problems with the within estimator. The difference estimator uses lagged levels to instrument for a specification in first differences; this has the effect of magnifying gaps in unbalanced panels like ours and reducing the number of usable observations. In our case, using the difference estimator reduces the sample size to 38 observations, which we judge insufficient given that we must estimate 27 parameters (fixed effects for each state, plus time dummies, plus coefficients on the lagged dependant variable and demographic variables). The system estimator, on the other hand leads to a proliferation of instruments. In our case, 29 instruments are generated, relative to only 22 groups (panels). Such overfitting can result in biased estimates. Moreover, since the number of elements in the estimated variance matrix of moments is quadratic in the instrument count, it is quartic in T. In our case, with a relatively small sample size, the matrix becomes singular for both estimators, forcing the use of a generalized inverse. This distances the estimates from the asymptotic case and weakens the Sargan-Hansen test (Anderson and Sorensen [1996], Bowsher [2002]). Having said this, the estimates of the impact of demographic variables obtained from the difference and system estimators are qualitatively similar to those obtained by the within estimator (but not so for the lagged dependent variable).

increase in annual average per capita income growth over the succeeding decade. Since the standard deviation of ln $w_{i,t}$ across states is 0.03, a one standard deviation increase in the working-age ratio is associated with an increase of about 0.6 percentage points in per capita income growth. Also, a one standard deviation increase in the growth rate of the working-age ratio is 0.19, which would increase per capita income growth by about 0.5 percentage points.

TABLE 3. The Impact of Demography on Per-capita Growth Controlling for Migration[a]

	Dependent variable: Annual per capita income growth			
	(1)	*(2)*	*(3)*	*(4)*
Log initial income per capita	−0.088***	−0.101***	−0.090***	−0.101***
	0.0175	0.013	0.0167	0.014
Log initial working age ratio	0.188**	0.234***	0.201**	0.235***
	0.077	0.081	0.074	0.076
Growth rate of working age ratio	2.478**		2.548**	
	1.026		0.982	
Adjusted growth rate of working age ratio[b]		1.57***		1.56***
		0.50		0.49
Labor participation rate			−0.016	0.029
			0.032	0.025
R-sqaured	0.73	0.69	0.73	0.74
Observations	76	72	75	72
Groups	22	22	22	22

Source: Authors.

Notes: [a] All regressions employ the within estimator with robust standard errors.

[b] It is assumed that all migrants are of working age. Accordingly, for each decade a counterfactual growth rate of the working age ratio is constructed by deducting the number of net inward migrants over the decade from both the end-of-decade population and the end-of-decade working age population.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

As noted in the previous section, the initial working-age ratio should be predetermined with respect to per capita income growth. However, there is one obvious channel through which per capita income growth could have a contemporaneous impact on the growth rate of the working-age ratio: interstate migration. Although it is widely held that interstate migration is considerable and should therefore be associated with growth patterns, there has been little effort to quantitatively assess this possibility. Cashin and Sahay (1996) studied migration between the Indian states, and found scant evidence that interstate population flows responded to income differentials.[8]

8. They write (p. 162): "…while the [inward] migration rate for the states of India is positively related to initial per-capita income, it is not statistically different from zero. In that

They pointed to strong barriers to the mobility of labor, such as local labor unions that resist competition from migrants, lack of urban housing in migrant destinations, and most importantly, linguistic and cultural impediments to cross-border labor substitutability. In fact, most migration tends to be within-state female migration caused by newly married wives relocating to their husband's village (Datta 1985; Skeldon 1986).

Nonetheless, we attempt to control for the impact of migration on our contemporaneous regressor, using interstate migration data from the COI.[9] For each decade, we construct a counterfactual growth rate of the working-age ratio, i.e., that growth rate which would have prevailed in the absence of inward or outward migration. Lacking data on the age distribution of migrants, we assume that all migrants are of working age. For each decade and state, we subtract the number of (net inward) migrants from both the end-of-decade total population and the end-of-decade working-age population. This yields a migration-adjusted end-of-decade working-age ratio, which is compared to the initial working-age ratio to calculate an adjusted growth rate. Note that our assumption that all migrants are of working age maximizes the possible impact of migration on the growth rate of the working-age ratio. If we had assumed that migrants had the same age distribution as the initial age distribution of the existing population, this would lead to a much smaller adjustment for migration.

Column 2 in Table 3 shows the results from a specification with the growth rate of the working-age population adjusted for migration in this manner. Both the initial level of the working-age ratio and its growth rate remain significant. While the point estimate of the coefficient on the adjusted growth rate of the working-age ratio falls slightly, it is statistically indistinguishable from the non-adjusted coefficient, and is more tightly estimated. These results provide confidence that migration flows in response to per capita income growth are not the main story; instead, causation does seem to run from the demographic variables to income growth.

sense, the income elasticity of migration across the states of India more closely resembles the relatively weak responsiveness of population movements to differentials in the regions of Europe than the relatively stronger responsiveness to differentials in the states of the USA or the prefectures of Japan."

9. We are grateful to Cashin and Sahay for making their dataset on immigration available to us, which fills some omissions in the census data with calculations from vital statistics. Their dataset, however, only contains net migration data for the 1960s, 1970s, and 1980s. For the period 1991–2001 we use our own calculations. For each state, the net inward migration rate is given by $g_N - (b_r - d_r)$, where g_N is the annual growth rate of the population (in percentage terms), and b_r and d_r are the crude birth and death rate per 100 persons, respectively.

Columns 3 and 4 in Table 3 include the labor participation rate, constructed from census data.[10] In principle, a higher labor participation rate should also have a positive impact on economic growth, through the labor-input channel. However, the data do not indicate a significant relationship. While this topic deserves serious research in its own right, we can point to at least a couple of reasons why this might be the case. The average labor force participation rate across states fell precipitously from 83.5 percent in 1961 to 66.4 percent in 1971; it decreased further to 63.4 percent in 1981; and then rose to 67.4 percent in 1991 before falling again to 56.1 percent in 2001. This pattern—or rather, this absence of a pattern—suggests that some significant part of these variations reflect changing census definitions over time, as detailed in footnote 10. Moreover, participation rates—unlike structural variables such as the working-age ratio—are likely to vary with the business cycle. Since state-wise participation rates are measured in a single (pre-census) year, they are likely to incorporate business cycle effects and therefore poorly predict economic growth over the next decade. For the remainder of this paper, we omit participation rates from the specifications.

Table 4 provides an alternative approach to identify the impact of growth in the working-age ratio on income growth. Column 1 reports again the result from the baseline specification. Columns 2 and 3 are IV specifications to reduce the potential bias arising from endogeneity, or from omitted or mismeasured variables. In column 2, the lagged birth rate is used as an instrument.[11] That is, the birth rate in 1961 is used as an instrument for the

10. From 1981 onward, the Census of India reports state level data on two categories of workers: “Main Workers” and “Marginal Workers.” Main workers are those who worked for major part of year preceding enumeration (for 183 or more days in the year). Marginal workers are those who worked any time at all in preceding year, but for less than 183 days. Participation rates are defined as the ratio of Main Workers to the working-age population. Unfortunately the censuses of 1971 and 1961 follow a different convention, reporting only a single category: “Worker.” For these two decades the participation rate is defined as the ratio of Workers to the working-age population. The 1961 Census defines workers as (*a*) those engaged in seasonal tasks and who worked for more than one hour a day through the greater part of the working season and (*b*) those in regular employment in any trade, profession, service, business, or commerce who were employed during any of the 15 days before enumeration (or absent due to illness or other good cause). The 1971 Census changes the definition of “Worker,” bringing it closer to the “Main Worker” of 1981; thus the 1981 Census notes, “It was expected that the Main Worker of 1981 would correspond to the worker of 1971, and the Main Worker and Marginal Worker together of 1981 would correspond to the worker of 1961.”

11. State-wise data on birth and death rates in India have several gaps. Moreover, because their source is the Sample Registration System (initiated in 1964–65), and various fertility surveys (initiated in 1972), no direct estimates are available for 1961. For that year we use

TABLE 4. The Impact of Demography on Per-capita Growth Instrumental Variables

	Dependent variable: Annual per capita income growth		
	(1)	(2)	(3)
Log initial income per capita	−0.088***	−0.076***	−0.080***
	0.0175	0.025	0.025
Log initial working age ratio	0.188**	0.36***	0.38***
	0.077	0.12	0.093
Growth rate of working age ratio	2.478**	4.13*	4.98**
	1.026	2.34	1.98
Instruments			
Lagged birth rate		Y	Y
Lagged working age ratio		N	Y
R-sqaured	0.73		
Observations	76	48	47
Groups	22	18	18
First stage F-statistic		10.7	8.3
Overidentifying restrictions (H0: Instruments uncorrelated with error process)			
Sargan-Hansen statistic			0.23
p-value			0.63
Exogeneity of instrumented explanatory variable (H0: Variable is exogenous)			
Difference in Sargan statistic		0.032	0.067
p-value		0.86	0.79

Source: Authors.

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

average annual growth rate of the working-age ratio between 1971 and 81, and so on. And the presumption is that fertility decisions lagged by a decade are exogenous with respect to current income growth. With one instrument for one endogenous variable, standard tests of overidentifying restrictions are not possible, so column 3 uses the lagged working-age ratio as an additional instrument, with almost identical results.

There are two ways of interpreting these results with past birth rates as an instrument for working-age population growth. A purely statistical approach is based on the argument that lagged fertility is a valid instrument if: (*a*) it is strongly correlated with the regressor that is likely endogenous, and (*b*) it also does not itself belong in the regression, that is, it satisfies the exclusion restriction. Fertility is statistically significant in the first stage equation that explains the growth in working-age population. The F-statistic is greater

intracensal 1961–71 estimates from Bhat et al. (1984). Bhat et al. estimate 1961–71 birth and death rates using both forward and reverse survival analysis; we take the mean of these two techniques.

than 10, assuaging concerns about instrument strength (Staiger and Stock 1997). Moreover, the Sargan-Hansen statistic implies that fertility does not necessarily belong directly in the growth equation, that is, we cannot reject the null hypothesis of zero correlation between the instruments and the error process of the structural equation.

The broader question of interest is whether the validity of fertility as an instrument gives us further insights into the process that generates the demographic dividend. In the first stage regression, the coefficient on fertility has a negative sign. In other words, a decline in fertility is associated, all else equal, with a rise in the growth rate of the working-age population. As Sah noted in 1991, empirical studies had a clear consensus that fertility declined in response to lower child mortality. More recent studies have robustly confirmed that a dominant component of fertility decline is due to the decline in mortality rates, especially child mortality rates (see World Bank 2010; especially Angeles 2010 and Herzery et al. 2011). As is well-known, fertility falls at a slower speed than the decline in child mortality, such that the "net fertility rate," or the fertility net of survival of children, rises for some decades. It is this process that generates the demographic bulge, which leads to the growth in the working-age population. The lags in this process are complex and are not precisely pinned down. In using fertility lagged by a decade, we believe we are capturing a summary statistic of this transition at a relevant moment.

Thus, the first stage regression provides *prima facie* evidence that the growth in the working-age population is primarily driven by the classic demographic transition. In turn, this transition is aided by a variety of public health interventions, primarily improved sanitation to reduce child and maternal mortality, as well as greater access to contraception (Van De Walle 1992) and family planning services (Robinson and Ross 2001), along with the associated rise in the age of first union (Bongaarts 1982). It is possible that some of these as also other social and economic determinants of demographic transition (e.g., urbanization) affect future income growth not only through the working-age ratio but also directly. If so, that would undermine the validity of the instrument. Indeed, Herzery et al. (2011) find that reduced fertility is associated with higher growth. Our interpretation of the post-estimation statistics, which suggest that the exclusion restriction is satisfied, is that the component of fertility decline associated with the demographic transition works primarily through the growth in the working-age population to spur growth.

In the absence of a natural experiment there is no perfect instrumentation scheme. As such, the plausibility of our results rests on the slow-moving nature of age distribution variables, the restriction of changes in the working-age ratio to those changes induced by fertility decisions from a decade ago or earlier (which, in turn, are induced by prior infant mortality trends), and the post-estimation tests supporting the exclusion restriction.

Although columns 2 and 3 verify the important impact of our demographic variables on income growth, the IV procedure suggests an even stronger impact of demographic variables on income growth (although the error bands of point estimates in columns 2 and 3 encompass the point estimate in column 1). This may imply that higher growth, rather than stimulating an increase in the working-age population through inducing inward migration, has the contemporary effect of lowering the working-age population, possibly by increasing the demand for children. The result could also reflect differences in the sample. The IV procedure necessitates a significantly smaller sample: our data on birth rates begins in 1961, so the observations in the structural equation are limited to the period 1971–2001.

Finally, a large enough quantitative difference between the baseline and IV estimates could indicate that the growth rate of the working-age ratio is not, in fact, exogenous in the structural equation. To assuage this concern, a formal test of exogeneity is provided by the Difference-in-Sargan statistic. This is constructed as the difference of two Sargan-Hansen statistics, one in which the suspect regressor is treated as endogenous, and the other in which it is treated as exogenous. Under the null hypothesis that the regressor is actually exogenous, the statistic is distributed as chi-squared with one degree of freedom.[12] In our case, the null cannot be rejected at conventional levels of significance under either IV specification. Given this result, and given the much larger sample available, the basic fixed-effects framework and its greater efficiency relative to IV, we use the standard within estimator in the rest of this paper. While the remaining results are presented using non-adjusted growth rate for the working-age ratio, all specifications with the adjustment for net migration described in Table 3 lead to qualitatively identical and quantitatively very similar results.

5. Allowing for Other Growth Influences

Are the demographic variables reflecting other growth influences? In this section, we consider a variety of other correlates of growth to assess the

12. The test is a heteroskedasticity-robust variant of a Hausman test, to which it is numerically equivalent under homoskedastic errors. See Hayashi (2000).

robustness of our estimates of the demographic dividend. Table 5 introduces three "core" variables to control for human capital and social development.[13] These include the literacy rate, the number of hospital beds per 1,000 residents, and the sex ratio. Of course, there are numerous alternative indicators of education and health. Hospital beds, in particular, are an "input" measure of health rather than the kind of "output" measure that would be more desirable in principle. But in the context of the Indian states, these variables have the best data availability in long time series.[14]

TABLE 5. Introducing Core Control Variables

	Dependent variable: Annual per capita income growth			
	(1)	*(2)*	*(3)*	*(4)*
Log initial income per capita	−0.096***	−0.09***	−0.092***	−0.103***
	0.0133	0.017	0.016	0.013
Log initial working age ratio	0.226***	0.177**	0.147*	0.169***
	0.056	0.084	0.076	0.059
Growth rate of working age ratio	2.375**	2.52**	2.22**	2.214**
	0.917	1.019	1.04	0.928
Core controls				
Literacy rate	0.03			0.031
	0.019			0.02
Hospital beds per 1,000 residents		0.003		0.006
		0.005		0.007
Sex ratio (females/males)			0.133**	0.123***
			0.053	0.042
R-sqaured	0.74	0.75	0.75	0.76
Observations	76	76	76	76
Groups	22	22	22	22

Source: Authors.

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

The sex ratio captures gender bias. Sen (1992) and others have argued that the phenomenon of "missing women" reflects the cumulative effect of gender discrimination against all cohorts of females alive today. Gender bias

13. Several studies have used educational attainment to measure the stock of human capital in an accounting framework, such as Klenow and Rodriguez-Clare (1997), Hall and Jones (1999), Aiyar and Dalgaard (2002), and Caselli (2005). Cross-country panel studies have found that education has a significant impact on income growth (Barro and Lee 1994; Islam 1995; and Caselli, Esquivel, and Lefort 1996). Indicators of health—often proxied by life expectancy—are almost as ubiquitous in the development accounting and empirical growth literatures. Examples include Barro and Lee (1994), Caselli, Esquivel, and Lefort (1996), Shastri and Weil (2003) and Weil (2007). Aiyar (2001) and Purfield (2006) have used both variables to proxy for human capital in cross-state growth regressions for India.

14. For example data on infant mortality rates—a frequently used "output" measure of health—is only widely available on a state-specific basis since the 1980s.

could impact economic growth through higher child mortality, increased fertility rates, and greater malnutrition (Abu-Ghaida and Klasens 2004). Gender bias also acts to reduce the current average level of human capital (Knowles et al. 2002), while limiting the educational gains of the next generation. More generally, increased bargaining power for women within the household is associated with a range of positive development outcomes (World Bank 2001). As such, gender bias acts as a proxy indicator for social development more generally.

Because data on these variables is complete, introducing them into the baseline specification leads to no reduction in observations, an important consideration given our limited sample size. We subsequently report results with additional variables of policy relevance, but that entails substantial attenuation of the sample size.

Columns 1 to 3 of Table 5 introduce each of these variables separately, and column 4 introduces them in tandem. The sex ratio is highly significant: more women relative to men is not only good social policy but is associated with higher economic growth. The other two human capital indicators, though bearing the right signs, are not statistically significant. Importantly, the working-age ratio variables remain strongly robust to the introduction of these additional explanatory variables.

Much effort has been devoted to identifying various growth-enhancing policies in the Indian context (as surveyed by Purfield 2006). Besley and Burgess (2000) examine the impact of land reforms and labor legislation on agricultural and manufacturing growth. Banerjee and Iyer (2005) find differences in agricultural productivity between districts that assigned proprietary land rights to cultivators rather than landlords. Kocchar et al. (2006) find that states with weaker institutions and infrastructure suffer lower GDP and industrial growth.

In many cases, the time dimension or cross section dimension (or both) of the data is severely limited. For example, the measure of transport infrastructure (used, for example, in Purfield 2006) would reduce the number of observations from 76 to 29. We, therefore limit attention to variables whose introduction does not reduce the sample size to below 50 observations.[15] The variables studied are:

- *Social and economic expenditure per capita:* The Indian census reports data on capital expenditure by state governments on social

15. We are grateful to Catriona Purfield for sharing the policy variables' data used in Purfield (2006).

infrastructure (categories such as education, water supply, sanitation and medical, and public health), and on economic infrastructure (expenditures on transportation, power and electricity, telecommunications, and irrigation projects). Taken together, these expenditures comprise "development expenditure." Aiyar (2001) found evidence that these expenditures, measured on a per-capita basis, promoted human capital development and private investment, thus contributing indirectly to economic growth.

- *Scheduled commercial bank credit per capita:* While there are no state-level data available on investment rates or other direct measures of capital accumulation, some studies have used credit extended by scheduled commercial banks as a proxy. The measure should also proxy for financial deepening. Aiyar (2001) and Purfield (2006) found a significant impact of this variable on income growth. Data are sourced from several issues of the Reserve Bank of India's *Statistical Tables Relating to Banking.*
- *Land concentration:* This variable measures inequality in agricultural land holdings. It is only partially a measure of policy, since it is also likely to reflect initial conditions. A priori land inequality could have a positive or negative impact on income growth, with different theories yielding different relationships. Data are taken from the Besley and Burgess (2000) database, which are originally sourced from various rounds on the National Sample Survey (NSS).
- *Cumulative land reform index:* This variable directly measures and aggregates different categories of legislative reforms undertaken at the state level. Besley and Burgess (2000) classify land reforms into four categories: tenancy reforms, abolishing intermediaries, establishing land ceilings, and consolidation of disparate landholdings. Their paper finds no impact of land reform legislation on state per-capita income; a positive impact of land consolidation legislation on agricultural income, and a negative impact of tenancy reform on agricultural income.
- *Cumulative labor reforms index*: Besley and Burgess (2004) examine state amendments to the Industrial Disputes Act of 1947, and code all amendments as being pro-worker, pro-employer, or neutral. The index rises in the degree to which cumulative legislation has been pro-worker.[16] They find that labor reforms are uncorrelated with per-capita

16. The method classifies Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan, and Tamil Nadu as pro-employer states. Gujarat, Maharashtra, Orissa, and West Bengal are

income, but negatively related to manufacturing output (i.e., they find that pro-labor reform is bad for manufacturing growth). Their data is extended to include amendments implemented post-1992 reported in Malik (2003).

Tables 6 and 7 report the results of introducing these policy variables. There is some evidence that development expenditure—particularly economic expenditure—by state governments can spur growth. And land reforms appear to be negatively related to per-capita growth. Of relevance, however, is the robustness of the demographic variables to the introduction of these diverse control variables. The point estimate of the coefficient on

TABLE 6. Controlling for Core and Policy Variables (Part 1)

	Dependent variable: Annual per capita income growth			
	(1)	*(2)*	*(3)*	*(4)*
Log initial income per capita	–0.104***	–0.121***	–0.13***	–0.084***
	0.018	0.0131	0.018	0.025
Log initial working age ratio	0.246**	0.196**	0.243***	0.188*
	0.114	0.075	0.07	0.105
Growth rate of working age ratio	2.281	2.549***	2.925***	3.14**
	1.51	0.841	0.878	1.426
Core controls				
Log literacy rate	–0.007	–0.029	–0.017	0.047
	0.032	0.033	0.033	0.034
Log hospital beds per 1,000 residents	–0.002	–0.002	–0.002	0.009
	0.011	0.009	0.011	0.007
Log sex ratio (females/males)	0.094	0.073*	0.057	0.451***
	0.086	0.039	0.044	0.146
Policy controls				
Log social expenditure per capita	0.001			
	0.019			
Log economic expenditure per capita		0.029**		
		0.014		
Log development expenditure per capita			0.035*	
			0.017	
Log scheduled commercial bank credit per capita				–0.004
				0.006
R-squared	0.76	0.82	0.80	0.81
Observations	58	58	58	57
Groups	16	16	16	21

Source: Authors.

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

pro-worker states. India's six other large states did not implement any amendments to the Industrial Disputes Act over the period. For critiques of the Besley–Burgess methodology, see Bhattacharjea (2006) and Gupta, Hasan, and Kumar (2008).

TABLE 7. Controlling for Core and Policy Variables (Part 2)

	Dependent variable: Annual per capita income growth		
	(1)	*(2)*	*(3)*
Log initial income per capita	–0.113***	–0.121***	–0.104***
	0.0196	0.009	0.016
Log initial working age ratio	0.241***	0.304***	0.24***
	0.072	0.068	0.0809
Growth rate of working age ratio	2.945**	2.928***	2.272*
	1.124	0.88	1.187
Core controls			
Log literacy rate	0.025	–0.034	–0.007
	0.047	0.036	0.032
Log hospital beds per 1,000 residents	0.004	–0.007	–0.002
	0.013	0.008	0.01
Log sex ratio (females/males)	0.132*	0.184**	0.101*
	0.076	0.078	0.059
Policy controls			
Log land gini co-efficient	0.092		
	0.074		
Cumulative land reforms index		–0.003*	
		0.001	
Cumulative labor reforms index			–0.001
			0.003
R-squared	0.78	0.82	0.76
Observations	55	58	58
Groups	15	16	16

Source: Authors.

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

the initial working-age ratio is significant in every specification and quantitatively fairly stable. The growth rate of the working-age ratio is significant in six out of seven specifications, and falls within a narrow numerical range.

We also tried various specifications with age-structure variables interacted with the control variables (see Bloom and Canning 2004). Significant interaction terms would suggest, for example, that the impact of demographic change is enhanced by the presence of a well-educated and healthy labor force, or by a lack of gender bias. But, surprisingly, no significant role for such interactions was found. While this result should be regarded as tentative, the implication is that the health and educational preconditions that make the demographic dividend possible are also sufficient conditions for the exploitation of the dividend.

This explanation, however, is less likely to account for the lack of significant interaction terms with policy variables. Here it seems more plausible that the variables examined in this paper do not adequately capture the kinds of institutions and policies that are complementary to demographic change.

For example, three of the key elements of the economic reforms of the 1980s and 1990s were the dismantling of industrial licensing, trade policy reforms, and greater exchange rate flexibility. All these reforms were applied at an all-India level. The absence of state-level variation may be one reason why there is no evidence of interacting effects. However, in principle, reforms at the all-India level could have a differential impact by state if one state's industrial base contains many more deregulated industries than another, or if it engages in more international trade than another. Such policy complementarities constitute a worthwhile future research agenda, and could possibly provide the counterpart to the interaction between economic openness and the demographic dividend found in cross-country panels. Similarly, a case could be made that considerable social change in the Southern and Western states accompanied the demographic transition and together these had an important impact on the totality of opportunities and policy environment. Where the demographic transition is occurring faster than social change, the gains from that transition may be more difficult to realize.[17]

6. Extra Growth from Demographic Change: Some Simulations

We now apply the point estimates from our regression to assess the past and likely future magnitude of the growth dividend. Let $t = 0$ for some base year. In any period $t > 0$, per-capita income growth *inclusive* of changes in age structure between period t and period t+1 is defined by equation (5) from Section 3:

$$g\_y_{i,t} = \rho \ln y_{i,t} + \beta_1 \ln w_{i,t} + \beta_2 g\_w_{i,t} + \gamma' X_{i,t} + f_i + \eta_t + \varepsilon_{i,t} \qquad (5)$$

Now consider a counterfactual in which the working-age ratio remains fixed at the level of the base year, that is, there is no change in the age structure between period 0 and period t. In this case, $w_{i,t} = w_{i,0}$ and $g\_w_{i,t} = 0$. It follows that:

$$g\_y_{i,t} = \rho \ln y_{i,t} + \beta_1 \ln w_{i,0} + \gamma' X_{i,t} + f_i + \eta_t + \varepsilon_{i,t} \qquad (6)$$

The demographic dividend, DD_t, is the difference between (5) and (6):

17. We are grateful to Dr Venugopal Reddy for this thought. The specific social change that he refers to in personal communication to us is the upliftment of backward classes in the Southern and Western states.

$$DD_t = \beta_1(\ln w_t - \ln w_0) + \beta_2 g\_w_{i,t} \tag{7}$$

Thus DD_t represents the average annual increment in per-capita income growth over the decade starting in year t that can be attributed to changes in the age structure from period zero onwards. It consists of two terms, which have an intuitive interpretation. The first term represents the boost to income growth from the increase in the working-age ratio that has already occurred (relative to the base year). The second term represents the boost to income growth from the growth in the working-age ratio that will occur over the ongoing decade.

6.1. The Dividend thus Far

Applying this formula to historical working-age ratios, Table 8 shows calculations of the dividend by decade, against a counterfactual of no demographic change since 1961. We use the point estimates from the baseline specification in column 1, Table 4 ($\beta_1 = 0.188$; $\beta_2 = 2.478$).

TABLE 8. India's Past Age Distribution and Demographic Dividend[a]

(in percent)

Age group	*1961*	*1971*	*1981*	*1991*	*2001*
0–14	41.0	42.0	39.6	37.3	35.4
15–59	53.3	52.0	53.9	56.7	57.1
60 +	5.6	6.0	6.5	6.0	7.5
	1960s	*1970s*	*1980s*	*1990s*	
Demographic dividend	–0.61	0.42	1.46	1.34	
Per capita income growth[b]	1.24	0.91	3.16	3.44	
Net of demographic dividend	1.85	0.49	1.70	2.10	

Source: Census of India; CSO; and authors' calculations.

Notes: [a] Demographic dividend calculated as the increment to annual per capita income growth relative to a counterfactual in which the working age ratio stays fixed at the 1961 level.

[b] Growth in per capita net domestic product in constant 1993–94 prices.

India's working-age ratio rose—from a very low level—after 1971, with the share of children in the population falling more rapidly than the rise in the share of the old. Moreover, the working-age population accelerated in the 1980s. The demographic dividend mirrored these trends in the age distribution. From small and negative in the 1960s and small and positive in the 1970s, the dividend became substantial in the 1980s and 1990s.

Thus, a considerable fraction of India's growth acceleration from the 1980s to the new millennium may be attributed to the shift in the structure of the country's age distribution. This vital contributor to growth has been missed even in comprehensive accounts for India's growth (e.g., Rodrik and Subramanian 2005). Thus, the dramatic increase in per-capita income growth dating from the 1980s is less dramatic—although still substantial—after netting out the demographic dividend. Indeed, the most striking characteristic of the demography-adjusted per-capita income growth series is that the 1970s appear to be a "lost decade," surrounded on either side by much higher growth regimes.[18]

6.2. The State-wise Distribution of the Dividend

We revisit the experience of the selected states examined in Section 2, to highlight the role played by the demographic dividend. Table 9 illustrates the pivotal role played by the evolution of the age distribution in the economic performance of leaders and laggards among Indian states. Tamil Nadu, Karnataka, and Gujarat, among the best-performing Indian states in recent times, have also reaped an enormous demographic dividend: in the 1980s the increment to per-capita income growth generated by the age distribution was 2.4 percent per annum, rising to 3 percent in the 1990s. Meanwhile, the laggards of the Hindi Heartland reaped a meager dividend, averaging only 0.6 percent in the 1980s and zero in the 1990s. This discrepancy explains a substantial part of the divergence between leaders and laggards from 1981–2001, as illustrated by the bottom panel containing growth rates net of the demographic dividend.

6.3. What May the Future Hold?

Finally, we calculate the demographic dividend for the previous and next four decades, relative to a counterfactual in which the working-age ratio stays at its 2001 level. Table 10 shows a range of projections for India's age distribution.[19] The Census of India 2001 provides projections through 2026,

18. The 1970s were a turbulent decade, encompassing a war with Pakistan in 1971 and the imposition of emergency rule by Prime Minister Indira Gandhi from 1975–77 (see Guha 2007). Even before netting out the demographic dividend, the lower rate of growth in this decade stands in stark contrast to the 1960s and 1980s.

19. The standard method for projecting forward the age distribution is the cohort-component method (the US Census Bureau 2010 has a useful summary). This tracks cohorts of individuals belonging to the same age- and sex-group through their lifetimes. Typically five-year age groups are used. An initial or base year population, disaggregated by age and sex, is exposed to estimated age- and sex-specific chances of dying as determined by estimated and projected mortality levels and age patterns. Once deaths are estimated, they are subtracted from each age, yielding the next older age in the subsequent time period. Fertility rates are projected and applied to the female population of childbearing age to estimate the number of births every

TABLE 9. Demographic Dividend: Selected States

		1960s	*1970s*	*1980s*	*1990s*
Demographic dividend	Leaders (South and West)				
	Tamil Nadu	–0.1	0.8	2.2	2.7
	Karnataka	–0.3	0.9	2.4	3.2
	Gujarat	–0.2	1.5	2.6	3.0
	Simple Average	–0.2	1.0	2.4	3.0
	Laggards (Heartland)				
	Bihar	–0.3	–0.2	0.8	0.0
	Madhya Pradesh	–1.7	–0.4	0.7	0.3
	Uttar Pradesh	–0.9	–0.6	0.4	–0.4
	Simple Average	–0.9	–0.4	0.6	0.0
Per capita income growth rate	Leaders (South and West)				
	Tamil Nadu	0.4	0.1	4.1	5.1
	Karnataka	2.0	0.7	3.0	6.0
	Gujarat	1.9	0.9	3.1	3.6
	Simple Average				
	Laggards (Heartland)	1.4	0.5	3.4	4.9
	Bihar	0.3	0.6	2.7	–0.1
	Madhya Pradesh	–0.5	0.6	2.2	1.1
	Uttar Pradesh	0.7	0.7	2.6	0.8
	Simple Average	0.2	0.6	2.5	0.6
Per capita income growth rate net of demographic dividend	Leaders (South and West)				
	Tamil Nadu	0.5	–0.7	1.9	2.4
	Karnataka	2.3	–0.2	0.6	2.8
	Gujarat	2.1	–0.6	0.5	0.6
	Simple Average	1.7	–0.5	1.0	1.9
	Laggards (Heartland)				
	Bihar	0.6	0.8	1.9	–0.1
	Madhya Pradesh	1.2	1.0	1.5	0.8
	Uttar Pradesh	1.6	1.3	2.2	1.2
	Simple Average	1.1	1.0	1.9	0.6

Source: Census of India; Central Statistical Organization; and authors' calculations.

while the United Nations Population Division (UNPD) and the International Data Base (IDB) of the US Census Bureau provide projections through 2050. Differences in projections arise because of different assumptions about age-specific fertility and mortality, which are themselves based on patterns estimated from past data and international comparisons.[20]

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year. Each cohort of children born is also followed through time and survivors are calculated after exposure to mortality.

20. The UNPD projections, for example, have eight variants corresponding to parametric assumptions: low fertility; medium fertility; high fertility; constant-fertility; instant-replacement-fertility; constant-mortality; no change (constant-fertility and constant-mortality); and zero-migration. Here we show the medium fertility variant, highlighted in United Nations (2009).

TABLE 10. Demographic Projections for India[a]

	Census of India					
Age group	*2001*	*2011*	*2021*	*2026*		
0–14	35.5	29	25.1	23.4		
15–59	57.8	62.7	64.0	64.3		
60+	6.9	8.2	10.7	12.5		
	United Nations Population Division[b]					
Age group	*2001*	*2010*	*2020*	*2030*	*2040*	*2050*
0–14	35.5	30.8	26.7	22.8	19.7	18.2
15–59	57.8	61.6	63.5	64.8	64.6	62.2
60+	6.9	7.5	9.8	12.4	15.6	19.6
	IDB, US Census Bureau[b]					
Age group	*2001*	*2010*	*2020*	*2030*	*2040*	*2050*
0–14	35.5	30.1	26.3	23.5	21.4	19.8
15–59	57.8	61.7	63.5	63.3	61.9	60.1
60+	6.9	8.2	10.2	13.2	16.7	20.1

Source: Census of India; United Nations Population Division; and US Census Bureau.
Notes: [a] All numbers are in percent of total population.
[b] Estimates for 2001 are from the Census of India.

All projections show rapid growth in India's working-age ratio from 2001 through 2021, as the reduction in the country's population of children outstrips the increase in the ranks of the old. The Census of India shows a further (albeit decelerating) increase in the working-age ratio through 2026, and the UNPD through 2030. The IDB projects the working-age ratio as leveling off in 2030. The UNPD projects a leveling-off of the ratio by 2040 and then a decline in the decade leading to 2050.

Table 11 reports the calculations. These suggest that over the previous decade, the increment to per-capita income growth from demographic change has been between 1.5 and 2 percent points per annum. Over the next two decades, the demographic dividend (relative to the age structure in 2001) is projected to peak—adding about 2 percentage points to annual per-capita income growth. Subsequently the dividend should begin to decrease gradually (while remaining positive) based on the UNPD projections, and decrease rapidly according to the IDB projections.

We are unaware of any state-wise projections of the evolution of the age-distribution over the next few decades. However, it is possible to speculate about the likely direction of future changes. The states in the south and west of India have already undergone a major part of their demographic transition, while the laggards have not. Since the average 2001 working-age ratio among the leaders was 62.1 percent versus 53.4 percent in the

TABLE 11. India's Coming Demographic Dividend by Decade[a]

(in percent)

	2000s	*2010s*	*2020s[b]*	*2030s*	*2040s*
Using projections from					
Census of India 2001	2.02	2.04	2.16		
United Nations Population Division	1.60	1.95	2.27	2.10	1.17
US Census Bureau	1.62	1.93	1.69	1.15	0.57
Average	1.74	1.98	2.04	1.62	0.87

Source: Census of India; United Nations Population Division; US Census Bureau; and authors' calculations.

Notes: [a] Calculates the increment to annual per capita income growth relative to a counterfactual in which the working age ratio stays fixed at the 2001 level.

[b] 2021–2026 for projections from the Census of India.

laggards, it seems likely that the bulk of the projected large increments to India's working-age ratio will come from the laggards. A sustained growth acceleration in India's poorest states may now be feasible.

Indeed, the process may already have started. Consider Bihar, the worst of the laggard states. From 2001 through 2009, Bihar's per-capita income grew at an average rate of 6.2 percent per annum, representing a tremendous acceleration from about zero in the previous decade, and well above the median growth rate in our sample for this period.[21] This impressive economic performance has been attributed, especially in the later part of the decade, to the good governance and developmental focus of state's administration.[22] While the reforms implemented have undoubtedly been instrumental in Bihar's turnaround, it is also likely that Bihar's working-age ratio has risen from the very low level of 52.5 percent in 2001 and hence contributed to the growth acceleration. The Census of 2011—whose results are being released in a piecemeal fashion—will reveal the extent of such an increase. The age distribution of the population by state in 2011 would allow the calculation of the growth rate of the working-age ratio from 2001 to 2011, and help assess the contribution of the demographic dividend and its state-wise distribution during the past decade.

21. Among the four big Hindi heartland states, Rajasthan also registered above-median growth of 6.1 percent per annum, while Uttar Pradesh and Madhya Pradesh registered much lower average growth rates of 3.2 percent and 2.7 percent respectively. The median growth rate was 5.7 percent.

22. Chief Minister Nitish Kumar's efforts to improve the law and order in the state, combined with efforts to build infrastructure and expand health and education services, have been viewed as critical to recent improvements in growth performance.

7. Conclusion

The level and the growth rate of the working-age ratio have been robustly associated with India's economic growth. Indeed, a substantial part of India's growth acceleration since the 1980s can be attributed to demographic change. At the very least, to the extent that economic reforms unlocked India's growth potential, demography was fortuitously supportive. That said, the evidence in this paper is, somewhat surprisingly, more favorable to a view that the age structure was an independent source of growth. We find little empirical evidence of complementarities between demographic variables and various facets of social development or the policy environment.

It is possible that the social preconditions for the demographic transition also generate the ability to benefit from the resulting increase in the share of the working-age population. In particular, the demographic transition requires public health and associated social innovations, which, our results imply, work their way to improved growth outcomes through a larger working-age population. It is also possible that the economic policies and reforms most complementary to demographic change were those applied at the national level. We do control for such national influences, although only imperfectly, through time dummies. Research into such complementarities could shed further light on the likely trajectory of economic growth in India and in other countries with the potential to exploit the demographic dividend over the next few decades.

If past relationships hold over the next two decades, India's continuing demographic transition relative to the age structure at the turn of the millennium could yield a further growth dividend of about 2 percent per annum. More interestingly, while the largest expansions in the working-age ratio to date have occurred in southern and western states that have led India in terms of recent economic growth, the bulk of the remaining demographic transition will be concentrated in lagging states, thus raising the prospect of substantial income convergence between rich and poor states.

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Comments and Discussions

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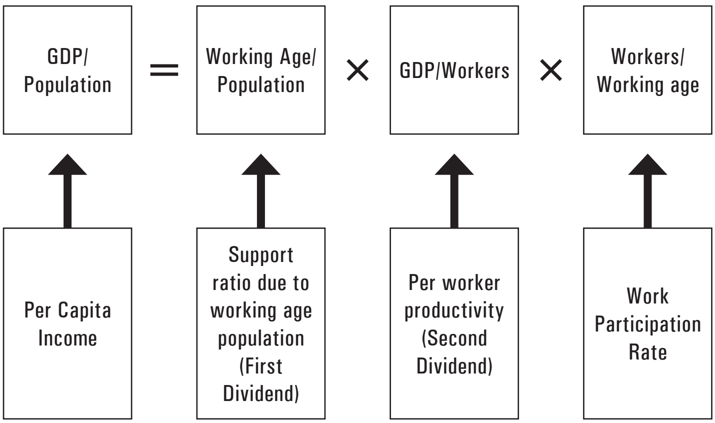
As a demographer, I find it somewhat ironic that after decades of claiming that demographic growth is "neutral" to economic growth, increasing attention is being directed toward positive impacts of demographically driven age structure on economic growth. While I hate to look a gift horse in the mouth, we have not fully understood how demographic dividend operates and whether it has a long term transformative impact on the economy or whether it is simply a deposit that current generation of workers make, to be withdrawn when they get older. Unfortunately the paper by Aiyar and Mody does little to help us address this issue.

Research on the link between population growth and economic growth appears to have come a full circle. The 1960s and 1970s were dominated by studies that suggested that population growth depressed capital/labor ratio and reduced growth (Coale and Hoover 1958; Meadows, Meadows, Randers, and Breherns 1972), in contrast the literature in 1980s and 1990s focused on medium and long term benefits of larger population to be contrasted with short term costs (Cassen 1994; Johnson and Lee 1986). It is only since mid-1990s that following the East Asian economic growth, the attention has shifted to the positive impact of lower dependency ratio during the twilight when past high fertility allows for a large working age population while recent fertility decline results in fewer dependent children. It would be great to accept this optimism; certainly it bodes well for India's future. However, until we understand why and under what conditions we expect this lower dependency ratio to convert into higher economic growth, it would be difficult to bank on this dividend.

As Figure 1 indicates, increase in GDP per capita can be divided into three components: increase in per-capita income is a function of working age population, productivity per worker and work participation rate. Aiyar and Mody summarize these three components nicely. The first component is based on working-age population as a proportion of population, frequently called support ratio. This component, called first demographic dividend by Ronald Lee in a seminal paper (Lee 2003) is more or less mechanical. More workers mean more production. This first demographic dividend is more of a deposit. Fertility decline results in a demographic bulge that leads to higher production while the bulge generation is of working and will lead to higher consumption when it grows older. Lee estimates the size of this first demographic dividend for India to be about 0.5 percent per year—remarkably similar to Aiyar and Mody's estimate of 0.6 percent.

FIGURE 1. Components of Demographic Dividend



Source: Author.

But greed for demographic dividend goes beyond this first dividend—often called a one-time bonus. It is also expected that as dependency burden declines, society will be able to increase savings and improve education, thereby increasing productivity. However, the extent to which India is able to realize this second demographic dividend remains an open question. The very small difference between estimates of Ron Lee's first demographic dividend (about 0.5 percent per year) and Aiyar and Mody's estimates of combined effect of first and second demographic dividend (about 0.6 percent per year) suggests that size of the second demographic dividend in India may well be quite modest. If we reflect on why we expect the second demographic dividend to be important, it is easy to see why its size may not be large for India. Cross-national regressions show that economic growth is far more sensitive to child population size than adult population size (Heady and Hodge 2009), perhaps because decline in child dependency ratio allows for great savings. But decline in total investment in children in India is counterbalanced with growing enrollment and rising privatization of education. While this investment in children may lead to higher productivity in the next generation, poor quality of Indian education, documented by Karthik Muralidharan in this volume may dampen this impact. Comparison of private educational expenditure with children's skill acquisition across states suggests little benefit of additional spending in terms of educational quality.

Moreover, lack of non-manufacturing job opportunities along with very slow agricultural productivity growth has meant that an increasing proportion of Indian labor force is been crowded into agriculture whose weight in the economy is rapidly diminishing. Without increasing labor absorption in nonagricultural employment, size of the second demographic dividend is likely to stay small.

It is the third component, work participation rate, which deserves the greatest attention when engaging in cross-national or interstate comparisons. Here demography is swamped by differences in female labor force participation rates. Female labor force participation rates differ substantially across countries and across states. Indian female labor force participation rate is about half that of China. Thus, any advantage India is likely to have with increasing size of working age population is washed away when we compare proportion of workers in the population and in terms of dependency ratio, India actually is going to remain far behind China for at least until 2030.

One might argue that both development and declining fertility will lead to higher female labor force participation but this is not an automatic relationship. Boserup argued that there is a U-shaped curve of female labor force participation rate with development (Boserup 1970), with female employment falling in initial stages of development and rising in the later stages. This is consistent with the Indian experience where we have seen a 6-percentage point decline in female workforce participation rate between 2004–05 and 2009–10 as per NSS data. Nor is low fertility automatically associated with high female labor force participation. Spain and Italy have very low female labor force participation rates and extremely low fertility whereas Sweden has much higher fertility and higher rates of women's employment. Social institutions such as child care systems, cultural norms and work opportunities shape this relationship or lack thereof. In India, women who have more children also seem to be working more, partly because they are rural, and partly because they come from poorer households.

As we start disentangling different aspects of demographic dividend and explore the pathways through which demography may affect economic growth, four aspects of Aiyar and Mody paper deserve greater attention:

1. *First vs Second Dividend*: First demographic dividend is more or less automatic. Additional workers should add to GDP. However, the size

of the dividend depends on changes in per worker productivity. Thus, it would be helpful if the dependent variable for Aiyar and Mody's analysis were GNP per worker in addition to GNP per capita. This is a particular concern because unless there is a long-term systemic change due to the demographic bonus of having extra workers, added workers of today are simply added dependents of tomorrow. As discussed above, it is possible that per worker productivity growth in India may be may be modest at best.

2. *Focus on Workers Rather than Working-age Population*: Independent variable for this analysis should be worker/population ratio rather than working age/population ratio. This is particularly important in comparing across states. Demographic laggards have considerably lower female work participation rates than the leaders. For example, 41 percent of the women in rural Tamil Nadu work compared to 7 percent in rural Bihar (National Sample Survey Office 2011). Hence, any future predication regarding demographic dividend in laggard states are likely to be overestimates.
3. *Spillover Effects across States*: Aiyar and Mody do a very nice job of examining spillover effects via migration. However, it is important to analyze which pathway for increasing worker productivity is most important in Indian conditions and to see if this may involve spillovers across states. For example, if demographic dividend is obtained via higher savings rates and higher worker to capital ratios, do savings get invested within the same state or are they invested in other states? The paper pays more attention to the mechanical aspects of age composition and less to theory underlying economic changes. Unfortunately when it comes to speculations regarding future impacts of demographic change, greater attention to theory and potential pathways through which demography may affect economy are required.
4. *Endogeneity of Fertility*: Aiyar and Mody assume that main determinants of fertility are socio-cultural norms and public health and not income. However, this assumption runs contrary to substantial accumulated evidence on development as the best contraception. While there are many on-going debates within demography on the role of development vs. ideational change in fertility decline, there is a need to at least consider the potential that fertility may be endogenous (Bloom, Canning, and Sevilla, 2003). Even the data presented in Aiyar and Mody's paper hints at this. Demographic leaders, net of dividend, experienced growth rate of 1.9 percent compared to 0.6 percent for the laggards.

Given these conceptual and empirical concerns, Aiyar and Mody's optimism that demographic changes will help ameliorate spatial inequalities may be closer to wishful thinking.

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The paper is on an important topic. It shows a large role of demographic dividend in explaining the rise in growth rate since the 1980s. This is in line with several papers, like that of Bloom and Williamson (1997) which shows that the demographic transition explained as much as one-third of the East Asian "miracle" growth.

A hopeful aspect of the results in the paper is that for some of the poorer states in the next two decades demographic transition is going to increase the growth rate (already apparent in the last decade's high growth in Bihar, Orissa, and Chhattisgarh).

Four sets of comments:

1. Two mechanisms through which demographic dividend works are not emphasized in the paper:

   (i) Increase in female participation in labor force (since general labor participation is found statistically insignificant in a regression quite early in the paper, it is dropped from further discussion).
   (ii) The effect of saving on the growth rate is not considered in the model of the paper. The age-groups relevant to increasing productivity (through a younger work force) and those for increasing the saving rate are not the same. So, looking to the future, the effect of saving on the growth rate will peak later than the peak in the working age population.

2. A conspicuous absentee in the "other correlates of growth" that the authors consider is sectoral reallocation of labor (from agriculture to other sectors). Census data are available on this.

   In fact in the original Bloom and Canning (2004) paper, on which the regression equation (5) is based, the labor productivity variable is a weighted average of the sectoral labor productivities.

This is important, because if the working age population increase remains trapped in low-productivity agriculture and other informal activities, growth effect will be small

Here policy reform may be quite relevant.

3. In the discussion on State-wise distribution of the demographic dividend, the authors discuss the cases of the leading states (Tamil Nadu, Karnataka, Gujarat) and laggard states (Bihar, MP, UP).

   But one state I'd like more discussion of is Kerala, where the demographic transition and the health and educational improvements came first in India. Yet over the decades considered in this paper Kerala's growth performance has not been spectacular. So more analysis is needed. Two special things to note about Kerala:

   (i) it's partly a remittance economy (which is not captured directly in SDP); and (ii) Kerala has not been an enthusiastic adopter of economic reforms.

4. Some comments on the statistical exercise:

   Is the exclusion restriction satisfied for the instrument variable? A lagged birth rate, through fewer children, may lead to a rise in female participation for the same working age group, which may have a direct effect on the growth rate. The power of the Sargan test (based on asymptotic approximation) is not strong enough, particularly in cases of limited observations, to rule out this likely economic effect.

The "policy control variables" in Table 6 may be endogenous. There may be reverse causality, as growth may affect the variable scheduled commercial bank credit per capita, or social and economic expenditure per capita (through generating more tax resources). An exogenous variable like average distance to ports may capture effects of trade liberalization and other aspects of the policy environment

In general, policies that are complementary to demographic change are not adequately captured, as the paper admits.

In the "core" variables some obvious growth correlates are not considered because data limitations reduce the number of observations for the whole period. One variable, on which Census data should be available for the whole period, is the percentage of villages that are sparsely populated, reflecting problems of rural infrastructure and geographic barriers.

General Discussion

The Chair, Surjit Bhalla, opened the discussion. He stated that the paper made much of the acceleration in GDP growth that took place starting in the mid-1980s when Indian GDP growth went up to about 5.5 percent. One hypothesis is that the drop in the share of agriculture in the GDP explains that acceleration. You now offer the alternative hypothesis that demographic transition is behind that acceleration. Bhalla said that his own view was that the authors' calculations attribute too high a proportion of the acceleration to the demographic transition. It basically left no role, practically zero role, for any contribution to growth of capital formation. He thought that updating the analysis to the 2000s will radically change the results because all the laggard states are now going faster. So then one will need to explain how come this happened in just this decade and not the decade before and the decade before that.

The first speaker from the floor stated that it would be nice to know more about the relationship between these demographic changes and the saving rate. It is inside the model doesn't quite become explicit. At the aggregate level, we know that in the last decade, the national saving rate is gone up hugely but that is not because of household savings have gone up. The increase in savings rate is all due to corporate savings going up.

T. N. Srinivasan said that he was still trying to absorb the paper. One thing that he didn't quite understand is that the authors start from growth equation and then do the counterfactual exercise to get the demographic dividend. But then they later on add policy controls to that equation that were not part of the original theory that led to the growth equation. So what is being estimated later seems an exercise devoid of any theory.

Sheetal Sekhri said that it appeared from the results that there is some degree of heterogeneity to the dividend. So for example, it has increased over the years and you do not see it in Kerala. So maybe it does not pay off in vacuum. Maybe institutions are relevant to whether you will see a demographic dividend or not. It would be worthwhile to look at some sort of heterogeneity in terms of when and where this type of dividend pays off.

Dilip Mukherjee said that he was surprised to hear Sonalde Desai say that economists think that demographics is unimportant. In development economics we think that it's fundamental. The Solow model initially dominated growth theory. We then had the convergence literature *à la* Mankiw, Romer, and Weil. Capital was very important in this literature. You start with the production function, then the output per capita is a function of the total factor productivity and the capital labor ratio and then if you want to look at changes, then savings and population growth come in naturally. Look at all the Mankiw, Romer, and Weil calculations; the population growth rate number is very negative and significant. Demographics are certainly very important. But if we take that as a departure, which seems to be well received part of macro tradition, then it would seem that it would be natural to extend Mankiw, Romer, and Weil kind of decomposition and so you would have savings rates, population growth rates, but then you'd add labor force participation and you'd add age structure. But the present paper is not decomposing growth in that way; it just has the initial per-capita income and then it's only the working age ratio. So the working age ratio is obviously correlated with everything else, with the savings rate, with labor force participation rates, with population growth rates and so on. So what we've got is a reduced form, but the problem is to interpret the reduced form. It would be much preferred if the authors had written down a production function with savings rates, with population growth rates, labor force participation rates and age structure which would naturally arise if you took the age structure seriously in writing down the economy's production function. Then you would have a direct effect of changes in the age structure, but the age structure would also affect the savings rate and the population growth rates. So then hopefully, if all of this can be done, you could decompose the direct and the indirect effects, which will help us interpret what really is going on here. Mukherjee said he felt a bit suspicious of all the controls because, for instance, one of the authors' controls that seemed to be significant was the sex ratio. Now, do we have any theory on how the sex ratio affects growth rates, and one would suspect that the control is really serving as a proxy for health improvements and so on. This goes back to what Srinivasan said that it would be much preferable to write down the theory upfront and then use that to estimate the whole way through, so that we can properly interpret what's happening.

In response, Ashoka Mody opened by stating that it is always tempting to start a paper with a China–India comparison, because it perks up people's interest, as it indeed did. In a way, this comes at an odd time when Indian growth rates are slowing down and the idea that India is embarking on a transition to overtake China seems a little bit less likely than when the paper was initially drafted. What this brings out is that just because China is ageing doesn't mean that China will not continue to benefit from some positive demographic forces. Here it is helpful to go back to the literature. The literature says everything else equal if the share of the working age population goes up, your growth rate per capita may or may not go up. The answer to why it may not can be found in the Arab literature under the rubric Youth Bulge. If you produce a lot of people who are in the working age group and you don't have productive opportunities for them you are actually going to make things worse than if you have a lot of people who are in the working age group and are employed productively. So we are asking the sample question whether more people in the working-age group translate into a higher per-capita income. There is a separate question about the mechanism through which the increase happens. Mody pointed out that one of the early comments they got on the paper related to the Bloom and Canning paper, which says that there is a demographic dividend provided economies are open. The interpretation of that conclusion is that if there is some degree of competitiveness in the economy, some pressures to deploy people productively then having more people in the work force will lead to greater growth and not otherwise.

Turning to the issue of mechanism, Mody noted that this is a question the paper has not addressed. Savings is an important way to address it but it is unlikely that the available state-level data will allow it. Referring to similar mechanism issues raised by Bhalla and Bardhan, Mody said that he saw the issue as one of the nature of deployment of the additional work force that demographic transition makes possible. One possibility was that the gains came from the reallocation out of agriculture into other activities. Another possibility is that the gains came from increased savings. Whatever the mechanism that the gains came through is an interesting and legitimate question and one worthy of further research.

Mody concluded by retuning to China. He noted that just because China was ageing, it was not inevitable that it would slow down. As Bardhan pointed out, it may take a while for the savings rate to decline. Another possibility is that the labor force participation may rise. The demographic dividend as narrowly defined in the paper did not include the labor force participation. Countries like Japan, China, and others, which are ageing, are countering it by changing the labor force participation rates.

Shekhar Aiyar provided additional responses. He said that this paper could be seen as opening the door to a much richer literature. There's plenty more that can be done. Just to go forward with what Mody had said, if one were to take the results seriously, then there is a rich agenda in terms of figuring out the exact mechanisms whereby this increase in the working age ratio is actually translated into growth. You could have a series of papers examining things like savings rates, sectoral reallocation, and all the other mechanisms by which this might operate. Related, many commentators talked about the female participation rate but state-level data going back in a time on this variable could not be found. Exclusion of female participation may bias the estimates in the paper if it is correlated with the working age ratios. If female participation tends to be higher in those States which have either higher working age ratio or those States in which the working age ratio is growing faster, the estimate of the demographic dividend would be higher than what is reported in the paper.

Turning to interactions with policy variables, Aiyar said that he and Mody had carried out a number of tests but found no significant effects but further investigation along the lines suggested by Bardhan was possible. One could investigate whether the reforms in 1991, carried out at the central level, could have differential effects across states depending on state-level policies relating to, say, restrictiveness of labor laws. So, the same federal intervention could actually have differential impacts by State and it would be worthwhile research agenda to look at whether those different effective state interventions interact with the demographic dividend.

Mody rejoined the discussion by commenting on Kerala. He said that there were two points to be made with respect to that state. One, for several decades, it seemed that Kerala was not growing very rapidly. But according to Arvind Panagariya, Kerala has actually done better than most people believe. But one could still persist that that is a more recent and we still need to explain the prior decades. That leads to the second point, which is that is there was extensive migration from Kerala and this is not just a Gulf phenomenon but much older. So the one State that did have a demographic dividend in the sense defined in the paper gave it away to the world through migration.

The Chair concluded by thanking the authors for an excellent paper and other participants for very interesting discussion. He noted that demographic dividend was now an important stylized facts in the development literature, second only the catch up. He felt, however, that the estimates offered by the authors were far too high.

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