

Income, Health, and Fertility: Convergence Puzzles

“... real development cannot ultimately take place in one corner of India while the other is neglected.”

– Pandit Jawaharlal Nehru

Despite rapid overall growth, there is striking evidence of divergence, or widening gaps in income and consumption across the Indian states, in sharp contrast to patterns within China and across the world. This trend is particularly puzzling since that the forces of equalization—trade in goods and movement of people—are stronger within India than they are across countries, and they are getting stronger over time. This raises the possibility that governance traps are impeding equalization within India. In contrast, health outcomes are converging within India. Compared to international standards and accounting for levels of income, India does well on life expectancy, not-so-well on infant mortality rate, and strikingly well on fertility rate.

I. INTRODUCTION

10.1. As Chapter 1 has documented, India's economic performance has been remarkable in the aggregate. Its continued success as a federation depends on the progress of each of its individual states. What can be a reasonable standard for assessing how well the states are doing? One intuitive metric can be to see how well individual states have done over time on two broad sets of indicators: economic and health/demographic indicators. This analysis starts from the 1980s because it allows for a longer term perspective; but also because that is the time when the structural break from the previous era of the “Hindu Growth Rate” (to use the late Professor Raj Krishna's term)

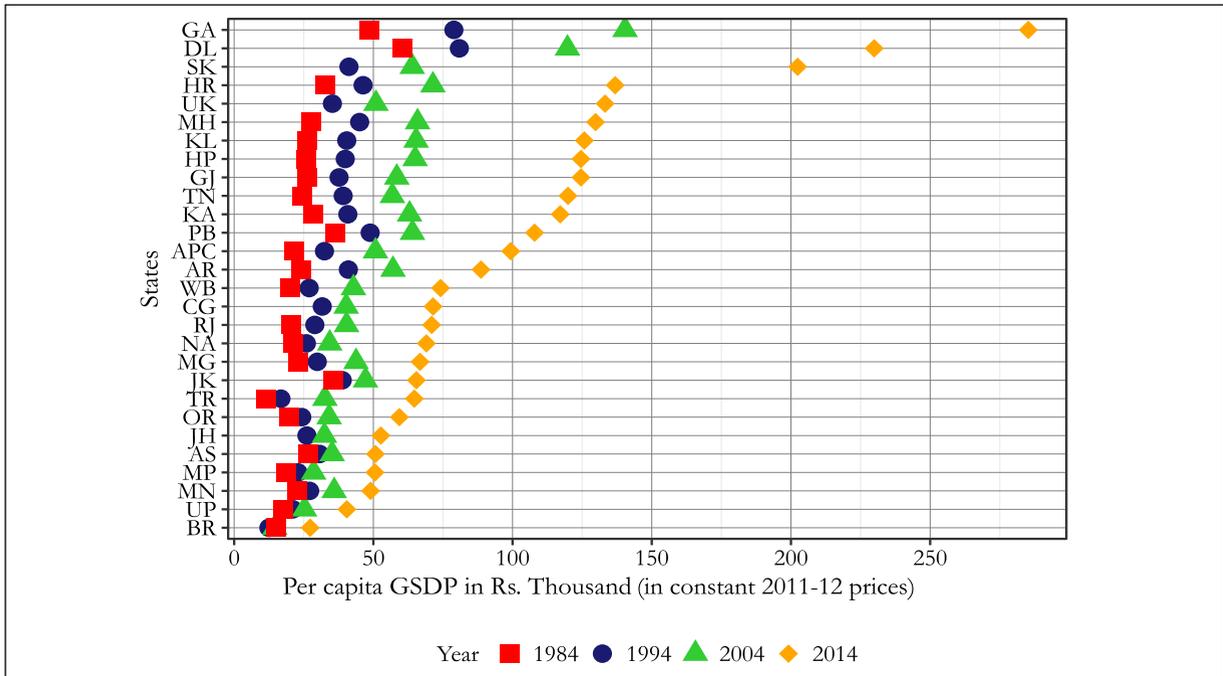
occurred (De Long, 2001; Williamson and Zaghera, 2002; Rodrik and Subramanian, 2004).

10.2. Figure 1 plots the level of real per capita GSDP over time between 1983 and 2014 (the latest year for which comprehensive data is available). It is clear that, especially during the last decade, there has been an across-the-board improvement reflected in the whole distribution shifting right. For example, between 1984 and 2014, the least developed state (Tripura) increased its per capita GSDP 5.6 fold; (from per capita GSDP of Rs. 11,537 in 1984 to Rs. 64,712 in 2014) and the median state (Himachal Pradesh) increased its income level 4.3 fold.

10.3. Figures 2A, 2B and 2C show plots

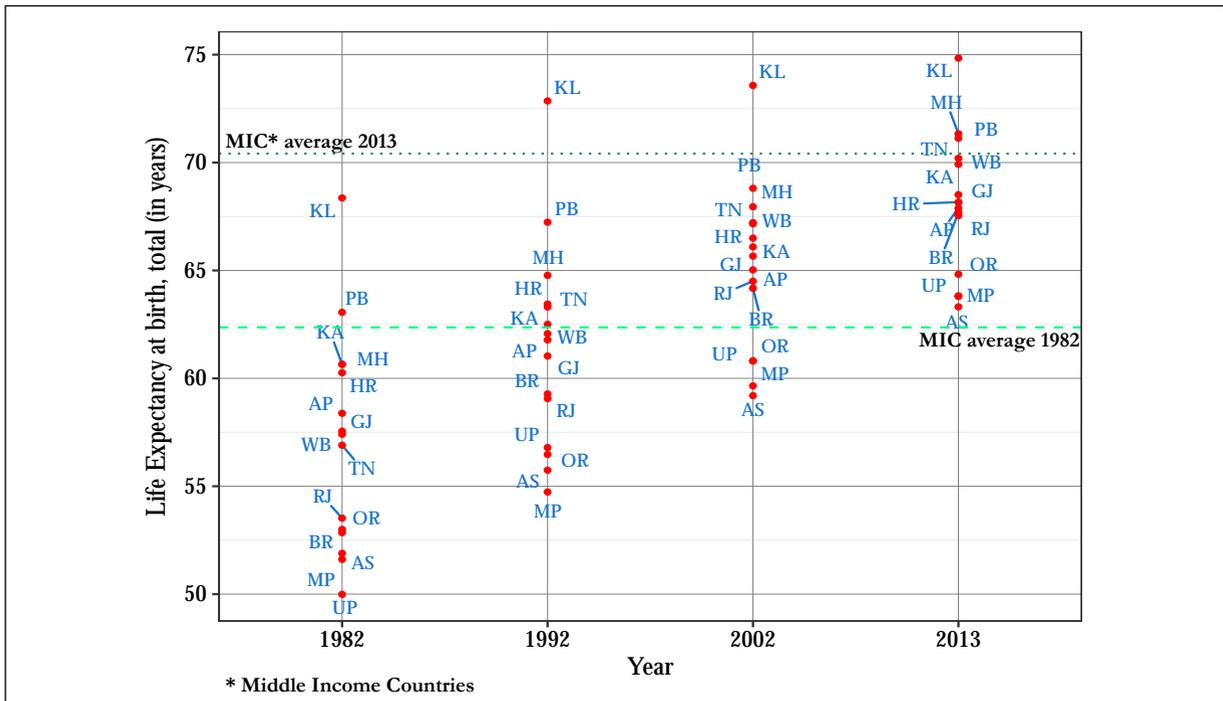
¹ In 2011-12 prices. The words "income" and "per capita GSDP" are used interchangeably in this chapter.

Figure 1. Income Levels over the years in India, All Indian States



Source: Survey estimates

Figure 2A. Life Expectancy Levels Over Time in India



for life expectancy, infant mortality rate, and total fertility rate for Indian states². Life expectancy at birth (LE) indicates the number

of years a newborn would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

² We focus on a sub-set of overall health indicators for reasons of space and tractability. It is possible that other indicators such as child stunting and maternal mortality do not conform to the patterns of the indicators we discuss here. Last year's Survey (Vol. 1, Chapter 5) contained an extensive discussion of outcomes relating to "mother and child," including stunting and health of pregnant women.

Figure 2B. Infant Mortality Rate (IMR) Levels Over Time in India

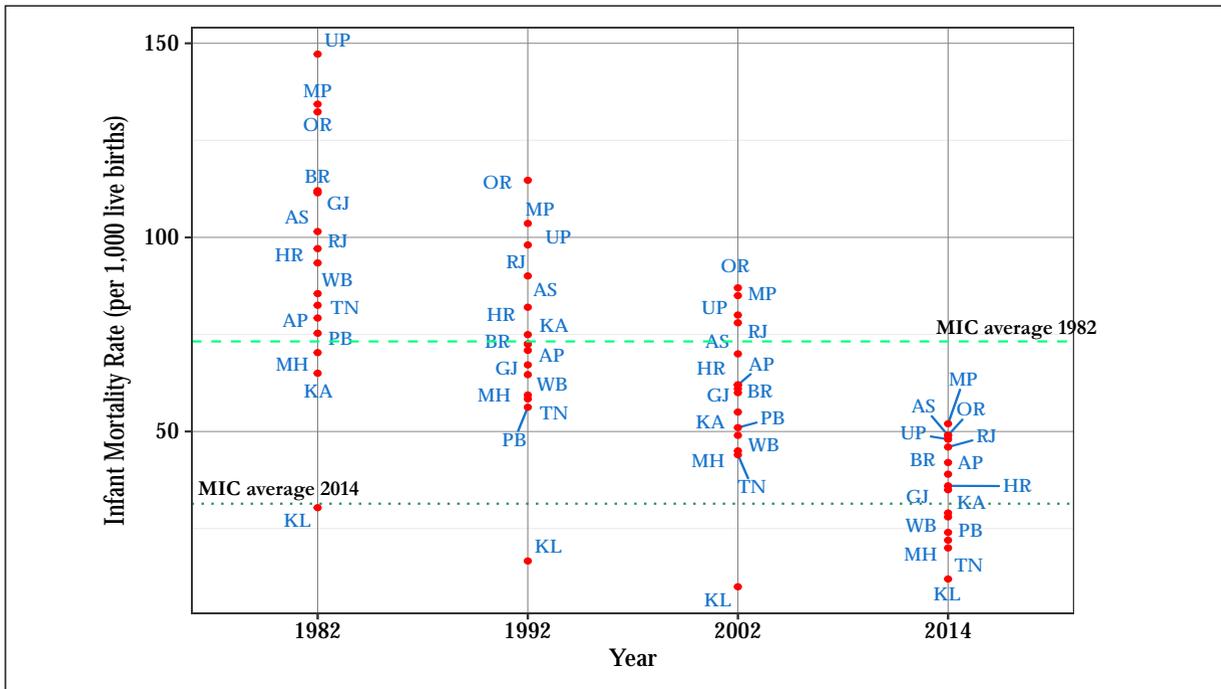
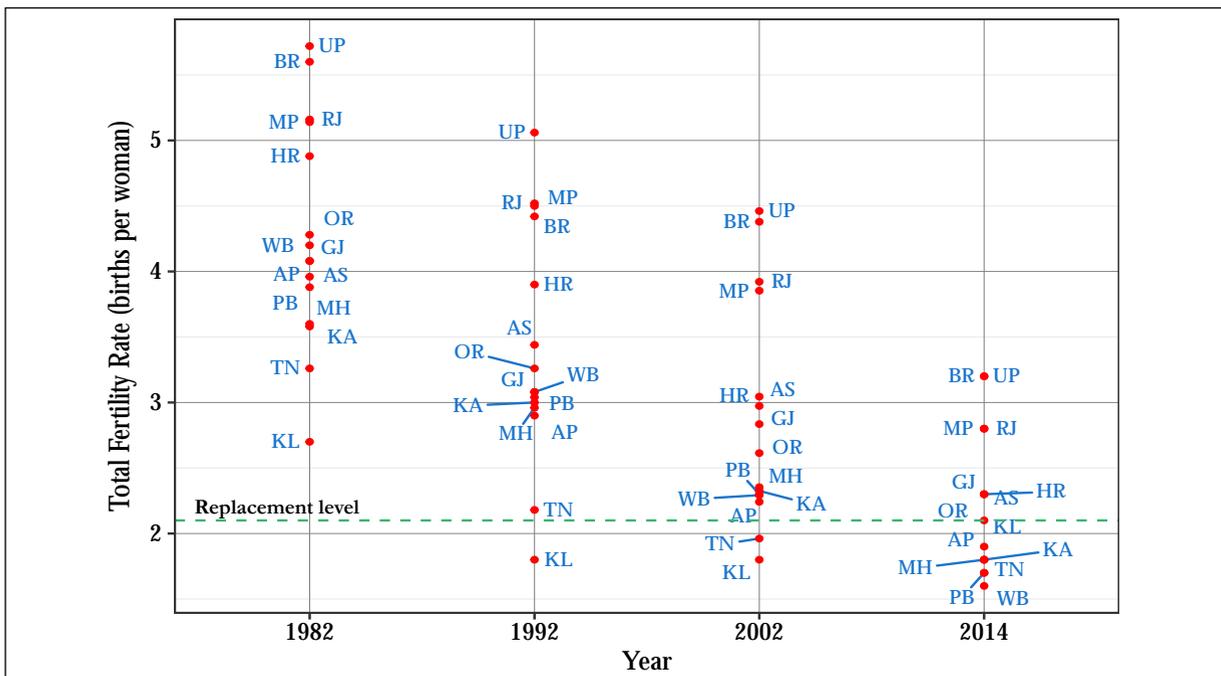


Figure 2C. Total Fertility Rate (TFR) Levels Over Time in India



Source: Sample Registration System

Infant mortality rate (IMR) is defined as the number of infants dying before reaching one year of age, per 1,000 live births in a given year. Total fertility rate (TFR) is defined as the number of children that would be born

to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates in a given year.

10.4. Across these health and demographic

China. Figure 3 captures these divergent developments for the period 2004-2014. It plots income convergence for the world, China and India. In the figure, the growth of per capita GDP is on the y-axis and the log value of initial level of per capita GDP (in PPP terms) on the x-axis. For convergence or catch-up to occur, the relationship should be negative (the line of best fit should be downward sloping because convergence theory says that the less developed you are to start off with the faster you should grow subsequently). The blue, red, and green lines plot, respectively, the relationship for India, China, and the world.

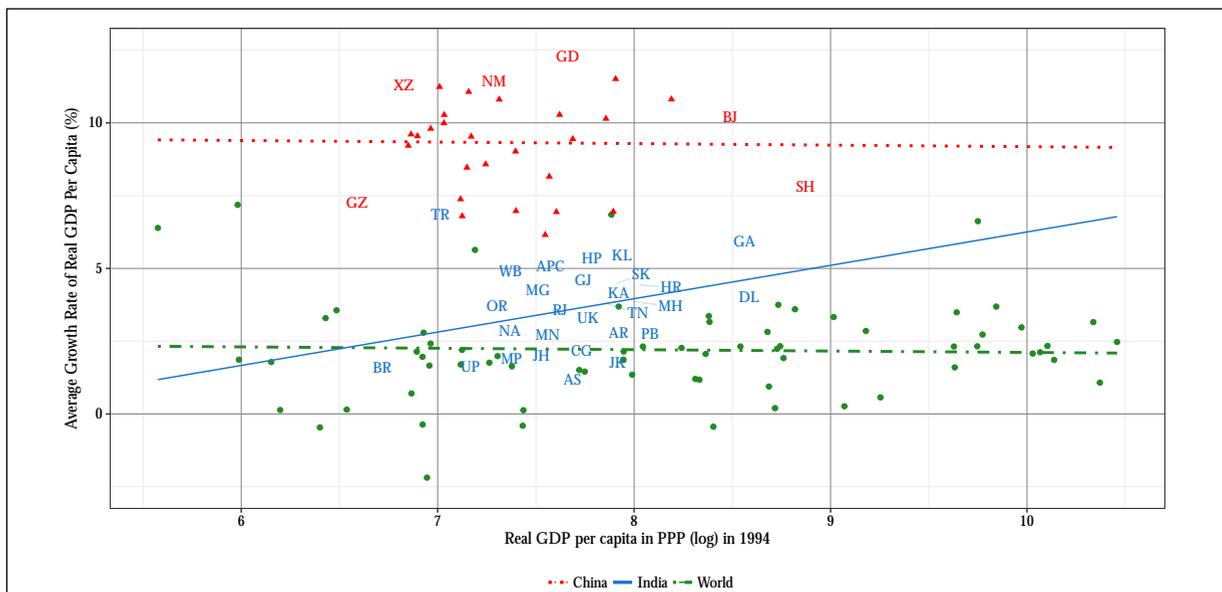
10.10. The figure speaks for itself: the relationship is strongly negative for the world and China, and weakly positive for India. Poorer countries are catching up with richer countries, the poorer Chinese provinces are catching up with the richer ones, but in India, the less developed states are not catching up; instead they are, on average, falling behind the richer states.

10.11. Internationally, growth rates of per

capita GDP widened at least since the 1820s with poorer countries growing slower than richer countries, leading to the basic divide between advanced and developing countries (Pritchett, 1997). However, since 1980 this long term trend was reversed and poorer countries started catching up with richer ones (Roy et. al., 2016). In stark contrast, there continues to be divergence within India or an aggravation of regional inequality.

10.12. What is especially striking is how convergence has evolved over time. In the 1990s, convergence patterns were not dissimilar (Figure 4 plots the same for the 1990s) across the world, China and India with either weak convergence or divergence. But things really changed for both the world and China in the 2000s;³ they did not, however, for India. This was despite the promise that less developed states such as Bihar, Madhya Pradesh and Chhattisgarh had started improving their relative performance⁴. But the data show that those developments were neither strong nor durable enough to change the underlying picture of divergence or growing inequality.

Figure 4. Income Convergence: India, China and the World, 1994-2004



³ This analysis finds that per capita incomes in the world and China are converging significantly.

⁴ See Appendix II

10.13. A similar exercise for consumption was conducted. Using data from the four reliable “thick” rounds of the National Sample Survey (1983, 1993-94, 2004-05, and 2011-12), convergence for both the state level and the level of regions within states was tested (which the NSS data allows for). Figure 5 plots state level consumption convergence regressions for the three decades. Again, no sign of convergence in the 2000s was found. The 1990s (purple line) and 2000s (brown line) show that consumption has been diverging for the last two decades⁵.

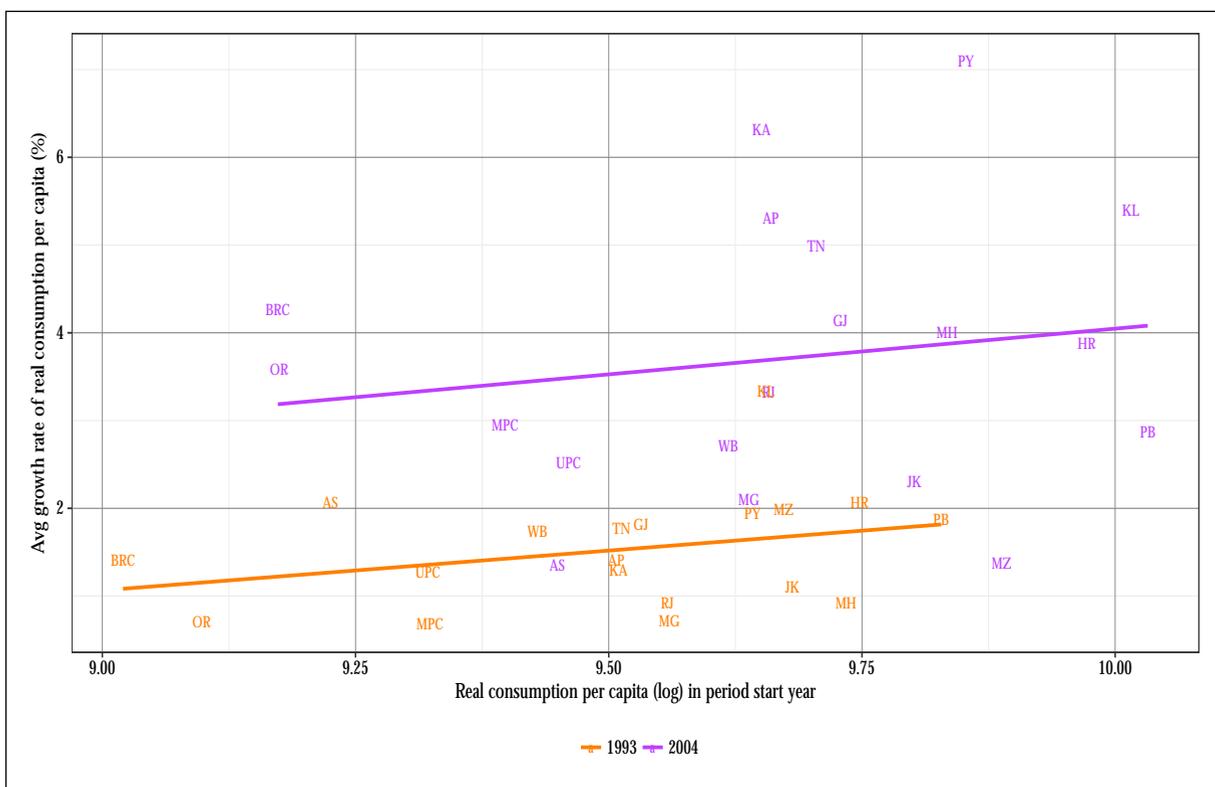
10.14. A robustness check that was performed relates to the sample. All the data described above for India pertains to the major states that account for 98 percent of the population and 93 percent of GDP in 2011-12. Appendix II contains figures that

plot the same convergence relationship for a sample including all the states. The same pattern of divergence appears to hold.

10.15. A final check was performed by lengthening the time period of examination. Since convergence is a long term process, there might be evidence for it over a several decade horizon rather than a shorter time frame. There was no evidence of convergence in per capita NSDP in India for the 1970-2014 period.

10.16. Barro and Sala-i-Martin have documented that convergence occurred within the United States and Japan over long periods and that the average rate of convergence was about 2 percent⁶ in income. This implies that a country will reach half the distance to the frontier in 35 years. During the 2000s, China posted a convergence rate

Figure 5. Consumption Convergence within India: 1993-2004, 2004-2011



⁵ See Appendix II figure 4 for consumption convergence patterns over the last 3 decades.

⁶ This can be calculated by noting that the half-life, say t^* , of a variable growing at a constant negative growth rate (say λ) is the solution to $e^{-\lambda t^*} = 0.5$. Taking logs, $t^* = 0.69/\lambda$.

of nearly 3 percent in income which implies that the poorest province will catch up with half the level of the richest province in 23 years. The evidence so far suggests that in India, catch-up remains elusive.

10.17. The opposing results in India versus those in China and internationally pose a deep puzzle. Convergence happens essentially through trade and through mobility of factors of production. If a state/country is poor, the returns to capital must be high and should be able to attract capital and labor, thereby raising its productivity and enabling catch up with richer states/countries. Trade, based on comparative advantage, is really a surrogate for the movement of underlying factors of production as Samuelson pointed out early on. A less developed country that has abundant labor and scarce capital will export labor-intensive goods (a surrogate for exporting unskilled labor) and imports capital-intensive goods (a surrogate for attracting capital).

10.18. The main finding suggests that India stands out as an exception. Within India, where borders are porous, convergence has failed whereas in China, we observe successful convergence. Even across countries where borders are much thicker (because of restrictions on trade, capital and labor) the convergence dynamic has occurred. The driving force behind the Chinese convergence dynamic has been the migration of people from farms in the interior to factories on the coast, raising productivity and wages in the poorer regions faster than in richer regions.

10.19. The Indian puzzle is deeper still because in Chapter 11 it can be seen that, contrary to perception, trade within India is quite high. And that chapter also documents that mobility of people has surged dramatically—almost doubled in the 2000s. These indicate that India has porous

borders—reflected in actual flows of goods and people—convergence has not happened.

10.20. Although further research is required to understand the underlying reasons, one possible hypothesis is that convergence fails to occur due to governance or institutional traps. If that is the case, capital will not flow to regions of high productivity because this high productivity may be more notional than real. Poor governance could make the risk-adjusted returns on capital low even in capital scarce states. Moreover, greater labor mobility or exodus from these areas, especially of the higher skilled, could worsen governance.

10.21. A second hypothesis relates to India's pattern of development. India, unlike most growth successes in Asia, has relied on growth of skill-intensive sectors rather than low-skill ones (reflected not just in the dominance of services over manufacturing but also in the patterns of specialization within manufacturing). Thus, if the binding constraint on growth is the availability of skills, there is no reason why labor productivity would necessarily be high in capital scarce states. Unless the less developed regions are able to generate skills, (in addition to providing good governance) convergence may not occur.

10.22. Both these hypotheses are ultimately not satisfying because they only raise an even deeper political economy puzzle. Given the dynamic of competition between states where successful states serve both as models (examples that become evident widely) and magnets (attracting capital, talent, and people), why isn't there pressure on the less developed states to reform their governance in ways that would be competitively attractive? In other words, persistent divergence amongst the states runs up against the dynamic of competitive federalism which impels, or at

least should impel, convergence.

III. FINDING 2: HEALTH CONVERGENCE WITHIN INDIA WITH ROOM FOR IMPROVEMENT AGAINST INTERNATIONAL STANDARD

10.23. India’s low level of expenditures on health (and education) have been the subject of criticism. It is worth understanding states’ health and demographic outcomes since the 1980s. Two such key indicators are life expectancy at birth and infant mortality rate.

10.24. There are two primary reasons to expect convergence in these key health indicators. Intuitively, the worse the initial situation, the faster progress will occur not least because many medical “technologies” such as antibiotics and other medical practices are commonly available across the world and India.

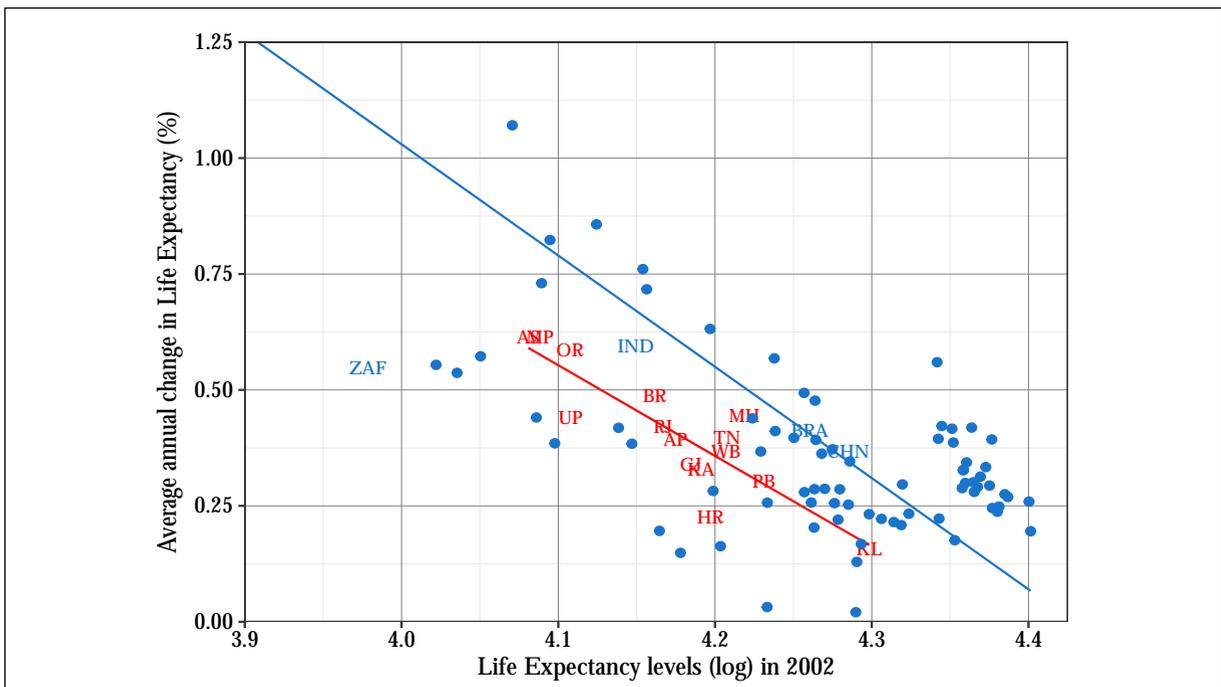
10.25. Second is a measurement issue, there are much clearer bounds on health

indicators that would naturally lead to convergence. For instance, once a country has reduced its infant mortality to near zero, it is fundamentally impossible for it to experience a drastic reduction while countries with high mortality rates have much more room for improvement. This type of natural limit found in LE and IMR does not exist for income or consumption.

10.26. Figures 6A and 6B plot such convergence charts for LE and IMR for the 2000s for Indian states and countries in the world⁷. The y-axis shows the annual average change during the 2000s (measured in percent growth rates for LE, level shifts for IMR), while the x-axis plots the initial value of LE, and initial values for IMR.⁸

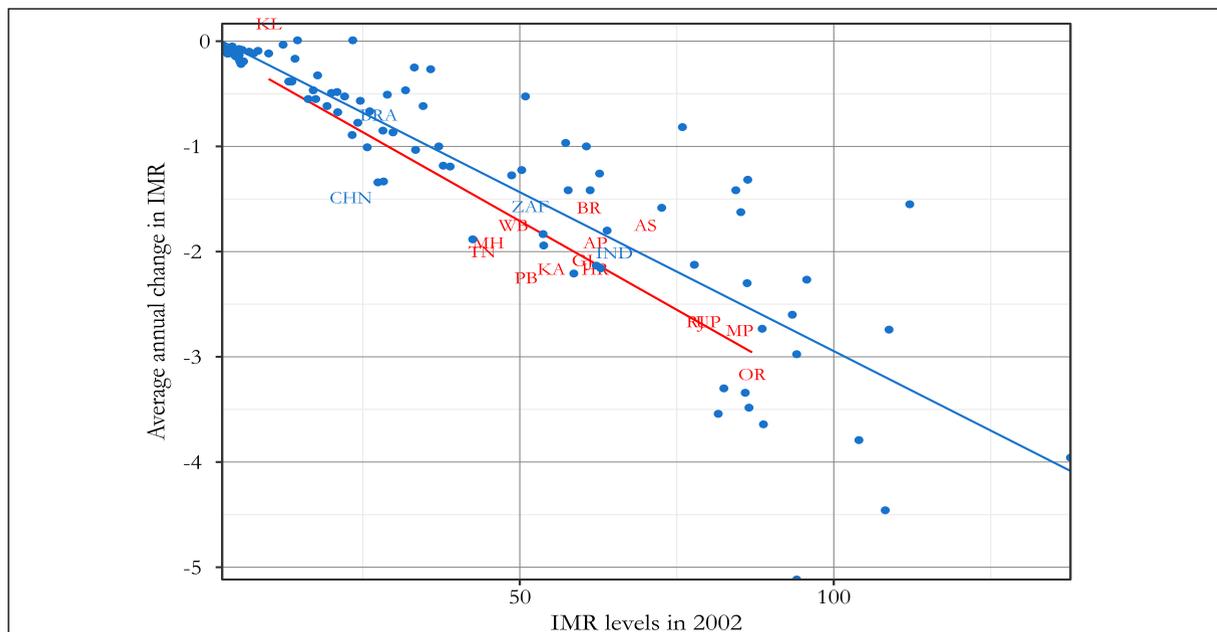
10.27. On both indicators of health, there is strong evidence of convergence within India. Kerala, which started off with a life expectancy of 73.5 years in 2002, posted an increase of about 1.27 years over 11 years; UP,

Figure 6A. Life Expectancy Convergence: India and the World, 2000s



⁷ The patterns for the earlier periods are similar so we do not present them for tractability.

⁸ See Appendix I

Figure 6B. Infant Mortality Rate (IMR) Convergence: India and the World, 2000s

which started off with an LE of 60.8 years in 2002, saw a gain that was twice as large of about 3 years. Similarly, even more than a decade later, Kerala experienced little change in its IMR of 11 while Odisha registered a 49 point decrease, moving from an IMR of 87 to 38 points. The fact that convergence is occurring in key health indicators within India suggests that there are no traps of the sort described earlier that prevent technologies from flowing freely within the country.

10.28. How does this progress compare on a global scale? There is an interesting contrast here. In LE, there is strong evidence of international convergence; however, the Indian states all lie below the line of best fit, indicating that the Indian states are making slower progress than the average country. For example, Kerala's LE increases by 1.7% in 11 years, whereas the representative country that started off at the same position as Kerala, posted greater gains in LE. This is true for all the Indian states. Further analysis shows that the under-performance of the Indian states was not true of the 1990s, but that owed in part to the AIDS epidemic that

drastically reduced LE in large parts of sub-Saharan Africa. The world recovered from that in the 2000s and seems to have posted stronger gains than the Indian states.

10.29. The interpretation is the opposite for IMR, as Figure 6B indicates. Nearly all the Indian states lie below the line, indicating that they posted larger declines in the IMR than the average country. For example, Odisha registered a 38 point decline in IMR over the 2000s whereas the average country with similar IMRs in 2002 posted only a 28 point decline (Bihar, the median state in 2002, reports a drop from an IMR of 61 in 2002 to 42 in 2014.)

10.30. So, there is convergence within India on the two health outcomes and India does not fare too badly in the 2000s compared to other countries. Another key comparison—which gives a sense of long-run performance—is simply to compare the level of these two outcomes today against a country's level of per capita GDP.

10.31. Figures 7A-7B plot LE and IMR against GDP per capita for Indian states and the world. In LE, the Indian states are

Figure 7A. Life Expectancy and Per Capita GDP: India and the World, 2013

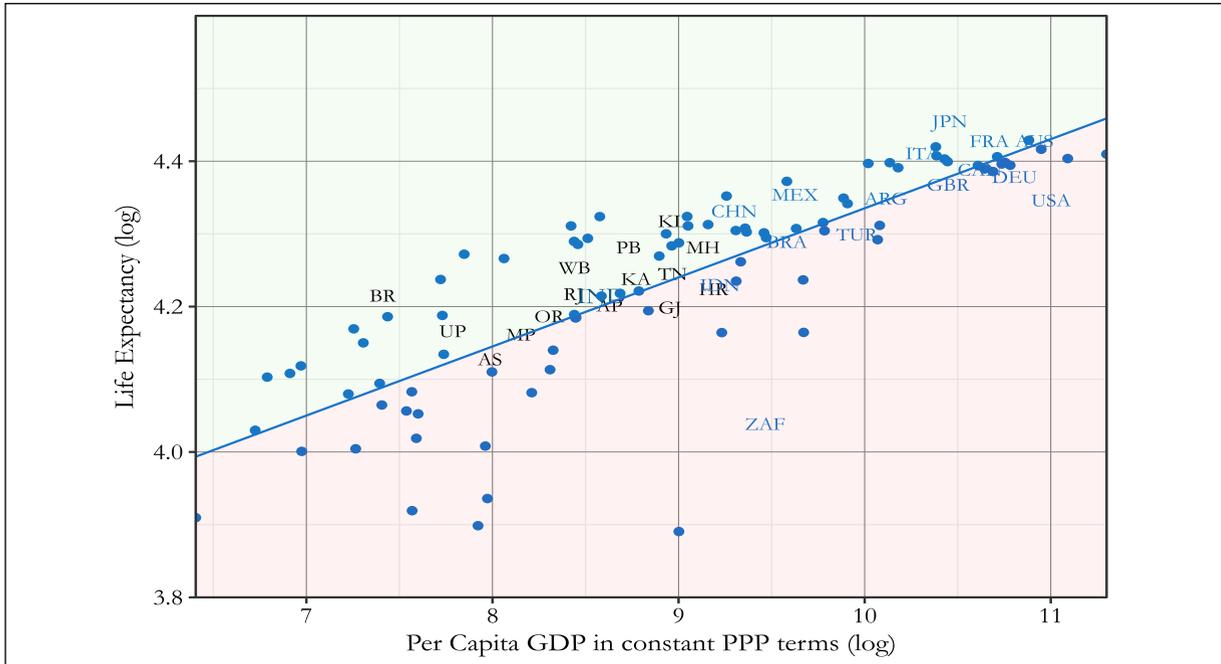
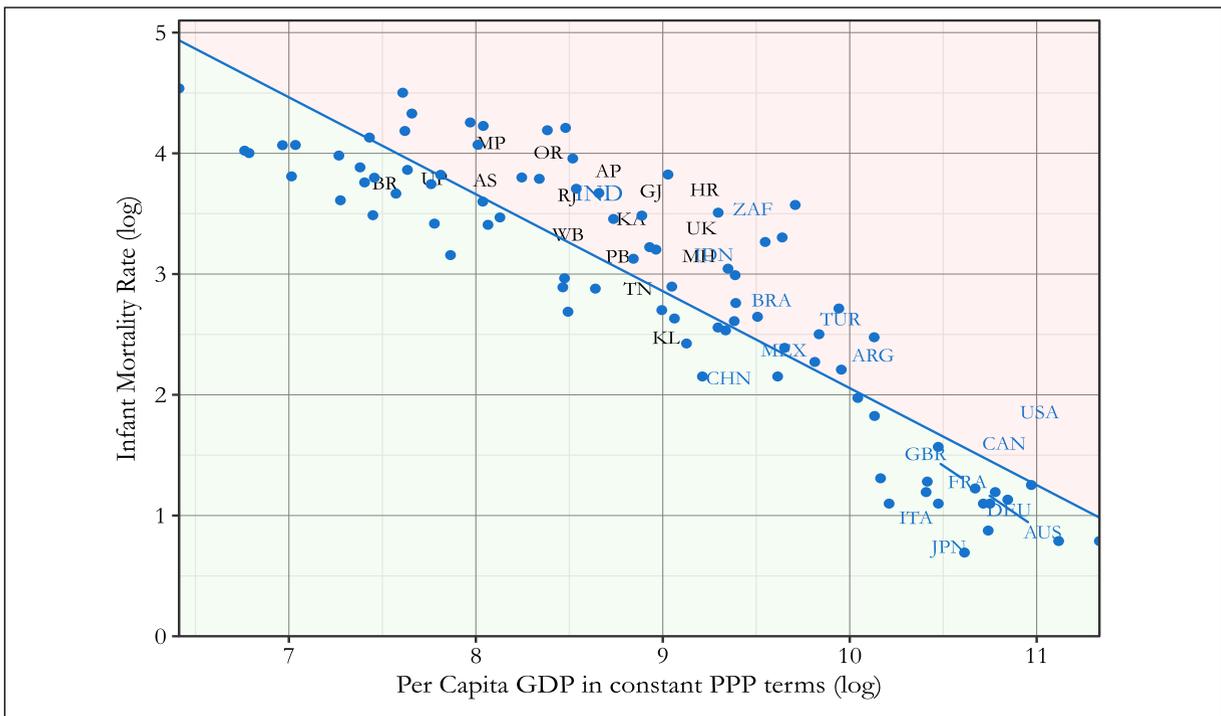


Figure 7B. Infant Mortality Rate and Per Capita GDP: India and the World, 2014



doing about the same or better on average than their international counterparts (they are mostly above the line of best fit); but for IMR, most states look worse in this international comparison (they are above the line of best fit). This is consistent with

last year's Survey finding that children and women perhaps bear the burden of deficient systems of health delivery.

10.32. In sum, India is doing reasonably well on life expectancy on an international scale, but on IMR has scope for improvement.

IV. FINDING 3: FERTILITY: EXCEPTIONAL PERFORMANCE

10.33. Perhaps one of the most striking developments over the past decade has been in fertility. First, 12 Indian states out of the reporting 23 states have reached levels of fertility that are below the replacement rate (2.1). Second, like in the case of LE and IMR but unlike income, there is evidence of strong convergence across the states. Figure 8A shows in the last decade, a pattern that was not true in the 1980s and 1990s. For example, between 2002 and 2014, UP reduced its TFR by 1.3 points compared with Kerala that registered an increase and Tamil Nadu which posted a very small decline.

10.34. Again, all the Indian states (with the exception of Kerala) lie below the line of best fit, suggesting that they are performing much “better” (in the sense of more rapid fertility declines) than countries on average. The extent to which they are doing better is striking especially for the high TFR states such as Bihar, UP, MP and Rajasthan. These states are in fact posting much stronger fertility declines than is true of the average country.

10.35. All these developments are reinforced when doing a comparison of Indian states against their international counterparts. Figure 8B plots the level of TFR for countries and the Indian states against the level of per capita GDP. The figures show the striking over-performance of the Indian states which are all below the line of best fit. For their level of development, the Indian states have much lower levels of fertility than countries internationally.

10.36. These fertility developments have strong implications for the demographic dividend going forward that are explored in the overview chapter.

V. CONCLUSIONS

10.37. Despite growing rapidly on average, there is sign of growing regional inequality among the Indian states. This is puzzling because the underlying forces in favor of equalization within India—namely strong and rising movements of goods and people—are strongly evident. One possible hypothesis that there might be governance traps that impede the catch-up process. And if there are such traps, labor and capital mobility

Figure 8A. Total Fertility Rate Convergence: India and the World, 2000s

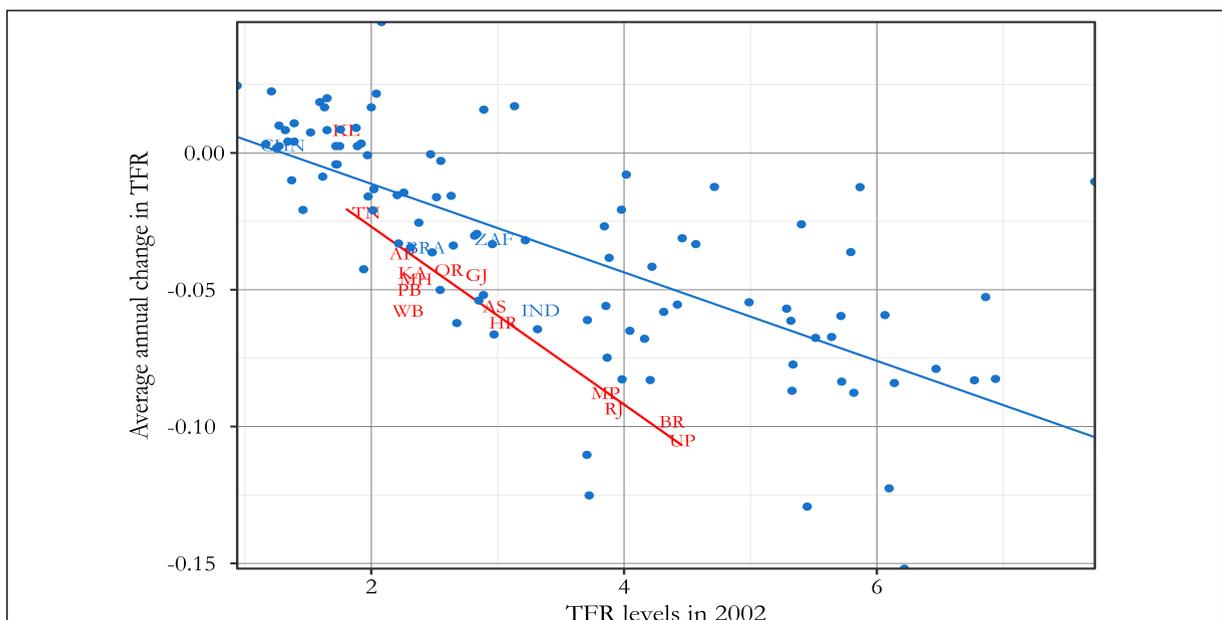
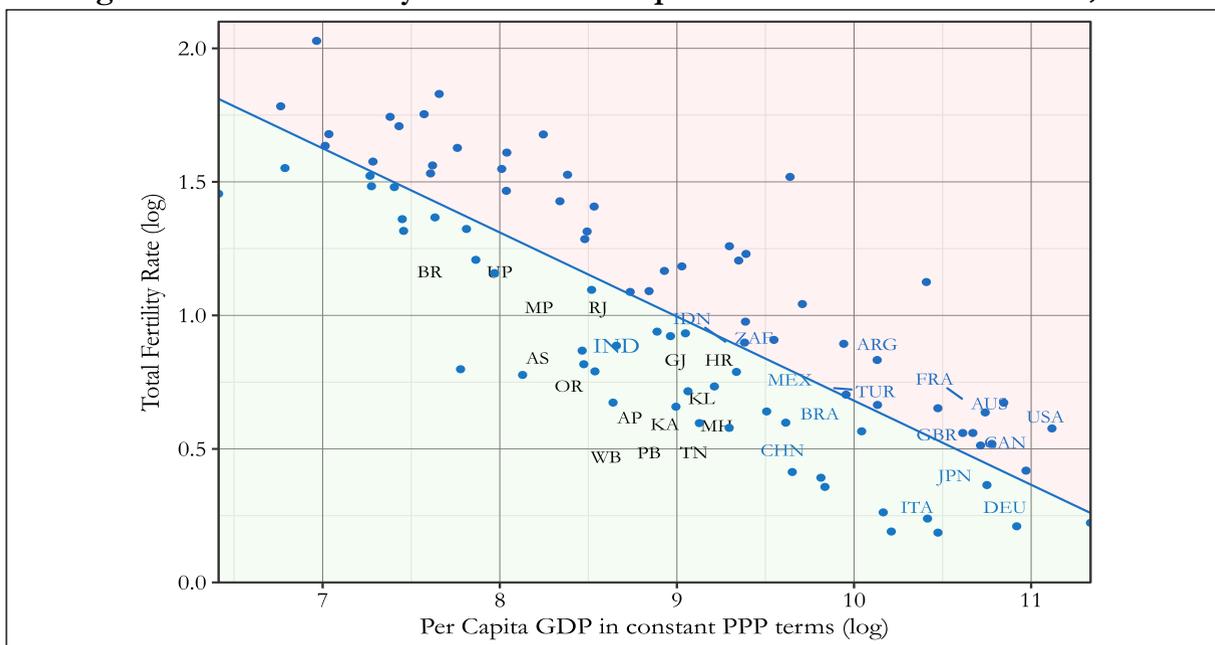


Figure 8B. Total Fertility Rate and Per Capita GDP: India and the World, 2014



might even aggravate underlying inequalities. But why such traps persist if competitive federalism is forcing change upon the lagging states remains an open question.

9.38. In contrast, on health and demography, there is strong evidence of convergence amongst the states in the 2000s. This was not true in the previous decades for IMR and fertility. Here it is the international contrast is striking. With regards to life expectancy, the Indian states are close to where they should be given their level of income. However, this is not true of IMR, suggesting that the “mother and child” (discussed also in last year’s Survey) bear the brunt of weaker delivery of health services. What really stands out in the international comparison is fertility and how much better the Indian states are performing than their international counterparts on that metric. These unusually large declines in fertility have strong—and positive—implications for India’s demographic dividend going forward.

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PER CAPITA GDP CONVERGENCE

1. 1980 to 2014-15 state GDP (provided by CSO) spliced series has been used for analysis. The series has been spliced at 2011-12 prices.
2. Decadal (1981, 1991, 2001, 2011) state level populations have been used for the analysis. For all the in between years, simple linear interpolation has been done to calculate the population numbers for calculating the per capita GSDP.
3. CAGR has been used for running unconditional convergence regressions on GDP per capita for various states, countries and regions.
4. The international per capita income data was taken from WDI Databank, and WEO databases.
5. BRC, MPC, UPC, APC stand for Bihar Combined (Bihar + Jharkhand), Madhya Pradesh Combined (Madhya Pradesh + Chhattisgarh), Uttar Pradesh Combined (Uttar Pradesh+Uttarakhand) and Andhra Pradesh Combined (Andhra Pradesh +Telangana) respectively. The per capita income for these entities were calculated (post split) by adding the GSDPs for each state and dividing by the total population of both states.
6. West Bengal GSDP series is not available at 2011-12 prices. Its 2011-12, splicing factor has been calculated using the ratio of sum of all other state GSDPs for 2011-12 (in 2004-05 prices) to sum of all other state GSDPs in 2011-12 (in 2011-12 prices)
7. Financial year (April to March) GDP numbers have been converted into calendar year (January to December) numbers by using a 0.25/0.75 ratio for every year. (E.g. The 2011 GSDP figure is $0.25 * 2010-2011 \text{ GSDP} + 0.75 * 2011-2012 \text{ GSDP}$)
8. Major states have been defined as those that had a population of 10 million and above in 2011. Only they are used in unconditional convergence analysis. Results remain robust even if all the states are used.
9. For the long convergence between 1970 and 2014, NSDP data from EPW foundation has been used because CSO data is unavailable for this period.
10. In making the China, India, and world comparison: PPP current international \$ (2011 prices) time series for GDP per capita for the world has been used. For China, the GDP per capita has been calculated for provinces in RMB. It has been divided by the RMB PPP conversion factor as of 2011 (3.506). For India, the GDP per capita for states has been calculated in Rupees. It has been divided by Rupees PPP conversion factor as of 2011 (15.109).
11. A balanced panel of 87 countries has been used for the analysis. Countries with population less than 1 million and oil countries⁹ have been excluded.

⁹ **Countries with population less than one million in 2011:** Antigua and Barbuda, Bahamas, Belize, Bermuda, Barbados, Brunei Darussalam, Bhutan, Comoros, Cape Verde, Cyprus, Djibouti, Dominica, Fiji, Equatorial Guinea, Grenada, Iceland, St Kitts and Nevis, St Lucia, Luxembourg, Macao, Maldives, Malta, Montenegro, Sao Tome and Principe, Suriname, St. Vincent and the Grenadines.

Oil exporting countries: Algeria, Angola, Chad, Congo, Kuwait, Gabon, Nigeria, Sudan, Kazakhstan, Russian Federation, Libya, Oman, Saudi Arabia, Turkmenistan, Azerbaijan, United Arab Emirates, Yemen, Iran, Qatar, Bahrain, Ecuador, Venezuela, Trinidad & Tobago

CONSUMPTION CONVERGENCE

1. NSSO Consumption surveys data of the 38th (1983) Round, 50th (1993-94) Round, 61st (2004-05) round, and 68th (2011-12) round have been used for calculating the Monthly Per Capita Expenditure (MPCE). Uniform Recall Period (URP)-based MPCE have been used in the analysis.
2. Real Monthly Per Capita Expenditure has been calculated using the CPI deflators. The aggregate deflator has been calculated by taking rural and urban population weighted CPI-AL and CPI-IW average.
3. For all the NSSO rounds except 38th round, the survey period is July to June. In 38th round, the survey period was January 1983 to December 1983. CPI deflators for corresponding periods have been taken for creating the Real MPCEs.
4. Real MPCEs have been deflated on the basis of July 2011 to June 2012 CPI base prices.
5. Delhi and Chandigarh are outliers in terms of real MPCE levels. Therefore they have not been kept in the analysis.
6. All the states with less than 1 million population .i.e. Lakshadweep, Andaman & Nicobar Islands, Daman & Diu, Dadra & Nagar Haveli and Sikkim have been dropped for analysis.
7. In the unconditional convergence regressions, CAGR values have been used as growth rates calculation.
8. In order to keep a balanced panel through time, the entities of Bihar Combined (BRC), Madhya Pradesh Combined (MPC) and Uttar Pradesh Combined (UPC) have been created. Real MPCE values have been calculated for these entities by taking population weighted averages of Bihar and Jharkhand; Madhya Pradesh and Chhattisgarh; Uttar Pradesh and Uttarakhand respectively. This exercise is done to make state level analysis comparable across time.

HEALTH INDICATORS CONVERGENCE

1. For the international level analysis, a balanced panel (using World Bank Data) has been created for each of the health indicators. Total Fertility Rate (TFR) panel has 103 countries. Life Expectancy and IMR panels have 101 countries.
2. Countries with population less than 1 million and major oil exporting countries have been dropped.
3. For Indian states, the data provided by Sample Registration System (SRS) reports and bulletins have been used for the analysis.
4. Life Expectancy (LE) numbers are not available for 2014. So for LE, the analysis is done only up to 2013. For the other two measures, data up to 2014 has been used.
5. Life expectancy values for Jharkhand, Chhattisgarh, and Uttarakhand are not provided in the SRS reports and bulletins. Therefore, they have not been kept in the analysis. IMR numbers for the same set of states show volatility. Hence, even for IMR these states are not kept in the analysis. TFR data for these three states is only available from 2004 onwards.
6. For the three health parameters in the pre-split period, data is used for undivided Bihar,

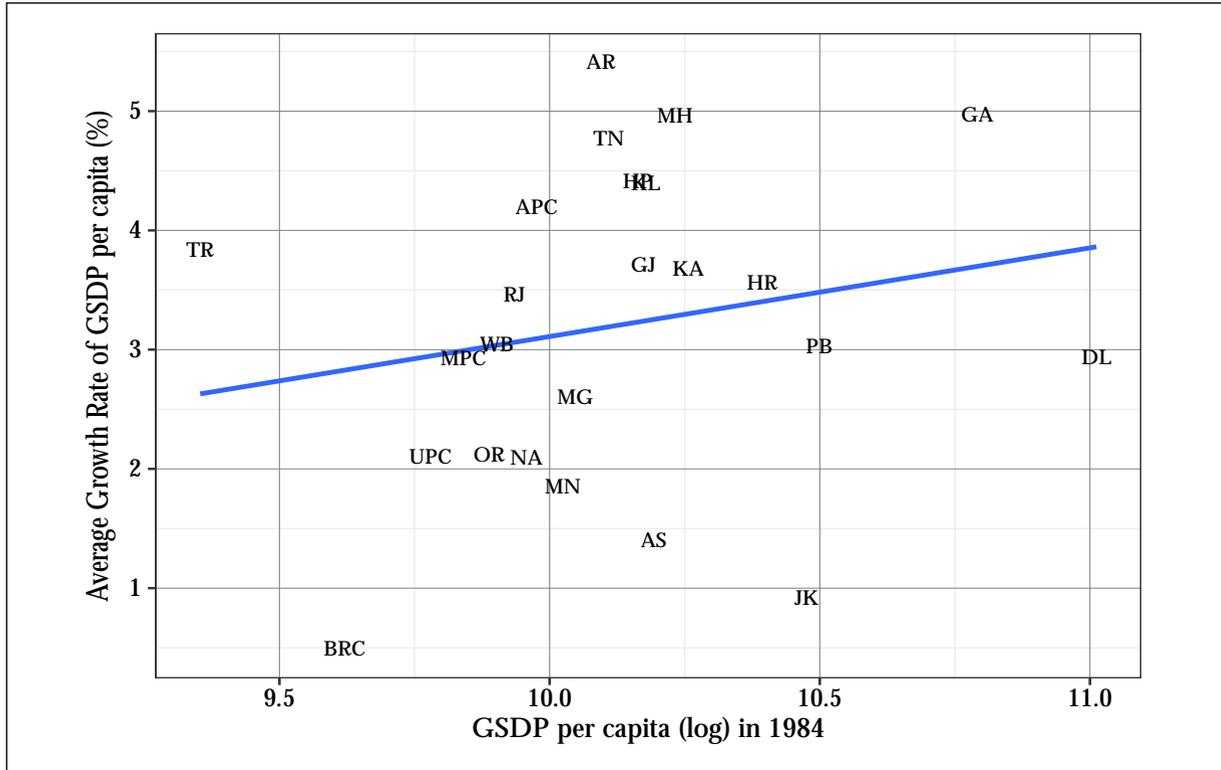
Madhya Pradesh and Uttar Pradesh. Whereas in the post-split period, the data is used for the split Bihar, Madhya Pradesh and Uttar Pradesh.

7. The growth rate for life expectancy is Compounded Annual Growth Rate (CAGR), whereas the growth rate for IMR and TFR are annual average of the differences. This distinction has been made keeping in mind that TFR and IMR are already expressed as ratios and they have a lower bound of zero, whereas life expectancy is a level variable.
8. Indian states IMR data has been prepared by taking 3-year moving averages. TFR data has been prepared by linearly interpolating the values for the intermediate years.
9. Indian states LE data values are given in period class intervals. LE value has been taken to remain the same for all the years between each period class interval.
10. IMR and TFR are expressed in term of ratios whereas LE is a level number. Therefore, CAGR has been taken for LE and yearly averages have been taken for IMR and TFR.

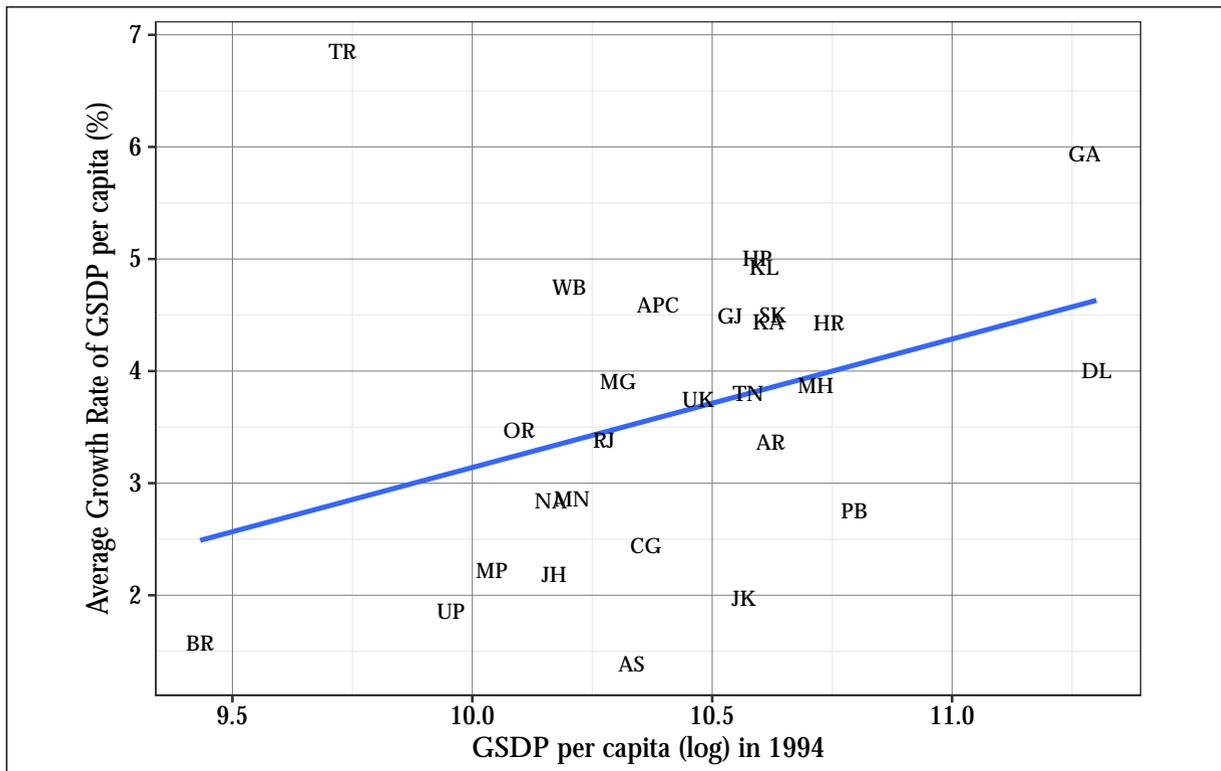
| Abbreviations | |
|---------------|-------------------------------|
| Statecode | Statename |
| APC | Telangana + Andhra Pradesh |
| AR | Arunachal Pradesh |
| AS | Assam |
| BR | Bihar |
| BRC | Bihar + Jharkhand |
| CG | Chhattisgarh |
| DL | Delhi |
| GA | Goa |
| GJ | Gujarat |
| HR | Haryana |
| HP | Himachal Pradesh |
| JK | Jammu & Kashmir |
| JH | Jharkhand |
| KA | Karnataka |
| KL | Kerala |
| MP | Madhya Pradesh |
| MPC | Madhya Pradesh + Chhattisgarh |
| MH | Maharashtra |
| MN | Manipur |
| MG | Meghalaya |
| MZ | Mizoram |
| NA | Nagaland |
| OR | Odisha |
| PB | Punjab |
| RJ | Rajasthan |
| SK | Sikkim |
| TN | Tamil Nadu |
| TR | Tripura |
| UP | Uttar Pradesh |
| UPC | Uttar Pradesh + Uttarakhand |
| UK | Uttarakhand |
| WB | West Bengal |

Appendix II

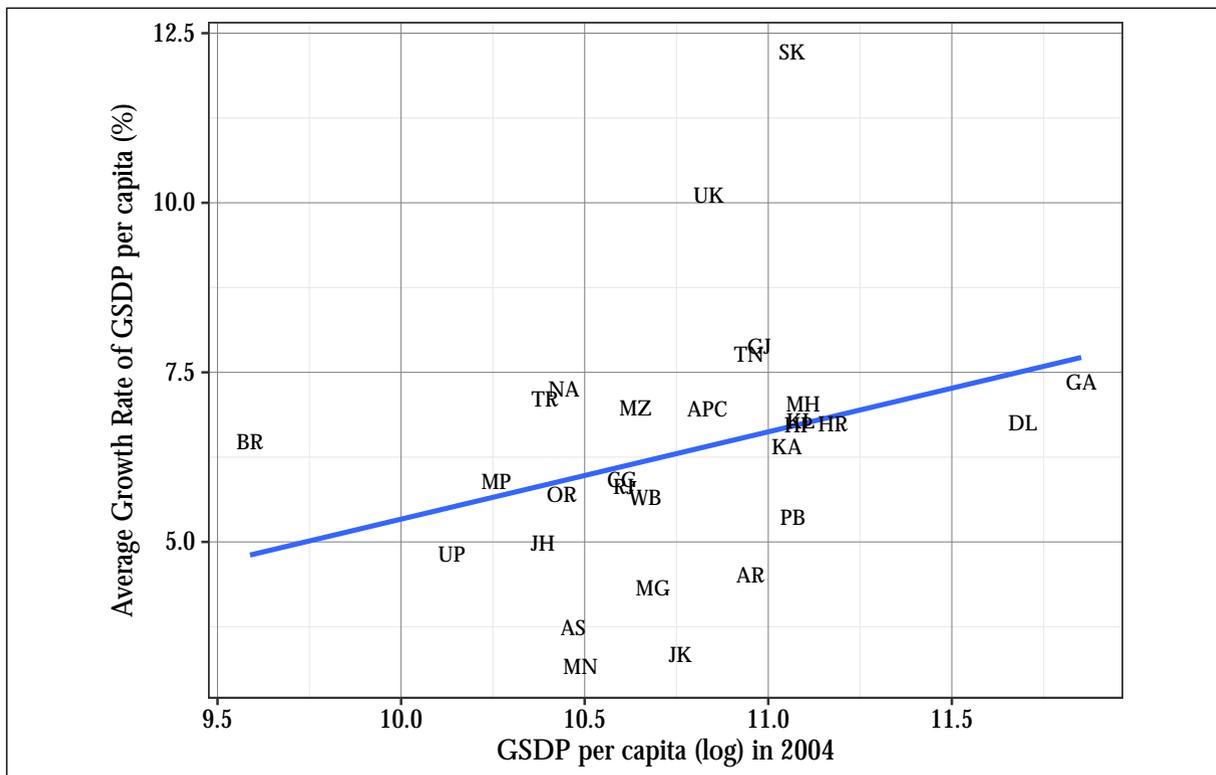
1. Income convergence in India, 1984-1994



2. Income Convergence, 1994-2004



3. Income Convergence in India, 2004-14



4. Consumption Convergence within India: 1983-1993, 1993-2004, 2004-2011

