

Statistical Analysis & Visualization on Indian Development using R

“Using R to uncover patterns of development, inequality, and future challenges across Indian states.”

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R Ecosystem & Analytical Toolkit



Wrangling

Leveraged **dplyr** and **tidyr** libraries to ingest, clean, and reshape multi-period state records from Census 2011, MoSPI, and Reserve Bank of India files.



Exploration

Utilized **ggplot2** alongside packages like **corrplot** and **ggbeeswarm** to isolate correlations and map critical development parameters.

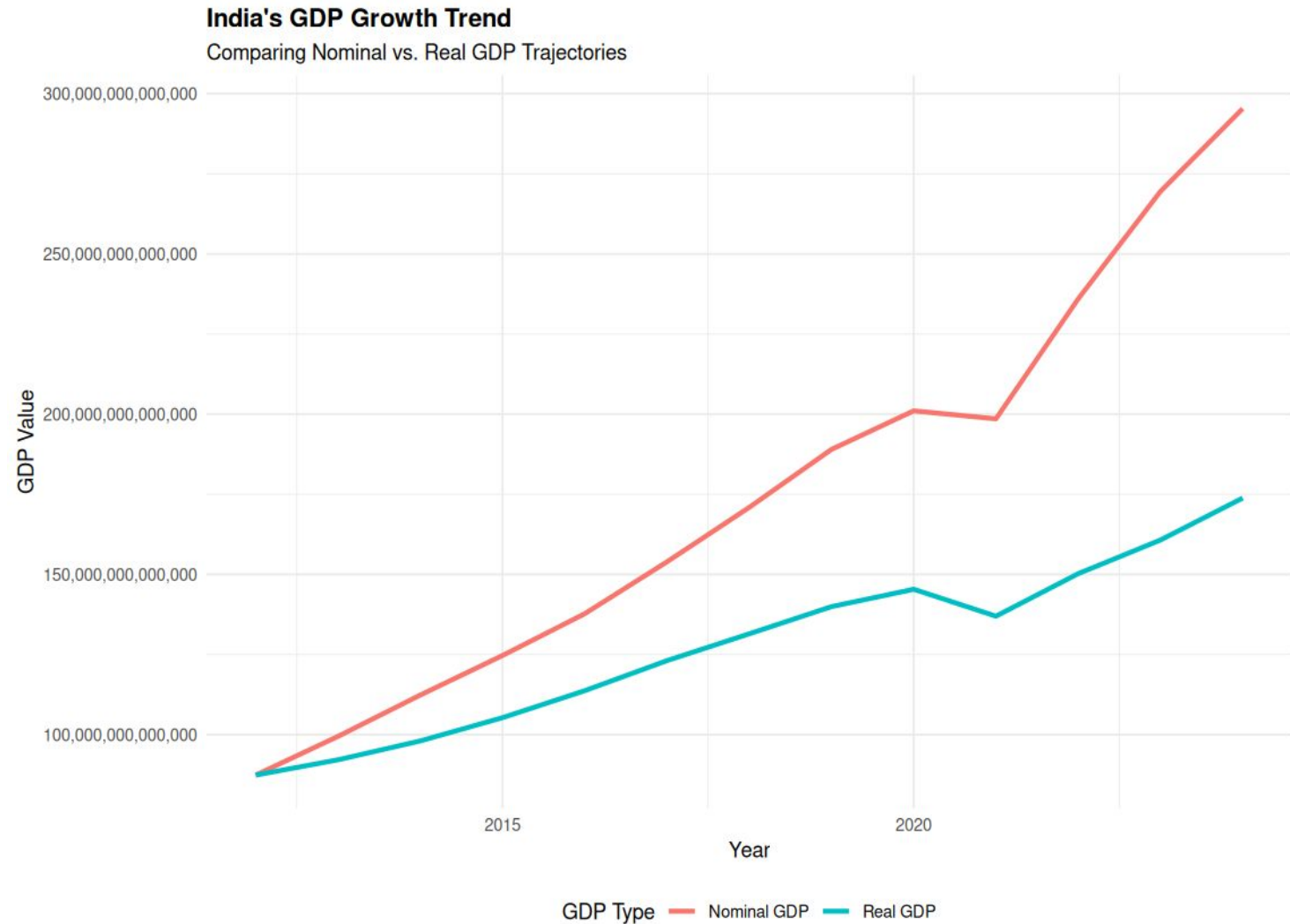


Grouping

Segmented deep structural differences across territories using K-Means clustering frameworks with dimensionality reduction via **FactoMineR**.

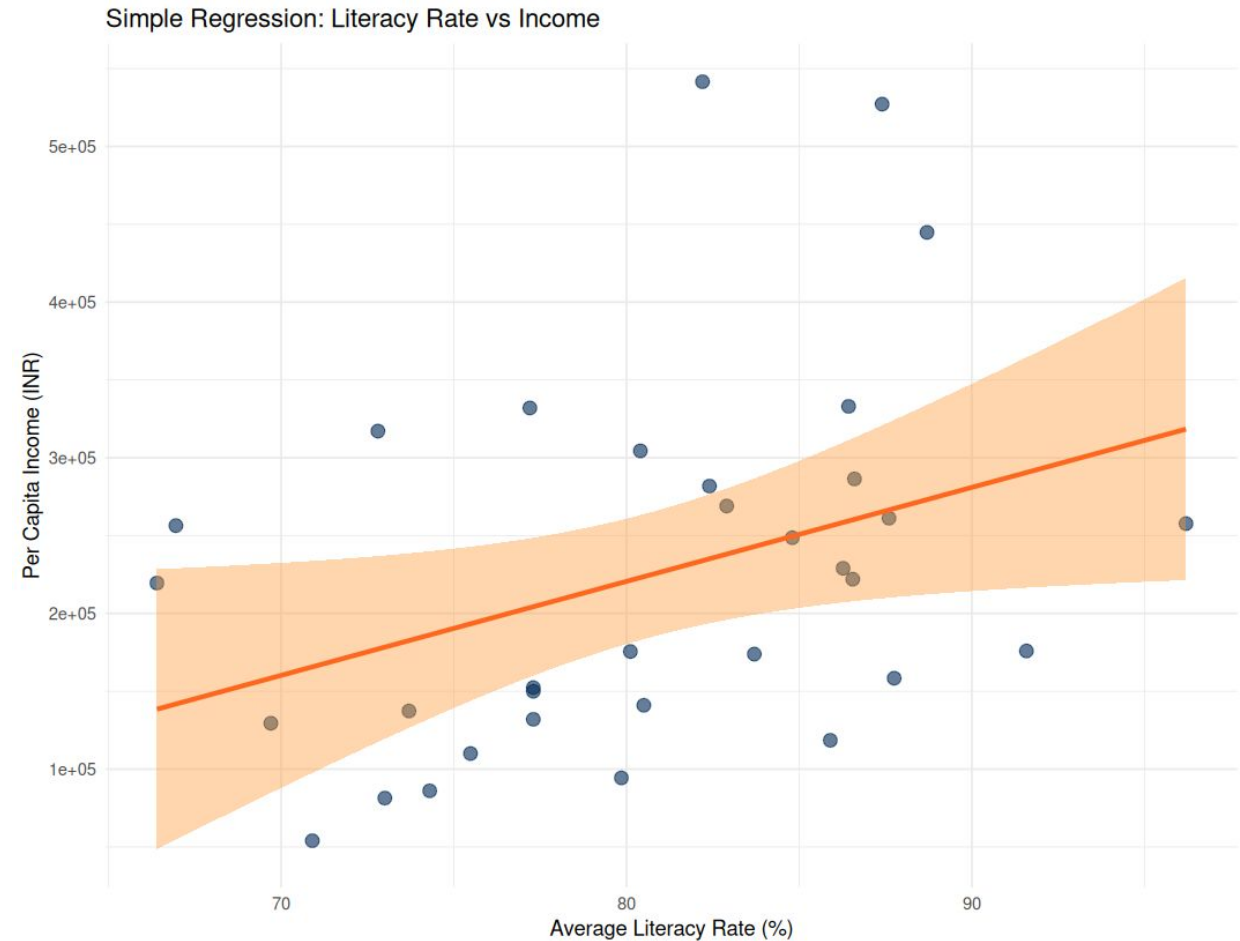
Macroeconomic Trajectory: Nominal vs. Real GDP Growth

- 📌 **Widening Nominal-Real Gap:** While both trajectories display strong upward momentum, the widening gap between Nominal and Real GDP highlights the compounding impact of inflation over the decade.
- 📌 **2020 Shock and Recovery:** Both metrics vividly capture the sharp economic contraction around the year 2020, followed by a remarkably steep, parallel post-crisis recovery.



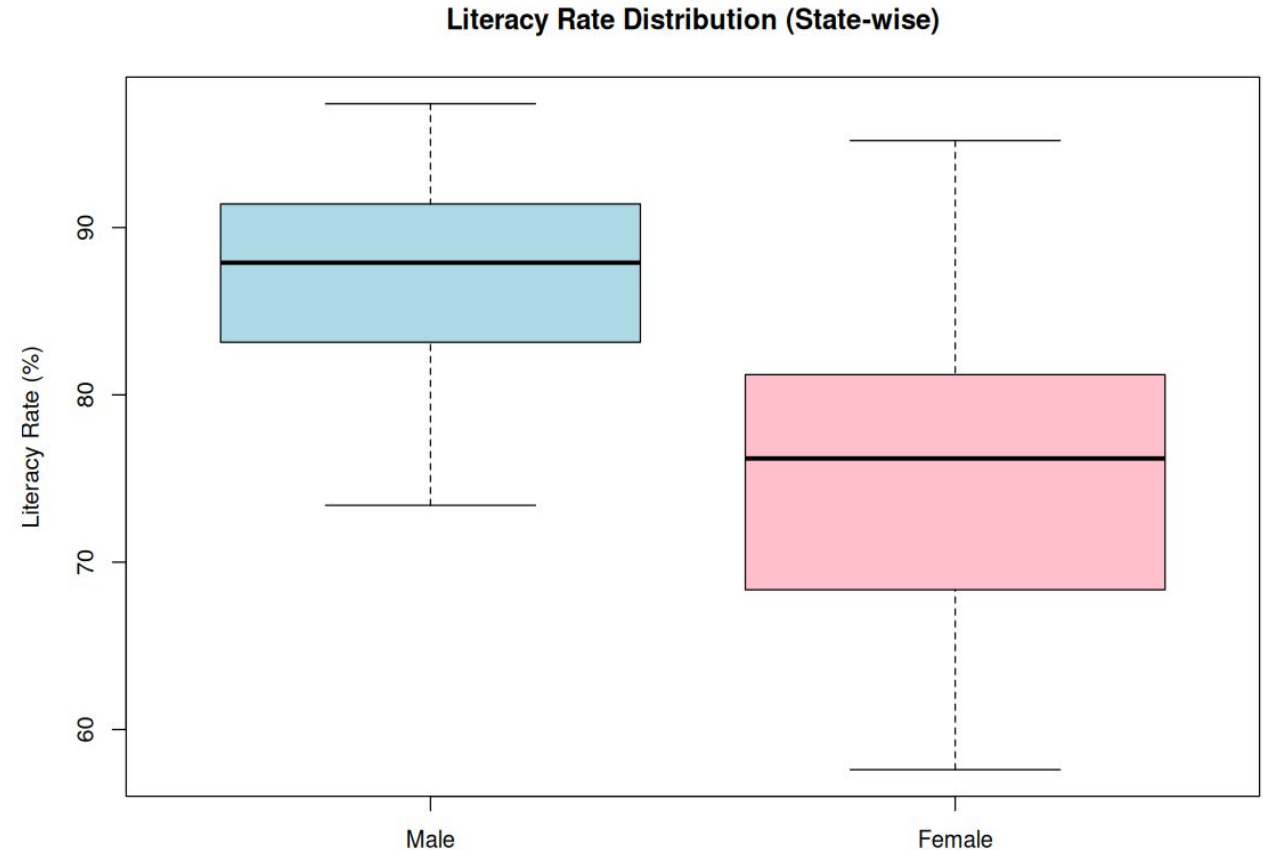
Economic Impact: Literacy Rate vs. Per Capita Income

- 🔍 **Significant Predictor:** The analysis confirms a statistically reliable positive relationship ($p = 0.0375$), where a 1% increase in the average literacy rate is associated with an estimated increase of Rs. 6,037 in per capita income.
- 🔍 **$R^2 = 13.23\%$:** While literacy is a significant driver, the model account for roughly 13% of the total variance, indicating that the vast majority of income variation is driven by other external, multivariate factors.



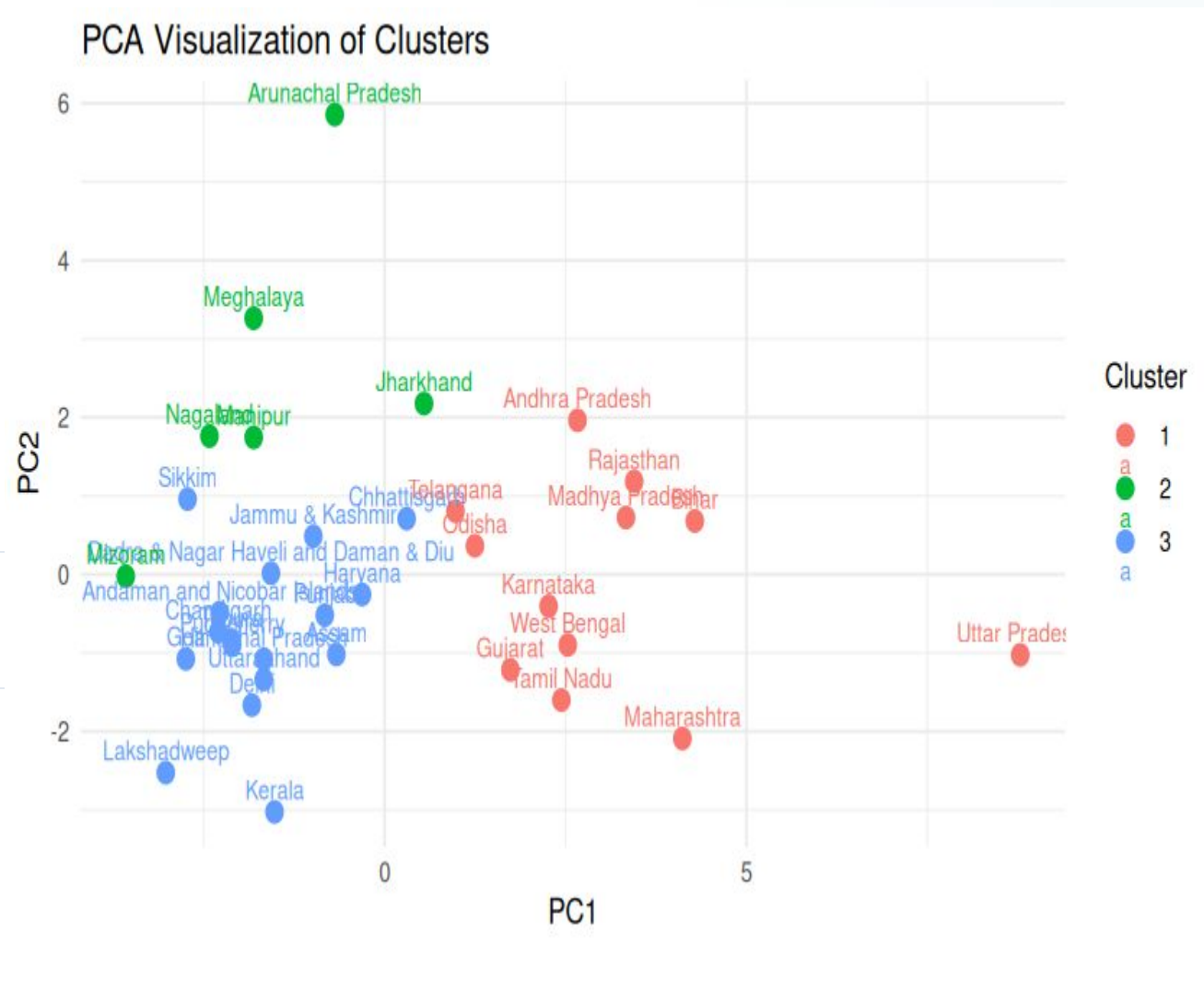
Economic Impact: Literacy Rate vs. Per Capita Income

- 🔊 **Persistent Median Gender Gap:** The median male literacy rate sits substantially higher at nearly 88%, creating a stark baseline disparity against the female median of roughly 76%.
- 🔊 **Higher Volatility in Female Literacy:** Female literacy displays a much wider spread and a significantly lower floor, indicating severe state-to-state inequality in regional educational access.



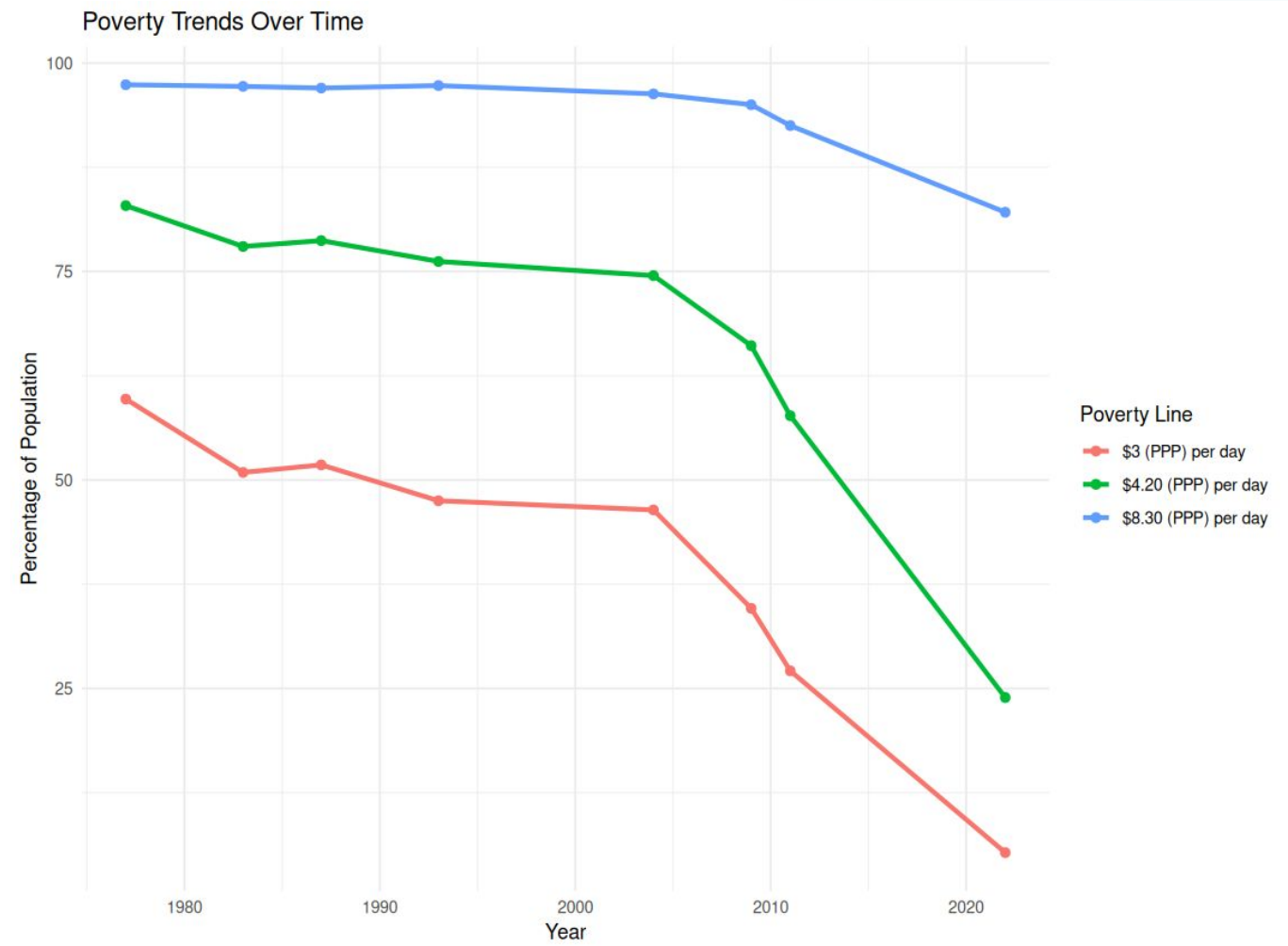
Socio-Economic Profiles: Regional Development Clusters

Cluster Segment	Characteristics	Key States
1. Macro Giants	Demographic and economic giants; massive scale acting as the backbone of the aggregate economy with a high total GDP.	UP, Maharashtra
2. Hilly & Northeast	Regional and cultural homogeneity; characterized by unique religious distributions and hilly terrains.	Northeastern states (e.g., Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram), Jharkhand
3. Social Leaders	High human development and urban centers; characterized by high literacy rates, superior sex ratios, and a reliance on the service economy rather than large-scale agriculture.	Kerala, Delhi



Historical Shifts: Poverty Reduction Trends Over Time

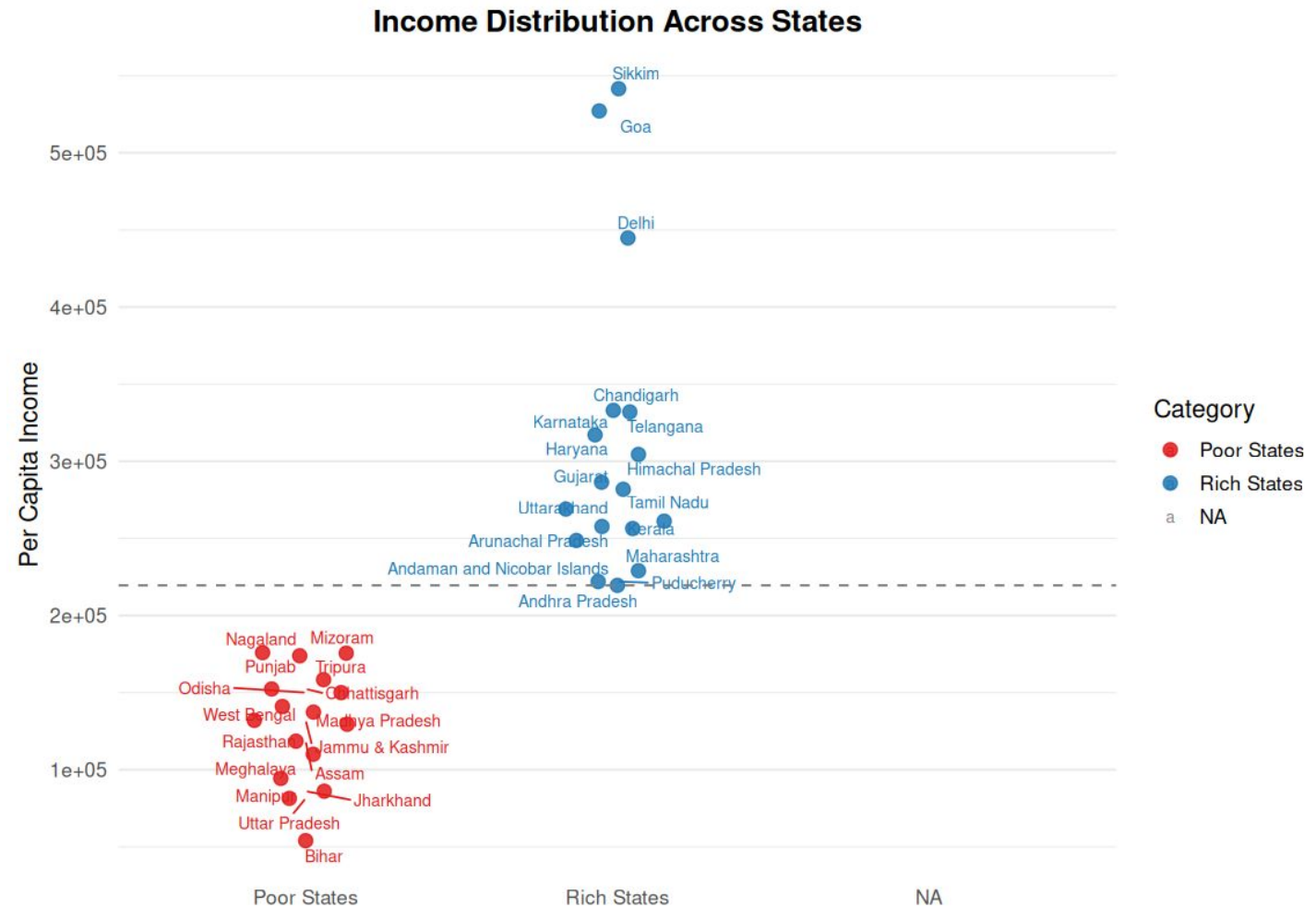
- ★ **Rapid Fall in Extreme Poverty:** The percentage of the population living under the lowest threshold (\$3 per day) experienced a massive drop, falling from around 60% in the late 1970s to less than 10% by the 2020s, with the steepest decline occurring after 2004.
- ★ **The \$8.30 Resilience Threshold:** Conversely, the \$8.30 threshold remained frozen near 95% for decades, only beginning its downward shift in the most recent years.



Economic Stratification: Per Capita Income Across States

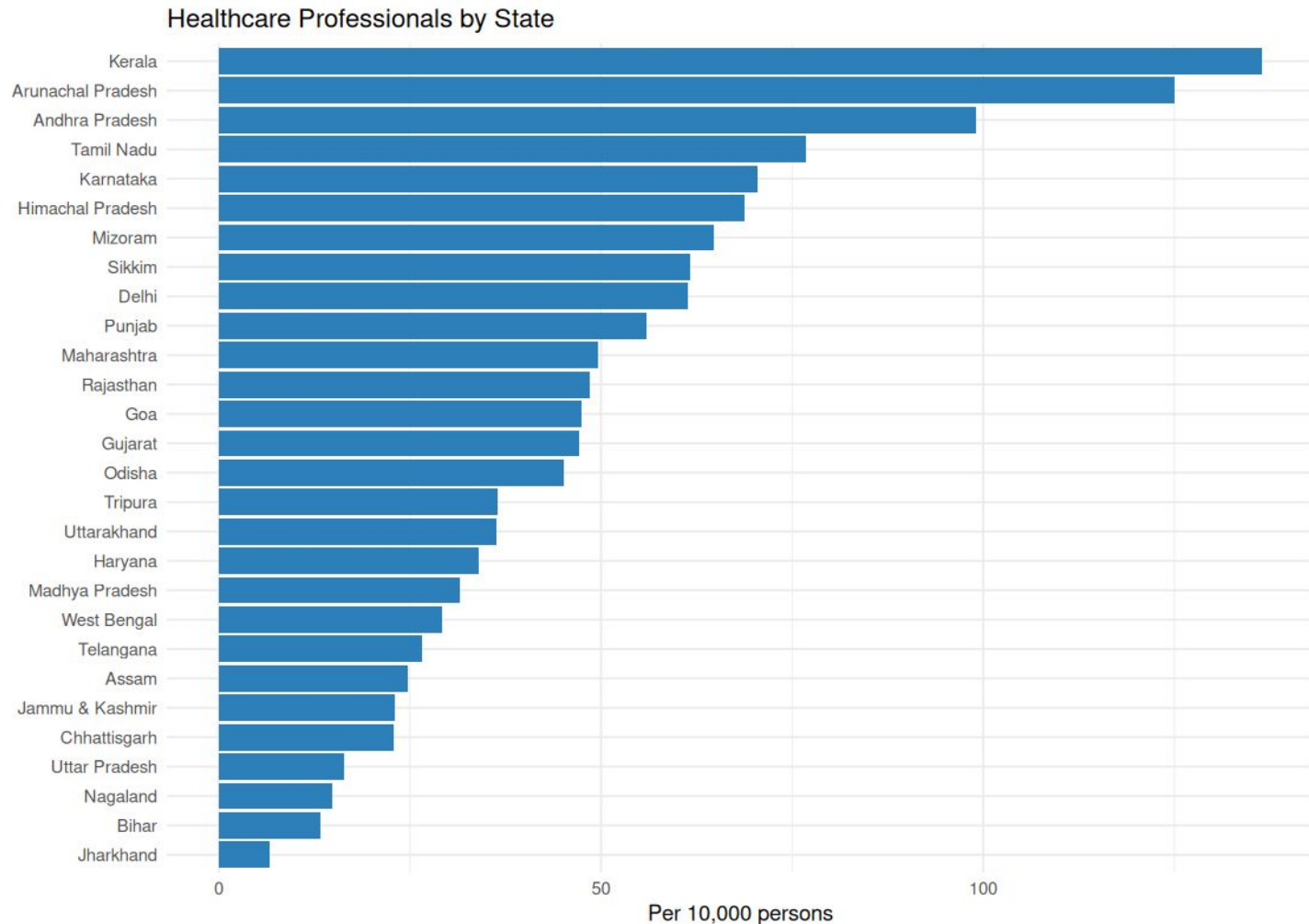
★ **Threshold Segregation:** The data reveals a sharp economic divide at the Rs. 2.2 Lakh threshold, cleanly separating the lower-income clusters from the higher-performing state economies.

★ **High-Income Outliers:** Within the upper tier, an elite group of regions—specifically Sikkim, Goa, and Delhi—significantly outpace the rest of the country, soaring well above the Rs. 4.5 Lakh mark.



| State-wise Distribution of Healthcare Professionals in India

- ★ **High Workforce Concentration:** Kerala leads with the highest healthcare professional density (~140 per 10,000 persons). Arunachal Pradesh and Andhra Pradesh also report relatively high workforce availability.
- ★ **Regional Disparities:** Low healthcare workforce density in states like Jharkhand, Bihar, and Uttar Pradesh underscores regional disparities.



| Conclusion & Strategic Outlook

- ★ **Economic Growth & Inequality:** Even with massive national GDP growth and a historic drop in extreme poverty, progress slows down at higher income brackets, showing that wealth remains concentrated in specific regions.
- ★ **Education & Economic Development:** Education drives economic progress, but persistent gender and regional literacy gaps highlight the need for targeted investments in female education and underserved states.
- ★ **Healthcare Workforce Distribution:** Healthcare capacity remains uneven across states, emphasizing the need for equitable workforce distribution and stronger healthcare infrastructure in underserved regions.

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