



Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL

SUB-NATIONAL PROJECTIONS

ACCOUNTING FOR SOCIAL & SPATIAL HETEROGENEITY IN POPULATION PROJECTIONS BY STATE, RESIDENCE, & EDUCATION

Presenters:

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- Works Session on Demographic Projections (Geneva) | item 03 – “Sub-national Projections” | 18-04-2016
- Asian Demographic Research Institute (ADRI), Shanghai University and Wittgenstein Centre (IIASA,/OeAW,/WU)

STUDY: PURPOSE

- > The breakdown of a population by residence, sub-national region and education is highly **relevant for policy and planning**
 - > education, health, economy, environment,...
- > To conduct sensitivity analysis how different levels of explicitly incorporated **social** and **spatial heterogeneity** in population dynamics will affect projections results.

Research Question

At the individual level, **who** you are and **where** you live matters for demographic events, **how does it matter for the population?**

CONCEPT: DIMENSIONS

“A basic cohort-component projection requires...”

| Demographic Rates and Characteristics | Fertility | Mortality | Migration international |
|---------------------------------------|-----------|-----------|-------------------------|
| Country | • | • | • |
| Age | • | • | • |
| Sex | • | • | • |

CONCEPT: DIMENSIONS

“Additionally socio-economic heterogeneity was considered...”

| Demographic Rates and Characteristics | Fertility | Mortality | Migration international | Education transition |
|---------------------------------------|-----------|-----------|-------------------------|----------------------|
| Country | • | • | • | • |
| Age | • | • | • | • |
| Sex | • | • | • | • |
| Education | • | • | • | • |

CONCEPT: DIMENSIONS

“..., but we need to add **spatial** heterogeneity to study **urbanization...**”

| Demographic Rates and Characteristics | Fertility | Mortality | Migration international | Education transition | Migration internal |
|---------------------------------------|-----------|-----------|-------------------------|----------------------|--------------------|
| Country | • | • | • | • | • |
| Age | • | • | • | • | • |
| Sex | • | • | • | • | • |
| Education | • | • | • | • | • |
| Rural/urban | • | • | • | • | • |

CONCEPT: DIMENSIONS

“... as well as **sub-national** population dynamics.”

| Demographic Rates and Characteristics | Fertility | Mortality | Migration international | Education transition | Migration internal | Migration subnational |
|---------------------------------------|-----------|-----------|-------------------------|----------------------|--------------------|-----------------------|
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| Education | • | • | • | • | • | • |
| Rural/urban | • | • | • | • | • | • |
| Subnational | • | • | • | • | • | • |

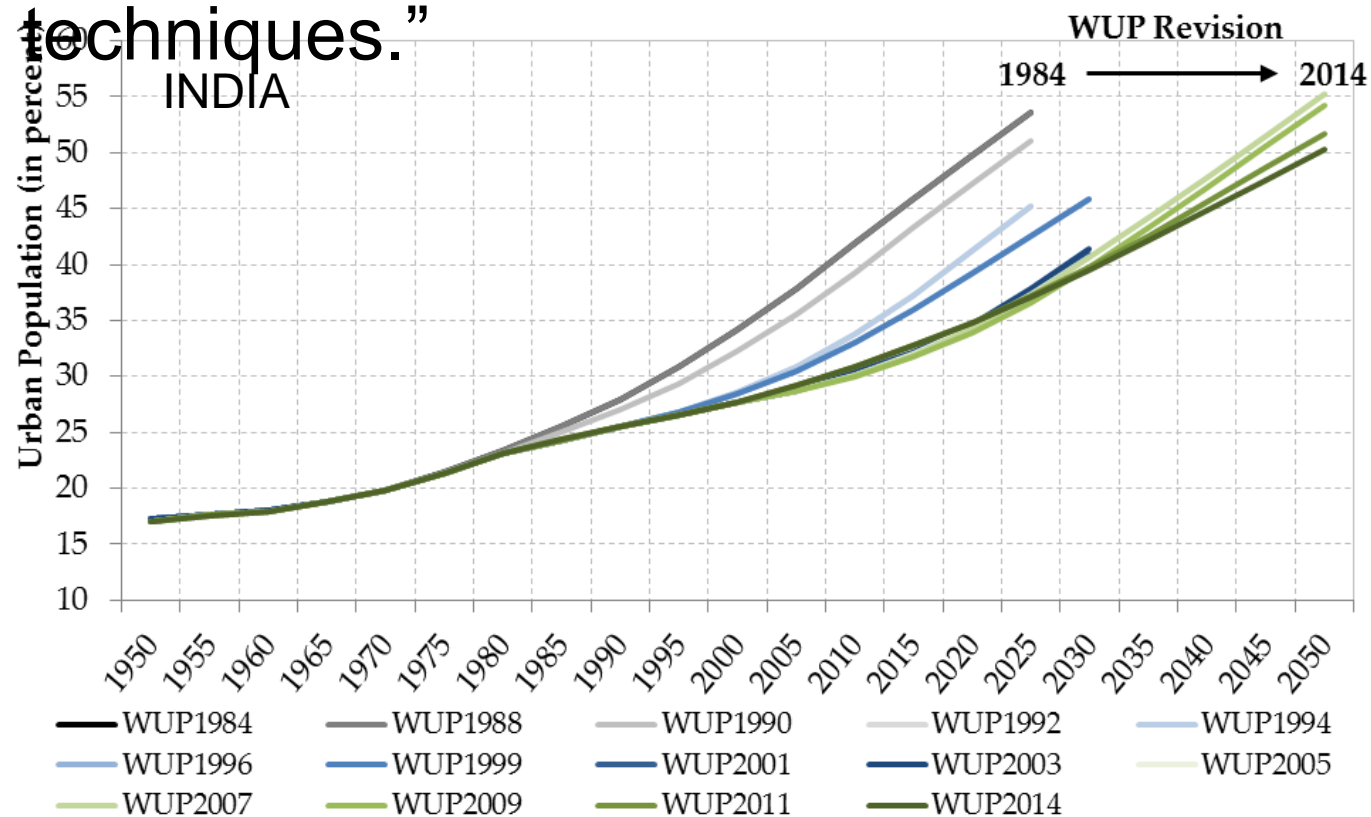
FOCUS: HETEROGENEITY

Population Prospects: There are various dimensions, but we focus in our results on...



URBANIZATION: OTHER ATTEMPTS

“So far the development of population size and urbanization has been mainly considered at national level with simple projection techniques.”



- > Higher level of urbanization expected
- > Applying experience of other countries, mostly developed ones

Source: World Urbanization Prospects (1984 to 2014)

SOCIAL & SPATIAL HETEROGENEITY

- > In INDIA, considering 'where you live?' requires to consider 35 States and 2 types of residences
 - > Share of urban population varies from 10% in Himachal Pradesh to 97% in Delhi (2011)
 - > Total Fertility Rate varies from 1.6 in West Bengal to 3.4 in Bihar (SRS, 2013) + Migration + Mortality
- > Considering 'who you are?' requires 2 sexes, 17 age groups and 6 education groups
 - > Large education differential in Fertility

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CONCEPT: DIMENSIONS

“... as well as **sub-national** population dynamics.”

| Demographic Rates and Characteristics | Fertility | Mortality | Migration international | Education transition | Migration internal | Migration subnational |
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| Education | • | • | • | • | • | • |
| Rural/urban | • | • | • | • | • | • |
| Subnational | • | • | • | • | • | • |

METHODOLOGY: PROJECTION

“As the prospective population size and urbanization is **affected by various dimensions**, we untied our projection model.”

> Five Dimensions

- > 35 states and India
- > 2 places of residence (urban/rural)
- > 6 levels of education
- > 17 age groups
- > 2 sexes

$$\text{> } 36 * 2 * 6 * 17 * 2 = 14688$$

> Scenario Building

- > Narratives
- > Assumptions

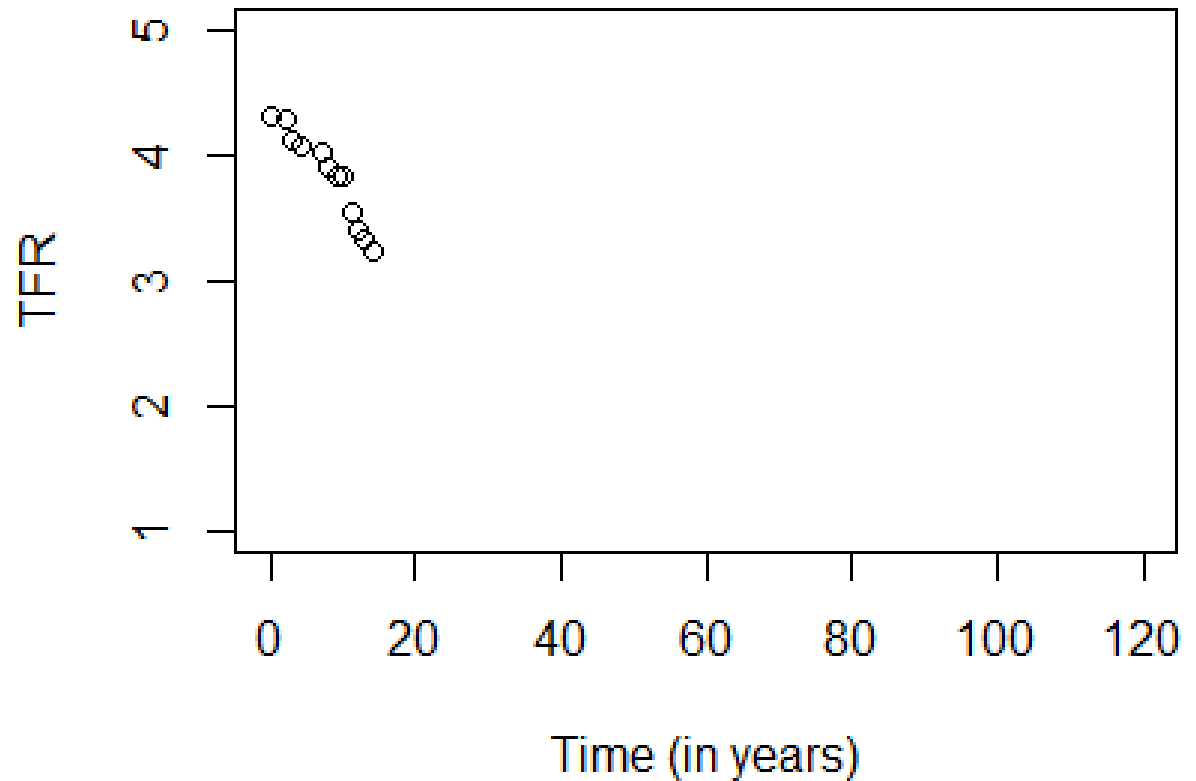
> Multi-state population model

- > Transition between states/place of residence by age, sex, and education
- > Education transitions
- > Fertility rates by **education**
- > Life tables
- > Internal migration

“Estimating fertility pathways...”

- > 1999-2013 (SRS)
- > Rural India
- > No education

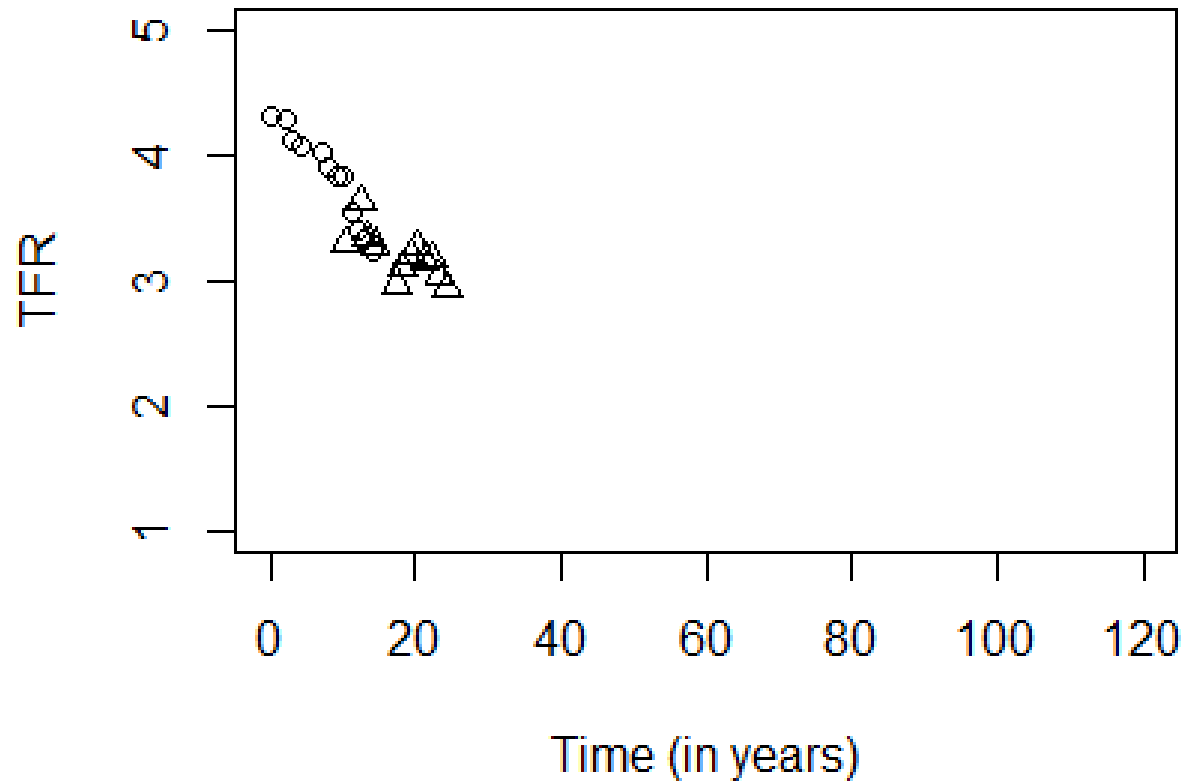
METHODOLOGY: FERTILITY



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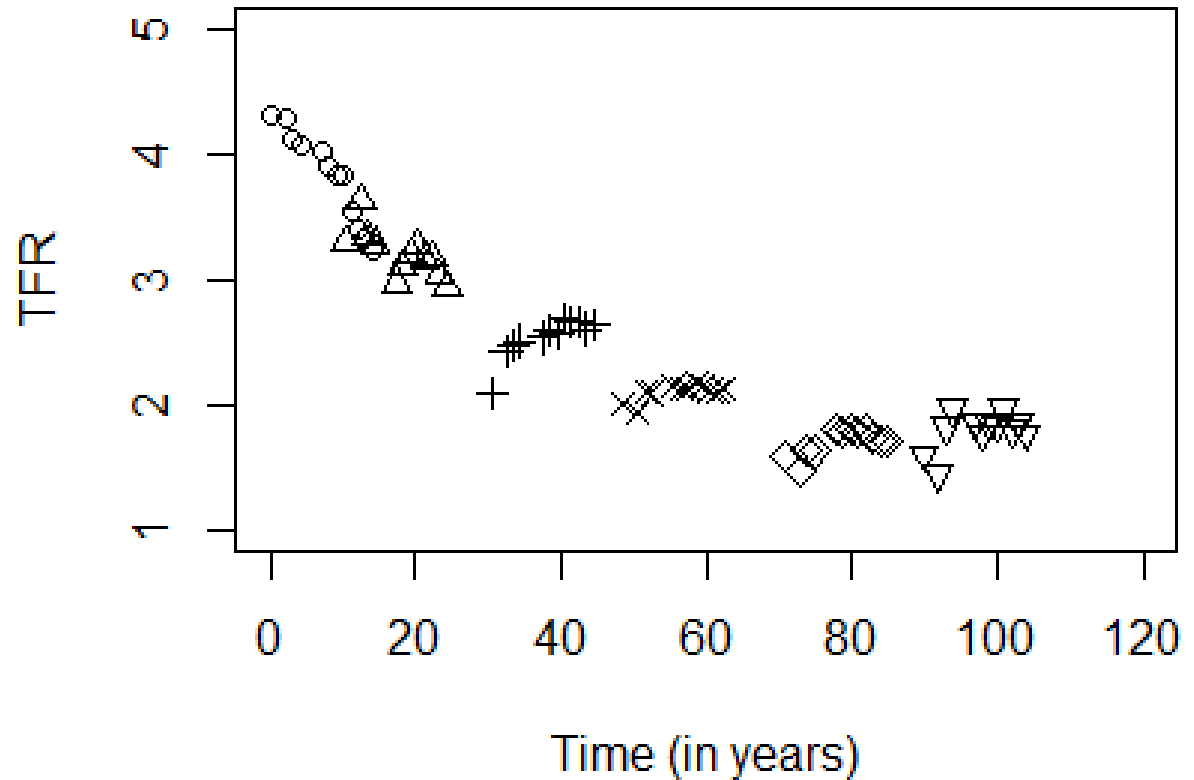
METHODOLOGY: FERTILITY



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- ...
- > Post secondary

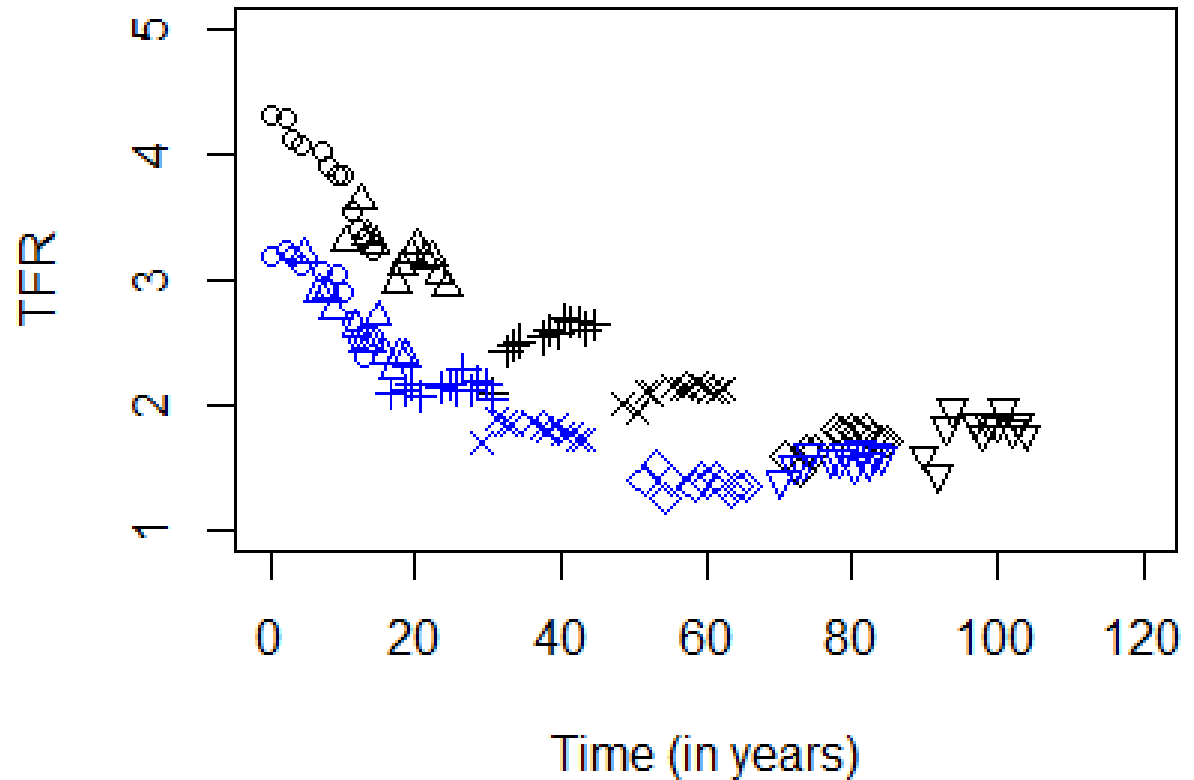
METHODOLOGY: FERTILITY



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- ⋮
- > Post secondary

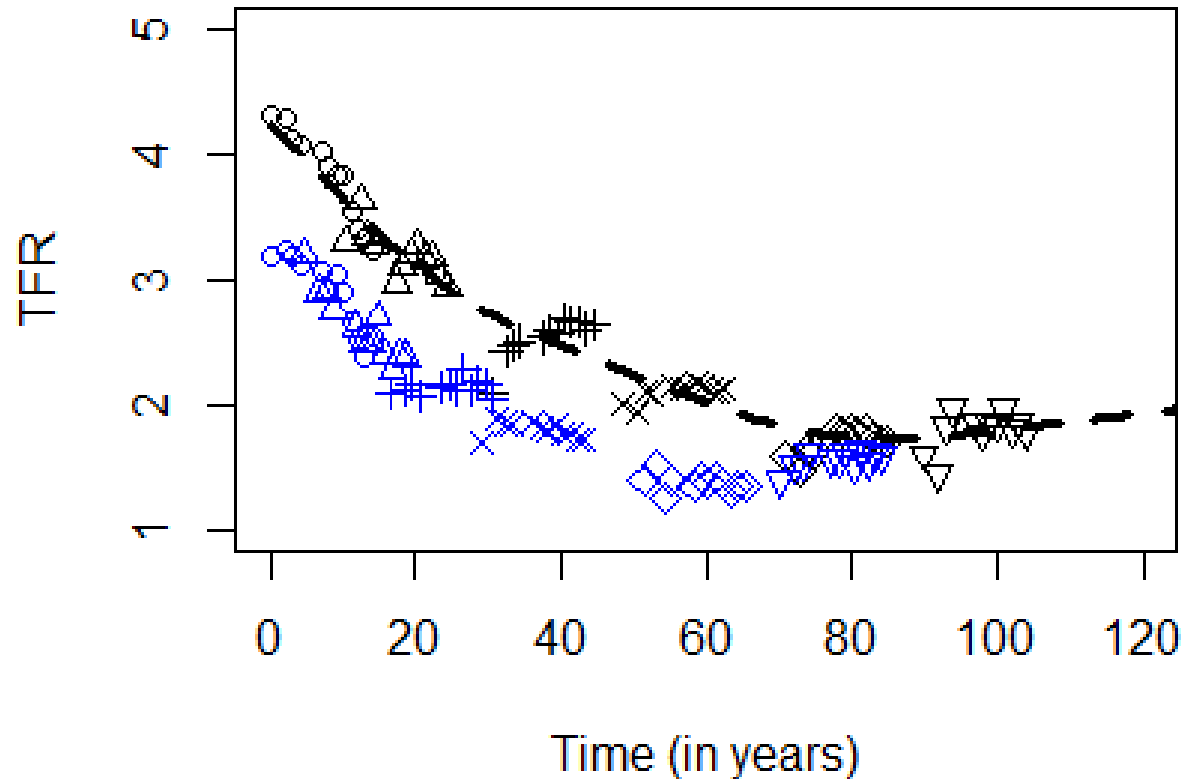
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“Estimating fertility pathways...”

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- > Post secondary
- > Fitting a cubic spline

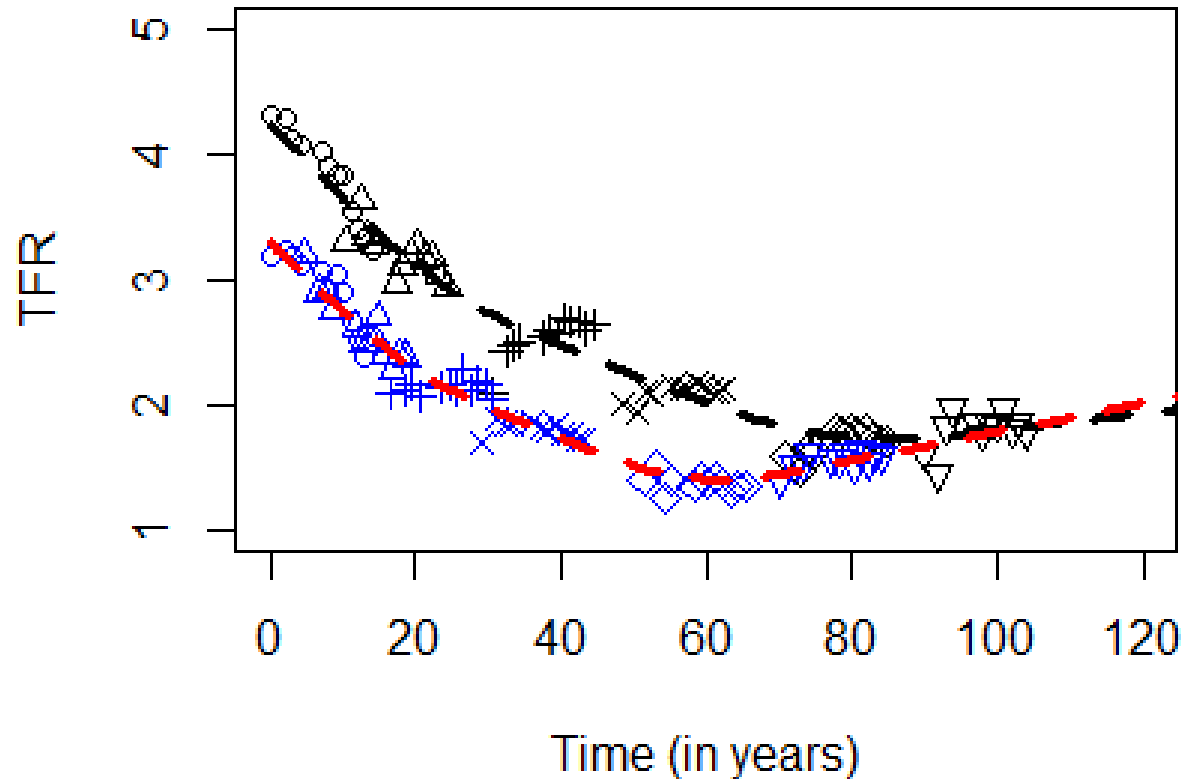
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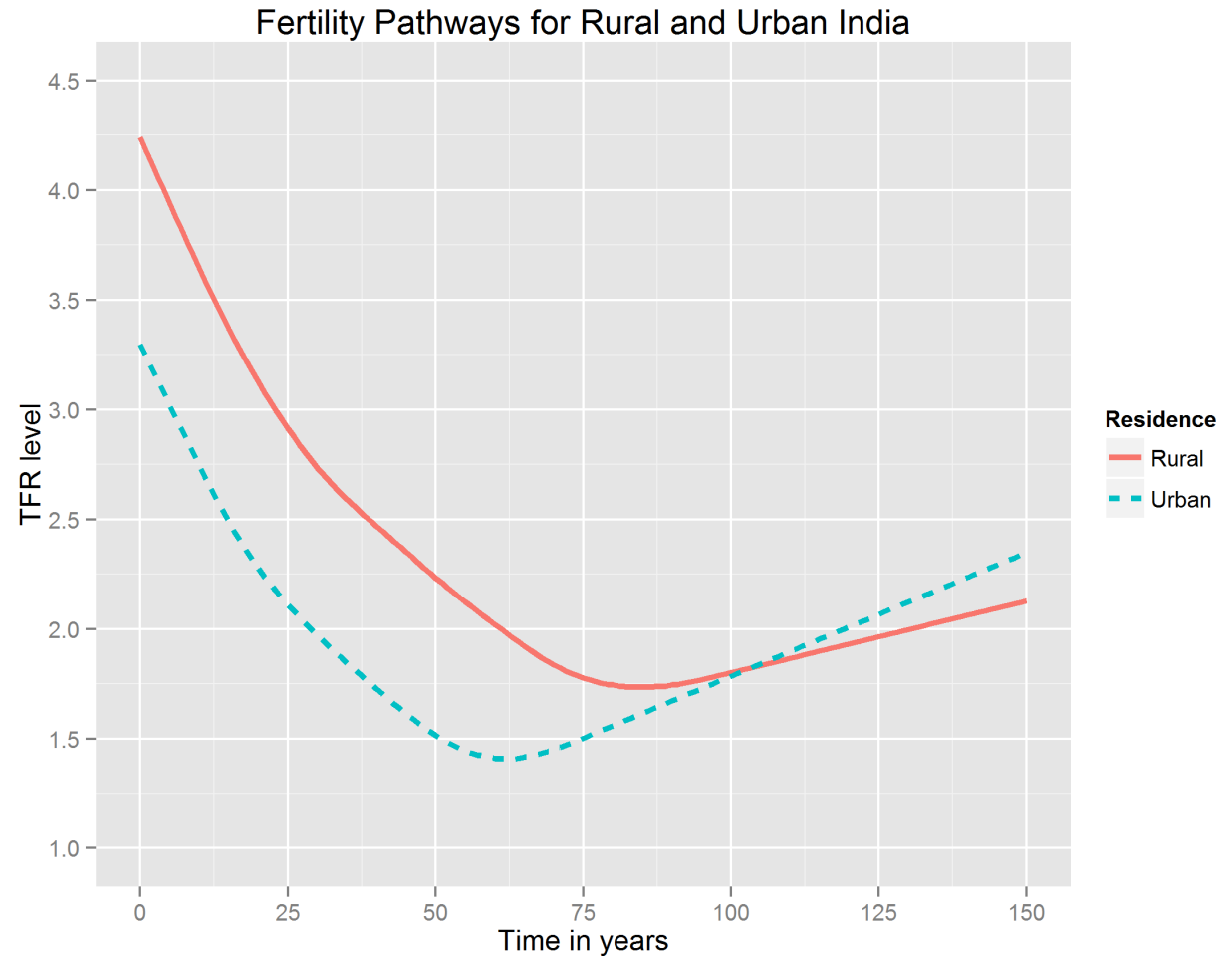
METHODOLOGY: FERTILITY



“Fertility pathways for India...”

- Edu-specific TFR follows these paths **except** for the lowest three categories levels at 2.08 for **rural** and 1.75 for **urban**
- Minima for rural (1.40) and urban (1.73)
- All education TFRs will ultimately converge at 1.75 (urban) and 2.08 (rural) except for those with lower fertility than the minima

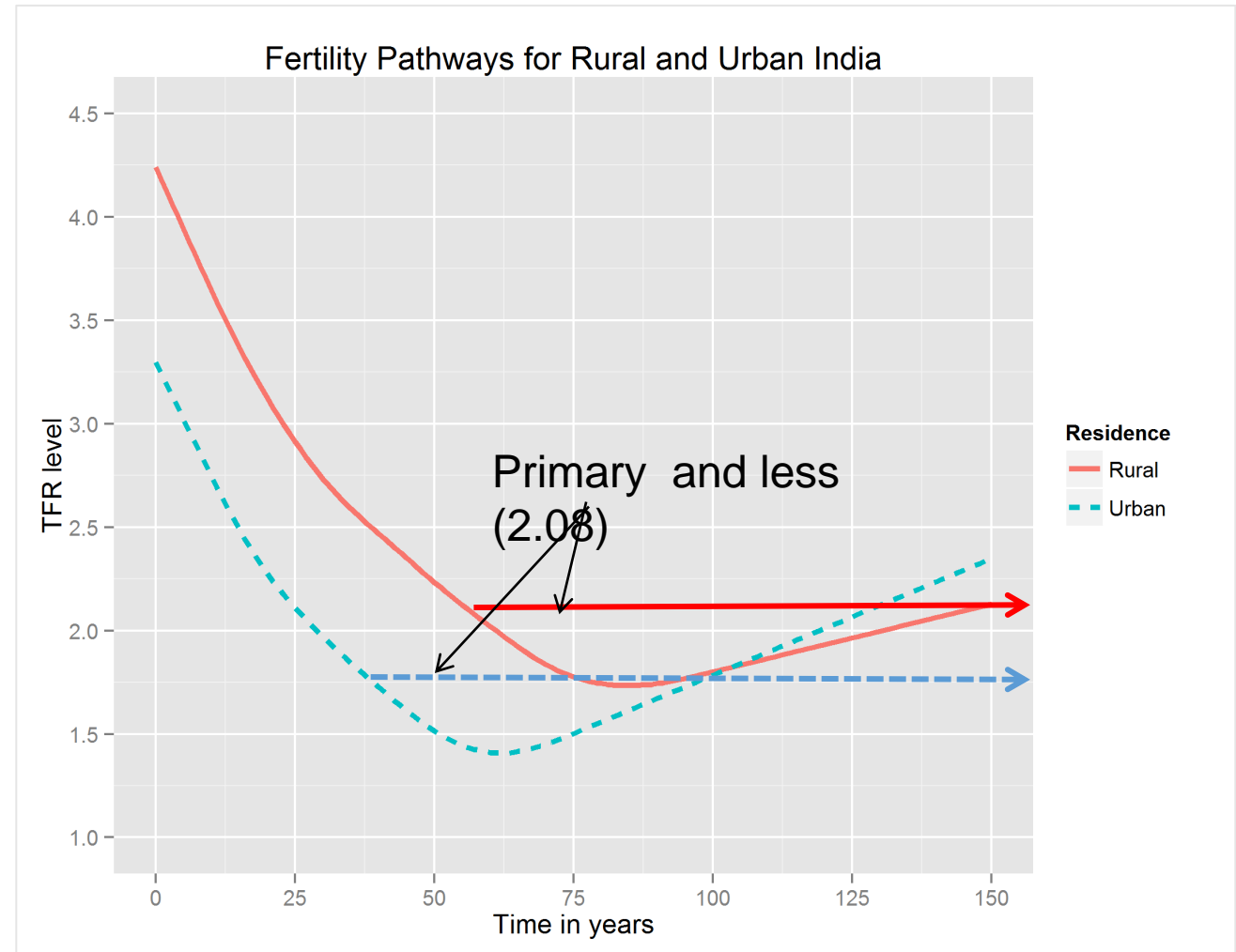
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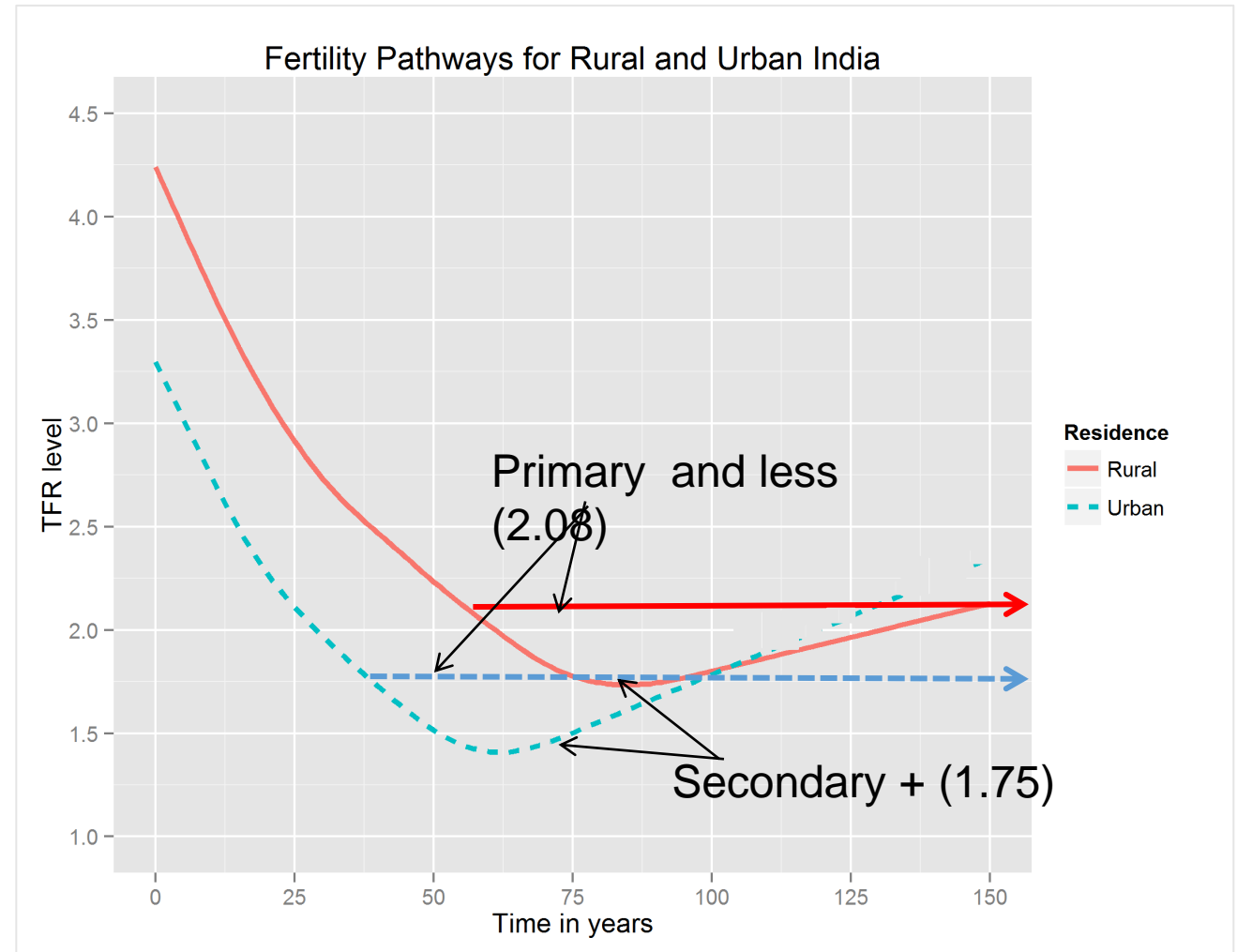
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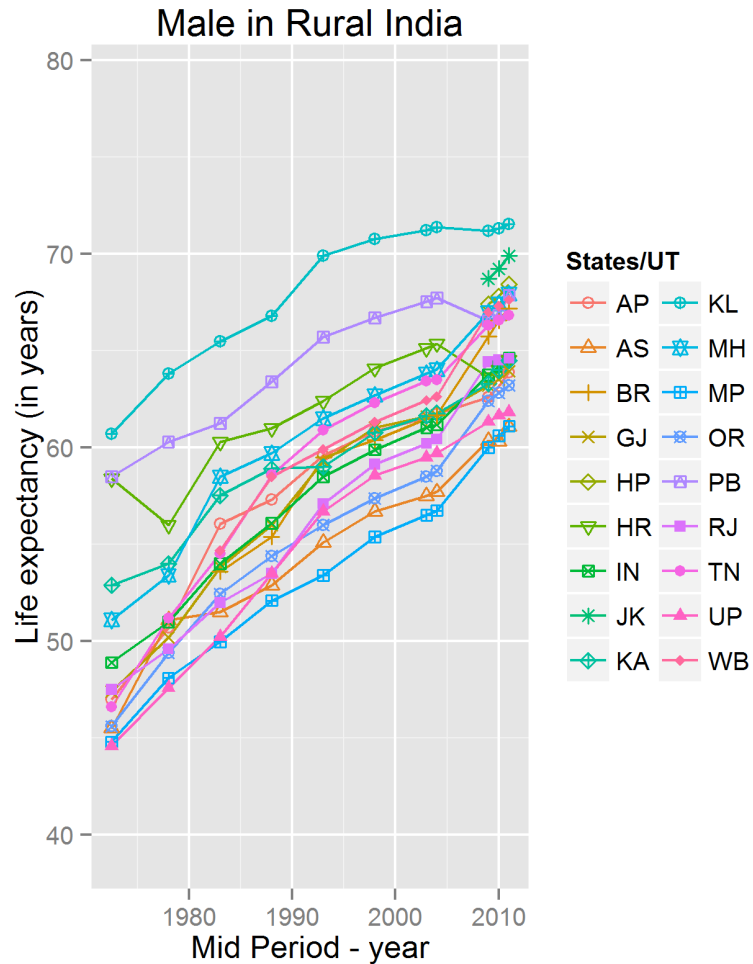
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METHODOLOGY: FERTILITY



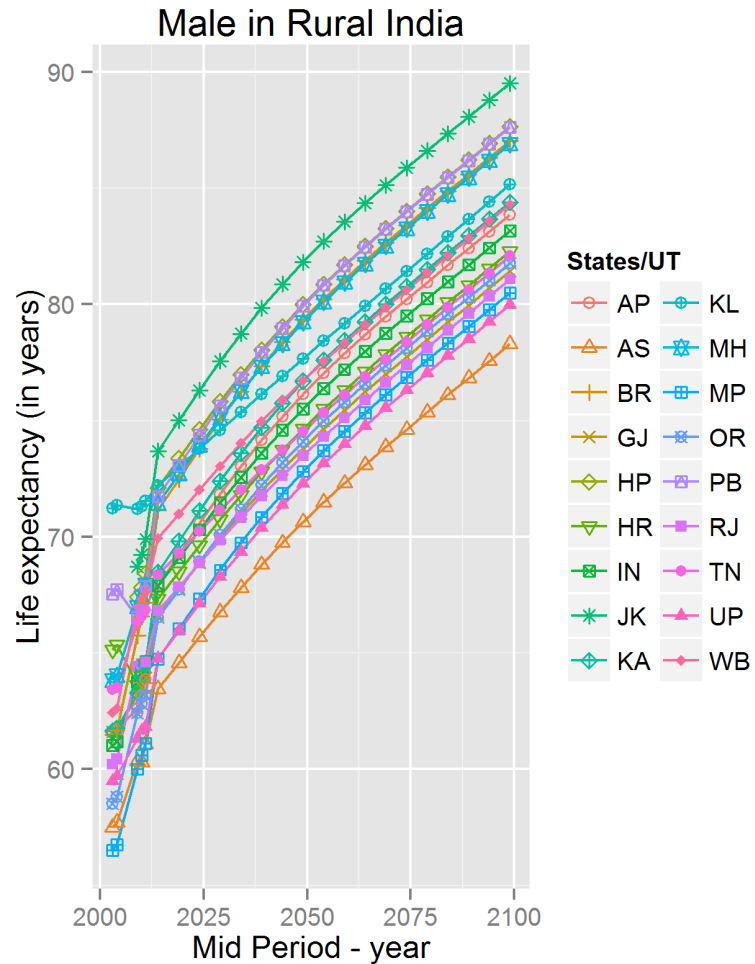
METHODOLOGY: MORTALITY



Source: SRS

- > Average gain for India (by Sex)
- > State-specific gain projected to converge to the Average gain by 2030
- > a maximum of 3.00 years
- > a minimum of 0.75 years (male) and 1.00 year for males
- > Missing States = PROXY

METHODOLOGY: MORTALITY



Source: SRS

item 03 /// Samir KC /// 2016-04-18

- > Age pattern: UN Medium Variant
- > Rural/urban gap limited to the current value
- > Gender gap (not considered yet)
- > Question about convergence?

METHODOLOGY: (INTERNAL) MIGRATION

INTERNAL MIGRATION

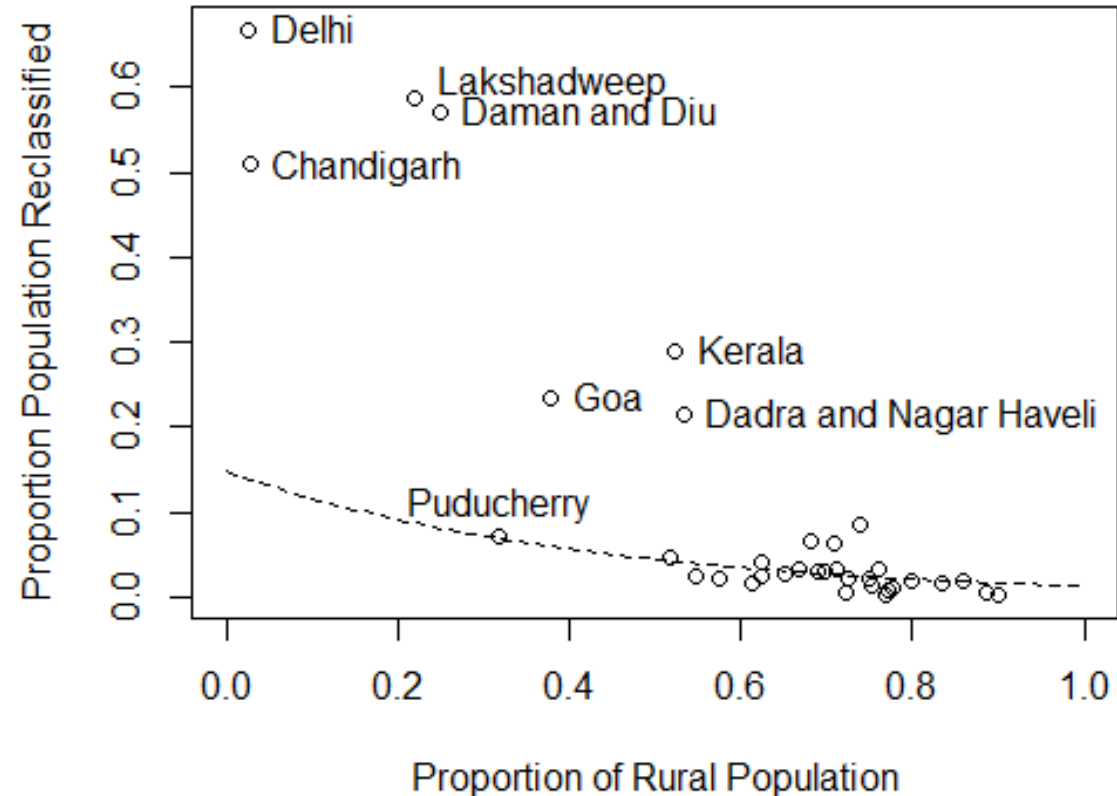
- > Census 2001
- > **Volume of migration flows:** the total number of migrants by sex in the current place of residence (by States/UT and by rural/urban) and last place of residence
- > **Five- yearly age and sex distribution of migrants,** who have been living in the current region (destination) since up to 9 years, is available by origin State/UT and by rural/urban
- > Decided to use same age-pattern from an origin to all destinations.
- > Further analysis required...

“Rural to urban reclassification...”

- > Pradhan (2013)
- > 30% of the urban population growth due to reclassification
- > $\log(y) = A+Bx$
- > Excluded outliers (and held constant for the future)
- > Predicted using the relationship

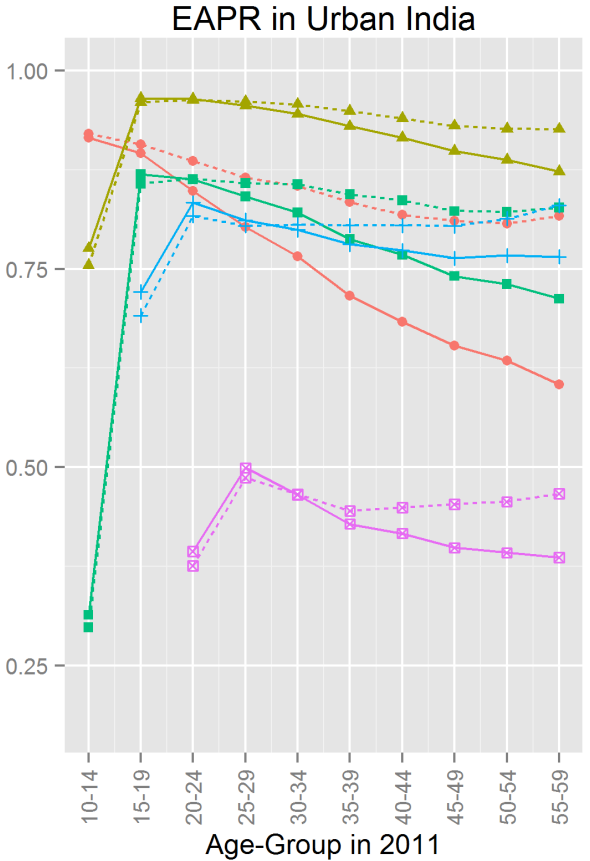
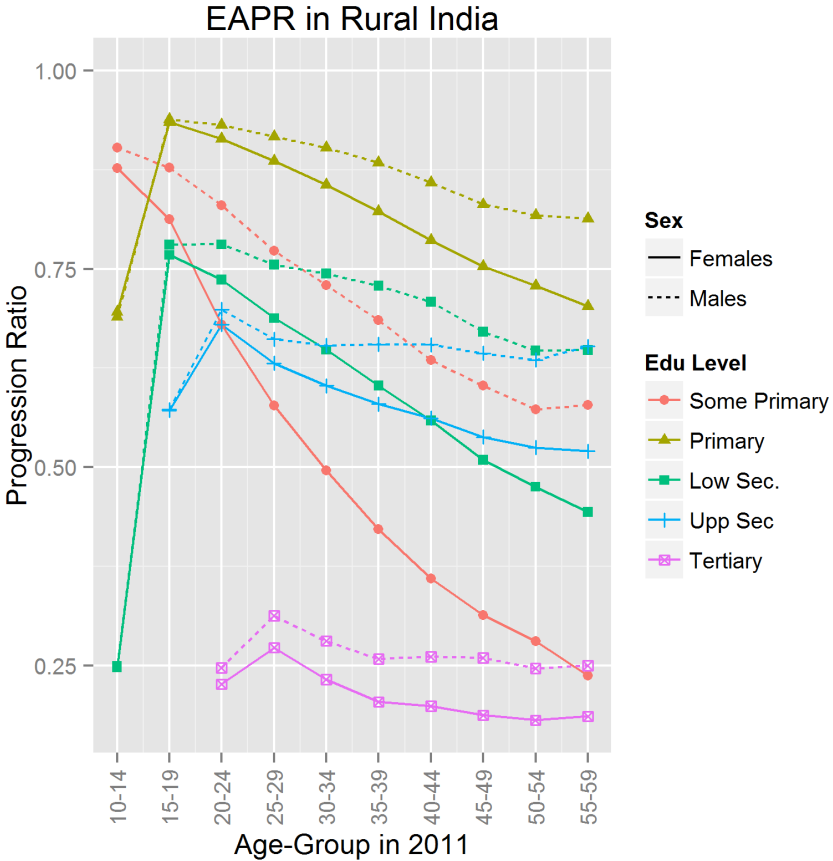
METHODOLOGY: RECLASSIFICATION

Proportion of population reclassified to Census Towns from rural population



METHODOLOGY: EDUCATION

“Education transitions...”



Source: Census 2011, own calculation

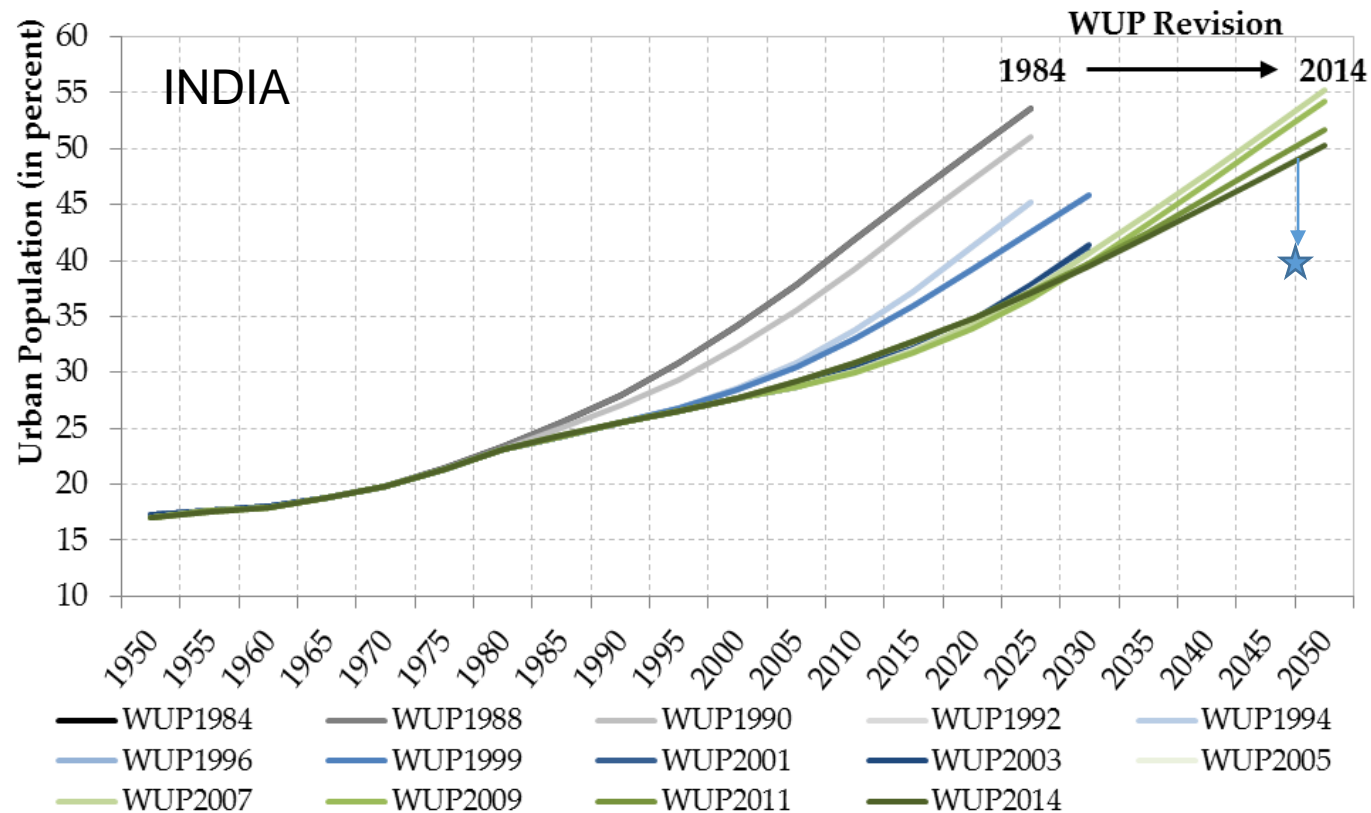
“Considering ‘where you live?’ in the projection India leads to slower rate of urbanization...?”

URBANIZATION

- > urbanization in India from 31% in 2011 to 41% in 2051 compared to the UN projections.
- > because of the largely rural, less educated, large populations in Bihar and Uttar Pradesh that are slowing down the momentum of urbanization in India.
- > when we calculate the speed of urbanization in the rest of the 33 States/UT, the speed is much faster from 35% in 2011 to 51% by 2051.

RESULTS: URBANIZATION

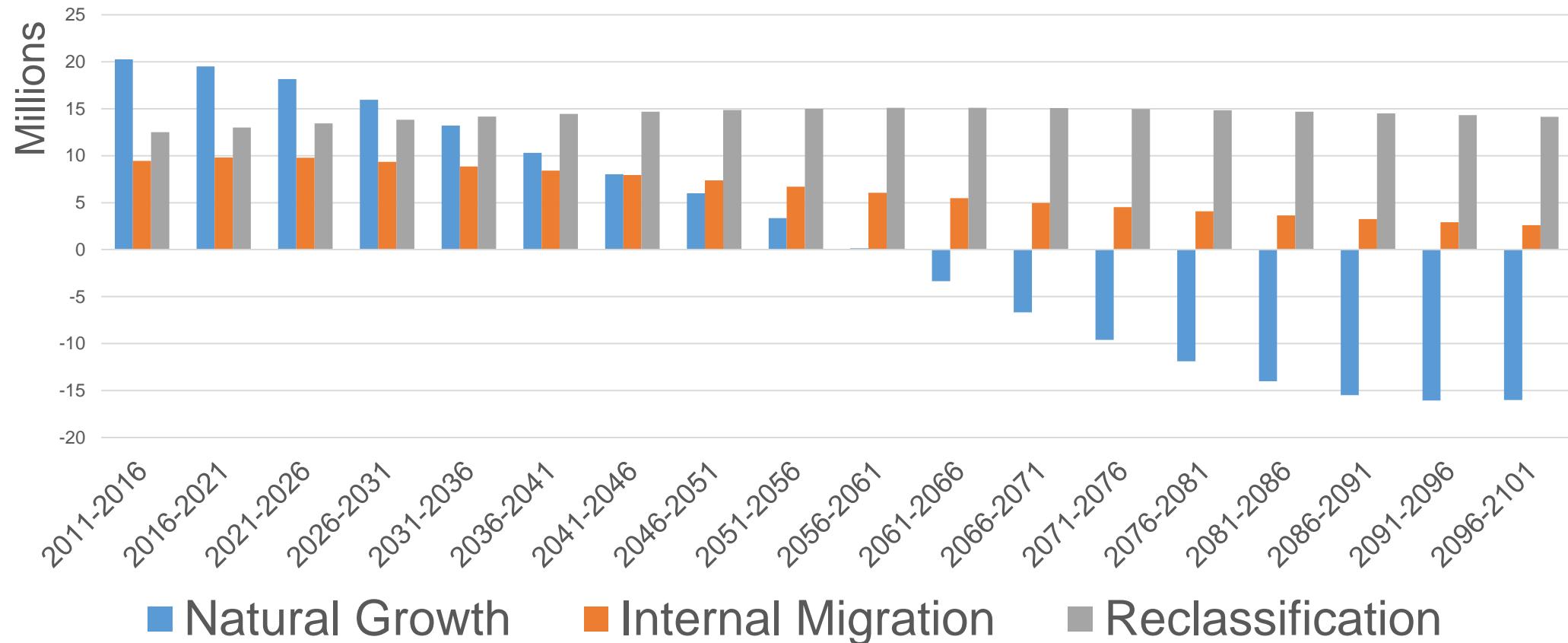
urbanization in India from 31% in 2011 to 41% in 2051 LESS compared to the UN projections.



Source: World Urbanization Prospects (1984 to 2014)

PROJECTION: **OUTCOME**

Source of Population Change in Urban India



Source: **Census 2011**, own calculation

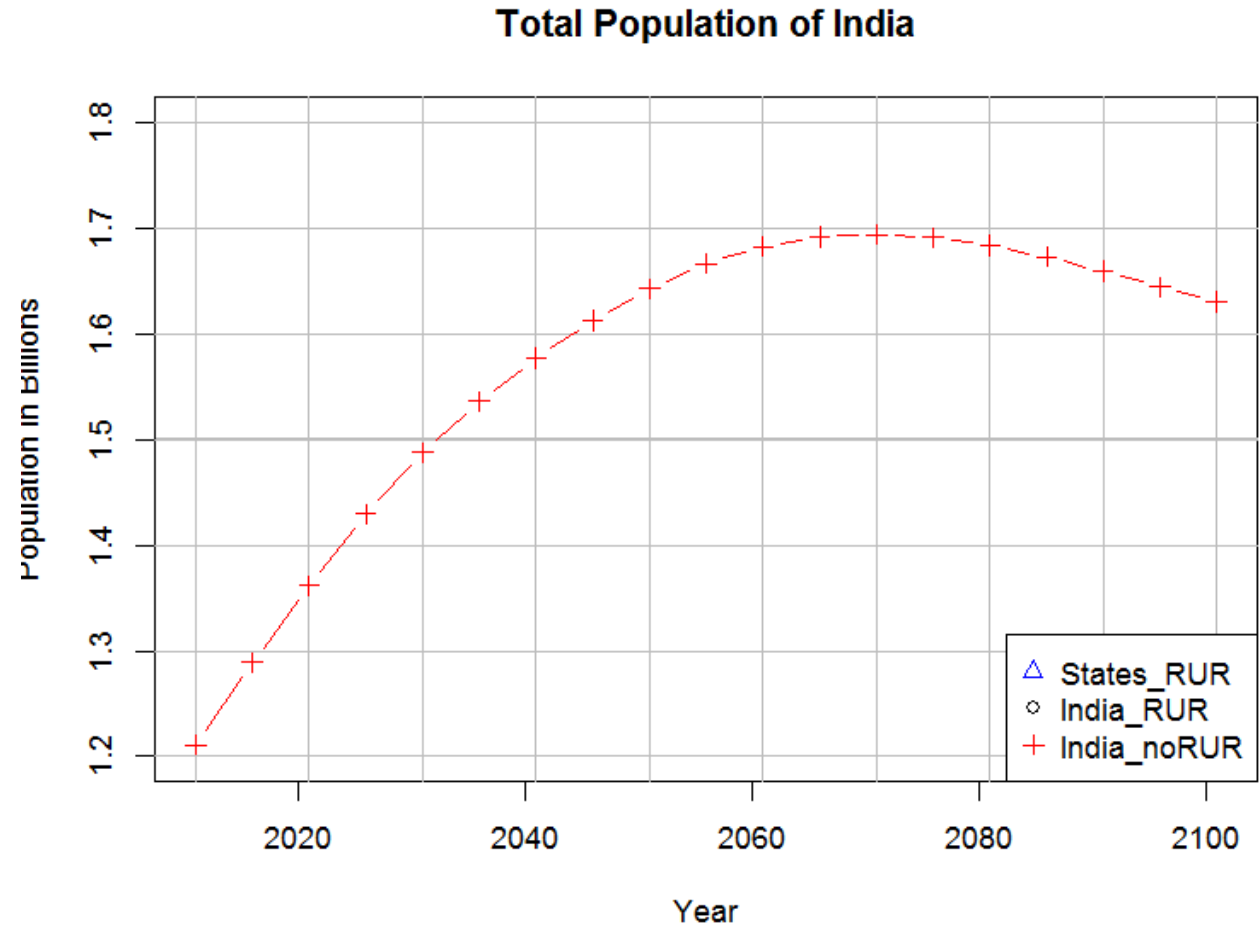
“...and lower population growth in India?”

Population

- > Higher rate of population growth in state-wise projection than in the national projection
- > For similar reason, that the higher rate of population growth in States UP and Bihar that is explicit in the state-wise projection is slowing the deceleration...

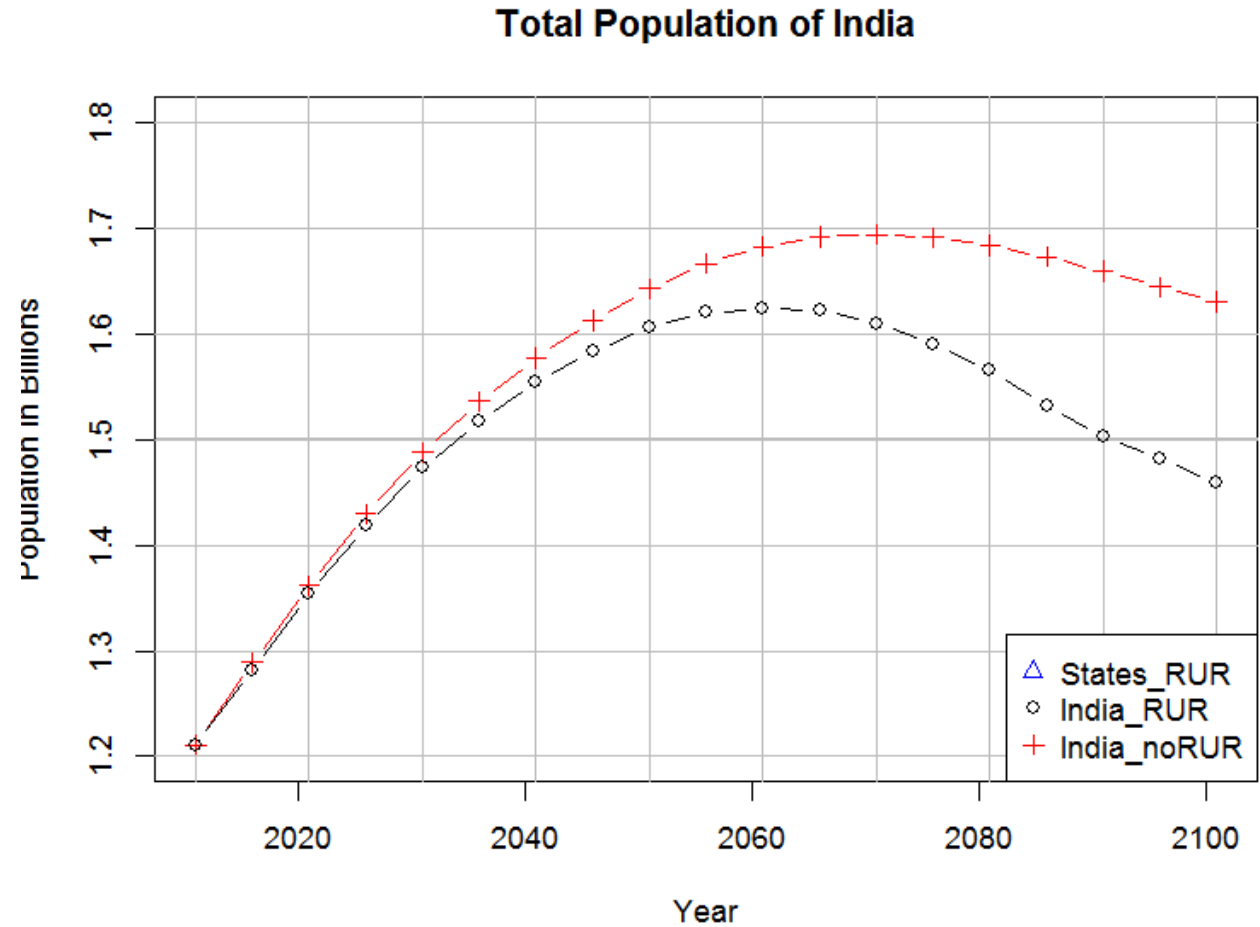
PROJECTION: OUTCOME

- **INDIA Rural/Urban** projection **without migration**: peaks at **1.7** billion by 2071
- + internal migration: peaks at 1.61 billion by 2061
- + States: peaks at 1.65 billion by 2061



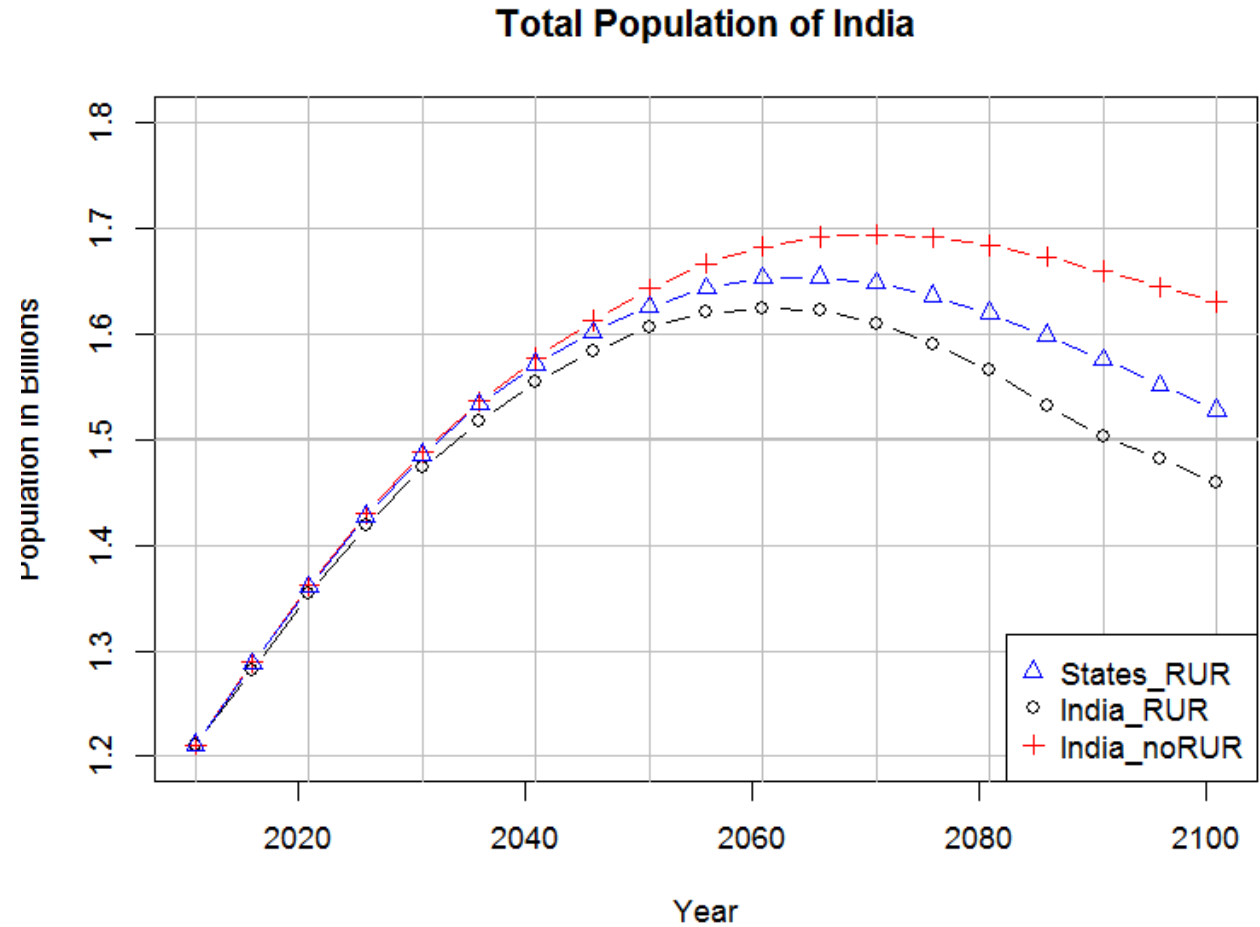
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PROJECTION: OUTCOME

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CHALLENGES

- > Develop INDIA population model
- > Adding International Migration
- > Adding International Migration
- > Refine reclassification process
- > Internal Migration (data)
- > Convergence or Divergence?

UPCOMING

- > to work further on **baseline scenario** identified in this iteration
- > Run **sensitivity** tests /and elasticity tests
- > define alternative **scenarios**
- > Simulate **existing narratives** for India (e.g., SDG scenario, Shared Socio-economic Pathways)