Income distribution in large-scale models

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The bigger picture

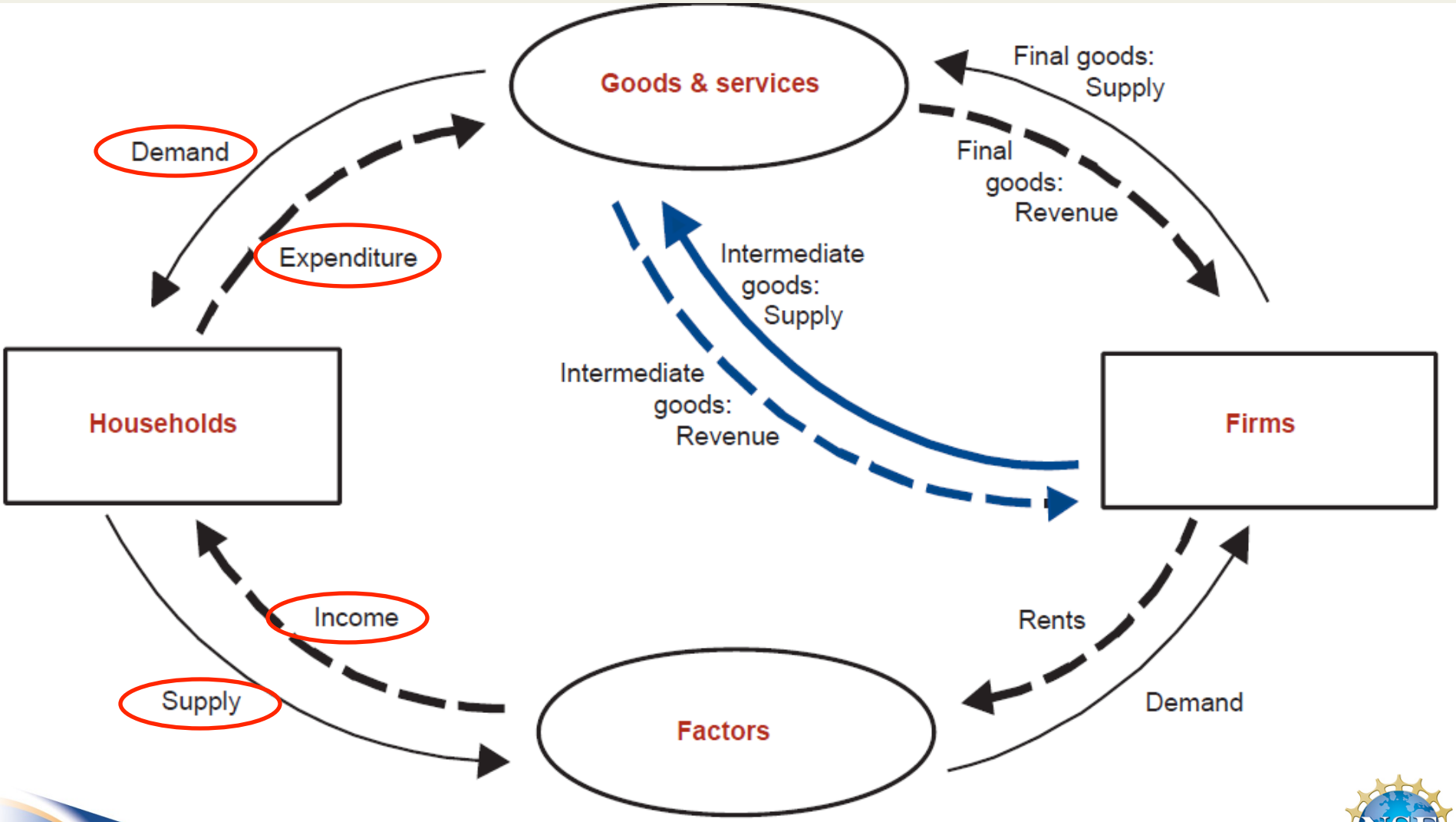
- Multi-model process to generate income distribution scenarios, linked to SSP's

- Today:
  - Overview of CGE-approaches
  - IIASA ideas
  - SEI income inequality model

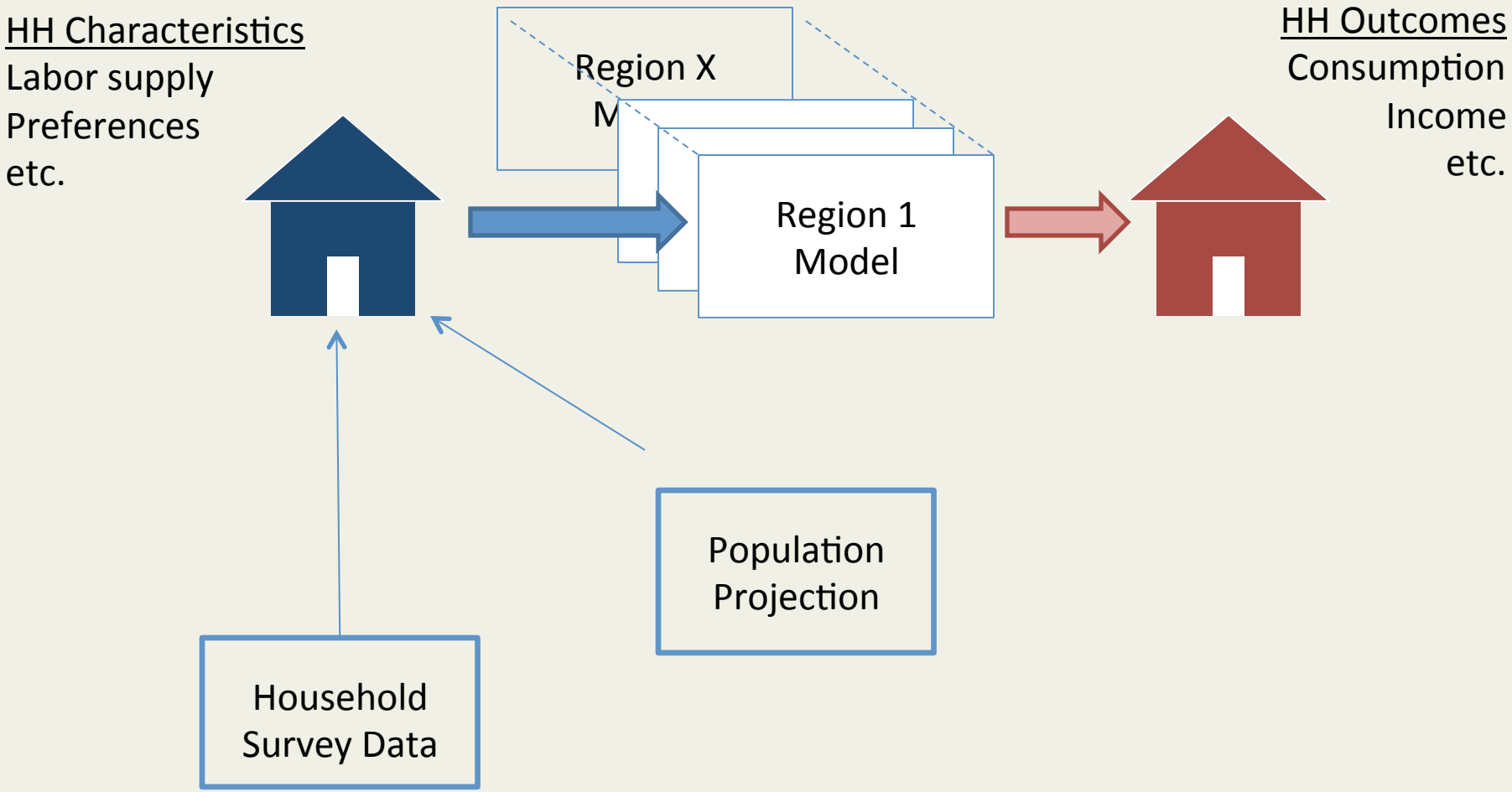
Approaches in CGE models

- Multiple household types
  - Small number, large number, hybrid
- Econometric income distribution
- Micro-simulation (accounting / behavioral)
  - Top-Down / sequential
  - TD-BU / iterative

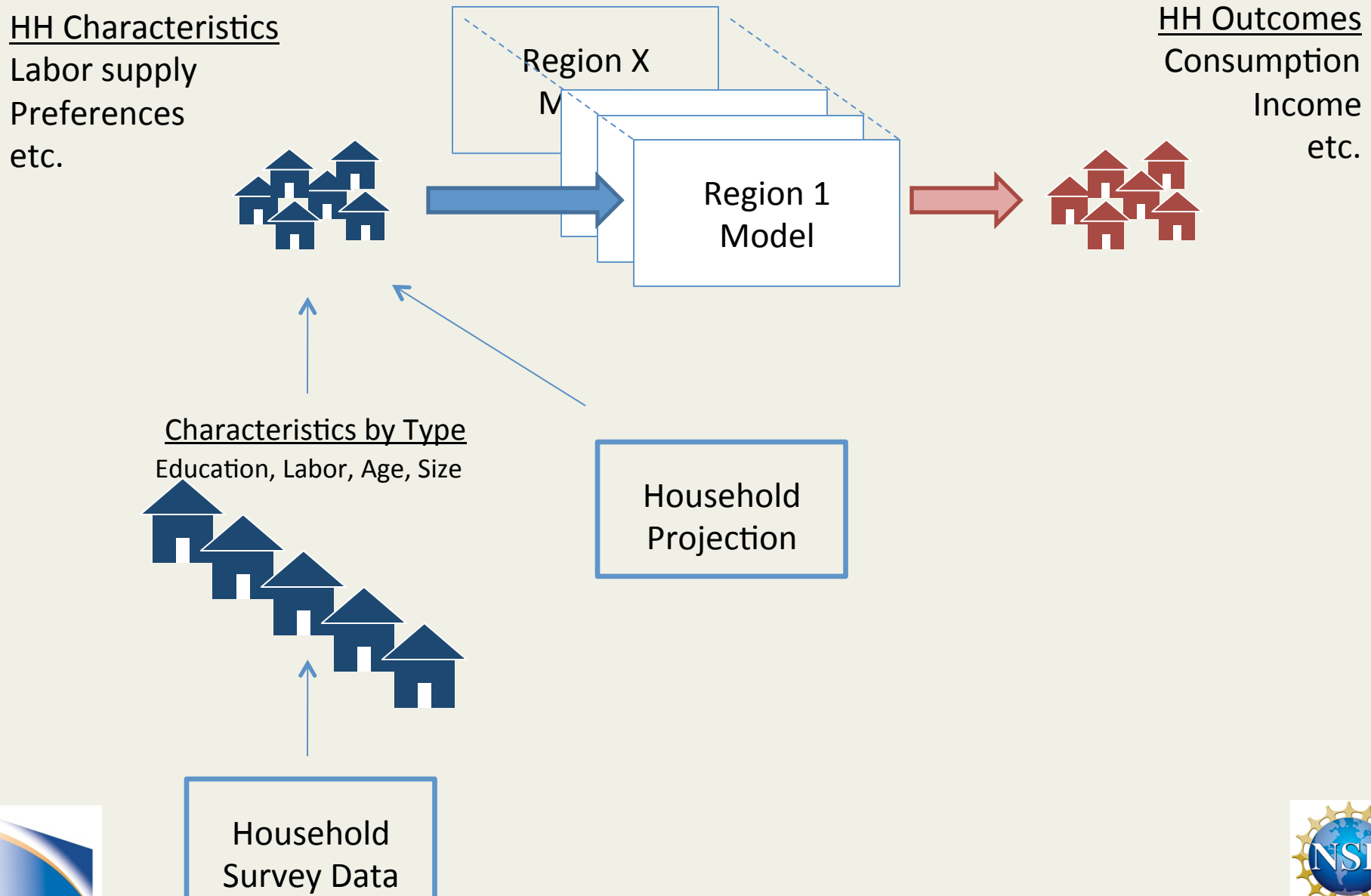
Distribution of what?



Single representative household



Multiple household Types



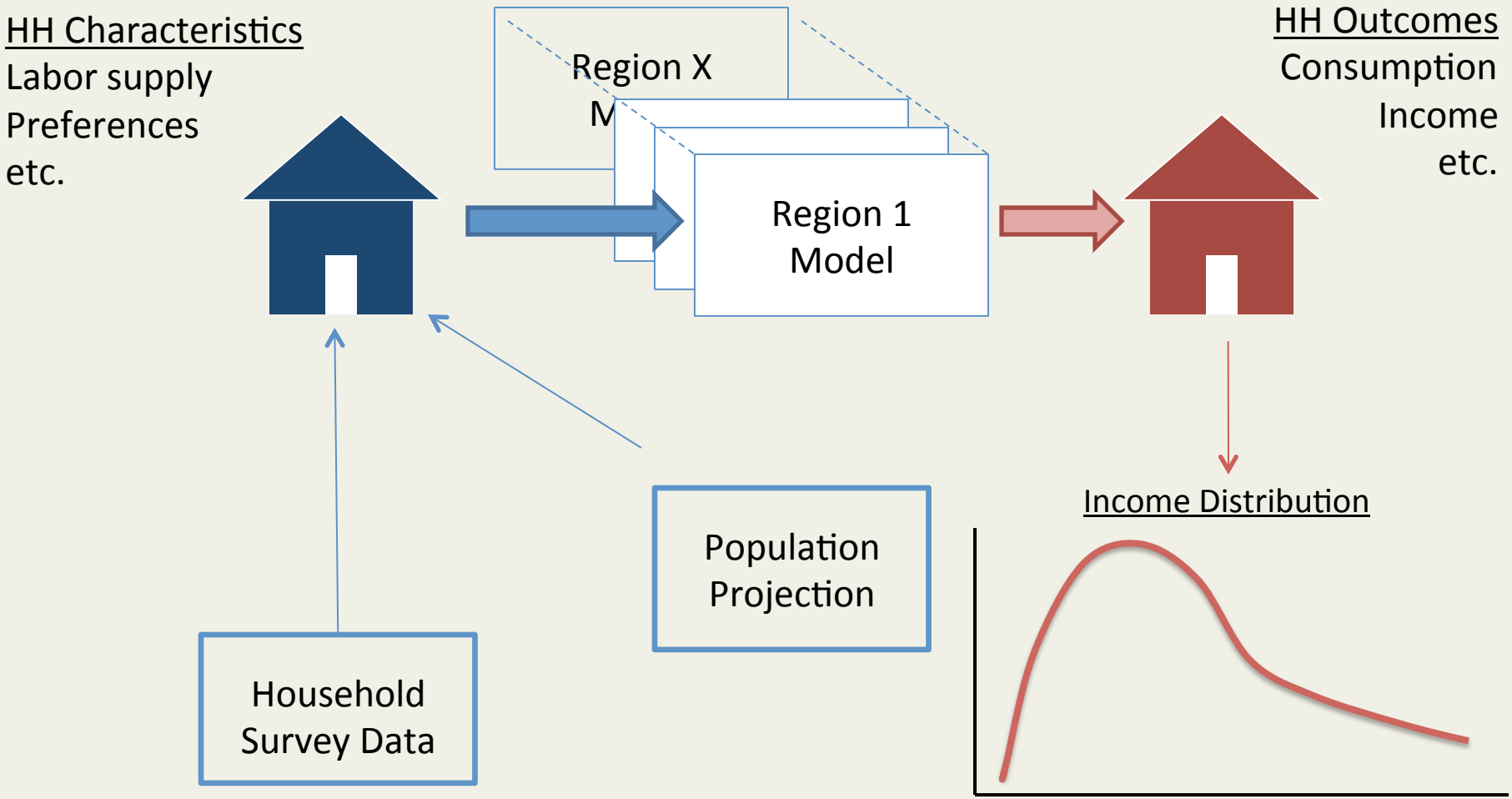
Multiple Household Types

- Each HH type represented explicitly within CGE framework (own utility function)
- Captures general equilibrium effects among HH's, and between HH's and rest of economy
- Can become computationally demanding depending on number of HH types, structure of CGE model
- Example: Lofgren, IFPRI model, 2003

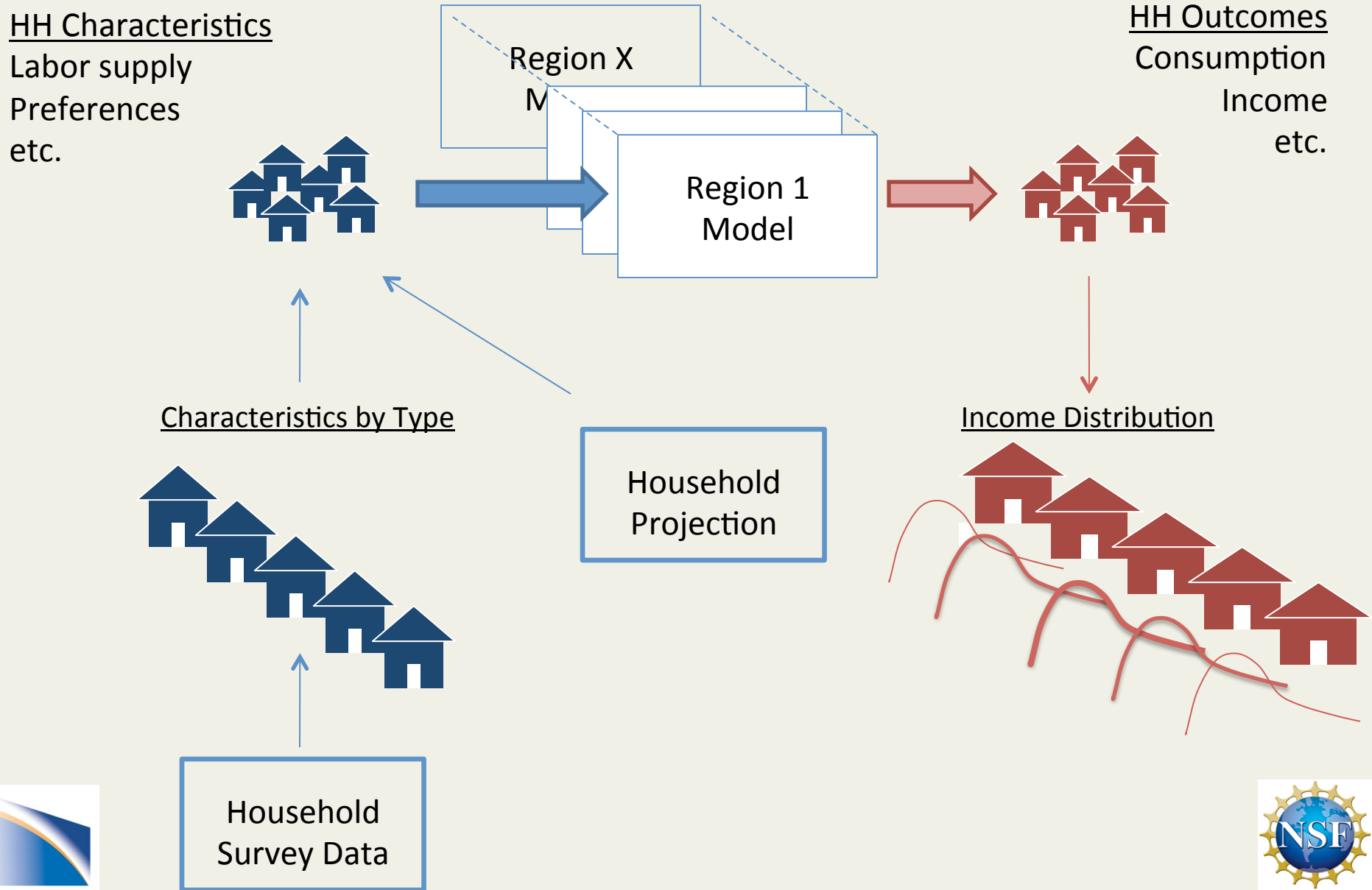
Multiple Household Types: Small vs large number of Types

- Small number of HH types (~10)
  - Each is a "representative household", large within-type heterogeneity can still remain
  - Sometimes combined with further disaggregation of each HH type by econometric or micro-simulation approaches
- Large number of HH types (100s – 10000s)
  - Reduces within-type heterogeneity
  - Sometimes implemented as one type for each household in a nationally representative survey

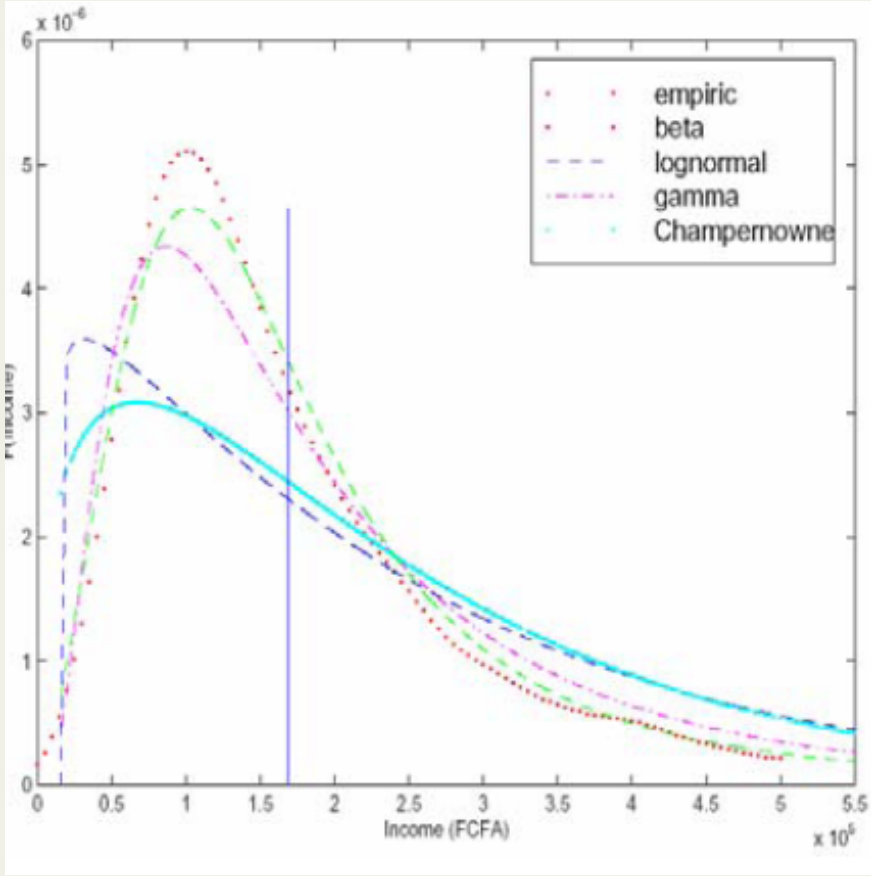
Econometric income distribution

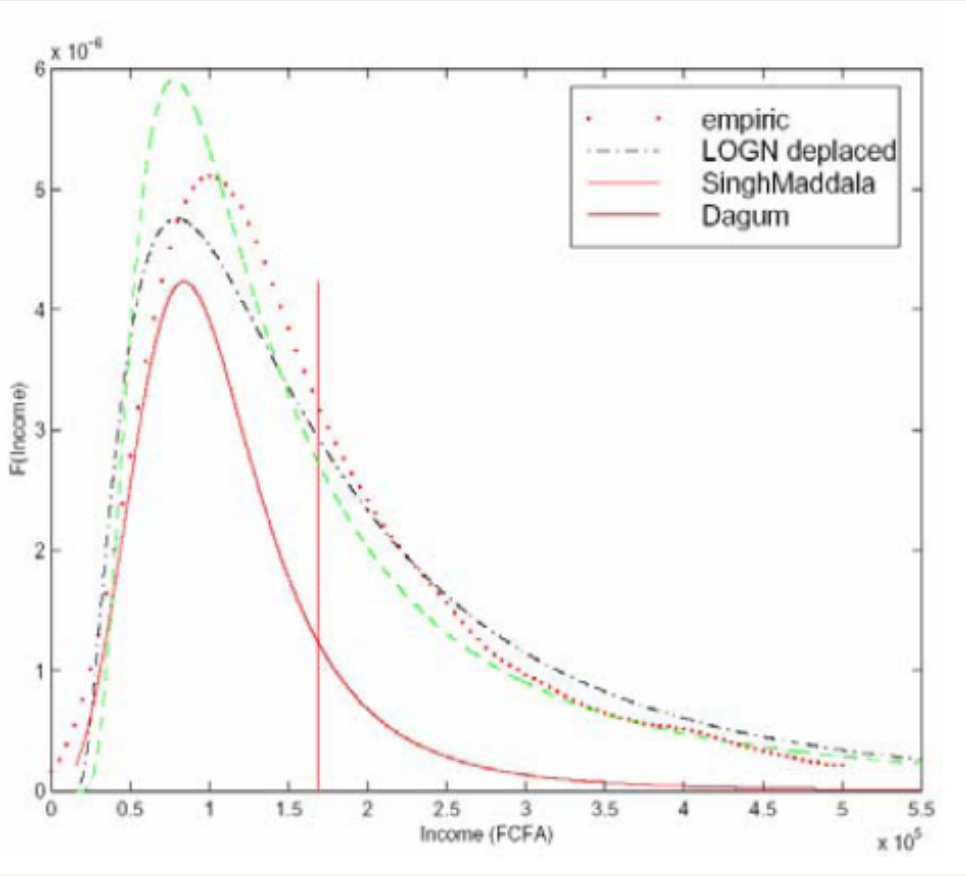


Econometric income distribution



Econometric income distribution





Boccanfuso et al., 2003

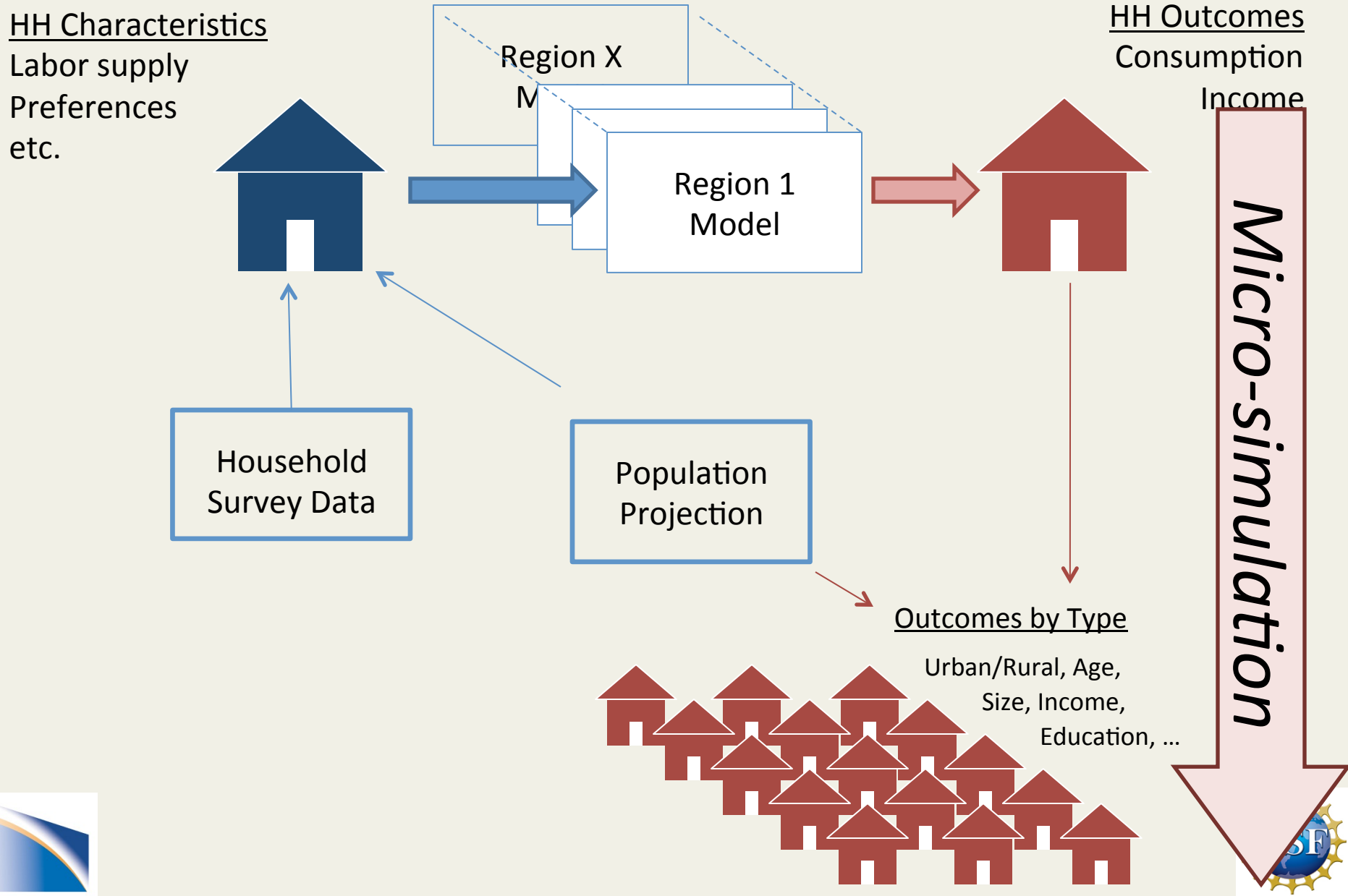
Econometric income distribution

- Fixed relative distribution within HH types
- Mean of distribution corresponds to CGE
- Ex-post calculation on CGE-output

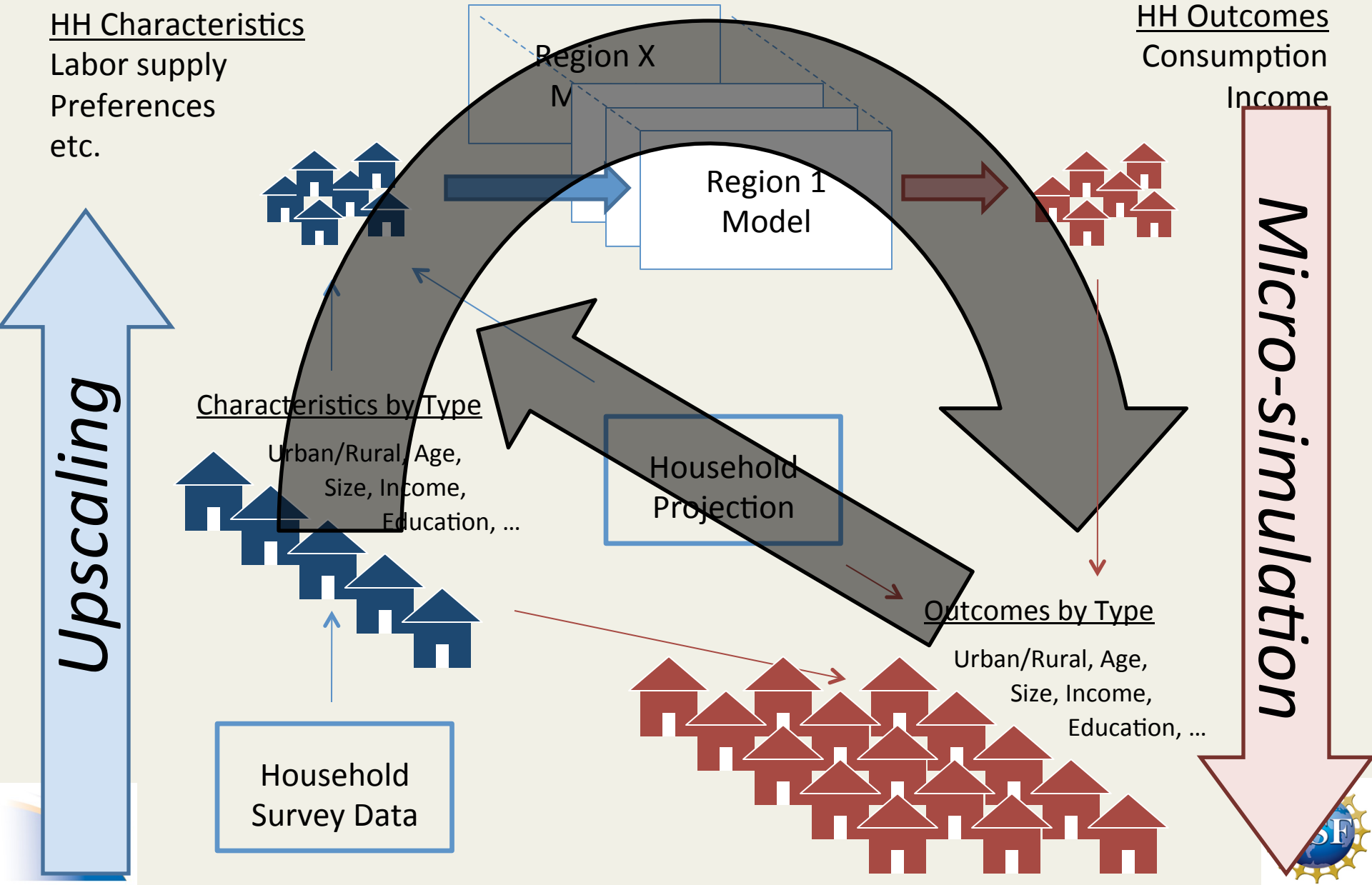
- Data need, relatively low (only income dist)
- No feedbacks, dynamic effects, time
- Functional form is subjective choice

- Examples: Adelman & Robinson 1978; Decaluwé et al., 1999; Boccanfuso et al., 2003

Micro-simulation



Micro-simulation



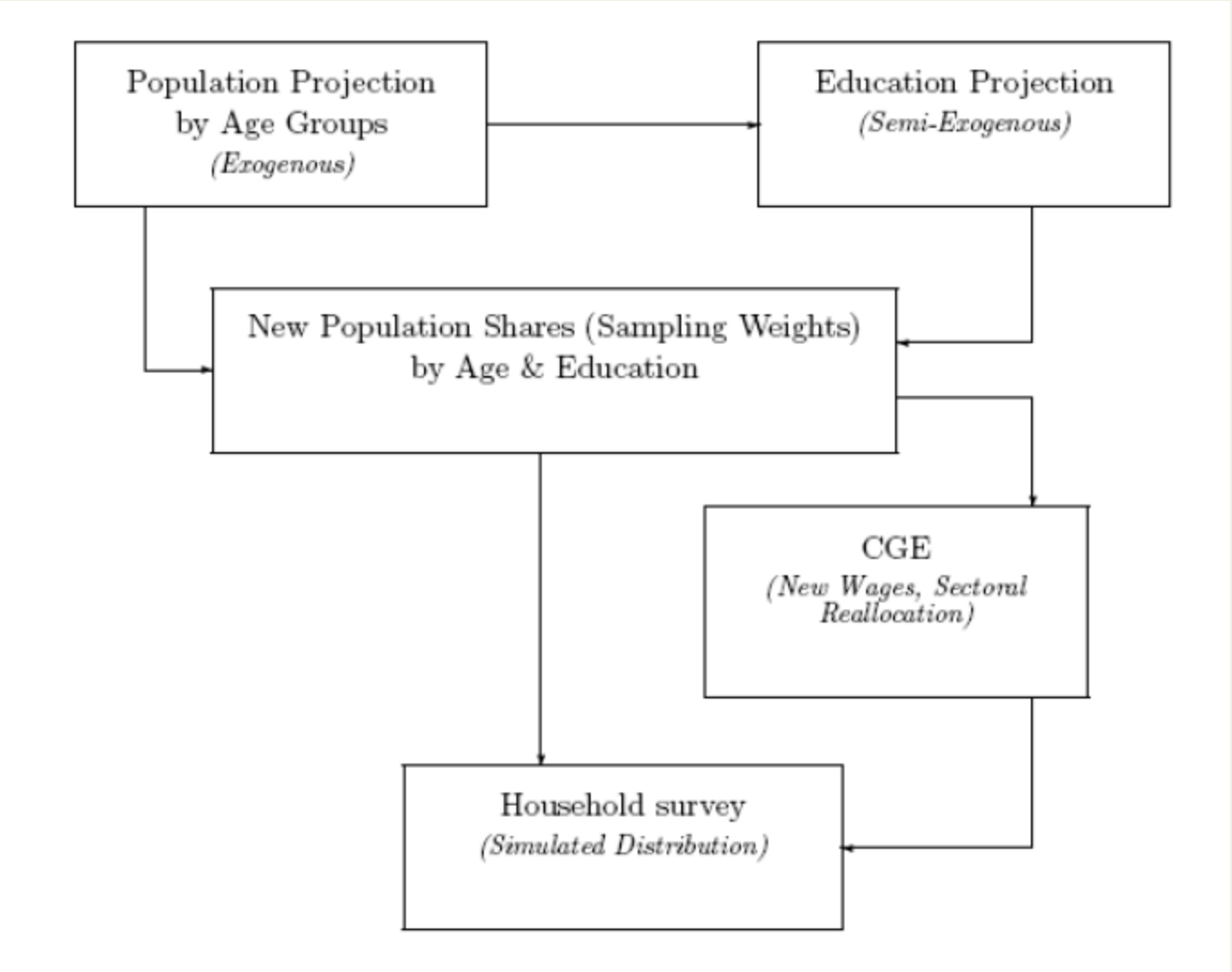
Micro-simulation

- Large number of household types
- Data intensive
  - Nationally representative HH survey

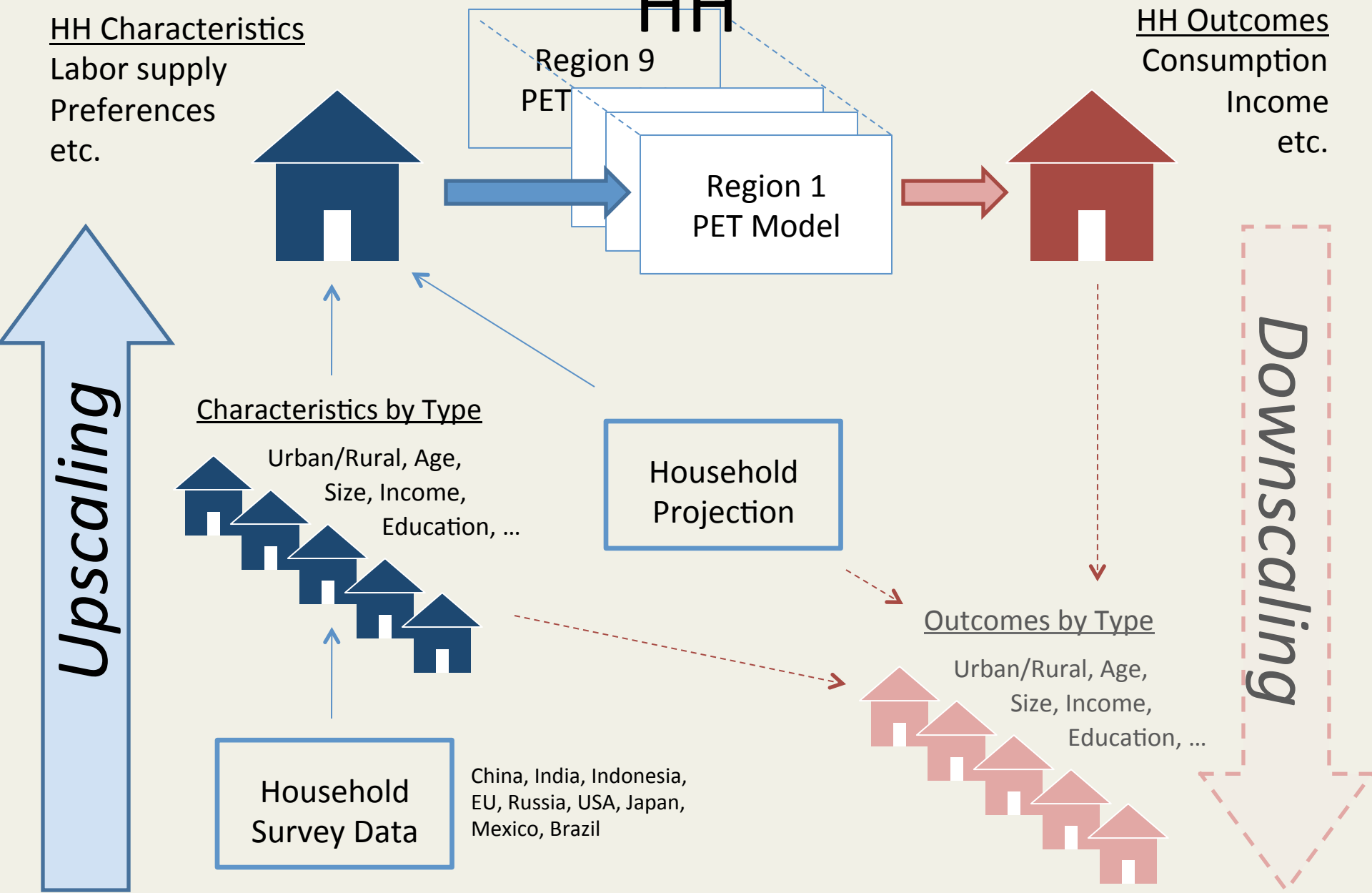
- Accounting (impact of wage/price/tax change)
- Behavioral (change in labor, consumption)

- Examples: Bourguignon et al., 2003; Savard, 2003; Buddelmeyer et al., 2008; Busselo et al., 2010

Example – World Bank GIDD/ENVISAGE



Example iPETS – Representative HH



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Approaches to Projecting Intranational Income Distributions

Jesus Crespo Cuaresma, Shonali Pachauri, Narasimha Rao, Keywan Riahi

1. Econometric Approach

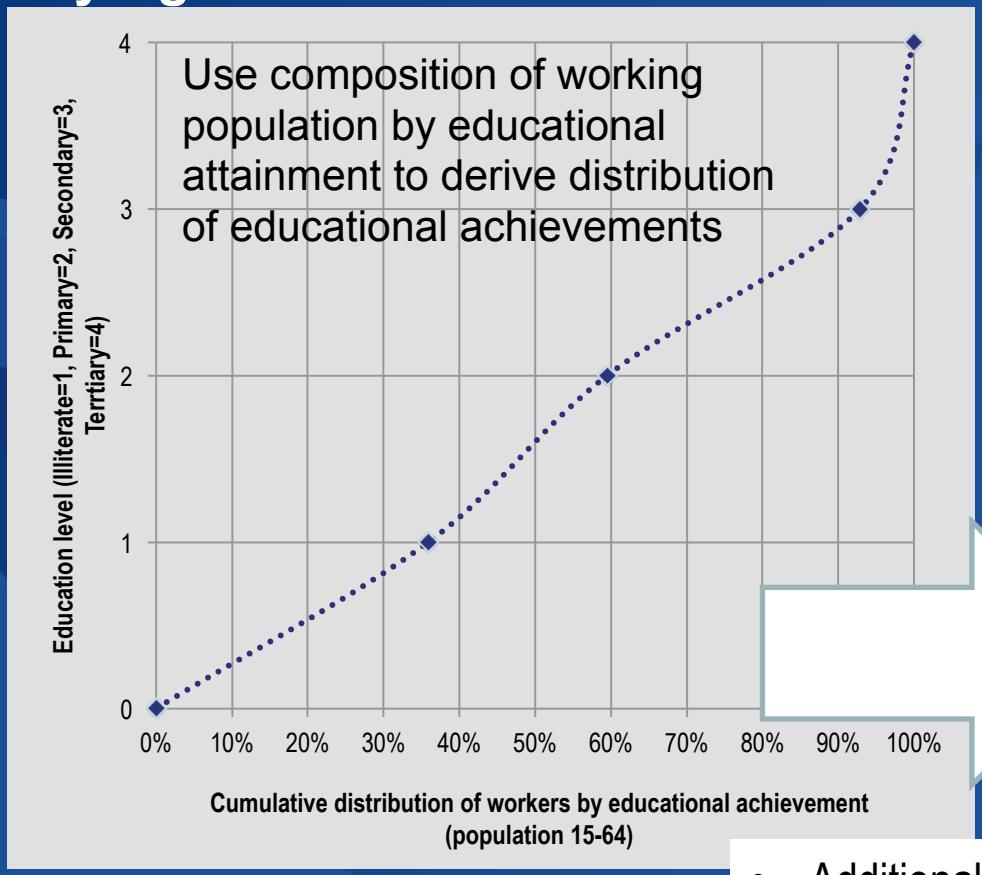
- Scenario-building based on estimated elasticities using econometric evidence
- Econometric model: Gini as a function of
  - Educational attainment, income (Kuznets curve), income growth
  - Policy variables: Taxes, government expenditure, …
  - Trade variables: Economic theory based (Stolper-Samuelson)
- Advantages:
  - Direct linkage to SSP projections for population and GDP
  - Empirically sound elasticities
  - Flexibility to link policy (and eventually trade) scenarios to SSPs
- Disadvantages:
  - Econometric evidence based mostly on highly developed economies
  - Data inputs required for projecting trade largely unknown
  - Limited distributional flexibility (as compared to modeling deciles, for instance)

2. Parametric Approach

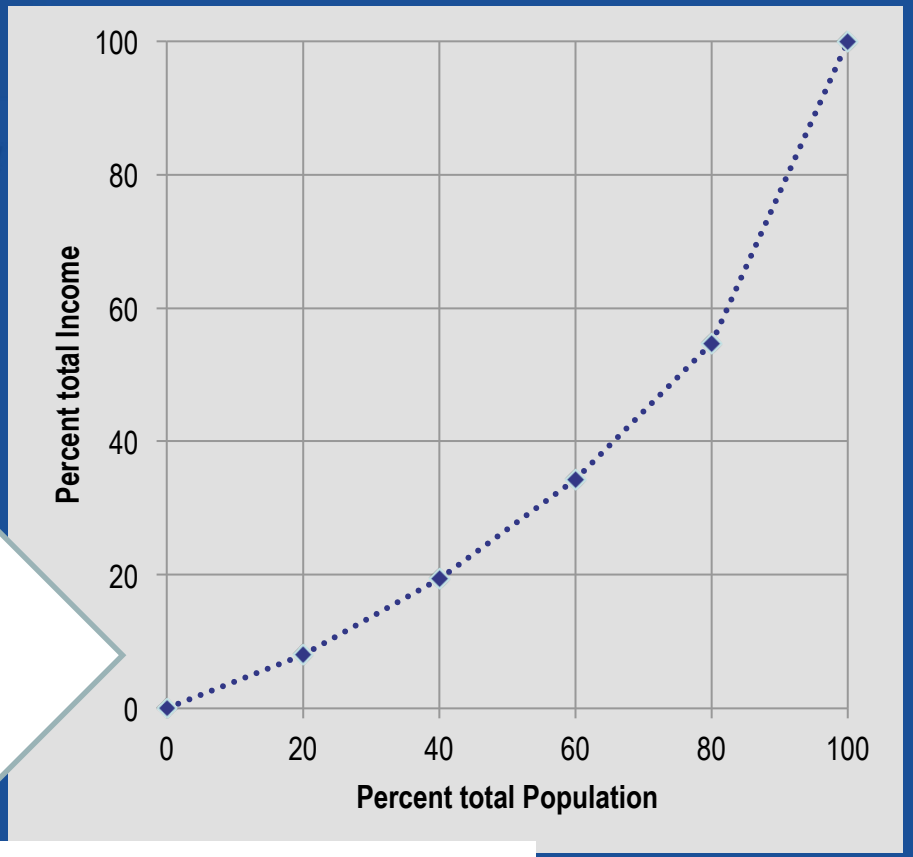
- Use population distributions by age and education, along with additional information on capital distribution and social policy, over time to parameterize income distributions
- Advantages:
  - Direct linkage to SSP projections for population and GDP
  - Computationally simple and transparent
  - Potential to fit distributions with long tails or bimodal
  - Education is one important determinant of income and educational inequality is positively associated with Gini coefficient of income inequality
- Disadvantages:
  - Largely able to capture distribution of labor income but additional information needed to capture non-wage and capital or asset income distribution
  - Differences in labor force participation and returns across economic sectors may not be sufficiently captured

2. Illustration - Parametric Approach – India 2005

INPUTS - Population Distribution by Age and Education



OUTPUTS - Income Distribution



- Additional parameters being considered (e.g., social policy, capital)
- Functional form required