PSIA for transport investment using market accessibility and poverty

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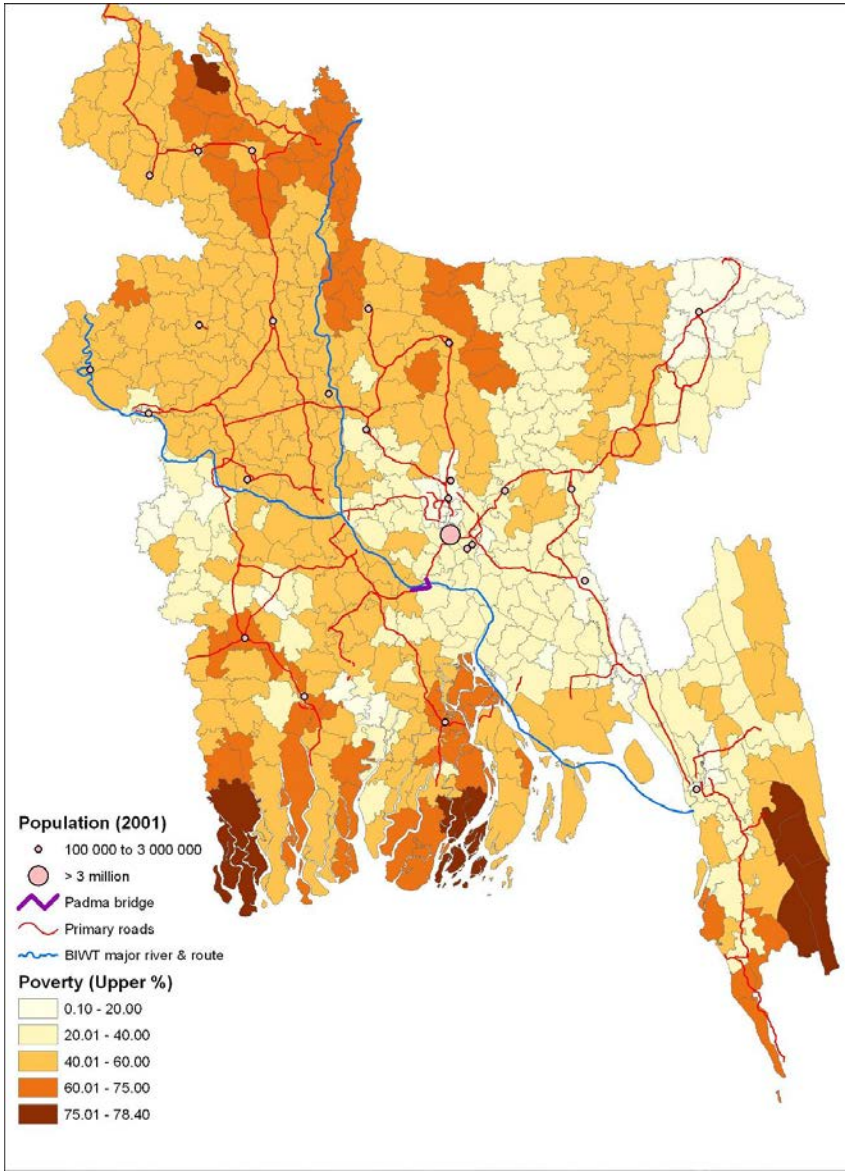
Geography and Poverty Map of Bangladesh



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East-West Division in Bangladesh

- Large river separate the country's economy between the east (poorer areas) and the west (richer areas)
- Building a bridge to connect the east with the west likely have a big economic impact on both sides
- It is often very costly to build a big bridge
- PSIA will be very useful before investing a huge resource

Our approach

Three step approach to measure the poverty and distributional impact of large infrastructure investment

1. Measure the impact of infrastructure investment on market accessibility
2. Estimate the relationship between the market accessibility and poverty
3. Project poverty reduction via infrastructure using the above

Market accessibility (potential) index

- Market accessibility (potential) index is a measure to see how far a village/town is from big cities
- This measure uses the population size of a city as a proxy of market size
- This measure discounts the market size proxy by travel time

A little more details

The simplest formula of the market accessibility (potential) index is:

$$I_i = \sum_j \frac{S_j}{T_{ij}^{\alpha}}$$

S_j is a size indicator at target j (e.g., population of large cities/towns);

T_{ij}^{α} is the distance (or travel time) between origin and target

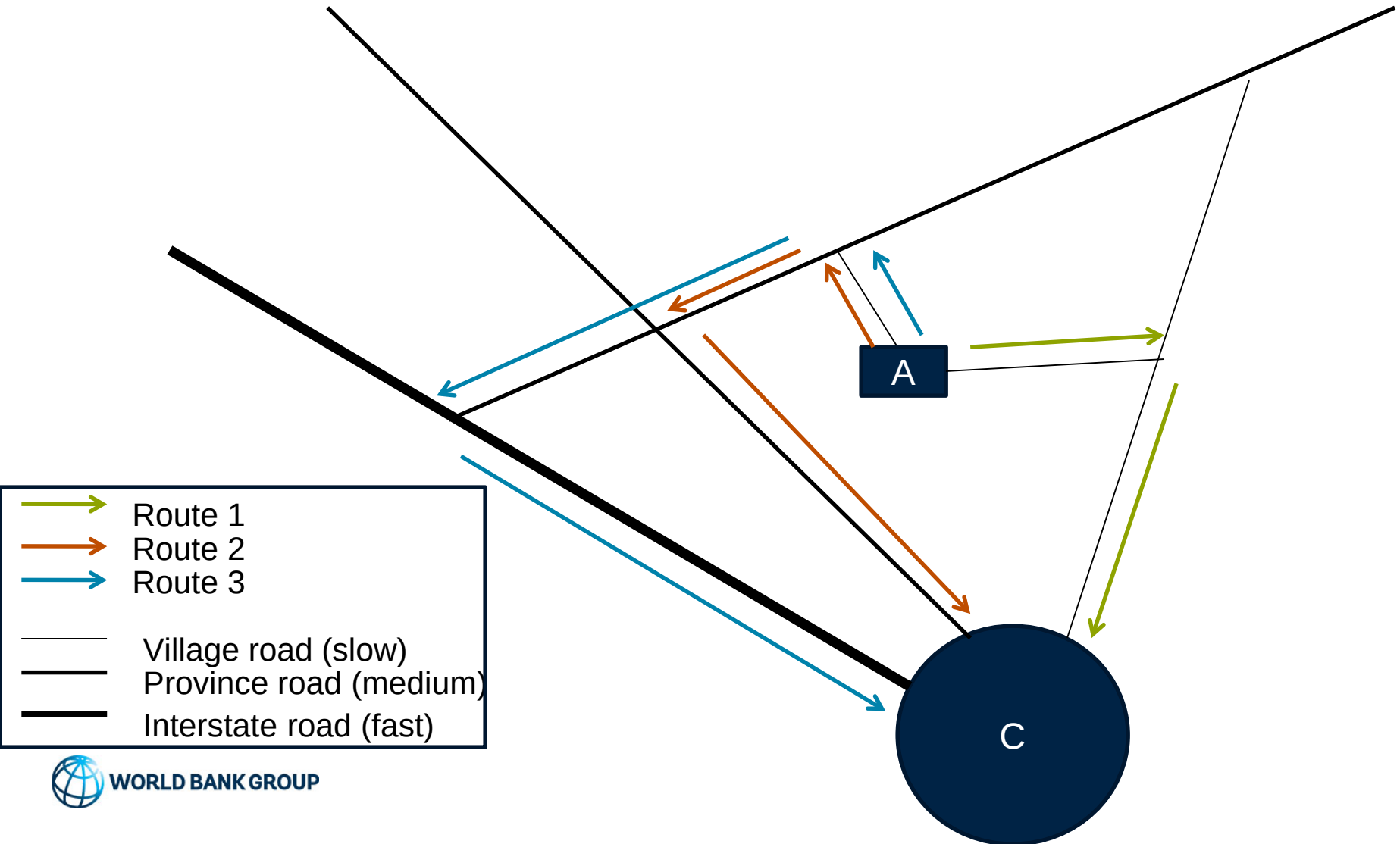
As α becomes larger, the influence of market sizes in distant areas declines

Need to select target cities, populations and travel time estimates

Estimating travel time

- GIS data and technology play an important role here
- GIS software does the following:
  - Locates all target cities
  - Assess all possible routes between each target city and the origin
  - Search for a route with the shortest travel time for each target city, taking into account road conditions
- This task becomes extremely complex quickly as we increase the number of origins and target cities

An example: Three roots to go from A to C – Which is quickest?



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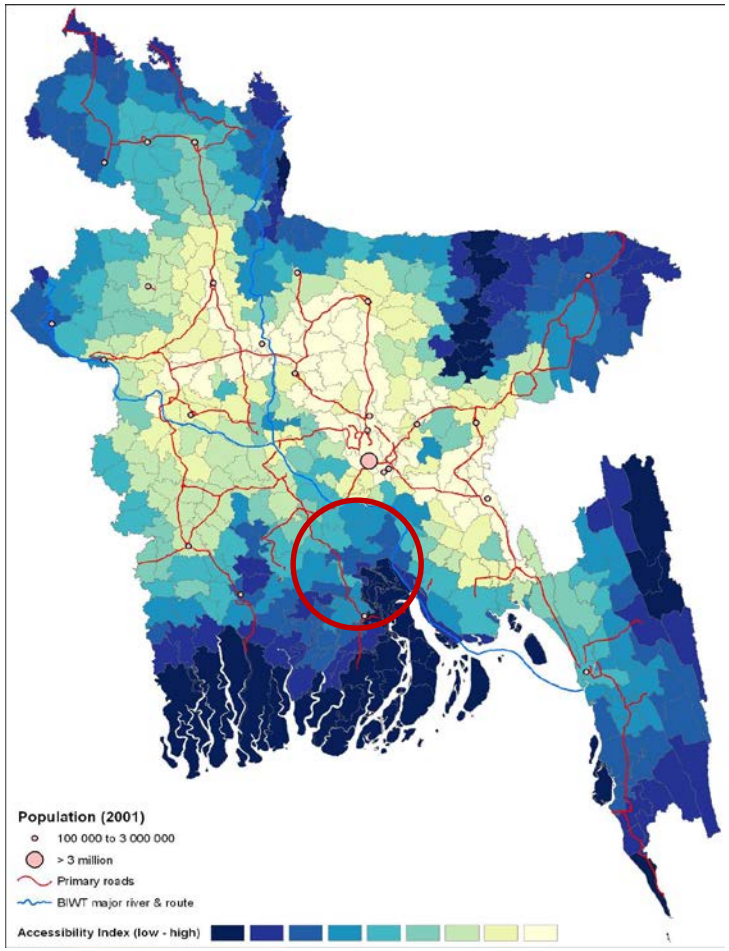
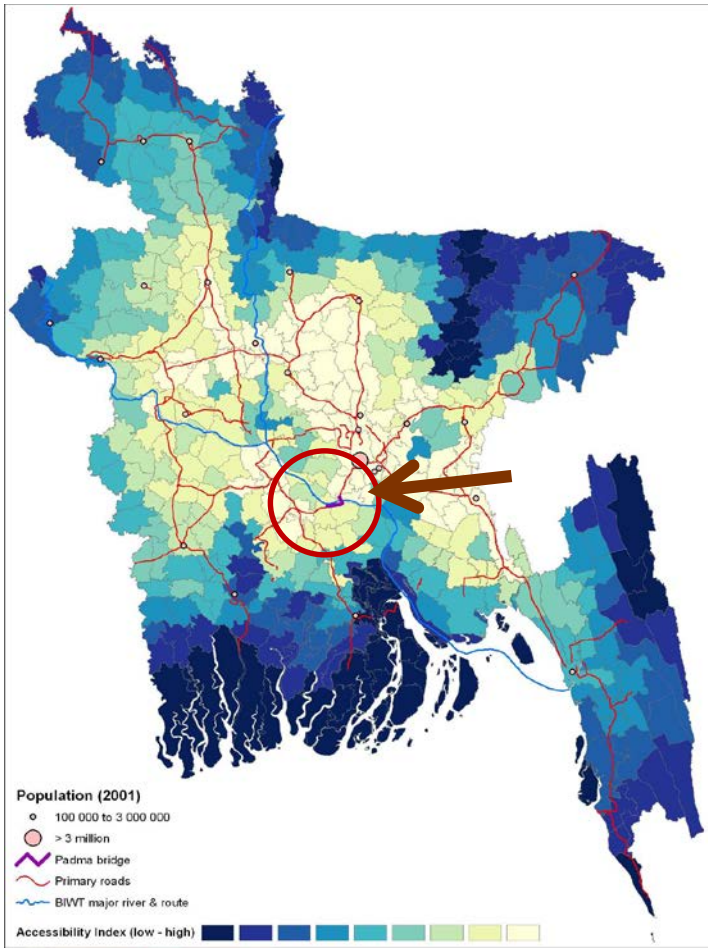
Padma Bridge Effect on Market Accessibility



Pre-Padma bridge



Post-Padma bridge

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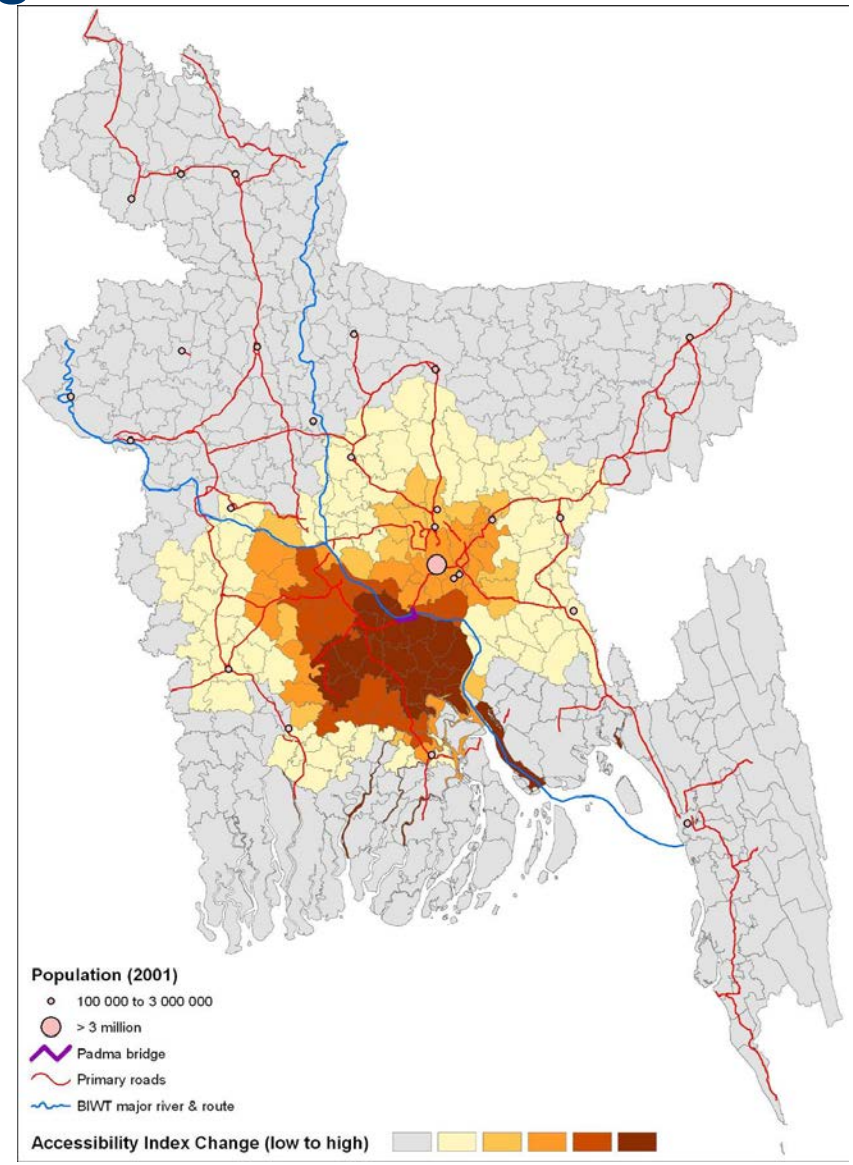
Changes in Market Accessibility Index due to Padma Bridge



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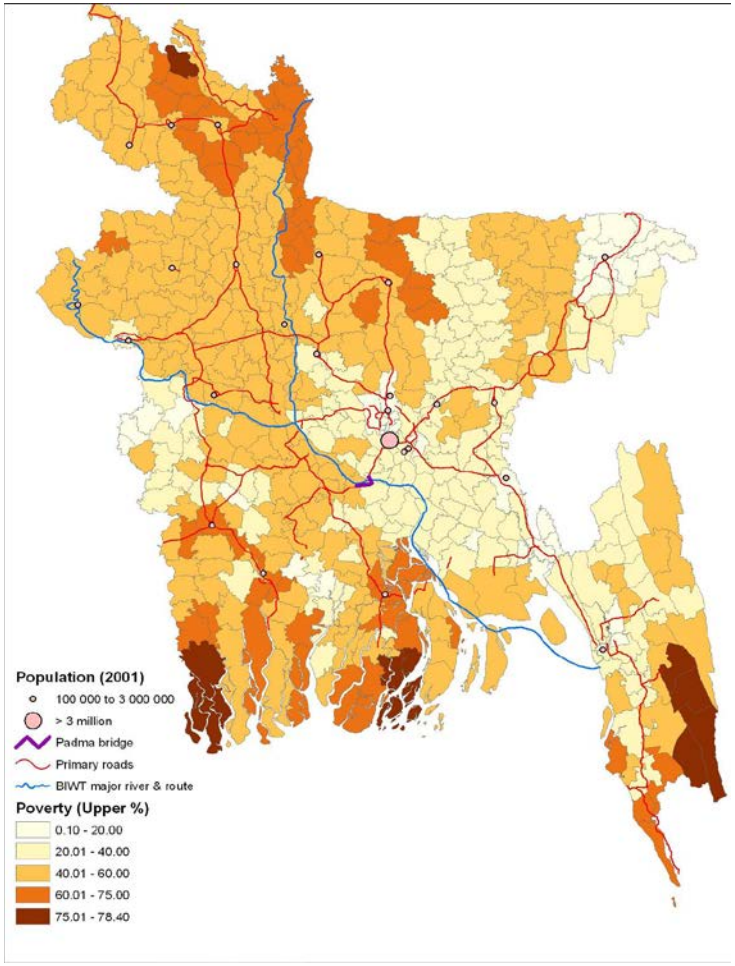
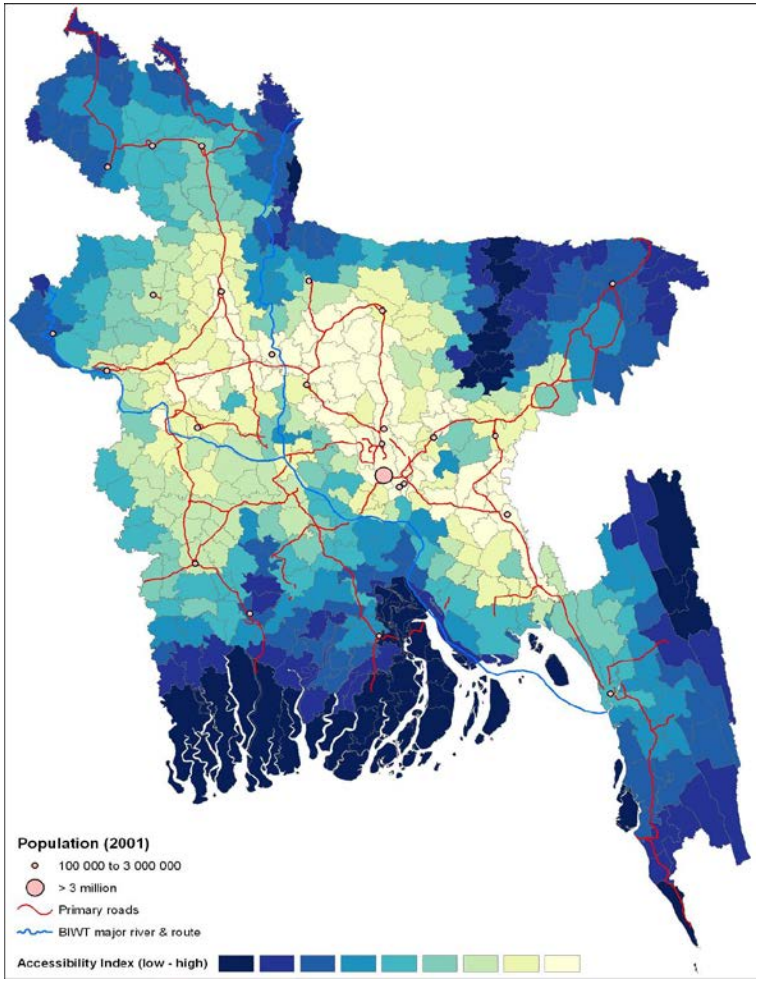
Poverty and Market Accessibility



Poverty map



Market accessibility map

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Develop an estimation model

- We estimate the relationship between poverty and market accessibility using a spatial regression

$$H_t^i = f\left(M_{t-1}^i, X_{t-1}^i, Z^i\right) + \varepsilon_t^i$$

M_{t-1}^i	Market accessibility index (lagged)
X_{t-1}^i	Other statistics at region i (lagged)
Z^i	Regional fixed effects
ε_t^i	Residuals

Estimate the impact of Padma Bridge on poverty reduction

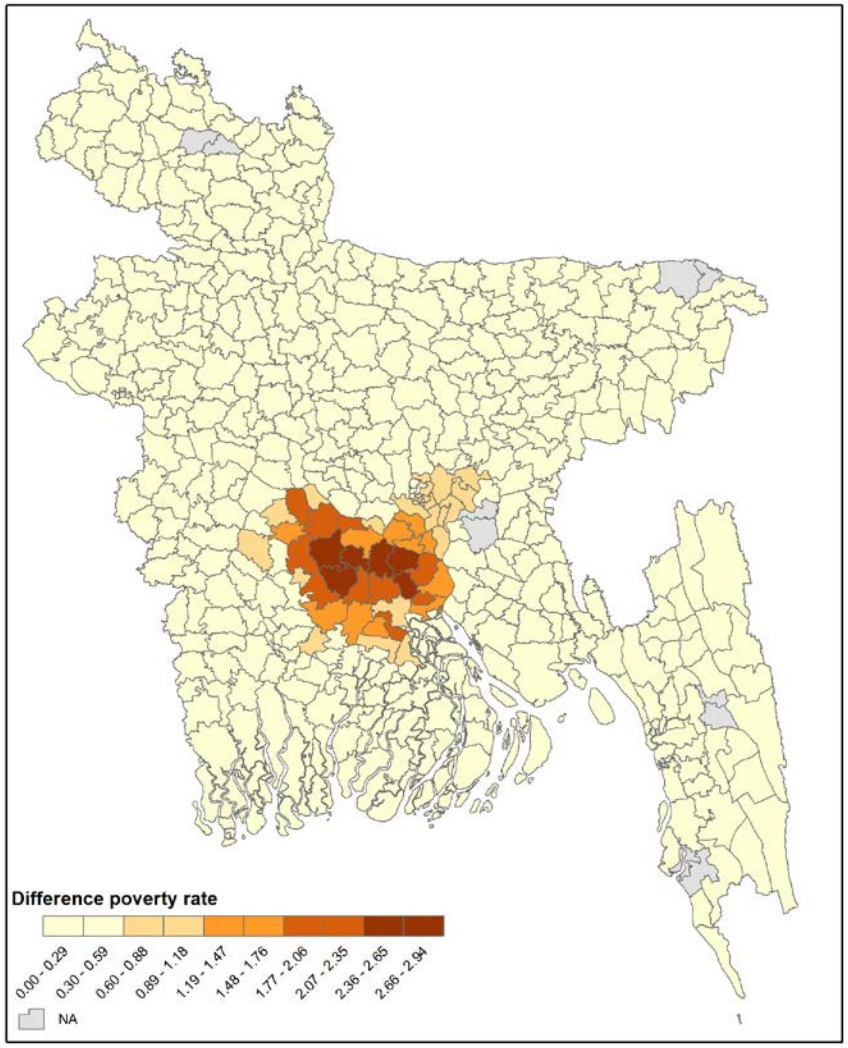
- Simulate the effects of changes in market accessibility due to infrastructure investment on poverty

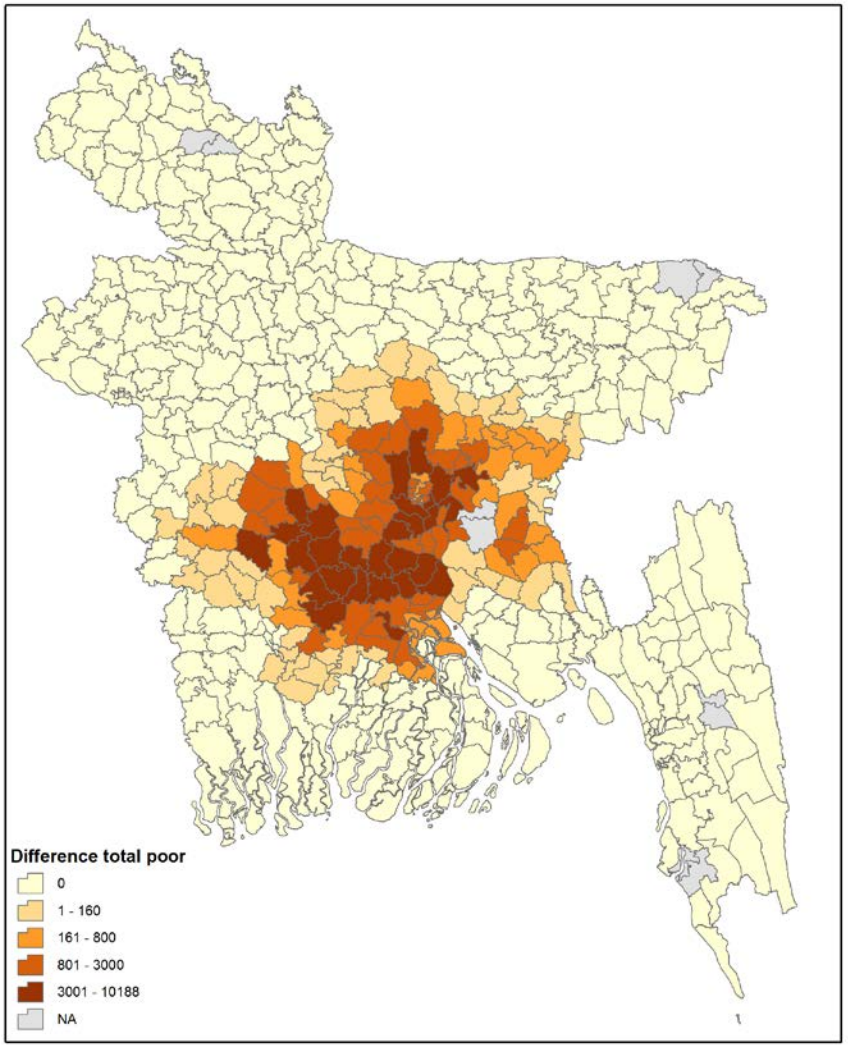
$$\Delta H_t^i = \hat{f}\left(M_{t-1}^{i*}, X_{t-1}^i, Z^i\right) - \hat{f}\left(M_{t-1}^{i0}, X_{t-1}^i, Z^i\right)$$

M_{t-1}^{i0}: Market accessibility (pre investment)

M_{t-1}^{i*}: Market accessibility (post investment)

Results on Poverty Headcount Rate (%) and Poor Population





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Data Needs

- Poverty maps (preferably multiple rounds)
- Road network (preferably, lagged and multiple rounds)
- Other spatial data (Remote sensing; Census aggregates)
- Boundary maps

Thank you!

If you have any question, please let me know at nyoshida@worldbank.org

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