Adjustment for Sub-National Prices: A Spatial and Small Area Approach to Adjust for Subnational Cost of Living

The World Bank
The Poverty and Equity Global Practice
Global Solutions Group on Welfare Measurement and Statistical Capacity

João Pedro Wagner De Azevedo
Paul Andres Corral Rodas
Context

• The WB and EU Commission, in conjunction with statistical agencies of EU member states, recently produced maps that estimate poverty rates for small geographic areas within EU countries.

• These do not account for sub-national differences in costs of living
Adjusting income for costs of living – Why?

• For a given budget, households choose to consume goods with the goal of achieving a maximum utility

• A poverty line may be defined as the minimum level of welfare required to no longer be considered poor (Ravallion et al., 2003)

• During a given year the AROP threshold within an EU member state is the same across the land, whether a family lives in the capital or in a rural area

• Empirical evidence supports the notion that cost of living varies by geography

• Considering spatial variations in the cost of living which could lead to considerably different outcomes for budget allocation
Adjusting income for costs of living – How?

Example done using Romanian data

- Three distinct datasets are used to test different approaches towards geographical differences in the cost of living (SILC, HBS, Census)
  - HBS for food prices
  - SILC for income and poverty
  - Census to complement SILC for small area estimates
A price index is a useful way to separate real income/consumption from nominal income/consumption to allow for welfare comparisons.

A Paasche index prices the household’s consumed bundle using fixed prices and yields a constant price total (Deaton and Zaidi, 2002)

\[ P_p = \left( \sum_{k=1}^{K} w_{hk} \frac{p_{0k}}{p_{hk}} \right)^{-1} \]
Adjusting income for costs of living (Food) – How?

County level Paasche used to spatially impute Paasche value for all municipalities

- Municipalities with observed Paasche
Adjusting income for costs of living (Food) – How?

• County’s index is assigned to most populous municipality
• For all municipalities missing a spatially weighted average of all other non-missing values is used
• Akin to K-Nearest-Neighbor approaches
• Has various assumptions:
  • Transportation cost is what is driving the spatial differential in prices
  • Cost of travel between towns is uniform and depends solely on a linear distance
Adjusting income for costs of living (Food) – How?

Municipal level imputed Paasche

- Imputed Paasche for each municipality in Romania
Adjusting income for costs of living (Rent) – How?

Hedonic approach using rental data

- Used to account for housing price differences across space
- For the LAUs with rent data in the SILC, we regress rent against LAU characteristics
- Obtain small area estimates of rental value: simulate rental value for each municipality in Romania
- Using the estimated rental value for each Census household, we calculate the average rental value for every LAU
Adjusting income for costs of living (Rent) – How?

Hedonic approach using rental data

- Simulated rent index for municipalities of Romania
Validating the Indexes

Getis-Ord to test for clustering of rental index

• The spatial pattern is reminiscent of the Paasche index: an expensive central band extending toward Bucharest and cheaper areas to the north and south.
Validating the Indexes

Paasche food index

- The spatial pattern is similar to the hot-cold spots of the rent index
Validating the Indexes

Test relationship between LAU level deflators and Income (LAU level income from small area estimates)
Validating the Indexes

Test relationship between LAU level deflators and Income (LAU level income from small area estimates)
Conclusions and future work

• Still have to test how the spatial patterns of poverty and inequality are affected
  • In the context of poverty mapping in the EU, current results suggest that there are considerable differences in local costs of living and thus in welfare
  • Ignoring these could not only lead to potential misallocation of funds, but also severely change the picture of where the majority of the poorest of the poor in the EU reside
• Test for more countries
  • Latvia, and Bulgaria are in the pipeline