A Stata 17 implementation of the local autonomy ratio: Calling Python

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SUMMARY

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Introduction: The Local Autonomy Ratio

- Countries whose public sector is decentralized: +Efficiency in public services
- Level of decentralization approximated through the **Local Income Ratio**
  - **but** it has been proven that this covariate is **endogenous**
  - **and** due to the **unobservable heterogeneity**

Introduction: The Local Autonomy Ratio

- In **Chile**, the participation of the **Municipal Compensation Fund (FCM)**, in the total revenues of the municipality, is the best **indicator of decentralization (**Letelier and Sáez-Lozano, 2020)

- In 2011, Martínez-Vazquez, Vulovic, and Liu paper:
  - an **instrument variable (**V_{st}**)** shall be used to test the robustness of the empirical model
  - to control for **possible measurement errors** of the FCM
  - and detect **endogeneity biases**

Introduction: The Local Autonomy Ratio

- Martínez-Vázquez et al. (2011) and Sanogo (2019) define the **instrumental variable** of municipality *s* in year *t*, V_{st}:

- $$V_{st} = \frac{1}{\sum_{m-1}^{M} \frac{1}{d_m}} \sum_{m-1}^{M} \frac{1}{d_m} FCM_{mt}\ ,\ s \neq m\ |\ d_m \leq \bar{d}$$

- where, d_m is distance between municipality *s* and *m*; FCM_{mt} is FCM of the municipality *m* in year *t; M* is the total number of municipalities; $\boldsymbol{d_m}$ is the distance between municipality *m* and the other municipalities in the country; $\bar{d}$ is the threshold distance.

Introduction: The Local Autonomy Ratio

- Letelier and Sáez (2020) **modified $\boldsymbol{V_{st}}$** to apply it to Chile, including, also to the "distance" restriction, the population size limit:

$$V_{st} = \frac{1}{\sum_{m-1}^{M} \frac{1}{d_m}} \sum_{m-1}^{M} \frac{1}{d_m} FCM_{mt\,,\ s \neq m \mid d_m \leq \bar{d} \ and \ Pob_{st} \geq \overline{Pob}} \qquad (2)$$

  - where, Pob_{st} is the population of municipality *s* in period *t;* and $\overline{Pob}$ is the threshold population.

SUMMARY

Why python?

- To compute the instrumental variable "v" for the **Improved Local Autonomy Ratio** we face:
  1. Large dataset (a matrix with distances between every single pair of municipalities in a given country)
     a) *e.g.: In Chile there are 343 municipalities, we have to deal with a 343x343 matrix*
  2. Necessity to update the dataset (Possibility to use API's for data scrapping)
  3. Apply different restrictions
     a) minimum distance between towns
     b) or a minimum population per town

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Why python?

4. Automatize its calculation to facilitate its application

a) Allow non-python users to take advantage of Stata's power

b) Attract python users to use the best Stata features vs python (Econometrics)

5. Explore Stata 17's newest python features
   a) SFI library
   b) Pystata (writing Stata code in Jupyter Lab)
   c) ...

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The code: Calculating the Improved Local Autonomy Ratio (Vst)

- The structure:

1. Python: read the data (Excel, stata,...)
2. Python: apply restrictions, calculated V for each municipality.
3. Stata: Use the SFI module to load data back into Stata's Data Editor
4. Stata: apply econometrics models to reveal possible correlations

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APPLICATIONS

- The **instrumental variable V_{st}** is a **covariate of the happiness model** that Letelier and Saez-Lozano (2020) estimated for the case of Chile, in the years 2011 and 2013.

- Since happiness is a latent variable, the **level of satisfaction** with individual life, as a **proxy** variable for happiness. The authors specified a multilevel model, in which one of the covariates was V_{st}.

- They used the Newton-Raphson algorithm to maximize the likelihood function, which is done according to the adaptive quadrature procedure proposed by Rabe-Hesketh et. to the. (2005). The main conclusion that this research provides **evidence in support of the hypothesis that decentralization (V_{st}) increases the level of happiness of the Chilean population.**

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Thanks for your attention!

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