Unit Averaging for Heterogeneous Panels

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Problem: Estimation of Individual Parameter and Using Panel Data

- Object of interest: parameter θ in a potentially nonlinear model (can be anything). For example – quarterly GDP nowcast for Spain.
- We have a panel of time series, but every unit has its own θ_i. Example: cross-country heterogeneity (Marcellino et al. 2003)

How to estimate θ with minimal MSE? Answer depends on time series length T:

- T large $\Rightarrow$ just use data on unit of interest
- If T is not large, individual estimator is not very precise. In this case hope to use panel information to reduce estimation uncertainty without incurring too much bias. Interesting case: moderate T – when potential bias and variance are of the same magnitude $\leftarrow$ our paper.

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Our Solution: Unit Averaging With MSE-Minimizing Weights

Our estimator for parameter of interest θ for the fixed unit of interest.: a compromise unit averaging estimator:

$$\hat{\theta}(\boldsymbol{w}) = \sum_{i=1}^{N} w_i \hat{\theta}_i, \quad w_i \geq 0, \sum_{i=1}^{N} w_i = 1.$$

where $\hat{\theta}_i$ is the individual estimator of unit i, $i = 1, \ldots, N$.

How to pick weights to minimize MSE? Try to target the unit of interest

- We derive an approximation to the MSE of $\hat{\theta}(\boldsymbol{w})$ for θ for moderate T
- For T moderate MSE cannot be estimated consistently... (individual heterogeneity can be estimated only from individual time series, which are not long)
- ...But we give a "nice" estimator
- Feasible weights are obtained by minimizing estimated MSE

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Our Results: Theory and Application

Theoretical results: in a moderate-T/local heterogeneity regime:

- Formal justification of the MSE approximation
- Asymptotic distribution of averaging estimator and feasible weights
- Analysis depending on behavior of N: fixed-N and large-N approximations

Application: does unit averaging work in simulations and in practice? Yes! We do nowcasting quarterly GDP for Eurozone members.

- Unit averaging AIC weights on average 5% better than individual estimation.
- Our MSE-optimal weights on average 9% better.
- Equal weights – average 50% worse

Unit averaging with smooth weights leads to improvements.

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