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Purging Heterogeneity from Technical inefficiency Estimation in a Stochastic Frontier Models

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Background

- Technical inefficiency measure based on traditional fixed and random effect stochastic frontier models fail to distinguish between individual heterogeneity unrelated to inefficiency and the inefficiency itself

Objective

Fit an alternative 'true' fixed and 'true' random-effects models that incorporate unobserved heterogeneity on estimates of technical inefficiency that avoid biased efficiency estimates

Methodology

- Panel stochastic frontier models:

Traditional

- Fixed effect: Schmidt-Sickles [SC84]
- Random effect: Pitt-Lee 1981 [PL81]
- Battese and Coelli 1995 [BC95]

Green's (2005)

- "True" fixed effect (TFE)
- "True" random effect (TRE)

Time varying Model

$$Y_{it} = \alpha_0 + \beta'X_{it} + V_{it} - U_{it}$$

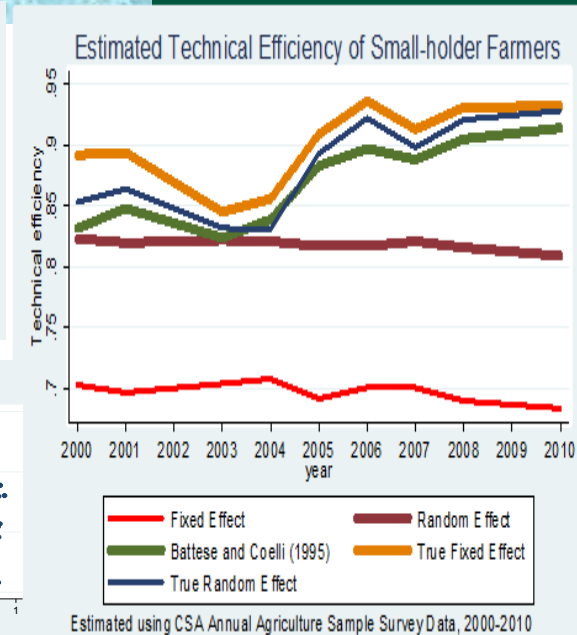
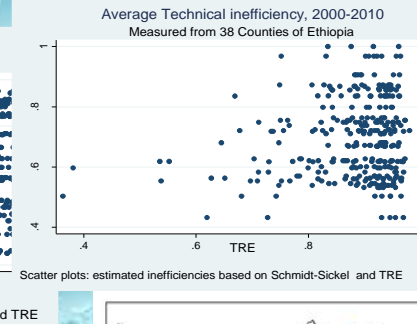
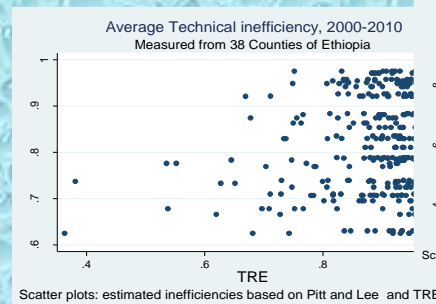
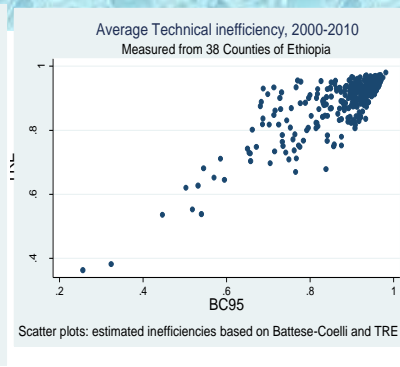
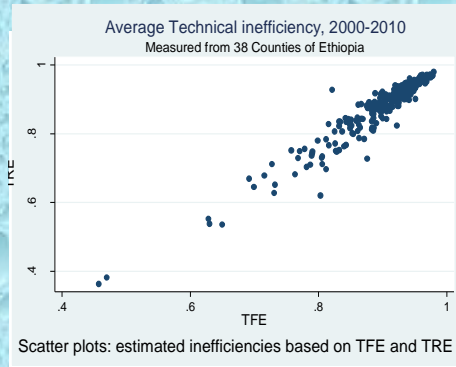
$$E[U_{it}] = \delta_{it} + h_{it}\delta$$

Time varying inefficiency distribution

Y: log of: cereal yield, Kg ha⁻¹yr⁻¹

X: log of: Labor, animal power, Fertilizer & Improved seed (Kg ha⁻¹)

h_{it}=measured-heterogeneity: [Evapotranspiration-Anomaly(ETA)

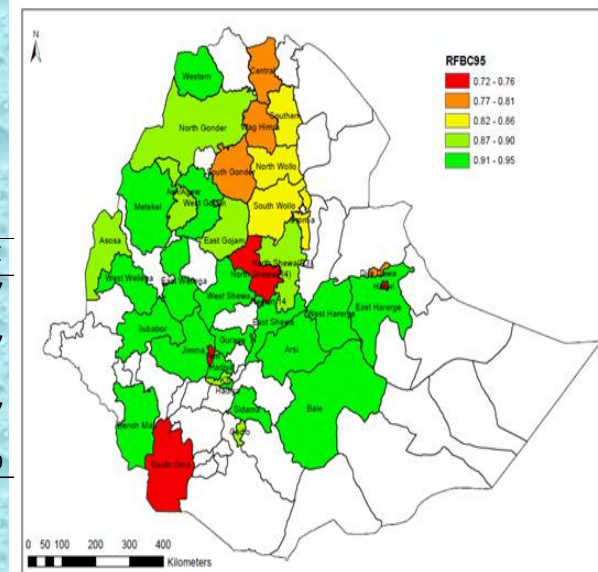


Data

- annual agriculture sample survey from the Ethiopian central statistics agency in a year 2000 to 2010
- 38 zone/counties of Ethiopia

Distribution	SS84	PL81	Bc95	TFE	TRE
σ_u , inefficiency	0.20	0.28*** (5.24)	1.73 (0.46)	0.14	0.17
σ_v , of error	0.13	0.13*** (16.04)	0.10*** (5.92)	0.08*** (5.65)	0.07
$\eta = \sigma_u / \sigma_v$	1.48	2.12*** (39.12)	17.78** (4.76)	1.71	2.47
σ	1.27	1.50	4.23	1.34	1.59

- the larger the asymmetry (η) parameter, greater is the inefficiency component in the model



Conclusion

The implicit assumption that the inefficiency is constant over the years and inability of distinguishing unobserved heterogeneity from inefficiency made the 'traditional' random and fixed stochastic frontier models a poor candidate to choose