The Panel Stochastic Frontier Model with Firm Heterogeneity and Dynamic Technical Inefficiency

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1.What is the question?

This paper develop a panel stochastic frontier (DF) model in order to capture the dynamic adjustment of the heteroscedastic inefficiency and use the pairwise composite -likelihood (PCL) to estimate the model.In the meantime,we conduct some Monte Carlo experiments to examine the finite sample performance of the PCL estimator and also investigate how much of the estimation efficiency we lose due to adopting the PCL instead of full likelihood(FML).

2.Why should we care about this question?

In most of the panel stochastic frontier models,the main concern focuses on the temporal behavior of technical inefficiency and the inefficiency term is usually assumed to be independent across time.This results in the failure of capturing dynamic adjustment process.Therefore,we should incorporate the dynamic structure in the technical inefficient as well as fims'heterogeneity and then find a better estimation method to estimate it.

3.What is the answer?

After conducting the Monte Carlo experiments,we find that the PCL estimation is not necessarily less efficient than the FML estimation.On the contrary,the finite sample performance of the PCL estimator is quite good in the Monte Carlo experiments.In addition,we demonstrate this approach using a cross-country panel data taken from the World Development Indicator database 2008.This empirical finding also shows the importance to incorporate the dynamics of inefficiency into the model when conducting empirical analysis using panel data.It seems that the issue of loss estimation efficiency when using the PCL estimation instead of the FML estimation is not a serious problem.

4.How did you get there?

The mainly part to analyse the problem is to use the panel SF model with dynamic technical inefficiency that follows a first-order autoregressive(AR(1)) process and propose to estimate the model by a likelihood -based approach.After obtaining the ML or PCL estimator for the parameters,we can predict the technical efficiency(TE) index and inefficiency.Then,we conduct some Monte Carlo experiments to test whether the PCL ectimation is less efficient or not.Finally,we implement this method on empirical data and find PCL estimation is an easy way to estimate the dynamic SF model.

符號表

y_{it}	log output
x_{it}	kX1 log input vector
g_t	time-varying component of technology
v_{it}	the symmetric stochastic error
u_{it}	the one-sided stochastic technical inefficiency
ρ	the AR coefficient
u_{it}^*	a nonnegative noise
$\phi_T(\cdot;\eta,\Xi)$	pdf of a T-dimensional normal distribution with mean η and variance matrixΞ
$\Phi_T(\cdot;\eta,\Xi)$	cdf of a T-dimensional normal distribution with mean η and variance matrixΞ
I_T	a $T \times T$ identity matrix
O_T	a $T \times 1$ vector of zeros
d	the dimension of θ
$\hat{\varepsilon}_{i.}$	the predicted residual vector of the transformed model
Ω_t	the information set available at time t
$\underline{\varepsilon}_{it}$	a 2×1 vector of the composite errors from consecutive periods