Estimation of Dynamic Panel Data Models using Particle Filters

Wen Xu*
Department of Economics & Oxford-Man Institute
University of Oxford

Preliminary, Comments Welcome

June 14, 2014

Abstract

In this paper we study dynamic panel data models with stochastic volatility in a macroeconomic context. The models are represented in state space forms and estimated using particle filter techniques in both a frequentist framework (maximization of approximate simulated-likelihood) and in a Bayesian framework (particle Metropolis-Hastings sampler). A two-step LSDV-QML estimator is also proposed. Ignoring the existence of stochastic volatility might induce systematically false rejection in panel unit root tests. Monte Carlo studies show that particle-filter based estimators are more precise than other estimators on average in finite samples in the presence of stochastic volatility and even in the case of homoscedasticity especially when T is large. Our methodology is straightforwardly applied to panel VAR models.

Keywords: Dynamic Panel Data Models, Stochastic Volatility, Particle Filters, State Space Modeling, Least Squares Dummy Variable, Quasi-Maximum Likelihood, Panel Unit Root Tests

1 Introduction

It has been well documented that there is time-varying volatility in macroeconomic time series data. Many studies focused on the moderated volatility in the growth rate of U.S. real GDP. For example, Kim and Nelson (1999) and McConnell and Perez-Quiros (2000) independently identified a structural decline in the volatility in the first quarter of 1984. Blanchard and Simon (2001) argued however that the substantial reduction in volatility commenced

*This version is preliminary. Email: wen.xu@economics.ox.ac.uk. We thank Neil Shephard, Kevin Sheppard and Arnaud Doucet for helpful advice.