Asymptotic Efficiency of Estimates for Panel Data Models with Fixed Effects Abstract

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Abstract

When we consider estimation, efficiency is an important issue. However, there have not been many studies on the asymptotic efficiency in panel data models when both the cross-sectional sample size (N) and the length of the time series (T) tend to infinity.

The objective of the present thesis is to establish asymptotic optimality theory of estimation that is applicable to a wide range of panel data models when both N and T tend to infinity.

We consider general panel data models with individual and/or time effects and derive the information bounds for those models. Furthermore, to illustrate the usefulness of our bounds, we apply the efficiency results to specific models to assess the efficiency of various estimators existing in the literature.

In Capter 2, we explore the asymptotic efficiency in static nonlinear panel data models with individual effects. We consider a general semiparametric model where the law of the panel data is characterized by a finite-dimension a parameter of interest, individual specific effects and an unknown nuisance function. The specification of this chapter is general enough to include many important nonlinear panel data models as special cases. Panel binary choice and censored regression models are a few of the examples. In this general setting, the chapter contributes to the panel data literature by providing a general formula of the information bound for the model parameters. As an application, we consider the setting of Hahn and Newey (2004) and show that their bias-corrected fixed effect estimators are asymptotically efficient.

In Chapter 3, we extend the efficiency results presented in Chapter 2 to models with interactive effects (or a factor structure). Models with interactive effects are found to be useful in econometric applications because they provide a flexible and tractable way to model unobserved heterogeneous impacts of common macro shocks.By arguments similar to Chapter 2, we derive the efficiency bounds for models with interactive effects. We apply the efficiency results to a linear model considered in Bai (2009) and show that Bai's bias-corrected fixed effects estimator is asymptotically efficient.

In Chapter 4, we investigate the asymptotic efficiency in dynamic error-component models with a factor structure. We assume that the idiosyncratic error is Gaussian stationary and independently and identically distributed across individuals. We also assume that the dynamics of the error terms can be characterized by a finite dimensional parameter, which we call a common parameter. This specification is

general enough to include many important dynamic panel data models. For example, panel autoregressive models can be treated in our general framework. Our setting can also be regarded as a factor model, which is frequently used to analyze macro economic variables. In factor analysis, the values of factors are of interest, while in dynamic panel data analysis, the common parameters are of interest. In this chapter, we derive the efficiency bounds for factors, factor loadings and common parameters and apply the results to various situations to assess the efficiency of estimators existing in the literature. In particular, our efficiency results indicate that the principal component analysis (PCA) estimator of factors, which is arguably the most popular estimator in factor models, is efficient.