Part I

Econometric Analysis of Cross-Sectional Dependence Models

Chapter 1

Cross-Sectional Dependence

Humans are social animals (Aristotle).

1.1 Social interaction

We cannot live alone away from other people. Our behavior is inevitably affected by those around us and the social groups we belong to, and vice versa. This interaction with others is called **social interaction**. Thus, in order to precisely understand the nature of human behavior, such feature, i.e. social interaction, should not (or often cannot) be overlooked.

In the literature of econometrics, there is a long history in modeling the dependence structure of time series data – the interactions between the past and present. Estimation of econometric models with social interactions (i.e., "cross-sectional" interactions) is a relatively young research theme (as compared to time series literature), and now growing attention has been devoted to this field.

In an early seminal paper, [**?**] considered a linear social interaction model, which is called a **linear-in-means model**, and distinguished three types of effects among the social interaction effects: an individual's outcome can be affected by the average outcome in the group to which he/she belongs (**endogenous effects**), by the average individual characteristics in the group (**contextual effects**), and by the common environment of the group (**correlated effects**).

For example, consider a student's academic achievement as the dependent variable of interest, say, Y. Let X be a determinant of academic achievement, such as whether or not belonging to an academic club. Further, denote e as the quality of class teacher. There is an endogenous effect if individual achievement Y tends to vary with the mean achievement $\overline{Y}$ of the students in the same school, class room, or other reference groups ($\overline{Y} \to Y$). Similarly, there is a contextual effect if achievement Y tends to vary with $\overline{X}$, where $\overline{X}$ is, for example, the ratio of students belonging to academic clubs ($\overline{X} \to Y$). There are correlated effects if the students in the same class tend to achieve similarly because they are taught by the same teacher ($e \to Y$).