

Semi-nonparametric econometrics

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Semi-nonparametric (SNP) models are models for which the functional form is only partly parametrized and where the non-specified parts are one or more unknown functions. Using Hilbert space theory it can be shown that these unknown functions can be approximated arbitrarily close by parametric functions, but with an increasing number of parameters. Therefore, these models can be estimated as fully parametric models, except that the dimension of the parameter space increases with the sample size. This is called sieve estimation.

I will give two mini-courses in July 2009 on these topics at CAEN. Each mini-course consists of four lectures of two hours each. The first mini-course deals with the Hilbert space theoretical foundation of SNP modeling. In the second mini-course I will focus on SNP sieve estimation and its applications.

Hilbert space theory and its role in semi-nonparametric modeling

1. Examples of semi-nonparametric (SNP) models
 - 1.1 The SNP index model
 - 1.1 The SNP discrete choice model
 - 1.2 SNP mixed proportional hazard model
2. Hilbert spaces of functions
 - 2.1 Introduction to Hilbert spaces
 - 2.2 The Hilbert space $L^2(w)$ of square integrable functions with respect to a density $w(\cdot)$ on \mathbb{R} : $L^2(w) = \{f: \int f(x)^2 w(x) dx < \infty\}$.
 - 2.3 Orthonormal polynomials and the Hilbert spaces they span: Hermite polynomials, Legendre polynomials, and Chebyshev polynomials

- 2.4 Non-polynomial orthonormal sequences in $L^2(w)$: Fourier series and the cosine series.

Sieve estimation, with applications

1. Introduction to sieve estimation
2. Compact metric spaces of density and distribution functions
3. Sieve spaces of density and distribution functions
4. Asymptotic theory
 - 4.1 A uniform law of large numbers for random functions on compact metric spaces
 - 4.2 Consistency of sieve estimators
5. Applications to:
 - 5.1 SNP discrete choice model
 - 5.2 Mixed proportional hazard (MPH) models with interval censoring
 - 5.3 Mixed proportional hazard (MPH) models with right censoring
 - 5.4 SNP competing risk models

Course material

Bierens, H. J., 2008a, Semi-Nonparametric Interval Censored Mixed Proportional Hazard Models: Identification and Consistency Results, *Econometric Theory*, 24, 749-794.

Bierens, H. J., 2008b, Semi-Nonparametric Identification of the Right Censored Mixed Proportional Hazard Model, Lecture note (<http://econ.la.psu.edu/hbierens/IMPHM.PDF>).

Bierens, H.J., 2009a, Hilbert Space Theory and Its Applications in Econometrics, Lecture note (<http://econ.la.psu.edu/hbierens/HILBERTSPACE.PDF>).

Bierens, H.J., 2009b, Semi-Nonparametric Modeling and Estimation, Review paper (http://econ.la.psu.edu/~hbierens/SNP_REVIEW.PDF)

Bierens, H.J. & J. R. Carvalho, 2007, Semi-Nonparametric Competing Risks Analysis of Recidivism, *Journal of Applied Econometrics*, 22, 971-993.