The properties of alternative algorithms for estimating unobserved product characteristics in the Pure Characteristics Demand Model

Zoltán Makó, Júlia Salamon
Sapientia University
Faculty of Economic and Human Sciences, Miercurea Ciuc
Department of Economic Sciences

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Abstract

Our goal is to investigate the properties of alternative algorithms for estimating unobserved product characteristics in the Pure Characteristics Demand Model (henceforth PCD) elaborated by Berry and Pakes (2007). The unobserved product characteristics are the analog of the disturbances in the standard demand model. The estimation technique of unobserved product characteristics are similar as the techniques using in the demand model elaborated by Berry, Lensohn and Pakes (1995, henceforth BLP). The difference between them consists of definition of utility function and of calculation of market share. Under certain standard conditions of regularity, if the coefficient of deviation in the model BLP tends to zero, then we find the market shares of the model PCD. For this reason we can state, that the model PCD is the marginal case of the model BLP.

Reynaerts et al. (2012), Dubé et al (2012) and Song (2008) show that in the model BLP the inner-loop tolerance must be set at a level of 10-14 with a corresponding outer-loop tolerance of 10-6. Since the model PCD is a marginal model of BLP this property is true for model PCD too. To overcome this drawback in the model BLP, Reynaerts et al. (2012) suggest four alternative methods to determine the unobserved product characteristics by using the equivalence between nonlinear rootfinding and fixed-point iteration: the algorithm of Newton-Raphson, the algorithm of Quasi-Newton-Broyden, the spectral gradient algorithm and squared polynomial extrapolation algorithm.

In this lecture we present a study of the real convergence rate for the enumerated algorithms in the model PCD.