

A Quasi-Bayes Approach to Nonparametric Demand Estimation with Economic Constraints

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This paper offers a new estimation approach for balancing statistical flexibility and economic regularity in structural econometric models. We focus our analysis on nonparametric demand systems for differentiated goods where such trade-offs are especially salient. Our framework is based on a quasi-Bayes model that transforms a sieve-based estimator of the inverse demand function into a quasi-likelihood, and then uses priors to regularize and enforce economic constraints. The induced quasi-posterior is defined over a complex domain which poses challenges for off-the-shelf sampling methods. We implement novel sampling procedures that (i) repose the heavily constrained target as the limit of a sequence of softly constrained targets, and then (ii) utilize Sequential Monte Carlo algorithms to push and filter samples through this sequence. We evaluate the performance of our approach using both simulations and retail scanner data. We find that our proposed quasi-Bayes framework can more effectively enforce constraints relative to previous methods and, by doing so, improves finite sample performance. Finally, we introduce an accompanying Julia package (NPDemand.jl) to help make nonparametric demand estimation more feasible in applied work.

A full version of this paper can be found at <https://ssrn.com/abstract=5100826>.

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