Chapter 8

KUHN-TUCKER DEMAND SYSTEM APPROACHES TO NON-MARKET VALUATION

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Abstract In this chapter we summarize recent advances with Kuhn-Tucker demand system approaches to non-market valuation. Over the past five years, simulation-based estimation and welfare calculation strategies have been developed that enable the Kuhn-Tucker framework to address policy-relevant valuation questions in applications with many quality-differentiated goods. We review these modeling innovations in the context of three generic Kuhn-Tucker specifications that differ in terms of their ability to account for unobserved preference heterogeneity. For illustration, we apply the alternative specifications to Canadian moose hunting data and present parameter and welfare estimates. We conclude the chapter by suggesting important areas for future research within the Kuhn-Tucker framework.

Keywords: Kuhn-Tucker models, applied demand analysis, simulation-based estimation, welfare measurement.

1. Introduction

Policy recommendations arising from economic research often depend critically on the public's willingness to pay or willingness to accept for price and quality changes. To construct these welfare measures, analysts must often estimate coherent demand systems for the affected commodities. In microeconometric applications with numerous quality-differentiated goods, both demand system estimation and welfare calculation can be daunting in practice.

Environmental economists routinely confront these challenges when using outdoor recreation data to infer the non-market value of changes in site attributes and availability. In this chapter we provide an overview and synthesis of existing continuous demand system approaches to addressing these issues. Our discussion is couched in the context of recreation demand analysis and focused on so-called "Kuhn-Tucker" approaches, or continuous demand system models estimated within the primal framework.[1] Significant progress has been made with these models in recent years, and we emphasize throughout the critical role that simulation has played. We illustrate these advances with recreation data on Canadian moose hunting.

Frequently in recreation demand applications, the analyst has seasonal trip data for a sample of individuals and a relatively large number of recreational sites (10 or more), socio-demographic information, and site attributes. For a given individual, many sites are unvisited but some are visited more than once. To consistently derive welfare measures for price and attribute changes with such data, structural econometric models that behaviorally and statistically account for the mixture of corner solutions (unvisited sites) as well as interior solutions (sites with one or more trips) are required. Over the past three decades, recreation demand modelers have developed an impressive array of econometric models to fit data with these characteristics (See Phaneuf and Smith (forthcoming) for a recent review), but since their introduction by Hanemann (1978), variations of the discrete choice random utility maximization (RUM) model have dominated. In discrete choice RUM models, the recreation season is decomposed into separable choice occasions with independent discrete trip choices made on each. These models are tractable in estimation, can account for a potentially large number of sites, and provide a consistent theoretical framework from which choice occasion welfare measures can be calculated. However, by focusing on the decision process at the choice occasion, discrete choice models are ill suited for estimating seasonal demands

[1] Continuous demand system models estimated within the dual framework have also been proposed by Lee and Pitt (1986). Although Phaneuf (1999) and Wang (2003) have recently used the framework to estimate preferences for 5 and 15 sites in the recreation demand context, respectively, considerably less progress has been made with the dual approach relative to the primal framework in terms of estimation and welfare calculation. Our discussion in this chapter therefore focuses on the primal framework.