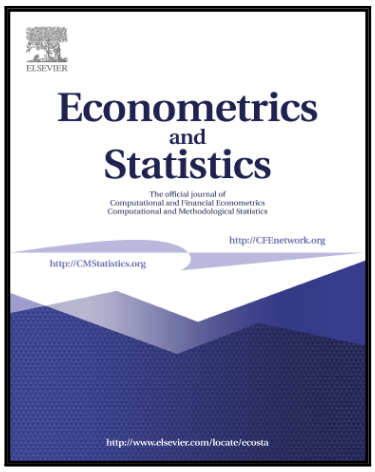


# Estimating the Competitive Storage Model: A Simulated Likelihood Approach

Tore Selland Kleppe, Atle Oglend

PII: S2452-3062(17)30033-3
DOI: 10.1016/j.ecosta.2017.04.001
Reference: ECOSTA 57

To appear in: *Econometrics and Statistics*

Received date: 10 May 2016
Revised date: 28 March 2017
Accepted date: 2 April 2017

Please cite this article as: Tore Selland Kleppe, Atle Oglend, Estimating the Competitive Storage Model: A Simulated Likelihood Approach, *Econometrics and Statistics* (2017), doi: 10.1016/j.ecosta.2017.04.001

# Estimating the Competitive Storage Model: A Simulated Likelihood Approach☆

Tore Selland Kleppe,[a,*], Atle Oglend[b]

[a] *University of Stavanger, Department of Mathematics and Natural Sciences*
[b] *University of Stavanger, Department of Industrial Economics*

**Abstract**

A particle filter maximum likelihood estimator for the competitive storage model is developed. The estimator is suitable for inference problems in commodity markets where only reliable price data is available for estimation, and shocks are temporally dependent. The estimator efficiently utilizes the information present in the conditional distribution of prices when shocks are not iid. Compared to Deaton and Laroque's composite quasi-maximum likelihood estimator, simulation experiments and real-data estimation show substantial improvements in both bias and precision. Simulation experiments also show that the precision of the particle filter estimator improves faster than for composite quasi-maximum likelihood with more price data. To demonstrate the estimator and its relevance to actual data, the storage model is fitted to data set of monthly natural gas prices. It is shown that the storage model estimated with the particle filter estimator beats, in terms of log-likelihood, commonly used reduced form time-series models such as the linear AR(1), AR(1)-GARCH(1,1) and Markov Switching AR(1) models for this data set.

*Keywords:* commodity prices, competitive storage model, particle filter, rational expectations, simulated likelihood

## 1. Introduction

This paper addresses the problem of estimating the structural parameters of the competitive storage model when only price data is available for estimation and supply shocks are temporally dependent. We propose and investigate a particle filter estimator based on recently developed methods in the particle filter literature (Gordon et al., 1993; Fernandez-Villaverde and Rubio-Ramirez, 2007; Malik and Pitt, 2011; DeJong et al., 2013). We demonstrate that this estimator has superior large sample properties and improved parameter identification properties over the conventional composite pseudo maximum likelihood estimator (CML) (Deaton and Laroque, 1995, 1996). Compared to the CML, the estimator also displays substantial reduction in bias when it comes to various predicted price characteristics, including price autocorrelation, where the CML estimator appears to underestimate price persistence.

☆The authors are indebted to the Editor; Ana Colubi, two anonymous reviewers, Frank Asche, Hans Karlsen, Hans Julius Skaug and Bård Støve for comments that greatly improved the paper.

*Corresponding author: email: tore.kleppe@uis.no, address: University of Stavanger, 4036 Stavanger, Norway, telephone: +47 51831717, fax: +47 51831750