

# Code Supplement to *Local Cost Synergies in Reverse Auctions: An Application to Road Salt Procurement*

## Overview

This directory contains three Matlab scripts that simulate bidding data and then estimate the structural model on that data.

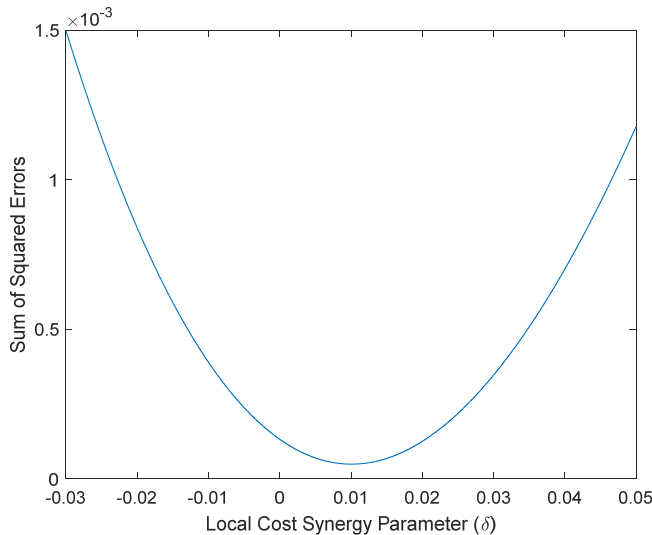
- master.m: Run this file to perform the entire procedure of simulating the data and estimating the model.
- bidprofit.m: This function simulates optimal bids given depot-year-specific costs, quantities, the local cost synergy parameter, and draws from the competing bid distribution.
- bidinversion.m: This function returns the value of the non-linear least squares objective function given a candidate value of the local cost synergy parameter. As explained in the paper, given a candidate local cost synergy parameter, this procedure involves (i) finding the unique depot-year-specific costs that rationalize observed bids and (ii) using least squares to estimate the parameters underlying depot-year-specific costs.

## Description of Code

The code as written simulates data for a single area with 6 depots over 5 years. The code can straightforwardly be modified to include additional areas. The parameters to be estimated are the local cost synergy parameter ( $\delta$ ) and the parameters determining depot-year-specific costs: a constant, the coefficient on depot quantity ( $\beta$ ), year fixed effects ( $\gamma$ ), and depot fixed effects ( $\alpha$ ).

The overall procedure of the code is to (i) simulate optimal bids for each year given draws from the firm's belief about the competing bid distribution and (ii) implement the estimation procedure described by equations (5) to (7) in the paper. In step (i), optimal bidding is simulated using the non-derivative based solver `fminsearch`. Numerical imprecision in this step arises from having a finite number of draws from the competing bid distribution and due to the tolerances set in the `fminsearch` algorithm. In step (ii), the main computational difficulty is estimating how the probability of winning each possible subset changes with each bid. Numerical imprecision in this step arises from utilizing numerical differentiation to estimate these derivatives.

The figure below (created by `master.m`) plots the value of the objective function as the local cost synergy parameter varies. The table on the right reports the values of each parameter used to simulate the data and the values recovered through the estimation procedure. The remaining (small) differences can be eliminated by adding additional areas and years and/or tightening the sources of numerical imprecision described above (e.g., by taking more draws from the competing bid distribution when simulating optimal bids).



True Parameter Values and Estimates		
	True Value	Estimated Value
Local cost synergy	0.010	0.010
Depot quantity	1.000	1.000
Constant	-0.300	-0.299
Year fixed effect 1	0.050	0.050
Year fixed effect 2	0.070	0.070
Year fixed effect 3	0.080	0.079
Year fixed effect 4	0.090	0.090
Depot fixed effect 1	-0.020	-0.021
Depot fixed effect 2	0.100	0.098
Depot fixed effect 3	0.090	0.090
Depot fixed effect 4	-0.070	-0.070
Depot fixed effect 5	0.040	0.039