Efficient consignment auctions

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1. Version of software and operating system

1. STATA/MP 16.1 for Mac (64-bit Intel) REvision 30 Jun 2020 on macOS Venture Version 13.5

2. MATLAB R2021b on macOS Venture Version 13.4.1.

2. Original data and instructions to turn to the dataset analyzed

1. The original data is *biannual_data.dta* from Fowlie and Perloff (2013).

2. Run *stata.do* on STATA/MP to convert *biannual_data.dta* file to *biannualdata.csv*.

3. Instructions to reproduce the results

1. Run *main.m* on MATLAB R2021b to reproduce results. The results are either figures or data variables produced by *main.m*. Section 4 provide details.

4. A list of results in the paper and the corresponding programs

1. Figure 1: section **Figure 1 plot of one firm's alloc vs emission id 12372, Mission Clay Product** in *main.m*.

2. Section 4.2 the expected VCG revenues that we obtain from the empirical endowments: data varibale *emp_rev*.

3. Figure 2: section **Figure 2 trading volume** in *main.m*.

4. Figure 3: section **Fig 3 revenue plots** in *main.m*.

5. Figure 4: section **Fig 4 comparing endowments** in *main.m*.

6. Section 4.3 KL distances between the average empirical endowment with $\mathbf{r}^*$, $\bar{\mathbf{r}}$ and a completely uniform endowment: data varibales *kl_rast*, *kl_ea*, *kl_uniform*.

7. Online Appendix Section 2.1 KL distances the optimal endowments from assuming power distribution to those from assuming $F_g(x) = 1 - (1 - x)^{a_g}$ and those from assuming the symmetric beta distribution: data variables *KL_po* and *KL_beta*.

8. Online Appendix Section 2.1 sum of squared errors from assuming different distribution assumptions: data variables *distance_pi*, *distance_po*, *distance_beta*.

9. Table OA.1: data variable *summarytable*.

10. Table OA.2: data variable *table_noname*.

11. Figure OA.2, Figure OA.3: section **Fig OA.** in *main.m*.

5. A list programs and what they do.

1. *stata.do* converts *biannual_data.dta* file to *biannualdata.csv*.

2. *code0.m* loads data.

3. *main.m* is the main script.

4. *loaddataandgroup.m*: filter *biannualdata* to only have data from facilities that belong to cycle 1, and that participated in the period from 2001-02 to 2006-01. The final output is the variable *datafac* and *datafac_norm1* that are the main data inputs.

   (a) *artfac.m* creates the artifitial facility that balances total emission to total allocation

(b) *data_norm1.m* normalizes the total supply, accounting for minimum demands.

5. *ordering.m*: organize results in *agent_ordering.m* into a list

   - *agent_ordering.m*: exhaustive list of combinations of allocations restricting to when the agent has positive allocation

6. *powerinv.m*: calibration results for the power distribution assumption that is usedin the mainbody. It returns *alp_po*, *r_ast_pi*, *ea_fac_pi*, *r_ast_rev*, *r_sw_rev*, *emp_rev*, *corner_share*, *corner_rev*, *emp_vol*, *mean_eff_trading_vol*, *eff_trading_vol_5*, *eff_trading_vol_95*.

7. *power_dist.m*: calibration results for the distribution assumption $F_g(x) = 1-(1-x)^{a_g}$. It returns *alp_po* and *r_ast_po*.

8. *beta_dist.m*: calibration results for the symmetric beta distribution assumption. It returns *alp_beta* and *r_ast_beta*.

6. Data dictionary

1. *datafac*: main data input, before normalizing supply to 1 and grouping

   - *fac*, *facid*: facility ID
   - *period*: period
   - *alloc*: allocation in tons of emissions
   - *emi*: emission in tons of emissions
   - *q*: normalized emission, not accounting for minimum demand
   - *d*,*fac_d*: normalized minimum demand
   - *hatR*: $\hat{R}$ as defined in the paper
   - *r*: normalized allocation, not accounting for minimum demand

2. *datafac_norm1*: main data input that contains part of *datafac* and

- q: normalized emission, used as an approx for efficient allocation
- r: normalized allocation, used as initial endowment
- *norm1_average*: normalized emission, averaged over time.
- *facd*: normalized minimum demand

3. *alp_po*: estimated distribution parameter for the distribution assumption $F_g(x) = 1 - (1-x)^{a_g}$.

4. *r_ast_po*: estimated optimal endowment for the distribution assumption $F_g(x) = 1 - (1-x)^{a_g}$.

5. *alp_beta*: estimated distribution parameter for the symmetric beta distribution assumption.

6. *r_ast_beta*: estimated optimal endowment for the symmetric beta distribution assumption.

7. *ea_fac_pi*: $\overline{\mathbf{r}}$.

8. *r_ast_rev*: expected VCG revenue from $\mathbf{r}^*$,

9. *r_sw_rev*: expected VCG revenue from $\overline{\mathbf{r}}$.

10. *emp_rev*: expected VCG revenues from the empirical endowments.

11. *corner_share*: $\mathbf{r}^o$.

12. *corner_rev*: expected VCG revenue from $\mathbf{r}^o$.

13. *emp_vol*: empirical trading volumes.

14. *mean_eff_trading_vol*, *eff_trading_vol_5*, *eff_trading_vol_95*: the mean, 5−th, and 95−th percentiles of trading volumes simulated under the assumption of ex post efficient reallocation, given the empirical endowments.

15. *kl_rast*, *kl_ea*, *kl_uniform*: KL distances between the average empirical endowment with $\mathbf{r}^*$, $\overline{\mathbf{r}}$ and a completely uniform endowment.

16. *distance_pi*, *distance_po*, *distance_beta*: sum of squared errors from assuming power distribution, $F_g(x) = 1 - (1-x)^{a_g}$ and the symmetric beta distribution.

17. *KL_po* and *KL_beta*: KL distances the optimal endowments from assuming power distribution to those from assuming $F_g(x) = 1 - (1-x)^{a_g}$ and those from assuming the symmetric beta distribution.

References

Fowlie, M. and J. M. Perloff (2013): "Distributing Pollution Rights in Cap-and-Trade Programs: Are Outcomes Independent of Allocation?" *Review of Economics and Statistics*, 95, 1640–1652.