README

Multidimensional Auctions of Contracts: An Empirical Analysis

Repository: openicpsr-154601

Yunmi Kong Isabelle Perrigne Quang Vuong

Data

Data availability

All data used in the paper are provided in the replication package with the following exceptions: historical crude oil futures prices from Quandl, historical crude oil options prices from the CME Group, and oil production data from Drillinginfo require an account and/or purchase from the respective data providers and are not provided here. Replicators may obtain these data from the respective data providers. Meanwhile, the replication package provides sufficient derived analysis to enable replication of the paper using only what is provided in the package.

Data sources

◦ Main data

- Louisiana Department of Natural Resources (DNR)
  - Publicly available state government records
    - Louisiana Department of Natural Resources (DNR) Tract sheets of auction results. Accessed April 2017 at http://reports.dnr.state.la.us/reports/rwservlet?SRMN9031B_p
    - Louisiana Department of Natural Resources (DNR) Lease information. Accessed September 2017 at http://sonlite.dnr.state.la.us/sundown/cart_prod/cart_min_qld1

◦ Auxiliary data

- Federal Reserve Bank of St. Louis (1974-2003)
  - Publicly available federal reserve bank statistics

    * Spot Crude Oil Price: West Texas Intermediate (WTISPLC). Accessed August 2019 at
      https://fred.stlouisfed.org/series/WTISPLC

- U.S. Bureau of Economic Analysis (BEA)
  - Publicly available federal bureau statistics
    * GDP implicit price deflator, in National Income and Product Accounts table 1.1.9. Accessed October 2017 at
      https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=13#reqid=19&step=3&isuri=1&1921=survey&1903=13

- Board of Governors of the Federal Reserve System (US) (FRB)
  - Publicly available federal reserve bank statistics
    * 1-Year Treasury Constant Maturity Rate, Percent, Monthly, Not Seasonally Adjusted. Accessed March 2018 at
      https://fred.stlouisfed.org/series/GS1

- Quandl (1983-2019) (was Quandl at time of access, now Nasdaq Data Link)
  - Data access requires an account (free). Accessed April 2019.
    https://data.nasdaq.com
    * Historical Crude Oil Futures Prices (Data product: Wiki Continuous Futures, Frequency: daily, Nasdaq data link code: CHRIS/CME_CL1 through CHRIS/CME_CL36), up to April 22, 2019.

- CME Group Inc. (CME)
  - Data must be purchased from the CME Group. Accessed January 2019.
    https://www.cmegroup.com
    * Crude oil options complete historical (product category: EOD, product name: Crude Oil Options, symbol: LO, order type: Complete Historical).

- Drillinginfo (1962-2018) (was Drillinginfo at time of access, now Enverus)
  - Data access requires an account. Accessed March 2018.
    https://www.enverus.com

    * Monthly production data for Louisiana wells, up to January 2018. Steps for access: once logged in, apply Data Filters > Filter > State > LA. Among the datasets, select "Production". Click "Apply". Then go to the Exports tab, select "Production", then click "Next". Select "Production Headers.csv" and "Producing Entity Monthly Production.csv", click "Next", and complete the data export.

Dataset list

	Data file	Provided	Source
[1]	data/maindata.dta	Yes	DNR, St. Louis Fed
[2]	data/townships.dta	Yes	DNR
[3]	data/gdpipdeflatorQ.dta	Yes	BEA
[4]	data/treasury_1y_monthly.dta	Yes	FRB
[5]	data/quandl/CHRIS-CME_CL'm'.csv	No	Quandl
[6]	data/cme/cme_lo'date'.csv	No	CME
[7]	data/Producing Entity Monthly Production.csv	No	Drillinginfo
[8]	data/Production Headers.csv	No	Drillinginfo
[9]	calculations/tractnum_iv.dta	Yes	Derived from [1],[5],[6]
[10]	calculations/twp_idx_pre.dta	Yes	Derived from [2],[7],[8]
[11]	calculations/twp_prod_post.dta	Yes	Derived from [2],[7],[8]
[12]	calculations/twp_aveprod_1987_2006.dta	Yes	Derived from [2],[7],[8]

- Notes
  - [5] and [6] are not needed for replication given [9].
  - [7] and [8] are not needed for replication given [10], [11], [12].

Computational requirements

Software requirements

- Matlab (code was run with Matlab Release 2020a)
  - Curve Fitting Toolbox
  - Optimization Toolbox
  - Statistics and Machine Learning Toolbox
- R 4.1.1

  - quantmod (0.4.18)
  - There is only one R file; it includes installation of dependencies.
  - Note: R is used only in preparing data file [5] (see dataset list) which is not provided. R is not needed when running the replication with what is provided in this package.

- STATA (code was run with STATA SE 15.1)
  - estout (as of 2020-02-03)
  - outreg2 (as of 2020-02-03)

Memory and runtime requirements

The code was run on a 56-core Intel-based desktop with 512 GB of RAM, 2 TB of fast local storage. Some Matlab programs contain `parfor` (parallel for-loop) commands, so the number of cores substantially affects run times. Run times were as follows.

Program	Software	Time
A_run_stata_code.do	Stata	1 sec
matlab/B_heatmap3.m	Matlab	33 sec
C_run_stata_code.do	Stata	70 sec
D_run_matlab_code.m	Matlab	3 hrs
E_run_appendix_matlab_code.m	Matlab	1 hr 8 min

Description of programs/code

- The file `0_setup.do` installs necessary Stata packages and sets a global macro for the Stata working directory.
- Programs in `stata/prep` will prepare auxiliary variables, merge them with the main data, and export data for use in Matlab programs. The files `A_run_stata_code.do` and `C_run_stata_code.do` will run them in the correct order.
- Programs in `stata/tables` will generate Tables 1 and 3 in the main manuscript and Table A1 in the appendix. The file `C_run_stata_code.do` will run these.
- Among programs in `matlab`, file names starting in 'E' will estimate the model of the paper, file names starting in 'C' will perform counterfactual simulations, and file names starting with 'figure' or 'table' will generate figures and/or tables. The

file `D_run_matlab_code.m` will run them in the correct order to replicate the main manuscript. The file `B_heatmap3.m` is run separately as part of data preparation, per the Instructions to replicators below.

- The file `E_run_appendix_matlab_code.m` will run Matlab files in the correct order to replicate the appendix.

Instructions to replicators

After downloading the replication folder in its entirety without changing, moving, or renaming its contents, follow these steps in strict sequence:

1. Edit `0_setup.do` to adjust the path to the downloaded replication folder, and run it.
2. Run `A_run_stata_code.do` in Stata.
3. Run `matlab/B_heatmap3.m` in Matlab.
4. Run `C_run_stata_code.do` in Stata.
5. Run `D_run_matlab_code.m` in Matlab.
6. To replicate the appendix, run `E_run_appendix_matlab_code.m` in Matlab.

- Details
  - Order matters. The steps should be followed in sequence. If running programs individually, they should be run in the order listed in the master files above.
  - The steps above allow replication of the paper's analysis using only what is provided in the package. To replicate starting with the data files [5]-[8] (see dataset list) which are not provided, uncomment and run the programs in lines 13-36 of `A_run_stata_code.do`.
  - `calculations` is a folder in which intermediate calculations will be deposited.
  - `output` is a folder in which figures and tables will be deposited.
  - The steps above were last run top to bottom in November 2021.

List of tables and programs

Main manuscript

Figure/Table #	Program	Output file (in 'output' folder)
Table 1	stata/tables/table1.do	Table1a.xml, Table1b.xml
Table 2	n/a; Table 2 is not empirical.	n/a
Table 3	stata/tables/table3.do	Table3.tex
Table 4	matlab/figure8_table_4_5.m	Table4.csv
Table 5	matlab/figure8_table_4_5.m	Table5.csv
Figure 1	matlab/figure1.m	figure1.eps
Figure 2	matlab/figure2.m	figure2.eps
Figure 3	matlab/E2_Estimate_gchoice.m	figure3.eps
Figure 4	matlab/figure4.m	figure4.eps
Figure 5	matlab/figure5_6_7.m	figure5.eps
Figure 6	matlab/figure5_6_7.m	figure6.eps
Figure 7	matlab/figure5_6_7.m	figure7.eps
Figure 8	matlab/figure8_table_4_5.m	figure8.eps

Appendix

Figure/Table #	Program	Output file (in 'output' folder)
Table A1	stata/tables/tableA1.do	TableA1.tex
Table A2	matlab/tableA2.m	TableA2.csv
Table A3	matlab/tableA3.m	TableA3.csv
Table A4	matlab/figureA8_table_A4_A5.m	TableA4.csv
Table A5	matlab/figureA8_table_A4_A5.m	TableA5.csv
Figure A1	matlab/figureA1toA4.m	figureA1.eps
Figure A2	matlab/figureA1toA4.m	figureA2.eps
Figure A3	matlab/figureA1toA4.m	figureA3.eps
Figure A4	matlab/figureA1toA4.m	figureA4.eps
Figure A5	matlab/C16_Increase_t_compare_am.m	figureA5.eps
Figure A6	matlab/C16_Increase_t_compare_am.m	figureA6.eps
Figure A7	matlab/C09_Increase_p_compare.m	figureA7.eps
Figure A8	matlab/figureA8_table_A4_A5.m	figureA8.eps
Figure A9	matlab/figureA9toA15.m	figureA9.eps
Figure A10	matlab/figureA9toA15.m	figureA10.eps
Figure A11	matlab/figureA9toA15.m	figureA11.eps
Figure A12	matlab/figureA9toA15.m	figureA12.eps
Figure A13	matlab/figureA9toA15.m	figureA13.eps
Figure A14	matlab/figureA9toA15.m	figureA14.eps
Figure A15	matlab/figureA9toA15.m	figureA15.eps
Figure A16	matlab/figureA16.m	figureA16.eps

References

Board of Governors of the Federal Reserve System (US). 1953-2018. "Market Yield on U.S. Treasury Securities at 1-Year Constant Maturity [GS1]." Retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GS1 (accessed March 2018).

CME Group Inc. (CME). 1987-2003. "Crude oil options complete historical." CME Group, https://www.cmegroup.com (accessed January 2019).

Drillinginfo. 1962-2018. "Producing Entity Monthly Production." Enverus, https://www.enverus.com (accessed March 2018).

Federal Reserve Bank of St. Louis. 1974-2003. "Spot Crude Oil Price: West Texas Intermediate (WTI) [WTISPLC]." Retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WTISPLC (accessed August 2019).

Louisiana Department of Natural Resources (DNR). 1974-2003*a*. "Lease Data." http://sonlite.dnr.state.la.us/sundown/cart_prod/cart_min_qld1 (accessed September 2017).

Louisiana Department of Natural Resources (DNR). 1974-2003*b*. "Tract Sheets." http://reports.dnr.state.la.us/reports/rwservlet?SRMN9031B_p (accessed April 2017).

Quandl. 1983-2019. "Historical Crude Oil Futures Prices, Wiki Continuous Futures, Daily." Nasdaq Data Link, https://data.nasdaq.com (accessed April 2019).

U.S. Bureau of Economic Analysis (BEA). 1947-2017. "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product." Interactive Data Tables (accessed October 2017).