README

Overview

This readme file describes how the analysis in "Farm-level responses to weather trends: A structural model", published in the *American Journal of Agricultural Economics*, can be replicated.

The programs store all tables and figures presented in the manuscript and in the online supplementary appendix in the folders "Tables" and "Figures", respectively. The folder "rOutput" contains the estimated parameters and (semi-)elasticities and the simulation results needed to create the tables and figures. Estimation of the models is not possible because farm-level data is disclosed.

Data Availability Statement

Statement about Rights

I certify that the authors of the manuscript have legitimate access to and permission to use the data used in this manuscript.

Summary of Availability

Some data cannot be made publicly available.

Details on each Data Source

Data.Name	Data.Files	Location	Provided	Citation
Farm-level accountancy data	tbn_FINAL_all.xlsx	Data/	No	BMEL (2020)
Weather data	weatherMarAug.xlsx	Data/	Yes	DWD (2021)
Input price indices	destatis_inputs_61221-0002.xlsx	Data/	Yes	Destatis (2021)
Fertilizer prices and quantities	Fertilizer prices and quantities_1992-2020.xlsx	Data/	Yes	BMEL (2021)

- Farm-level data of the German Farm Accountancy Data Network

Individual farm-level data of the German Farm Accountancy Data Network are confidential, but available under the regulations of the Federal Ministry of Food and Agriculture. Data access and use require official approval by the Ministry. Due to the complexity and high confidentiality of the data, access is only possible on-site at the Thuenen Institute of Farm Economics. Researchers interested in the data need to apply with their project at the Federal Ministry of Food and Agriculture.

- Weather data

Daily weather data on precipitation and temperature (minimum and maximum) at 1x1 km grid cells was provided to us by the Deutscher Wetterdienst (DWD, *engl.* German Meteorological Service). The raw data can be downloaded from the Climate Data Center (DWD, 2021). We aggregated the gridded weather data to administrative units (LAU 2 level, formerly NUTS 5) using shapefiles provided by the Federal agency for Cartography and Geodesy (see BKG, 2023). We share the SAS code to

operationalize the historical weather data over the growing season March to August and the resulting data table.

- Input price indices

Input price indices can be downloaded from the Genesis-Online database of the statistical office in Germany (Destatis 2021), table 61221-0002 (“Index der Einkaufspreise landwirtschaftlicher Betriebsmittel: Deutschland, Wirtschaftsjahr, Landwirtschaftliche Betriebsmittel”). The downloaded data table is published along with the article.

- Fertilizer prices and quantities

Prices and quantities of fertilizer use are extracted from multiple statistical yearbooks published by the Federal Ministry of Food and Agriculture in Germany (BMEL, 2021). The compiled data are published along with the article.

Software requirements

- R 4.0.2
    - boot (1.3-25)
    - cellranger (1.1.0)
    - doFuture (0.12.0)
    - doRNG (1.8.6)
    - dplyr (1.0.8)
    - ggplot2 (3.4.2)
    - ggpattern(1.1.0-0)
    - ggpubr (0.4.0)
    - GJRM (0.2-5.1)
    - nlsur (0.7)
    - parallel (4.0.2)
    - patchwork (1.1.1)
    - plm (2.4-3)
    - readxl (1.3.1)
    - reshape2 (1.4.4)
    - sampleSelection (1.2-12)
    - sf (1.0-7)
    - stargazer (5.2.2)
    - stringr (1.4.0)
    - systemfit (1.1-24)
    - tidyverse (1.3.1)
    - writexl (1.4.0)
- SAS 9.4

Description of programs/code

- Programs in 01a_OperWeather.txt operationalize the weather variables (in SAS).
- Programs in 01b_PrepWeather.R and 01c_WeatherMaps.R prepare and map the weather data used for the analysis.
- Programs in 02_PrepPrices.R prepare the outputs and input price indices.
- Programs in 03_PrepFADN.R prepare the farm-level data.

- Programs in 04_PrepSampleVars construct the sample and the variables used in the analysis.
- Programs in 05a_EstSim_main estimates the main model and simulates farm-level responses to a drought shock; Programs in 05b_Bootstrap_main run the bootstrap and create the results figure and tables for the main model.
- Programs in 06a & 06b – 11a & 11b and 13a & 13b do the same for alternative models (heterogeneity with respect to farm size, different lag structures in the weather variables, nonlinearity in weather, curvature restriction, and a model without accounting for non-random crop selection).
- Programs in 12_Est_OutOfSample.R estimate the model without the final year of the data and assesses out-of-sample prediction.

List of tables and figures

Table/ Figure #	Program	Line #	Output file
Main text			
Table 1	04_PrepSampleVars.R	751	Tables/Table_1.xlsx
Table 2	05b_Bootstrap_main.R	1460	Tables/Table_2.xlsx
Table 3	05b_Bootstrap_main.R	1570	Tables/Table_3. xlsx
Figure 1	01c_WeatherMaps	344	Figures/Figure_1.png
Figure 2	05b_Bootstrap_main.R	1163	Figures/Figure_2.png
Figure 3	05a_EstSim_main	542	Figures/Figure_3.png
Figure 4	06a_EstSim_het.R	1013	Figures/Figure_4.png
Appendix			
Table A.1	05b_Bootstrap_main.R	1259	Tables/Table_A1.xlsx
Table A.2	05a_EstSim_main	319	-
Table A.3	05b_Bootstrap_main.R	1346	Tables/ Table_A3.xlsx
Supplementary material online			
Table S2.1	01b_PrepWeather.R	429	Tables/Table_S2.1.xlsx
Table S3.1	04_PrepSampleVars.R	941	Tables/Table_S3.1.xlsx
Table S4.1	05b_Bootstrap_main.R	1261	Tables/Table_S4.1.xls
Table S4.2	05b_Bootstrap_main.R	1348	Tables/Table_S4.2.xls
Table S4.3	05b_Bootstrap_main.R	1462	Tables/Table_S4.3.xls
Table S4.4	05b_Bootstrap_main.R	1572	Tables/Table_S4.4.xls
Table S5.1	06b_Bootstrap_het.R	1794	Tables/Table_S5.1.xls
Table S5.2	06b_Bootstrap_het.R	1896	Tables/Table_S5.2.xls
Table S5.3	06b_Bootstrap_het.R	2006	Tables/Table_S5.3.xls
Table S5.4	06b_Bootstrap_het.R	2114	Tables/Table_S5.4.xls
Table S5.5	06b_Bootstrap_het.R	2217	Tables/Table_S5.5.xls
Table S5.6	06b_Bootstrap_het.R	2321	Tables/Table_S5.6.xls
Table S6.1.1	07b_Bootstrap_1to5_6to10.R	1094	Tables/Table_S6.1.1.xlsx
Table S6.1.2	07b_Bootstrap_1to5_6to10.R	1177	Tables/Table_S6.1.2.xlsx
Table S6.1.3	07b_Bootstrap _1to5_6to10.R	1287	Tables/Table_S6.1.3.xlsx
Table S6.1.4	07b_Bootstrap _1to5_6to10.R	1393	Tables/Table_S6.1.4.xlsx
Table S6.2.1	08b_Bootstrap _1to5_6to20.R	1093	Tables/Table_S6.2.1.xlsx
Table S6.2.2	08b_Bootstrap _1to5_6to20.R	1177	Tables/Table_S6.2.2.xlsx
Table S6.2.3	08b_Bootstrap_1to5_6to20.R	1287	Tables/Table_S6.2.3.xlsx
Table S6.2.4	08b_Bootstrap_1to5_6to20.R	1393	Tables/Table_S6.2.4.xlsx
Table S6.3.1	09b_Bootstrap_1_2to10.R	1095	Tables/Table_S6.3.1.xlsx
Table S6.3.2	09b_Bootstrap_1_2to10.R	1178	Tables/Table_S6.3.2.xlsx

Table S6.3.3	09b_Bootstrap_1_2to10.R	1288	Tables/Table_S6.3.3.xlsx
Table S6.3.4	09b_Bootstrap_1_2to10.R	1394	Tables/Table_S6.3.4.xlsx
Table S6.4.1	10b_Bootstrap_nonlinear.R	1103	Tables/Table_S6.4.1.xlsx
Table S6.4.2	10b_Bootstrap_nonlinear.R	1187	Tables/Table_S6.4.2.xlsx
Table S6.4.3	10b_Bootstrap_nonlinear.R	1297	Tables/Table_S6.4.3.xlsx
Table S6.4.4	10b_Bootstrap_nonlinear.R	1403	Tables/Table_S6.4.4.xlsx
Table S6.5.1	11b_Bootstrap_restricted.R	1910	Tables/Table_S6.5.1.xlsx
Table S6.5.2	11b_Bootstrap_restricted.R	2020	Tables/Table_S6.5.2.xlsx
Table S6.5.3	11b_Bootstrap_restricted.R	2126	Tables/Table_S6.5.3.xlsx
Table S7.1	12_Est_OutOfSample.R and 12_Est_OutOfSample.R	416-423 671-678	-
Table S7.2	12_Est_OutOfSample.R	663-669	-
Table S8.1	13b_Bootstrap_wosel.R	851	Tables/Table_S8.1.xlsx
Table S8.2	13b_Bootstrap_wosel.R	961	Tables/Table_S8.2.xlsx
Table S8.3	13b_Bootstrap_wosel.R	1067	Tables/Table_S8.3.xlsx
Figure S3.1	01c_WeatherMaps	623	Figures/Figure_S3.1.png
Figure S3.2	01c_WeatherMaps	903	Figures/Figure_S3.2.png
Figure S3.3	01c_WeatherMaps	1183	Figures/Figure_S3.3.png
Figure S5.1	06a_EstSim_het.R	1013	Figures/Figure_4.png
Figure S6.1.1	07a_EstSim_1to5_6to10.R	538	Figures/Figure_S6.1.1.png
Figure S6.2.1	08a_EstSim_1to5_6to20.R	581	Figures/Figure_S6.2.1.png
Figure S6.3.1	09a_EstSim_1_2to10.R	538	Figures/Figure_S6.3.1.png
Figure S6.4.1	10a_EstSim_nonlinear.R	562	Figures/Figure_S6.4.1.png
Figure S6.5.1	11a_EstSim_restricted.R	1299	Figures/Figure_S6.5.1.png
Figure S8.1	13a_EstSim_wosel.R	388	Figures/ Figure_S8.1.png

Acknowledgement

This readme file is based on the guidelines provided on https://social-science-data-editors.github.io/template_README/.

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