June 16, 2022 - cascad#233

Execution Report

Title: **Bounds on a Slope from Size Restrictions on Economic Shocks**

Authors: **Marco Stenborg Petterson, David Seim, Jesse M. Shapiro**

Full reference: Peterson, Marco Stenborg, Seim, David, & Shapiro, Jesse M. "Bounds on a Slope from Size Restrictions on Economic Shocks" AEA ID: AEJMicro-2021-0365.R2

The structure and contents of this execution report provided by **cascad** for the certification are similar to those recommended by the AEA Data Editor.

1. DATA DESCRIPTION

This paper studies the problem of learning about the effect of one market-level variable (e.g., price) on another (e.g., quantity) in the presence of shocks to unobservables (e.g., preferences). It shows that intuitions about the bounds on the shocks can provide information on the parameter of interest. It then uses data from three studies to illustrate this approach: one on the price elasticity of world demand for staple food grains by Roberts and Schlenker (2013), a second on the crowding out of male employment by female employment following Fukui, Nakamura, and Steinsson (2020), and an illustration of a data-driven approach to informing bounds based on Ellison and Ellison (2009).

2. CODE DESCRIPTION

This replication package is divided into four folders:

- The “source” folder stores all the programs used for data analysis, written in Python, Stata, Matlab and R, LyX files for the paper, figures and supporting documents, as well as some of the raw data files. It is itself divided in several subfolders:
    - “source/derived”, which contains programs that extract and reformat all raw datasets.
    - “source/analysis/compute_bounds”, which contains programs that perform most of the necessary calculations needed to generate the figures in the article and its online appendix.
    - “source/analysis/shocks”, which contains programs that perform some additional calculations for quantities used in the article.

    - "source/analysis/plots", which contains programs that generate all the figures in the article and its appendix.
    - "source/analysis/autofill_numbers", which contains programs that generate a `.tex` file used to autofill numbers in the paper.

- The "output" folder will store most of the output files produced by the programs and the LyX files. Its structure in this directory parallels the structure of "source". For example, the results of the programs in "source/analysis/compute_bounds/" will be saved in "output/analysis/compute_bounds/", and so on.

- The "datastore" folder stores most of the raw data files as well as some output files.

- Finally, the "temp" subfolder will store some temporary files during the replication procedure.

The replication package relies on SCons to execute the programs and specify dependencies between them and their input/output files. Those dependencies are specified in files called SConscript. One can be found in the root folder of the replication package, and each subdirectory of "source" that executes programs with SCons contains one or more file with the same name.

To compile all the results created by programs executed with SCons, one must open a terminal in the root folder and simply run the "SCons" command.

3. REPLICATION STEPS

For the purpose of this certification, we aimed to check the results displayed in Figures 1-5, A1-A4, B1-B2 and C1 as well as the numerical values displayed throughout the paper.

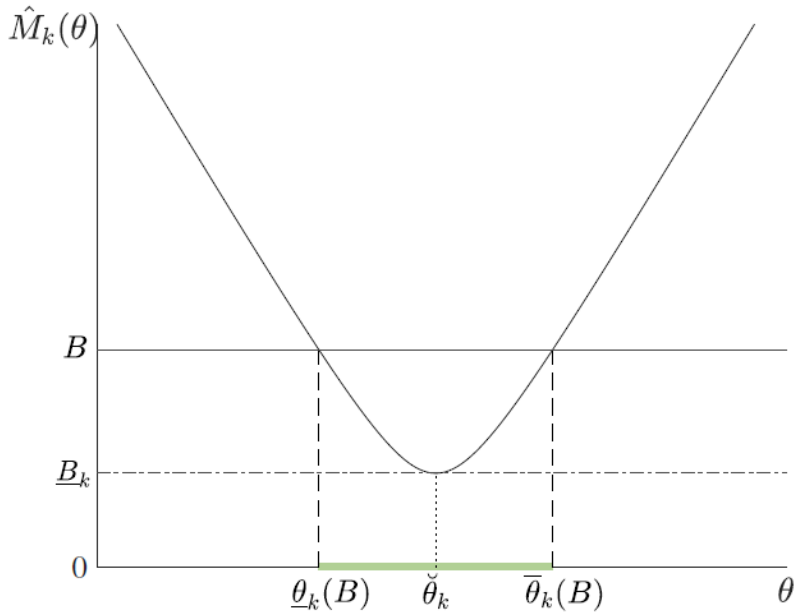
The replication materials were downloaded from the ICPSR repository, and run as per readme, using Stata 17, Python 3.9.4, Matlab R2022a, R 4.0.4, LyX 2.3, and Scons 4.2.0 on a computer with 64GB RAM, intel® Core™ i9-9900K CPU @3.60-5.00GHz, Nvidia Geforce RTX 2060, and Windows 10 OS. We encountered no issues during the replication.

4. FINDINGS

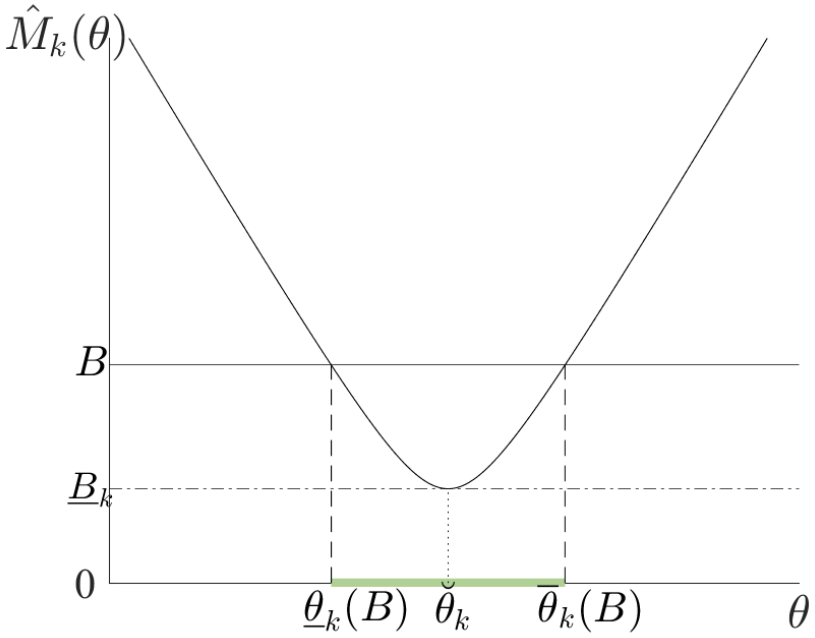
We reproduced all the Figures and numerical values with accuracy.

4.1. FIGURE 1: FIGURE 1. ILLUSTRATION OF PROPOSITION 2

Original:

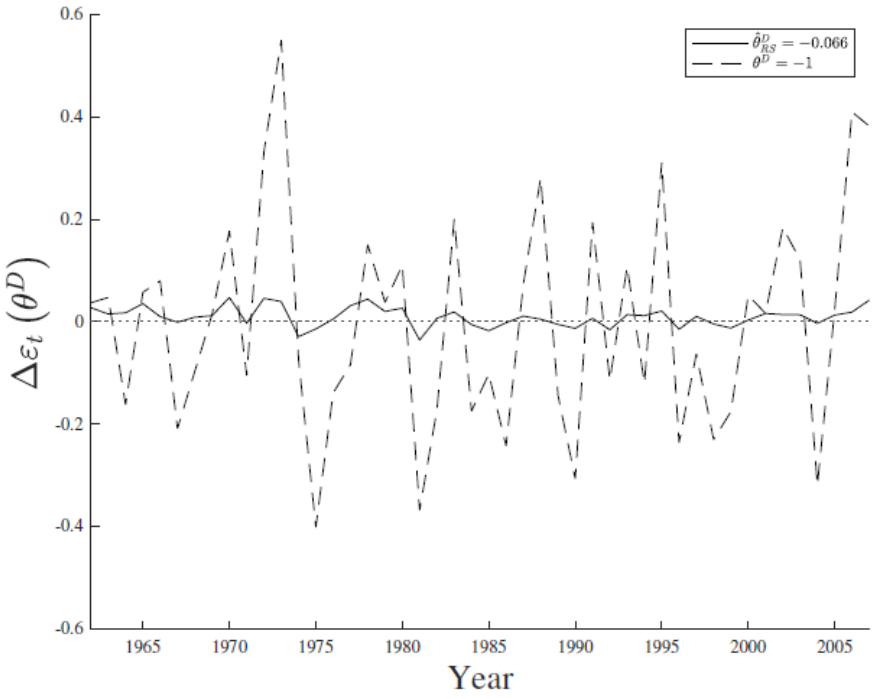


Reproduced:



4.2. FIGURE 2. IMPLIED SHOCKS TO WORLD DEMAND FOR FOOD GRAIN UNDER DIFFERENT ELASTICITIES

Original:



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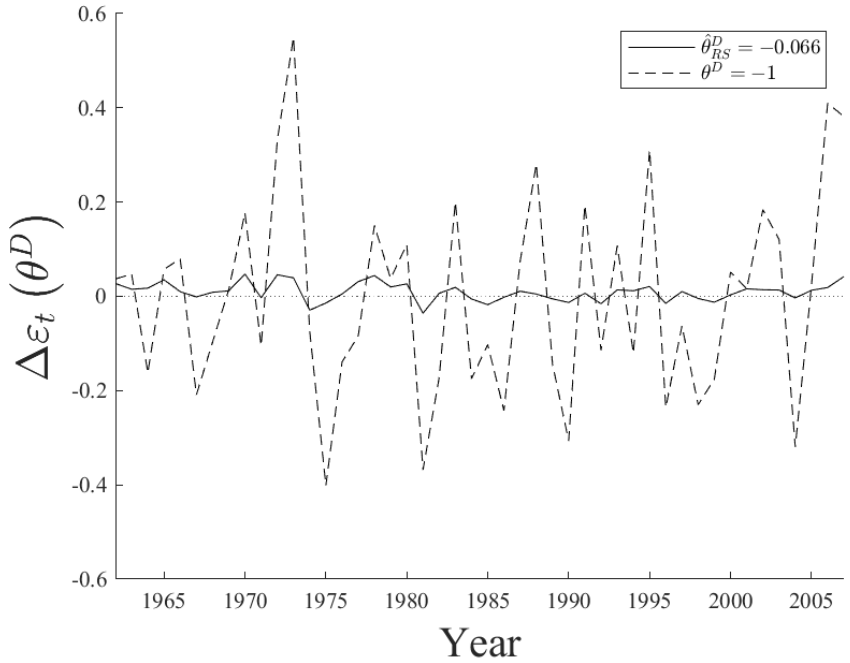
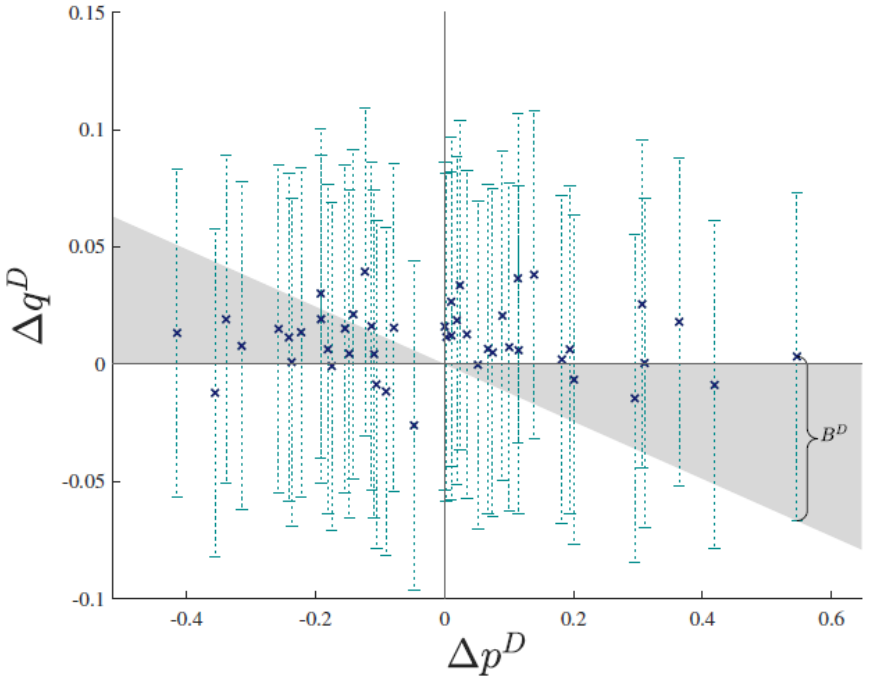
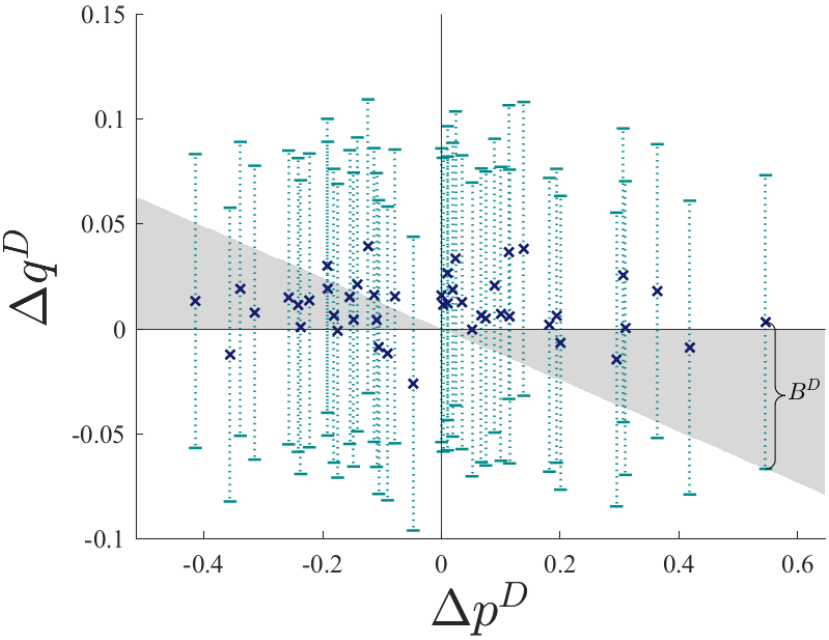


4.3. FIGURE 3. CONSTRUCTING BOUNDS ON AN ELASTICITY FROM BOUNDS ON SHOCKS

Original:

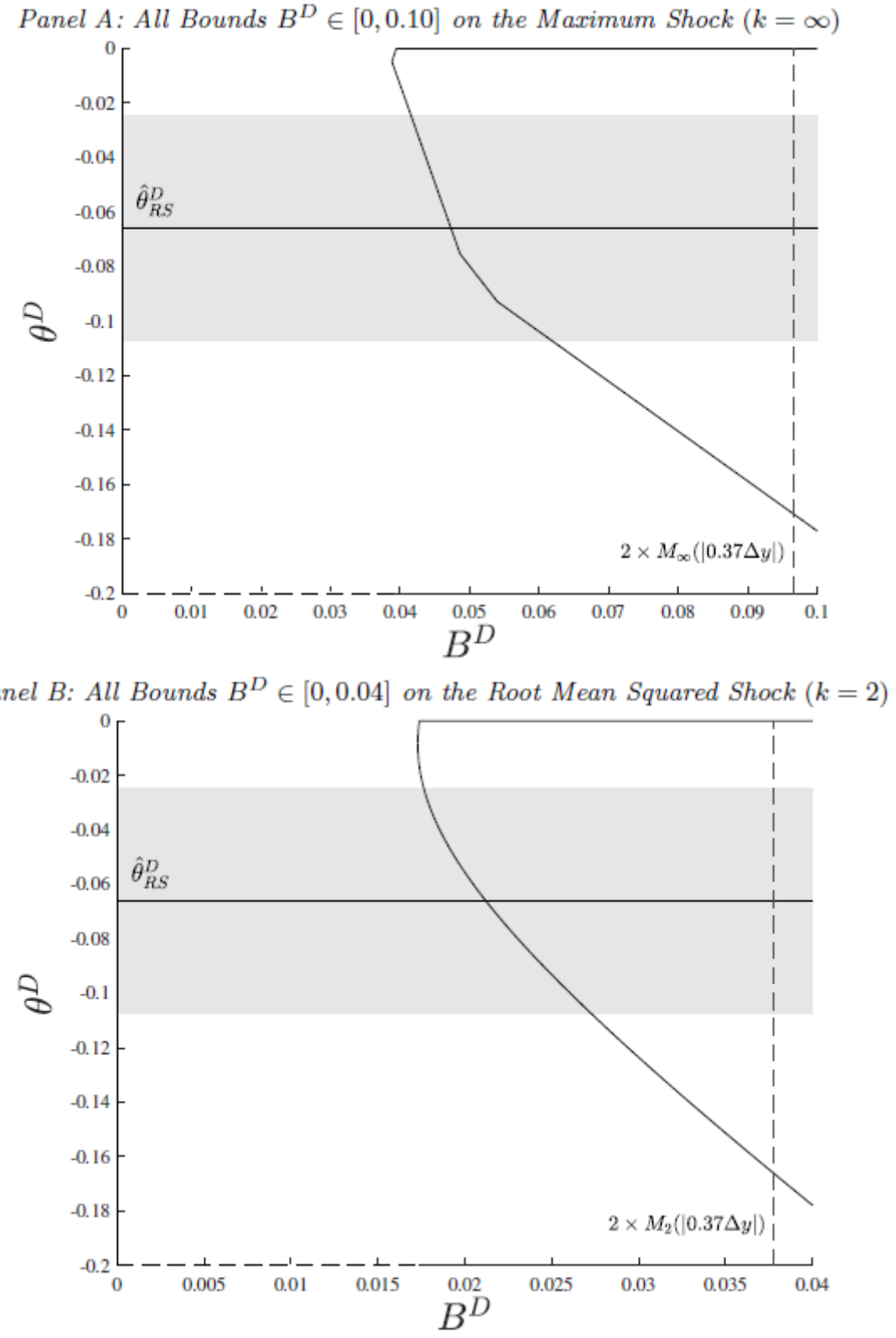


Reproduced:

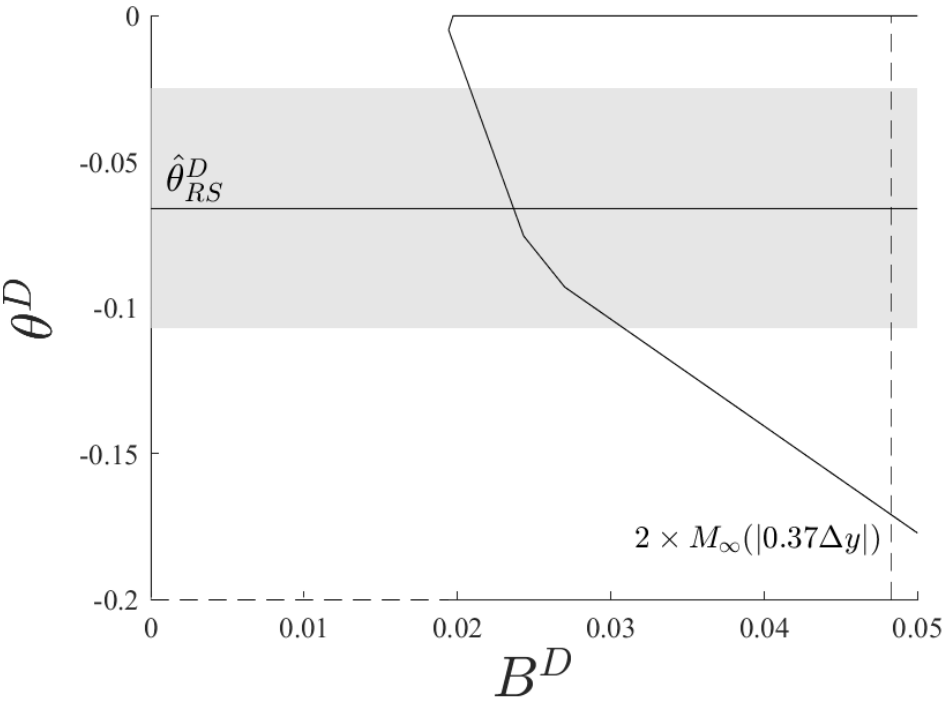


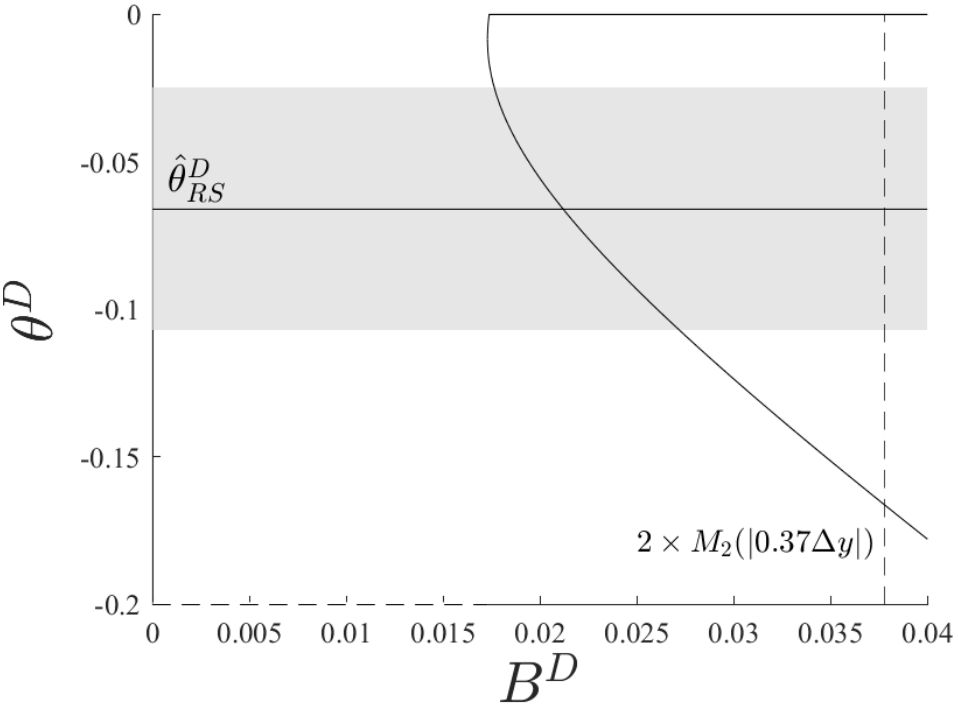
4.4. FIGURE 4. IMPLICATIONS OF BOUNDS ON SHOCKS TO WORLD DEMAND FOR FOOD GRAIN

Original:



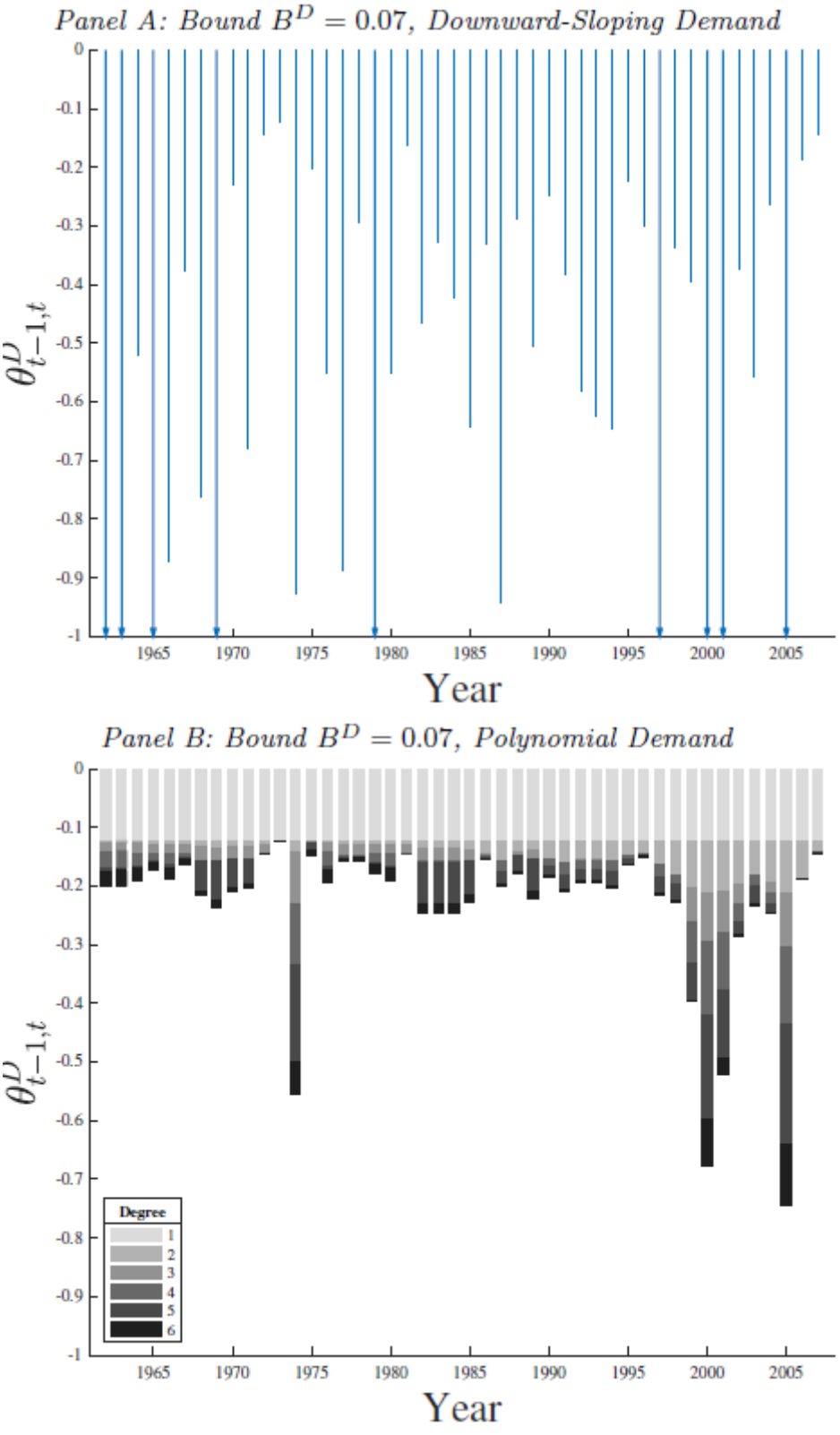
Reproduced:


0
-0.05
-0.1
-0.15
-0.2
$\hat{\theta}^D_{RS}$
θ^D
$2 \times M_\infty(|0.37\Delta y|)$
0
0.01
0.02
0.03
0.04
0.05
B^D


0
-0.05
-0.1
-0.15
-0.2
$\hat{\theta}^D_{RS}$
θ^D
$2 \times M_2(|0.37\Delta y|)$
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
B^D

4.5. FIGURE 5. RELAXING LINEARITY OF THE DEMAND FUNCTION

Original:



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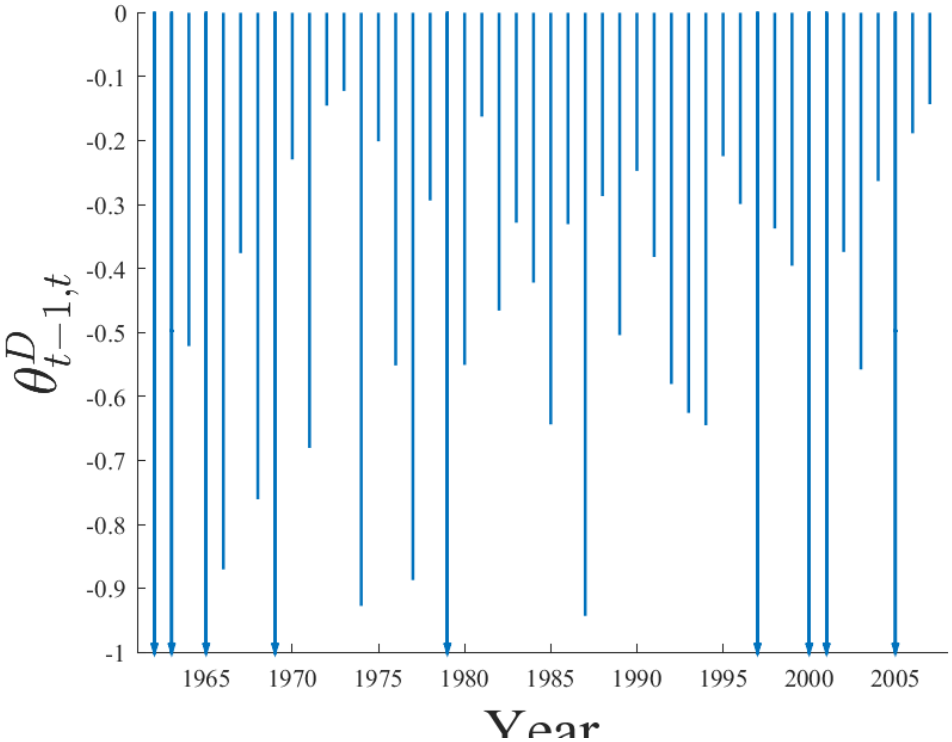
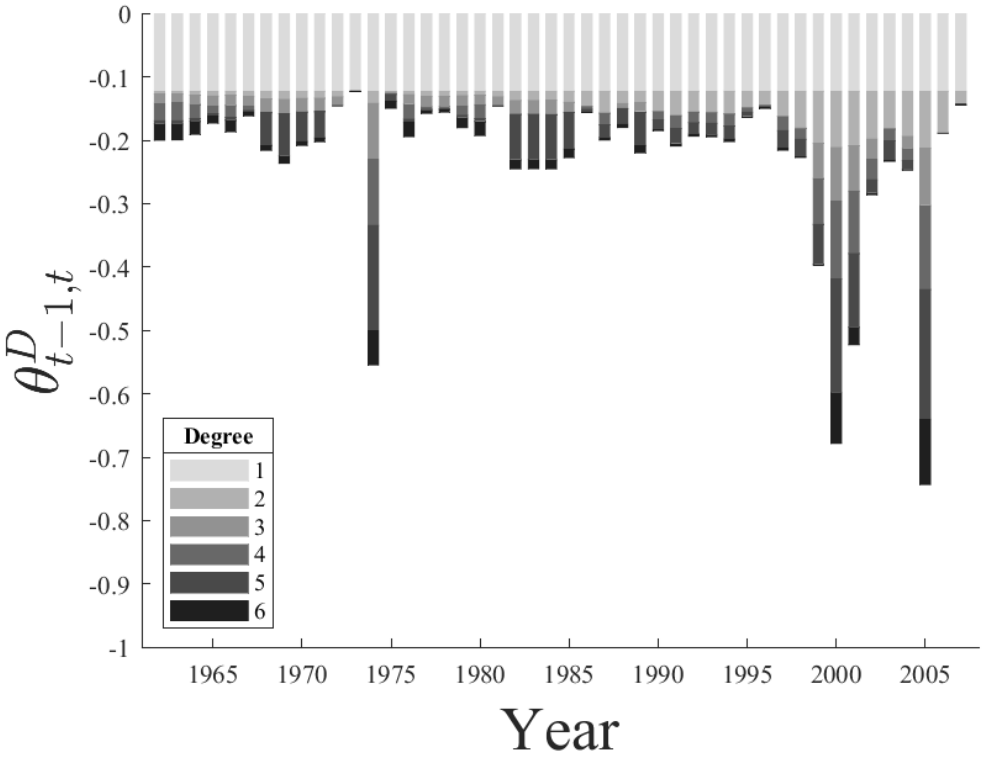
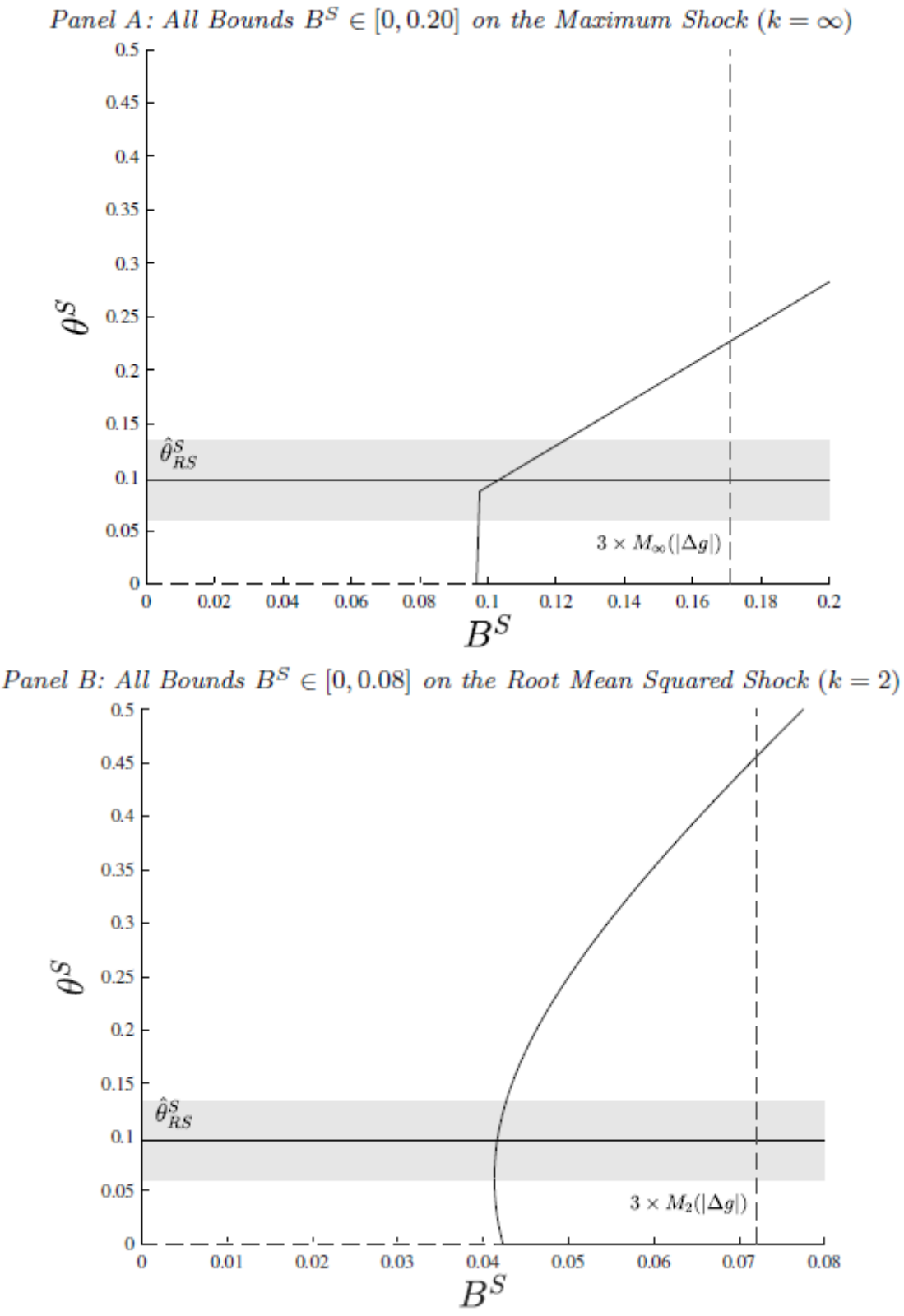

0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
$\theta^D_{t-1,t}$
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year

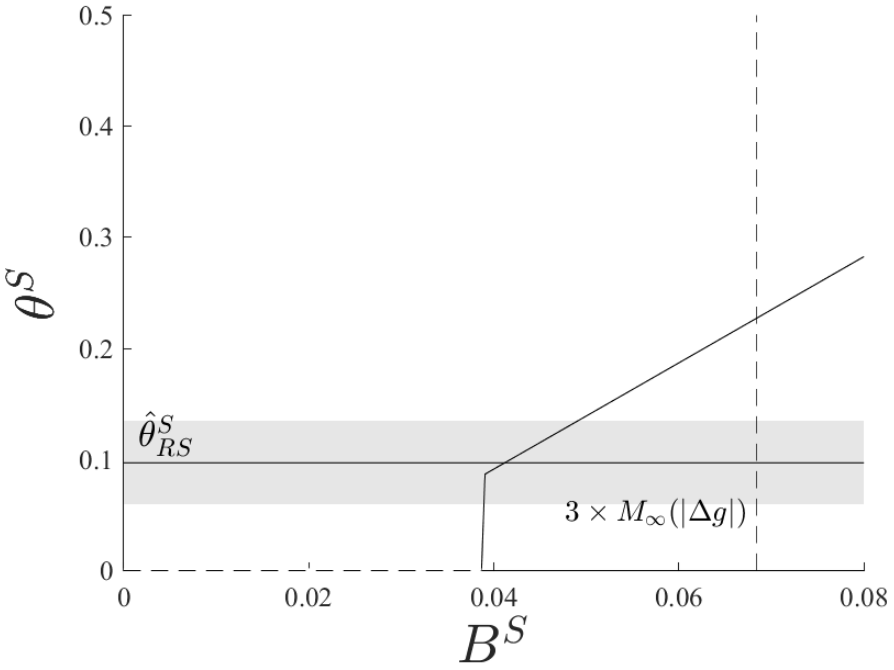

0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
$\theta^D_{t-1,t}$
Degree
1
2
3
4
5
6
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year

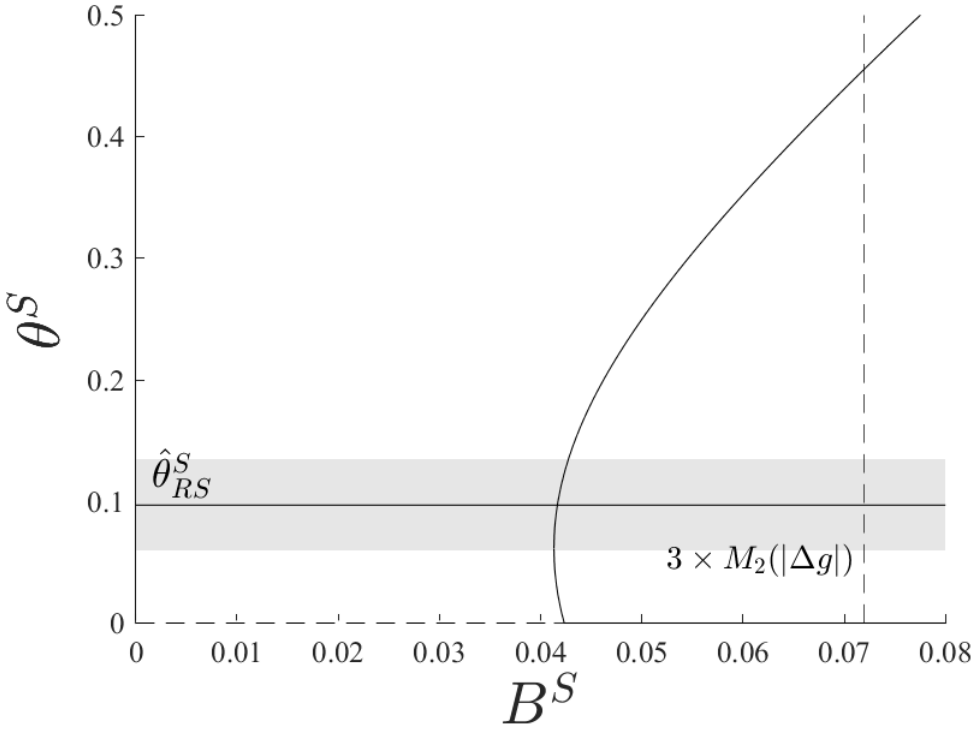
4.6. FIGURE A1. IMPLICATIONS OF BOUNDS ON SHOCKS TO WORLD SUPPLY OF FOOD GRAIN

Original:



Reproduced:

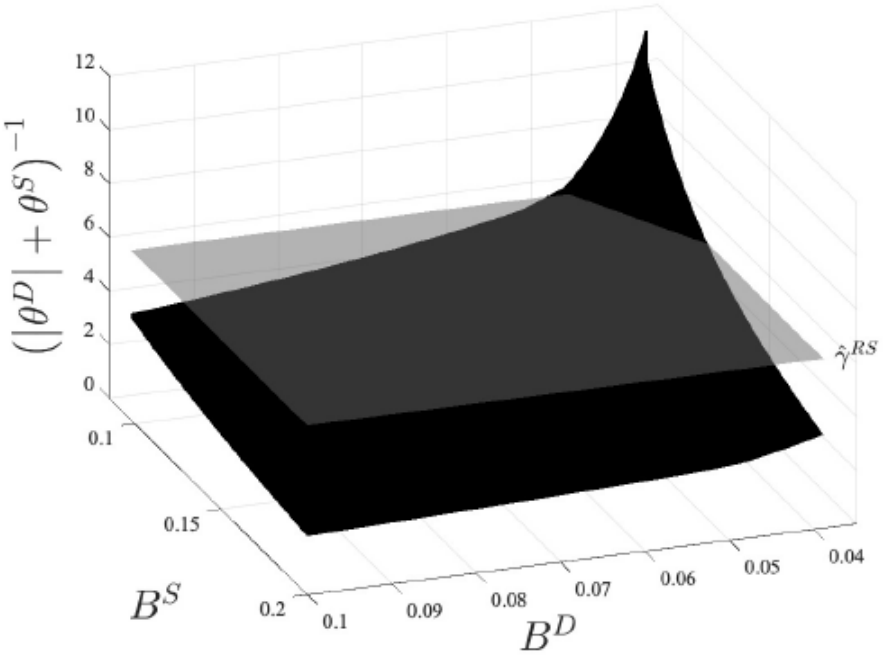

0.5
0.4
0.3
0.2
0.1
0
θ^S
$\hat{\theta}^S_{RS}$
$3 \times M_\infty(|\Delta g|)$
0
0.02
0.04
0.06
0.08
B^S


0.5
0.4
0.3
0.2
0.1
0
θ^S
$\hat{\theta}^S_{RS}$
$3 \times M_2(|\Delta g|)$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
B^S

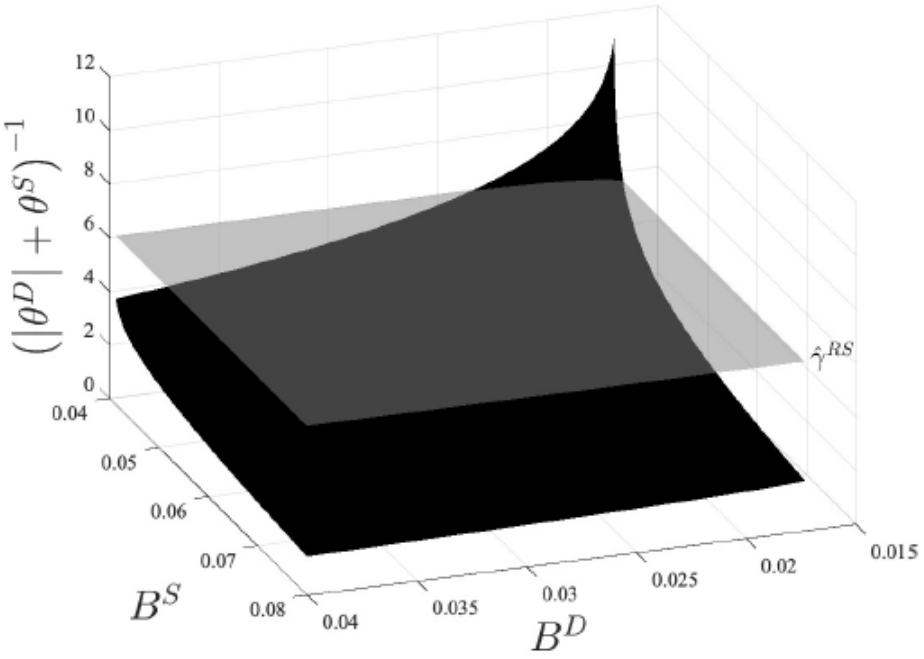
4.7. URE A2. IMPLICATIONS OF BOUNDS ON SHOCKS FOR THE MULTIPLIER PARAMETER

Original:

Panel A: Bounds on the Maximum Shock ($k = \infty$)



Panel B: Bounds on the Root Mean Squared Shock ($k = 2$)



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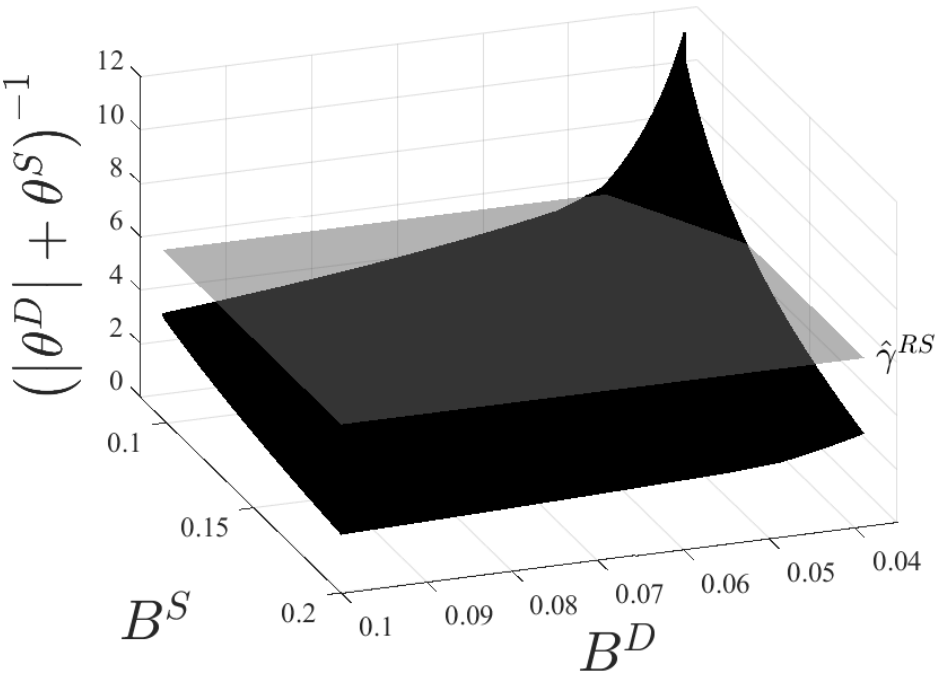
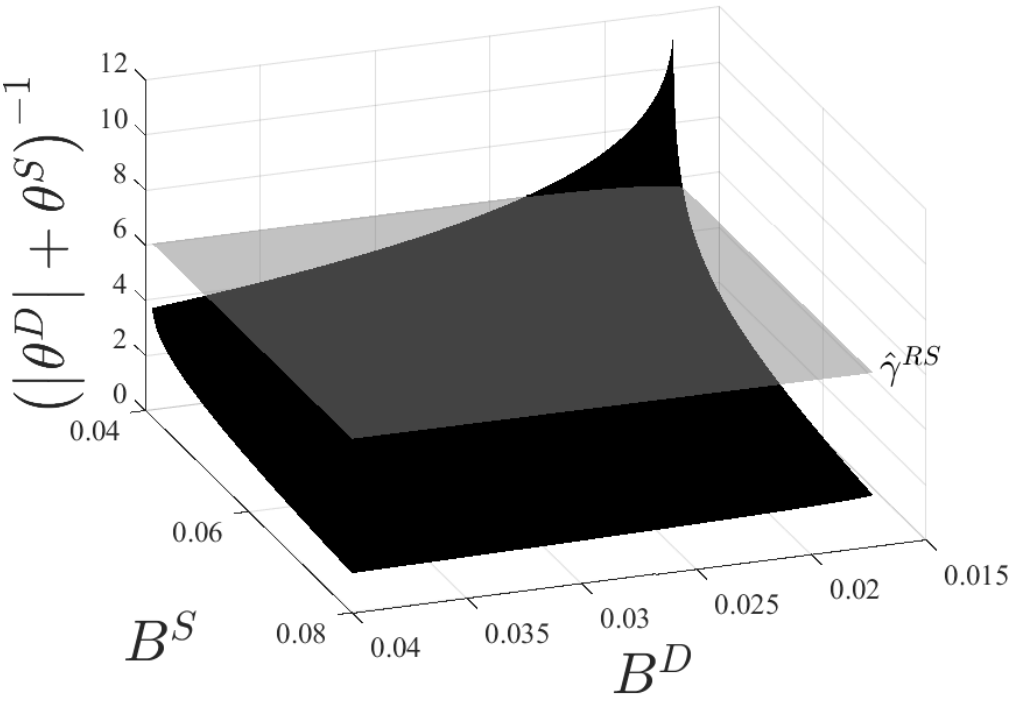
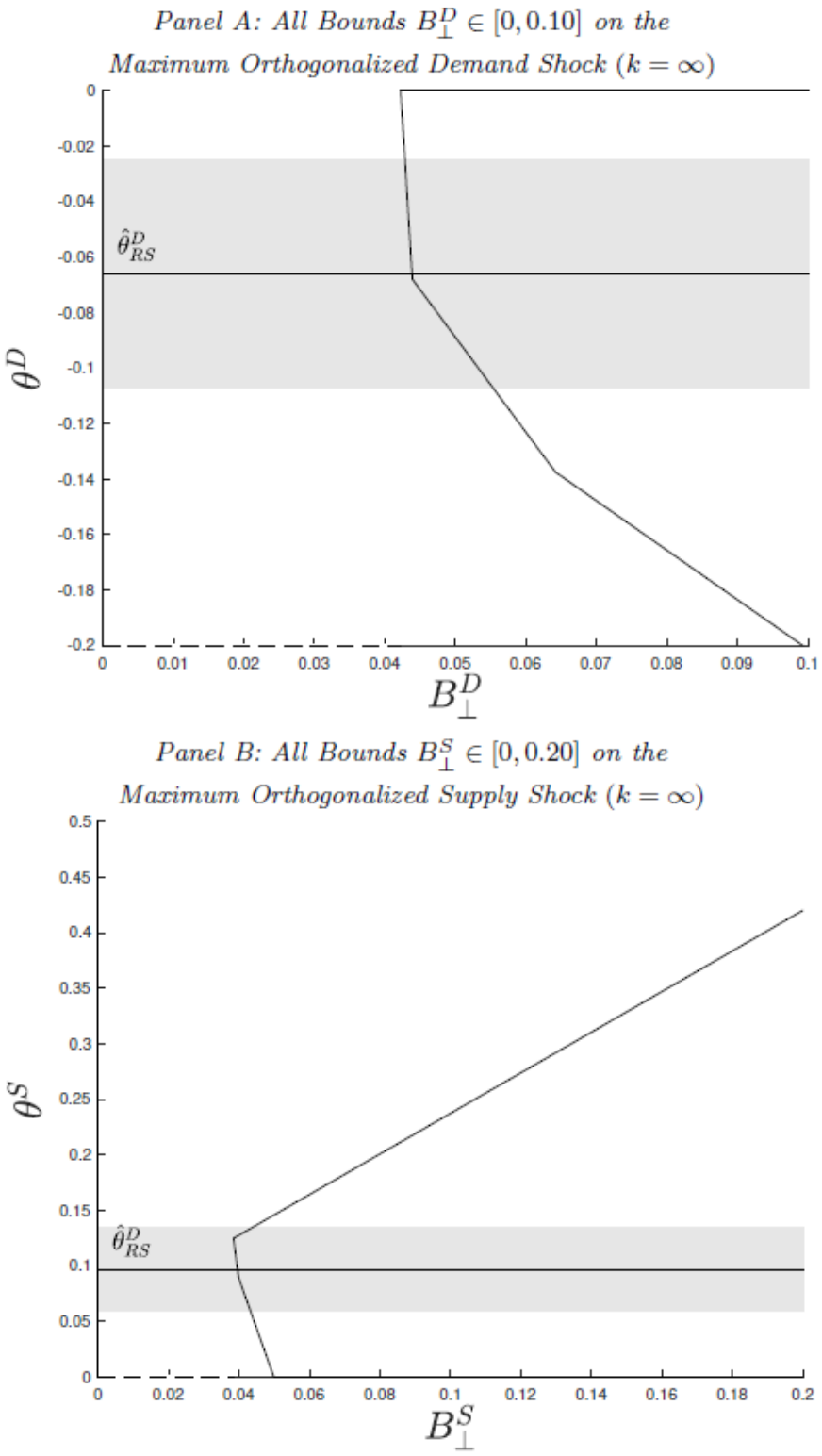

$\left(\left|\theta^D\right| + \theta^S\right)^{-1}$
12
10
8
6
4
2
0
0.1
0.15
B^S
0.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
B^D
$\hat{\gamma}^{RS}$

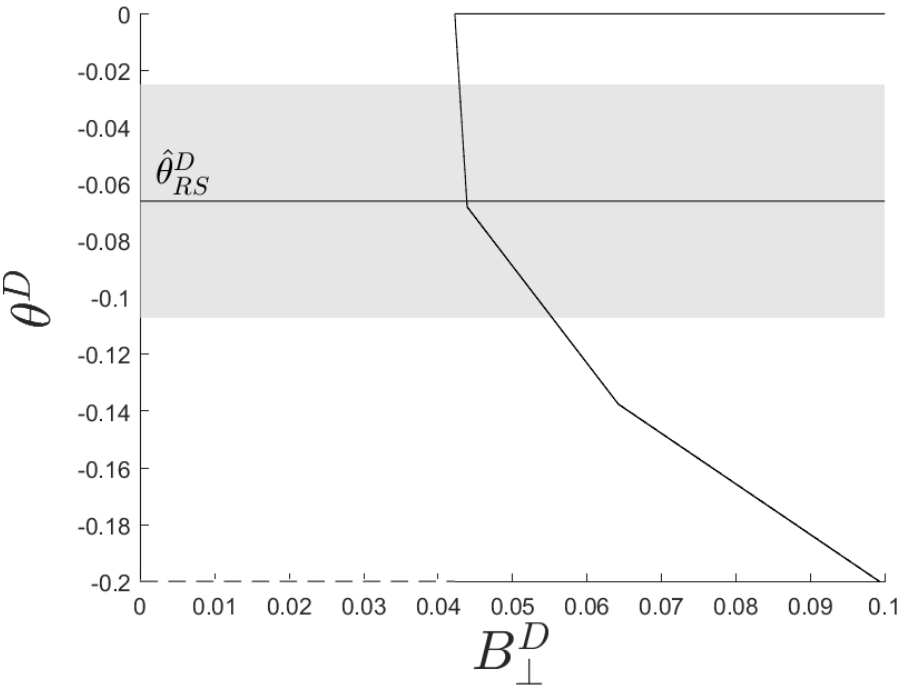

$\left(\left|\theta^D\right| + \theta^S\right)^{-1}$
12
10
8
6
4
2
0
0.04
0.06
B^S
0.08
0.04
0.035
0.03
0.025
0.02
0.015
B^D
$\hat{\gamma}^{RS}$

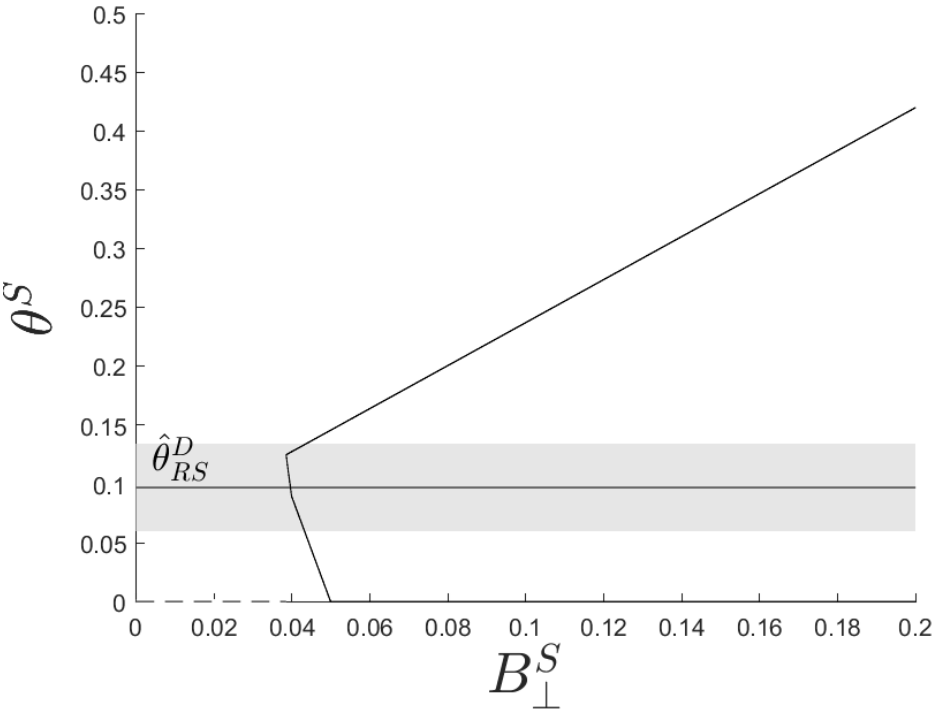
4.8. FIGURE A3. IMPLICATIONS OF BOUNDS ON ORTHOGONALIZED SHOCKS TO WORLD DEMAND AND SUPPLY FOR FOOD GRAIN

Original:



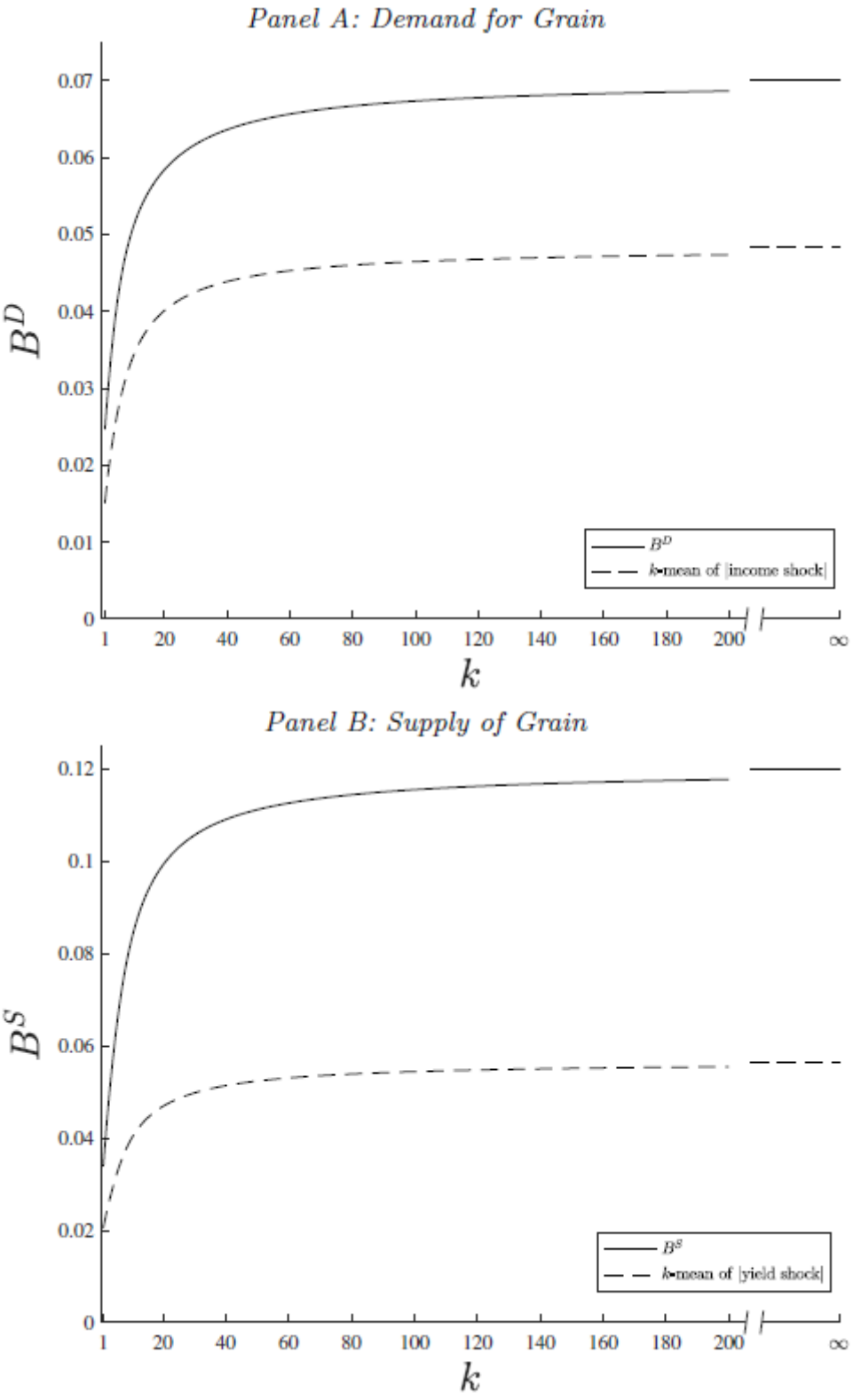
Reproduced:


0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
$\hat{\theta}^D_{RS}$
θ^D
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
$B^D_\perp$

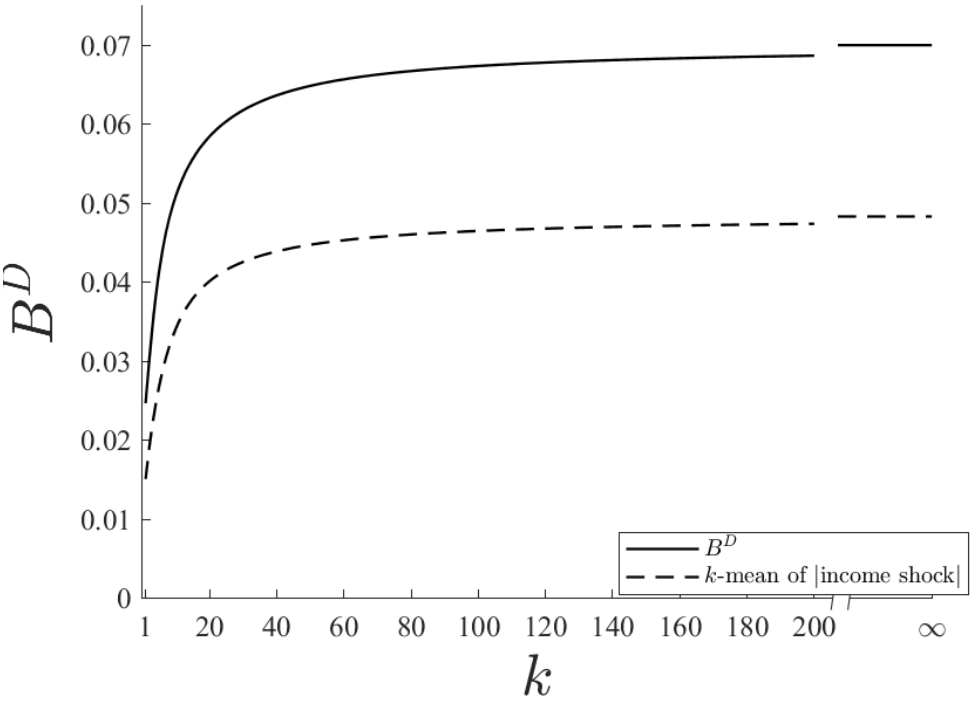

0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
$\hat{\theta}^D_{RS}$
θ^S
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
$B^S_\perp$

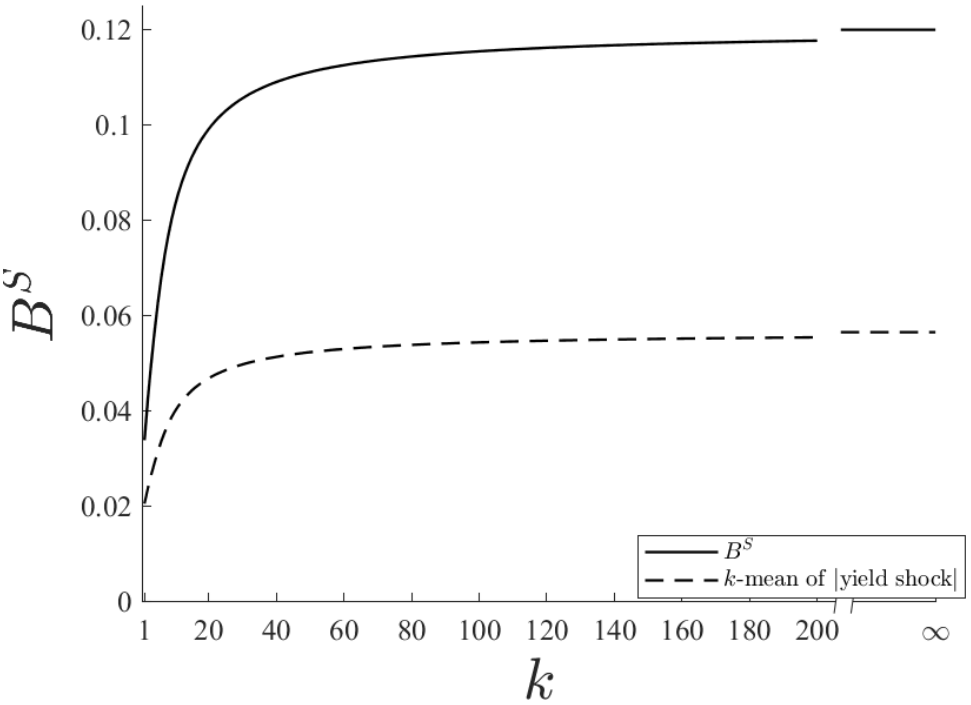
4.9. FIGURE A4. BOUNDS ON SHOCKS TO DEMAND AND SUPPLY OF GRAIN, VARYING K

Original:



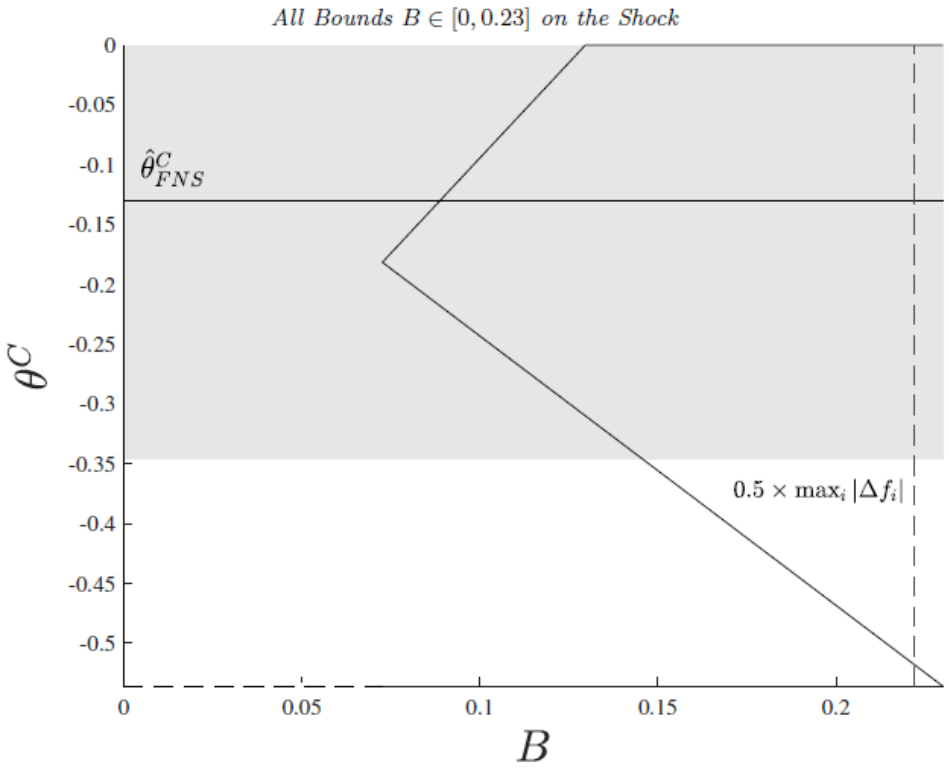
Reproduced:


0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
B^D
B^D
k-mean of |income shock|
1
20
40
60
80
100
120
140
160
180
200
∞
k


0.12
0.1
0.08
0.06
0.04
0.02
0
B^S
B^S
k-mean of |yield shock|
1
20
40
60
80
100
120
140
160
180
200
∞
k

4.10. FIGURE B1. IMPLICATIONS OF BOUNDS ON SHOCKS TO MALE EMPLOYMENT

Original:



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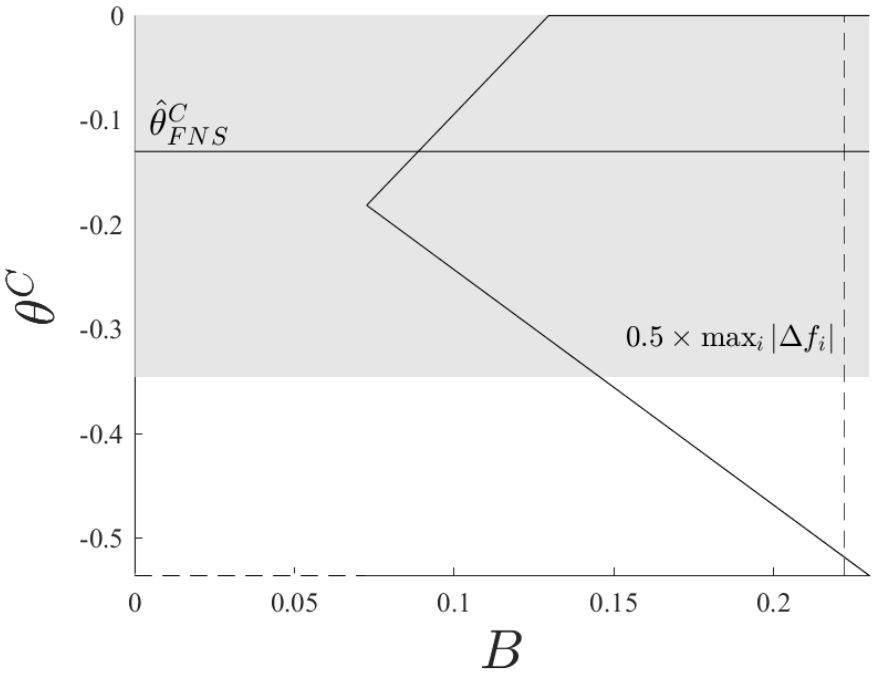
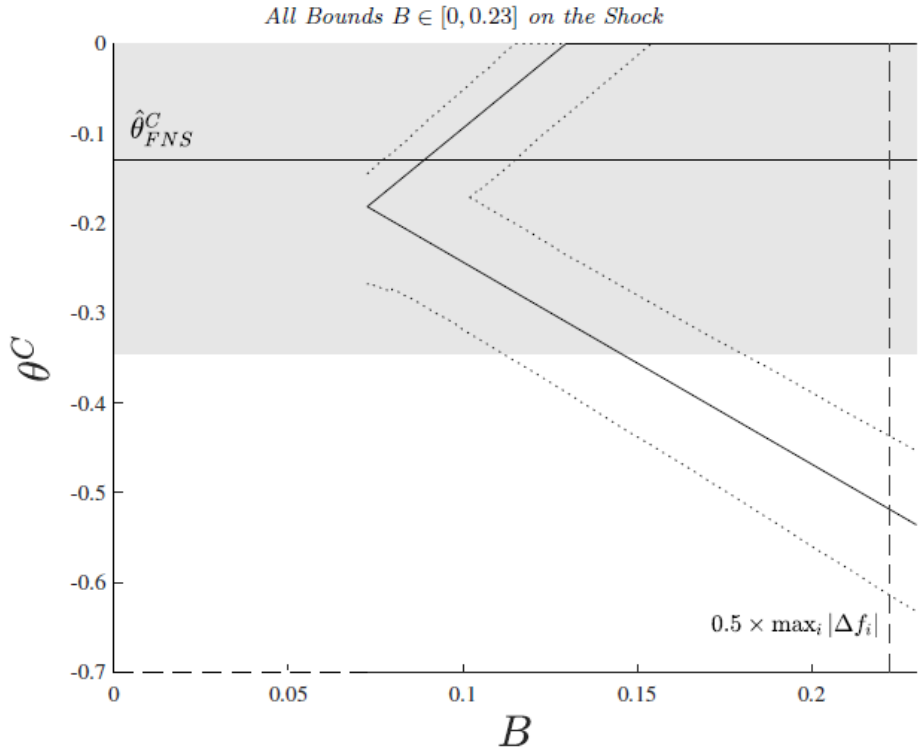
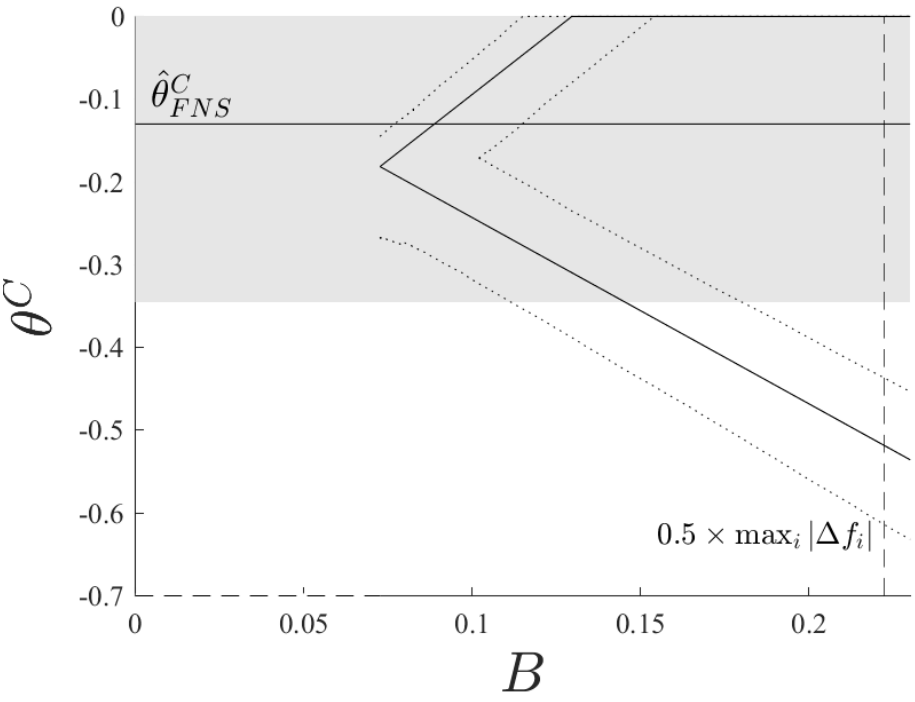


4.11. FIGURE B2. IMPLICATIONS OF BOUNDS ON SHOCKS TO MALE EMPLOYMENT, ACCOUNTING FOR SAMPLED DATA

Original:

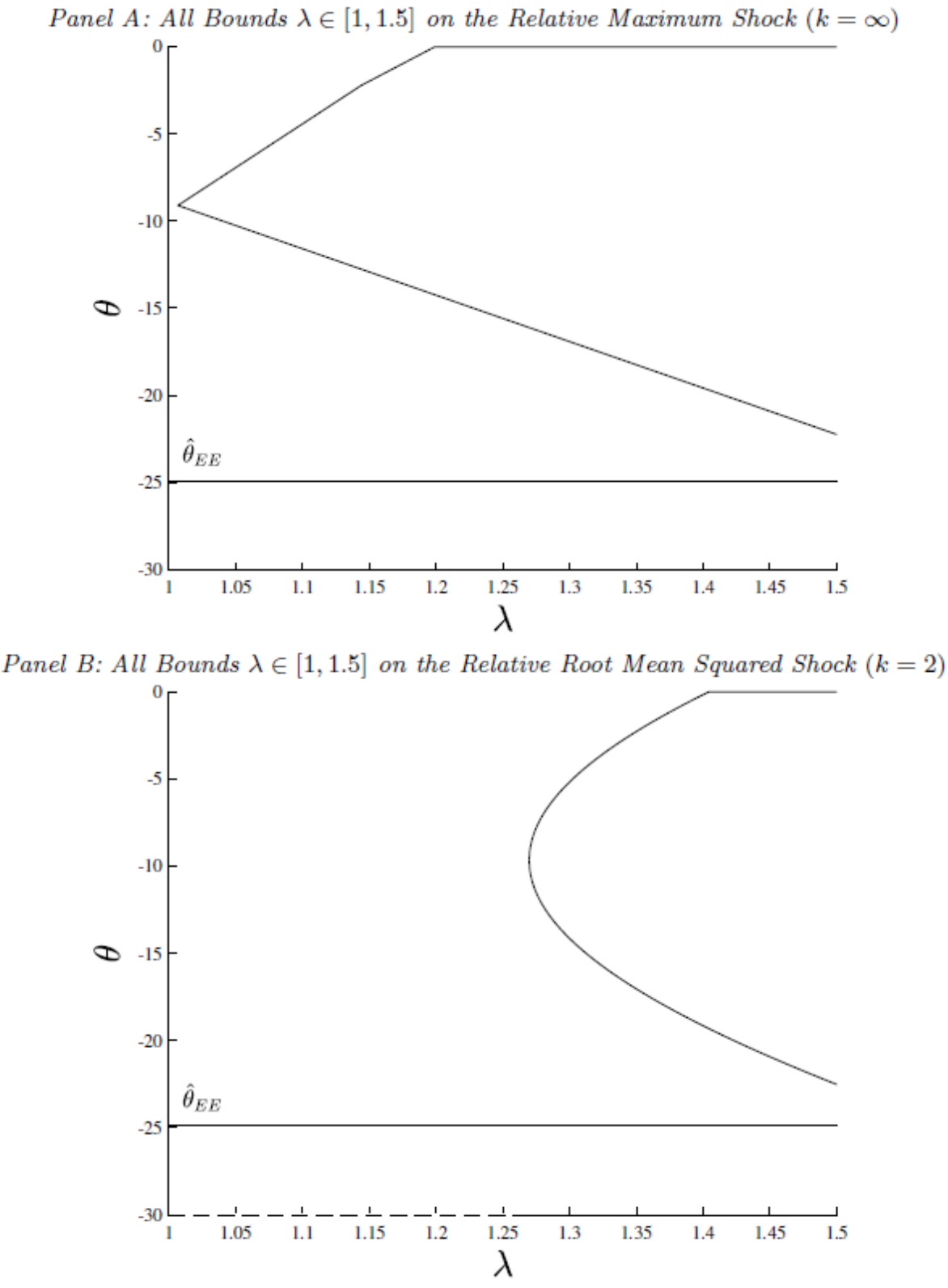


Reproduced:

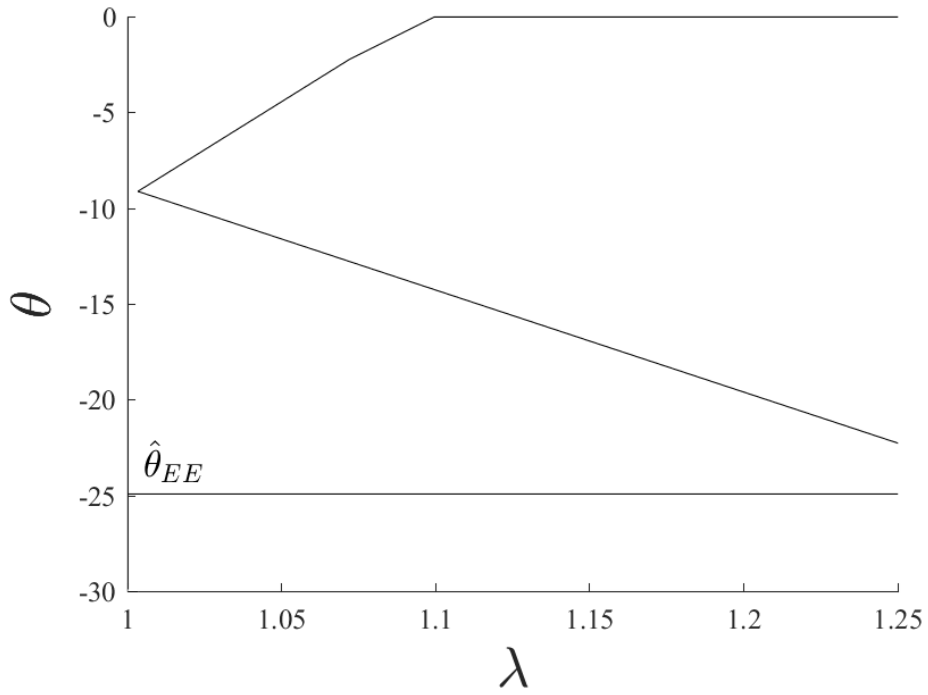


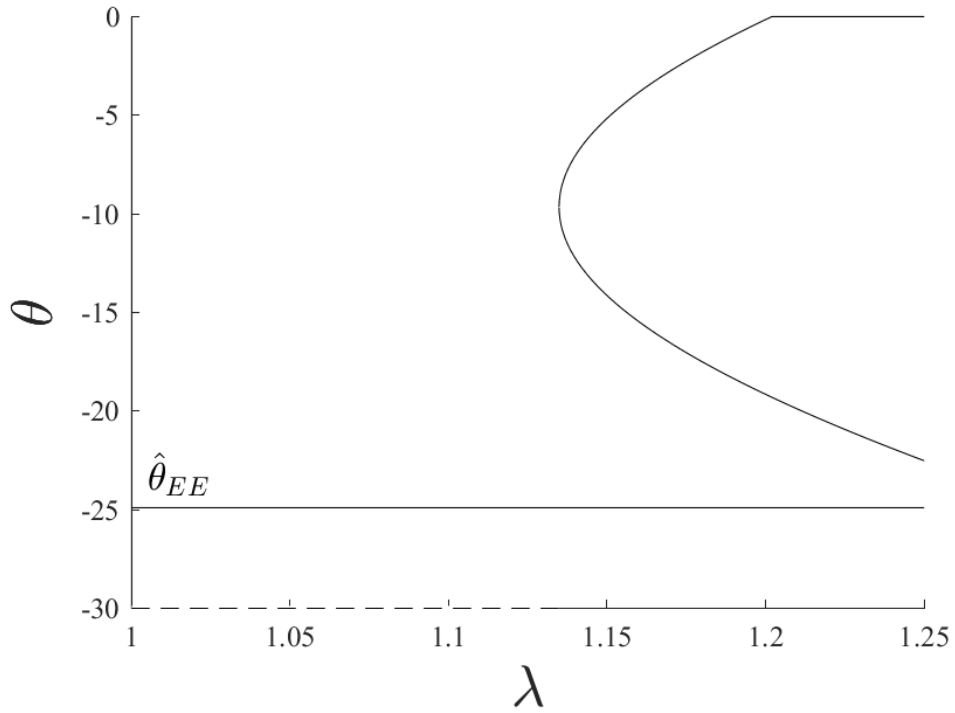
4.12. FIGURE C1. IMPLICATIONS OF BOUNDS ON SHOCKS TO MEMORY MODULE DEMAND

Original:



Reproduced:


0
-5
-10
-15
-20
-25
-30
θ
$\hat{\theta}_{EE}$
1
1.05
1.1
1.15
1.2
1.25
λ


0
-5
-10
-15
-20
-25
-30
θ
$\hat{\theta}_{EE}$
1
1.05
1.1
1.15
1.2
1.25
λ

elasticitylower	0.09	polysmallerd	89
elasticityupper	0.37	nochglambdatwo	0.72
maxshockupper	0.05	nochglambdainf	2.89
rmsshockupper	0.02	lambdainelastic	1.38
maxshocklower	0.01	lambdalimit	1.58
rmsshocklower	0.00	lambdagraph	1.5
maxshockyield	0.057	nosalelq	7
rmsshockyield	0.024	totaldays	343
sethetas	0.02	nopricechangelq	171
	46.00	medchange	0.27
maxbsupply	0.20	largestchange	0.44
sqrtmaxbs	0.08	thetafn	-0.13
maxbounds	0.12	setheta	0.11
absmaxthetas	0.13	cithetal	-0.35
maxabsshockselasts	0.57	cithetau	0.09
multlbound	3.97	maxbfns	0.23
sethetad	0.02	minboundfeas	0.07
maxbdemand	0.10	examplebound	0.14
sqrtmaxbd	0.04	examplelastl	-0.33
maxboundd	0.07	examplelastu	0.03
absmaxthetad	0.12	minboundthetafns	0.09
maxabsshockselastd	0.55	crowdingoutbound	0.13
multiplier	6.31		
bcovd	0.10		
bcovs	0.20		
rmaxuboundd	0.18		
cimultiplierl	4.6		
cimultiplieru	9.1		
thetad	-0.066		
thetas	0.097		
minbdinf	0.039		
minbdrmsnorm	0.017		
minbsinf	0.097		
minbsrmsnor	0.041		
cithetasl	0.060		
cithetasu	0.134		
cithetadl	-0.107		
cithetadu	-0.025		
maxthetas	0.130		
maxthetad	-0.122		
sqrtbounds	0.043		
sqrtboundd	0.030		
minbdmult	0.035		
minsqrtbdmult	0.015		
minsqrtbsmult	0.040		
minbsmult	0.085		
fracd	80		

5. REFERENCES

Ellison, Glenn and Sara Fisher Ellison. 2009 “Search, obfuscation, and price elasticities on the internet.” Econometrica 77(2): 427-52

Fukui, Masao, Nakamura, Emi, and Steinsson, Jón. 2020 “Women, wealth effects, and slow recoveries.” National Bureau of Economic Research Working Paper No. 25311. https://www.nber.org/system/files/working papers/w25311/revisions/w25311.rev2.pdf. Accessed on April 22 2022.

Roberts, Michael J. and Schlenker, Wolfram. 2013 “Identifying supply and demand elasticities of agricultural commodities: Implications for the US ethanol mandate.” American Economic Review 103(6): 2265-95.