This file contains the replication file for "Estimation and Inference with Weak, Semi-strong, and Strong Identification" by Donald W.K. Andrews and Xu Cheng.

All calculations are carried out using MATLAB (R2010a).

Programs

Figures:

(1) Figures_1_2_3_5_and_S1_to_S6.m: This program plots Figures 1, 2, 3, 5, and S-1 to S-6.

(2) Figures_4_and_S10.m: This program plots Figures 4 and S-10.

(3) Figures_6_7_and_S7_S8_S9.m: This program plots Figures 6, 7, S-7, S-8, and S-8.

(4) Figures_8_and_S26_to_S32.m: This program plots Figures 8 and S-26 to S-32.

(5) Figures_S11_to_S25.m: This program plots Figures S-11 to S-25.

Tables:

(6) Tables_S1_S2.m: This program generates data in Tables S-1 and S-2.

(7) Tables_S3_S4.m: This program generates data in Tables S-3 and S-4.

(8) Tables_S5_to_S10.m: This program generates data in Tables S-5 to S-10.

Functions

The functions below are used in the programs that plot figures and generate tables. The functions are organized by category.

Asymptotic Distributions for the ARMA(1,1) Model

(1) ARMA_Asy.m: This function simulates the asymptotic distributions of the estimators and the t and QLR statistics, calculates the asymptotic coverage probabilities of the standard, least favorable, and type 2 robust CIs with different κ values.

(2) cf_asy_qlr.m: This function calculates the asymptotic stochastic process for the restricted maximum likelihood criterion function.

(3) cf_asy_unres.m: This function calculates the asymptotic stochastic process for the unrestricted maximum likelihood criterion function.

Finite-sample Distributions for the ARMA(1,1) Model

(4) MA_F.m: For a given true value of the MA parameter, this function simulates the finite-sample distributions of the estimators and the t and QLR statistics, calculates the finite-sample coverage probabilities of the standard, least favorable, and type 2 robust CIs with different κ values.

(5) AR_F.m: For a given true value of the AR parameter, this function simulates the finite-sample distributions of the estimators and the t and QLR statistics, calculates the finite-sample coverage probabilities of the standard, least favorable, and type 2 robust CIs with different κ values.

(6) cf_pi.m: This is the maximum likelihood sample criterion function when beta is fixed at a given value. This criterion function is indexed by pi.

(7) cf_beta.m: This is the maximum likelihood sample criterion function when pi is fixed at a given value. This criterion function is indexed by beta.

(8) cf_theta.m: This is the unrestricted maximum likelihood sample criterion function.

Robust CI Calculation

(9) sizecorr.m: This function calculates the constants used for size correction for the type 2 robust CI.

(10) sfn.m: This is the smooth-transition function used by the type 2 robust CI.

(11) rejprob.m: This function calculates the rejection probability of the type 2 robust test for a given κ value.

(12) covprob.m: This function calculates the coverage probability of the standard, least favorable, and type 2 robust CIs with various κ values.

False Coverage Probabilities for the ARMA(1, 1) Model Used to Select κ

(14) MA_FCP.m: For a given true value of the MA parameter, this function simulates the finite-sample distributions of the t and QLR statistics under various null values of the MA parameter that are different from the true value.

(15) AR_FCP.m: For a given true value of the AR parameter, this function simulates the finite-sample distributions of the t and QLR statistics under various null values of the AR parameter that are different from the true value.

(16) fcp.m: This function computes the false coverage probability of the type 2 robust CIs for the MA (or AR) parameter.

LIML Model

(17) LIML_power.m: This function computes the power functions of the CLR test, the Type 2 robust QLR tests with null-imposed or unrestricted ICS statistics, the LM test, and the AR test.

(18) LIML_LF.m: This program computes the LF critical value and size correction factors for the type 2 robust CI.

(19) LIML_ICS.m: This function computes the unrestricted identification category selection (ICS) statistic.

(20) LIML_ST.m: This function computes the S and T statistics defined in (13.22) in the Supplemental Material.

Data

(1) LF_SizeCorrection.mat: This file contains the least favorable critical values and the size correction factors for the type 2 robust $|t|$ and QLR CIs. Codes that generate this file are provided in Tables_S1_S2.m. This file is used in the computation of the coverage probabilities and false coverage probabilities of the least favorable and type 2 robust CIs in various Figures and Tables. This file contains eight variables: (i) LF_abs_piV, (ii) LF_qlr_piV, (iii) abs_tau1, (iv) abs_tau2, (v) qlr_tau1, (vi) qlr_tau2, (vii) K_V, and (viii) pi_V. Variables (i) and (ii) are the least favorable critical values for the $|t|$ and QLR statistics, respectively. Both variables have two rows. The first row is the true value of the MA parameter (or AR parameter) and the second row is the corresponding least favorable critical value. Variables (iii) and (iv) are the size correction factors Δ_1 and Δ_2, respectively, for the type 2 robust $|t|$ CI. Variables (v) and (vi) are the size correction factors Δ_1 and Δ_2, respectively, for the type 2 robust QLR CI. Variables (iii) to (vi) are all matrices. Element (i,j) in each matrix is the size correction factor when the constant κ is the ith element of the vector K_V and the true value of the MA parameter (or AR parameter) is the jth element of the vector pi_V. Variables (vii) and (viii) are vectors of the constant κ and the true MA (or AR) parameter.

(2) CLR_CV.mat: This file contains the critical values for the CLR test documented in "Supplement to 'Optimal Two-sided Invariant Similar Test for Instrumental Variables Regression' " By Donald W.K. Andrews, Marcelo J. Moreira, and James H. Stock. These critical values are used to compute the power of the CLR test for the LIML model. The file contains one variable: CLR_CV. The first column is the conditional statistic, $\ln(Q_t/\kappa)$. The second to fifth columns are the 5% critical values when the number of interments, k, is 2, 5, 10, and 20, respectively.

Computation Time

The computation time for the figures and tables for the ARMA (1,1) model are determined by the computation time of the functions that involve data-generating and/or nonlinear optimizations. These functions include: ARMA_asy.m, MA_F.m, AR_F.m, MA_FCP.m, AR_FCP.m, LIML_power.m. For 100 simulation repetitions (which is not the number used in the paper), the computation times for these function are reported below. All computations are carried out on a PC with Intel(R)Core(TM)i7 2.93 GHz processor.

ARMA_asy.m: 4.3 minutes

MA_F.m: 37.0 minutes

AR_F.m: 53.3 minutes

MA_FCP.m: 7.1 minutes

AR_FCP.m: 9.9 minutes

LIML_power.m: 8.9 seconds