INTERINDUSTRY FORECASTING PROJECT

UNIVERSITY OF MARYLAND

Research Memorandum No. 4

TIME SERIES REgression WITH PLOT

By

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17 July 1967
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TISERP

This regression program is specifically designed for analysis of time series. Besides the usual statistics, it provides a plot of the actual and predicted values and partial derivatives of the regression coefficients with respect to one another. It reads variables one at a time in the order in which they are to be introduced, with the dependent variable read last. All observations on one variable are read before proceeding to the next. A variable may have several components; for example, if we wish to use per capita income as a variable but have series already punched only for income and population, we may have the machine make up the per capita series. We let income be the first component and direct that it should be added to the zero entry with which the program begins. Then population is the second component, and we direct that it should be divided into what is already in the variable. The description of the data cards explains the details. See also the comment cards in the program.

The TISERP deck is composed of three parts: a main program which loads the matrix of observations, X, into the computer, a REGRES subroutine which performs the regression and gives the results step-by-step if desired, and a PLOTER subroutine which plots the actual and predicted values. Actual values are plotted with an *; predicted, with a +. Plotter may be used independently of the other two for any time series plotting job, and REGRES and PLOTER may be used with any main program which forms the X matrix. With minor modification, REGRESS can be used for cross-section studies. The program follows closely the approach described in Matrix Methods in Economics by Clopper Almon (Addison-Wesley Publishing Co.), which should be read before asking any questions.
A listing of the Fortran accompanies this description.

1st card contains title of Regression

2nd card (613, 2 F10.10) contains

Number of Independent Variables (counting an intercept supplied by the pgm)

Number of Periods (or Observations)

Number of the variable after the introduction of which printed results are desired,

1 if the program is to supply the intercept; otherwise, a 0.

Last two digits of calendar date of year zero.

1 if the dependent variable is in logarithms. (otherwise zero).

Vertical coordinate of the bottom line of the graph.

Vertical interval on the graph. (The graph contains 120 intervals).

The variables are then stacked in order, the dependent variable last. In the deck of each variable there is

Title Card (I3, 12A6) containing

The number of components in this variable,

(+1 if the logs or first differences are to be taken.)

The name of the variable

For each component there is a

Code and format card (I3, 12A6) containing

The code for what is to be done with this component: 1 add,

2 subtract, 3 multiply, 4 divide, 5 take logs of what is in the column already.

Format for the data

Data for the component.
GENERAL REGRESSION LOADING PROGRAM

COMMON NP,NIV,X(50,8),P(50,2),TITLE(13),A(8,8)
DIMENSION VARTIT(12),FMT(13),O(50)

10 DO 2 I = 1,50
   DO 2 J = 1,8
      Y(I,J) = 0.
      WRITE (5,10) (TITLE(I), I = 1,13)
   WRITE (6,11) (TITLE(I), I = 1,13)
20 FORMAT(13A6)
11 FORMAT(1H1,13A6)
   READ (5,15) NIV,NP,ISTART,INTCNP,10,LOGS,XBOT,XINT
   WRITE (6,15) NIV,NP,ISTART,INTCNP,10,LOGS,XBOT,XINT
   DO 40 N = INT,NP1
      READ (5,20) NCOMP,N(VARTIT(I),I = 1,12)
      WRITE (6,20) N,N(VARTIT(I),I = 1,12)
30 FORMAT(13,12A6)
   DO 36 W = 1,NCOMP
      READ (5,20) NCODE,FMT(I),I = 1,12
      IF NCODE = 1 ADD TO THIS COMPONENT
      2 SUBTRACT THIS COMPONENT
      3 MULTIPLY BY THIS SERIES
      4 DIVIDE BY THIS SERIES
      5 TAKE LOGARITHMS AND ADD
      6 TAKE LOGARITHMS AND SUBTRACT
      7 TAKE FIRST DIFFERENCE OF PRECEDING SERIES READ ONLY YEAR
      0 ZERO OBSERVATION UN FIRST 12 COLUMNS OF FOLLOWING CARD
      IF IT IS DESIRED TO MULTIPLY THE COMPONENT BY A CONSTANT BEFORE PUTTING
      IT IN JUST ADD 10 TO NCODE AND PUT THE CONSTANT IN THE FIRST 12
      COLUMNS OF THE FIRST CARD AFTER THE COMPONENT.
      IF NCODE = 7 25,27,29
      IF NCODE = 10 (5,FMT)(Q(I), I = 1,NP)
      IF NCODE = 20 READ (5,22)
22 FORMAT(15A0)
   24 DO 40 I = 1,NP
      Q(I) = Q(I)*W
      NCODE = NCODE - 10
   26 GO TO (31,32,33,34,35,36),NCODE
31 DO 31 I = 1,NP
   31 P(I) = X(I,N) + Q(I)
   32 GO TO 29
32 DO 32 I = 1,NP
   32 X(I,N) = X(I,N) - Q(I)
   33 GO TO 29
33 DO 33 I = 1,NP
   33 X(I,N) = X(I,N) + Q(I)
   34 GO TO 29
34 DO 34 I = 1,NP
   34 X(I,N) = X(I,N) / Q(I)
   35 GO TO 29
35 DO 35 I = 1,NP
   35 X(I,N) = A LOG (Q(I))
SUBROUTINE REGRES(ISTART, INTCEP, IO, TAXIS, YINT, LOGS)
C
C REGRESSION WITH PLOTTING OF PREDICTED VALUES.
C N IS THE NUMBER OF INDEPENDENT VARIABLES INCLUDING THE INTERCEPT
C IF IT IS TO BE SUPPLIED. NO IS THE NUMBER OF OBSERVATIONS.
C ISTART IS THE NUMBER OF THE VARIABLE AFTER THE INTRODUCTION
C OF WHICH PRINTED RESULTS ARE DESIRED
C INTCEP IS 1 IF YOU WANT THE PROGRAM TO SUPPLY AN INTERCEPT, OTHERWISE 0.
C IO IS THE YEAR 0 OF THE GRAPH
C TAXIS AND YINT ARE THE ORDIATE OF THE BOTTOM OF THE GRAPH AND THE
C VERTICAL INTERVAL (OF WHICH THERE ARE 115) RESPECTIVELY.
C LOGS = 1 IF THE DEPENDENT VARIABLE IS IN LOGS AND YOU WANT THE
C PLOTTING DONE IN THE ORIGINAL UNIT, OTHERWISE PUT LOGS = 0.
C X IS THE MATRIX OF OBSERVATIONS, WITH THE DEPENDENT VARIABLE IN
C COLUMN N + 1.
C COMMON NO, N, X(50, 8), P(50, 2), TITLE(13), A(8, 8)
C DIMENSION S(8)
C NP1 = N + 1
C INT = INTCEP + 1
C 110 WRITE (6, 111) ((X(I, J), J = 1, NP1)
C 111 FORMAT (AF13.5)
C YEAR = 0.
C IF (INT - 1) 13, 13, 113
C IF AN INTERCEPT IS TO BE SUPPLIED, TAKE MEANS AND DEVIATIONS FROM
C MEANS. FIX FIRST ROW AND COLUMN OF A AS IT WOULD BE AFTER
C PIVOT ON FIRST VARIABLE WHEN THAT IS A CONSTANT 1.0.
C 112 XNO = NO
C 113 DO 115 J = 2, NP1
C A(I, J) = 0.
C DO 114 I = 1, NO
C A(I, J) = A(I, J) + X(I, J)
C A(I, J) = A(I, J) / XNO
C A(J, I) = - A(I, J)
C DO 115 I = 1, NO
C 116 X(I, J) = X(I, J) - A(I, J)
C A(I, J) = 1 / XNO
C YEAR = A(I, NP1)
C FORM CROSS-PRODUCTS MATRIX, XPRIMEX
C 12 DO 14 J = INT, NP1
C DO 14 J = 1, NP1
A(I,J) = 0.0
DO 14 KI = 1, NO
14 A(I,J) = A(I,J) + X(KI, I) * X(KI, J)
C RECORD THE MEAN OF THE SQUARED DEVIATIONS OF THE DEPENDENT
C VARIABLE. IT IS USED IN CALCULATION OF RRARSO.
C
T = NO - 1
SSDY = A(NP1, NP1)/T
RRARSO = 0.
IF(INTECF. EQ. 1) GO TO 19
YBAR = 0.
DO 17 I = 1, NO
17 YBAR = YBAR + X(I, NP1)
T = NO
YBAR = YBAR/T
SSDY = 0.
DO 18 I = 1, NO
18 SSM = SSM + (X(I, NP1) - YBAR)**2
T = NO - 1
SSDY = SSM/T
YBAR = 0.
C INVERSION
C
10 DO 100 I = INT, N
TM1 = T - 1
T = A(I, I)
A(I, I) = 1.
DO 20 K = 1, NP1
20 A(K, I) = A(I, K)
21 IF(TM1) 23, 23, 21
22 DO 22 K = 1, TM1
23 A(K, I) = - A(K, I)/T
24 DO 26 J = 1, NP1
25 T = A(J, I)
26 A(J, K) = A(J, K) - A(I, K)* T
27 CONTINUE
C ARE WE READY FOR OUTPUT TO BE PRINTED/ NO, YES, YES
IF(I = START) 100, 31, 31
28 WRITE (6, 5) (TITL(K), K = 1, 12), TAXIS, YINT
6 FORMAT (1H1, 12A6, 7H0TAXIS = F12.3, 6H YINT = F10.4)
C COMPUTE RSS
T = NO - 1
RSS = 1. - A(NP1, NP1)/(T*SSDY).
C COMPUTE RRARSO IF INTERCEPT HAS BEEN SUPPLIED.
IF(INTECF = 1) 34, 34, 33
32 T = NO - 1
RRARSO = 1. - A(NP1, NP1)/(T*SSDY)
C REGRESSION COEFFICIENTS ARE IN [A(J, NP1), J = 1, I]
34 WRITE (6, 35) I, A(NP1, NP1), RRARSO, RSS, (A(J, NP1), J = 1, I)
C COMPUTE STANDARD ERRORS OF REGRESSION COEFFICIENTS
DO 32 J = 1, I
37 S(J) = SORT (A(J, J) * A(NP1, NP1)/T)
WRITE (6, 36) S(J), J = 1, I
35 FORMAT (1H0T13, 11H VAR SSR = F16.8, 9H RRARSO = F8.4, 6H RSS = F8.4/
*24 FORMAT ( 1X, 9(1H, (E11.6, 1H)))
"W" = W
*25 FORMAT (6, 39)
COMPUTE PARTIAL DERIVATIVES OF REGRESSION COEFFICIENT WITH
RESPECT TO EACH OTHER.
DO 28 J = 1, 1
J(J) = J - 1
DO 27 K = 1, J + 1
27 S(K) = A(K, J) / A(J, J)
DO 28 K = J + 1
28 WRITE (6, 381) (S(K), K = 1, 1)
*29 FORMAT (9F14.6)
30 FORMAT (66HC) PARTIAL DERIVATIVES OF REGRESSION COEFFICIENTS WITH RESPECT TO
EACH OTHER 
DM = 0.
DO 40 L = 1, NO
P(L, 1) = YLR
P(L, 2) = X(L, NP1) + YLR
DO 40 K = 1, L + 1
40 P(L, 1) = P(L, 1) + A(K, NP1) * X(L, K)
IF (L.EQ.1) GO TO 402
DM = DM + ((P(L, 2) - P(L, 1)) - (P(L - 1, 2) - P(L - 1, 1))) ** 2
402 CONTINUE
DM = DM / A(NP1, NP1)
WRITE (6, 401) DM
*31 FORMAT (16H00URPRIN-MATSON = F6.2)
TE (LOGS) 44, 74, 47
41 DO 42 L = 1, NO
P(L, 1) = EXP (P(L, 1))
42 P(L, 2) = EXP (P(L, 2))
43 WRITE (6, 451) (P(L, 1), L = 1, NO)
WRITE (6, 461) (P(L, 2), L = 1, NO)
*32 FORMAT (12H1PREDICTIONS/(10F12.3))
*33 FORMAT (9H0ACTUAL /(10F12.3))
CALL PLOTER(P, NO, 2, TATIS, YINT, 10)
100 CONTINUE
RETURN
END
*34 FC PLOT 500
*35 SUBROUTINE PLOTER (X, NO, NV, XBOT, XINT, 10)
C THIS MATRIX OF TIME SERIES TO BE PLOTED, EACH SERIES IN A COLUMN, NO =
NUMBER OF OBSERVATIONS, NV = NUMBER OF VARIABLES, XBOT = BOTTOM LINE OF GRAPH
XINT = INTERVAL BETWEEN BEING 115 OF THEM, 10 IS INITIAL DATE
C WARNING
IF THIS ROUTE IS USED TO PLOT MORE THAN ONE SERIES, YOU MUST BE SURF
THAT THESE STATEMENT FOR X HERE HAS THE SAME NUMBER OF
ROWS AS THE CORRESPONDING MATRIX IN THE CALLING PROGRAM.
C DIMENSION X(50, 4), A(125), DQT(4), LJ(4)
DATA OUT=BLANK, (DOT(I)) = 1*4/1HA, 1H, 1H*, 1H**1H*1H*1H*/
1 DO 5 I = 1, 125
5 A(I) = BLANK
M = 1
6 DO 10 I = 1, 125, 10
10 A(I) = DOT(I)
   WRITE (6, 13) (A(I), I = 1, 125)
13 FORMAT (5X, 125A1)
   GO TO (14, 100), M
14 DO 15 I = 1, 125, 10
15 A(I) = BLANK
   DO 30 T = 1, NO
   DO 25 J = 1, NV
   L = (X(T, J) - XROT/EINT) + 1.
   IF (125 < L) 21, 23, 23
21 A(125) = OUT
   LJ(J) = 125
   GO TO 25
22 IF (L) 22, 22, 24
22 A(I) = OUT
   LJ(J) = 1
   GO TO 25
24 A(I) = DOT(J)
   LJ(J) = L
25 CONTINUE
   INDATE = 10 + 1
   WRITE (6, 12) INDATE, (A(K), K = 1, 125)
12 FORMAT (1HO, 14, 125A1)
   DO 26 J = 1, NV
   L = LJ(J)
26 A(I) = BLANK
   CONTINUE
   M = 2
   GO TO 6
100 RETURN
END