PDL

PDL and Shiller Lag Variables:
varname(*degree*,*# lags*,NONE or FAR or NEAR or BOTH,XIPRIOR)

Function:

PDL variable specification may be used for a right hand side variable in any linear estimation procedure (OLSQ, INST, LIML, AR1, PROBIT and TOBIT). It constrains the coefficients on the lags of that variable to lie on a polynomial of the degree specified. The Shiller lag uses the XIPRIOR argument to relax this constraint somewhat. For a full description of Shiller lags, see section 4.7.3 of the *TSP 4.3 User's Guide***.**

Usage:

You may include a PDL (polynomial distributed lag) specification anywhere in the list of right hand side variables in an OLSQ, INST, or AR1 equation. There is no explicit limit on the number of right hand side variables which may contain a PDL specification. The form of a PDL variable is the name of the variable whose lags you want in the model, followed by parentheses containing three items: the number of terms in the polynomial (the degree plus one), the number of lags of the variable to be included (including the zeroth lag), and what kind of end-point constraint you place on the polynomial.

The polynomial distributed lag is a method for including a large number of lagged variables in a model, while reducing the number of coefficients which have to be estimated by requiring the coefficients to lie on a smooth polynomial in the lag. The purpose of the constraints is to force the lag coefficients at either end of the lags over which you are estimating to go to zero, that is, the NEAR constraint forces the coefficient of the first lead to zero, while the FAR constraint forces the coefficient of the lag one past the last included lag to zero. The BOTH and NONE constraints are self-explanatory.

The number of coefficients which are estimated for a PDL variable are the number of terms in the polynomial less the number of constraints. This must be positive and less than or equal to the number of lags in the unconstrained model. For a long, totally unconstrained distributed lag, an implicit list (-) is best. For example, the following are equivalent:

```
OLSQ CONS72 C GNP72 GNP72(-1)-GNP72(-15);

OLSQ CONS72 C GNP72(16,16,NONE);

OLSQ CONS72 C GNP72 GNP72(-1) GNP72(-2) GNP72(-3) GNP72(-4) GNP72(-5) GNP72(-6) GNP72(-7)
    GNP72(-8) GNP72(-9) GNP72(-10) GNP72(-11) GNP72(-12) GNP72(-13) GNP72(-14) GNP72(-15) ;
```

Examples:

```
OLSQ I,C,GNP(4,16,FAR) ;
```

specifies a distributed lag on GNP which covers 16 periods where the lag coefficients are constrained to lie on a third degree polynomial and go to zero at the 16th lag.

PDL

```
OLSQ I C GNP(4,16,FAR) R(4,24,NEAR) ;
```

adds another distributed lag in R which covers 24 periods and is constrained to go to zero at the first lead.

PDL variables can also be used with INST and AR1:

```
INST I C GNP(3,5,NONE) INVR C LM LM(-1) LM(-2) ;
AR1 (METHOD=CORC) CONS C GNP (3,5,NONE) ;
```

The instrumental variable estimation specifies just enough instruments for the number of independent variables which will appear in the estimation: the constant and 3 weighted combinations of GNP and its lags.

Output:

The coefficients of PDL variables are estimated by forming linear combinations of the underlying lags and including these variables in the regression. The estimates of their coefficients are not easily interpreted, and so TSP "unscrambles" these results for each PDL variable after the regression and presents the estimates in terms of the original variable and its lags.

The results begin with a title 'Distributed Lag Interpretation for: variable name,' followed by the estimated mean lag and its standard error, computed as the average lag weighted by the lag coefficients. If any of the lag coefficients are less than zero, this quantity does not have very much meaning. The estimated sum of the lag coefficients and its standard errors are also shown. Both these standard errors are computed by taking into account the covariance of the estimates of the lag coefficients.

Following these summary statistics a table and a plot of the individual lag coefficients is printed. This table also shows the standard errors of the estimates and plots standard error bands around the lag coefficients. These coefficients are also stored in data storage with the following names:

Name	Type	Length	Variable Description
@SLAG	scalar	1	Sum of the lag coefficients.
@MLAG	scalar	1	Mean lag.
@LAGF	vector	#lags	Estimated lag coefficients after "unscrambling".
@PDL1,2,...	series	#obs	Scrambled rhs variables.

Method:

PDL estimates are obtained by forming linear combinations of the underlying variable and its lags, with weights determined by the order of the lag polynomial and the value of the constraint options. These "scrambled" variables are used as regressors, and then "unscrambled" after estimation to obtain the implied lag coefficients. Further details are given in the *TSP User's Guide* and Almon (1965). The method TSP uses is described in Cooper (1972). It uses Lagrangian interpolation polynomials that are orthogonal, in order to minimize multicollinearity problems.

References:

Almon, Shirley, "The Distributed Lag between Capital Appropriations and Expenditures," **Econometrica 33,** January 1965, pp. 178-196.

Cooper, J. Phillip, "Two Approaches to Polynomial Distributed Lags Estimation: An Expository Note and Comment,"

The American Statistician, June 1972, pp. 32-35.

Hall, Robert E., "Polynomial Distributed Lags," Econometrics Working Paper No. 7, Department of Economics, MIT, July 1967.

Shiller, Robert, "A Distributed Lag Estimator Derived from Smoothness Priors,", **Econometrica** 41, 1973, pp. 775-787.