Almonreg 0.3

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First off, I should say that this is a rather trivial package, mostly intended for my own use in testing certain aspects of package management in gretl. That said, maybe somebody might find it useful.

1 The Almon lag model

This package esimates an Almon lag or PDL (Polynomial Distributed Lag) model.[1] This model can be a useful way of reducing the number of parameters to be estimated in the distributed lag model given by

$$y_t = \sum_{i=0}^{p} \beta_i x_{t-i} + \cdots + \varepsilon_t \tag{1}$$

where the ellipsis indicates the possible presence of regressors besides the lags of x.

In the Almon approach we assume that the $p + 1$ coefficients $\{\beta_i\}$ can be represented by the ordinates of a polynomial $P(i)$ of degree q, with q less than p. In that case we can write

$$\beta_i = P(i) = \sum_{j=0}^{q} \gamma_j i^j \qquad i = 0, \ldots, p \tag{2}$$

The equations (2) may be written out explicitly as

$$\begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_p \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & \cdots & 1 \\ 1 & 2 & 4 & \cdots & 2^q \\ 1 & 3 & 9 & \cdots & 3^q \\ \vdots & \vdots & \vdots & & \vdots \\ 1 & p & p^2 & \cdots & p^q \end{bmatrix} \begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \\ \vdots \\ \gamma_q \end{bmatrix}$$

Substituting from (2) into (1) we get

$$\begin{aligned} y_t &= \sum_{i=0}^{p} \sum_{j=0}^{q} \gamma_j i^j x_{t-i} + \cdots + \varepsilon_t \\ &= \sum_{j=0}^{q} \gamma_j z_{jt} + \cdots + \varepsilon_t \end{aligned} \tag{3}$$

where $z_{jt} = \sum_{i=0}^{p} i^j x_{t-i}$. We can think of the z_js as "artificial regressors," which can be constructed quite easily given the time series for x. The procedure is then to run an OLS regression of y on the z_js plus any other regular regressors. With estimates of $\gamma_0, \ldots, \gamma_q$ in hand, we can use (2) to compute estimates of the β_is. Standard errors for these estimates can be obtained via the delta method.

[1] I need to acknowledge D. S. G. Pollock, from whose exposition of the Almon lag this section is basically stolen—see `http://www.le.ac.uk/users/dsgp1/COURSES/TOPICS/Almonlag.pdf`.

2 The implementation

3 Command-line use

The function available for command-line and scripting use is named `almonreg`. It returns a bundle (to be described below) and takes the following arguments:

name	*type*	*comment*	*default value*
y	series	the dependent variable	–
x	series	for PDL treatment	–
p	integer	the maximum lag	4
q	integer	the degree of the polynomial	2
c	boolean	include a constant?	1 (yes)
X	list	additional regressors	null
quiet	boolean	quiet operation?	0 (no)

We illustrate a call to this function by reference to the sample script included in the package, which replicates the analysis of Almon (1965). This script begings with

```
include almonreg.gfn
open almon.gdt --frompkg=almonreg
```

The data file `almon.gdt` contains two quarterly time series running from 1952Q1 to 1966Q4, namely `ce` (capital expenditures) and `ca` (capital appropriations). These are National Industrial Conference Board data, a variant of the data used by Shirley Almon. The next two lines generate a list, `X`, containing dummy variables representing the first, second and third quarters, to allow for seasonality.

```
genr dummy
list X = dq1 dq2 dq3
```

We then select the lag and polynomial orders and invoke `almonreg`, saving the result.

```
scalar p = 5 # maximum lag length
scalar q = 2 # order of Almon polynomial
bundle B = almonreg(ce, ca, p, q, 1, X)
```

If we hadn't wanted to include seasonal dummies the function call could have been abbreviated to

```
bundle B = almonreg(ce, ca, p)
```

in which case the model would have used $q = 2$ and included a constant, these being the defaults.

4 GUI use

References

Almon, S. (1965) 'The distributed lag between capital appropriations and expenditures', *Econometrica* 33(1): 178–196.