Distributed Lag Model: Agricultural Supply Examples

The following are very simple examples of hog supply models with naive expectations. The models illustrate reasonable model fitting practice. The results can be used to calculate elasticities. The data are from 1960-1996 and the models also include a trend variable which is not reported and are corrected for serial correlation.

**Example 1:** This example uses the hog-corn price ratio for the six previous years with a third-order polynomial to explain variations in hog supply. This model is used to identify how long it takes producers to respond to price incentives.

$$\begin{array}{lcccc}
HOGS_t = & 8411 & +\ 87.62\ (HP/CP)_{t-1} & +\ 105.83\ (HP/CP)_{t-2} & +\ 73.07\ (HP/CP)_{t-3} \\
 & (3807) & (44.8) & (48.9) & (54.3) \\
 & 0.0369 & 0.0620 & 0.0406 & 0.1913
\end{array}$$

$$\begin{array}{cccc}
+\ 23.15\ (HP/CP)_{t-4} & -\ 10.12\ (HP/CP)_{t-5} & +\ 7.06\ (HP/CP)_{t-6} & R^2=0.8440 \\
(55.9) & (53.2) & (49.2) & \\
0.6824 & 0.8506 & 0.8871 &
\end{array}$$

where $HOGS_t$ = Hog Supply in Year t (Thousand Head),
$(HP/CP)_t$ = Hog-Corn Price Ratio in Year t.

**Example 2:** This example uses the hog price and the corn price for the previous four years to explain variations in hog supply. A third-order polynomial with a back endpoint restriction. Supply elasticities can be calculated from these results.

$$\begin{array}{lccccc}
HOGS_t = & 16286 & +\ 38.4968P_{t-1} & +\ 43.67\ HP_{t-2} & +\ 30.17\ HP_{t-3} & +\ 11.21\ HP_{t-4} \\
 & (3119) & (18.18) & (22.26) & (17.57) & (19.56) \\
 & 0.0001 & 0.0448 & 0.0614 & 0.0988 & 0.5346
\end{array}$$

$$\begin{array}{ccccc}
-\ 767.0\ CP_{t-1} & -\ 925.6\ CP_{t-2} & -\ 657.6\ CP_{t-3} & -\ 252.6\ CP_{t-4} & R^2=0.8884 \\
(441.3) & (317.4) & (264.1) & (332.8) & \\
0.0950 & 0.0076 & 0.0201 & 0.4552 &
\end{array}$$

where $HOGS_t$ = Hog Supply in Year t (Thousand Head),
$HP_t$ = Deflated Hog Price in Year t ($/cwt.),
$CP_t$ = Deflated Corn Price in Year t ($/bu.).

**Summary**

Four lags on each price. Longer lags are insignificant and including them does not impact the results that are presented.

Using four lags and a third-order polynomial results in OLS results -- it's like using no restriction.

Third-order polynomial:
$\omega$-hp (0.6348) $\omega$-cp (0.7251) R-Square: 0.8901

Third-order polynomial with back endpoint restriction to zero:
$\omega$-hp (0.6328) $\omega$-cp (0.6411)
$\beta$-hp (0.6604) $\beta$-cp (0.6452) R-Square: 0.8884

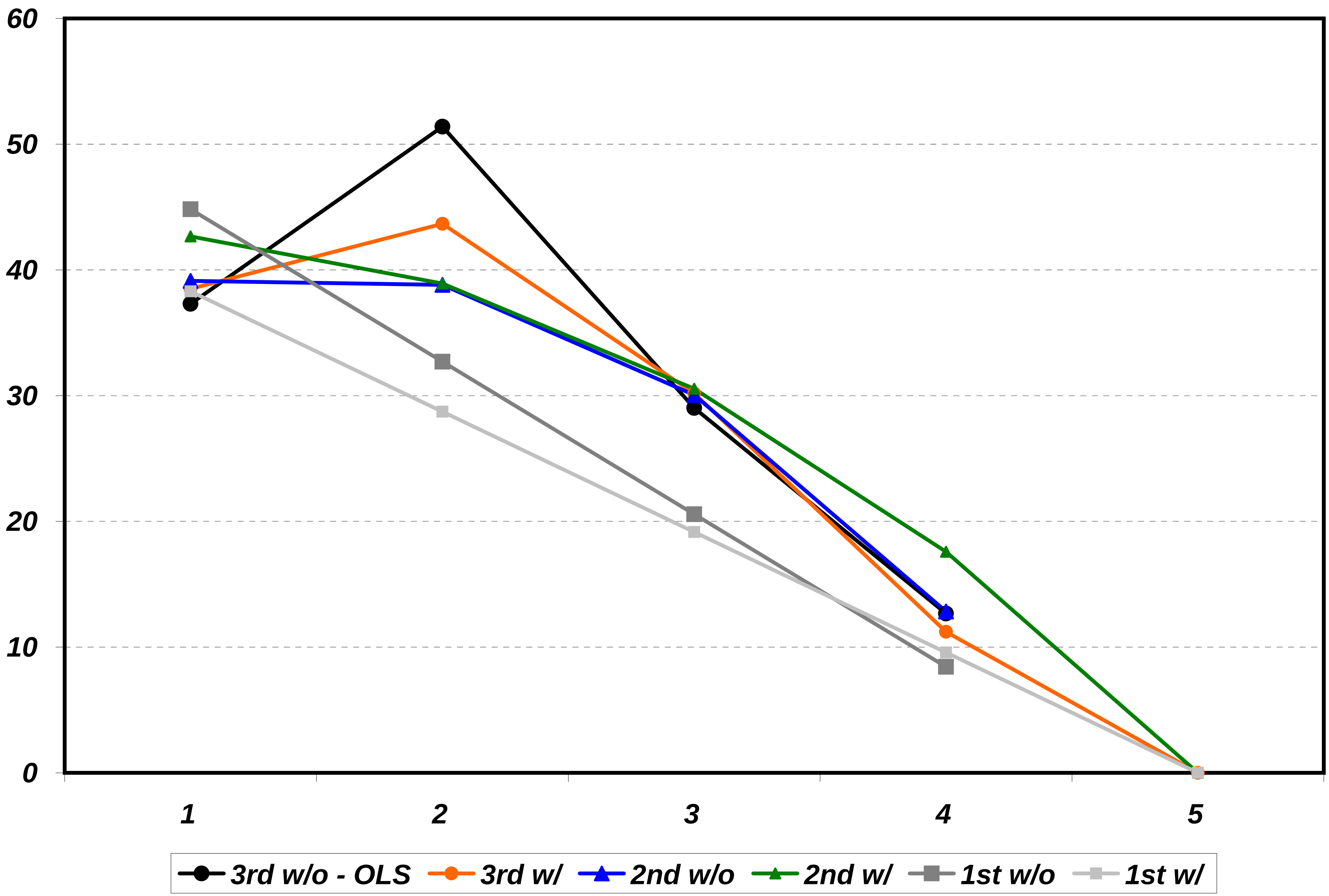
Second-order polynomial:
$\omega$-hp (0.6396) $\omega$-cp (0.4424) R-Square: 0.8869

Second-order polynomial with back end-point restriction to zero:
$\omega$-hp (0.6037) $\omega$-cp (0.2861)
$\beta$-hp (0.5365) $\beta$-cp (0.4383) R-Square: 0.8839

First-order polynomial:
$\omega$-hp (0.1492) $\omega$-cp (0.2046) R-Square: 0.8801

First-order polynomial with back end-point restriction to zero:
$\omega$-hp (0.0152) $\omega$-cp (0.0024)
$\beta$-hp (0.8113) $\beta$-cp (0.5972) R-Square: 0.8779

So which model is best? We want the constraints/restrictions to be binding but not too binding.



60
50
40
30
20
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0
1
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5
3rd w/o - OLS
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