Economics 312 **Spring 2012**
Daily Problem #23 **March 9**

Note: This problem uses HGL's dataset ex9-13.dta, which is also used for several exercises in Chapter 9. The data are weekly data on advertising and sales for a Midwest department store. The advertising variable in this dataset was also used as x *in your first Monte Carlo exercise.*

The following table gives an OLS regression of the model $sales_t = \alpha + \beta_0 adv_t + \beta_1 adv_{t-1} + \gamma sales_{t-1} + e_t$.

```
. reg sales l.sales l(0/1)adv

      Source |       SS       df       MS              Number of obs =     156
-------------+------------------------------           F(  3,   152) =   48.99
       Model |  209.251815     3  69.750605            Prob > F      =  0.0000
    Residual |  216.413032   152  1.42376995           R-squared     =  0.4916
-------------+------------------------------           Adj R-squared =  0.4816
       Total |  425.664847   155  2.74622482           Root MSE      =  1.1932

------------------------------------------------------------------------------
       sales |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       sales |
         L1. |   .1430939   .0733045     1.95   0.053    -.0017333    .2879211
             |
         adv |
         --. |   2.818347   .8228803     3.42   0.001     1.192588    4.444107
         L1. |   3.540486   .9384818     3.77   0.000     1.686333    5.394638
             |
       _cons |   17.52318   1.731551    10.12   0.000     14.10217    20.94419
------------------------------------------------------------------------------
```

1. Give an assessment of this regression. Do the signs and magnitudes of the coefficients seem reasonable? What additional information would you like to have to determine whether it accurately captures the dynamic relationship between advertising and sales?

2. Use the estimated coefficients to get a point estimate of the "impact multiplier" $\frac{\partial sales_t}{\partial adv_t}$.

3. Calculate the first 5 dynamic "*s*-period delay" multipliers $\frac{\partial sales_t}{\partial adv_{t-s}}$ and the corresponding cumulative "interim multipliers" $\sum_{\tau=0}^{s} \frac{\partial sales_t}{\partial adv_{t-\tau}}$. Is the pattern what you would expect?

4. Calculate the long-run "total multiplier" $\sum_{\tau=0}^{\infty} \frac{\partial sales_t}{\partial adv_{t-\tau}} = \lim_{s\to\infty} \sum_{\tau=0}^{s} \frac{\partial sales_t}{\partial adv_{t-\tau}}$.

Suppose that we are concerned about possible autocorrelation of the error term, so we rerun this regression with Newey-West (HAC) standard errors. The result (using four lags) is

```
. newey sales l.sales l(0/1)adv , lag(4)

Regression with Newey-West standard errors          Number of obs  =       156
maximum lag: 4                                      F(  3,    152)  =     44.99
                                                    Prob > F       =    0.0000

------------------------------------------------------------------------------
             |             Newey-West
       sales |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       sales |
         L1. |   .1430939   .0663963     2.16   0.033     .0119152    .2742726
             |
         adv |
         --. |   2.818347   .7823502     3.60   0.000     1.272663    4.364032
         L1. |   3.540486   1.064071     3.33   0.001     1.438208    5.642764
             |
       _cons |   17.52318   1.648464    10.63   0.000     14.26632    20.78004
------------------------------------------------------------------------------
```

5. Stock and Watson argue that the appropriate number of lags to use for the Newey-West approximation to the error covariance matrix is $m = \frac{3}{4}\sqrt[3]{T}$. Does the choice of four lags seem appropriate here? How, if at all, does using the Newey-West standard errors change our results?