

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		
Model	209.251815	3	69.750605	F(3, 152) = 48.99		
Residual	216.413032	152	1.42376995	Prob > F = 0.0000		
Total	425.664847	155	2.74622482	R-squared = 0.4916		
				Adj R-squared = 0.4816		
				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” $\sum_{\tau=0}^{\infty} \frac{\partial sales_t}{\partial adv_{t-\tau}} = \lim_{s \rightarrow \infty} \sum_{\tau=0}^s \frac{\partial sales_t}{\partial adv_{t-\tau}}$.

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
maximum lag: 4

Number of obs = 156
F(3, 152) = 44.99
Prob > F = 0.0000

	Coef.	Newey-West 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 $m = \frac{3}{4}\sqrt{T}$. Does the choice of four lags seem appropriate here? How, if at all, does using the Newey-West standard errors change our results?