

# ECOM20001: Econometrics 1

## Tutorial 12: Time Series Regression

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### *A. Getting Started*

Please create a Tutorial12 folder on your computer, and then go to the LMS site for ECOM 20001 and download the following files into the Tutorial12 folder:

- [tute12.R](#)
- [tute12\\_petrol.csv](#)

The first file is the R code for tutorial 12, the second file is the .csv file that contains the dataset for the tutorial.<sup>1</sup> The dataset has the following 3 variables:

- **week**: week of the year in 2013, from week 1 (start of January) to week 48
- **search**: number of website hits on the online petrol price reporting platform Fuelwatch: <https://www.fuelwatch.wa.gov.au/>
- **price**: average retail petrol price in a week in Perth, WA
- **cost**: average wholesale petrol cost in a week in Perth, WA

In total, the dataset contains this information for 48 weeks in 2013 in Perth.

### *B. Go to the Code*

With the R file downloaded into your Tutorial12 folder, you are ready to proceed with the tutorial. Please go to the [tute12.R](#) file to continue with the tutorial.

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<sup>1</sup> The reference for these data is Byrne, D. and N. De Roos (2017): "Consumer Search in Retail Gasoline Markets," *Journal of Industrial Economics*, 65(1), pp. 183-193.

### C. Questions

Having worked through the [tute12.R](#) code and graphs, please answer the following:

1. Construct the following variables:

- First and second lags of **search**, **price**, and **cost**
- First difference of **search**, **price**, and **cost**
- First and second lags of the first difference of **search**, **price**, and **cost**
- Dummy variables for the four quarters (or seasons) of the year

Explain why any lags, differences, or seasonal dummies that you constructed do not have observations.

2. Construct the following two time series plots and provide a brief interpretation of your findings:

- Plot 1: **price** and **cost** on the vertical axis, **week** on the horizontal axis
- Plot 2: **search** on the vertical axis, **week** on the horizontal axis

3. Compute autocorrelation functions for **price**, **cost**, and **search** and the first differences of **price**, **cost**, and **search**.

- Briefly comment on the persistence of these variables both in levels (the first 3 autocorrelations plots) and in first differences (the second 3 autocorrelations plots).
- What does first differencing do to the autocorrelations?

4. Run three separate regressions where in each respective regression the dependent variable is **price**, **cost**, and **search**, and where the regressors in each regression are the quarter dummy variables you constructed in question 1.

- Interpret the regression coefficients, and explain how you have avoided the dummy variable trap in the regressions.
- Do your results suggest seasonal differences in the levels of any of the dependent variables?

5. Estimate the following set of 8 time series regressions below, where **search** is the dependent variable in each. Briefly interpret your results in each in terms of

their economic and statistical significance. Also compute the BIC and AIC for each model, and conclude which model would be chosen based on these two information criteria.

- AR(1) with **search**
  - AR(1) + seasonal dummies with **search**
  - AR(2) + seasonal dummies with **search**
  - ADL(0,2) + seasonal dummies with **search** and **price**
  - ADL(1,1) + seasonal dummies with **search** and **price**
  - ADL(1,2,2) + seasonal dummies with **search**, **price**, and **cost**
6. Using the ADL(1,1) + seasonal dummies you estimated in question 5, compute the predicted values from the regression, which yield the within-sample forecasts of **search** for each week.
- Plot your within-sample forecasts for **search** against the actual **search** values that were realised and comment on your results. Do any weeks yield particularly poor within-sample forecasts?
  - What is the sample average and standard deviation of the within-sample forecast error?
7. Using the ADL(1,1) + seasonal dummies model you estimated in question 5, compute the out-of-sample forecast for **search** in week 49 of 2013 (e.g., one week after the sample ends) and the 95% confidence interval for this forecast.
8. Using the ADL(1,2,2) + seasonal dummies with **search**, **price**, and **cost** model you estimated in question 5, conduct a Granger Causality test to determine whether **price** Granger causes **search**.