Fall 2020

MKT6971

Exercise 1

Durbin Watson

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This exercise focuses on the Durbin Watson test. Answer the following short answer questions. Show all your work – **remember to cut and paste results into your exercise.**

1. **What is the issue using multiple regression on a data set that is ordered by time? What bad thing happens?**

* The issue with using multiple regression on data that is ordered by time is **serial autocorrelation** – correlated or dependent errors. If the errors are correlated, you will not see them flip flop back and forth across the zero line as time goes on (this is a problem). As a result, this suggests a deflated standard error for the regression coefficient.

1. **Pick one of the data sets provided (retail 1 to retail 6). Open the data in GRETL. Plot the time series data set. Does your examination by Mark I eyeball suggest that the problem that you mention in answer #1 above is present? Why or why not?**

**Data Set:** 03. Retail 3.gdt

**Time Series Data Plot** (Left) and **Regression** **Residuals** **Plot** (Right):

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The problem mentioned in #1 doesn’t appear to be present. It appears that serial autocorrelation does **not** exist in the data because there is a “flip flop” in the errors across the zero line as time goes on. It looks like we may have uncorrelated error terms.

1. **Using the Durbin Watson tables for alpha = .05 and tell me what the DL and DU boundaries are.**

**# of observations:** 34 (days)

**# of Independent Variable(s)**: 1 (sales)

**DL:** 1.393

**DU:** 1.514

1. **Run OLS regression on the data set and obtain the Durbin Watson statistic. What is the value?**

Model 1: OLS, using observations 2011-05-16:2011-06-18 (T = 34)

Dependent variable: sales

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* |  |
| const | 15180.8 | 1125.64 | 13.49 | <0.0001 | \*\*\* |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mean dependent var | 15180.76 |  | S.D. dependent var | 6563.580 |
| Sum squared resid | 1.42e+09 |  | S.E. of regression | 6563.580 |
| R-squared | 0.000000 |  | Adjusted R-squared | 0.000000 |
| Log-likelihood | −346.5723 |  | Akaike criterion | 695.1446 |
| Schwarz criterion | 696.6710 |  | Hannan-Quinn | 695.6652 |
| rho | 0.138212 |  | **Durbin-Watson** | **1.706250** |

**Durbin-Watson Statistic:** 1.706250

1. **Compare the Durbin Watson statistic to the boundaries in question #3. What is your conclusion?**

The Durbin-Watson Statistic is **above** the upper limit, so we do not reject the null hypothesis; therefore, there is no serial autocorrelation.

* + **Null:** No serial autocorrelation – the errors are independent
  + **Alternative:** There is serial autocorrelation – correlation between the errors

1. **Randomly pick another retail data set from retail1 to retail6. Repeat steps 2 through 5 for that data set.**

**Data Set:** 05. Retail 5.gdt

**Time Series Data Plot** (Left) and **Regression** **Residuals** **Plot** (Right):

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It appears that serial autocorrelation **does** **not** exist in the data because there is a “flip flop” in the errors across the zero line as time goes on. It looks like we may have uncorrelated error terms.

**# of observations:** 36 (days)

**# of Independent Variable(s)**: 1 (sales)

**DL:** 1.411

**DU:** 1.525

Model 1: OLS, using observations 2011-09-16:2011-10-21 (T = 36)

Dependent variable: sales

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* |  |
| const | 21365.1 | 1594.62 | 13.40 | <0.0001 | \*\*\* |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mean dependent var | 21365.14 |  | S.D. dependent var | 9567.713 |
| Sum squared resid | 3.20e+09 |  | S.E. of regression | 9567.713 |
| R-squared | 0.000000 |  | Adjusted R-squared | 0.000000 |
| Log-likelihood | −380.5561 |  | Akaike criterion | 763.1122 |
| Schwarz criterion | 764.6957 |  | Hannan-Quinn | 763.6649 |
| rho | −0.077383 |  | **Durbin-Watson** | **2.089557** |

**Durbin-Watson Statistic:** 2.089557

The Durbin-Watson Statistic is **above** the upper limit, so we do not reject the null hypothesis; therefore, there is no serial autocorrelation.

* + **Null:** No serial autocorrelation – the errors are independent
  + **Alternative:** There is serial autocorrelation – correlation between the errors