Mohamed Khidher University

Faculty of economics, Commercial and Management Sciences
Department of commerce

Specialty: International Commerce & Finance
Module: Time Series Analysis
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Exercise series N°04

Assume you are studying the effect of exports and imports on foreign exchange reserves. The table below provides data on these macroeconomic indicators for Algeria

Month	Export	Import	foreign exchange reserve
2018-Q1	10098	11200	94529
2018-Q2	10170	11280	92119
2018Q3	10290	12060	88609
2018Q4	10220	11180	8516
2019-Q1	10430	13050	79880
2019-Q2	9410	12577	72600
2019-Q3	8513	11481	70500
2019-Q4	8335	10374	62000
2020-Q1	9055	10200	62800
2020-Q2	6782	9906	58900
2020-Q3	4321	8064	54800
2020-Q4	5136	8774	51216
2021-Q1	5686	8803	48167
2021-Q2	7722	9439	44323
2021-Q3	9551	9502	43464
2021-Q4	9907	9028	44724
2022-Q1	11374	9495	45296
2022-Q2	13228	9694	45607
2022-Q3	16940	9974	47921
2022-Q4	17497	9192	52763

Question

- calculate the Mean, Variance, Standard deviation and Covariance, using excel? explain the meaning of each value calculated?
- Draw the chart representing the movement of the variables in the table, explain the trend of these variable?

- draw the graph which show the relationship between the change in Trade balance and change in foreign exchange reserve?
- Formulate the regression equation and provide an interpretation of the results.

Exercise 2

Economist would like to examine the effects of job training, experience and education on wage.

1- Formulate the equation and model that might represent this relationship?
2- Formulate the hypothesis of this study?
3- What is the kind of the data the economist use in his study?
4- Tell the step the economist have to follow?
5- If the result of the estimation are as in the following table, please give the interpretation of each value in the table? Which factor affect more the wage? Why?

```
regress  Wage educ exper training
------------------------------------------------------------------------------
        Wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |  -.9439459    .496859    -1.90   0.058    -1.921528    .0336359
       exper |   .0895431   .0206835     4.33   0.000     .0488478    .1302384
    Training|    .161511   .0559692     2.89   0.004     .0513902    .2716318
       _cons |   34.71386   6.943318     5.00   0.000     21.05272    48.37501
------------------------------------------------------------------------------
Number of obs =     319
   F(  3,   315) =   33.69
   Prob > F      =  0.0000
   R-squared     =  0.2429
   Adj R-squared =  0.2357
```

Exercise 3

Suppose you study the impact of the budget deficit (B_t) and economic growth (G_t) on interest rates (r_t) in the economy of a particular country, the results you obtained are as follows:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Const	0.050	0.015	…….	0.043
B_t	0.009	0.0026	……..	0.0067
G_t	-0.003	0.0015	…….	0.0085
R-Squared …… Adjusted R-Squared …….. Observations 32		F-Stat …….. SSE 10.06 SSR. 52.82 SST……..		

1. Calculate the omitted values from the table.
2. Write the equation of the regression that showing the relationship between variables under the study.
3. Test the hypothesis of the relationship between the budget deficit and the interest rate at the 5% level of significance.

4. Determine the confidence interval for the coefficient of the relationship between economic growth budget deficit and interest rates.
5. Give the interpretation of the relationship between economic growth and interest rate.
6. Do the two independent variables explain well the variation of the dependent variable?

Exercise 4

Suppose you are studying the relationship between the demand for bank deposits *S* and the affecting factors such as the disposable income Y_d and the interest rate *r*. We obtain the first model using only disposable income:

$$S = 91.83 + 2.9Y_d + \varepsilon \text{ .....Model 1}$$
$$(1.87)$$

SSE = 1964.75 SST = 13581.137 F-stat =137.972 Prob (F-statistic) = 2.53E-06 n=52

We added the interest rate variable to the model and we obtained model 2:

$$S = 110.46 + 3.362Y_d + 10.197r + \varepsilon \text{.....Model 2}$$
$$(0.421) \quad (1.582)$$

SSE = 1592.301 SST = 13581.137 F-stat = 67.824 Prob (F-statistic) = 2.53E-06 n=52

If the significance level is 5% or the confidence interval is 95%, then:

1- Determine the study hypotheses regarding the relationship between the independent variables and the dependent variable
2- Give the interpretation of the above results in economic terms.
3- Did adding the variable improve the model? Compare the two models, by conducting a test of added variables ?

Exercise 5

1. Which of the following statements about multiple linear regression is correct?
A) Multiple linear regression includes only one independent variable.
B) The coefficients in multiple linear regression indicate the effect of each independent variable, holding all others constant.
C) Multiple linear regression assumes that all independent variables are categorical.
D) The intercept in multiple linear regression represents the highest value of the dependent variable.
2. Which of these is NOT an assumption of multiple linear regression?
A) Linearity between each independent variable and the dependent variable.
B) Homoscedasticity of residuals.
C) Independence of residuals.
D) Each independent variable must be normally distributed.
3. In a multiple linear regression model, the R^2 value represents:
A) The proportion of variance in the dependent variable explained by the independent variables.

B) The sum of all the coefficients in the model.
C) The correlation between two specific variables.
D) The average difference between observed and predicted values.

4. Multicollinearity in multiple linear regression occurs when:

A) The residuals are not normally distributed.
B) There is a high correlation between two or more independent variables.
C) The dependent variable is not normally distributed.
D) The independent variables are unrelated to the dependent variable.

5. If the p-value for a coefficient in multiple linear regression is greater than 0.05, this suggests that:

A) The coefficient is statistically significant.
B) The coefficient is not statistically significant, and we fail to reject the null hypothesis.
C) The independent variable has no effect on the dependent variable.
D) The coefficient should be removed from the model.

6. Which of the following would be a reason to use multiple linear regression instead of simple linear regression?

A) To predict a categorical outcome.
B) To evaluate the relationship between multiple independent variables and a single dependent variable.
C) To ensure the independent variables are normally distributed.
D) To reduce the number of predictors to one.

7. In the context of multiple linear regression, which diagnostic is used to detect multicollinearity?

A) Durbin-Watson test.
B) VIF (Variance Inflation Factor).
C) t-test for individual coefficients.
D) R-squared value.

8. When performing multiple linear regression, which of these indicates that a model may be overfitting?

A) A high R^2 value on the training set but a low R^2 on the test set.
B) Low residuals across both the training and test sets.
C) Similar performance on both the training and test sets.
D) A high p-value for most coefficients.

9. The adjusted R^2 value is preferable over R^2 in multiple linear regression because:

A) It always gives a higher value than R^2.
B) It adjusts for the number of independent variables, penalizing the addition of unnecessary predictors.
C) It only applies to linear relationships.
D) It provides the exact proportion of explained variance for any model.

10. Which of the following can be a sign of heteroscedasticity in a multiple linear regression model?

A) Constant variance of residuals across all levels of the independent variables.
B) A scatterplot of residuals showing an even distribution around zero.
C) Residuals that fan out or show a pattern when plotted against predicted values.
D) A low p-value for one of the independent variables.