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Exercise series N°5

Exercise 1: Choose the correct answer for the following question

1. **Which of the following statements about the Augmented Dickey-Fuller (ADF) test is true?**
 - a) It is used to test for the presence of cointegration.
 - b) It is used to test for stationarity in a time series.
 - c) It is used to test for the presence of unit root.
 - d) **Both b & c.**
2. **What is the null hypothesis in an Augmented Dickey-Fuller (ADF) test?**
 - a) The time series is stationary.
 - b) **The time series has a unit root.**
 - c) The time series has no unit root test.
 - d) The time series is cointegrated.
3. **Which of the following tests is used to determine the number of cointegrating relationships among a set of time series variables?**
 - a) Augmented Dickey-Fuller (ADF) test
 - b) Phillips-Perron (PP) test
 - c) **Johansen's test**
 - d) Engle-Granger test
5. **Which of the following statements about unit root tests is true?**
 - a) A unit root indicates that a time series is stationary.
 - b) A unit root indicates that a time series is non-stationary.
 - c) Unit root tests are used to test for the presence of trends in a time series.
 - d) **A significant p-value in a unit root test implies stationarity.**
6. **Which test is commonly used to detect the presence of a unit root in a time series?**
 - A) Engle-Granger test
 - B) **Augmented Dickey-Fuller (ADF) test**
 - C) Johansen test
 - D) Granger causality test
7. **Cointegration between two time series means that:**
 - a) Both series are non-stationary.
 - b) Both series are stationary.
 - c) **There is a long-term relationship between the two series.**
 - d) The two series are perfectly correlated.

8. Which of the following tests is used to test for cointegration between multiple time series?
- Augmented Dickey-Fuller (ADF) test
 - Engle-Granger test
 - Johansen test
 - Phillips-Perron test
9. A p-value of less than 0.05 in an Augmented Dickey-Fuller test indicates:
- The presence of a unit root
 - The absence of a unit root
 - Strong stationarity of the time series
 - Weak stationarity of the time series
10. What is the purpose of conducting a cointegration test between two time series?
- To test for unit roots in each series
 - To determine if there is a long-term relationship between the series
 - To check for multicollinearity in regression analysis
 - To assess the normality of the data distribution
11. In Ordinary Least Squares (OLS) regression analysis, what is the primary objective?
- Minimize the sum of squared residuals
 - Maximize the correlation coefficient
 - Minimize the p-values of the coefficients
 - Maximize the R-squared value
12. What does the coefficient of determination (R-squared) measure in OLS regression?
- The proportion of the variance in the dependent variable explained by the independent variables
 - The probability that the regression coefficients are statistically significant
 - The standard error of the regression
 - The strength of the linear relationship between the dependent and independent variables
13. Which of the following assumptions in linear regression refers to the condition where the errors (residuals) have constant variance across all levels of the independent variables?
- Normality assumption
 - Homoscedasticity assumption
 - Autocorrelation assumption
 - Multicollinearity assumption

Exercise 3:

Suppose you have conducted an Augmented Dickey-Fuller (ADF) test. After running the test, you obtain the following results table:

Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.385303	0.1606
Test critical values:		
1% level	-3.920350	
5% level	-3.065585	
10% level	-2.673460	

Based on the results in the above table answer the following question:

1. What is the lag length used in the Augmented Dickey-Fuller (ADF) test? **The lag length is 1**
2. What is the calculated t-statistic value for the ADF test? **T-stat = -2.3853**
3. What action should be taken regarding the null hypothesis based on the provided results?
 - a) Reject the null hypothesis
 - b) **Fail to reject the null hypothesis**
 - c) The null hypothesis is indeterminate
 - d) There is insufficient evidence to make a decision

Explanation since, the absolute value of t-statistic is less than the absolute value of t-stat critical, so we can't or we fail to reject the null hypothesis (accept the null Hypothesis) // or // since the p-value of the ADF statistic is greater than the significance level **5%**, so we cannot reject H_0 or we fail to reject H_0

4. Based on the provided results, what is the conclusion regarding the stationarity of the time series data?
 - a) The data is stationary
 - b) **The data is non-stationary**
 - c) The results are inconclusive
 - d) More observations are needed to determine stationarity

Explanation: Because we fail to reject the null hypothesis of non-stationary data, so our time series is non-stationary.

Exercise 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.694979	25.10377	29.79707	0.1578
At most 1	0.301439	6.105768	15.49471	0.6830
At most 2	0.022619	0.366053	3.841465	0.5452

1. **What does the trace statistic value represent in the Johansen cointegration test?**
 - a) The critical value at the 10% significance level
 - b) **The critical value at the 5% significance level**
 - c) The critical value at the 1% significance level
 - d) A test statistic used to evaluate the null hypothesis of no cointegration
2. **What conclusion can be drawn based on the provided results regarding the presence of cointegration?**

- a) There is evidence of cointegration between the variables
 - b) **There is no evidence of cointegration between the variables**
 - c) The results are inconclusive
 - d) More information is needed to determine cointegration
- 3. What is the purpose of the critical values provided in the Johansen cointegration test results table?**
- a) To determine the number of cointegrating equations
 - b) **To compare with the trace statistic to determine statistical significance**
 - c) To estimate the eigenvalue for the test
 - d) To identify outliers in the dataset
- 4. What significance level is commonly used to determine statistical significance in the Johansen cointegration test?**
- a) 10%
 - b) **5%**
 - c) 1%
 - d) All of the above
- 5. What action should be taken regarding the null hypothesis based on the provided results?**
- a) Reject the null hypothesis
 - b) **Fail to reject the null hypothesis**
 - c) The null hypothesis is indeterminate
 - d) There is insufficient evidence to make a decision