CHAPTER 2

TIME-SERIES ANALYSIS

1. (B) **time series must have a positive trend.**

Explanation

For a time series to be covariance stationary:

(1) the series must have an expected value that is constant and finite in all periods,

(2) the series must have a variance that is constant and finite in all periods, and

(3) the covariance of the time series with itself for a fixed number of periods in the past or future must be constant and finite in all periods.

(Module 2.2, LOS 2.c)

Related Material

SchweserNotes - Book 1

2. (B) **$117.0 million**

Explanation

The forecast is $e^{2.9803+(13\times0.1371)}$ = 117.01

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

3. (C) **The presence of seasonality makes it impossible to forecast using a time-series model.**

Explanation

The goal of a time series model is to identify factors that can be predicted. Seasonality in a time series refers to patterns that repeat at regular intervals. When a time series exhibits seasonality, seasonal lags should be included in the model in order to increase its predictive ability.

(Module 2.4, LOS 2.l)

Related Material

SchweserNotes - Book 1

4. (C) 27.22.

Explanation

Using the chain-rule of forecasting,

Forecasted x_{51} = –6.0 + 1.1(22) + 0.3(20) = 24.2.

Forecasted x_{52} = –6.0 + 1.1(24.2) + 0.3(22) = 27.22.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

5. (C) The Durbin-Watson statistic cannot be used with AR(1) models.

Explanation

The Durbin-Watson statistic is not useful when testing for serial correlation in an autoregressive model where one of the independent variables is a lagged value of the dependent variable. The existence of serial correlation in an AR model is determined by examining the autocorrelations of the residuals.

(Module 2.2, LOS 2.e)

Related Material

SchweserNotes - Book 1

6. (A) re-estimate the model with generalized least squares.

Explanation

If the residuals have an ARCH process, then the correct remedy is generalized least squares which will allow Popov to better interpret the results.

(Module 2.5, LOS 2.o)

Related Material

SchweserNotes - Book 1

7. (B) Yes, both are significant.

Explanation

The respective t-statistics are 6.7400 / 0.6803 = 9.9074 and 0.1371 / 0.0140 = 9.7929. For 10 degrees of freedom, the critical t-value for a two-tailed test at a 5% level of significance is 2.228, so both slope coefficients are statistically significant.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

8. (C) a linear trend model.

Explanation

If the goal is to simply estimate the dollar change from one period to the next, the most direct way is to estimate $x_t = b_0 + b_1$ x (Trend) + e_t, where Trend is simply 1, 2, 3, ...T. The model predicts a change by the value b_1 from one period to the next.

(Module 2.5, LOS 2.o)

Related Material

SchweserNotes - Book 1

9 (A) not improved the results for either possible problems.

Explanation

The fact that there is a significant trend for both equations indicates that the data is not stationary in either case. As for autocorrelation, the analyst really cannot test it using the Durbin-Watson test because there are fewer than 15 observations, which is the lower limit of the DW table. Looking at the first-order autocorrelation coefficient, however, we see that it increased (in absolute value terms) for the log-linear equation. If anything, therefore, the problem became more severe.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

10. (A) $97.6 million.

Explanation

The forecast is 10.0015 + (13 × 6.7400) = 97.62.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

11. (B) Serial correlation.

Explanation

One of the primary assumptions of linear regression is that the residual terms are not correlated with each other. If serial correlation, also called autocorrelation, is present, then trend models are not an appropriate analysis tool.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

12. (B) 24.2.

Explanation

Forecasted x_{51} = –6.0 + 1.1 (22) + 0.3 (20) = 24.2.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

13. (A) a log-linear transformation of the time series.

Explanation

The log-linear transformation of a series that grows at a constant rate with continuous compounding (exponential growth) will cause the transformed series to be linear.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

14. (B) contains seasonality.

Explanation

The time series contains seasonality as indicated by the strong and significant autocorrelation of the lag-4 residual.

(Module 2.4, LOS 2.l)

Related Material

SchweserNotes - Book 1

15. (C) 67.20.

Explanation

To get the answer, Dillard will use the data for 2006: IV and 2006: I, x_{t-1} = 66 and x_{t-4} = 72 respectively:

$E[x2007:1] = 93 - 0.5 \times X_{t-1} + 0.1 \times X_{t-4}$

$E[x2007:1] = 93 - 0.5 \times 66 + 0.1 \times 72$

E[x2007:1] = 67.20

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

16. (A) A log-linear trend model, because the data series exhibits a predictable, exponential growth trend.

Explanation

The log-linear trend model is the preferred method for a data series that exhibits a trend or for which the residuals are predictable. In this example, sales grew at an exponential, or increasing rate, rather than a steady rate.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

17. (B) 1.46.

Explanation

The formula for the mean reverting level is $b_0/(1 – b_1)$ = 0.4563/(1 – 0.6874) = 1.46

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

18. (A) There is no unit root.

Explanation

The null hypothesis of g = 0 actually means that $b_1 – 1 = 0$, meaning that $b_1 = 1$. Since we have rejected the null, we can conclude that the model has no unit root.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

19. (B) use a t-test on the residual autocorrelations over several lags.

Explanation

To test for serial correlation in an AR model, test for the significance of residual autocorrelations over different lags. The goal is for all t-statistics to lack statistical significance. The Durbin-Watson test is used with trend models; it is not appropriate for testing for serial correlation of the error terms in an autoregressive model. Constant and finite unconditional variance is not an indicator of serial correlation but rather is one of the requirements of covariance stationarity.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

20. (B) Use the model with the lowest RMSE calculated using the out-of-sample data.

Explanation

RMSE is a measure of error hence the lower the better. It should be calculated on the out-of-sample data i.e. the data not directly used in the development of the model. This measure thus indicates the predictive power of our model.

(Module 2.1, LOS 2.b)

Related Material
SchweserNotes - Book 1

21. (B) If the current value of the time series is above the mean reverting level, the prediction is that the time series will increase.

Explanation

If the current value of the time series is above the mean reverting level, the prediction is that the time series will decrease; if the current value of the time series is below the mean reverting level, the prediction is that the time series will increase.
(Module 2.2, LOS 2.f)

Related Material
SchweserNotes - Book 1

22. (B) estimate an autoregressive model (e.g., an AR(1) model), calculate the autocorrelations for the model's residuals, test whether the autocorrelations are different from zero, and revise the model if there are significant autocorrelations.

Explanation

The procedure is iterative: continually test for autocorrelations in the residuals and stop adding lags when the autocorrelations of the residuals are eliminated. Even if several of the residuals exhibit autocorrelation, the lags should be added one at a time.
(Module 2.2, LOS 2.e)

Related Material
SchweserNotes - Book 1

23. (B) first differencing.

Explanation

First differencing a series that has a unit root creates a time series that does not have a unit root.
(Module 2.3, LOS 2.j)

Related Material
SchweserNotes - Book 1

24. (B) 0.5.

Explanation

The prediction is $Y_{t+1} = b_0 / (1 – b_1) = 0.2 / (1 – 0.6) = 0.5$
(Module 2.2, LOS 2.f)

Related Material
SchweserNotes - Book 1

25. (A) the model is a linear trend model and log-linear models are always superior.

Explanation

Linear trend models are not always inferior to log-linear models. To determine which specification is better would require more analysis such as a graph of the data over time. As for the other possible answers, Collier can see that the slope coefficient is not significant because the t-statistic is 1.37 = 2.7/1.97. Also, regressing a variable on a simple time trend only describes the movement over time, and does not address the underlying dynamics of the dependent variable.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

26. (B) –0.73

Explanation

The mean reverting level is $X_1 = b_0/(1 - b_1)$

$X_1 = -0.9/[1 - (-0.23)] = -0.73$

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

27. (C) $65 million.

Explanation

Substituting the 1-period lagged data from 2004.4 and the 4-period lagged data from 2004.1 into the model formula, change in warranty expense is predicted to be higher than 2004.4.

$11.73 = -0.7 - 0.07*24 + 0.83*17.$

The expected warranty expense is (53 + 11.73) = $64.73 million.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

28. (A) Yes, because the coefficient on y_{t-4} is large compared to its standard error.

Explanation

The coefficient on the 4th lag tests the seasonality component.

The t-statistic is equal to 0.83/0.0186 = 44.62, which is greater than the critical t-value (5% LOS, 2-tailed, dof = 4) = 2.78

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

29. (C) Even if a time series has a unit root, the predictions from the estimated model are valid.

Explanation

The presence of a unit root means that the least squares regression procedure that we have been using to estimate an AR(1) model cannot be used without transforming the data first.

A time series with a unit root will follow a random walk process. Since a time series that follows a random walk is not covariance stationary, modeling such a time series in an AR model can lead to incorrect statistical conclusions, and decisions made on the basis of these conclusions may be wrong. Unit roots are most likely to occur in time series that trend over time or have a seasonal element.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

30. (A) 0.736.

Explanation

The variance at t = t + 1 is 0.25 + [0.60 $(0.9)^2$] = 0.25 + 0.486 = 0.736.

See also, ARCH models.

(Module 2.5, LOS 2.m)

Related Material

SchweserNotes - Book 1

31. (C) $\left(Sales_t - Sales_{t-1}\right) = b_0 + b_1\left(Sales_{t-1} - Sales_{t-2}\right) + e_t$

Explanation

Estimation with first differences requires calculating the change in the variable from period to period.

(Module 2.3, LOS 2.j)

Related Material

SchweserNotes - Book 1

32. (B) log-linear model to analyze the data because it is likely to exhibit a compound growth trend.

Explanation

A log-linear model is more appropriate when analyzing data that is growing at a compound rate. Sales are a classic example of a type of data series that normally exhibits compound growth.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

33. (A) AR(2).

Explanation

The b_1x_{t-1} and b_2x_{t-2} lag terms make this an autoregressive model of order p = 2 with a seasonal lag. The b_3x_{t-12} term is a seasonal term which does not transform the model to AR(12).

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

34. (B) (1.8225, 0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01) on (0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01, 2.7225)

Explanation

The test for ARCH is based on a regression of the squared residuals on their lagged values. The squared residuals are (1.8225, 0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01, 2.7225). So, (1.8225, 0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01) is regressed on (0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01, 2.7225). If coefficient a_1 in:

$$\hat{\varepsilon}_t^2 = a_0 + a_1\,\hat{\varepsilon}_{t-1}^2 + \mu_1$$

is statistically different from zero, the time series exhibits ARCH(1).

(Module 2.5, LOS 2.m)

Related Material

SchweserNotes - Book 1

35. (B) most financial and economic relationships are dynamic and the estimated regression coefficients can vary greatly between periods.

Explanation

Because all financial and time series relationships are dynamic, regression coefficients can vary widely from period to period. Therefore, financial and time series will always exhibit some amount of instability or nonstationarity.

(Module 2.2, LOS 2.h)

Related Material

SchweserNotes - Book 1

36. (A) The residuals of the forecasting model are autocorrelated.

Explanation

The one-period forecast of a random walk model without drift is $E(x_{t+1})$ $= E(x_{t+et})$

$= x_t + 0$, so the forecast is simply x_t = 2.2. For a random walk process, the variance changes with the value of the observation. However, the error term $e_t = x_t - x_{t-1}$ is not autocorrelated.

(Module 2.3, LOS 2.i)

Related Material

SchweserNotes - Book 1

37. (B) properly specified because there is no evidence of autocorrelation in the residuals.

Explanation

The Durbin-Watson test is not an appropriate test statistic in an AR model, so we cannot use it to test for autocorrelation in the residuals. However, we can test whether each of the four lagged residuals autocorrelations is statistically significant. The t-test to accomplish this is equal to the autocorrelation divided by the standard error with 61 degrees of freedom (64 observations less 3 coefficient estimates). The critical t-value for a significance level of 5% is about 2.000 from the table. The appropriate t-statistics are:

- Lag 1 = 0.015/0.129 = 0.116
- Lag 2 = –0.101/0.129 = –0.783
- Lag 3 = –0.007/0.129 = –0.054
- Lag 4 = 0.095/0.129 = 0.736

None of these are statically significant, so we can conclude that there is no evidence of autocorrelation in the residuals, and therefore the AR model is properly specified.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

38. (C) 0.256.

Explanation

The forecast for the following quarter is 0.155 + 0.240(0.240) + 0.168(0.260) = 0.256.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

39. (A) nothing.

Explanation

None of the information in the problem provides information concerning heteroskedasticity. Note that heteroskedasticity occurs when the variance of the error terms is not constant. When heteroskedasticity is present in a time series, the residuals appear to come from different distributions (model seems to fit better in some time periods than others).

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

40. (A) **First differencing the time series.**

Explanation

First differencing often transforms a random walk into a covariance stationary time series which can then be fitted using autoregressive models. ARCH is a type of AR model where the residuals exhibit conditional heteroscedasticity and is not an approach to convert a random walk into a covariance stationary time series. Taking natural log is recommended for a time series with an exponential growth prior to fitting a trend model.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

41. (C) **Batchelder is incorrect; Yenkin is incorrect.**

Explanation

The root mean squared error (RMSE) criterion is used to compare the accuracy of autoregressive models in forecasting out-of-sample values (not in-sample values). Batchelder is incorrect. Out-of–sample forecast accuracy is important because the future is always out of sample, and therefore out-of-sample performance of a model is critical for evaluating real world performance.

Yenkin is also incorrect. The RMSE criterion takes the square root of the average squared errors from each model. The model with the smallest RMSE is judged the most accurate.

(Module 2.2, LOS 2.g)

Related Material

SchweserNotes - Book 1

42. (A) **an autoregressive model with a seasonal lag.**

Explanation

Johnson will use the table to forecast values using an autoregressive model for periods in succession since each successive forecast relies on the forecast for the preceding period. The seasonal lag is introduced to account for seasonal variations in the observed data.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

43. (B) 164.

Explanation

The seasonal lagged change in sales shows the change in sales from the period 4 quarters before the current period. Sales in the year 2013 quarter 4 increased $164 million over the prior period.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

44. (A) 210.

Explanation

Substituting the 1-period lagged data from 2014.4 and the 4-period lagged data from 2014.1 into the model formula, change in sales is predicted to be –6.032 + (0.017 x 170) + (0.983 x –48) = –50.326. Expected sales are 260 + (–50.326) = 209.674.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

45. (B) nonstationarity in time series data.

Explanation

Johnson's model transforms raw sales data by first differencing it and then modeling change in sales. This is most likely an adjustment to make the data stationary for use in an AR model.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

46. (B) Dickey-Fuller test.

Explanation

The Dickey-Fuller test for unit roots could be used to test whether the data is covariance non–stationarity. The Durbin-Watson test is used for detecting serial correlation in the residuals of trend models but cannot be used in AR models. A t-test is used to test for residual autocorrelation in AR models.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

47. (A) invalid standard errors of regression coefficients and invalid statistical tests.

Explanation

The presence of conditional heteroskedasticity may leads to incorrect estimates of standard errors of regression coefficients and hence invalid tests of significance of the coefficients.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

48. (B) Dickey-Fuller test, which uses a modified t-statistic.

Explanation

The Dickey-Fuller test estimates the equation $(x_t - x_{t-1}) = b_0 + (b_1 - 1) * x_{t-1} + e_t$ and tests if H_0: $(b_1 – 1) = 0$. Using a modified t-test, if it is found that $(b_1 – 1)$ is not significantly different from zero, then it is concluded that b_1 must be equal to 1.0 and the series has a unit root.

(Module 2.5, LOS 2.n)

Related Material

SchweserNotes - Book 1

49. (B) $1,430.00

Explanation

Change in sales = $100 – 1.5 ($1,000 – 900) + 1.2 ($1,400 – 1,000)

Change in sales = $100 – 150 + 480 = $430

Sales = $1,000 + 430 = $1,430

(Module 2.5, LOS 2.n)

Related Material

SchweserNotes - Book 1

50. (A) Correlation (e_t, $e_{t–4}$)

Explanation

Although seasonality can make the other correlations significant, the focus should be on correlation (e_t, $e_{t–4}$) because the 4th lag is the value that corresponds to the same season as the predicted variable in the analysis of quarterly data.

(Module 2.4, LOS 2.l)

Related Material

SchweserNotes - Book 1

51. (B) an in-sample forecast.

Explanation

An in-sample (a.k.a. within-sample) forecast is made within the bounds of the data used to estimate the model. An out-of-sample forecast is for values of the independent variable that are outside of those used to estimate the model.

(Module 2.2, LOS 2.g)

Related Material

SchweserNotes - Book 1

52. (A) $1,730.00

Explanation

Note that since we are forecasting 2000.3, the numbering of the "t" column has changed.

Change in sales = $30 + 1.25 ($2,000-1,800) + 1.1 ($1,400 –1,900)

Change in sales = $30 + 250 – 550 = –$270

Sales = $2,000 – 270 = $1,730

(Module 2.5, LOS 2.n)

Related Material

SchweserNotes - Book 1

53. (A) 0.081.

Explanation

As Brice makes more distant forecasts, each forecast will be closer to the unconditional mean. So, the two period forecast would be between 0.08 and 0.09, and 0.081 is the only possible answer.

(Module 2.2, LOS 2.f)

Related Material

SchweserNotes - Book 1

54. (A) 34.36.

Explanation

To get the answer, Dillard must first make the forecast for 2007:I

E[x2007:I] = $44 + 0.1 \text{ x } x_{t-1} - 0.25 \text{ x } x_{t-2} - 0.15 \text{ x } x_{t-3}$

E[x2007:I] = 44 + 0.1 x 33 – 0.25 x 32 – 0.15 x 35

E[x2007:I] = 34.05

Then, use this forecast in the equation for the first lag:

E[x2007:II] = 44 + 0.1 x 34.05 – 0.25 x 33 – 0.15 x 32

E[x2007:II] = 34.36
(Module 2.2, LOS 2.d)
Related Material
SchweserNotes - Book 1

55. (C) first differencing.
Explanation
Phillips obviously first differenced the data because the 1 = 6-5, –1 = 5 – 6, ... 1 = 9 – 8, 2 = 11 – 9.
(Module 2.3, LOS 2.j)
Related Material
SchweserNotes - Book 1

56. (C) 1.6258.
Explanation
The mean-reverting level is b_0 / (1 – b_1) = 1.3304 / (1 – 0.1817) = 1.6258.
(Module 2.2, LOS 2.f)
Related Material
SchweserNotes - Book 1

57. (B) The estimation results of an AR model involving a time series that is not covariance stationary are meaningless.
Explanation
Covariance stationarity requires that the expected value and the variance of the time series be constant over time.
(Module 2.2, LOS 2.c)
Related Material
SchweserNotes - Book 1

58. (B) $x_t = b_0 + b_i x_{t-1} + \varepsilon_t$.
Explanation
The best estimate of random walk for period t is the value of the series at (t – 1). If the random walk has a drift component, this drift is added to the previous period's value of the time series to produce the forecast.
(Module 2.3, LOS 2.i)
Related Material
SchweserNotes - Book 1

59. (B) model's specification can be corrected by adding an additional lag variable.
Explanation
The presence of autoregressive conditional heteroskedasticity (ARCH) indicates that the variance of the error terms is not constant. This is a violation of the

regression assumptions upon which time series models are based. The addition of another lag variable to a model is not a means for correcting for ARCH (1) errors.
(Module 2.5, LOS 2.m)

Related Material

SchweserNotes - Book 1

60. (B) $(Sales_t - Sales_{t-1}) = b_0 + b_1 (Sales_{t-1} - Sales_{t-2}) + b_2 (Sales_{t-4} - Sales_{t-5}) + \varepsilon_t$.

Explanation

This model is a seasonal AR with first differencing.

(Module 2.4, LOS 2.l)

Related Material

SchweserNotes - Book 1

61. (A) first difference the data because $b_1 = 1$.

Explanation

The condition $b_1 = 1$ means that the series has a unit root and is not stationary. The correct way to transform the data in such an instance is to first difference the data.

(Module 2.3, LOS 2.j)

Related Material

SchweserNotes - Book 1

62. (B) The low values for the t-satistics indicate that the model fits the time series.

Explanation

The t-statistics are all very small, indicating that none of the autocorrelations are significantly different than zero. Based on these results, the model appears to be appropriately specified. The error terms, however, should still be checked for heteroskedasticity.

(Module 2.2, LOS 2.e)

Related Material

SchweserNotes - Book 1

63. (C) Correlation (e_t, e_{t-2}) is significantly different from zero.

Explanation

If correlation(e_t, e_{t-2}) is not zero, then the model suffers from 2nd order serial correlation. Popov may wish to try an AR(2) model. Both of the other conditions are acceptable in an AR(1) model.

(Module 2.5, LOS 2.o)

Related Material

SchweserNotes - Book 1

64. (B) Model 1 because it has an RMSE of 3.23.

Explanation

The root mean squared error (RMSE) criterion is used to compare the accuracy of autoregressive models in forecasting out-of-sample values. To determine which model will more accurately forecast future values, we calculate the square root of the mean squared error. The model with the smallest RMSE is the preferred model. The RMSE for Model 1 is $\sqrt{10.429} = 3.23$, while the RMSE for Model 2 is $\sqrt{11.642} = 3.41$. Since Model 1 has the lowest RMSE, that is the one Zox should conclude is the most accurate.

(Module 2.2, LOS 2.g)

Related Material

SchweserNotes - Book 1

65. (A) $\ln(LuxCarSales) = b_0 + b_1(t) + e_t$.

Explanation

Whenever the rate of change is constant over time, the appropriate model is a log- linear trend model. A is a linear trend model and C is an autoregressive model.

(Module 2.1, LOS 2.b)

Related Material

SchweserNotes - Book 1

66. (C) 1.46.

Explanation

The formula for the mean reverting level is:

$$\frac{b_0}{(1 - b_1)} = \frac{0.4563}{(1 - 0.6874)} = 1.46$$

(Module 2.2, LOS 2.f)

Related Material

SchweserNotes - Book 1

67. (B) There is no unit root.

Explanation

The null hypothesis of g = 0 actually means that $b_1 - 1 = 0$, this will be the case if $b_1 = 1$. Since we have rejected the null, we can conclude that the model has no unit root.

(Module 2.3, LOS 2.j)

Related Material

SchweserNotes - Book 1

68. (A) use a t-test on the residual autocorrelations over several lags.

Explanation

To test for serial correlation in an AR model, test for the significance of residual autocorrelations over different lags. The goal is for all t-statistics to lack statistical significance. A is only used for trend models and C is one of the requirements of covariance stationarity.

(Module 2.2, LOS 2.e)

Related Material

SchweserNotes - Book 1

69. (C) Use the model with the lowest RMSE calculated using the out-of-sample data.

Explanation

RMSE, or root of the mean squared error, is a measure similar to the SEE from multiple regression. The lower, the better. It should be calculated on the out-of-sample data (i.e., the data not directly used in the development of the model) as this will be a better test of the relevance and predictive power of the model going forward. This measure thus indicates the predictive power of our model.

(Module 2.2, LOS 2.g)

Related Material

SchweserNotes - Book 1

70. (C) 10%

Explanation

To get the 20X2 value, plug today's value of 1.05 into the model:

0.4563 + 0.6874 x 1.05 = 1.18.

Then use the result, 1.18, to forecast 20X3 as follows:

0.4563 + 0.6874 x 1.18 = 1.27.

The annualized return between 20X1 and 20X3 is, therefore, $(1.27 / 1.05)^{0.5} - 1 = 9.87\%$.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

71. (A) No, because several of the residual autocorrelations are significant.

Explanation

At a 5% level of significance, the critical t-value is 1.98. Since the absolute values of several of the residual autocorrelation's t-statistics exceed 1.98, it can be concluded that significant serial correlation exists and the model should be respecified. The next logical step is to estimate an AR(2) model, then test the associated residuals for autocorrelation. If no serial correlation is detected, seasonality and ARCH behavior should be tested.

(Module 2.2, LOS 2.e)

Related Material

SchweserNotes - Book 1

72. (C) An autoregressive model with two lags is equivalent to a moving-average model with two lags.

Explanation

An autoregression model regresses a dependent variable against one or more lagged values of itself whereas a moving average is an average of successive observations in a time series. A moving average model can have lagged terms but these are lagged values of the residual.

(Module 2.2, LOS 2.i)

Related Material

SchweserNotes - Book 1

73. (A) shorter time series are usually more stable than those with longer time series.

Explanation

Those models with a shorter time series are usually more stable because there is less opportunity for variance in the estimated regression coefficients between the different time periods.

(Module 2.2, LOS 2.h)

Related Material

SchweserNotes - Book 1

74. (C) 683.18.

Explanation

The one-period forecast is –8.023 + (1.0926 x 544) = 586.35.

The two-period forecast is then –8.023 + (1.0926 x 586.35) = 632.62.

Finally, the three-period forecast is –8.023 + (1.0926 x 632.62) = 683.18.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

75. (B) Autoregressive (AR) Model.

Explanation

The model is specified as an AR Model, but there is no seasonal lag. No moving averages are employed in the estimation of the model.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

76. (A) 381.29 million.

Explanation

$$MRL = \frac{b_0}{1-b_1} = \frac{43.2}{1-0.8867} = 381.29 \text{ million}$$

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

77. (C) Incorrectly specified and first differencing the natural log of the data would be an appropriate remedy.

Explanation

If constant growth rate is an appropriate model for Car-tel, its dividends (as well as earnings and revenues) will grow at a constant rate. In such a case, the time series needs to be adjusted by taking the natural log of the time series. Taking the natural log of the time series would lead to a series that exhibits a constant amount of growth (and still not stationary). The final step would be to first difference the transformed series to make it covariance stationary. First differencing would remove the trending component of a covariance non-stationary time series but would not be appropriate for transforming an exponentially growing time series.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

78. (A) Forecasting is not possible for autoregressive models with more than two lags.

Explanation

Forecasts in autoregressive models are made using the chain-rule, such that the earlier forecasts are made first. Each later forecast depends on these earlier forecasts.

(Module 2.2, LOS 2.g)

Related Material

SchweserNotes - Book 1

79. (B) 3.6.

Explanation

The variance at t = t + 1 is 0.4 + [0.80 (4.0)] = 0.4 + 3.2. = 3.6.

(Module 2.5, LOS 2.m)

Related Material

SchweserNotes - Book 1

80. (A) 6.69.

Explanation

Wellington's out-of-sample forecast of $LN(x_t)$ is 1.9 = 1.4 + 0.02 × 25, and $e^{1.9}$ = 6.69. (Six years of quarterly observations, at 4 per year, takes us up to t = 24. The first time period after that is t = 25.)

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

81. (B) the long run mean is b_0 / (1 – b_1).

Explanation

For a random walk, the long-run mean is undefined. The slope coefficient is one, b_1 = 1, and that is what makes the long-run mean undefined: mean = $b_0/(1– b_1)$.

(Module 2.3, LOS 2.i)

Related Material

SchweserNotes - Book 1

82. (B) the model's specification.

Explanation

Serial correlation will bias the standard errors. It can also bias the coefficient estimates in an autoregressive model of this type. Thus, Briars and Holmes probably did not tell the statistician the model is an AR(1) specification.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

83. (A) correct, because the Hansen method adjusts for problems associated with both serial correlation and heteroskedasticity.

Explanation

The statistician is correct because the Hansen method adjusts for problems associated with both serial correlation and heteroskedasticity.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

84. (C) $54.108 million.

Explanation

Briars' forecasts for the next three years would be:

year one: 3.8836 + 0.9288 x 54 = 54.0388

year two: 3.8836 + 0.9288 x (54.0388) = 54.0748

year three: 3.8836 + 0.9288 x (54.0748) = 54.1083

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

85. (A) Briars computes is correct.

Explanation

Briars has computed a value that would be correct if the results of the model were reliable. The long-run mean would be 3.8836 / (1 – 0.9288) = 54.5450.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

86. (B) Covariance(x_t, x_{t-1}) = Covariance(x_t, x_{t-2}).

Explanation

If a series is covariance stationary then the unconditional mean is constant across periods. The unconditional mean or expected value is the same from period to period: $E[x_t] = E[x_{t+1}]$. The covariance between any two observations equal distance apart will be equal, e.g., the t and t – 2 observations with the t and t+2 observations. The one relationship that does not have to be true is the covariance between the t and t – 1 observations equaling that of the t and t – 2 observations.

(Module 2.2, LOS 2.c)

Related Material

SchweserNotes - Book 1

87. (B) revise the model to include at least another lag of the dependent variable.

Explanation

She should estimate an AR(4) model, and then re-examine the autocorrelations of the residuals.

(Module 2.2, LOS 2.e)

Related Material

SchweserNotes - Book 1

88. (C) AR(1) model with 3 seasonal lags.

Explanation

She has found that all the slope coefficients are significant in the model $x_t = b_0 + b_1x_{t-1} + b_2x_{t-4} + e_t$. She then finds that all the slope coefficients are significant in the model $x_t = b_0 + b_1x_{t-1} + b_2x_{t-2} + b_3x_{t-3} + b_4x_{t-4} + e_t$. Thus, the final model should be used rather than any other model that uses a subset of the regressors.

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

89. (C) (In $sale_t$ – In $sales_{t-1}$) = b_0 + b_1 (In $sales_{t-1}$ – In $sales_{t-2}$) + b_2(In $sales_{t-4}$ – In $sales_{t-5}$)+ ε_t

Explanation

Seasonality is taken into account in an autoregressive model by adding a seasonal lag variable that corresponds to the seasonality. In the case of a first-differenced quarterly time series, the seasonal lag variable is the first difference for the fourth time period. Recognizing that the model is fit to the first differences of the natural logarithm of the time series, the seasonal adjustment variable is (In $sales_{t-4}$ – In $sales_{t-5}$).

(Module 2.4, LOS 2.l)

Related Material

SchweserNotes - Book 1

90. (A) Current underlying economic and market conditions.

Explanation

There will always be a tradeoff between the increase statistical reliability of a longer time period and the increased stability of estimated regression coefficients with shorter time periods. Therefore, the underlying economic environment should be the deciding factor when selecting a time series sample period.

(Module 2.2, LOS 2.h)

Related Material

SchweserNotes - Book 1

91. (B) change in the dependent variable per time period is b_1.

Explanation

The slope is the change in the dependent variable per unit of time. The intercept is the estimate of the value of the dependent variable before the time series begins. The disturbance term should be independent and identically distributed. There is no reason to expect the disturbance term to be mean-reverting, and if the residuals are autocorrelated, the research should correct for that problem.

(Module 2.1, LOS 2.a)

Related Material

SchweserNotes - Book 1

92. (C) an autoregressive model, AR(4).

Explanation

This is an autoregressive model (i.e., lagged dependent variable as independent variables) of order p = 4 (that is, 4 lags).

(Module 2.2, LOS 2.d)

Related Material

SchweserNotes - Book 1

93. (B) can be used to test for a unit root, which exists if the slope coefficient equals one.

Explanation

If you estimate the following model $x_t = b_0 + b_1 \times x_{t-1} + e_t$ and get $b_1 = 1$, then the process has a unit root and is nonstationary.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

94. (B) Multiple-R of the model is 0.87.

Explanation

R^2 = RSS/SST = 15/20 = 0.75

Multiple-R = $(0.75)^{0.50}$ = 0.87.

Correct interpretation of the coefficient of determination is that all the independent variables (ΔINT, STIM, CRISIS) collectively help explain 75% of the variation in the independent variable (Foreclosure Share).

(Module 1.2, LOS 1.d)

Related Material

SchweserNotes - Book 1

95. (A) Breusch-Pagan, which is a one-tailed test

Explanation

The Breusch-Pagan is used to detect conditional heteroskedasticity and it is a one-tailed test. This is because we are only concerned about large values in the residuals coefficient of determination.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

96. (C) 0.56

Explanation

The formula for the Standard Error of the Estimate (SEE) is:

$$SEE = \frac{\sqrt{SSE}}{n-k-1} = \frac{\sqrt{5}}{16}$$

= 0.56

The SEE equals the standard deviation of the regression residuals. A low SEE implies a high R^2.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

97. (C) Both are correct

Explanation

Jessica is correct. White-corrected standard errors are also known as robust standard errors. Jonathan is correct because White-corrected errors are higher than the biased errors leading to lower computed t-statistics and therefore less frequent rejection of the Null Hypothesis (remember incorrectly rejecting a true Null is Type I error).

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

98. (C) stimulus packages do not have significant effects on foreclosure percentages, but housing crises do have significant effects on foreclosure percentages.

Explanation

The appropriate test statistic for tests of significance on individual slope coefficient estimates is the t-statistic, which is provided in Exhibit 2 for each regression coefficient estimate. The reported t-statistic equals -2.10 for the STIM slope estimate and equals 2.35 for the CRISIS slope estimate. The critical t-statistic for the 5% significance level equals 2.12 (16 degrees of freedom, 5% level of significance).

Therefore, the slope estimate for STIM is not statistically significant (the reported t-statistic, -2.10, is not large enough). In contrast, the slope estimate for CRISIS is statistically significant (the reported t-statistic, 2.35, exceeds the 5% significance level critical value).

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

99. (A) There is no value to calendar trading.

Explanation

This question calls for a computation of the F-stat. F = (0.0039/4) / (0.9534 /(780 – 4 – 1) = 0.79. The critical F is somewhere between 2.37 and 2.45 so we fail to reject the Null that all the coefficients are equal to zero.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

100. (B) Smith is correct on the two-step ahead forecast for change in foreclosure share only.

Explanation

Forecasts are derived by substituting the appropriate value for the period t-1 lagged value.

$$\Delta \text{Foreclosure Share}_t = 0.05 + 0.25\left(\Delta \text{Foreclosure Share}_{t-1}\right)$$

= 0.05 + 0.25(1) = 0.30

So, the one-step ahead forecast equals 0.30%. The two-step ahead (%) forecast is derived by substituting 0.30 into the equation.

$\Delta \text{Foreclosure Share}_{t-1}$ = 0.05 + 0.25(0.30) = 0.125

Therefore, the two-step ahead forecast equals 0.125%.

mean reverting level = $\frac{b_0}{(1-b_1)} = \frac{0.05}{(1-0.25)}$ = 0.067

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

101. (B) The return on a particular trading day.

Explanation

The omitted variable is represented by the intercept. So, if we have four variables to represent Monday through Thursday, the intercept would represent returns on Friday.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

102. (C) ΔINT has unit root and is cointegrated with foreclosure share.

Explanation

The error terms in the regressions for choices A, B, and C will be nonstationary. Therefore, some of the regression assumptions will be violated and the regression results are unreliable. If, however, both series are nonstationary (which will happen if each has unit root), but cointegrated, then the error term will be covariance stationary and the regression results are reliable.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

103. (B) The variance of the error term.

Explanation

A Model is ARCH(1) if the coefficient a_1 is significant. It will allow for the estimation of the variance of the error term.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1

104. (B) Four

Explanation

There are 5 trading days in a week, but we should use (n – 1) or 4 dummies in order to ensure no violations of regression analysis occur.

(Module 2.5, LOS 2.m)

Related Material

SchweserNotes - Book 1

105. (B) Incorrect on both Concerns.

Explanation

Smith's Concern 1 is incorrect. Heteroskedasticity is a violation of a regression assumption, and refers to regression error variance that is not constant over all observations in the regression. Conditional heteroskedasticity is a case in which the error variance is related to the magnitudes of the independent variables (the error variance is "conditional" on the independent variables). The consequence of conditional heteroskedasticity is that the standard errors will be too low, which, in turn, causes the t-statistics to be too high. Smith's Concern 2 also is not correct. Multicollinearity refers to independent variables that are correlated with each other. Multicollinearity causes standard errors for the regression coefficients to be too high, which, in turn, causes the t-statistics to be too low. However, contrary to Smith's concern, multicollinearity has no effect on the F-statistic.

(Module 2.3, LOS 2.k)

Related Material

SchweserNotes - Book 1