Question #1 of 112

Consider the estimated model $x_t = -6.0 + 1.1\ x_{t-1} + 0.3\ x_{t-2} + \varepsilon_t$ that is estimated over 50 periods.

The value of the time series for the 49^{th} observation is 20 and the value of the time series for the 50^{th} observation is 22. What is the forecast for the 51^{st} observation?

A) 23

B) 24.2.

C) 30.2.

Explanation

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

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #2 of 112

Which of the following statements regarding unit roots in a time series is *least* accurate?

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

B) A time series with a unit root is not covariance stationary.

C) A time series that is a random walk has a unit root.

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #3 of 112

Consider the following estimated model:

$$(Sales_t - Sales_{t-1}) = 30 + 1.25\,(Sales_{t-1} - Sales_{t-2}) + 1.1\,(Sales_{t-4} - Sales_{t-5}) \quad t=1,2,..\,T$$

and Sales for the periods 1999.1 through 2000.2:

t	Period	Sales
T	2000.2	$2,000
T-1	2000.1	$1,800
T-2	1999.4	$1,500
T-3	1999.3	$1,400
T-4	1999.2	$1,900
T-5	1999.1	$1,700

The forecasted Sales amount for 2000.3 is *closest* to:

A) $1,730.00

B) $2,625.00

C) $2,270.00

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

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Bill Johnson, CFA, has prepared data concerning revenues from sales of winter clothing made by Polar Corporation. This data is presented (in $ millions) in the following table:

		Change In Sales	Lagged Change In Sales	Seasonal Lagged Change In Sales
Quarter	**Sales**	**Y**	**Y + (−1)**	**Y + (−4)**
2013.1	182			
2013.2	74	−108		
2013.3	78	4	−108	
2013.4	242	164	4	
2014.1	194	−48	164	
2014.2	79	−115	−48	−108
2014.3	90	11	−115	4
2014.4	260	170	11	w

Question #4 of 112

The preceding table will be used by Johnson to forecast values using:

A) an autoregressive model with a seasonal lag.

B) a log-linear trend model with a seasonal lag.

C) a serially correlated 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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #5 of 112

The value that Johnson should enter in the table in place of "w" is:

A) 164.

B) −48.

C) −115.

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #6 of 112

Imagine that Johnson prepares a change-in-sales regression analysis model with seasonality, which includes the following:

	Coefficients
Intercept	−6.032
Lag 1	0.017
Lag 4	0.983

Based on the model, expected sales in the first quarter of 2015 will be *closest* to:

A) 210.

B) 155.

C) 190.

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 × 170) + (0.983 × −48) = −50.326. Expected sales are 260 + (−50.326) = 209.674.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #7 of 112

Johnson's model was *most likely* designed to incorporates correction for:

A) cointegration in the time series.

B) nonstationarity in time series data.

C) heteroskedasticity of model residuals.

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #8 of 112

To test for covariance-stationarity in the data, Johnson would *most likely* use a:

A) t-test.

B) Dickey-Fuller test.

C) Durbin-Watson 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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #9 of 112

The presence of conditional heteroskedasticity of residuals in Johnson's model is would *most likely* to lead to:

A) invalid standard errors of regression coefficients, but statistical tests will still be valid.

B) invalid standard errors of regression coefficients and invalid statistical tests.

C) invalid estimates of regression coefficients, but the standard errors will still be valid.

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #10 of 112

Which of the following statements regarding an out-of-sample forecast is *least* accurate?

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

B) There is more error associated with out-of-sample forecasts, as compared to in-sample forecasts.

C) Out-of-sample forecasts are of more importance than in-sample forecasts to the analyst using an estimated time-series model.

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.

(Study Session 3, Module 9.2, LOS 9.g)

Related Material

SchweserNotes - Book 1

Question #11 of 112

The procedure for determining the structure of an autoregressive model is:

A) estimate an autoregressive model (e.g., an AR(1) model), calculate the autocorrelations for the model's residuals, test whether the autocorrelations are

B) test autocorrelations of the residuals for a simple trend model, and specify the number of significant lags.

C) estimate an autoregressive model (for example, an AR(1) model), calculate the autocorrelations for the model's residuals, test whether the autocorrelations are

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.

(Study Session 3, Module 9.2, LOS 9.e)

Related Material

SchweserNotes - Book 1

Question #12 of 112

Which of the following statements regarding the instability of time-series models is *most* accurate? Models estimated with:

A) a greater number of independent variables are usually more stable than those with a smaller number.

B) shorter time series are usually more stable than those with longer time series.

C) longer time series are usually more stable than those with shorter 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.

(Study Session 3, Module 9.2, LOS 9.h)

Related Material

SchweserNotes - Book 1

Question #13 of 112

A monthly time series of changes in maintenance expenses (ΔExp) for an equipment rental company was fit to an AR(1) model over 100 months. The results of the regression and the first twelve lagged residual autocorrelations are shown in the tables below. Based on the information in these tables, does the model appear to be appropriately specified? (Assume a 5% level of significance.)

Regression Results for Maintenance Expense Changes				
Model: $DExp_t = b_0 + b_1DExp_{t-1} + e_t$				
	Coefficients	**Standard Error**	**t-Statistic**	**p-value**
Intercept	1.3304	0.0089	112.2849	< 0.0001
Lag-1	0.1817	0.0061	30.0125	< 0.0001

Lagged Residual Autocorrelations for Maintenance Expense Changes					
Lag	**Autocorrelation**	**t-Statistic**	**Lag**	**Autocorrelation**	**t-Statistic**
1	−0.239	−2.39	7	−0.018	−0.18
2	−0.278	−2.78	8	−0.033	−0.33
3	−0.045	−0.45	9	0.261	2.61
4	−0.033	−0.33	10	−0.060	−0.60
5	−0.180	−1.80	11	0.212	2.12
6	−0.110	−1.10	12	0.022	0.22

A) Yes, because the intercept and the lag coefficient are significant.

B) No, because several of the residual autocorrelations are significant.

C) Yes, because most of the residual autocorrelations are negative.

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.

(Study Session 3, Module 9.2, LOS 9.e)

Related Material

SchweserNotes - Book 1

Question #14 of 112

Suppose that the following time-series model is found to have a unit root:

$$\text{Sales}_t = b_0 + b_1 \text{ Sales}_{t-1} + \varepsilon_t$$

What is the specification of the model if first differences are used?

A) $(\text{Sales}_t - \text{Sales}_{t-1}) = b_0 + b_1 (\text{Sales}_{t-1} - \text{Sales}_{t-2}) + \varepsilon_t$.

B) $\text{Sales}_t = b_1 \text{ Sales}_{t-1} + \varepsilon_t$.

C) $\text{Sales}_t = b_0 + b_1 \text{ Sales}_{t-1} + b_2 \text{ Sales}_{t-2} + \varepsilon_t$.

Explanation

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

(Study Session 3, Module 9.3, LOS 9.j)

Related Material

SchweserNotes - Book 1

Diem Le is analyzing the financial statements of McDowell Manufacturing. He has modeled the time series of McDowell's gross margin over the last 15 years. The output is shown below. Assume 5% significance level for all statistical tests.

Autoregressive ModelGross Margin – McDowell ManufacturingQuarterly Data: 1st Quarter 1985 to 4th Quarter 2000			
Regression Statistics			
R-squared	0.767		
Standard error of forecast	0.049		
Observations	64		
Durbin-Watson	1.923 (not statistically significant)		
	Coefficient	*Standard Error*	*t-statistic*
Constant	0.155	0.052	?????
Lag 1	0.240	0.031	?????

Lag 4	0.168	0.038	?????

Autocorrelation of Residuals			
Lag	**Autocorrelation**	**Standard Error**	**t-statistic**
1	0.015	0.129	?????
2	-0.101	0.129	?????
3	-0.007	0.129	?????
4	0.095	0.129	?????

Partial List of Recent Observations	
Quarter	**Observation**
4th Quarter 2002	0.250
1st Quarter 2003	0.260
2nd Quarter 2003	0.220
3rd Quarter 2003	0.200
4th Quarter 2003	0.240

Abbreviated Table of the Student's t-distribution (One-Tailed Probabilities)					
df	**p = 0.10**	**p = 0.05**	**p = 0.025**	**p = 0.01**	**p = 0.005**
50	1.299	1.676	2.009	2.403	2.678
60	1.296	1.671	2.000	2.390	2.660
70	1.294	1.667	1.994	2.381	2.648

Question #15 of 112

This model is *best* described as:

A) an AR(1) model with a seasonal lag.

B) an ARMA(2) model.

C) an MA(2) model.

Explanation

This is an autoregressive AR(1) model with a seasonal lag. Remember that an AR model regresses a dependent variable against one or more lagged values of itself.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #16 of 112

Which of the following can Le conclude from the regression? The time series process:

A) Does not include a seasonality factor and has insignificant explanatory power.

B) Does not include a seasonality factor and and has significant explanatory power.

C) includes a seasonality factor, has significant explanatory power.

Explanation

The gross margin in the current quarter is related to the gross margin four quarters (one year) earlier. To determine whether there is a seasonality factor, we need to test the coefficient on lag 4. The t-statistic for the coefficients is calculated as the coefficient divided by the standard error with 61 degrees of freedom (64 observations less three coefficient estimates). The critical t-value for a significance level of 5% is about 2.000 (from the table). The computed t-statistic for lag 4 is 0.168/0.038 = 4.421. This is greater than the critical value at even alpha = 0.005, so it is statistically significant. This suggests an annual seasonal factor.

The process has significant explanatory power since both slope coefficients are significant and the coefficient of determination is 0.767.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #17 of 112

Le can conclude that the model is:

A) properly specified because the Durbin-Watson statistic is not significant.

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

C) not properly specified because there is evidence of autocorrelation in the residuals and the Durbin-Watson statistic is not significant.

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.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #18 of 112

What is the 95% confidence interval for the gross margin in the first quarter of 2004?

A) 0.168 to 0.240.

B) 0.158 to 0.354.

C) 0.197 to 0.305.

Explanation

The forecast for the following quarter is 0.155 + 0.240(0.240) + 0.168(0.260) = 0.256. Since the standard error is 0.049 and the corresponding t-statistic is 2, we can be 95% confident that the gross margin will be within 0.256 – 2 × (0.049) and 0.256 + 2 × (0.049) or 0.158 to 0.354.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #19 of 112

With respect to heteroskedasticity in the model, we can definitively say:

A) nothing.

B) heteroskedasticity is not a problem because the DW statistic is not significant.

C) an ARCH process exists because the autocorrelation coefficients of the residuals have different signs.

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).

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #20 of 112

Using the provided information, the forecast for the 2nd quarter of 2004 is:

A) 0.250.

B) 0.192.

C) 0.253.

Explanation

To get the 2nd quarter forecast, we use the one period forecast for the 1st quarter of 2004, which is 0.155 + 0.240(0.240) + 0.168(0.260) = 0.256. The 4th lag for the 2nd quarter is 0.22. Thus the forecast for the 2nd quarter is 0.155 + 0.240(0.256) + 0.168(0.220) = 0.253.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Housing industry analyst Elaine Smith has been assigned the task of forecasting housing foreclosures. Specifically, Smith is asked to forecast the percentage of outstanding mortgages that will be foreclosed upon in the coming quarter. Smith decides to employ multiple linear regression and time series analysis.

Besides constructing a forecast for the foreclosure percentage, Smith wants to address the following two questions:

Research Question 1:	Is the foreclosure percentage significantly affected by short-term interest rates?
Research Question 2:	Is the foreclosure percentage significantly affected by government intervention policies?

Smith contends that adjustable rate mortgages often are used by higher risk borrowers and that their homes are at higher risk of foreclosure. Therefore, Smith decides to use short-term interest rates as one of the independent variables to test Research Question 1.

To measure the effects of government intervention in Research Question 2, Smith uses a dummy variable that equals 1 whenever the Federal government intervened with a fiscal policy stimulus package that exceeded 2% of the annual Gross Domestic Product. Smith sets the dummy variable equal to 1 for four quarters starting with the quarter in which the policy is enacted and extending through the following 3 quarters. Otherwise, the dummy variable equals zero.

Smith uses quarterly data over the past 5 years to derive her regression. Smith's regression equation is provided in Exhibit 1:

Exhibit 1: Foreclosure Share Regression Equation

foreclosure share = $b_0 + b_1(\Delta INT) + b_2(STIM) + b_3(CRISIS) + \varepsilon$	
where:	
Foreclosure share	= the percentage of all outstanding mortgages foreclosed upon during the quarter
ΔINT	= the quarterly change in the 1-year Treasury bill rate (e.g., ΔINT = 2 for a two percentage point increase in interest rates)
STIM	= 1 for quarters in which a Federal fiscal stimulus package was in place
CRISIS	= 1 for quarters in which the median house price is one standard deviation below its 5-year moving average

The results of Smith's regression are provided in Exhibit 2:

Exhibit 2: Foreclosure Share Regression Results

Variable	Coefficient	t-statistic
Intercept	3.00	2.40
ΔINT	1.00	2.22
STIM	-2.50	-2.10
CRISIS	4.00	2.35

The ANOVA results from Smith's regression are provided in Exhibit 3:

Exhibit 3: Foreclosure Share Regression Equation ANOVA Table

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares
Regression	3	15	5.0000
Error	16	5	0.3125
Total	19	20	

Smith expresses the following concerns about the test statistics derived in her regression:

Concern 1:	If my regression errors exhibit conditional heteroskedasticity, my t-statistics will be underestimated.
Concern 2:	If my independent variables are correlated with each other, my F-statistic will be overestimated.

Before completing her analysis, Smith runs a regression of the changes in foreclosure share on its lagged value. The following regression results and autocorrelations were derived using quarterly data over the past 5 years (Exhibit 4 and Exhibit 5, respectively):

Exhibit 4. Lagged Regression Results

Δ foreclosure share$_t$ = 0.05 + 0.25(Δ foreclosure share$_{t-1}$)

Exhibit 5. Autocorrelation Analysis

Lag	Autocorrelation	t-statistic
1	0.05	0.22
2	-0.35	-1.53
3	0.25	1.09

4	0.10	0.44

Exhibit 6 provides critical values for the Student's *t*-Distribution

Exhibit 6: Critical Values for Student's t-Distribution

	Area in Both Tails Combined			
Degrees of Freedom	**20%**	**10%**	**5%**	**1%**
16	1.337	1.746	2.120	2.921
17	1.333	1.740	2.110	2.898
18	1.330	1.734	2.101	2.878
19	1.328	1.729	2.093	2.861
20	1.325	1.725	2.086	2.845

Question #21 of 112

Using a 1% significance level, which of the following is *closest* to the lower bound of the lower confidence interval of the ΔINT slope coefficient?

A) −0.316

B) −0.296

C) −0.045

Explanation

The appropriate confidence interval associated with a 1% significance level is the 99% confidence level, which equals;

slope coefficient ± critical t-statistic (1% significance level) × coefficient standard error

The standard error is not explicitly provided in this question, but it can be derived by knowing the formula for the *t*-statistic:

$$\text{t-statistic} = \frac{\text{COEF}}{\text{STD ERROR}}$$

From Exhibit 1, the ΔINT slope coefficient estimate equals 1.0, and its *t*-statistic equals 2.22. Therefore, solving for the standard error, we derive:

$$\text{STD ERROR for the } \Delta\text{INT slope estimate} = \frac{\text{COEF}}{\text{t-statistic}} = \frac{1.00}{2.22} = 0.450$$

The critical value for the 1% significance level is found down the 1% column in the *t*-tables provided in Exhibit 6. The appropriate degrees of freedom for the confidence interval equals n − k − 1 = 20 − 3 − 1 = 16 (k is the number of slope estimates = 3). Therefore, the critical value for the 99% confidence interval (or 1% significance level) equals 2.921.

So, the 99% confidence interval for the ΔINT slope coefficient is:

1.00 ± 2.921(0.450): lower bound equals 1 − 1.316 and upper bound 1 + 1.316

or (−0.316, 2.316).

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #22 of 112

Based on her regression results in Exhibit 2, using a 5% level of significance, Smith should conclude that:

A) stimulus packages do not have significant effects on foreclosure percentages, but housing crises do have significant effects on foreclosure percentages. ✓

B) both stimulus packages and housing crises have significant effects on foreclosure percentages. ✗

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

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #23 of 112

The standard error of estimate for Smith's regression is *closest* to:

A) 0.16

B) 0.56

C) 0.53

Explanation

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

$$\text{SEE} = \sqrt{\frac{\text{SSE}}{n - k - 1}} = \sqrt{\frac{5}{16}} = 0.56$$

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

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #24 of 112

Is Smith correct or incorrect regarding Concerns 1 and 2?

A) Incorrect on both Concerns.

B) Only correct on one concern and incorrect on the other.

C) Correct 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.

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #25 of 112

The most recent change in foreclosure share was +1 percent. Smith decides to base her analysis on the data and methods provided in Exhibit 4 and Exhibit 5, and determines that the two-step ahead forecast for the change in foreclosure share (in percent) is 0.125, and that the mean reverting value for the change in foreclosure share (in percent) is 0.071. Is Smith correct?

A) Smith is correct on both the forecast and the mean reverting level.

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

C) Smith is correct on the mean-reverting level for forecast of change in foreclosure share only.

Explanation

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

ΔForeclosure Share$_t$ = 0.05 + 0.25(ΔForeclosure Share$_{t-1}$)

= 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.

ΔForeclosure Share$_{t+1}$ = 0.05 + 0.25(0.30) = 0.125

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

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

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #26 of 112

Assume for this question that Smith finds that the foreclosure share series has a unit root. Under these conditions, she can most reliably regress foreclosure share against the change in interest rates (ΔINT) if:

A) ΔINT has unit root and is cointegrated with foreclosure share. ✓

B) ΔINT has unit root and is not cointegrated with foreclosure share. ✗

C) ΔINT does not have unit root. ✗

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.

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #27 of 112

Frank Batchelder and Miriam Yenkin are analysts for Bishop Econometrics. Batchelder and Yenkin are discussing the models they use to forecast changes in China's GDP and how they can compare the forecasting accuracy of each model. Batchelder states, "The root mean squared error (RMSE) criterion is typically used to evaluate the in-sample forecast accuracy of autoregressive models." Yenkin replies, "If we use the RMSE criterion, the model with the largest RMSE is the one we should judge as the most accurate."

With regard to their statements about using the RMSE criterion:

A) Batchelder is incorrect; Yenkin is correct.

B) Batchelder is incorrect; Yenkin is incorrect.

C) Batchelder is correct; 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.

(Study Session 3, Module 9.2, LOS 9.g)

Related Material

SchweserNotes - Book 1

Yolanda Seerveld is an analyst studying the growth of sales of a new restaurant chain called Very Vegan. The increase in the public's awareness of healthful eating habits has had a very positive effect on Very Vegan's business. Seerveld has gathered quarterly data for the restaurant's sales for the past three years. Over the twelve periods, sales grew from $17.2 million in the first quarter to $106.3 million in the last quarter. Because Very Vegan has experienced growth of more than 500% over the three years, the Seerveld suspects an exponential growth model may be more appropriate than a simple linear trend model. However, she begins by estimating the simple linear trend model:

$$(\text{sales})_t = \alpha + \beta \times (\text{Trend})_t + \varepsilon_t$$

Where the Trend is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

Regression Statistics	
Multiple R	0.952640
R^2	0.907523
Adjusted R^2	0.898275
Standard Error	8.135514
Observations	12
1st order autocorrelation coefficient of the residuals: −0.075	

ANOVA		
	df	SS
Regression	1	6495.203
Residual	10	661.8659
Total	11	7157.069

	Coefficients	Standard Error
Intercept	10.0015	5.0071
Trend	6.7400	0.6803

The analyst then estimates the following model:

$$(\text{natural logarithm of sales})_t = \alpha + \beta \times (\text{Trend})_t + \varepsilon_t$$

Regression Statistics	
Multiple R	0.952028
R^2	0.906357
Adjusted R^2	0.896992
Standard Error	0.166686
Observations	12
1st order autocorrelation coefficient of the residuals: −0.348	

ANOVA		
	df	SS
Regression	1	2.6892

Residual	10	0.2778
Total	11	2.9670

	Coefficients	Standard Error
Intercept	2.9803	0.1026
Trend	0.1371	0.0140

Seerveld compares the results based upon the output statistics and conducts two-tailed tests at a 5% level of significance. One concern is the possible problem of autocorrelation, and Seerveld makes an assessment based upon the first-order autocorrelation coefficient of the residuals that is listed in each set of output. Another concern is the stationarity of the data. Finally, the analyst composes a forecast based on each equation for the quarter following the end of the sample.

Question #28 of 112

Are either of the slope coefficients statistically significant?

A) The simple trend regression is, but not the log-linear trend regression.

B) The simple trend regression is not, but the log-linear trend regression is.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #29 of 112

Based upon the output, which equation explains the cause for variation of Very Vegan's sales over the sample period?

A) The cause cannot be determined using the given information.

B) Both the simple linear trend and the log-linear trend have equal explanatory power.

C) The simple linear trend.

Explanation

To actually determine the explanatory power for sales itself, fitted values for the log-linear trend would have to be determined and then compared to the original data. The given information does not allow for such a comparison.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #30 of 112

With respect to the possible problems of autocorrelation and nonstationarity, using the log-linear transformation appears to have:

A) improved the results for nonstationarity but not autocorrelation.

B) improved the results for autocorrelation but not nonstationarity.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #31 of 112

The primary limitation of both models is that:

A) regression is not appropriate for estimating the relationship.

B) each uses only one explanatory variable.

C) the results are difficult to interpret.

Explanation

The main problem with a trend model is that it uses only one variable so the underlying dynamics are really not adequately addressed. A strength of the models is that the results are easy to interpret. The levels of many economic variables such as the sales of a firm, prices, and gross domestic product (GDP) have a significant time trend, and a regression is an appropriate tool for measuring that trend.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #32 of 112

Using the simple linear trend model, the forecast of sales for Very Vegan for the first out-of-sample period is:

A) \$113.0 million.

B) \$123.0 million.

C) \$97.6 million.

Explanation

The forecast is $10.0015 + (13 \times 6.7400) = 97.62$.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #33 of 112

Using the log-linear trend model, the forecast of sales for Very Vegan for the first out-of-sample period is:

A) \$109.4 million.

B) \$121.2 million.

C) $117.0 million.

Explanation

The forecast is $e^{2.9803 + (13 \times 0.1371)} = 117.01$.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Clara Holmes, CFA, is attempting to model the importation of an herbal tea into the United States which last year was $ 54 million. She gathers 24 years of annual data, which is in millions of inflation-adjusted dollars.

She computes the following equation:

$(\text{Tea Imports})_t$	= 3.8836 + 0.9288	$\times$ $(\text{Tea Imports})_{t-1} + e_t$
t-statistics	(0.9328)	(9.0025)

$R^2 = 0.7942$

Adj. $R^2 = 0.7844$

SE = 3.0892

N = 23

Holmes and her colleague, John Briars, CFA, discuss the implication of the model and how they might improve it. Holmes is fairly satisfied with the results because, as she says "the model explains 78.44 percent of the variation in the dependent variable." Briars says the model actually explains more than that.

Briars asks about the Durbin-Watson statistic. Holmes said that she did not compute it, so Briars reruns the model and computes its value to be 2.1073. Briars says "now we know serial correlation is not a problem." Holmes counters by saying "rerunning the model and computing the Durbin-Watson statistic was unnecessary because serial correlation is never a problem in this type of time-series model."

Briars and Holmes decide to ask their company's statistician about the consequences of serial correlation. Based on what Briars and Holmes tell the statistician, the statistician informs them that serial correlation will only affect the standard errors and the coefficients are still unbiased.

The statistician suggests that they employ the Hansen method, which corrects the standard errors for both serial correlation and heteroskedasticity.

Given the information from the statistician, Briars and Holmes decide to use the estimated coefficients to make some inferences. Holmes says the results do not look good for the future of tea imports because the coefficient on (Tea Import)t − 1 is less than one. This means the process is mean reverting. Using the coefficients in the output, says Holmes, "we know that whenever tea imports are higher than 41.810, the next year they will tend to fall. Whenever the tea imports are less than 41.810, then they will tend to rise in the following year." Briars agrees with the general assertion that the results suggest that imports will not grow in the long run and tend to revert to a long-run mean, but he says the actual long-run mean is 54.545. Briars then computes the forecast of imports three years into the future.

Question #34 of 112

With respect to the statements made by Holmes and Briars concerning serial correlation and the importance of the Durbin-Watson statistic:

A) Briars was correct and Holmes was incorrect.

B) they were both incorrect.

C) Holmes was correct and Briars was incorrect.

Explanation

Briars was incorrect because the DW statistic is not appropriate for testing serial correlation in an autoregressive model of this sort. Holmes was incorrect because serial correlation can certainly be a problem in such a model. They need to analyze the residuals and compute autocorrelation coefficients of the residuals to better determine if serial correlation is a problem.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #35 of 112

With respect to the statement that the company's statistician made concerning the consequences of serial correlation, assuming the company's statistician is competent, we would most likely deduce that Holmes and Briars did not tell the statistician:

A) the sample size.

B) the model's specification.

C) the value of the Durbin-Watson statistic.

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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #36 of 112

The statistician's statement concerning the benefits of the Hansen method is:

A) not correct, because the Hansen method only adjusts for problems associated with heteroskedasticity but not serial correlation.

B) not correct, because the Hansen method only adjusts for problems associated with serial correlation but not heteroskedasticity.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #37 of 112

Using the model's results, Briar's forecast for three years into the future is:

A) $54.108 million.

B) $54.543 million.

C) $47.151 million.

Explanation

Briars' forecasts for the next three years would be:

year one: 3.8836 + 0.9288 × 54 = 54.0388

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

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

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #38 of 112

With respect to the comments of Holmes and Briars concerning the mean reversion of the import data, the long-run mean value that:

A) Briars computes is correct.

B) Briars computes is not correct, but his conclusion is probably accurate.

C) Briars computes is not correct, and his conclusion is probably not accurate.

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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #39 of 112

Given the nature of their analysis, the most likely potential problem that Briars and Holmes need to investigate is:

A) unit root.

B) multicollinearity.

C) autocorrelation.

Explanation

Multicollinearity cannot be a problem because there is only one independent variable. For a time series AR model, autocorrelation is a bigger worry. The model may have been misspecified leading to statistically significant autocorrelations. Unit root does not seem to be a problem given the value of b1<1.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #40 of 112

David Brice, CFA, has tried to use an AR(1) model to predict a given exchange rate. Brice has concluded the exchange rate follows a random walk without a drift. The current value of the exchange rate is 2.2. Under these conditions, which of the following would be *least likely*?

A) The residuals of the forecasting model are autocorrelated.

B) The process is not covariance stationary.

C) The forecast for next period is 2.2.

Explanation

The one-period forecast of a random walk model without drift is $E(x_{t+1}) = E(x_{t} + e_{t}) = x_t + 0$, 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.

(Study Session 3, Module 9.3, LOS 9.i)

Related Material

SchweserNotes - Book 1

Question #41 of 112

Alexis Popov, CFA, is analyzing monthly data. Popov has estimated the model $x_t = b_0 + b_1 \times x_{t-1} + b_2 \times x_{t-2} + e_t$. The researcher finds that the residuals have a significant ARCH process. The best solution to this is to:

A) re-estimate the model using a seasonal lag.

B) re-estimate the model with generalized least squares.

C) re-estimate the model using only an AR(1) specification.

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.

(Study Session 3, Module 9.5, LOS 9.o)

Related Material

SchweserNotes - Book 1

Jason Cranfell, CFA, has hypothesised that sales of luxury cars have grown at a constant rate over the past 15 years.

Question #42 of 112

Which of the following models is most appropriate for modelling these data?

A) $LuxCarSales_t = b_0 + b_1 LuxCarSales_{(t-1)} + e_t$

B) $\ln(LucCarSales) = b_0 + b_1(t) + e_t$

C) $LuxCarSales = b_0 + b_1(t) + e_t$

Explanation

Whenever the rate of change is constant over time, the appropriate model is a log-linear trend model. The other two choices are a linear trend model and an autoregressive model.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #43 of 112

After discussing the above matter with a colleague, Cranwell finally decides to use an autoregressive model of order one i.e. AR(1) for the above data. Below is a summary of the findings of the model:

b_0	0.4563
b_1	0.6874
Standard error	0.3745
R-squared	0.7548
Durbin Watson	1.23
F	12.63
Observations	180

Calculate the mean reverting level of the series:

A) 1.66

B) 1.46

C) 1.26

Explanation

The formula for the mean reverting level is $b_0/(1\text{-}b_1)$ = 0.4563/(1-0.6874)=1.46

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #44 of 112

Cranwell is aware that the Dickey Fuller test can be used to discover whether a model has a unit root. He is also aware that the test would use a revised set of critical t-values. What would it mean to Bert to reject the null of the Dickey Fuller test (H_0: g = 0) ?

A) There is a unit root but the model can be used if covariance-stationary

B) There is a unit root and the model cannot be used in its current form

C) 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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #45 of 112

Cranwell would also like to test for serial correlation in his AR(1) model. To do this, Cranwell should:

A) determine if the series has a finite and constant covariance between leading and lagged terms of itself. ✗

B) use the provided Durbin Watson statistic and compare it to a critical value. ✗

C) 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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #46 of 112

When using the root mean squared error (RMSE) criterion to evaluate the predictive power of the model, which of the following is the most appropriate statement?

A) Use the model with the lowest RMSE calculated using the out-of-sample data. ✓

B) Use the model with the lowest RMSE calculated using the in-sample data. ✗

C) Use the model with the highest RMSE calculated using the in-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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #47 of 112

If Cranwell suspects that seasonality may be present in his AR model, he would *most correctly*:

A) test for the significance of the slope coefficients.

B) use the Durbin Watson statistic.

C) examine the t-statistics of the residual lag autocorrelations.

Explanation

Seasonality in monthly and quarterly data is apparent in the high (statistically significant) t-statistics of the residual lag autocorrelations for Lag 12 and Lag 4 respectively. To correct for that, the analyst should incorporate the appropriate lag in his/her AR model.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #48 of 112

Barry Phillips, CFA, has the following time series observations from earliest to latest: (5, 6, 5, 7, 6, 6, 8, 8, 9, 11). Phillips transforms the series so that he will estimate an autoregressive process on the following data (1, -1, 2, -1, 0, 2, 0, 1, 2). The transformation Phillips employed is called:

A) moving average.

B) first differencing.

C) beta drift.

Explanation

Phillips obviously first differenced the data because the 1=6-5, -1=5-6, ... 1 = 9 - 9, 2 = 11 - 9.

(Study Session 3, Module 9.3, LOS 9.j)

Related Material

SchweserNotes - Book 1

Question #49 of 112

Which of the following statements regarding time series analysis is *least* accurate?

A) An autoregressive model with two lags is equivalent to a moving-average model with two lags. ✓

B) If a time series is a random walk, first differencing will result in covariance stationarity. ✗

C) We cannot use an AR(1) model on a time series that consists of a random walk. ✗

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.

(Study Session 3, Module 9.3, LOS 9.i)

Related Material

SchweserNotes - Book 1

Question #50 of 112

William Zox, an analyst for Opal Mountain Capital Management, uses two different models to forecast changes in the inflation rate in the United Kingdom. Both models were constructed using U.K. inflation data from 1988-2002. In order to compare the forecasting accuracy of the models, Zox collected actual U.K. inflation data from 2004-2005, and compared the actual data to what each model predicted. The first model is an AR(1) model that was found to have an average squared error of 10.429 over the 12 month period. The second model is an AR(2) model that was found to have an average squared error of 11.642 over the 12 month period. Zox then computed the root mean squared error for each model to use as a basis of comparison. Based on the results of his analysis, which model should Zox conclude is the *most accurate*?

A) Model 1 because it has an RMSE of 5.21.

B) Model 2 because it has an RMSE of 3.41.

C) 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.

(Study Session 3, Module 9.2, LOS 9.g)

Related Material

SchweserNotes - Book 1

Question #51 of 112

The regression results from fitting an AR(1) to a monthly time series are presented below. What is the mean-reverting level for the model?

Model: $\Delta Exp_t = b_0 + b_1 \Delta Exp_{t-1} + \varepsilon_t$				
	Coefficients	Standard Error	t-Statistic	p-value
Intercept	1.3304	0.0089	112.2849	< 0.0001
Lag-1	0.1817	0.0061	30.0125	< 0.0001

A) 7.3220.

B) 0.6151.

C) 1.6258.

Explanation

The mean-reverting level is b_0 / (1 − b_1) = 1.3304 / (1 − 0.1817) = 1.6258.

(Study Session 3, Module 9.2, LOS 9.f)

Related Material

SchweserNotes - Book 1

Vikas Rathod, an enrolled candidate for the CFA Level II examination, has decided to perform a calendar test to examine whether there is any abnormal return associated with investments and disinvestments made in blue-chip stocks on particular days of the week. As a proxy for blue-chips, he has decided to use the S&P 500 index. The analysis will involve the use of dummy variables and is based on the past 780 trading days. Here are selected findings of his study:

RSS	0.0039
SSE	0.9534
SST	0.9573
R-squared	0.004
SEE	0.035

Jessica Jones, CFA, a friend of Rathod, overhears that he is interested in regression analysis and warns him that whenever heteroskedasticity is present in multiple regression this could undermine the regression results. She mentions that one easy way to spot conditional heteroskedasticity is through a scatter plot, but she adds that there is a more formal test. Unfortunately, she can't quite remember its name. Jessica believes that heteroskedasticity can be rectified using White-corrected standard errors. Her son Jonathan who has also taken part in the discussion, hears this comment and argues that White correction would typically reduce the number of Type I errors in financial data.

Question #52 of 112

How many dummy variables should Rathod use?

A) Four

B) Five

C) Six

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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #53 of 112

What is *most likely* represented by the intercept of the regression?

A) The drift of a random walk.

B) The intercept is not a driver of returns, only the independent variables.

C) 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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #54 of 112

What can be said of the overall explanatory power of the model at the 5% significance?

A) The coefficient of determination for the above regression is significantly higher than the standard error of the estimate, and therefore there is value to calendar

B) There is no value to calendar trading.

C) There is 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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #55 of 112

The test mentioned by Jessica is known as the:

A) Durbin-Watson, which is a two-tailed test

B) Breusch-Pagan, which is a two-tailed test

C) 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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #56 of 112

Are Jessica and her son Jonathan, correct in terms of the method used to correct for heteroskedasticity and the likely effects?

A) Neither is correct

B) One is correct

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).

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #57 of 112

Assuming the a_1 term of an ARCH(1) model is significant, the following can be forecast:

A) A significant a1 implies that the ARCH framework cannot be used.

B) The variance of the error term.

C) The square 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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #58 of 112

The model $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-3} + b_4 x_{t-4} + \varepsilon_t$ is:

A) an autoregressive conditional heteroskedastic model, ARCH.

B) a moving average model, MA(4).

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).

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #59 of 112

Which of the following statements regarding a mean reverting time series is *least* accurate?

A) If the time-series variable is x, then $x_t = b_0 + b_1 x_{t-1}$.

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

C) If the current value of the time series is above the mean reverting level, the prediction is that the time series will decrease.

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.

(Study Session 3, Module 9.2, LOS 9.f)

Related Material

SchweserNotes - Book 1

Question #60 of 112

Marvin Greene is interested in modeling the sales of the retail industry. He collected data on aggregate sales and found the following:

$$\text{Sales}_t = 0.345 + 1.0\ \text{Sales}_{t-1}$$

The standard error of the slope coefficient is 0.15, and the number of observations is 60. Given a level of significance of 5%, which of the following can we NOT conclude about this model?

A) The model has a unit root.

B) The model is covariance stationary.

C) The slope on lagged sales is not significantly different from one.

Explanation

The test of whether the slope is different from one indicates failure to reject the null H_0: $b_1=1$ (t-critical with df = 58 is approximately 2.000, t-calculated = (1.0 - 1.0)/0.15 = 0.0). This is a 2-tailed test and we cannot reject the null since 0.0 is not greater than 2.000. This model is nonstationary because the 1.0 coefficient on $Sales_{t-1}$ is a unit root. Any time series that has a unit root is not covariance stationary which can be corrected through the *first-differencing* process.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #61 of 112

Which of the following statements regarding covariance stationarity is CORRECT?

A) A time series that is covariance stationary may have residuals whose mean changes over time.

B) The estimation results of an AR model involving a time series that is not covariance stationary are meaningless.

C) A time series may be both covariance stationary and heteroskedastic.

Explanation

Covariance stationarity requires that the expected value and the variance of the time series be constant over time.

(Study Session 3, Module 9.2, LOS 9.c)

Related Material

SchweserNotes - Book 1

Question #62 of 112

In the time series model: $y_t=b_0 + b_1 t + \varepsilon_t$, t=1,2,...,T, the:

A) disturbance term is mean-reverting.

B) disturbance terms are autocorrelated.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #63 of 112

The main reason why financial and time series intrinsically exhibit some form of nonstationarity is that:

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

B) serial correlation, a contributing factor to nonstationarity, is always present to a certain degree in most financial and time series.

C) most financial and time series have a natural tendency to revert toward their means.

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.

(Study Session 3, Module 9.2, LOS 9.h)

Related Material

SchweserNotes - Book 1

Question #64 of 112

To qualify as a covariance stationary process, which of the following does not have to be true?

A) Covariance(x_t, x_{t-2}) = Covariance(x_t, x_{t+2}).

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

C) E[x_t] = E[x_{t+1}].

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.

(Study Session 3, Module 9.2, LOS 9.c)

Related Material

SchweserNotes - Book 1

Question #65 of 112

A time series x that is a random walk with a drift is *best* described as:

A) $x_t = b_0 + b_1 x_{t-1}$.

B) $x_t = x_{t-1} + \varepsilon_t$.

C) $x_t = b_0 + b_1 x_{t-1} + \varepsilon_t$.

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.

(Study Session 3, Module 9.3, LOS 9.i)

Related Material

SchweserNotes - Book 1

Question #66 of 112

One choice a researcher can use to test for nonstationarity is to use a:

A) Dickey-Fuller test, which uses a modified χ^2 statistic.

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

C) Breusch-Pagan 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.

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Question #67 of 112

Suppose you estimate the following model of residuals from an autoregressive model:

$$\varepsilon_t^2 = 0.25 + 0.6\varepsilon^2_{t-1} + \mu_t, \text{ where } \varepsilon = \varepsilon^\wedge$$

If the residual at time t is 0.9, the forecasted variance for time t+1 is:

A) 0.736.

B) 0.790.

C) 0.850.

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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #68 of 112

David Brice, CFA, has used an AR(1) model to forecast the next period's interest rate to be 0.08. The AR(1) has a positive slope coefficient. If the interest rate is a mean reverting process with an unconditional mean, a.k.a., mean reverting level, equal to 0.09, then which of the following could be his forecast for two periods ahead?

A) 0.072.

B) 0.113.

C) 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.

(Study Session 3, Module 9.2, LOS 9.f)

Related Material

SchweserNotes - Book 1

Question #69 of 112

Modeling the trend in a time series of a variable that grows at a constant rate with continuous compounding is best done with:

A) simple linear regression.

B) a moving average model.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #70 of 112

Suppose you estimate the following model of residuals from an autoregressive model:

$$\varepsilon_t^2 = 0.4 + 0.80\varepsilon_{t-1}^2 + \mu_t, \text{ where } \varepsilon = \varepsilon\hat{}$$

If the residual at time t is 2.0, the forecasted variance for time t+1 is:

A) 3.6.

B) 2.0.

C) 3.2.

Explanation

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

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #71 of 112

David Wellington, CFA, has estimated the following log-linear trend model: $LN(x_t) = b_0 + b_1 t + \varepsilon_t$. Using six years of quarterly observations, 2001:I to 2006:IV, Wellington gets the following estimated equation: $LN(x_t) = 1.4 + 0.02t$. The first out-of-sample forecast of x_t for 2007:I is *closest* to:

A) 1.88.

B) 4.14.

C) 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.)

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #72 of 112

Alexis Popov, CFA, wants to estimate how sales have grown from one quarter to the next on average. The most direct way for Popov to estimate this would be:

A) an AR(1) model.

B) a linear trend model.

C) an AR(1) model with a seasonal lag.

Explanation

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

(Study Session 3, Module 9.5, LOS 9.o)

Related Material

SchweserNotes - Book 1

Question #73 of 112

The table below shows the autocorrelations of the lagged residuals for the first differences of the natural logarithm of quarterly motorcycle sales that were fit to the AR(1) model: $(\ln \text{sales}_t - \ln \text{sales}_{t-1}) = b_0 + b_1(\ln \text{sales}_{t-1} - \ln \text{sales}_{t-2}) + \varepsilon_t$. The critical *t*-statistic at 5% significance is 2.0, which means that there is significant autocorrelation for the lag-4 residual, indicating the presence of seasonality. Assuming the time series is covariance stationary, which of the following models is *most likely* to CORRECT for this apparent seasonality?

Lagged Autocorrelations of First Differences in the Log of Motorcycle Sales			
Lag	**Autocorrelation**	**Standard Error**	**t-Statistic**
1	−0.0738	0.1667	−0.44271
2	−0.1047	0.1667	−0.62807
3	−0.0252	0.1667	−0.15117
4	0.5528	0.1667	3.31614

A) $(\ln \text{sales}_t - \ln \text{sales}_{t-4}) = b_0 + b_1(\ln \text{sales}_{t-1} - \ln \text{sales}_{t-2}) + \varepsilon_t$.

B) $\ln \text{sales}_t = b_0 + b_1(\ln \text{sales}_{t-1}) - b_2(\ln \text{sales}_{t-4}) + \varepsilon_t$.

C) $(\ln \text{sales}_t - \ln \text{sales}_{t-1}) = b_0 + b_1(\ln \text{sales}_{t-1} - \ln \text{sales}_{t-2}) + b_2(\ln \text{sales}_{t-4} - \ln \text{sales}_{t-5}) + \varepsilon_t$.

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 $(\ln \text{sales}_{t-4} - \ln \text{sales}_{t-5})$.

(Study Session 3, Module 9.4, LOS 9.l)

Related Material

SchweserNotes - Book 1

Question #74 of 112

Consider the estimated AR(2) model, $x_t = 2.5 + 3.0\, x_{t-1} + 1.5\, x_{t-2} + \varepsilon_t$ t=1,2,...50. Making a prediction for values of x for $1 \le t \le 50$ is referred to as:

A) an out-of-sample forecast.

B) an in-sample forecast.

C) requires more information to answer the question.

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.

(Study Session 3, Module 9.2, LOS 9.g)

Related Material

SchweserNotes - Book 1

Question #75 of 112

Alexis Popov, CFA, has estimated the following specification: $x_t = b_0 + b_1 \times x_{t-1} + e_t$. Which of the following would *most likely* lead Popov to want to change the model's specification?

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

B) $b_0 < 0$.

C) Correlation(e_t, e_{t-1}) is not 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.

(Study Session 3, Module 9.5, LOS 9.o)

Related Material

SchweserNotes - Book 1

Question #76 of 112

Consider the estimated model $x_t = -6.0 + 1.1\, x_{t-1} + 0.3\, x_{t-2} + \varepsilon_t$ that is estimated over 50 periods. The value of the time series for the 49th observation is 20 and the value of the time series for the 50th observation is 22. What is the forecast for the 52nd observation?

A) 24.2.

B) 27.22.

C) 42

Explanation

Using the chain-rule of forecasting,

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

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

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #77 of 112

The data below yields the following AR(1) specification: $x_t = 0.9 - 0.55x_{t-1} + E_t$, and the indicated fitted values and residuals.

Time	xt	fitted values	residuals
1	1	-	-
2	-1	0.35	-1.35
3	2	1.45	0.55
4	-1	-0.2	-0.8
5	0	1.45	-1.45
6	2	0.9	1.1
7	0	-0.2	0.2
8	1	0.9	0.1
9	2	0.35	1.65

The following sets of data are ordered from earliest to latest. To test for ARCH, the researcher should regress:

A) (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).

B) (-1.35, 0.55, -0.8, -1.45, 1.1, 0.2, 0.1, 1.65) on (0.35, 1.45, -0.2, 1.45, 0.9, -0.2, 0.9, 0.35)

C) (1, 4, 1, 0, 4, 0, 1, 4) on (1, 1, 4, 1, 0, 4, 0, 1)

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:

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

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

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Question #78 of 112

An analyst wants to model quarterly sales data using an autoregressive model. She has found that an AR(1) model with a seasonal lag has significant slope coefficients. She also finds that when a second and third seasonal lag are added to the model, all slope coefficients are significant too. Based on this, the best model to use would *most likely* be an:

A) AR(1) model with 3 seasonal lags.

B) AR(1) model with no seasonal lags.

C) ARCH(1).

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.

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #79 of 112

An AR(1) autoregressive time series model:

A) can be used to test for a unit root, which exists if the slope coefficient is less than one.

B) cannot be used to test for a unit root.

C) 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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #80 of 112

The model $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-12} + \varepsilon_t$ is an autoregressive model of type:

A) AR(2).

B) AR(12).

C) AR(1).

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).

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #81 of 112

Which of the following is a seasonally adjusted model?

A) $Sales_t = b_1 Sales_{t-1} + \varepsilon_t$.

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

C) $Sales_t = b_0 + b_1 Sales_{t-1} + b_2 Sales_{t-2} + \varepsilon_t$.

Explanation

This model is a seasonal AR with first differencing.

(Study Session 3, Module 9.4, LOS 9.l)

Related Material

SchweserNotes - Book 1

Question #82 of 112

Suppose that the time series designated as Y is mean reverting. If $Y_{t+1} = 0.2 + 0.6\ Y_t$, the best prediction of Y_{t+1} is:

A) 0.3.

B) 0.8.

C) 0.5.

Explanation

The prediction is $Y_{t+1} = b_0 / (1-b_1) = 0.2 / (1-0.6) = 0.5$

(Study Session 3, Module 9.2, LOS 9.f)

Related Material

SchweserNotes - Book 1

Question #83 of 112

The table below includes the first eight residual autocorrelations from fitting the first differenced time series of the absenteeism rates (ABS) at a manufacturing firm with the model $\Delta ABS_t = b_0 + b_1\Delta ABS_{t-1} + \varepsilon_t$. Based on the results in the table, which of the following statements *most accurately* describes the appropriateness of the specification of the model, $\Delta ABS_t = b_0 + b_1\Delta ABS_{t-1} + \varepsilon_t$?

Lagged Autocorrelations of the Residuals of the First Differences in Absenteeism Rates			
Lag	**Autocorrelation**	**Standard Error**	**t-Statistic**
1	−0.0738	0.1667	−0.44271
2	−0.1047	0.1667	−0.62807
3	−0.0252	0.1667	−0.15117
4	−0.0157	0.1667	−0.09418
5	−0.1262	0.1667	−0.75705
6	0.0768	0.1667	0.46071
7	0.0038	0.1667	0.02280
8	−0.0188	0.1667	−0.11278

A) The Durbin-Watson statistic is needed to determine the presence of significant correlation of the residuals.

B) The negative values for the autocorrelations indicate that the model does not fit the time series.

C) The low values for the *t*-statistics 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.

(Study Session 3, Module 9.2, LOS 9.e)

Related Material

SchweserNotes - Book 1

Question #84 of 112

An analyst modeled the time series of annual earnings per share in the specialty department store industry as an AR(3) process. Upon examination of the residuals from this model, she found that there is a significant autocorrelation for the residuals of this model. This indicates that she needs to:

A) alter the model to an ARCH model.

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

C) switch models to a moving average model.

Explanation

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

(Study Session 3, Module 9.2, LOS 9.e)

Related Material

SchweserNotes - Book 1

Question #85 of 112

Troy Dillard, CFA, has estimated the following equation using semiannual data: $x_t = 44 + 0.1 \times x_{t-1} - 0.25 \times x_{t-2} - 0.15 \times x_{t-3} + e_t$. Given the data in the table below, what is Dillard's best forecast of the second half of 2007?

Time	Value
2003: I	31
2003: II	31
2004: I	33
2004: II	33
2005: I	36
2005: II	35
2006: I	32
2006: II	33

A) 34.05.

B) 33.74.

C) 34.36.

Explanation

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

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

E[x2007:I] = 44 + 0.1×33 - 0.25×32 - 0.15×35

E[x2007:I] = 34.05

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

E[x2007:II] = 44 + 0.1×34.05 - 0.25×33 - 0.15×32

E[x2007:II] = 34.36

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #86 of 112

The table below shows the autocorrelations of the lagged residuals for quarterly theater ticket sales that were estimated using the AR(1) model: $\ln(\text{sales}_t) = b_0 + b_1(\ln \text{sales}_{t-1}) + e_t$. Assuming the critical *t*-statistic at 5% significance is 2.0, which of the following is the *most likely* conclusion about the appropriateness of the model? The time series:

Lagged Autocorrelations of the Log of Quarterly Theater Ticket Sales			
Lag	**Autocorrelation**	**Standard Error**	**t-Statistic**
1	−0.0738	0.1667	−0.44271
2	−0.1047	0.1667	−0.62807
3	−0.0252	0.1667	−0.15117
4	0.5528	0.1667	3.31614

A) would be more appropriately described with an MA(4) model.

B) contains ARCH (1) errors.

C) contains seasonality.

Explanation

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

(Study Session 3, Module 9.4, LOS 9.l)

Related Material

SchweserNotes - Book 1

Question #87 of 112

Which of the following is NOT a requirement for a series to be covariance stationary? The:

A) time series must have a positive trend.

B) expected value of the time series is constant over time.

C) covariance of the time series with itself (lead or lag) must be constant.

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.

(Study Session 3, Module 9.2, LOS 9.c)

Related Material

SchweserNotes - Book 1

Question #88 of 112

The primary concern when deciding upon a time series sample period is which of the following factors?

A) Current underlying economic and market conditions. ✓

B) The length of the sample time period. ✗

C) The total number of observations. ✗

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.

(Study Session 3, Module 9.2, LOS 9.h)

Related Material

SchweserNotes - Book 1

Question #89 of 112

Troy Dillard, CFA, has estimated the following equation using quarterly data: $x_t = 93 - 0.5 \times x_{t-1} + 0.1 \times x_{t-4} + e_t$. Given the data in the table below, what is Dillard's best estimate of the first quarter of 2007?

Time	Value
2005: I	62
2005: II	62
2005: III	66
2005: IV	66
2006: I	72
2006: II	70
2006: III	64
2006: IV	66

A) 66.40.

B) 66.60.

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:

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

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

$E[x2007{:}I] = 67.20$

(Study Session 3, Module 9.2, LOS 9.d)

Related Material

SchweserNotes - Book 1

Question #90 of 112

Dianne Hart, CFA, is considering the purchase of an equity position in Book World, Inc, a leading seller of books in the United States. Hart has obtained monthly sales data for the past seven years, and has plotted the data points on a graph. Which of the following statements regarding Hart's analysis of the data time series of Book World's sales is *most accurate*? Hart should utilize a:

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

B) linear model to analyze the data because the mean appears to be constant.

C) mean-reverting model to analyze the data because the time series pattern is covariance stationary.

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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #91 of 112

Given an AR(1) process represented by $x_{t+1} = b_0 + b_1 \times x_t + e_t$, the process would not be a random walk if:

A) the long run mean is $b_0 + b_1$.

B) $E(e_t)=0$.

C) $b_1 = 1$.

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 = $b_0/(1-b_1)$.

(Study Session 3, Module 9.3, LOS 9.i)

Related Material

SchweserNotes - Book 1

Question #92 of 112

Rhonda Wilson, CFA, is analyzing sales data for the TUV Corp, a current equity holding in her portfolio. She observes that sales for TUV Corp. have grown at a steadily increasing rate over the past ten years due to the successful introduction of some new products. Wilson anticipates that TUV will continue this pattern of success. Which of the following models is *most* appropriate in her analysis of sales for TUV Corp?

A) A linear trend model, because the data series is equally distributed above and below the line and the mean is constant.

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

C) A log-linear trend model, because the data series can be graphed using a straight, upward-sloping line.

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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #93 of 112

Trend models can be useful tools in the evaluation of a time series of data. However, there are limitations to their usage. Trend models are *not* appropriate when which of the following violations of the linear regression assumptions is present?

A) Model misspecification.

B) Serial correlation.

C) Heteroskedasticity.

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.

(Study Session 3, Module 9.1, LOS 9.b)

Related Material

SchweserNotes - Book 1

Question #94 of 112

Which of the following statements regarding seasonality is *least* accurate?

A) The presence of seasonality makes it impossible to forecast using a time-series model.

B) Not correcting for seasonality when, in fact, seasonality exists in the time series results in a violation of an assumption of linear regression.

C) A time series that is first differenced can be adjusted for seasonality by incorporating the first-differenced value for the previous year's corresponding

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.

(Study Session 3, Module 9.4, LOS 9.l)

Related Material

SchweserNotes - Book 1

Question #95 of 112

Barry Phillips, CFA, is analyzing quarterly data. He has estimated an AR(1) relationship ($x_t = b_0 + b_1 \times x_{t-1} + e_t$) and wants to test for seasonality. To do this he would want to see if which of the following statistics is significantly different from zero?

A) Correlation(e_t, e_{t-4}).

B) Correlation(e_t, e_{t-5}).

C) Correlation(e_t, e_{t-1}).

Explanation

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

(Study Session 3, Module 9.4, LOS 9.l)

Related Material

SchweserNotes - Book 1

Question #96 of 112

A time series that has a unit root can be transformed into a time series without a unit root through:

A) calculating moving average of the residuals.

B) mean reversion.

C) first differencing.

Explanation

First differencing a series that has a unit root creates a time series that does not have a unit root.

(Study Session 3, Module 9.3, LOS 9.j)

Related Material

SchweserNotes - Book 1

Question #97 of 112

Which of the following is *least likely* a consequence of a model containing ARCH(1) errors? The:

A) variance of the errors can be predicted.

B) regression parameters will be incorrect.

C) 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.

(Study Session 3, Module 9.5, LOS 9.m)

Related Material

SchweserNotes - Book 1

Albert Morris, CFA, is evaluating the results of an estimation of the number of wireless phone minutes used on a quarterly basis within the territory of Car-tel International, Inc. Some of the information is presented below (in billions of minutes):

Wireless Phone Minutes $(WPM)_t = b_o + b_1\ WPM_{t-1} + \varepsilon_t$

ANOVA	Degrees of Freedom	Sum of Squares	Mean Square
Regression	1	7,212.641	7,212.641
Error	26	3,102.410	119.324
Total	27	10,315.051	

Coefficients	Coefficient	Standard Error of the Coefficient
Intercept	-8.0237	2.9023
WPM_{t-1}	1.0926	0.0673

The variance of the residuals from one time period within the time series is not dependent on the variance of the residuals in another time period.

Morris also models the monthly revenue of Car-tel using data over 96 monthly observations. The model is shown below:

Sales (CAD$ millions) $= b_0 + b_1\ Sales_{t-1} + \varepsilon_t$

Coefficients	Coefficient	Standard Error of the Coefficient
Intercept	43.2	12.32
	0.8867	0.4122

$Sales_{t-1}$		

Question #98 of 112

The value for WPM this period is 544 billion. Using the results of the model, the forecast Wireless Phone Minutes three periods in the future is:

A) 586.35.

B) 683.18.

C) 691.30.

Explanation

The one-period forecast is −8.023 + (1.0926 × 544) = 586.35.

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

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

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #99 of 112

The R-squared for the WPM model is *closest* to:

A) 70%.

B) 97%.

C) 33%.

Explanation

R-squared = SSR/SST = 7,212.641/10,315.051 = 70%.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #100 of 112

The WPM model was specified as a(n):

A) Autoregressive (AR) Model with a seasonal lag.

B) Moving Average (MA) Model.

C) 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #101 of 112

Based upon the information provided, Morris would most likely get more meaningful statistical results by:

A) adding more lags to the model.

B) first differencing the data.

C) doing nothing. No information provided suggests that any of these will improve the specification.

Explanation

Since the slope coefficient is greater than one, the process may not be covariance stationary (we would have to test this to be definitive). A common technique to correct for this is to first difference the variable to perform the following regression: $\Delta(WPM)_t = b_o + b_1\ \Delta(WPM)_{t-1} + \varepsilon_t$.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #102 of 112

The mean reverting level of monthly sales is *closest* to:

A) 43.2 million.

B) 381.29 million.

C) 8.83 million.

Explanation

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

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #103 of 112

Morris concludes that the current price of Car-tel stock is consistent with single stage constant growth model (with g=3%). Based on this information, the sales model is *most likely*:

A) Incorrectly specified and taking the natural log of the data would be an appropriate remedy.

B) Correctly specified.

C) Incorrectly specified and first differencing 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. 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.

(Study Session 3, Module 9.1, LOS 9.a)

Related Material

SchweserNotes - Book 1

Question #104 of 112

The regression results from fitting an AR(1) model to the first-differences in enrollment growth rates at a large university includes a Durbin-Watson statistic of 1.58. The number of quarterly observations in the time series is 60. At 5% significance, the critical values for the Durbin-Watson statistic are d_l = 1.55 and d_u = 1.62. Which of the following is the *most* accurate interpretation of the DW statistic for the model?

A) Since DW > d_l, the null hypothesis of no serial correlation is rejected.

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

C) Since d_l < DW < $d_{u,}$ the results of the DW test are inconclusive.

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.

(Study Session 3, Module 9.2, LOS 9.e)

Related Material

SchweserNotes - Book 1

Question #105 of 112

Consider the following estimated model:

$$(\text{Sales}_t - \text{Sales}_{t-1}) = 100 - 1.5\,(\text{Sales}_{t-1} - \text{Sales}_{t-2}) + 1.2\,(\text{Sales}_{t-4} - \text{Sales}_{t-5})\ \ t=1,2,..\ T$$

and Sales for the periods 1999.1 through 2000.2:

t	Period	Sales
T	2000.2	$1,000
T-1	2000.1	$900
T-2	1999.4	$1,200
T-3	1999.3	$1,400
T-4	1999.2	$1,000
T-5	1999.1	$800

The forecasted Sales amount for 2000.3 is *closest* to:

A) $1,730.00

B) $1,430.00

C) $730.00

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

(Study Session 3, Module 9.5, LOS 9.n)

Related Material

SchweserNotes - Book 1

Winston Collier, CFA, has been asked by his supervisor to develop a model for predicting the warranty expense incurred by Premier Snowplow Manufacturing Company in servicing its plows. Three years ago, major design changes were made on newly manufactured plows in an effort to reduce warranty expense. Premier warrants its snowplows for 4 years or 18,000 miles, whichever comes first. Warranty expense is higher in winter months, but some of Premier's customers defer maintenance issues that are not essential to keeping the machines functioning to spring or summer seasons. The data that Collier will analyze is in the following table (in $ millions):

Quarter	Warranty Expense	Change in Warranty Expense y_t	Lagged Change in Warranty Expense y_{t-1}	Seasonal Lagged Change in Warranty Expense y_{t-4}
2002.1	103			
2002.2	52	-51		
2002.3	32	-20	-51	
2002.4	68	+36	-20	
2003.1	91	+23	+36	
2003.2	44	-47	+23	-51
2003.3	30	-14	-47	-20
2003.4	60	+30	-14	+36

2004.1	77	+17	+30	+23
2004.2	38	-39	+17	-47
2004.3	29	-9	-39	-14
2004.4	53	+24	-9	+30

Winston submits the following results to his supervisor. The first is the estimation of a trend model for the period 2002:1 to 2004:4. The model is below. The standard errors are in parentheses.

$(\text{Warranty expense})_t = 74.1 - 2.7^* \ t + e_t$

R-squared = 16.2%

(14.37) (1.97)

Winston also submits the following results for an autoregressive model on the differences in the expense over the period 2004:2 to 2004:4. The model is below where "y" represents the change in expense as defined in the table above. The standard errors are in parentheses.

$y_t = -0.7 - 0.07^* \ y_{t-1} + 0.83^* \ y_{t-4} + e_t$

R-squared = 99.98%

(0.643) (0.0222) (0.0186)

After receiving the output, Collier's supervisor asks him to compute moving averages of the sales data.

Question #106 of 112

Collier's supervisors would probably not want to use the results from the trend model for all of the following reasons EXCEPT:

A) it does not give insights into the underlying dynamics of the movement of the dependent variable.

B) the model is a linear trend model and log-linear models are always superior.

C) the slope coefficient is not significant.

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #107 of 112

For this question only, assume that Winston also ran an AR(1) model with the following results:

$y_t = -0.9 - 0.23^* y_{t-1} + e_t$

R-squared = 78.3%

(0.823) (0.0222)

The mean reverting level of this model is *closest* to:

A) 1.16.

B) 0.77.

C) −0.73.

Explanation

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

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

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #108 of 112

Based upon the output provided by Collier to his supervisor and without any further calculations, in a comparison of the two equations' explanatory power of warranty expense it can be concluded that:

A) the information provided is not sufficient to determine which equation has greater explanatory power. ✓

B) the two equations are equally useful in explaining warranty expense. ✗

C) the autoregressive model on the first differenced data has more explanatory power for warranty expense. ✗

Explanation

Although the R-squared values would suggest that the autoregressive model has more explanatory power, there are a few problems. First, the models have different sample periods and different numbers of explanatory variables. Second, the actual input data is different. To assess the explanatory power of warranty expense, as opposed to the first differenced values, we must transform the fitted values of the first-differenced data back to the original level data to assess the explanatory power for the warranty expense.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #109 of 112

Based on the autoregressive model, expected warranty expense in the first quarter of 2005 will be *closest* to:

A) $51 million. ✗

B) $60 million. ✗

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.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #110 of 112

Based upon the results, is there a seasonality component in the data?

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

B) No, because the slope coefficients in the autoregressive model have opposite signs.

C) Yes, because the coefficient on y_t is small compared to its standard error.

Explanation

The coefficient on the 4th lag tests the seasonality component. The t-ratio is 44.6. Even using Chebychev's inequality, this would be significant. Neither of the other answers are correct or relate to the seasonality of the data.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #111 of 112

Collier *most likely* chose to use first-differenced data in the autoregressive model:

A) because the time trend was significant.

B) in order to avoid problems associated with unit roots.

C) to increase the explanatory power.

Explanation

Time series with unit roots are very common in economic and financial models, and unit roots cause problems in assessing the model. Fortunately, a time series with a unit root may be transformed to achieve covariance stationarity using the first-differencing process. Although the explanatory power of the model was high (but note the small sample size), a model using first-differenced data often has less explanatory power. The time trend was not significant, so that was not a possible answer.

(Study Session 3, Module 9.3, LOS 9.k)

Related Material

SchweserNotes - Book 1

Question #112 of 112

Barry Phillips, CFA, has estimated an AR(1) relationship ($x_t = b_0 + b_1 \times x_{t-1} + e_t$) and got the following result: $x_{t+1} = 0.5 + 1.0x_t + e_t$. Phillips should:

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

B) not first difference the data because $b_1 - b_0 = 1.0 - 0.5 = 0.5 < 1$.

C) not first difference the data because $b_0 = 0.5 < 1$.

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.

(Study Session 3, Module 9.3, LOS 9.j)

Related Material

SchweserNotes - Book 1