# Schweser Printable Answers - Session Investment Tools: Quantitative Methods for Valuation

Test ID#: 1362402

Back to Test Review | Hide Questions | Print this Page

Question 1 - #12631

Toni Williams, CFA, has determined that commercial electric generator sales in the Midwest U.S. for Self-Start Company is a function of several factors in each area: the cost of heating oil, the temperature, snowfall, and housing starts. Using data for the most currently available year, she runs a cross-sectional regression where she regresses the deviation of sales from the historical average in each area on the deviation of each explanatory variable from the historical average of that variable for that location. She feels this is the most appropriate method since each geographic area will have different average values for the inputs, and the model can explain how current conditions explain how generator sales are higher or lower from the historical average in each area. In summary, she regresses current sales for each area minus its respective historical average on the following variables for each area.

- The difference between the retail price of heating oil and its historical average.
- The mean number of degrees the temperature is below normal in Chicago.
- The amount of snowfall above the average.
- The percentage of housing starts above the average.

Williams used a sample of 26 observations obtained from 26 metropolitan areas in the Midwest U.S. The results are in the tables below. The dependent variable is in sales of generators in millions of dollars.

| *Coefficient Estimates Table* | | |
|---|---|---|
| *Variable* | *Estimated Coefficient* | *Standard Error of the Coefficient* |
| Intercept | 5.00 | 1.850 |
| $ Heating Oil | 2.00 | 0.827 |
| Low Temperature | 3.00 | 1.200 |
| Snowfall | 10.00 | 4.833 |
| Housing Starts | 5.00 | 2.333 |

| *Analysis of Variance Table (ANOVA)* | | | |
|---|---|---|---|
| *Source* | *Degrees of Freedom* | *Sum of Squares* | *Mean Square* |
| Regression | 4 | 335.20 | 83.80 |
| Error | 21 | 606.40 | 28.88 |
| Total | 25 | 941.60 | |

One of her goals is to forecast the sales of the
Chicago metropolitan area next year. For that area and for the upcoming year, Williams obtains the following projections: heating oil prices will be $0.10 above average, the temperature in Chicago will be 5 degrees below normal, snowfall will be 3 inches above average, and housing starts will be 3 percent below average.

In addition to making forecasts and testing the significance of the estimated coefficients, she plans to perform diagnostic tests to verify the validity of the model's results.

Part 1)
According to the model and the data for the Chicago metropolitan area, the forecast of generator sales is:

A) $65 million above the average.
B) The average.
C) $35.2 million above the average.
D) $55 million above average.

Your answer: A was incorrect. The correct answer was C) $35.2 million above the average.

The model uses a multiple regression equation to predict sales by multiplying the estimated coefficient by the observed value to get:

[5 + (2 * 0.10) + (3 * 5) + (10 * 3) + (5 * -3)] * $1,000,000 = $35.2 million.

Part 2)
Williams proceeds to test the hypothesis that none of the independent variables has significant explanatory power. He concludes that, at a 5 percent level of significance:

A) none of the independent variables has explanatory power, because the calculated F-statistic does not exceed its critical value.
B) at least one of the independent variables has explanatory power, because the calculated F-statistic exceeds its critical value.
C) all of the independent variables have explanatory power, because the calculated F-statistic exceeds its critical value.
D) at least one of the independent variables has explanatory power, because the calculated F-statistic does not exceed its critical value.

Your answer: A was incorrect. The correct answer was B) at least one of the independent variables has explanatory power, because the calculated F-statistic exceeds its critical value.

From the ANOVA table, the calculated F-statistic is (mean square regression / mean square error) = (83.80 / 28.88) = 2.9017. From the F distribution table (4 df numerator, 21 df denominator) the critical F value is 2.84. Because 2.9017 is greater than 2.84, Williams rejects the null hypothesis and concludes that at least one of the independent variables has explanatory power.

Part 3)
With respect to testing the validity of the model's results, Williams may wish to perform:

A) a Durbin-Watson test, but not a Breusch-Pagan test.
B) a Breusch-Pagan test, but not a Durbin-Watson test.
C) neither a Durbin-Watson test nor a Breusch-Pagan test.
D) both a Durbin-Watson test and a Breusch-Pagan test.

Your answer: A was incorrect. The correct answer was D) both a Durbin-Watson test and a Breusch-Pagan test.

Since this is not an autoregression a test for serial correlation is appropriate so the Durbin-Watson test would be used. The Breusch-Pagan test for heteroskedasticity would be a good idea.

Part 4)
Williams decides to use two-tailed tests on the individual variables, at a 5 percent level of significance, to determine whether electric generator sales are explained by each of them individually. Williams concludes that:

A) all of the variables except snowfall and housing starts explain sales.
B) all of the variables explain sales.
C) only low temperature explains sales.
D) all of the variables except snowfall explain sales.

Your answer: A was incorrect. The correct answer was D) all of the variables except snowfall explain sales.

The calculated t–statistics are:

- Heating Oil: (2.00 / 0.827) = 2.4184
- Low Temperature: (3.00 / 1.200) = 2.5000
- Snowfall: (10.00 / 4.833) = 2.0691
- Housing Starts: (5.00 / 2.333) = 2.1432

All of these values are outside the t–critical value (at (26 – 4 – 1) = 21 degrees of freedom) of 2.080, except the change in snowfall. So Williams fails to reject the null hypothesis for the other variables and continues to conclude that they explain sales, but rejects the null hypothesis with respect to snowfall and concludes that increases or decreases in snowfall do not explain sales.

Part 5)
When Williams ran the model, the computer said the R-squared is 0.233. She examines the other output and concludes that this is the:

A) adjusted R-squared value.
B) unadjusted R-squared value.
C) the coefficient of correlation.
D) neither the unadjusted nor adjusted R-squared value, nor the coefficient of correlation.

Your answer: A was incorrect. The correct answer was A) adjusted R-squared value.

This can be answered by recognizing that the unadjusted R-square is (335.2/941.6)=0.356. Thus, the reported value must be the adjusted R-squared. To verify this we see that the adjusted R-squared is: 1-((26-1)/(26-4-1))*(1-0.356) = 0.233. Note that whenever there is more than one independent variable, the adjusted R-squared will always be less than R-squared.

Part 6)
In preparing and using this model, Williams has relied on all of the following assumptions **EXCEPT**:

A) the disturbance or error term is normally distributed.
B) there is a linear relationship between the independent variables.
C) the independent variables are uncorrelated with the residuals.
D) a linear relationship exists between the dependent and independent variables.

Your answer: A was incorrect. The correct answer was B) there is a linear relationship between the independent variables.

Multiple regression models assume that there is no linear relationship between two or more of the independent variables. The other answer choices are all assumptions of multiple regression.

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Question 2 - #8641

Erica Basenj, CFA, has been given an assignment by her boss. She has been requested to review the following regression output to answer questions about the relationship between the monthly returns of the Toffee Investment Management (TIM) High Yield Bond Fund and the returns of the index (independent variable).

| *Regression Statistics* | | | | | |
|---|---|---|---|---|---|
| R-squared | ?? | | | | |
| Standard Error | ?? | | | | |
| Observations | 20 | | | | |
| *ANOVA* | | | | | |
| | *df* | *SS* | *MS* | *F* | *Significance F* |
| Regression | 1 | 23,516 | 23,516 | ? | ? |
| Residual | 18 | ? | 7 | | |
| Total | 19 | 23,644 | | | |
| *Regression Equation* | | | | | |
| | | *Coefficients* | *Std. Error* | *t- statistic* | *p-value* |
| Intercept | | 5.2900 | 1.6150 | ? | ? |
| Slope | | 0.8700 | 0.0152 | ? | ? |

Part 1)
What is the value of the correlation coefficient?

A) -0.9973.
B) 0.8700.

C) 0.9973.
D) -0.8700.

Your answer: A was incorrect. The correct answer was C) 0.9973.

$R^2$
is the correlation coefficient squared, taking into account whether the relationship is positive or negative. Since the value of the slope is positive, the TIM fund and the index are positively related. $R^2$ is calculated by taking the (SSR/SST) = 0.99459. $(0.99459)^{1/2}$ = 0.9973.

Part 2)
What is the sum of squared errors (SSE)?

A) 23,515.
B) 23,644.
C) 3,283.
D) 128.

Your answer: A was incorrect. The correct answer was D) 128.

SSE = SST – SSR = 23,644 – 23,516 = 128

Part 3)
What is the value of $R^2$?

A) 0.0055.
B) 5.2900.
C) 0.9471.
D) 0.9946.

Your answer: A was incorrect. The correct answer was D) 0.9946.

$R^2$ = SSR/SST = 1 – SSE/SST = 23,516/23,644 = 0.9946.

Part 4)
Is the intercept term statistically significant at the 5 percent level of significance and the 1 percent level of significance, respectively?

| | 1% | 5% |
|---|---|---|
| A) | Yes | No |
| B) | No | No |
| C) | No | Yes |
| D) | Yes | Yes |

Your answer: A was incorrect. The correct answer was D)
Yes Yes

The test statistic is t = b/std error of b = 5.29/1.615 = 3.2755.

Critical t-values are +/– 2.101 for the degrees of freedom = n – k – 1 = 18 for alpha = 0.05. For alpha = 0.01, critical t-values are +/– 2.878. At both levels (two-tailed tests) we can reject $H_0$ that b = 0.

Part 5)
What is the value of the F-statistic?

A) 0.0003.
B) 0.9945.
C) 182.

D) 3,359.

Your answer: A was incorrect. The correct answer was D) 3,359.

F = mean square regression / mean square error = 23,516 / 7 = 3,359.

Part 6)
Heteroskedasticity can be defined as:

A) error terms that are dependent.
B) nonconstant variance of the error terms.
C) a regression that changes over time.
D) independent variables that are correlated with each other.

Your answer: A was incorrect. The correct answer was B) nonconstant variance of the error terms.

Heteroskedasticity occurs when the variance of the residuals is not the same across all observations in the sample. Autocorrelation refers to dependent error terms. Nonstationarity is when the regression changes over time.

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Question 3 - #8602

Miles Mason, CFA, works for ABC Capital, a large money management company based in New York. Mason has several years of experience as a financial analyst, but is currently working in the marketing department developing materials to be used by ABC's sales team for both existing and prospective clients. ABC Capital's client base consists primarily of large net worth individuals and Fortune 500 companies. ABC invests its clients' money in both publicly traded mutual funds as well as its own investment funds that are managed in-house. Five years ago, roughly half of its assets under management were invested in the publicly traded mutual funds, with the remaining half in the funds managed by ABC's investment team. Currently, approximately 75 percent of ABC's assets under management are invested in publicly traded funds, with the remaining 25 percent being distributed among ABC's private funds. The managing partners at ABC would like to shift more of its client's assets away from publicly-traded funds into ABC's proprietary funds, ultimately returning to a 50-50 split of assets between publicly traded funds and ABC funds. There are three key reasons for this shift in the firm's asset base. First, ABC's in-house funds have outperformed other funds consistently for the past five years. Second, ABC can offer its clients a reduced fee structure on funds managed in-house relative to other publicly traded funds. Lastly, ABC has recently hired a top fund manager away from a competing investment company and would like to increase his assets under management.

ABC Capital's upper management requested that current clients be surveyed in order to determine the cause of the shift of assets away from ABC funds. Results of the survey indicated that clients feel there is a lack of information regarding ABC's funds. Clients would like to see extensive information about ABC's past performance, as well as a sensitivity analysis showing how the funds will perform in varying market scenarios. Mason is part of a team that has been charged by upper management to create a marketing program to present to both current and potential clients of ABC. He needs to be able to demonstrate a history of strong performance for the ABC funds, and, while not promising any measure of future performance, project possible return scenarios. He decides to conduct a regression analysis on all of ABC's in-house funds. He is going to use 12 independent economic variables in order to predict each particular fund's return. Mason is very aware of the many factors that could minimize the effectiveness of his regression model, and if any are present, he knows he must determine if any corrective actions are necessary. Mason is using a sample size of 121 monthly returns.

Part 1)
In order to conduct an F-test, what would be the degrees of freedom used ($df_{numerator}$; $df_{denominator}$)?

A) 12; 108.
B) 108; 12.
C) 120; 11.
D) 11; 120.

Your answer: A was incorrect. The correct answer was A) 12; 108.

Degrees of freedom for the F-statistic is k for the numerator and n – k – 1 for the denominator.

k = 12

n – k – 1 = 121 – 12 – 1 = 108

Part 2)
In regards to multiple regression analysis, which of the following statements is **TRUE**?

A) R-squared is less than adjusted R-squared.
B) Adjusted R-squared is less than R-squared.
C) Adjusted R-squared always decreases as independent variables increase.
D) Adjusted R-squared does not account for the number of observations.

Your answer: A was incorrect. The correct answer was B) Adjusted R-squared is less than R-squared.

Whenever there is more than one independent variable, adjusted R-squared is less than R-squared. Adding a new independent variable will increase R-squared, but may either increase or decrease adjusted R-squared.

R-squared adjusted = 1 – [((n – 1) / (n – k - 1)) x (1 – R-squared)]

Where:
n = number of observations
K = number of independent variables
R-squared = unadjusted R-squared

Part 3)
Which of the following tests is used to detect autocorrelation?

A) Breusch-Pagan.
B) Residual Plot.
C) F-test.
D) Durbin-Watson.

Your answer: A was incorrect. The correct answer was D) Durbin-Watson.

Durbin-Watson is used to detect autocorrelation. Breusch-Pagan and the residual plot are methods to detect heteroskedasticity, while the F-test is used to test whether at least one independent variable in a set of variables explains the variation in the dependent variable.

Part 4)
One of the most popular ways to correct heteroskedasticity is to:

A) adjust the standard errors.
B) employ residual plots.
C) use generalized least squares.
D) improve the specification of the model.

Your answer: A was incorrect. The correct answer was C) use generalized least squares.

Using generalized least squares and calculating robust standard errors are possible remedies for heteroskedasticity. Employing residual plots is a method to detect, not correct, heteroskedasticity. Improving specifications remedies serial correlation. The standard error cannot be adjusted, only the coefficient of the standard errors.

Part 5)
Which of the following statements regarding the Durbin-Watson statistic is **TRUE**? The Durbin-Watson statistic:

A) is approximately equal to 1 if the error terms are not serially correlated.
B) only uses error terms in its computations.
C) can only be used to detect positive serial correlation.
D) can only be used to detect negative serial correlation.

Your answer: A was incorrect. The correct answer was B) only uses error terms in its computations.

The formula for the Durbin-Watson statistic uses error terms in its calculation. The Durbin-Watson statistic is approximately equal to 2 if there is no serial correlation. A Durbin-Watson statistic less than 2 indicates positive serial correlation, while a Durbin-Watson statistic greater then 2 indicates negative serial correlation.

Part 6)
If a regression equation shows that no individual t-tests are significant, but the F-statistic is significant, the regression probably exhibits:

A) multicollinearity.
B) serial correlation.
C) heteroskedasticity.
D) dummy variables.

Your answer: A was incorrect. The correct answer was A) multicollinearity.

Common indicators of multicollinearity include: high correlation (>0.7) between independent variables, no individual t-tests are significant but the F-statistic is, and signs on the coefficients that are opposite of what is expected.

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Question 4 - #8654

Rebecca Anderson, CFA, has recently accepted a position as a financial analyst with Eagle Investments. She will be responsible for providing analytical data to Eagle's portfolio manager for several industries. In addition, she will follow each of the major public corporations within each of those industries. As one of her first assignments, Anderson has been asked to provide a detailed report on one of Eagle's current investments. She was given the following data on sales for Company XYZ, the maker of toilet tissue, as well as toilet tissue industry sales ($ millions). She has been asked to develop a model to aid in the prediction of future sales levels for Company XYZ. She proceeds by recalling some of the basic concepts of regression analysis she learned while she was preparing for the CFA exam.

| *Year* | *Industry Sales (X)* | *Company Sales (Y)* | $X^2$ | $XY$ | $Y^2$ |
|---|---|---|---|---|---|
| 1 | $3,000 | $750 | 9,000,000 | 2,250,000 | 562,500 |
| 2 | $3,200 | $800 | 10,240,000 | 2,560,000 | 640,000 |
| 3 | $3,400 | $850 | 11,560,000 | 2,890,000 | 722,500 |
| 4 | $3,350 | $825 | 11,222,500 | 2,763,750 | 680,625 |
| 5 | $3,500 | $900 | 12,250,000 | 3,150,000 | 810,000 |
| Totals | $16,450 | $4,125 | 54,272,500 | 13,613,750 | 3,415,625 |

| *Coefficient Estimates* | | | |
|---|---|---|---|
| *Predictor* | *Coefficient* | *Stand. Error of the Coefficient* | *t-statistic* |
| Intercept | -94.88 | 32.97 | ?? |
| Slope (Industry Sales) | 0.2796 | 0.0363 | ?? |

| *Analysis of Variance Table (ANOVA)* | | | | |
|---|---|---|---|---|
| *Source* | *df (Degrees of Freedom)* | *SS (Sum of Squares)* | *Mean Square (SS/df)* | *F-statistic* |
| Regression | 1 (# of independent variables) | 11,899.50 (SSR) | 11,899.50 (MSR) | 59.45 |
| Error | 3 (n-2) | 600.50 (SSE) | 200.17 (MSE) | |
| Total | 4 (n-1) | 12,500 (SS Total) | | |

| *Abbreviated Two-tailed t-table* | | |
|---|---|---|
| *df* | *10%* | *5%* |
| 2 | 2.920 | 4.303 |

| | | |
|---|---|---|
| 3 | 2.353 | 3.182 |
| 4 | 2.132 | 2.776 |

Part 1)
Which of the following is the correct value of the correlation coefficient between industry sales and company sales?

A) 0.2192.
B) 0.9062.
C) 0.0023.
D) 0.9757.

Your answer: A was incorrect. The correct answer was D) 0.9757.

The $R^2$ = SSR/SS Total = 1 - SSE/SS Total = 1 - 600.50/12,500 = 0.952

The correlation coefficient is the square root of the $R^2$ in a simple linear regression, which is the square root of 0.952 = 0.9757.

Part 2)
Which of the following reports the correct value and interpretation of the $R^2$ for this regression? The $R^2$ is:

A) 0.048, indicating that the variability of industry sales explains about 4.8 percent of the variability of company sales.
B) 0.952, indicating that the variability of industry sales explains about 95.2 percent of the variability of company sales.
C) 0.952, indicating the variability of company sales explains about 95.2 percent of the variability of industry sales.
D) 0.048, indicating that the variability of company sales explains about 4.8 percent of the variability of industry sales.

Your answer: A was incorrect. The correct answer was B) 0.952, indicating that the variability of industry sales explains about 95.2 percent of the variability of company sales.

The $R^2$ = SSR/SS Total = 1 - SSE/SS Total = 1 - 600.50/12,500 = 0.952

The interpretation of this $R^2$
is that 95.2% of the variation in company XYZ's sales is explained by the variation in tissue industry sales.

Part 3)
What is the predicted value for sales of Company XYZ given industry sales of $3,500?

A) $900.00.
B) $883.72.
C) $994.88.
D) $978.60.

Your answer: A was incorrect. The correct answer was B) $883.72.

The regression equation is Y = -94.88 + 0.2796 * X = -94.88 + 0.2796 * (3,500) = 883.72.

Part 4)
What is the upper limit of a 95 percent confidence interval for the predicted value of company sales (Y) given industry sales of $3,300?

A) 318.42.
B) 827.87.
C) 877.13.

D) 160.09.

Your answer: A was incorrect. The correct answer was C) 877.13.

The predicted value is $\hat{Y} = -94.88 + 0.2796 * 3,300 = 827.8$.

The upper limit for a 95% confidence interval = $\hat{Y} + t_c s_f = 827.8 + 3.182 * 15.5028 = 827.8 + 49.33 = 877.13$ (Interim calculations below).

The critical value of $t_c$ at 95% confidence and 3 degrees of freedom is 3.182.

The standard error of the forecast, $s_f^2 = s_e^2[1 + 1/n + (X - \overline{X})^2/(n - 1)s_X^2]$, where

$s_e^2$ = MSE = 200.17
n = 5
X = 3,300
$\overline{X}$ = 16,450/5 = 3,290
$s_X^2 = [ \Sigma(Xi^2) - (\Sigma Xi)^2/n ] / (n - 1) = [ 54,272,500 - 16,450^2/5 ] / (5 - 1) = 38,000$

Substituting, $s_f^2 = 200.17 * \{1 + 1/5 + (3,300 - 3,290)^2 / [(5 - 1) * 38,000]\} = 240.335691$

$s_f = 15.5028$

Part 5)
What is the lower limit of a 95 percent confidence interval for the predicted value of company sales (Y) given industry sales of $3,300?

A) 1,337.06.
B) 827.80.
C) 160.00.
D) 778.47.

Your answer: A was incorrect. The correct answer was D) 778.47.

The predicted value is $\hat{Y} = -94.88 + 0.2796 * 3,300 = 827.8$.

The lower limit for a 95% confidence interval = $\hat{Y} - t_c s_f = 827.8 - 3.182 * 15.5028 = 827.8 - 49.33 = 778.47$ (Interim calculations below).

The critical value of $t_c$ at 95% confidence and 3 degrees of freedom is 3.182.

The standard error of the forecast, $s_f^2 = s_e^2[1 + 1/n + (X - \overline{X})^2/(n - 1)s_X^2]$, where

$s_e^2$ = MSE = 200.17
n = 5
X = 3,300
$\overline{X}$ = 16,450/5 = 3,290
$s_X^2 = [ \Sigma(Xi^2) - (\Sigma Xi)^2/n ] / (n - 1) = [ 54,272,500 - 16,450^2/5 ] / (5 - 1) = 38,000$

Substituting, $s_f^2 = 200.17 * \{1 + 1/5 + (3,300 - 3,290)^2 / [(5 - 1) * 38,000]\} = 240.335691$

$s_f = 15.5028$

Part 6)
What is the t-statistic for the slope of the regression line?

A) 3.1820.
B) 2.9600.
C) 7.7025.

D) 59.4500.

Your answer: A was incorrect. The correct answer was C) 7.7025.

Tb = ($b_1$hat – $b_1$) / $s_{b1}$ = ( 0.2796 – 0 ) / 0.0363 = 7.7025.

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Question 5 - #12630

Dave Turner is a security analyst who is using regression analysis to determine how well two factors explain returns for common stocks. The independent variables are the natural logarithm of the number of analysts following the companies, Ln(no. of analysts), and the natural logarithm of the market value of the companies, Ln(market value). The regression output generated from a statistical program is given in the following tables. Each p-value corresponds to a two-tail test.

Turner plans to use the result in the analysis of two investments. WLK Corp. has twelve analysts following it and a market capitalization of $2.33 billion. NGR Corp. has two analysts following it and a market capitalization of $47 million.

**Table 1: Regression Output**

| *Variable* | *Coefficient* | *Standard Error of the Coefficient* | *t-statistic* | *p-value* |
|---|---|---|---|---|
| Intercept | 0.043 | 0.01159 | 3.71 | <0.001 |
| Ln(No. of Analysts) | -0.027 | 0.00466 | -5.80 | <0.001 |
| Ln(Market Value) | 0.006 | 0.00271 | 2.21 | 0.028 |

**Table 2: ANOVA**

| | *Degrees of Freedom* | *Sum of Squares* | *Mean Square* |
|---|---|---|---|
| Regression | 2 | 0.103 | 0.051 |
| Residual | 194 | 0.559 | 0.003 |
| Total | 196 | 0.662 | |

Part 1)
In a one-sided test and a 1 percent level of significance, which of the coefficients are significantly different from zero?

A) The coefficient on ln(no. of Analysts) only.
B) The intercept and the coefficient on ln(no. of analysts) only.
C) The intercept and the coefficient on ln(market value) only.
D) All the coefficients.

Your answer: A was incorrect. The correct answer was B) The intercept and the coefficient on ln(no. of analysts) only.

The p-values correspond to a two-tail test. For a one-tailed test, divide the provided p-value by two to find the minimum level of significance for which a null hypothesis of a coefficient equaling zero can be rejected. Dividing the provided p-value for the intercept and ln(no. of analysts) will give a value less than 0.0005, which is less than 1% and would lead to a rejection of the hypothesis. Dividing the provided p-value for ln(market value) will give a value of 0.014 which is greater than 1%; thus, that coefficient is not significantly different from zero at the 1% level of significance.

Part 2)
The 95 percent confidence interval of the expected return of WLK Corp. is *closest* to:

A) -0.03 to 0.31.
B) 0.03 to 0.24
C) 0.05 to 0.25.
D) 0.0 to 0.21.

Your answer: A was incorrect. The correct answer was D) 0.0 to 0.21.

SEE = √[SSE/(n-k-1)] = √[0.559/(197-2-1)] = √(0.559/194) = √MSE = 0.0537

The estimate is 0.105 = 0.043 + ln(12)(-0.027)+ln(2330000000)(0.006) [Note: Remember order of operations – take the natural log before multiplying]

The t-statistic for a two-tailed test with a 95 percent confidence level is approximately 2. Subtracting and adding (2)(0.0537) around the forecast gives the 95% confidence interval for the forecast.

Part 3)
If the number of analysts on NGR Corp. were to double to 4, the change in the forecast of NGR would be *closest* to?

A) -0.019.
B) -0.035.
C) -0.012.
D) -0.055.

Your answer: A was incorrect. The correct answer was A) -0.019.

Initially, the estimate is 0.1303 = 0.043 + ln(2)(-0.027)+ln(47000000)(0.006)

Then, the estimate is 0.1116 = 0.043 + ln(4)(-0.027)+ln(47000000)(0.006)

0.1116 – 0.1303 = -0.0187, or -0.019

Part 4)
Based on a R-squared calculated from the information in Table 2, the analyst should conclude that the number of analysts and ln(market value) of the firm explain:

A) 15.6% of the variation in returns.
B) 84.4% of the variation in returns.
C) 18.4% of the variation in returns.
D) 14.7% of the variation in returns.

Your answer: A was incorrect. The correct answer was A) 15.6% of the variation in returns.

R-squared is the percentage of the variation in the dependent variable (in this case, variation of returns) explained by the set of independent variables. R-squared is calculated as follows: R-squared = (SSR/SST) = (0.103 / 0.662) = 15.6%.

Part 5)
What is the F-statistic from the regression? And, what can be concluded from its value at a 1 percent level of significance?

A) F = 17.00, reject a hypothesis that both of the slope coefficients are equal to zero.
B) F = 1.97, fail to reject a hypothesis that both of the slope coefficients are equal to zero.
C) F = 5.80, reject a hypothesis that both of the slope coefficients are equal to zero.
D) F = 33.65, reject a hypothesis that all three coefficients are equal to zero.

Your answer: A was incorrect. The correct answer was A) F = 17.00, reject a hypothesis that both of the slope coefficients are equal to zero.

The F-statistic is calculated as follows: F = MSR/MSE = 0.051/0.003 = 17.00; and 17.00 > 4.61, which is the critical F-value for the given degrees of freedom and a 1% level of significance. However, when F-values are in excess of 10 for a large sample like this, a table is not needed to know that the value is significant.

Part 6)
Upon further analysis, Turner concludes that multicollinearity is a problem. What might have prompted this further analysis and what is intuition behind the conclusion?

A) At least one of the t-statistics was not significant, the F-statistic was not significant, and a positive

relationship between the number of analysts and the size of the firm would be expected.

B) At least one of the t-statistics was not significant, the F-statistic was not significant, and an inverse relationship between the number of analysts and the size of the firm would be expected.

C) At least one of the t-statistics was not significant, the F-statistic was significant, and an intercept not significantly different from zero would be expected.

D) At least one of the t-statistics was not significant, the F-statistic was significant, and a positive relationship between the number of analysts and the size of the firm would be expected.

Your answer: A was incorrect. The correct answer was D) At least one of the t-statistics was not significant, the F-statistic was significant, and a positive relationship between the number of analysts and the size of the firm would be expected.

Multicollinearity occurs when there is a high correlation among independent variables and may exist if there is a significant F-statistic for the fit of the regression model, but at least one insignificant independent variable when we expect all of them to be significant. In this case the coefficient on ln(market value) was not significant at the 1% level, but the F-statistic was significant. It would make sense that the size of the firm, i.e., the market value, and the number of analysts would be positively correlated.

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Question 6 - #8562

Damon Washburn, CFA, is currently enrolled as a part-time graduate student at State University. One of his recent assignments for his course on Quantitative Analysis is to perform a regression analysis utilizing the concepts covered during the semester. He must interpret the results of the regression as well as the test statistics. Washburn is confident in his ability to calculate the statistics because the class is allowed to use statistical software. However, he realizes that the interpretation of the statistics will be the true test of his knowledge of regression analysis. His professor has given to the students a list of questions that must be answered by the results of the analysis.

Washburn has estimated a regression equation in which 160 quarterly returns on the S&P 500 are explained by three macroeconomic variables: employment growth (EMP) as measured by nonfarm payrolls, gross domestic product (GDP) growth, and private investment (INV). The results of the regression analysis are as follows:

| *Coefficient Estimates* | | |
|---|---|---|
| *Parameter* | *Coefficient* | *Standard Error of Coefficient* |
| Intercept | 9.50 | 3.40 |
| EMP | -4.50 | 1.25 |
| GDP | 4.20 | 0.76 |
| INV | -0.30 | 0.16 |

Other Data:

- Sum of squared regression (SSR) = 126.00
- Sum of squared errors (SSE) = 267.00
- Durbin-Watson statistic (DW) = 1.34

| *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* |
| 3 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 |
| 10 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 |
| 50 | 1.299 | 1.676 | 2.009 | 2.403 | 2.678 |
| 100 | 1.290 | 1.660 | 1.984 | 2.364 | 2.626 |
| 120 | 1.289 | 1.658 | 1.980 | 2.358 | 2.617 |
| 200 | 1.286 | 1.653 | 1.972 | 2.345 | 2.601 |

| *Critical Values for Durbin-Watson Statistic (α = 0.05)* | | | | | |
|---|---|---|---|---|---|
| | K=1 | K=2 | K=3 | K=4 | K=5 |

| n | $d_l$ | $d_u$ | $d_l$ | $d_u$ | $d_l$ | $d_u$ | $d_l$ | $d_u$ | $d_l$ | $d_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 1.20 | 1.41 | 1.10 | 1.54 | 1.00 | 1.68 | 0.90 | 1.83 | 0.79 | 1.99 |
| 50 | 1.50 | 1.59 | 1.46 | 1.63 | 1.42 | 1.67 | 1.38 | 1.72 | 1.34 | 1.77 |
| >100 | 1.65 | 1.69 | 1.63 | 1.72 | 1.61 | 1.74 | 1.59 | 1.76 | 1.57 | 1.78 |

Part 1)
How many of the three independent variables (not including the intercept term) are statistically significant in explaining quarterly stock returns at the 5.0 percent level?

A) One of the three is statistically significant.
B) None of the three are statistically significant.
C) All three are statistically significant.
D) Two of the three are statistically significant.

Your answer: A was incorrect. The correct answer was D) Two of the three are statistically significant.

To determine whether the independent variables are statistically significant, we use the student's t-statistic, where t equals the coefficient estimate divided by the standard error of the coefficient. This is a two-tailed test. The critical value for a 5.0% significance level and 156 degrees of freedom (160-3-1) is about 1.980, according to the table.

The t-statistic for employment growth = -4.50/1.25 = -3.60.

The t-statistic for GDP growth = 4.20/0.76 = 5.53.

The t-statistic for investment growth = -0.30/0.16 = -1.88.

Therefore, employment growth and GDP growth are statistically significant, because the absolute values of their t-statistics are larger than the critical value, which means two of the three independent variables are statistically significantly different from zero.

Part 2)
Can the null hypothesis that the GDP growth coefficient is equal to 3.50 be rejected at the 1.0 percent confidence level versus the alternative that it is not equal to 3.50? The null hypothesis is:

A) not rejected because the t-statistic is equal to 0.92.
B) accepted because the t-statistic is less than 2.617.
C) rejected because the t-statistic is greater than 0.92.
D) rejected because the t-statistic is less than 2.617.

Your answer: A was incorrect. The correct answer was A) not rejected because the t-statistic is equal to 0.92.

The hypothesis is:

$H_0$: $b_{GDP} = 3.50$
$H_a$: $b_{GDP} \neq 3.50$

This is a two-tailed test. The critical value for the 1.0% significance level and 156 degrees of freedom (160-3-1) is about 2.617. The t-statistic is (4.20 – 3.50)/0.76 = 0.92. Because the t-statistic is less than the critical value, we cannot reject the null hypothesis. Notice we cannot say that the null hypothesis is accepted; only that it is not rejected.

Part 3)
The percentage of the total variation in quarterly stock returns explained by the independent variables is *closest* to:

A) 42%.
B) 25%.
C) 47%.
D) 32%.

Your answer: A was incorrect. The correct answer was D) 32%.

The $R^2$ is the percentage of variation in the dependent variable explained by the independent variables. The $R^2$ is equal to the $SS_{Regession}/SS_{Total}$, where the $SS_{Total}$ is equal to $SS_{Regression} + SS_{Error}$. $R^2$ = 126.00/(126.00+267.00) = 32%.

Part 4)
According to the Durbin-Watson statistic, there is:

A) no significant positive serial correlation in the residuals.
B) significant positive serial correlation in the residuals.
C) no significant heteroskedasticity in the residuals.
D) significant heteroskedasticity in the residuals.

Your answer: A was incorrect. The correct answer was B) significant positive serial correlation in the residuals.

The Durbin-Watson statistic tests for serial correlation in the residuals. According to the table, $d_l$ = 1.61 and $d_u$ = 1.74 for three independent variables and 160 degrees of freedom. Because the DW (1.34) is less than the lower value (1.61), the null hypothesis of no significant positive serial correlation can be rejected. This means there is a problem with serial correlation in the regression, which affects the interpretation of the results.

Part 5)

What is the predicted quarterly stock return, given the following forecasts?

- Employment growth = 2.0%
- GDP growth = 1.0%
- Private investment growth = -1.0%

A) 4.4%.
B) -4.5%.
C) 23.0%.
D) 5.0%.

Your answer: A was incorrect. The correct answer was D) 5.0%.

Predicted quarterly stock return is 9.50% + (-4.50)(2.0%) + (4.20)(1.0%) + (-0.30)(-1.0%) = 5.0%.

Part 6)
What is the standard error of the estimate?

A) 0.81.
B) 2.52.
C) 1.71.
D) 1.31.

Your answer: A was incorrect. The correct answer was D) 1.31.

The standard error of the estimate is equal to $[SSE/(n - k - 1)]^{1/2}$ = $[267.00/156]^{1/2}$ = approximately 1.31.

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Back to Test Review | Hide Questions | Print this Page