The University of Kansas

Department of Economics

Quiz 1

Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

SECTION A - MULTIPLE CHOICE

12% 1. Among the measures of association between two variables we have:
A. Median
B. Variance
C. Standard Deviation
D. Correlation

12% 2. Let X be a discrete random variable. What is the following term?

$$\sum_{j=1}^{m} x_j f_{X|Y}(x_j|y)$$

A. the conditional distribution of X given Y
B. the joint distribution of X given Y
C. the joint distribution of Y given X
D. the conditional expectation of X given Y

12% 3. For the past 3 months you verified that **every time** the price of stock A raised, the price of stock B dropped. Then, based on your data, what is the Corr(A, B)?
A. 1
B. -1
C. 0
D. 0.5

SECTION B - TRUE OR FALSE

12% 1. Let X and Y be two independent random variables, such that $E[X] = 4$, $E[Y] = 5$, $Var[X] = 1$ and $Var[Y] = 2$. Then $Cov(X, Y) = 0$.
◯ True ◯ False

12% 2. Let X and Y be two random variables. If $Cov(X, Y) = 0$, then X and Y are independent.
◯ True ◯ False

SECTION C - SHORT ANSWER

40% 1. Let X be a random variable and

$$\bar{X} = \sum_{i=1}^{n} \frac{X_i}{n}$$

be its sample average. Show that the sum of the deviations from the sample average is always equal to 0, which means that $\sum_{i=1}^{n}(X_i - \bar{X}) = 0$.

The University of Kansas

Department of Economics

Quiz 2

Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

SECTION B - TRUE OR FALSE

10% 1. Let $Y_1, Y_2, \ldots, Y_n$ be i.i.d. random variables with mean μ, and variance σ^2. The *Central Limit Theorem (CLT)* states that, for n large, $Z_n = \dfrac{\bar{Y}_n - \mu}{\sigma/\sqrt{n}}$ will converge to a standard Normal distribution only if $Y_1, Y_2, \ldots, Y_n$ has Normal distribution.
◯ True ◯ False

10% 2. The *Law of Large Numbers* (LLN) states that the sample average of n independent and identically distributed random variables, for n large, follows a Normal distribution.
◯ True ◯ False

10% 3. The *Law of Large Number* (LLN) is related with the concept of convergence in probability, while *The Central Limit Theorem* (CLT) is related with convergence in distribution.
◯ True ◯ False

10% 4. We say that an estimator is unbiased if it converges in probability to the true parameter.
◯ True ◯ False

10% 5. Consistency of an estimator is related to its asymptotic properties, i.e., with the idea of what happens to the estimator when the samples size n gets large.
◯ True ◯ False

10% 6. Let $Y_1, Y_2, \ldots, Y_n$ be i.i.d. random variables with mean μ, and variance σ^2. Consider the following estimator: $W = \dfrac{Y_1 + Y_2}{2}$. Then, W is an unbiased estimator of μ.
◯ True ◯ False

SECTION C - SHORT ANSWER

40% 1. Suppose a researcher would like to know what is the mean hours per month Kansas residents spend commuting to work. In order to do that s/he **randomly drawn** 800 Kansas residents and tracked during a month the hours they spent commuting to work.
(a) What is the population of his/her problem? [1 or 2 line(s) answer]
(b) What is the sample? [1 or 2 line(s) answer]
(c) What (populational) parameter s/he wants to know? [1 line answer]
(d) What estimator could s/he use to accomplish the task? [1 line answer]

The University of Kansas

Department of Economics

Quiz 3

Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

SECTION A - MULTIPLE CHOICE

10% 1. If a change in variable x explains a change in a variable y. Then, the variable y is called:
   A. dependent variable
   B. predictor variable
   C. explanatory variable
   D. independent variable

10% 2. Nonexperimental data is also know as:
   A. cross-sectional data
   B. observational data
   C. time series data
   D. panel data

SECTION B - TRUE OR FALSE

10% 1. Depending if we either use the Method of Moments or the Least Squares Method to derive β_0 and β_1 of a simple regression model, we may get different estimators for both parameters.
   ◯ True ◯ False

10% 2. Regarding the association between the x and the error term in a simple linear regression model such as $y = \beta_0 + \beta_1 x + u$, if x and u are uncorrelated, then we have enough information to derive the estimators.
   ◯ True ◯ False

10% 3. In a simple linear regression model, the error term is related to the sample, while the residual is related to the population.
   ◯ True ◯ False

SECTION C - SHORT ANSWER

1. Suppose you want to study the effects of the number of students per classroom in algebra courses and students' performance in algebra courses for high schools in Kansas. You collected a random sample and now you have data for the above two variables. You called them as *number_students* (which refers to the number of students per classroom in algebra courses), and *students_performance* (which refers to the students' performance in algebra courses - measured as their final grade in a scale from 0 to 4). Therefore, you want to know how *number_students* explains *students_performance*.

5% (a) What is the independent variable? **[1 line answer maximum - don't exceed it]**

5% (b) What is the dependent variable? **[1 line answer - don't exceed it]**

10% (c) Using the variables names, write the simple linear regression model. **[1 line answer - don't exceed it]**

10% (d) Knowing that the OLS estimate for the intercept is 3.4, and for the slope is -0.02, write the estimated OLS regression line (or SRF) using the variables names. **[1 line answer - don't exceed it]**

10% (e) What is the predicted value for whichever is your dependent variable for a classroom with 20 students? **[1 line answer - don't exceed it]**

10% (f) What is the predicted effect on your dependent variable for each additional increment (i.e, when you increase one unit) of your independent variable? **[up to 2 lines answer - do not exceed it]**

The University of Kansas

Department of Economics

Quiz 4

Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

SECTION A - MULTIPLE CHOICE

Consider a random sample with the Grade Point Average (GPA) and standardized test scores (ACT), along with the performance in an introductory economics course, for students at a large public university. The variable to be explained is *score*, which is the final score in the course measured as a percentage. The variable *hsgpa* is the high school GPA, *actmth* is the ACT in math and *colgpa* is the college GPA of the student prior to take the economics course.

REGRESSION (A)

```
===============================================
                        Dependent variable:
                    ---------------------------
                            log(score)
-----------------------------------------------
hsgpa                        0.2120***
                             (0.0199)

Constant                     3.5563***
                             (0.0668)

-----------------------------------------------
Observations                    856
R2                             0.1174
Adjusted R2                    0.1163
Residual Std. Error      0.1997 (df = 854)
F Statistic          113.5666*** (df = 1; 854)
===============================================
Note:               *p<0.1; **p<0.05; ***p<0.01
```

12.5% 1. Based on the **Regression (A)** above, what is the effect on the dependent variable if *hsgpa* increases one unit?

A. $\widehat{log(score)}$ will increase 21.2%
B. $\widehat{log(score)}$ will increase 0.212%
C. $\widehat{score}$ will increase by 0.212 units
D. $\widehat{score}$ will increase 21.2%

REGRESSION (B)

```
==============================================
                     Dependent variable:
                 ---------------------------
                          log(score)
----------------------------------------------
log(actmth)               0.5084***
                          (0.0406)

Constant                  2.6735***
                          (0.1274)

----------------------------------------------
Observations                 814
R2                         0.1616
Adjusted R2                0.1606
Residual Std. Error      0.1915 (df = 812)
F Statistic         156.4957*** (df = 1; 812)
==============================================
Note:              *p<0.1; **p<0.05; ***p<0.01
```

12.5% 2. Based on the **Regression (B)** above, what is the effect on the dependent variable if *actmth* increases 10%?

A. $\widehat{log(score)}$ will increase 0.5084%
B. $\widehat{log(score)}$ will increase 50.84%
C. $\widehat{score}$ will increase by 5.084 units
D. $\widehat{score}$ will increase 5.084%

REGRESSION (C)

```
==============================================
                     Dependent variable:
                 ---------------------------
                            score
----------------------------------------------
colgpa                    14.3155***
                          (0.6997)

Constant                  32.3061***
                          (2.0049)

----------------------------------------------
Observations                 856
R2                         0.3289
Adjusted R2                0.3281
Residual Std. Error     10.9842 (df = 854)
F Statistic         418.5822*** (df = 1; 854)
==============================================
Note:              *p<0.1; **p<0.05; ***p<0.01
```

12.5% 3. Based on the **Regression (C)** above, what is the effect on the dependent variable if *colgpa* decreases 2 units?

A. $\widehat{score}$ will decrease by 28.631 units
B. $\widehat{score}$ will decrease 14.316%
C. $\widehat{score}$ will decrease 28.631%
D. $\widehat{score}$ will decrease by 7.158 units

12.5% 4. The variable *colgpa* is a number from 0 to 4. Consider the case that you would like to transform the college GPA to a scale from 0 to 100. Thus, you create a new variable: *colgpa_scaled*, such that $colgpa\_scaled = 25 \cdot colpga$. Then you rerun the **Regression (C)** replacing *colgpa* by *colgpa_scaled*. What is your new $\hat{\beta}_1$?

A. $25 \cdot 14.3155$

B. $\frac{1}{25} \cdot 14.3155$

C. $\frac{100}{25} \cdot 14.3155$

D. $0.25 \cdot 14.3155$

SECTION B - TRUE OR FALSE

For all models below, assume that you have a random sample, and that (i) $Var(x) \neq 0$ and (ii) $E(u|x) = 0$ for any independent variable x.

10% 1. Consider the following regression model: $log(score) = \beta_0 + \beta_1 colgpa^3 + u$. Then this model is linear in parameters.
◯ True ◯ False

10% 2. Consider the following regression model: $log(score) = \beta_0 + \beta_1 log(colgpa) + u$. Then the OLS is an unbiased estimator for the true β_0 and β_1.
◯ True ◯ False

10% 3. The following regression model: $log(score) = \beta_0 + \beta_1 log(hsgpa) + u$ is also known as constant percentage model.
◯ True ◯ False

10% 4. The following regression model: $log(score) = \beta_0 + \beta_1 colgpa + u$ is also known as constant elasticity model.
◯ True ◯ False

10% 5. In the following regression model: $log(score) = \beta_0 + \beta_1 log(colgpa) + u$, β_1 is the elasticity of *score* with respect to *hsgpa*.
◯ True ◯ False

The University of Kansas

Department of Economics

Quiz 5
Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

SECTION A - MULTIPLE CHOICE

[**Same dataset from Quiz 4**] Consider a random sample with the Grade Point Average (GPA) and standardized test scores (ACT), along with the performance in an introductory economics course, for students at a large public university. The variable to be explained is *score*, which is the final score in the course measured as a percentage. The variable *hsgpa* is the high school GPA, *actmth* is the ACT in math and *colgpa* is the college GPA of the student prior to take the economics course.

	Dependent variable:
	log(score)
hsgpa	0.0274
	(0.0204)
log(actmth)	0.3082***
	(0.0388)
colgpa	0.1784***
	(0.0125)
Constant	2.7073***
	(0.1119)
Observations	814
R2	0.3704
Adjusted R2	0.3681
Residual Std. Error	0.1662 (df = 810)
F Statistic	158.8443*** (df = 3; 810)
Note:	*p<0.1; **p<0.05; ***p<0.01

12.5% 1. Based on the above, what is the effect on the dependent variable if *colgpa* increases one unit?

A. $\widehat{log(score)}$ will increase 17.8%
B. $\widehat{log(score)}$ will increase 1.78%
C. $\widehat{score}$ will increase by 0.178 units
D. $\widehat{score}$ will increase 17.8%

12.5% 2. Based on the above, what is the effect on the dependent variable if *actmth* increases 10%?

A. $\widehat{log(score)}$ will increase 3.08%
B. $\widehat{log(score)}$ will increase 30.8%
C. $\widehat{score}$ will increase by 0.308 units
D. $\widehat{score}$ will increase 3.08%

12.5% 3. In order to find the OLS estimators for the true parameters β_0, β_1, β_2 and β_3 for the regression above, how many First Order Conditions do we have?

A. 2
B. 3
C. 4
D. 5

12.5% 4. Assume that *hsgpa* and $log(actmth)$ are uncorrelated with u, but *colgpa* is correlated with u. Then:

A. We say that *colgpa* is an endogenous explanatory variable, therefore $E(u|x_1, x_2, x_3, x_4) = 0$.
B. We say that *colgpa* is an endogenous explanatory variable, therefore $E(u|x_1, x_2, x_3, x_4) \neq 0$.
C. We say that *colgpa* is an exogenous explanatory variable, therefore $E(u|x_1, x_2, x_3, x_4) = 0$.
D. We say that *colgpa* is an exogenous explanatory variable, therefore $E(u|x_1, x_2, x_3, x_4) \neq 0$.

SECTION B - TRUE OR FALSE

Consider a random sample with 1005 observations of house purchases in Kansas. Your dataset consists of the following variables (variable's name and variable description):

house_price	price paid in thousands of dollars
number_bedrs	number of bedrooms
number_fullbaths	number of full bathrooms
number_halfbaths	number of half bathrooms
number_baths	= number_fullbaths + number_halfbaths
crime_rate	crime rate in the neighborhood
lot_size	lot size in square feet

12.5% 1. Consider the following regression model:

$$log(house\_price) = \beta_0 + \beta_1 log(lot\_size) + log(\beta_2) crime\_rate + u$$

where $log()$ represents the natural logarithm. Then this model is linear in parameters.

◯ True ◯ False

12.5% 2. Consider the following regression model:

$$house\_price = \beta_0 + \beta_1 number\_bedrs + \beta_2 number\_baths + \beta_3 number\_fullbaths + \beta_4 number\_halfbaths + u$$

Then this model suffers from perfect collinearity.

◯ True ◯ False

12.5% 3. Consider the following models:

$$\text{Model 1:} \quad house\_price = \beta_0 + \beta_1 number\_bedrs + \beta_2 number\_baths + u$$

$$\text{Model 2:} \quad house\_price = \beta_0 + \beta_1 number\_bedrs + \beta_2 number\_baths + \beta_3 crime\_rate + u$$

Then, $R^2_{model1} > R^2_{model2}$.

◯ True ◯ False

12.5% 4. Consider the following regression model:

$$house\_price = \beta_0 + \beta_1 number\_bedrs + \beta_2 number\_baths + u$$

Knowing that $\text{Corr}(number\_bedrs, number\_baths) = 0.98$, then the OLS estimator is a biased estimator for the true parameters.

◯ True ◯ False

The University of Kansas

Department of Economics

Quiz 6
Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

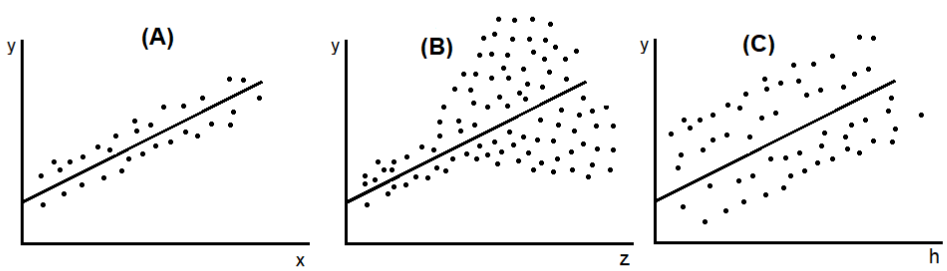
Name:

SECTION A - MULTIPLE CHOICE

Consider the following simple linear regression models, where x, z and h are different independent variables.

$$\begin{aligned} &\text{Model (A):} \quad y = \beta_0 + \beta_1 x + u \\ &\text{Model (B):} \quad y = \beta_0 + \beta_1 z + u \\ &\text{Model (C):} \quad y = \beta_0 + \beta_1 h + u \end{aligned}$$

Assuming you have a random sample, below are the scatter plots of your sample:



10% 1. Which models present heteroskedastic errors?
A. (A) and (B)
B. (B) and (C)
C. (A) and (C)
D. Only (B)

10% 2. Assuming that $E(u|x) = E(u|z) = E(u|h) = 0$ hold, for which models the OLS estimator will be unbiased?
A. (A), (B) and (C)
B. (A) and (C) only
C. Only (B)
D. Only (A)

10% 3. Assuming that $E(u|x) = E(u|z) = E(u|h) = 0$ hold, for which models the OLS estimator is more likely to be BLUE?
A. (A), (B) and (C)
B. (A) and (C) only
C. Only (B)
D. Only (A)

SECTION C - SHORT ANSWER

Consider a model relating the annual number of crimes on college campuses to the number of police officers and student enrollment. The econometric model is:

$$log(crime) = \beta_0 + \beta_1 police + \beta_2 log(enroll) + u$$

where *crime* is total campus crimes, *police* is the number of employed officers and *enroll* is the total enrollment. The *R* output is:

	Dependent variable:
	log(crime)
police	0.0240***
	(0.0073)
log(enroll)	0.9767***
	(0.1373)
Constant	-4.3758***
	(1.1990)
Observations	97
R2	0.6277
Adjusted R2	0.6198
Residual Std. Error	[redacted]
F Statistic	79.2389*** [redacted]
Note:	*p<0.1; **p<0.05; ***p<0.01

1. Below you can find additional information about this regression:

$$x_1 = \text{police}$$

$$x_2 = \text{log(crime)}$$

$$\sum_{i=1}^{97}(y_i - \hat{y}_i)^2 = 68.18$$

$$\sum_{i=1}^{97}(x_{i1} - \bar{x}_{i1})^2 = 23,454.25$$

10% (a) Under the assumption of homoskedastic errors, what is the variance of $\hat{\beta}_{police}$, i.e., what is the formula of $Var(\hat{\beta}_{police})$? [One line answer]

10% (b) What is the estimator of the variance of u given x_1, x_2, i.e., the estimator of $Var(u|x_1, x_2)$? [One line answer]

20% (c) Based on your answer above, find $\hat{\sigma}^2$.

10% (d) Based on your answer above, find $\hat{\sigma}$, i.e., the Residual Standard Error.

20% (e) Consider the following (additional) regression:

$$\widehat{police} = -93.798 + 12.187\ log(enroll)$$
$$n = 97,\ R^2 = 0.4206$$

What is the $se(\hat{\beta}_{police})$? Is the $se(\hat{\beta}_{police})$ presented in the regression output table correct?

The University of Kansas

Department of Economics

Quiz 7
Econ 526 - Introduction to Econometrics **Instructor: Caio Vigo Pereira**

Name:

[**Same dataset from Quiz 4 & 5**] Consider a random sample with the Grade Point Average (GPA) and standardized test scores (ACT), along with the performance in an introductory economics course, for students at a large public university. The variable to be explained is *score*, which is the final score in the course measured as a percentage.
The econometric model is:

$$log(score) = \beta_0 + \beta_1 hsgpa + \beta_2 log(actmth) + \beta_3 colgpa + u$$

where *hsgpa* is the high school GPA, *log(actmth)* is the natural logarithm of the ACT in math and *colgpa* is the college GPA of the student prior to take the economics course.
The *R* output is:

Regression (A)

```
================================================
                        Dependent variable:
                    ----------------------------
                             log(score)
------------------------------------------------
hsgpa                          0.0274
                              (0.0204)

log(actmth)                    0.3082
                              (0.0388)

colgpa                         0.1784
                              (0.0125)

Constant                       2.7073
                              (0.1119)

------------------------------------------------
Observations                     814
R2                             0.3704
Adjusted R2                    0.3681
Residual Std. Error       0.1662 (df = 810)
F Statistic           158.8443    (df = 3; 810)
================================================
```

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.70730    0.11192     ?     < 2e-16
hsgpa        0.02741    0.02037     ?        ?
log(actmth)  0.30816    0.03881     ?     6.7e-15
colgpa       0.17840    0.01250     ?     < 2e-16
---
```

SECTION A - MULTIPLE CHOICE

12% 1. Consider the **Regression (A)**. Suppose you want to test whether $\beta_1 > 0$ (one-sided). What is $t_{\hat{\beta}_1}$ equal to?
A. 0.7445
B. 24.1939
C. 1.3431
D. 0.0413

12% 2. Consider the **Regression (A)** again. Suppose you want to test whether $\beta_1 = 0$ (two-sided). Evaluate the statements below and determine which one is correct.
A. We can reject H_0 at 5% significance level, but not at 1% significance level.
B. We can reject H_0 at 10% significance level, but not at 5% significance level.
C. We can reject H_0 at 1% significance level, but not at 0.1% significance level.
D. We cannot reject H_0 at any significance level less than or equal to 10%.

12% 3. Consider the **Regression (A)** again. Suppose you want to test whether β_3 is statistically significant. Evaluate the statements below and determine which one is correct.
A. $\hat{\beta}_3$ is statistically significant at 1% significance level.
B. $\hat{\beta}_3$ is NOT statistically significant at 1% significance level.
C. $\hat{\beta}_3$ is NOT statistically significant at 5% significance level.
D. $\hat{\beta}_3$ is NOT statistically significant at 10% significance level.

12% 4. Consider the **Regression (A)** again. Suppose you want to test whether β_2 is statistically significant. Evaluate the statements below and determine which one is correct.
A. $\hat{\beta}_2$ is statistically significant at 0.1% significance level.
B. $\hat{\beta}_2$ is statistically significant at 1% significance level.
C. $\hat{\beta}_2$ is statistically significant at 5% significance level.
D. All the above.

12% 5. Consider the **Regression (A)** again. Suppose you want to test whether the elasticity of *score* with respect *actmth* is unitary, i.e., equal to 1 or not. Evaluate the statements below and determine which one is correct.
A. We can NOT reject the null hypothesis at 2% significance level.
B. the t statistic provides **no (or little)** evidence against the null hypothesis at small significance levels ($< 1\%$).
C. the t statistic provides evidence against the null hypothesis at small significance levels ($< 1\%$).
D. $\hat{\beta}_2$ is NOT statistically different from 1 at 5% significance level.

12% 6. Assume that the **Classical Linear Model (CLM)** assumptions hold. As can be seen in the regression output, $\hat{\beta}_3 = 0.178$ and $se(\hat{\beta}_3) = 0.0125$. What is the distribution of $\dfrac{0.178 - \beta_3}{0.0125}$?
A. t_{df}, where $df = 3$
B. $F_{(3,810)}$
C. $N(0, 0.0125^2)$
D. t_{df}, where $df = 810$

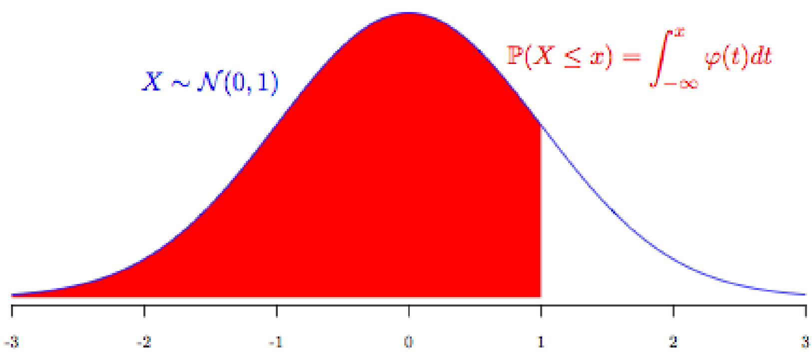
SECTION B - TRUE OR FALSE

10% 1. The 95% confidence interval for β_1 is approximately $[-0.013, 0.067]$.
◯ True ◯ False

9% 2. Consider any multiple linear regression. Knowing that you can reject H_0 for a specific parameter at 1% significance level, then you should be able to reject the H_0 at 2% significance level.
◯ True ◯ False

9% 3. Consider any multiple linear regression. Knowing that you can reject H_0 for a specific parameter at 1% significance level, then you should be able to reject the H_0 at 0.1% significance level.
◯ True ◯ False

Standard Normal Distribution



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

t-distribution

TABLE G.2 Critical Values of the t Distribution

		Significance Level				
1-Tailed:		**.10**	**.05**	**.025**	**.01**	**.005**
2-Tailed:		**.20**	**.10**	**.05**	**.02**	**.01**
	1	3.078	6.314	12.706	31.821	63.657
	2	1.886	2.920	4.303	6.965	9.925
	3	1.638	2.353	3.182	4.541	5.841
	4	1.533	2.132	2.776	3.747	4.604
	5	1.476	2.015	2.571	3.365	4.032
	6	1.440	1.943	2.447	3.143	3.707
	7	1.415	1.895	2.365	2.998	3.499
	8	1.397	1.860	2.306	2.896	3.355
	9	1.383	1.833	2.262	2.821	3.250
	10	1.372	1.812	2.228	2.764	3.169
Degrees of Freedom	11	1.363	1.796	2.201	2.718	3.106
	12	1.356	1.782	2.179	2.681	3.055
	13	1.350	1.771	2.160	2.650	3.012
	14	1.345	1.761	2.145	2.624	2.977
	15	1.341	1.753	2.131	2.602	2.947
	16	1.337	1.746	2.120	2.583	2.921
	17	1.333	1.740	2.110	2.567	2.898
	18	1.330	1.734	2.101	2.552	2.878
	19	1.328	1.729	2.093	2.539	2.861
	20	1.325	1.725	2.086	2.528	2.845
	21	1.323	1.721	2.080	2.518	2.831
	22	1.321	1.717	2.074	2.508	2.819
	23	1.319	1.714	2.069	2.500	2.807
	24	1.318	1.711	2.064	2.492	2.797
	25	1.316	1.708	2.060	2.485	2.787
	26	1.315	1.706	2.056	2.479	2.779
	27	1.314	1.703	2.052	2.473	2.771
	28	1.313	1.701	2.048	2.467	2.763
	29	1.311	1.699	2.045	2.462	2.756
	30	1.310	1.697	2.042	2.457	2.750
	40	1.303	1.684	2.021	2.423	2.704
	60	1.296	1.671	2.000	2.390	2.660
	90	1.291	1.662	1.987	2.368	2.632
	120	1.289	1.658	1.980	2.358	2.617
	∞	1.282	1.645	1.960	2.326	2.576

Source: Wooldridge, Jeffrey M. *Introductory Econometrics*, 2015.