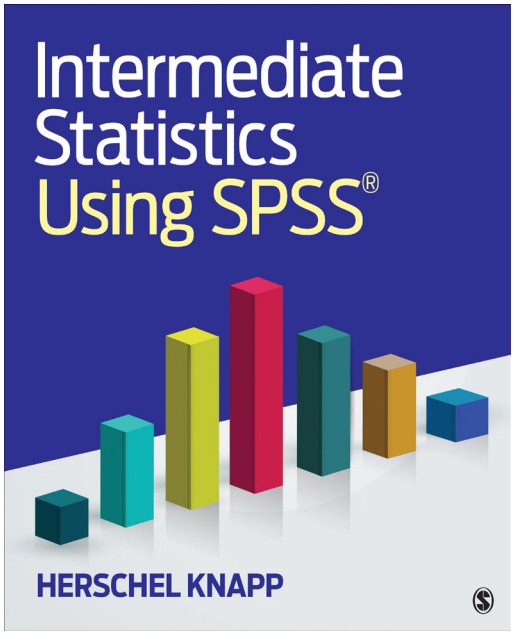
CHAPTER 12

Multiple Regression

Solutions to Odd-Numbered Exercises



Contents

EXERCISE 12.1A

(a)

H_0: Gender, getting a flu shot, having a chronic disease and age do not predict flu resilience

H_1: Gender, getting a flu shot, having a chronic disease or age predict flu resilience

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Flu_shot	Categorical	10	
Chronic_disease	Categorical	10	
Age	Continuous		10
Total *n* quota = 40		30	10

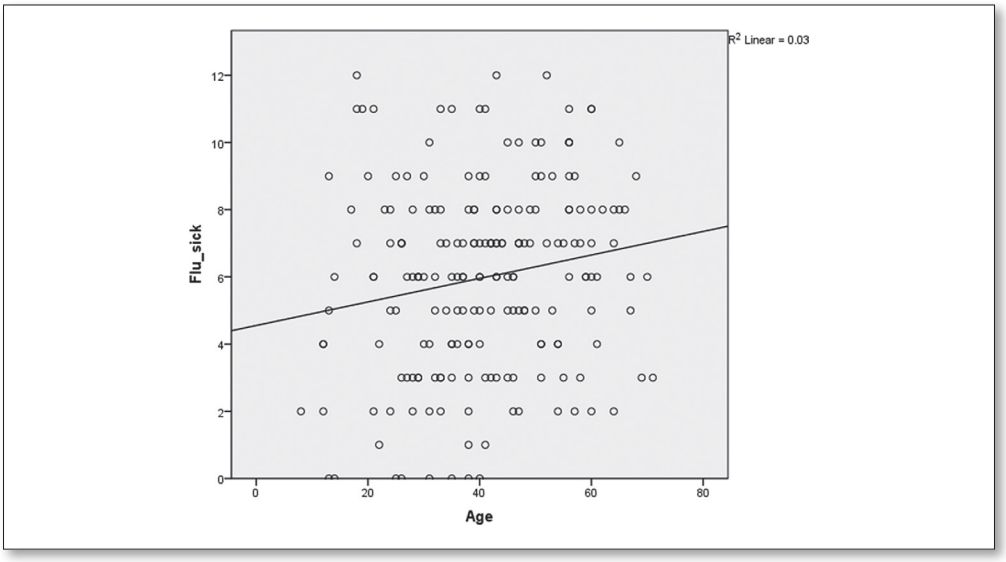
Statistics

Flu_sick

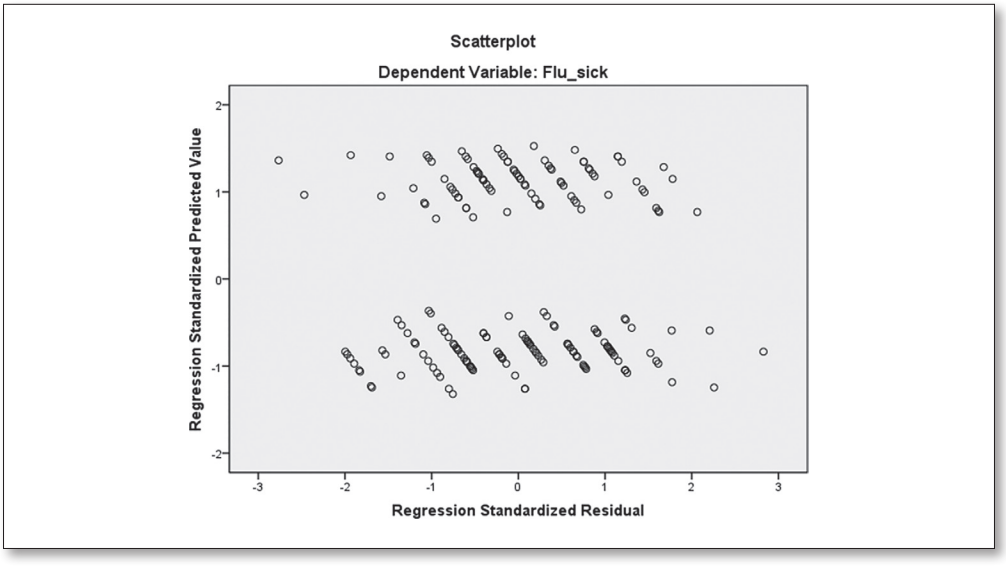
N	Valid	200
	Missing	0

The above table indicates that the *n* should be at least 40; the table below shows that the actual *n* for this data set is 200; hence, this criterion is satisfied.

Pretest criterion 2: Linearity: The scatterplot shows no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.



Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



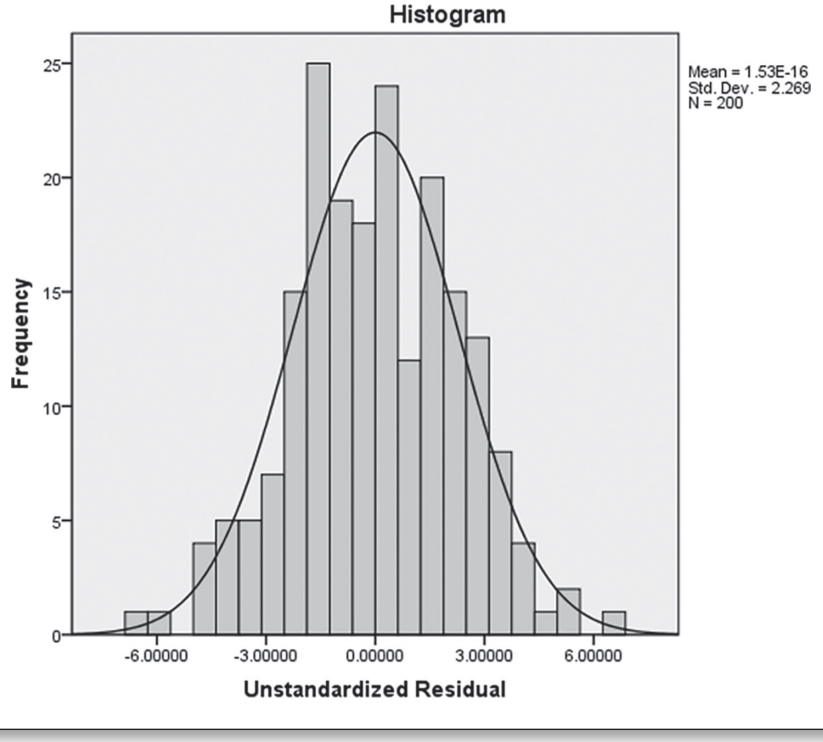
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.548	.215		21.169	.000		
	Flu_shot	3.370	.330	.588	10.226	.000	1.000	1.000
2	(Constant)	3.515	.506		6.947	.000		
	Flu_shot	3.313	.327	.578	10.125	.000	.994	1.006
	Age	.026	.012	.128	2.249	.026	.994	1.006

a. Dependent Variable: Flu_sick

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.588[a]	.346	.342	2.304	.346	104.568	1	198	.000
2	.602[b]	.362	.356	2.281	.016	5.059	1	197	.026

a. Predictors: (Constant), Flu_shot
b. Predictors: (Constant), Flu_shot, Age
c. Dependent Variable: Flu_sick

Two of the predictor variables (Flu_shot and Age) account for the overall R^2 of .362; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

To determine the effects of the flu shot this season, we surveyed 200 people asking how many days they were sick with the flu this season. Multiple regression analysis revealed that their flu shot status (got a flu shot / not gotten a flu shot) accounted for 34.6% of the variability in the outcome variable, and age accounted for an additional 1.6%. Chronic disease status was identified a statistically insignificant predictor ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. It appears that opting for a flu shot is the most significant predictor when it comes to reducing the impact of the flu.

EXERCISE 12.1B

(a)

H_0: Gender, getting a flu shot, having a chronic disease and age do not predict flu resilience

H_1: Gender, getting a flu shot, having a chronic disease or age predict flu resilience

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Flu_shot	Categorical	10	
Chronic_disease	Categorical	10	
Age	Categorical	10	
Total *n* quota = 40		40	

Statistics

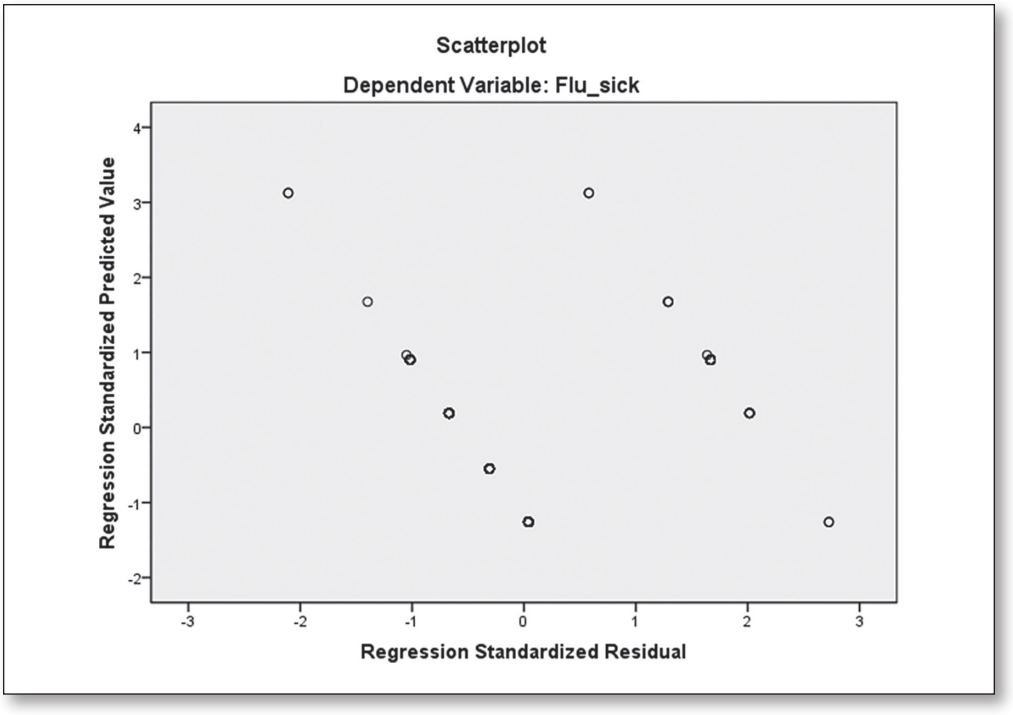
Flu_sick

N	Valid	200
	Missing	0

The above table indicates that the *n* should be at least 40; the table below shows that the actual *n* for this data set is 200; hence, this criterion is satisfied.

Pretest criterion 2: Linearity: Since there are no continuous predictors in this model, it is unnecessary to check for linearity, hence this criterion is satisfied.

Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied. This distribution of point is a bit atypical due to the fact that all of the predictors in this model are categorical.



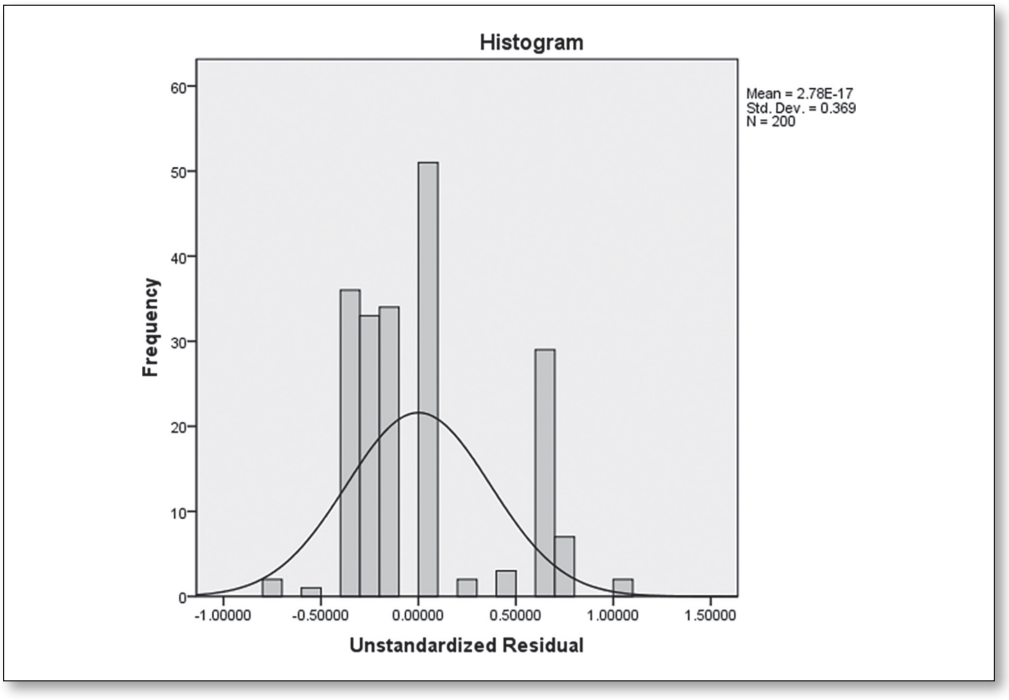
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.065	.040		1.603	.110		
	Flu_shot	.281	.055	.341	5.113	.000	1.000	1.000
2	(Constant)	.483	.121		3.990	.000		
	Flu_shot	.293	.053	.356	5.486	.000	.996	1.004
	Age	-.447	.122	-.237	-3.652	.000	.996	1.004
3	(Constant)	.391	.126		3.110	.002		
	Flu_shot	.264	.054	.321	4.865	.000	.945	1.059
	Age	-.405	.122	-.215	-3.316	.001	.976	1.025
	Gender	.129	.055	.157	2.371	.019	.933	1.072

a. Dependent Variable: Flu_sick

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.341[a]	.117	.112	.388	.117	26.139	1	198	.000
2	.415[b]	.173	.164	.377	.056	13.335	1	197	.000
3	.442[c]	.196	.183	.372	.023	5.621	1	196	.019

a. Predictors: (Constant), Flu_shot
b. Predictors: (Constant), Flu_shot, Age
c. Predictors: (Constant), Flu_shot, Age, Gender
d. Dependent Variable: Flu_sick

Three of the predictor variables (Flu_shot, Age, and Gender) account for the overall R^2 of .196; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

To determine the effects of the flu shot this season, we surveyed 200 people asking how many days they were sick with the flu this season. Multiple regression analysis revealed that their flu shot status (got a flu shot / not gotten a flu shot) accounted for 11.7% of the variability in the outcome variable, age (pediatric / adult) accounted for an additional 5.6%, and gender accounted for 2.3%. Chronic disease status was identified as a statistically insignificant predictor ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. It appears that opting for a flu shot is the most significant predictor when it comes to reducing the impact of the flu.

EXERCISE 12.3A

(a)

H_0: Age, gender, race, religion, or education do not predict death penalty opinions.

H_1: Age, gender, race, religion, or education predict death penalty opinions.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Age	Continuous		10
Gender	Categorical	10	
Race	Categorical	40	
Religion	Categorical	50	
Education	Continuous		10
Total *n* quota = 120		100	20

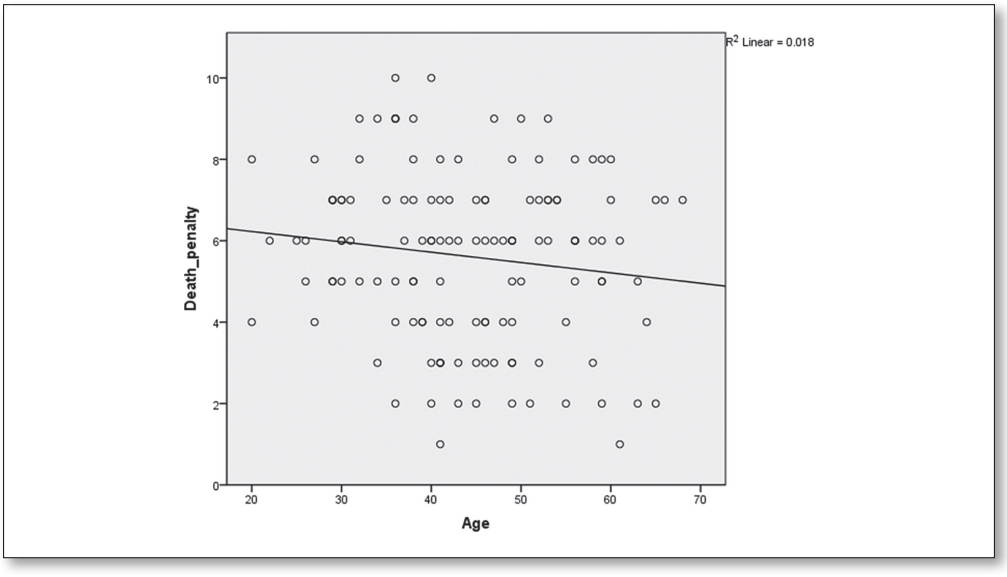
The above table indicates that the *n* should be at least 120; the table below shows that the actual *n* for this data set is 132; hence, this criterion is satisfied.

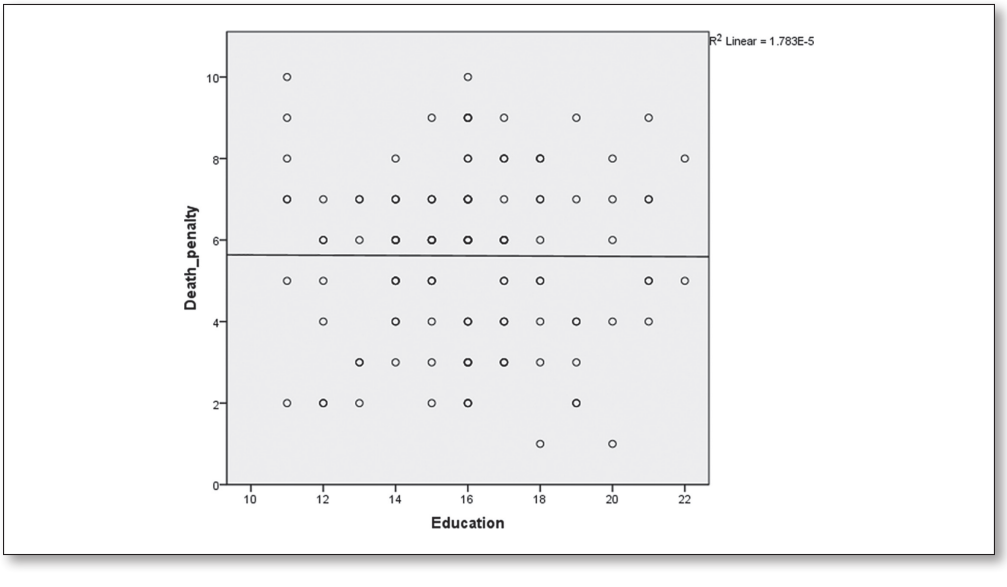
Statistics

Death_penalty

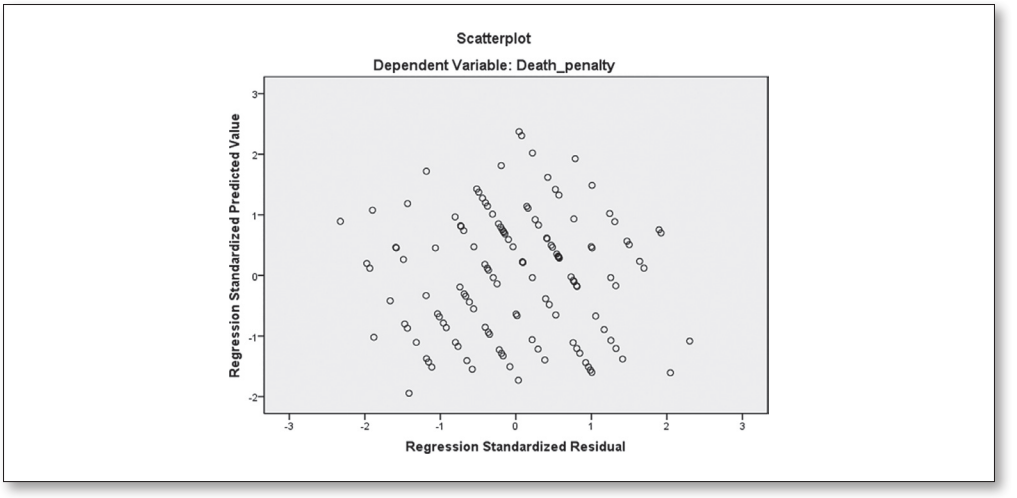
N	Valid	132
	Missing	0

Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.





Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



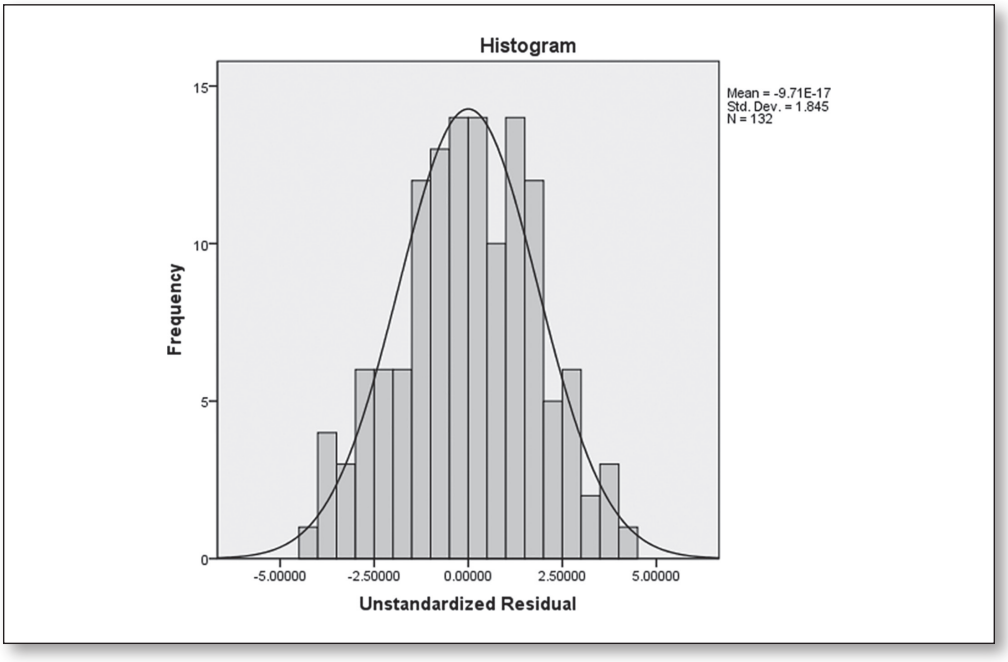
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.702	.256		18.361	.000		
	Gender	1.605	.340	.383	4.724	.000	1.000	1.000
2	(Constant)	6.078	.707		8.594	.000		
	Gender	1.665	.337	.397	4.947	.000	.993	1.008
	Age	-.032	.015	-.167	-2.084	.039	.993	1.008
3	(Constant)	5.778	.786		7.355	.000		
	Gender	1.694	.339	.404	4.995	.000	.988	1.012
	Age	-.028	.016	-.148	-1.754	.082	.908	1.101
	Race.1	.273	.755	.033	.361	.719	.770	1.299
	Race.2	-.026	.441	-.006	-.059	.953	.586	1.707
	Race.3	.920	.869	.092	1.058	.292	.851	1.175
	Race.4	.625	.614	.098	1.018	.311	.694	1.440
4	(Constant)	5.706	.895		6.375	.000		
	Gender	1.707	.348	.407	4.906	.000	.947	1.056
	Age	-.032	.016	-.170	-1.970	.051	.878	1.139
	Race.1	.328	.778	.040	.422	.674	.732	1.367
	Race.2	-.018	.453	-.004	-.040	.968	.558	1.791
	Race.3	.641	.894	.064	.717	.475	.811	1.232
	Race.4	.563	.621	.088	.906	.367	.684	1.462
	Religion.1	.236	.677	.033	.349	.728	.743	1.346
	Religion.2	.248	.436	.060	.569	.570	.592	1.690
	Religion.3	.242	.953	.022	.254	.800	.850	1.177
	Religion.4	1.193	.656	.171	1.819	.071	.737	1.357
	Religion.5	-.278	.897	-.028	-.310	.757	.807	1.240

a. Dependent Variable: Death_penalty

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.383[a]	.147	.140	1.933	.147	22.319	1	130	.000
2	.418[b]	.174	.162	1.909	.028	4.341	1	129	.039
3	.438[c]	.192	.153	1.919	.017	.669	4	125	.615
4	.466[d]	.217	.145	1.927	.025	.774	5	120	.570

a. Predictors: (Constant), Gender
b. Predictors: (Constant), Gender, Age
c. Predictors: (Constant), Gender, Age, Race.3, Race.1, Race.4, Race.2
d. Predictors: (Constant), Gender, Age, Race.3, Race.1, Race.4, Race.2, Religion.2, Religion.3, Religion.5, Religion.1, Religion.4
e. Dependent Variable: Death_penalty

Two of the predictor variables (Gender and Age) account for the overall R^2 of .174; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

To determine the variables associated with death penalty opinions, we surveyed 132 people. Multiple regression analysis revealed that gender accounts for 14.7% of the variability in the outcome variable, and age accounts for an additional 2.8%. Race, religion, and education were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that gender is the most relevant predictor when it comes to death penalty opinions.

EXERCISE 12.3B

(a)

H_0: Age, gender, race, religion, or education do not predict death penalty opinions.

H_1: Age, gender, race, religion, or education predict death penalty opinions.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Age	Continuous		10
Gender	Categorical	10	
Race	Categorical	40	
Religion	Categorical	50	
Education	Continuous		10
Total *n* quota = 120		100	20

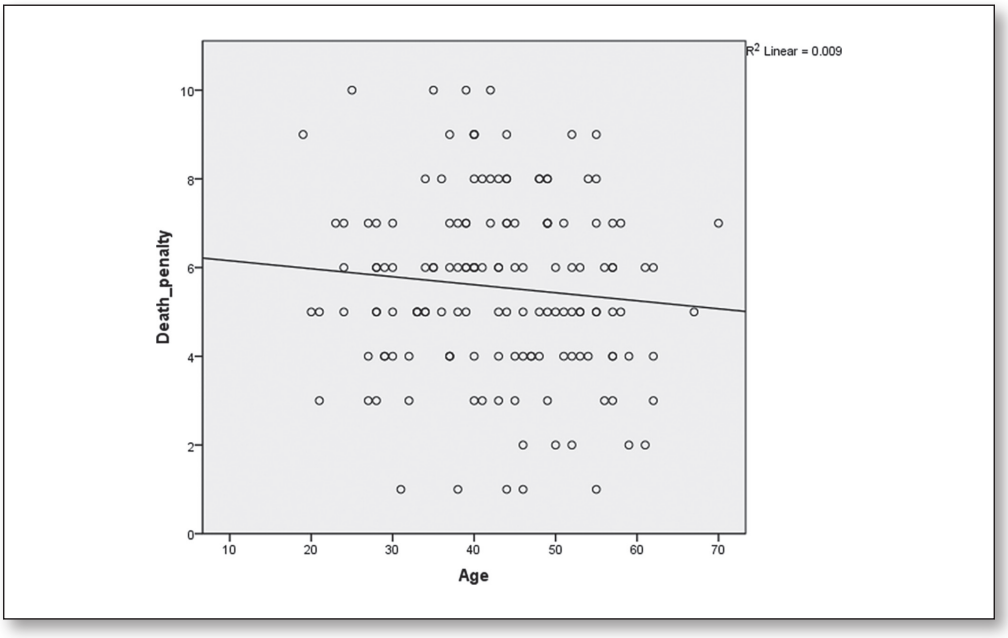
The above table indicates that the *n* should be at least 120; the table below shows that the actual *n* for this data set is 150; hence, this criterion is satisfied.

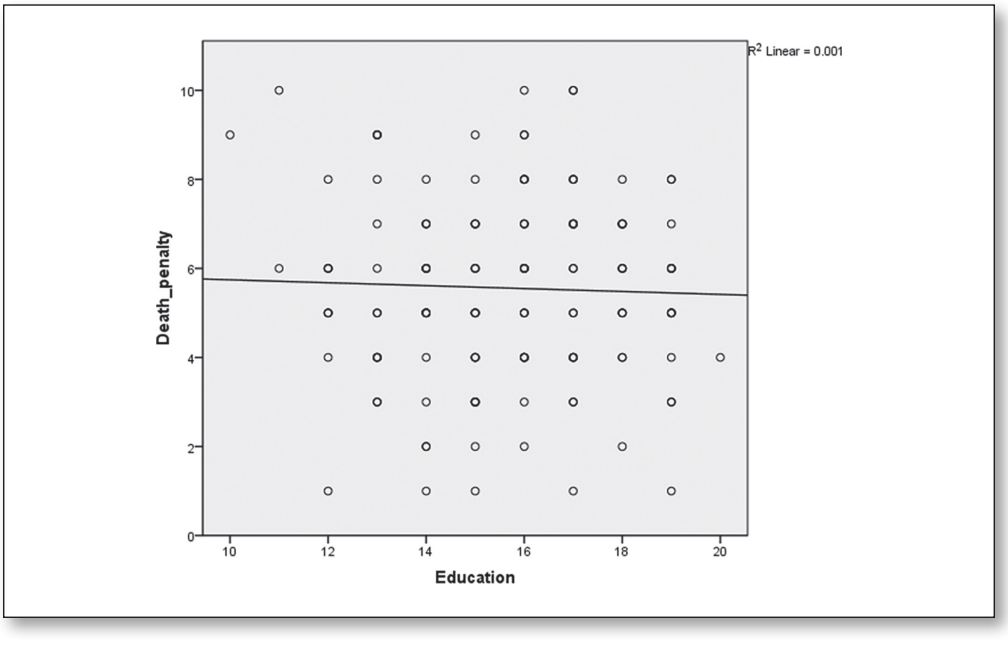
Statistics

Death_penalty

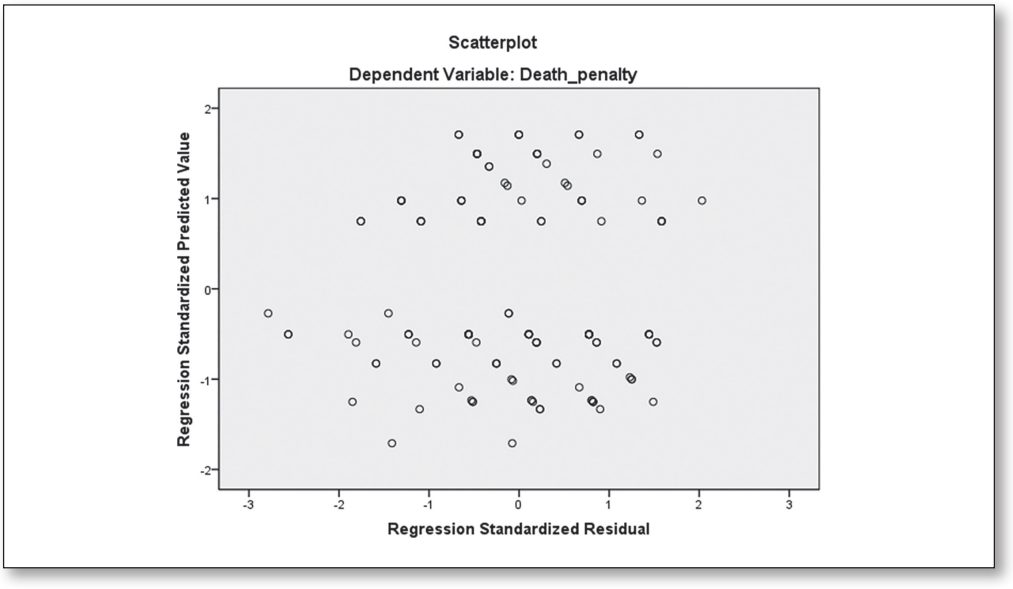
N	Valid	150
	Missing	0

Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.





Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



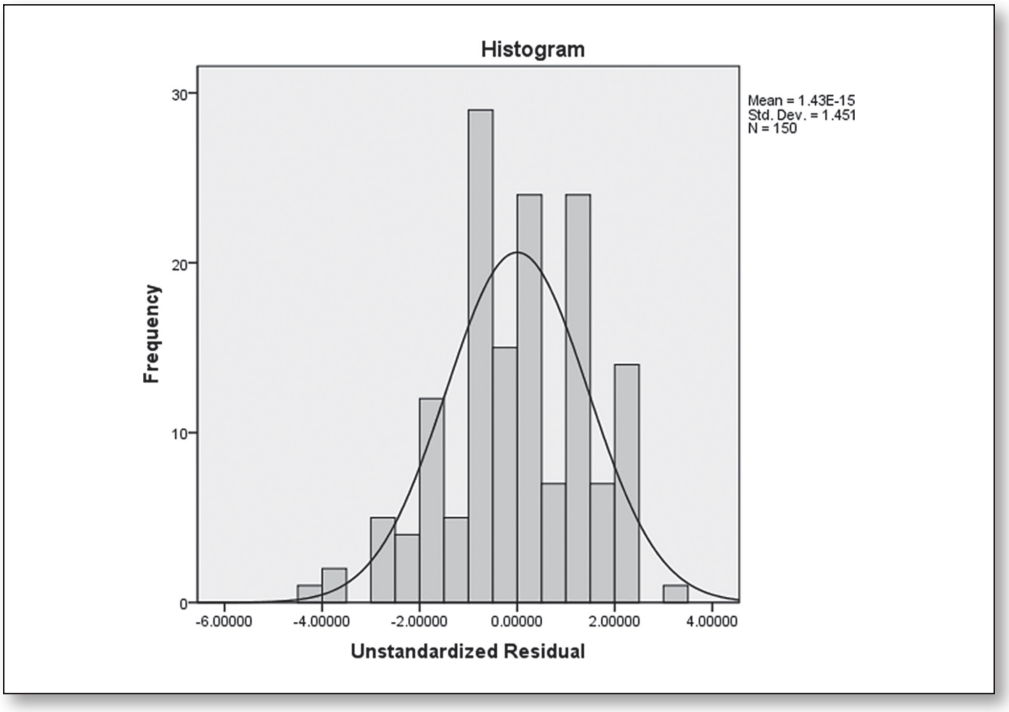
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.625	.417		13.498	.000		
	Race.1	-.125	.833	-.014	-.150	.881	.792	1.262
	Race.2	.136	.486	.033	.280	.780	.477	2.098
	Race.3	-.745	.583	-.137	-1.277	.204	.588	1.701
	Race.4	.029	.578	.005	.050	.960	.581	1.722
2	(Constant)	6.959	.345		20.198	.000		
	Race.1	.540	.687	.060	.786	.433	.628	1.592
	Race.2	1.045	.411	.256	2.543	.012	.358	2.793
	Race.3	.584	.494	.107	1.182	.239	.441	2.268
	Race.4	-.023	.526	-.004	-.044	.965	.376	2.656
	Religion.1	-3.845	.713	-.399	-5.390	.000	.660	1.515
	Religion.2	-3.165	.404	-.769	-7.831	.000	.376	2.662
	Religion.3	-4.004	1.126	-.226	-3.557	.001	.897	1.115
	Religion.4	-2.832	.513	-.464	-5.523	.000	.514	1.946
	Religion.5	-.304	.482	-.062	-.631	.529	.375	2.664

a. Dependent Variable: Death_penalty

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.154[a]	.024	-.003	2.042	.024	.878	4	145	.479
2	.702[b]	.493	.460	1.497	.469	25.909	5	140	.000

a. Predictors: (Constant), Race.4, Race.1, Race.3, Race.2
b. Predictors: (Constant), Race.4, Race.1, Race.3, Race.2, Religion.3, Religion.2, Religion.1, Religion.4, Religion.5
c. Dependent Variable: Death_penalty

One predictor variable (Religion) account for the overall R^2 of .469; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

To determine the variables associated with death penalty opinions, we surveyed 150 people. Multiple regression analysis revealed that religion accounts for 46.9% of the variability in the outcome variable. Age, gender, and education were identified as statistically insignificant predictors, ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that religion is the only relevant predictor when it comes to death penalty opinions. Note: The R Square column is cumulative. Since the results for Model 1, which was loaded via the Enter method, is statistically insignificant ($p = .479$), we gain a more accurate solution if we subtract the R Square in Model 1 (.024) from the R Square in model 2 (.493): .493 – .024 = .469.

EXERCISE 12.5A

(a)

H_0: Gender, age, number of academic units, work (job) hours, or treatment modality do not predict treatment effectiveness.

H_1: Gender, age, number of academic units, work (job) hours, or treatment modality predict treatment effectiveness.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Age	Continuous		10
Units	Continuous		10
Work	Continuous		10
Treatment_modality	Categorical	10	
Home	Categorical	20	
Total *n* quota = 70		40	30

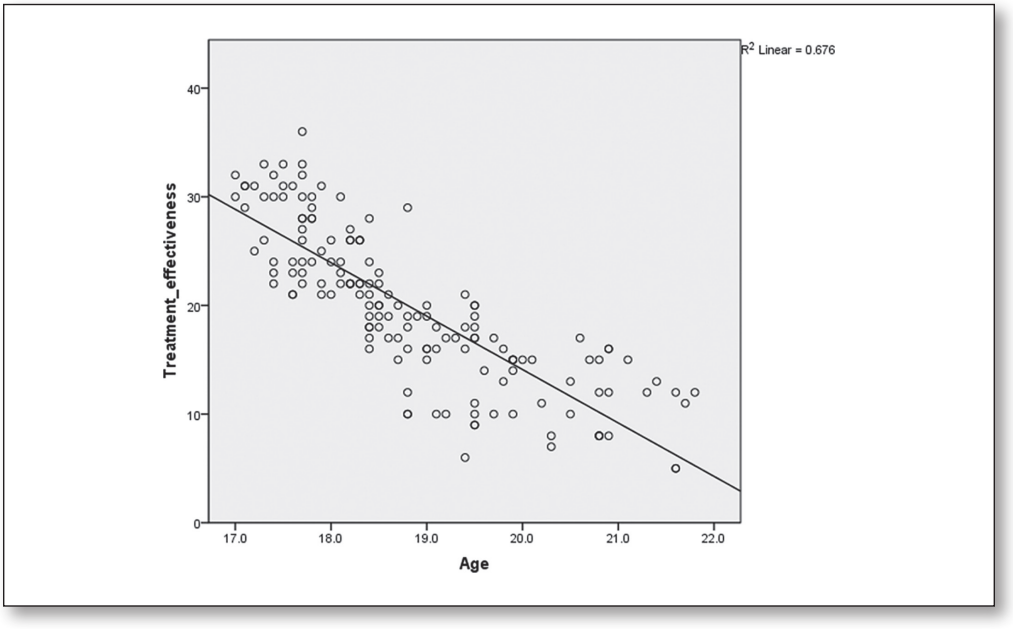
The above table indicates that the *n* should be at least 70; the table below shows that the actual *n* for this data set is 153; hence, this criterion is satisfied.

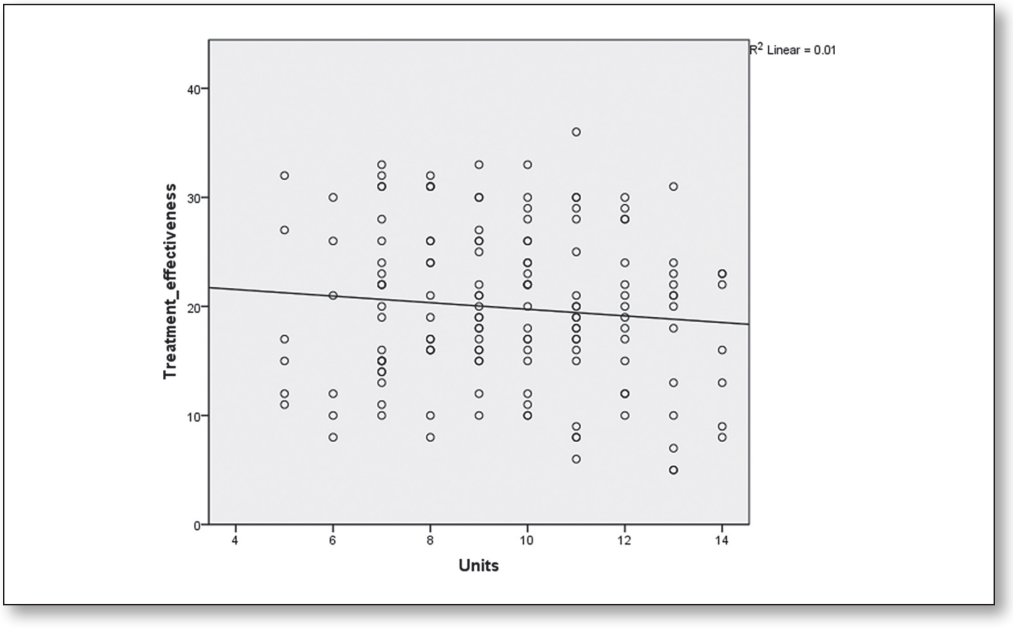
Statistics

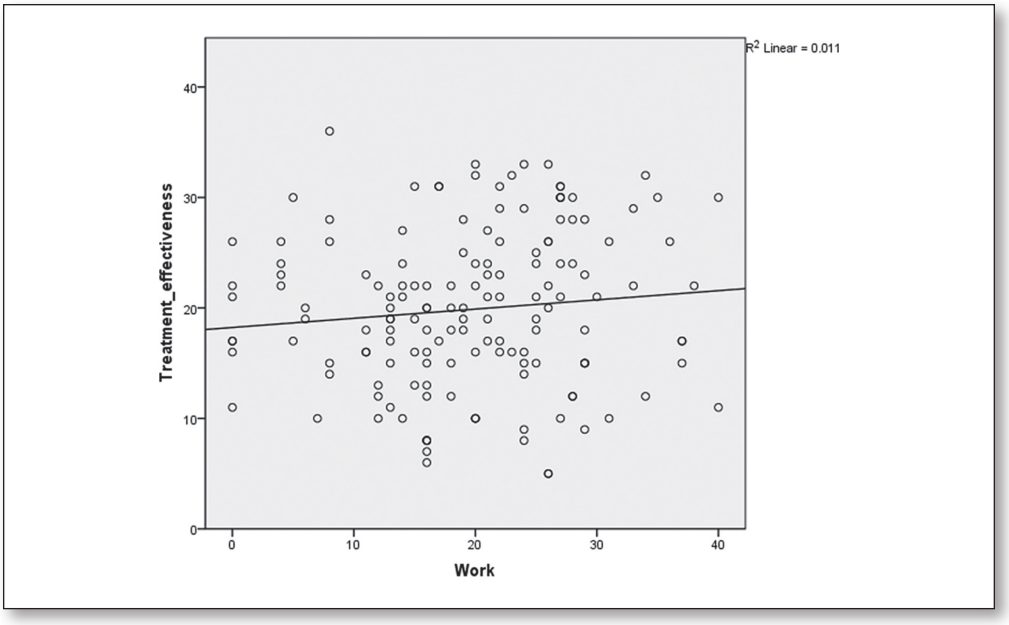
Treatment_effectiveness

N	Valid	153
	Missing	0

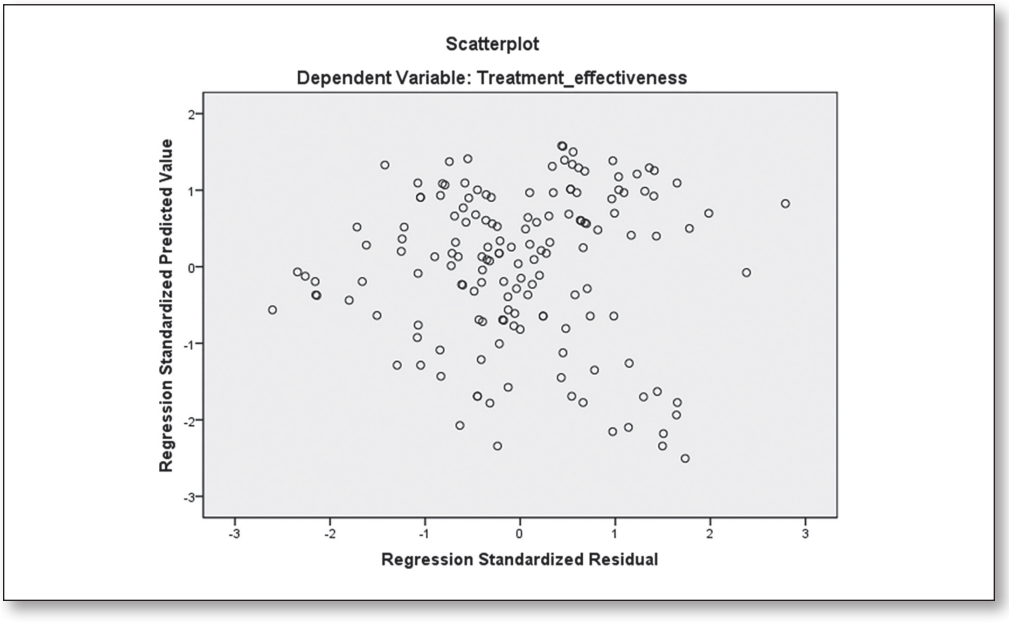
Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.







Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



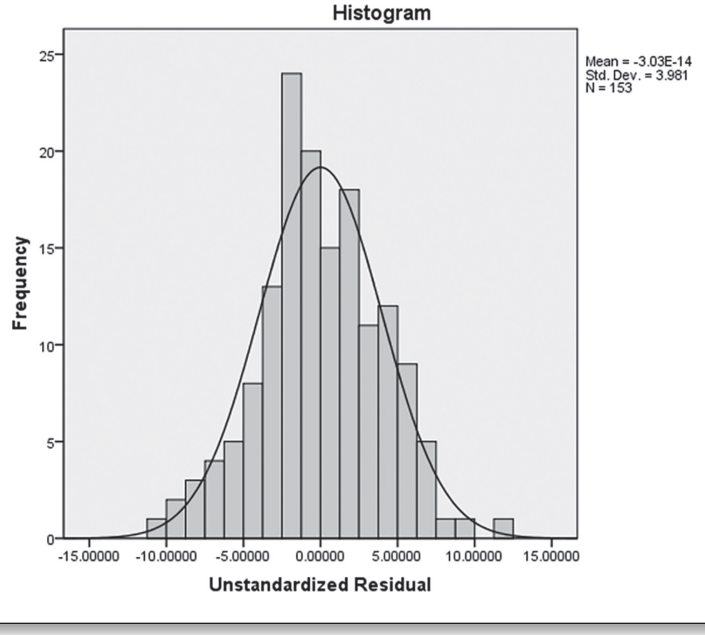
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	112.396	5.224		21.515	.000		
	Age	-4.915	.277	-.822	-17.749	.000	1.000	1.000
2	(Constant)	110.600	5.203		21.257	.000		
	Age	-4.775	.279	-.799	-17.101	.000	.955	1.047
	Gender	-1.573	.667	-.110	-2.359	.020	.955	1.047
3	(Constant)	111.606	5.360		20.824	.000		
	Age	-4.817	.284	-.806	-16.943	.000	.927	1.078
	Gender	-1.598	.670	-.112	-2.385	.018	.953	1.049
	Home.1	-.048	.820	-.003	-.059	.953	.896	1.115
	Home.2	-.748	.808	-.045	-.925	.356	.872	1.147

a. Dependent Variable: Treatment_effectiveness

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.822[a]	.676	.674	4.080	.676	315.038	1	151	.000
2	.829[b]	.688	.683	4.020	.012	5.563	1	150	.020
3	.830[c]	.690	.681	4.035	.002	.459	2	148	.633

a. Predictors: (Constant), Age
b. Predictors: (Constant), Age, Gender
c. Predictors: (Constant), Age, Gender, Home.1, Home.2
d. Dependent Variable: Treatment_effectiveness

Two predictor variables (Age and Gender) account for the overall R^2 of .688; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

A therapist at the Acme College Counseling Center noted a high prevalence of adjustment disorder among incoming freshman, with depression being the predominate symptom. The clinicians want to determine the characteristics of those most amenable to therapy over a course of 10 sessions, and assessed the treatment effectiveness of 153 students. Multiple regression analysis revealed that the student's age accounts for 67.6% of the variability in the outcome variable, and gender accounts for an additional 1.2%. Number of academic units, work (employment) hours, treatment modality (individual / group) or living condition (lives with family / roommate / alone) were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that the age of the student is the most relevant predictor when it comes to the effectiveness of this treatment.

EXERCISE 12.5B

(a)

H_0: Gender, age, number of academic units, work (job) hours, or treatment modality do not predict treatment effectiveness.

H_1: Gender, age, number of academic units, work (job) hours, or treatment modality predict treatment effectiveness.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Age	Continuous		10
Units	Continuous		10
Work	Continuous		10
Treatment_modality	Categorical	10	
Home	Categorical	20	
Total *n* quota = 70		40	30

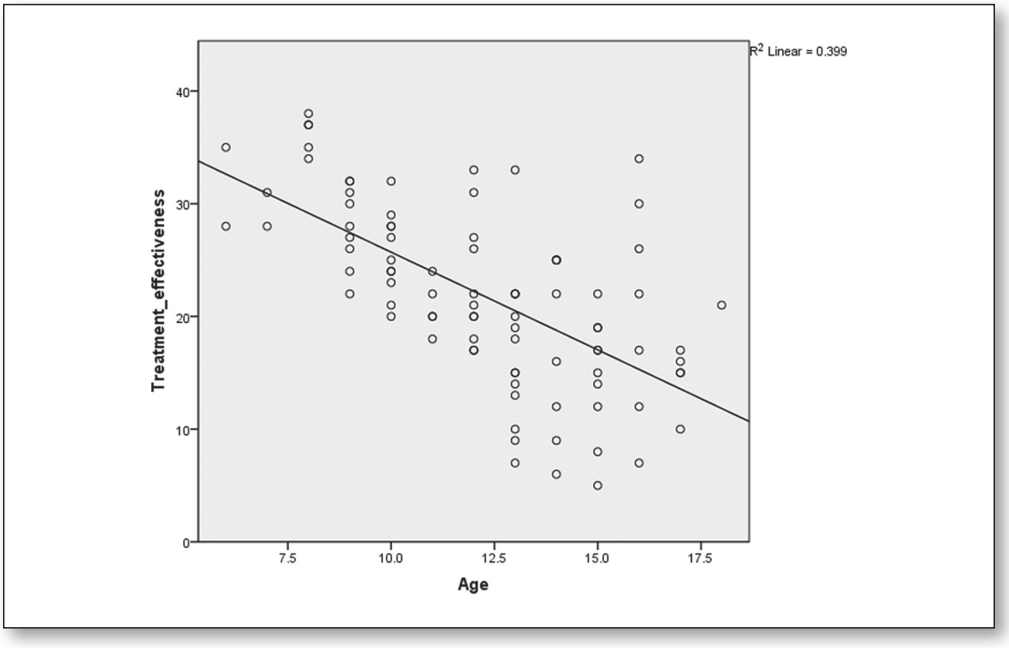
The above table indicates that the *n* should be at least 70; the table below shows that the actual *n* for this data set is 90; hence, this criterion is satisfied.

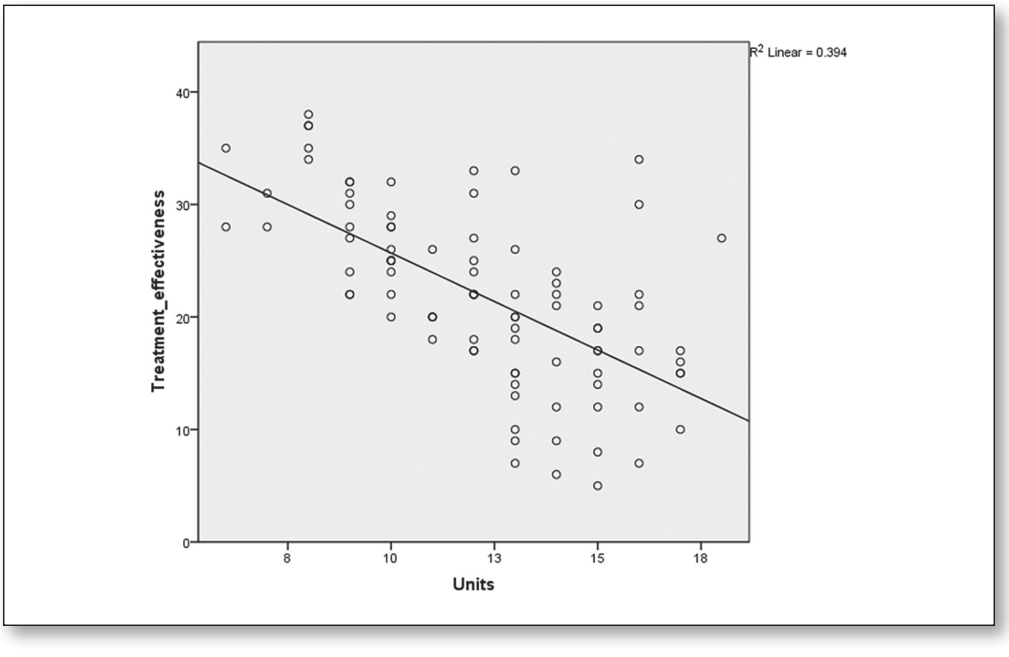
Statistics

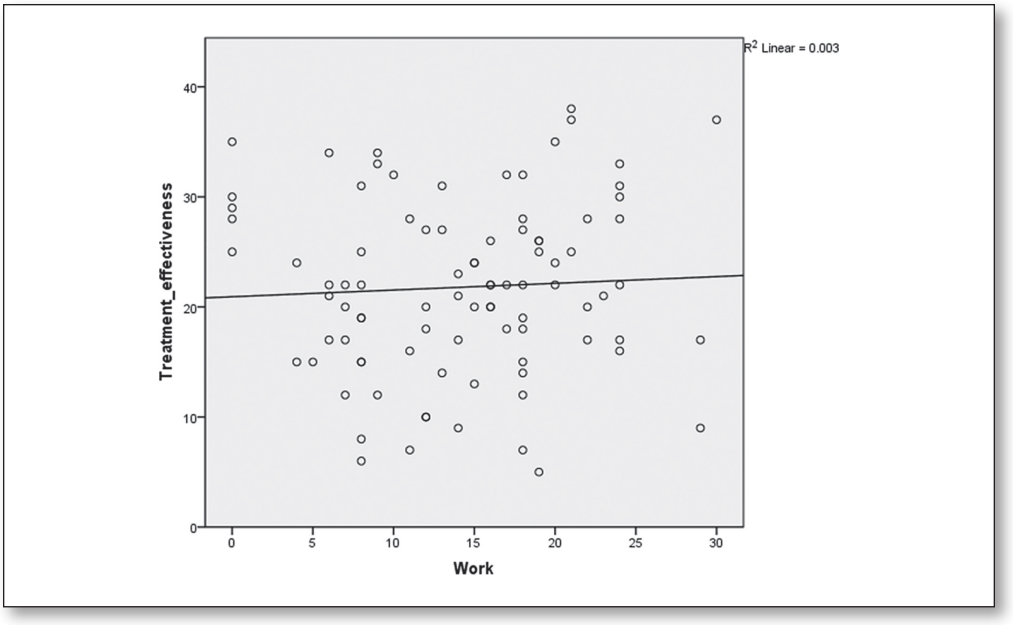
Treatment_effectiveness

N	Valid	90
	Missing	0

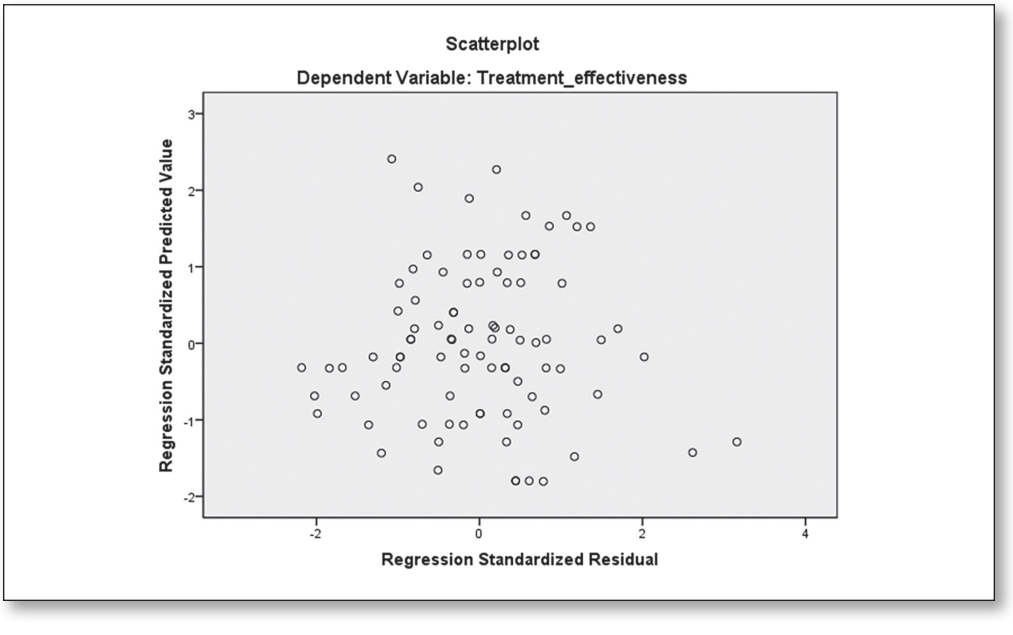
Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.







Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



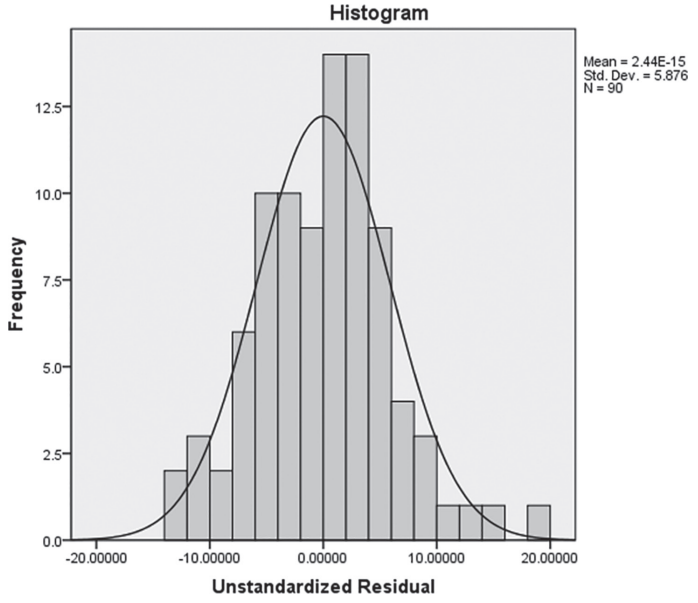
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	43.031	2.856		15.065	.000		
	Age	-1.733	.227	-.631	-7.636	.000	1.000	1.000
2	(Constant)	45.487	2.915		15.606	.000		
	Age	-.989	.357	-.360	-2.775	.007	.379	2.636
	Units	-.944	.357	-.344	-2.649	.010	.379	2.636
3	(Constant)	45.420	3.113		14.590	.000		
	Age	-.987	.363	-.359	-2.716	.008	.372	2.685
	Units	-.959	.362	-.349	-2.653	.010	.376	2.659
	Home.1	.730	1.498	.044	.488	.627	.820	1.219
	Home.2	-.041	1.597	-.002	-.026	.979	.806	1.241

a. Dependent Variable: Treatment_effectiveness

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.631[a]	.399	.392	6.154	.399	58.315	1	88	.000
2	.666[b]	.443	.431	5.954	.045	7.017	1	87	.010
3	.667[c]	.445	.419	6.013	.002	.150	2	85	.861

a. Predictors: (Constant), Age
b. Predictors: (Constant), Age, Units
c. Predictors: (Constant), Age, Units, Home.1, Home.2
d. Dependent Variable: Treatment_effectiveness

Two predictor variables (Age and Units) account for the overall R^2 of .443; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

A therapist at the Acme College Counseling Center noted a high prevalence of adjustment disorder among incoming freshman, with depression being the predominate symptom. The clinicians want to determine the characteristics of those most amenable to therapy over a course of 10 sessions, and assessed the treatment effectiveness of 90 students. Multiple regression analysis revealed that the student's age accounts for 39.9% of the variability in the outcome variable, and the number of units the student is enrolled in accounts for an additional 4.5%. Gender, number of work (employment) hours, treatment modality (individual / group) or living condition (lives with family / roommate / alone) were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that the age of the student is the most relevant predictor when it comes to the effectiveness of this treatment.

EXERCISE 12.7A

(a)

H_0: Age, gender, coffee brand, or income do not predict the likelihood of purchasing this product.

H_1: Age, gender, coffee brand, or income predict the likelihood of purchasing this product.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Age	Continuous		10
Gender	Categorical	10	
Acme_Coffee	Categorical	10	
Income	Continuous		10
Total *n* quota = 40		20	20

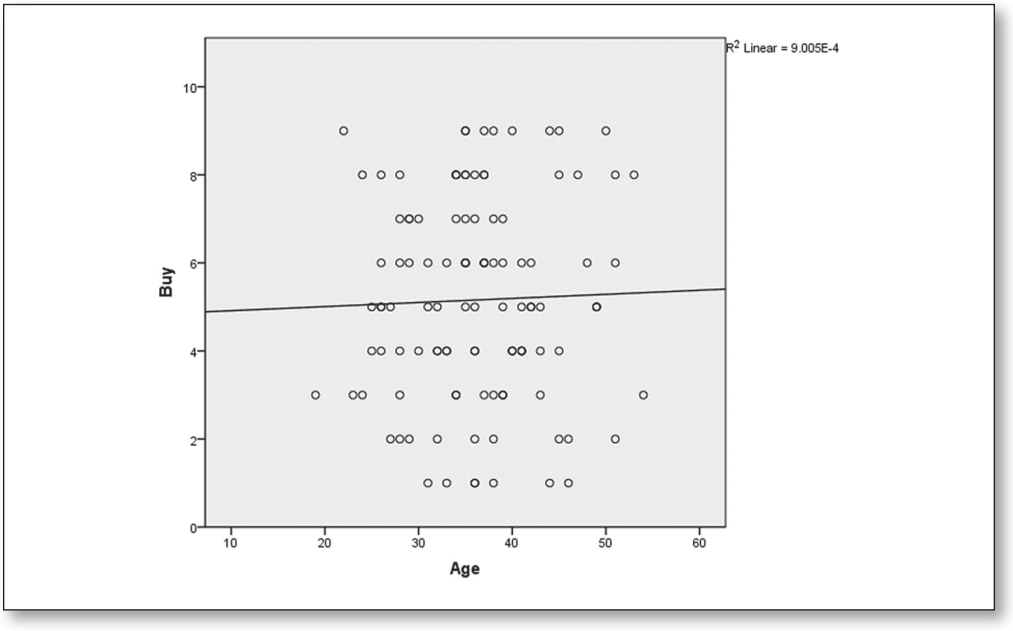
The above table indicates that the *n* should be at least 40; the table below shows that the actual *n* for this data set is 113; hence, this criterion is satisfied.

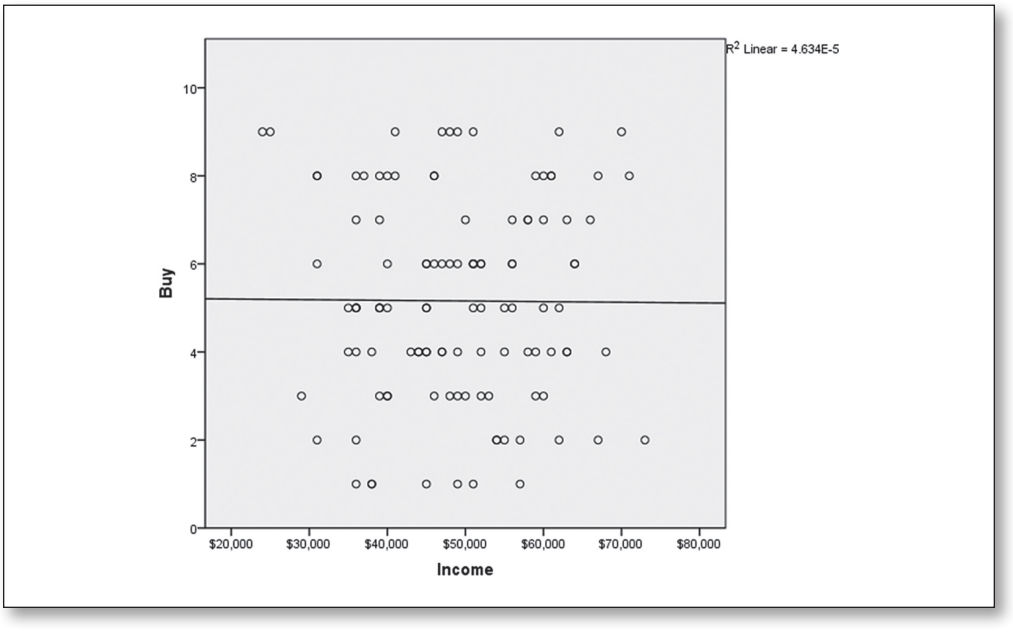
Statistics

Buy

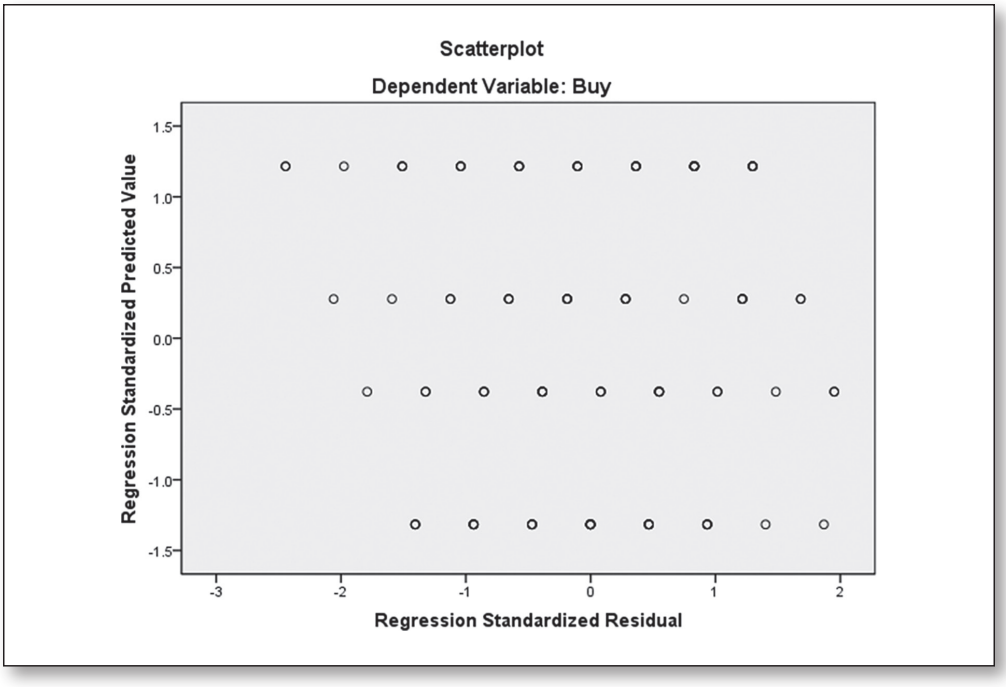
N	Valid	113
	Missing	0

Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.





Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



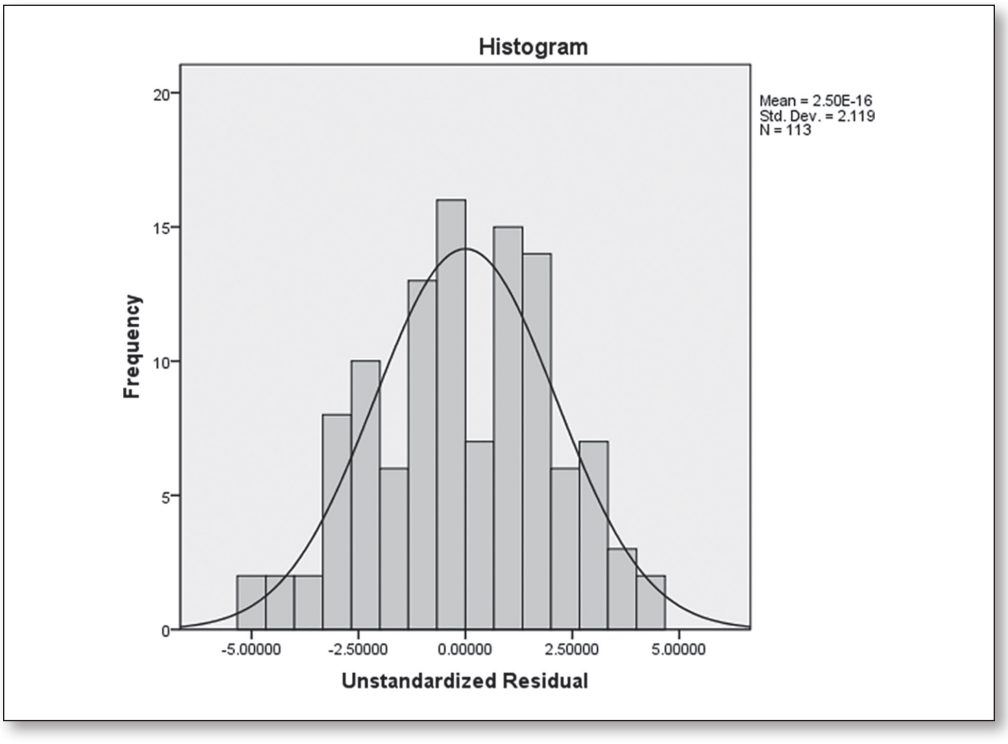
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.364	.292		14.933	.000		
	Acme_Coffee	1.550	.408	.339	3.801	.000	1.000	1.000
2	(Constant)	4.828	.370		13.064	.000		
	Acme_Coffee	1.398	.409	.306	3.415	.001	.966	1.035
	Gender	-.823	.410	-.180	-2.007	.047	.966	1.035

a. Dependent Variable: Buy

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.339[a]	.115	.107	2.167	.115	14.444	1	111	.000
2	.383[b]	.146	.131	2.138	.031	4.029	1	110	.047

a. Predictors: (Constant), Acme_Coffee
b. Predictors: (Constant), Acme_Coffee, Gender
c. Dependent Variable: Buy

Two predictor variables (Acme_Coffee and Gender) account for the overall R^2 of .146; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

Acme Coffee, which currently sells gourmet coffee blends, is now considering selling a single-serve coffee maker that brews a cup of coffee in 30 seconds. They survey 113 people to help identify the characteristics of potential customers for this high-tech coffee brewer. Multiple regression analysis revealed that current coffee choice (does / does not already buy Acme Coffee) accounts for 11.5% of the variability observed in the outcome variable; gender accounts for an additional 3.1%. Age, gender, and income were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that brand familiarity followed by gender are the most relevant predictors when it comes to purchasing this new product.

EXERCISE 12.7B

(a)

H_0: Age, gender, coffee brand, or income do not predict the likelihood of purchasing this product.

H_1: Age, gender, coffee brand, or income predict the likelihood of purchasing this product.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Age	Continuous		10
Gender	Categorical	10	
Acme_Coffee	Categorical	10	
Income	Continuous		10
Total *n* quota = 40		20	20

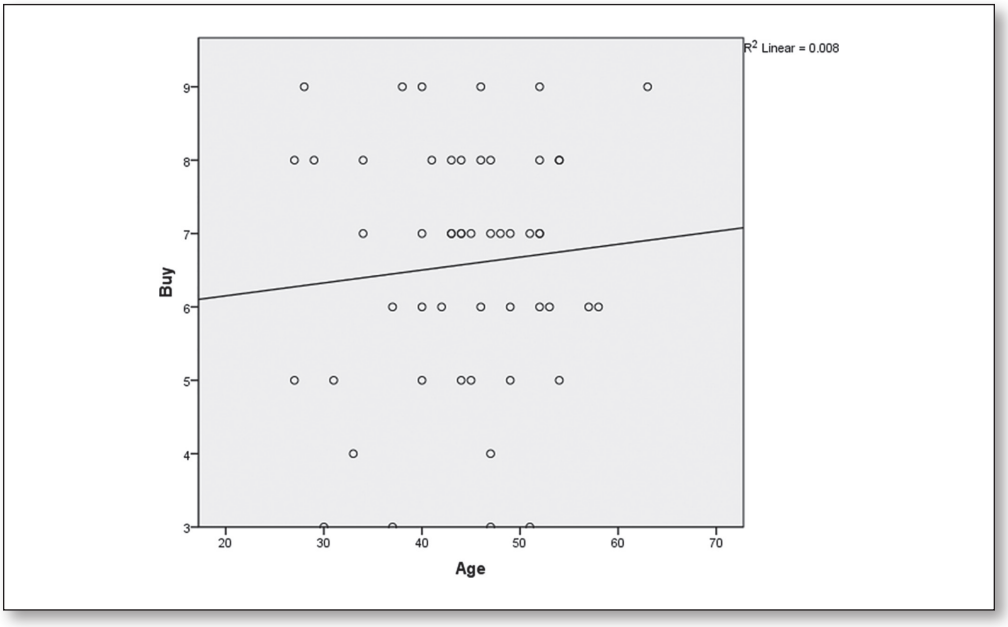
The above table indicates that the *n* should be at least 40; the table below shows that the actual *n* for this data set is 52; hence, this criterion is satisfied.

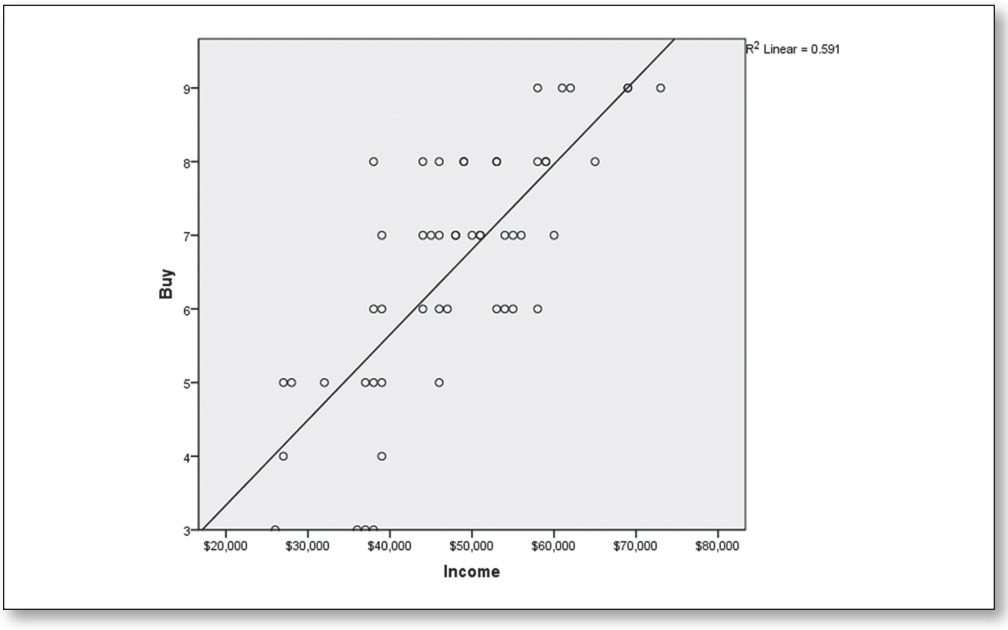
Statistics

Buy

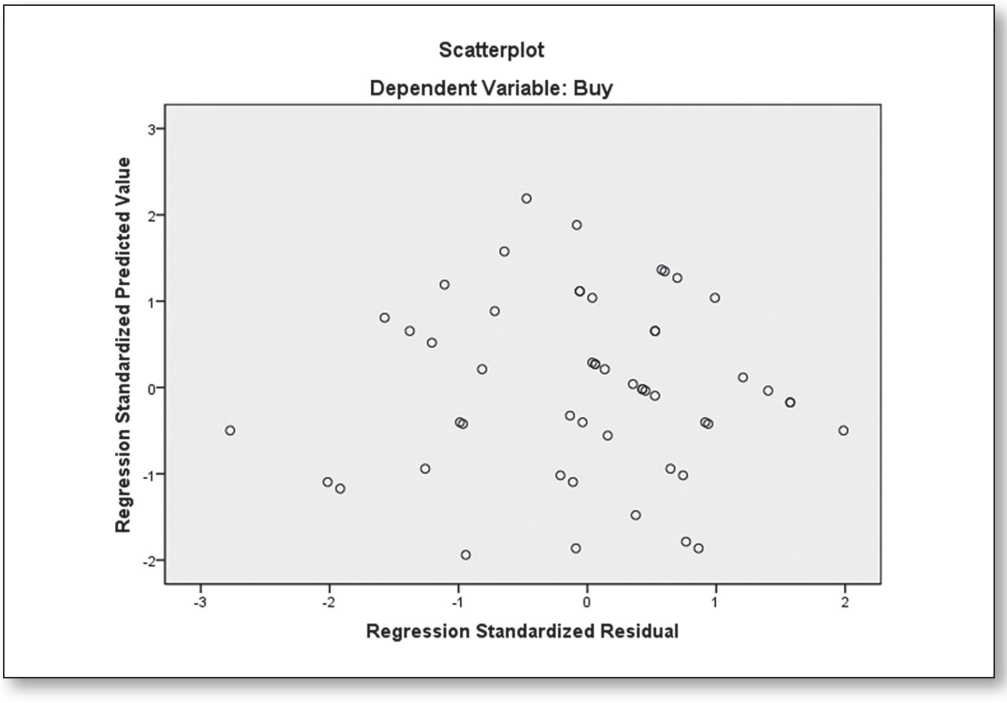
N	Valid	52
	Missing	0

Pretest criterion 2: Linearity: The scatterplots show no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.





Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



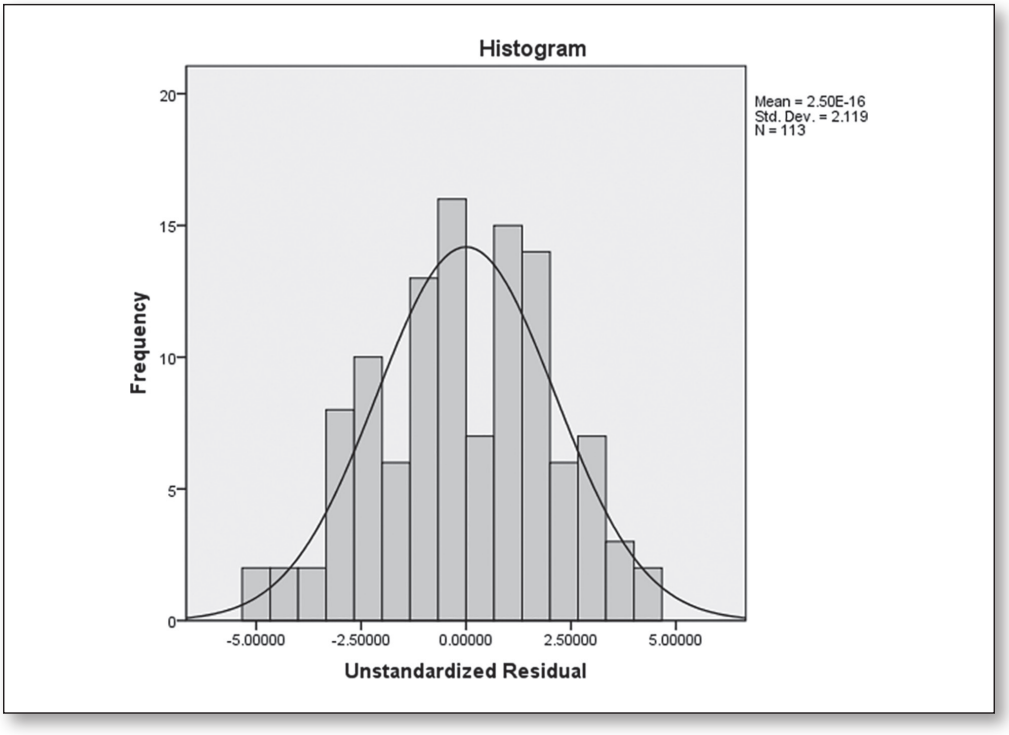
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.022	.671		1.524	.134		
	Income	.000	.000	.769	8.501	.000	1.000	1.000
2	(Constant)	2.021	.798		2.534	.015		
	Income	.000	.000	.680	7.041	.000	.817	1.223
	Gender	-.692	.323	-.207	-2.145	.037	.817	1.223

a. Dependent Variable: Buy

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.769[a]	.591	.583	1.088	.591	72.260	1	50	.000
2	.791[b]	.626	.611	1.051	.035	4.603	1	49	.037

a. Predictors: (Constant), Income
b. Predictors: (Constant), Income, Gender
c. Dependent Variable: Buy

Two predictor variables (Income and Gender) account for the overall R^2 of .626; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

Acme Coffee, which currently sells gourmet coffee blends, is now considering selling a single-serve coffee maker that brews a cup of coffee in 30 seconds. They survey 52 people to help identify the characteristics of potential customers for this high-tech coffee brewer. Multiple regression analysis revealed that income accounts for 59.1% of the variability observed in the outcome variable; gender accounts for an additional 3.5%. Age, gender, and income were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, it appears that income is the most relevant predictor when it comes to purchasing this new product.

EXERCISE 12.9A

(a)

H_0: Gender, age, religion, or SES do not predict organ donor willingness.

H_1: Gender, age, religion, or SES predict organ donor willingness.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Age	Continuous		10
Religion	Categorical	50	
SES	Categorical	20	
Total *n* quota = 90		80	10

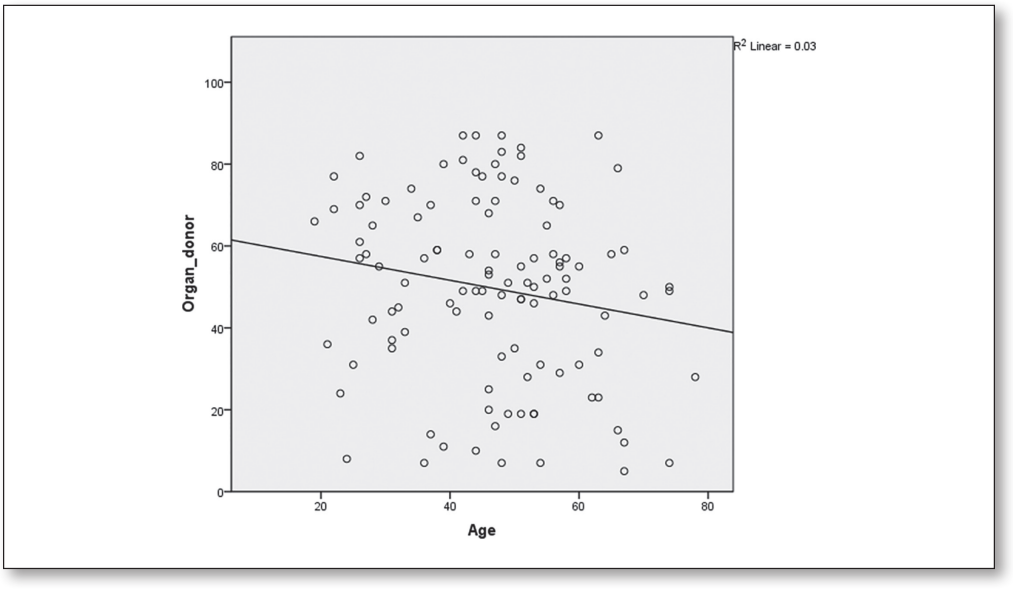
The above table indicates that the *n* should be at least 90; the table below shows that the actual *n* for this data set is 112; hence, this criterion is satisfied.

Statistics

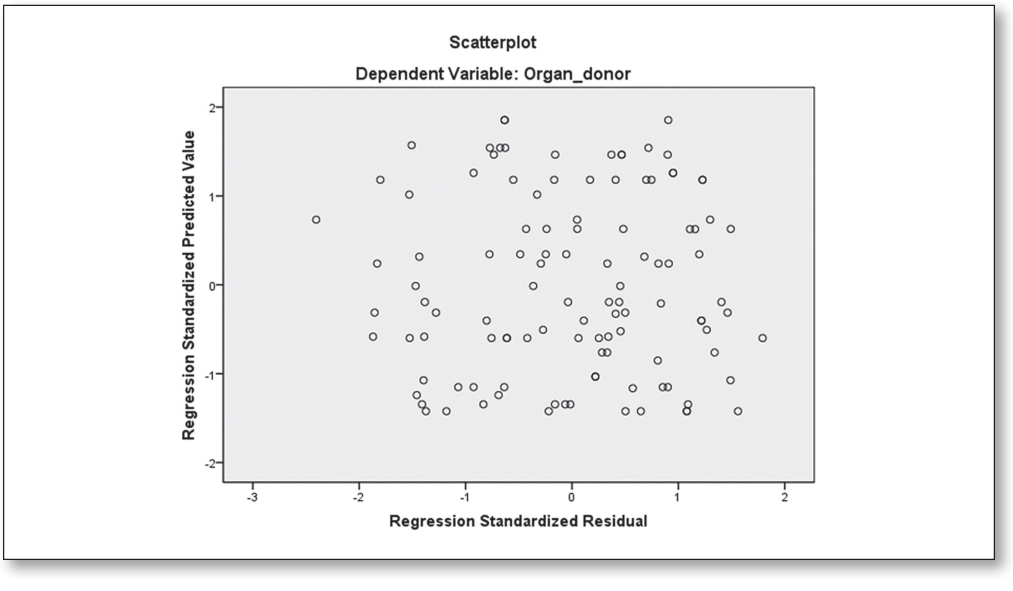
Organ_donor

N	Valid	112
	Missing	0

Pretest criterion 2: Linearity: The scatterplot shows no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.



Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



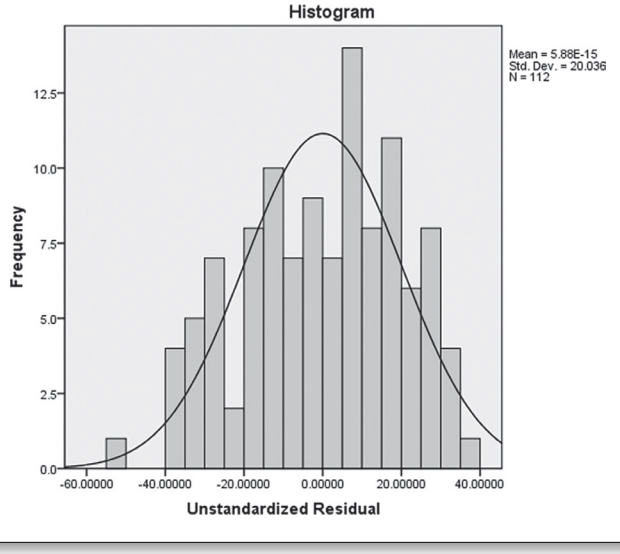
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	55.433	2.789		19.877	.000		
	Gender	-12.337	4.093	-.276	-3.014	.003	1.000	1.000
2	(Constant)	62.399	4.776		13.066	.000		
	Gender	-8.549	4.122	-.191	-2.074	.041	.903	1.108
	Religion.1	-14.722	7.262	-.219	-2.027	.045	.661	1.512
	Religion.2	-17.100	6.140	-.324	-2.785	.006	.567	1.762
	Religion.3	-9.059	6.313	-.162	-1.435	.154	.606	1.649
	Religion.4	-15.217	7.482	-.211	-2.034	.044	.712	1.404
	Religion.5	3.259	6.770	.052	.481	.631	.646	1.547
3	(Constant)	65.353	5.999		10.893	.000		
	Gender	-8.347	4.157	-.187	-2.008	.047	.899	1.113
	Religion.1	-14.881	7.311	-.221	-2.035	.044	.661	1.514
	Religion.2	-17.580	6.277	-.333	-2.801	.006	.550	1.818
	Religion.3	-9.388	6.365	-.167	-1.475	.143	.604	1.656
	Religion.4	-15.779	7.563	-.219	-2.086	.039	.706	1.417
	Religion.5	2.815	6.854	.045	.411	.682	.639	1.566
	SES.1	-3.879	4.744	-.087	-.818	.415	.692	1.445
	SES.2	-3.111	5.919	-.055	-.526	.600	.699	1.432

a. Dependent Variable: Organ_donor

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.276[a]	.076	.068	21.602	.076	9.086	1	110	.003
2	.439[b]	.193	.147	20.668	.117	3.032	5	105	.013
3	.445[c]	.198	.136	20.799	.005	.340	2	103	.712

a. Predictors: (Constant), Gender
b. Predictors: (Constant), Gender, Religion.3, Religion.4, Religion.1, Religion.5, Religion.2
c. Predictors: (Constant), Gender, Religion.3, Religion.4, Religion.1, Religion.5, Religion.2, SES.2, SES.1
d. Dependent Variable: Organ_donor

Two predictor variables (Religion and Gender) account for the overall R^2 of .193; the other predictor variables have been ruled-out as statistically insignificant ($p > .05$). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

We surveyed 112 adults to identify the factors that predict willingness to be an organ donor upon their death. Multiple regression analysis revealed that religion accounts for 11.7% of the variability observed in the outcome variable; gender accounts for an additional 7.6%. Gender, age and SES were identified as statistically insignificant predictors ($\alpha = .05$). Per these findings, we reject H_0 and accept H_1. Among these variables, religion appears to be the primary predictor regarding organ donation decision making, with gender as the secondary predictor.

EXERCISE 12.9B

(a)

H_0: Gender, age, religion, or SES do not predict organ donor willingness.

H_1: Gender, age, religion, or SES predict organ donor willingness.

(b)

Pretest criterion 1: *n* quota:

Variable	Type	Categorical (Categories – 1) × 10	Continuous 10
Gender	Categorical	10	
Age	Continuous		10
Religion	Categorical	50	
SES	Categorical	20	
Total *n* quota = 90		80	10

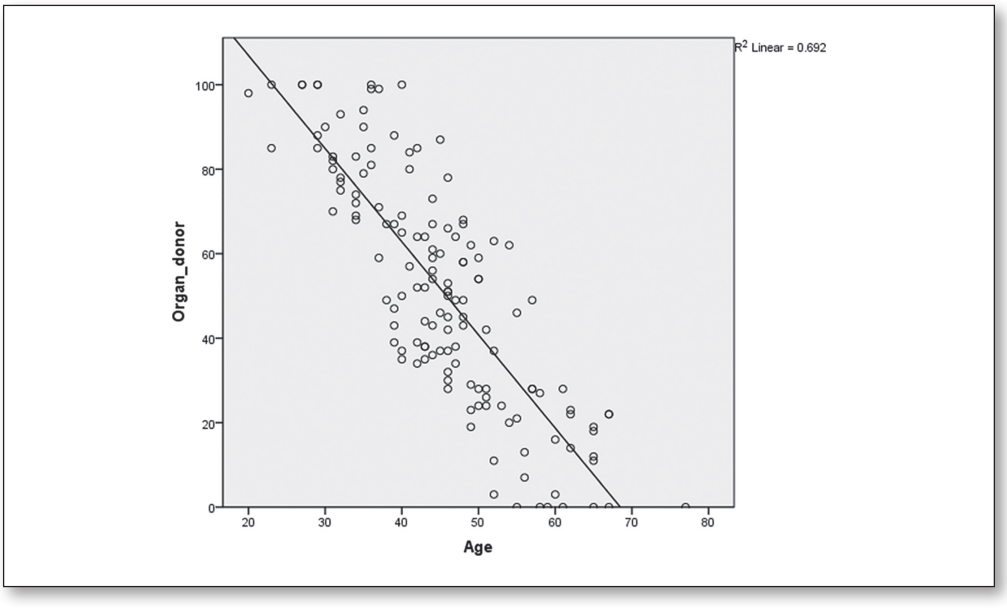
The above table indicates that the *n* should be at least 90; the table below shows that the actual *n* for this data set is 142; hence, this criterion is satisfied.

Statistics

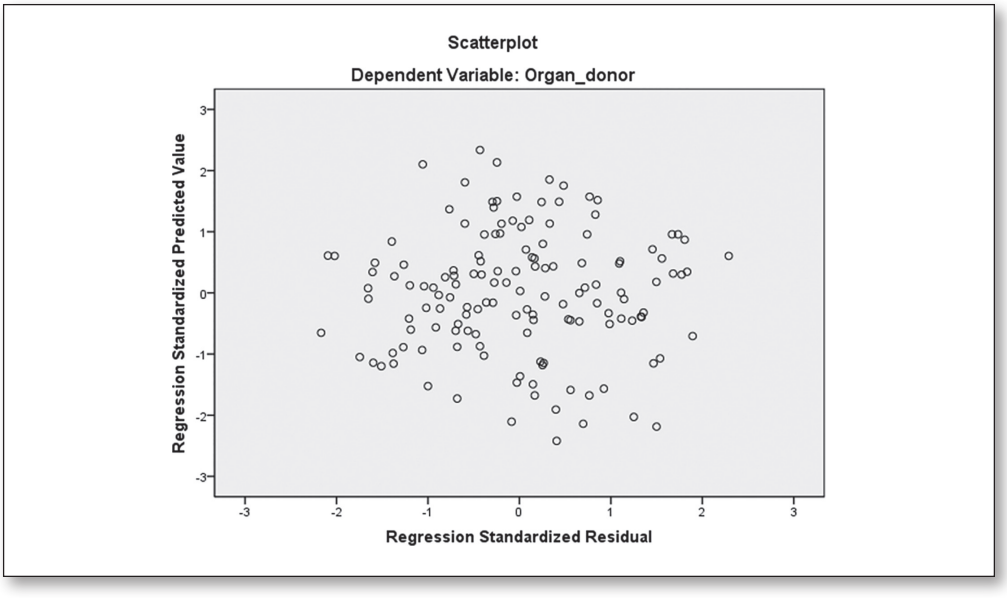
Organ_donor

N	Valid	142
	Missing	0

Pretest criterion 2: Linearity: The scatterplot shows no unexpected curves or twists in the cloud of points, hence this criterion is satisfied.



Pretest criterion 3: Homoscedasticity: The scatterplot shows that the majority of the predicted values in the outcome variable are within ±2 standard deviations of the residuals for this variable, hence, the homoscedasticity criterion is satisfied.



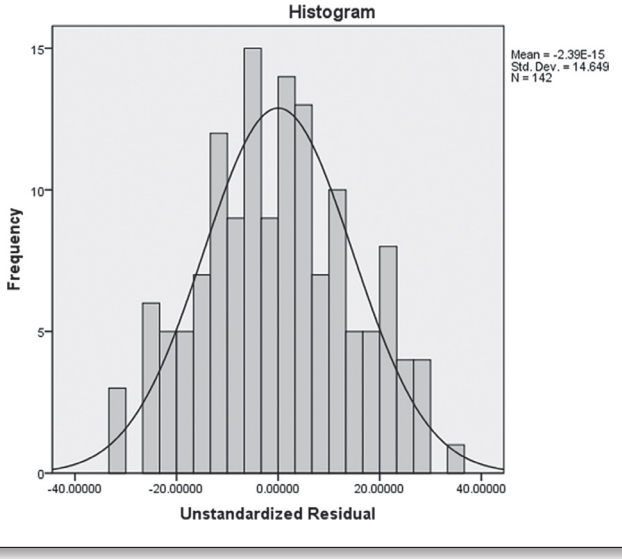
Pretest criterion 4: Multicollinearity: The values in the VIF (Variance Inflation Factor) column are all less than 5, indicating that multicollinearity is not an issue in this model; hence, this criterion is satisfied.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	151.021	5.775		26.151	.000		
	Age	-2.205	.124	-.832	-17.748	.000	1.000	1.000
2	(Constant)	151.020	6.584		22.936	.000		
	Age	-2.202	.130	-.831	-16.982	.000	.941	1.063
	Religion.1	-2.643	5.311	-.027	-.498	.620	.740	1.352
	Religion.2	-1.008	4.200	-.015	-.240	.811	.590	1.694
	Religion.3	2.807	4.198	.041	.669	.505	.606	1.651
	Religion.4	-.484	4.282	-.007	-.113	.910	.615	1.627
	Religion.5	-1.241	4.970	-.014	-.250	.803	.703	1.423
3	(Constant)	143.431	6.863		20.899	.000		
	Age	-2.086	.129	-.787	-16.214	.000	.883	1.133
	Religion.1	-7.350	5.268	-.076	-1.395	.165	.694	1.441
	Religion.2	-4.283	4.135	-.063	-1.036	.302	.562	1.778
	Religion.3	1.277	4.068	.019	.314	.754	.596	1.679
	Religion.4	-1.844	4.132	-.026	-.446	.656	.609	1.641
	Religion.5	-2.099	4.792	-.024	-.438	.662	.698	1.433
	SES.1	9.782	3.279	.175	2.983	.003	.606	1.651
	SES.2	-.522	3.414	-.009	-.153	.879	.651	1.536

a. Dependent Variable: Organ_donor

Pretest criterion 5: Normality: The histogram of the outcome variable residuals shows a normal distribution; hence this criterion is satisfied.



(c)

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.832[a]	.692	.690	15.503	.692	314.990	1	140	.000
2	.834[b]	.696	.682	15.698	.003	.307	5	135	.908
3	.850[c]	.723	.707	15.083	.028	6.615	2	133	.002

a. Predictors: (Constant), Age
b. Predictors: (Constant), Age, Religion.3, Religion.1, Religion.5, Religion.4, Religion.2
c. Predictors: (Constant), Age, Religion.3, Religion.1, Religion.5, Religion.4, Religion.2, SES.2, SES.1
d. Dependent Variable: Organ_donor

TECHNICAL TIP: In the above Model Summary table, Religion (Model 2) turned out to be a statistically insignificant (p = .908) predictor. To simplify the R^2 documentation process, rerun the analysis without the Religion (dummy variables) in the model. This produces the following Model Summary table:

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.832[a]	.692	.690	15.503	.692	314.990	1	140	.000
2	.846[b]	.715	.709	15.023	.023	5.548	2	138	.005

a. Predictors: (Constant), Age
b. Predictors: (Constant), Age, SES.2, SES.1
c. Dependent Variable: Organ_donor

Two predictor variables (Age and SES) account for the overall R^2 of .715; the other predictor variables have been ruled-out as statistically insignificant (p > .05). Since there is at least one predictor with a Sig. F Change (p) less than α (.05), I would reject H_0 and accept H_1.

(d)

We surveyed 142 adults to identify the factors that predict willingness to be an organ donor upon their death. Multiple regression analysis revealed that age accounts for 69.2% of the variability observed in the outcome variable; socioeconomic status accounts for an additional 2.3%. Gender and religion were identified as statistically insignificant predictors (α = .05). Per these findings, we reject H_0 and accept H_1. Among these variables, age appears to be the primary predictor regarding organ donation decision making, with SES as the secondary predictor.