

## Test for normality of Y and X

Obs	Animal_name	Body_Weight	Brain_weight
1	Africa giant poached rat	1.000	6.600
2	African elephant	6654.0	5712.0
3	Arctic fox	3.385	44.500
4	Arctic ground squirrel	0.920	5.700
5	Asian elephant	2547.0	4603.0

# Test for normality of Y and X

## The UNIVARIATE Procedure Variable: Brain\_weight (Brain Weight (gm))

Moments			
<b>N</b>	70	<b>Sum Weights</b>	70
<b>Mean</b>	247.255271	<b>Sum Observations</b>	17307.869
<b>Std Deviation</b>	865.910812	<b>Variance</b>	749801.534
<b>Skewness</b>	5.63845068	<b>Kurtosis</b>	32.0713003
<b>Uncorrected SS</b>	56015767.7	<b>Corrected SS</b>	51736305.9
<b>Coeff Variation</b>	350.209242	<b>Std Error Mean</b>	103.496138

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	247.2553	<b>Std Deviation</b>	865.91081
<b>Median</b>	25.3000	<b>Variance</b>	749802
<b>Mode</b>	1.0000	<b>Range</b>	5712
		<b>Interquartile Range</b>	169.30000

**Note:** The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	2.389029	<b>Pr &gt;  t </b>	0.0196
<b>Sign</b>	<b>M</b>	35	<b>Pr &gt;=  M </b>	<.0001
<b>Signed Rank</b>	<b>S</b>	1242.5	<b>Pr &gt;=  S </b>	<.0001

Trimmed Means								
Percent Trimmed in Tail	Number Trimmed in Tail	Trimmed Mean	Std Error Trimmed Mean	95% Confidence Limits		DF	t for H0: Mu0=0.00	Pr >  t
<b>10.00</b>	7	81.02588	20.73930	39.46338	122.5884	55	3.906875	0.0003

Quantiles (Definition 5)	
Level	Quantile
<b>100% Max</b>	5712.00
<b>99%</b>	5712.00
<b>95%</b>	490.00
<b>90%</b>	412.50
<b>75% Q3</b>	175.00
<b>50% Median</b>	25.30
<b>25% Q1</b>	5.70
<b>10%</b>	1.10
<b>5%</b>	0.33

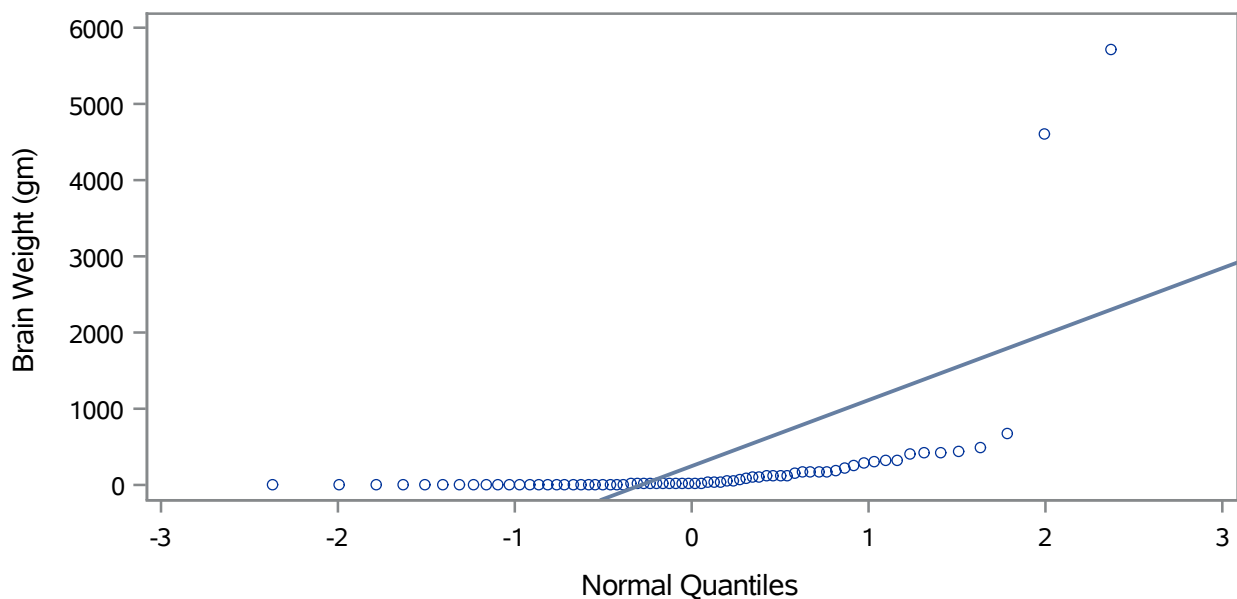
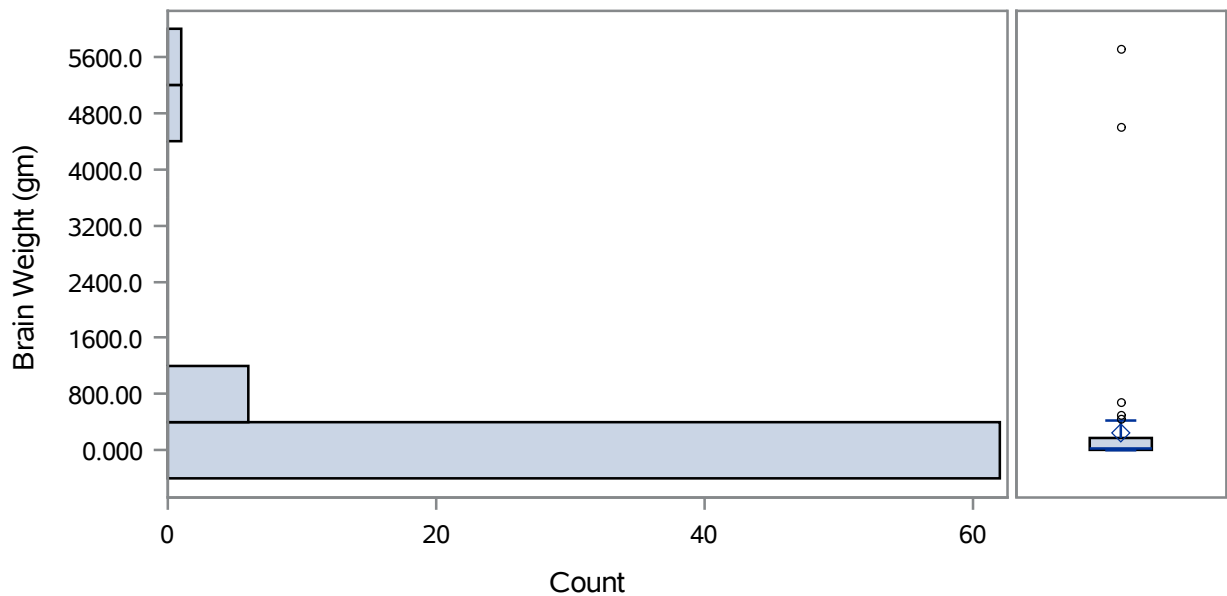
# Test for normality of Y and X

## The UNIVARIATE Procedure Variable: Brain\_weight (Brain Weight (gm))

Quantiles (Definition 5)	
Level	Quantile
1%	0.14
0% Min	0.14

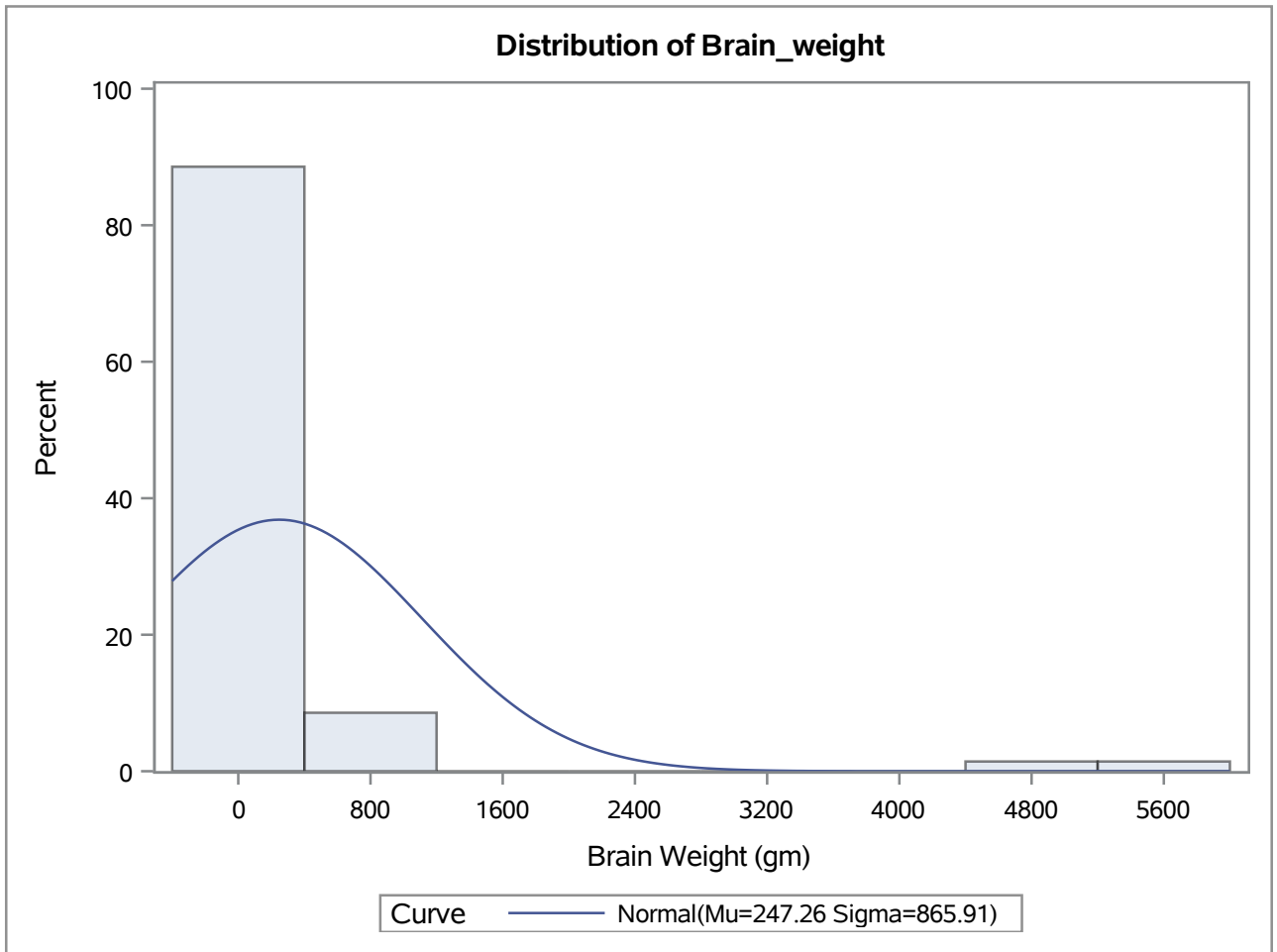
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.14	39	440	11
0.25	41	490	49
0.30	7	680	26
0.33	46	4603	5
0.40	45	5712	2

Distribution and Probability Plot for Brain\_weight



# Test for normality of Y and X

## The UNIVARIATE Procedure



# Test for normality of Y and X

## The UNIVARIATE Procedure Fitted Normal Distribution for Brain\_weight (Brain Weight (gm))

Parameters for Normal Distribution		
Parameter	Symbol	Estimate
Mean	Mu	247.2553
Std Dev	Sigma	865.9108

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.3876758	Pr > D	<0.010
Cramer-von Mises	W-Sq	3.7314961	Pr > W-Sq	<0.005
Anderson-Darling	A-Sq	18.6069200	Pr > A-Sq	<0.005

Quantiles for Normal Distribution		
Percent	Quantile	
	Observed	Estimated
1.0	0.14000	-1767.155
5.0	0.33000	-1177.041
10.0	1.10000	-862.454
25.0	5.70000	-336.793
50.0	25.30000	247.255
75.0	175.00000	831.303
90.0	412.50000	1356.965
95.0	490.00000	1671.552
99.0	5712.00000	2261.665

# Test for normality of Y and X

## The UNIVARIATE Procedure Variable: Body\_Weight (Body Weight (kg))

Moments			
<b>N</b>	70	<b>Sum Weights</b>	70
<b>Mean</b>	178.596571	<b>Sum Observations</b>	12501.76
<b>Std Deviation</b>	845.827224	<b>Variance</b>	715423.693
<b>Skewness</b>	7.01656835	<b>Kurtosis</b>	52.1471015
<b>Uncorrected SS</b>	51597006.3	<b>Corrected SS</b>	49364234.8
<b>Coeff Variation</b>	473.596563	<b>Std Error Mean</b>	101.09569

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	178.5966	<b>Std Deviation</b>	845.82722
<b>Median</b>	3.5500	<b>Variance</b>	715424
<b>Mode</b>	0.0230	<b>Range</b>	6654
		<b>Interquartile Range</b>	54.60000

**Note:** The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	1.766609	<b>Pr &gt;  t </b>	0.0817
<b>Sign</b>	<b>M</b>	35	<b>Pr &gt;=  M </b>	<.0001
<b>Signed Rank</b>	<b>S</b>	1242.5	<b>Pr &gt;=  S </b>	<.0001

Trimmed Means								
Percent Trimmed in Tail	Number Trimmed in Tail	Trimmed Mean	Std Error Trimmed Mean	95% Confidence Limits		DF	t for H0: Mu0=0.00	Pr >  t
<b>10.00</b>	7	29.27689	10.18318	8.869335	49.68445	55	2.875023	0.0057

Quantiles (Definition 5)	
Level	Quantile
<b>100% Max</b>	6654.000
<b>99%</b>	6654.000
<b>95%</b>	465.000
<b>90%</b>	199.500
<b>75% Q3</b>	55.500
<b>50% Median</b>	3.550
<b>25% Q1</b>	0.900
<b>10%</b>	0.088
<b>5%</b>	0.023

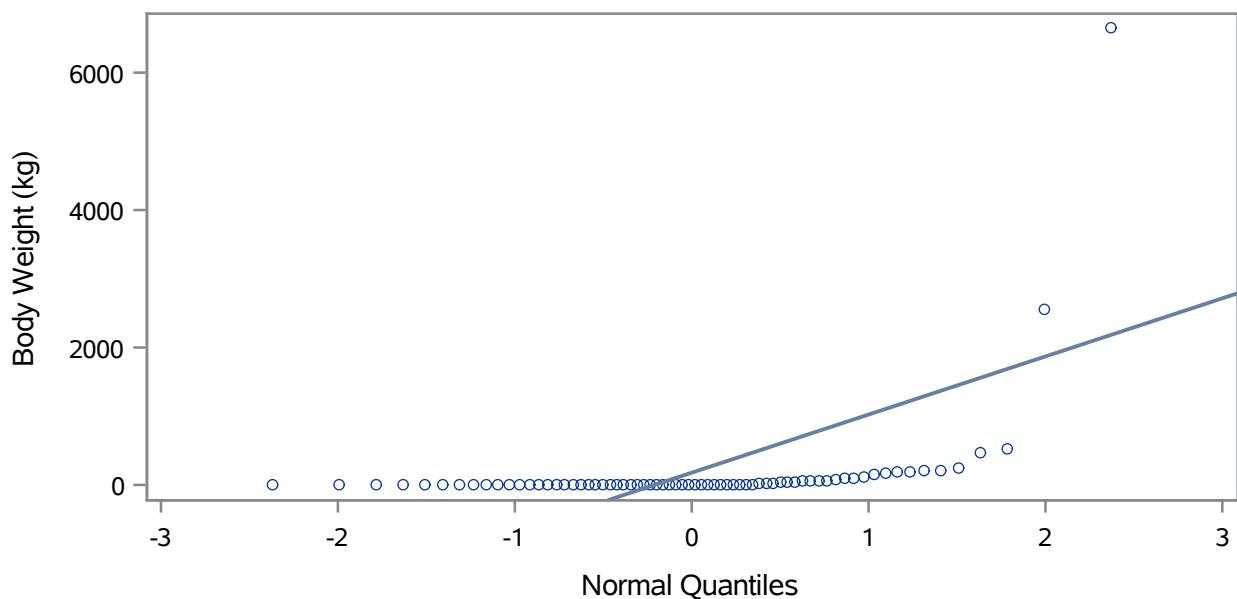
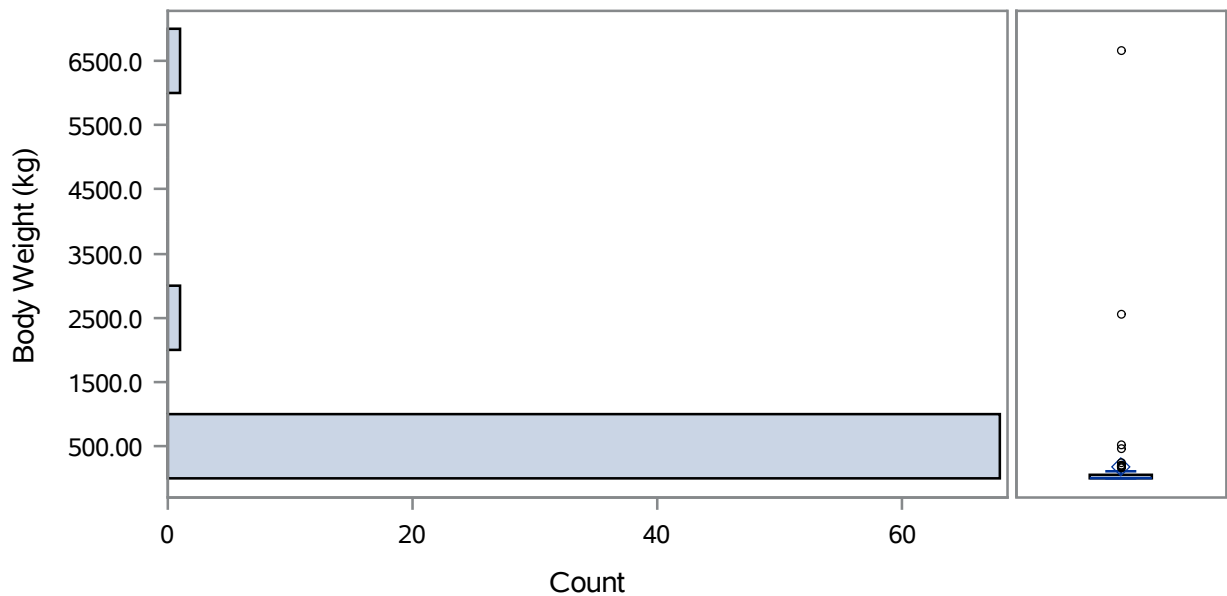
# Test for normality of Y and X

The UNIVARIATE Procedure  
Variable: Body\_Weight (Body Weight (kg))

Quantiles (Definition 5)	
Level	Quantile
1%	0.005
0% Min	0.005

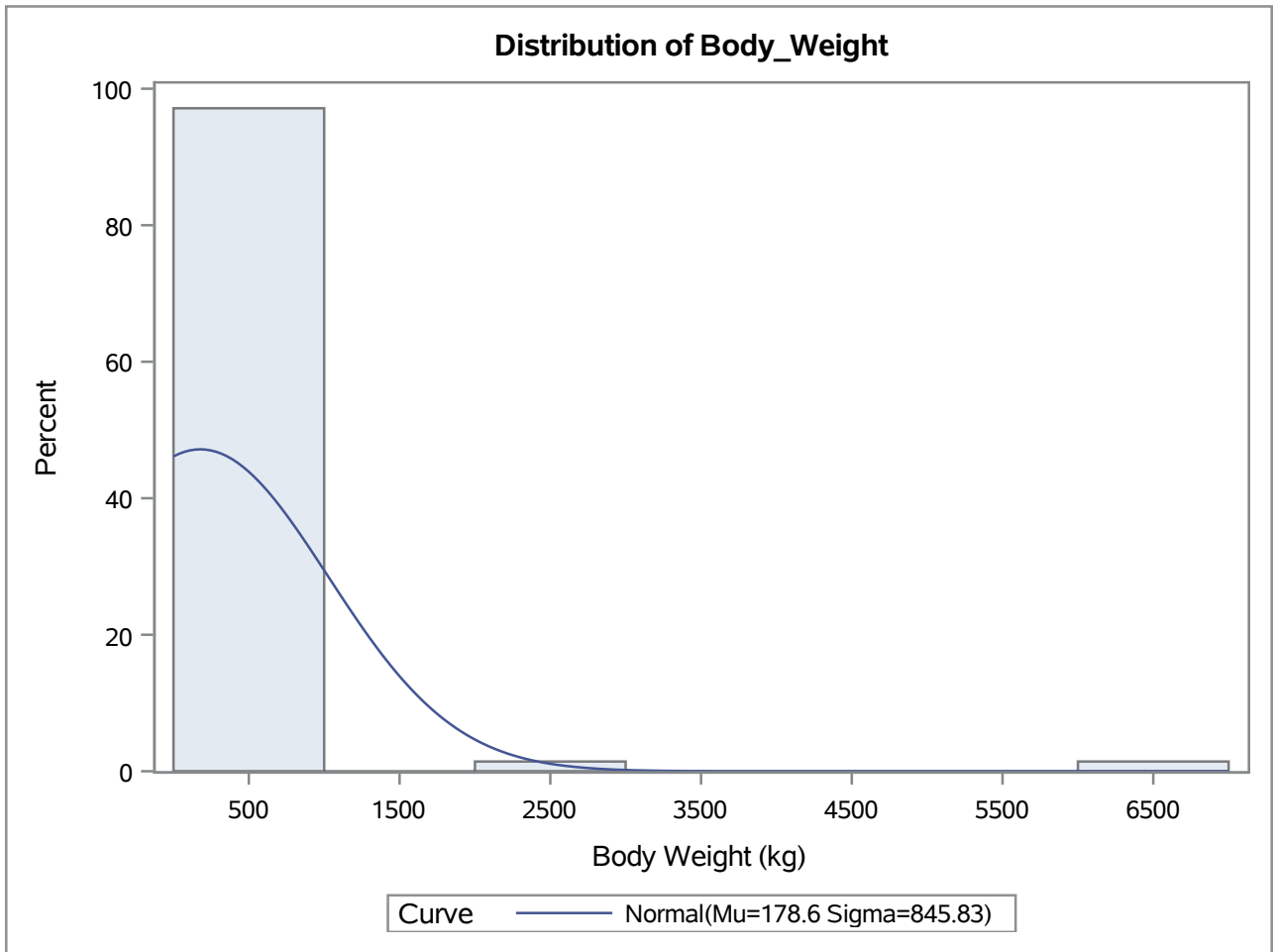
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.005	39	250.01	49
0.010	41	465.00	13
0.023	45	529.00	26
0.023	7	2547.00	5
0.048	46	6654.00	2

Distribution and Probability Plot for Body\_Weight



# Test for normality of Y and X

## The UNIVARIATE Procedure





# Test for normality of Y and X

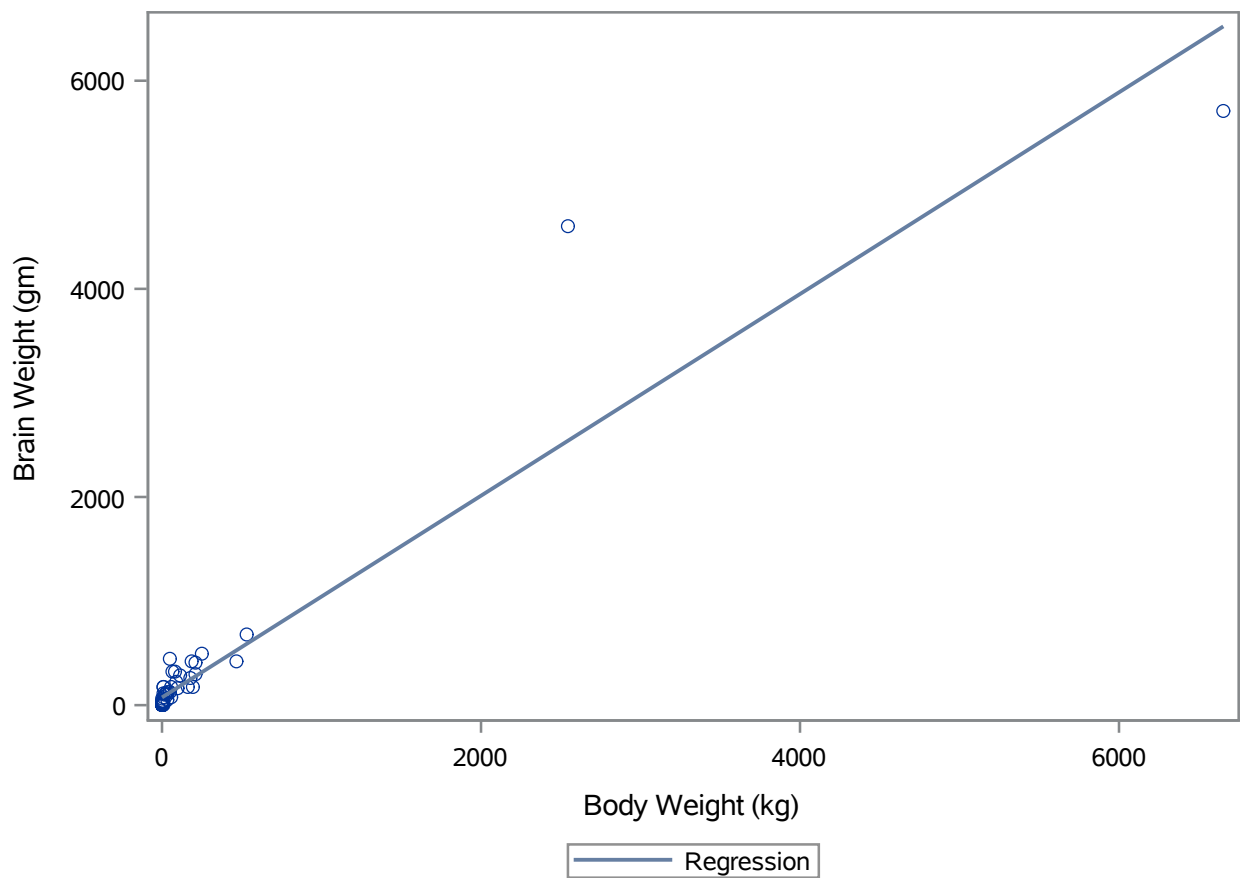
## The UNIVARIATE Procedure Fitted Normal Distribution for Body\_Weight (Body Weight (kg))

Parameters for Normal Distribution		
Parameter	Symbol	Estimate
Mean	Mu	178.5966
Std Dev	Sigma	845.8272

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.4163873	Pr > D	<0.010
Cramer-von Mises	W-Sq	4.4570446	Pr > W-Sq	<0.005
Anderson-Darling	A-Sq	21.3196296	Pr > A-Sq	<0.005

Quantiles for Normal Distribution		
Percent	Quantile	
	Observed	Estimated
1.0	0.00500	-1789.092
5.0	0.02300	-1212.665
10.0	0.08800	-905.375
25.0	0.90000	-391.905
50.0	3.55000	178.597
75.0	55.50000	749.098
90.0	199.50000	1262.568
95.0	465.00000	1569.859
99.0	6654.00000	2146.285

Linear Relationship Assumption



## Check autocorrelation

### The AUTOREG Procedure

Dependent Variable	Brain_weight
	Brain Weight (gm)

## Check autocorrelation

### The AUTOREG Procedure

Ordinary Least Squares Estimates			
<b>SSE</b>	5385909.77	<b>DFE</b>	68
<b>MSE</b>	79205	<b>Root MSE</b>	281.43304
<b>SBC</b>	994.704494	<b>AIC</b>	990.207504
<b>MAE</b>	108.75741	<b>AICC</b>	990.386608
<b>MAPE</b>	2890.59952	<b>HQC</b>	991.993763
		<b>Total R-Square</b>	0.8959

Durbin-Watson Statistics			
Order	DW	Pr < DW	Pr > DW
1	1.9544	0.4267	0.5733
2	1.9318	0.4161	0.5839
3	2.5538	0.9942	0.0058
4	1.8876	0.4406	0.5594

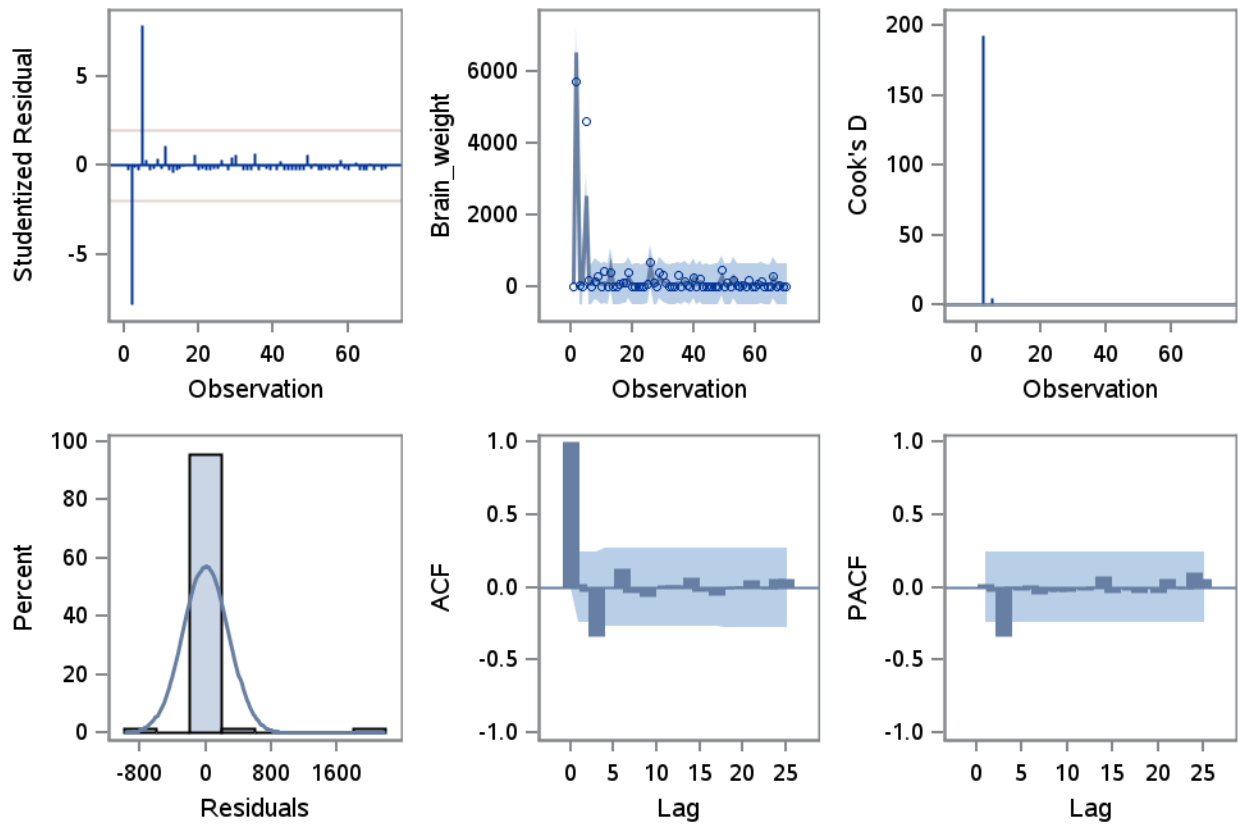
**NOTE:** Pr<DW is the p-value for testing positive autocorrelation, and Pr>DW is the p-value for testing negative autocorrelation.

Parameter Estimates						
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t	Variable Label
<b>Intercept</b>	1	74.1965	34.3900	2.16	0.0345	
<b>Body_Weight</b>	1	0.9690	0.0401	24.19	<.0001	Body Weight (kg)

# Check autocorrelation

## The AUTOREG Procedure

### Fit Diagnostics for Brain\_weight



Observations 70 MSE 79204.56 Model DF 2

# Regression Model with Fit Diagnostics

## The REG Procedure

Model: MODEL1

Dependent Variable: Brain\_weight Brain Weight (gm)

Number of Observations Read	70
Number of Observations Used	70

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	46350396	46350396	585.20	<.0001
Error	68	5385910	79205		
Corrected Total	69	51736306			

Root MSE	281.43304	R-Square	0.8959
Dependent Mean	247.25527	Adj R-Sq	0.8944
Coeff Var	113.82287		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr >  t
Intercept	Intercept	1	74.19649	34.38999	2.16	0.0345
Body_Weight	Body Weight (kg)	1	0.96899	0.04006	24.19	<.0001

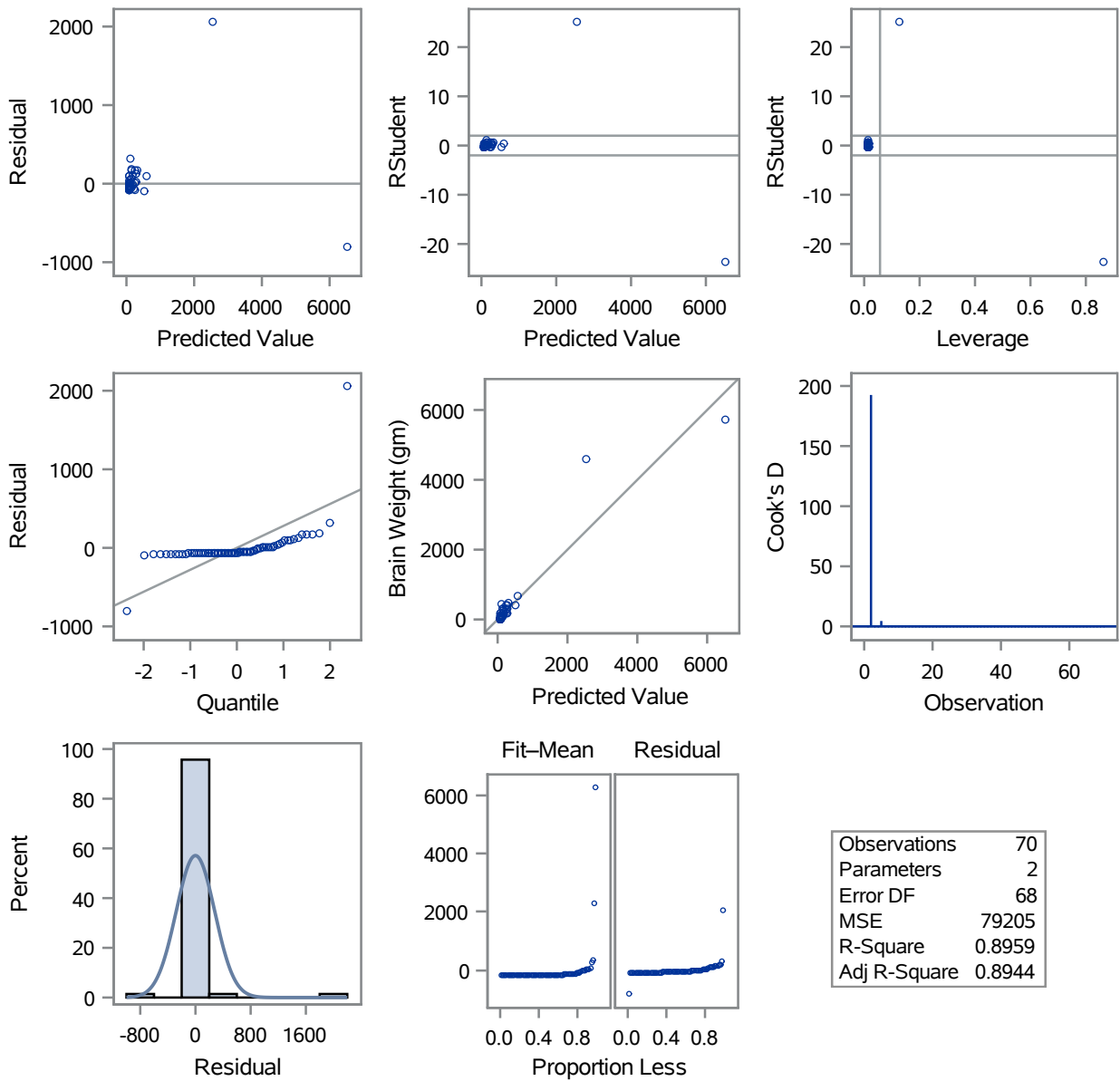
# Regression Model with Fit Diagnostics

## The REG Procedure

Model: MODEL1

Dependent Variable: Brain\_weight Brain Weight (gm)

### Fit Diagnostics for Brain\_weight

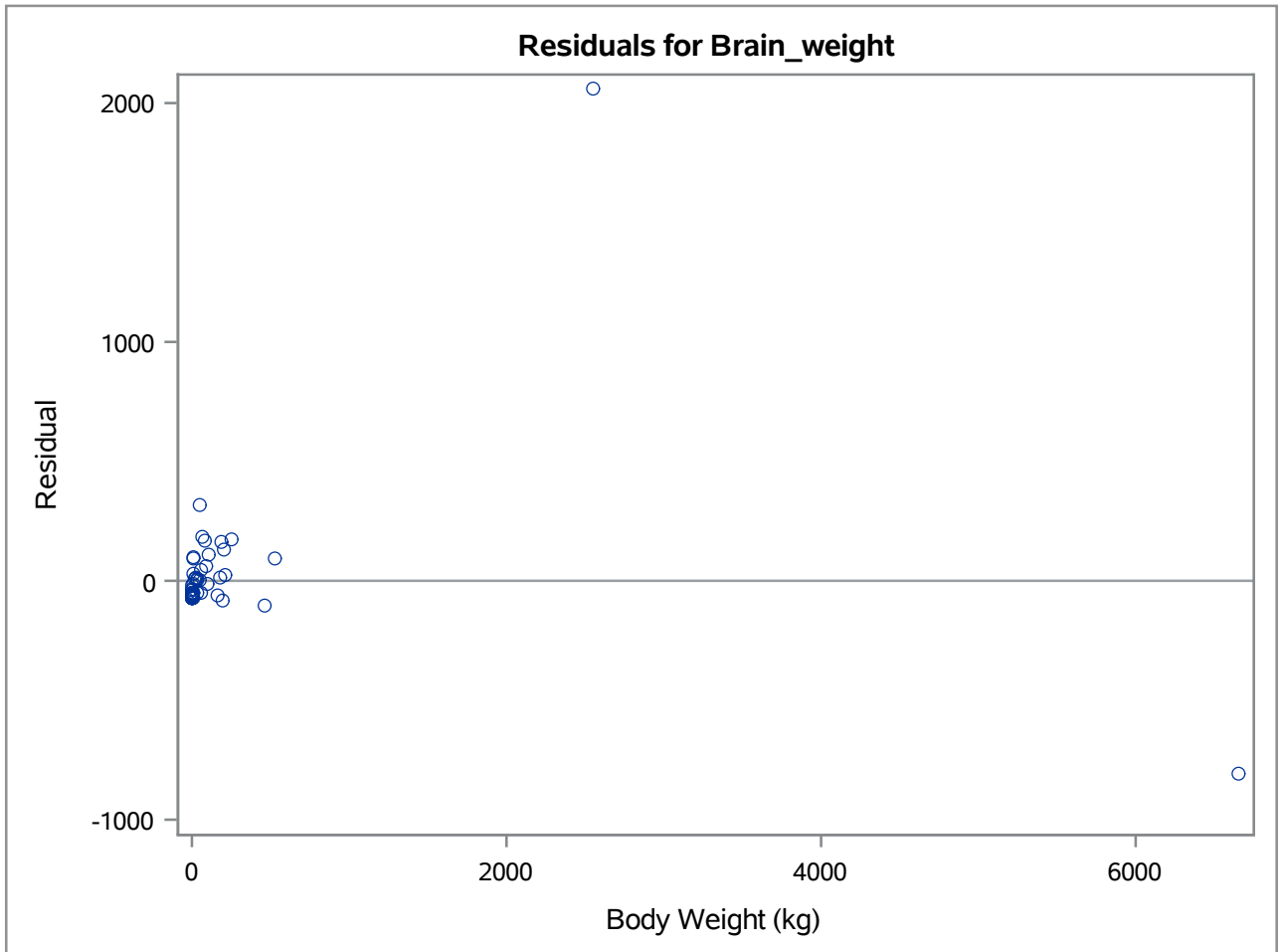


# Regression Model with Fit Diagnostics

The REG Procedure

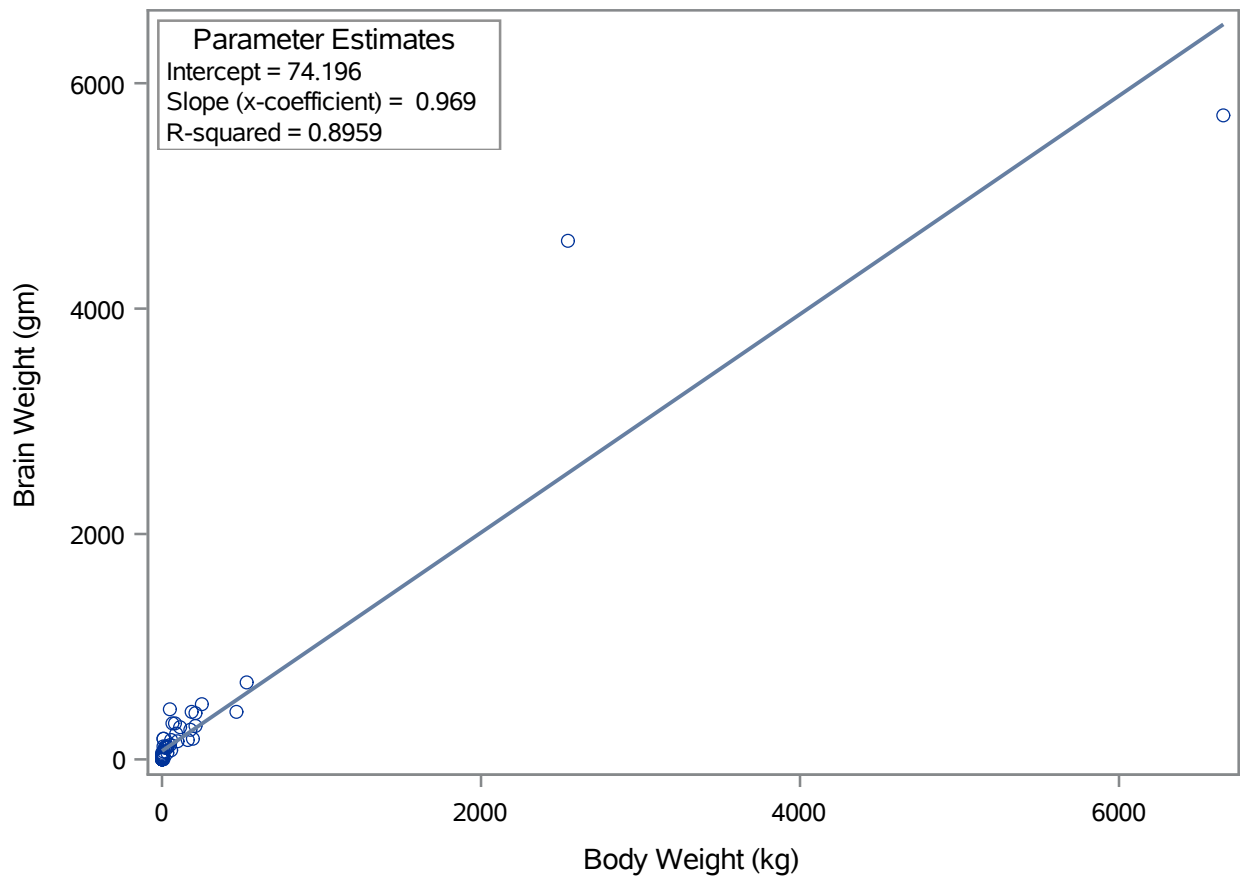
Model: MODEL1

Dependent Variable: Brain\_weight Brain Weight (gm)





Regression Line with Slope and Intercept



# Test for normality of Log Y and X

## The UNIVARIATE Procedure Variable: log\_brw

Moments			
<b>N</b>	70	<b>Sum Weights</b>	70
<b>Mean</b>	3.27817185	<b>Sum Observations</b>	229.47203
<b>Std Deviation</b>	2.31615242	<b>Variance</b>	5.36456204
<b>Skewness</b>	-0.1467524	<b>Kurtosis</b>	-0.3289218
<b>Uncorrected SS</b>	1122.40353	<b>Corrected SS</b>	370.154781
<b>Coeff Variation</b>	70.6537829	<b>Std Error Mean</b>	0.27683316

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	3.278172	<b>Std Deviation</b>	2.31615
<b>Median</b>	3.230734	<b>Variance</b>	5.36456
<b>Mode</b>	0.000000	<b>Range</b>	10.61644
		<b>Interquartile Range</b>	3.42432

**Note:** The mode displayed is the smallest of 3 modes with a count of 2.

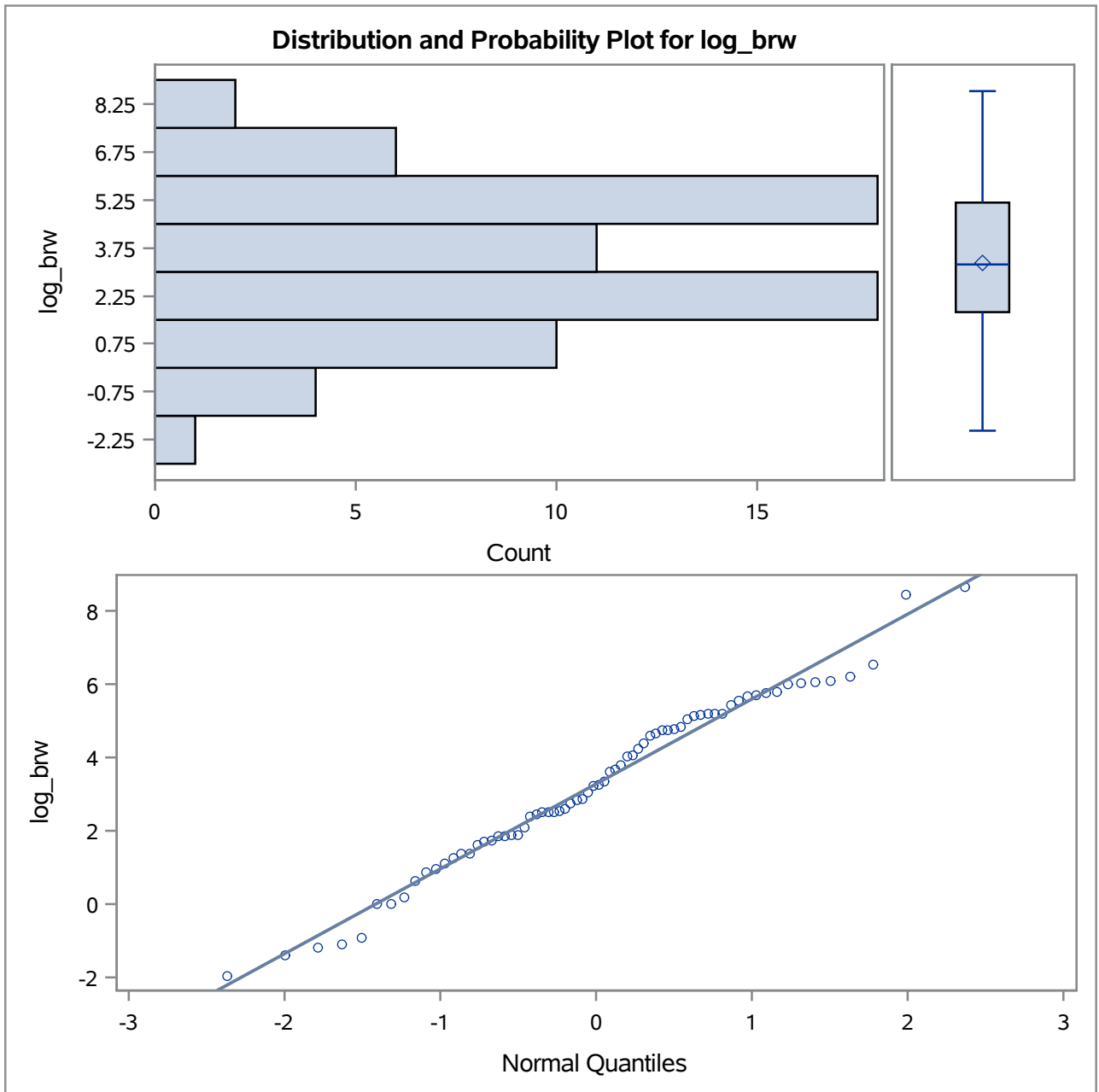
Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	11.84169	<b>Pr &gt;  t </b>	<.0001
<b>Sign</b>	<b>M</b>	29	<b>Pr &gt;=  M </b>	<.0001
<b>Signed Rank</b>	<b>S</b>	1122.5	<b>Pr &gt;=  S </b>	<.0001

Quantiles (Definition 5)	
Level	Quantile
<b>100% Max</b>	8.6503245
<b>99%</b>	8.6503245
<b>95%</b>	6.1944054
<b>90%</b>	6.0221120
<b>75% Q3</b>	5.1647860
<b>50% Median</b>	3.2307341
<b>25% Q1</b>	1.7404662
<b>10%</b>	0.0911608
<b>5%</b>	-1.1086626
<b>1%</b>	-1.9661129
<b>0% Min</b>	-1.9661129

# Test for normality of Log Y and X

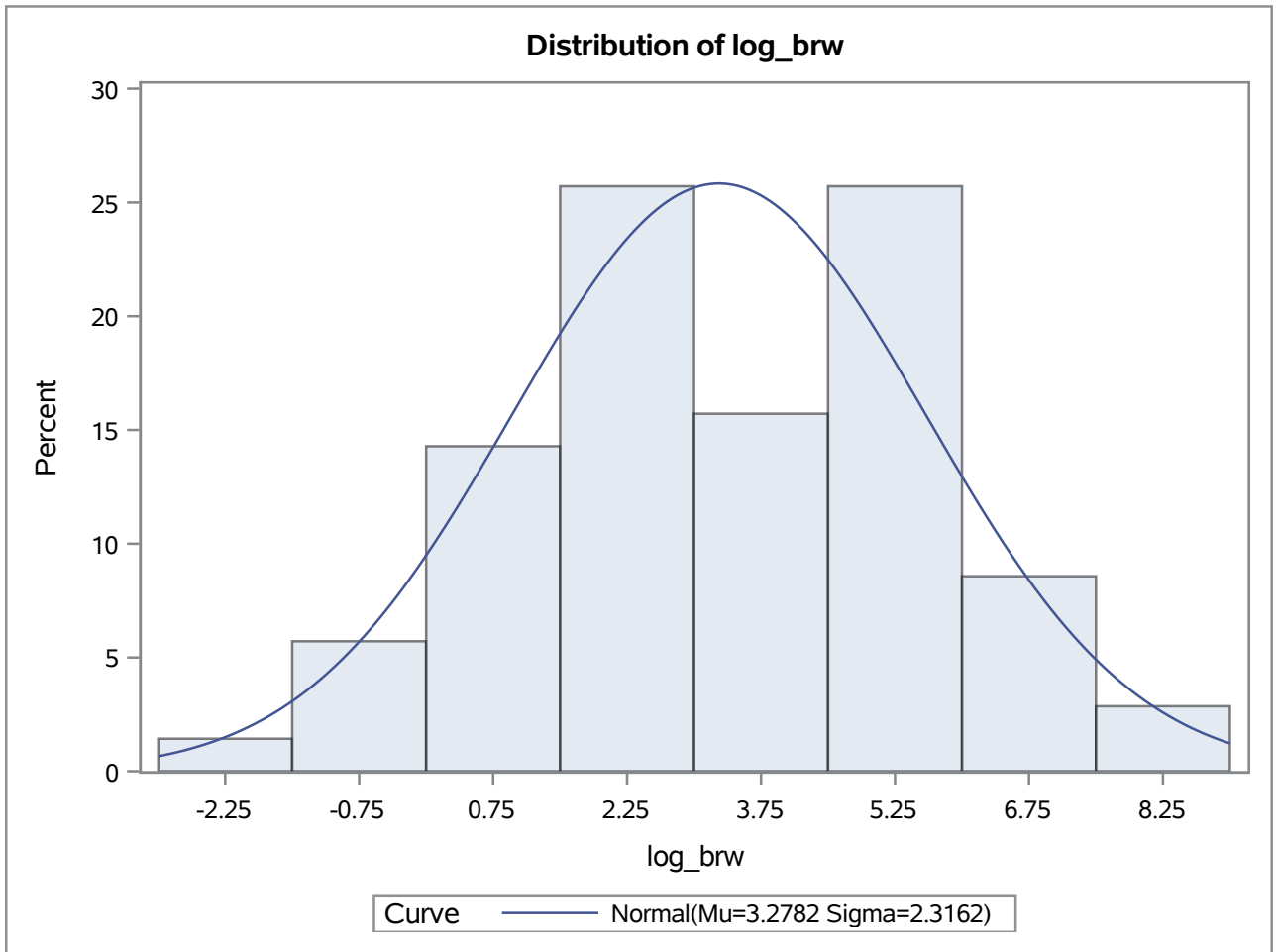
## The UNIVARIATE Procedure Variable: log\_brw

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-1.966113	39	6.08677	11
-1.386294	41	6.19441	49
-1.203973	7	6.52209	26
-1.108663	46	8.43446	5
-0.916291	45	8.65032	2



# Test for normality of Log Y and X

## The UNIVARIATE Procedure



# Test for normality of Log Y and X

## The UNIVARIATE Procedure Fitted Normal Distribution for log\_brw

Parameters for Normal Distribution		
Parameter	Symbol	Estimate
Mean	Mu	3.278172
Std Dev	Sigma	2.316152

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.08542227	Pr > D	>0.150
Cramer-von Mises	W-Sq	0.06920965	Pr > W-Sq	>0.250
Anderson-Darling	A-Sq	0.46267199	Pr > A-Sq	>0.250

Quantiles for Normal Distribution		
Percent	Quantile	
	Observed	Estimated
1.0	-1.96611	-2.11000
5.0	-1.10866	-0.53156
10.0	0.09116	0.30990
25.0	1.74047	1.71595
50.0	3.23073	3.27817
75.0	5.16479	4.84039
90.0	6.02211	6.24644
95.0	6.19441	7.08790
99.0	8.65032	8.66635

# Test for normality of Log Y and X

## The UNIVARIATE Procedure Variable: log\_bow

Moments			
<b>N</b>	70	<b>Sum Weights</b>	70
<b>Mean</b>	1.61039131	<b>Sum Observations</b>	112.727392
<b>Std Deviation</b>	2.99267692	<b>Variance</b>	8.95611518
<b>Skewness</b>	-0.0475829	<b>Kurtosis</b>	-0.2875183
<b>Uncorrected SS</b>	799.50716	<b>Corrected SS</b>	617.971947
<b>Coeff Variation</b>	185.835387	<b>Std Error Mean</b>	0.35769331

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	1.61039	<b>Std Deviation</b>	2.99268
<b>Median</b>	1.26685	<b>Variance</b>	8.95612
<b>Mode</b>	-3.77226	<b>Range</b>	14.10129
		<b>Interquartile Range</b>	4.12174

**Note:** The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	4.502157	<b>Pr &gt;  t </b>	<.0001
<b>Sign</b>	<b>M</b>	15.5	<b>Pr &gt;=  M </b>	0.0002
<b>Signed Rank</b>	<b>S</b>	678	<b>Pr &gt;=  S </b>	<.0001

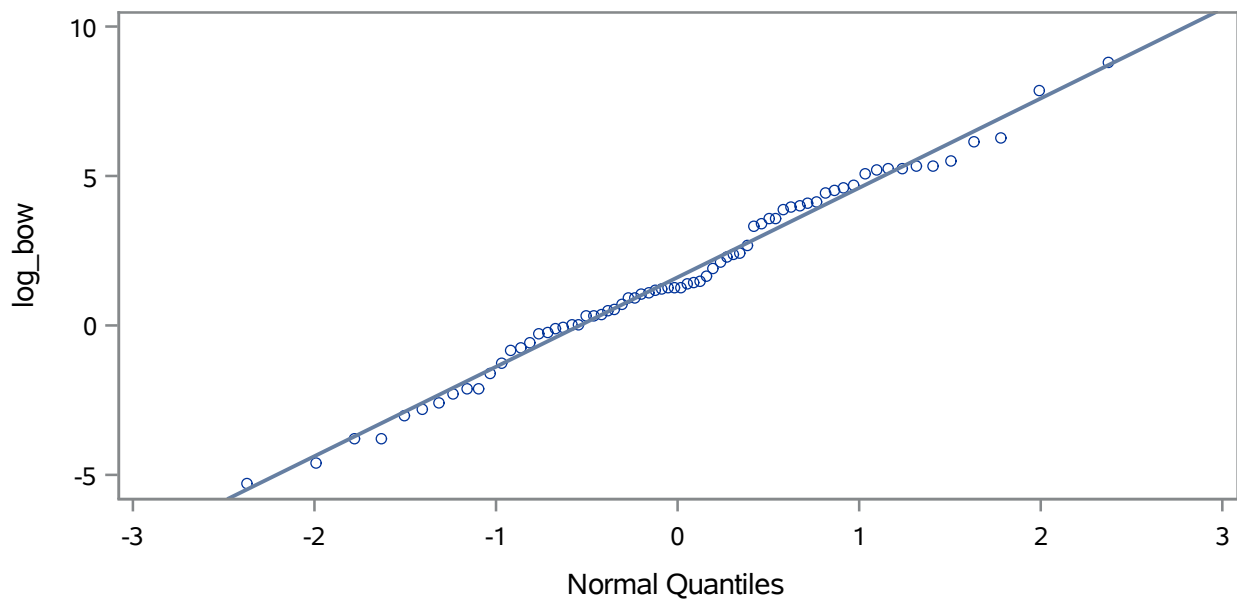
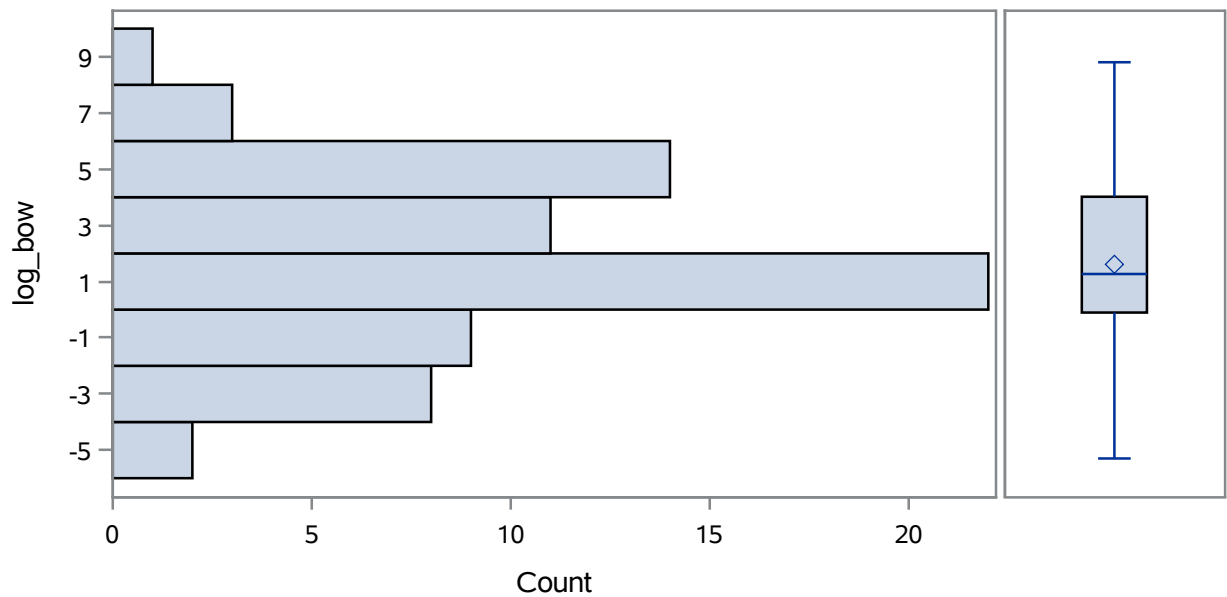
Quantiles (Definition 5)	
Level	Quantile
<b>100% Max</b>	8.802973
<b>99%</b>	8.802973
<b>95%</b>	6.142037
<b>90%</b>	5.295107
<b>75% Q3</b>	4.016383
<b>50% Median</b>	1.266848
<b>25% Q1</b>	-0.105361
<b>10%</b>	-2.441451
<b>5%</b>	-3.772261
<b>1%</b>	-5.298317
<b>0% Min</b>	-5.298317

# Test for normality of Log Y and X

## The UNIVARIATE Procedure Variable: log\_bow

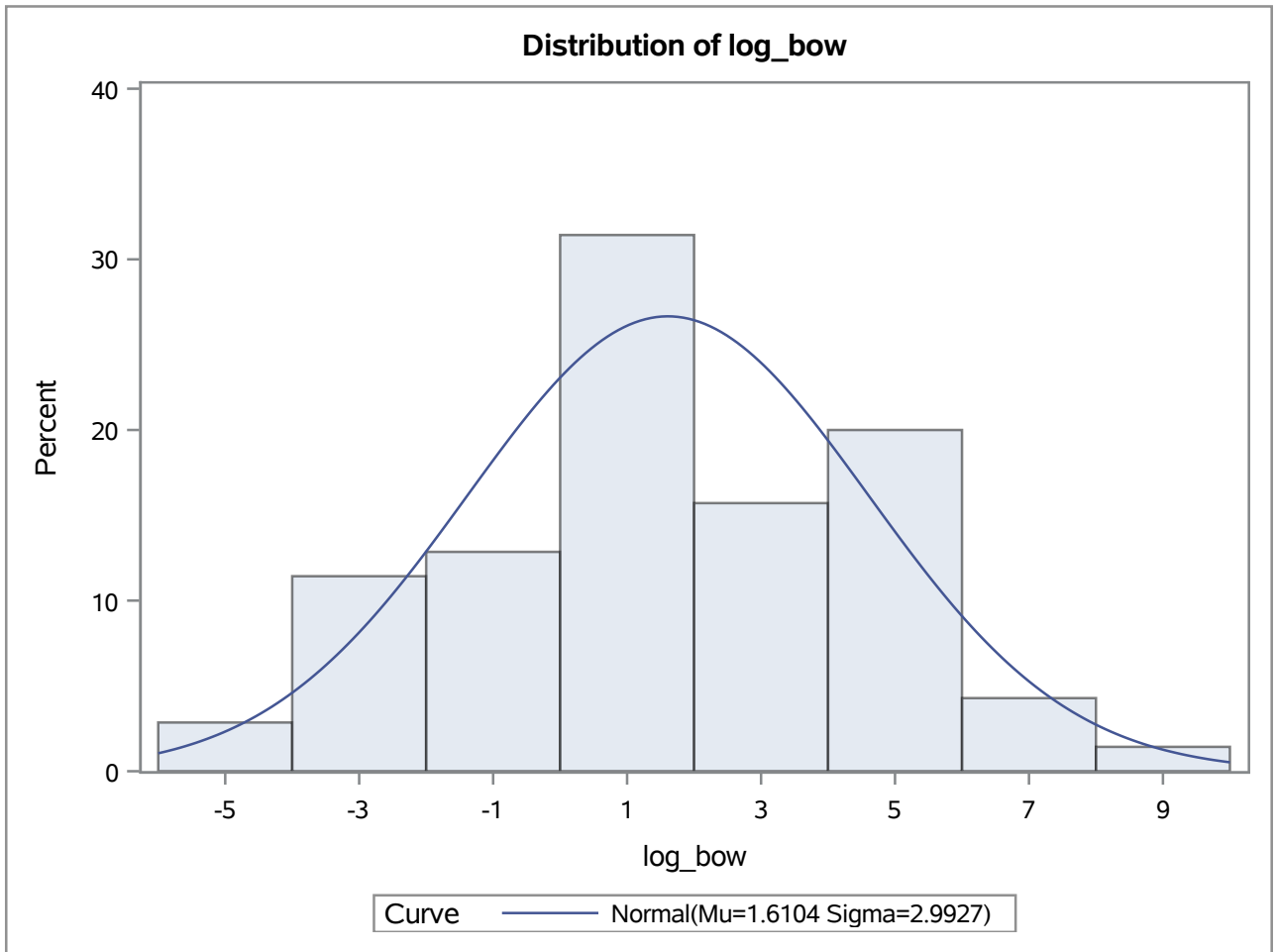
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-5.29832	39	5.52150	49
-4.60517	41	6.14204	13
-3.77226	45	6.27099	26
-3.77226	7	7.84267	5
-3.03655	46	8.80297	2

Distribution and Probability Plot for log\_bow



# Test for normality of Log Y and X

## The UNIVARIATE Procedure





# Test for normality of Log Y and X

## The UNIVARIATE Procedure Fitted Normal Distribution for log\_bow

Parameters for Normal Distribution		
Parameter	Symbol	Estimate
Mean	Mu	1.610391
Std Dev	Sigma	2.992677

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.07773895	Pr > D	>0.150
Cramer-von Mises	W-Sq	0.05766192	Pr > W-Sq	>0.250
Anderson-Darling	A-Sq	0.33193873	Pr > A-Sq	>0.250

Quantiles for Normal Distribution		
Percent	Quantile	
	Observed	Estimated
1.0	-5.29832	-5.35162
5.0	-3.77226	-3.31212
10.0	-2.44145	-2.22488
25.0	-0.10536	-0.40814
50.0	1.26685	1.61039
75.0	4.01638	3.62892
90.0	5.29511	5.44566
95.0	6.14204	6.53291
99.0	8.80297	8.57240

# Regression Model for Log Data with Fit Diagnostics

The REG Procedure  
Model: MODEL1  
Dependent Variable: log\_brw

Number of Observations Read	70
Number of Observations Used	70

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	342.44969	342.44969	840.52	<.0001
Error	68	27.70509	0.40743		
Corrected Total	69	370.15478			

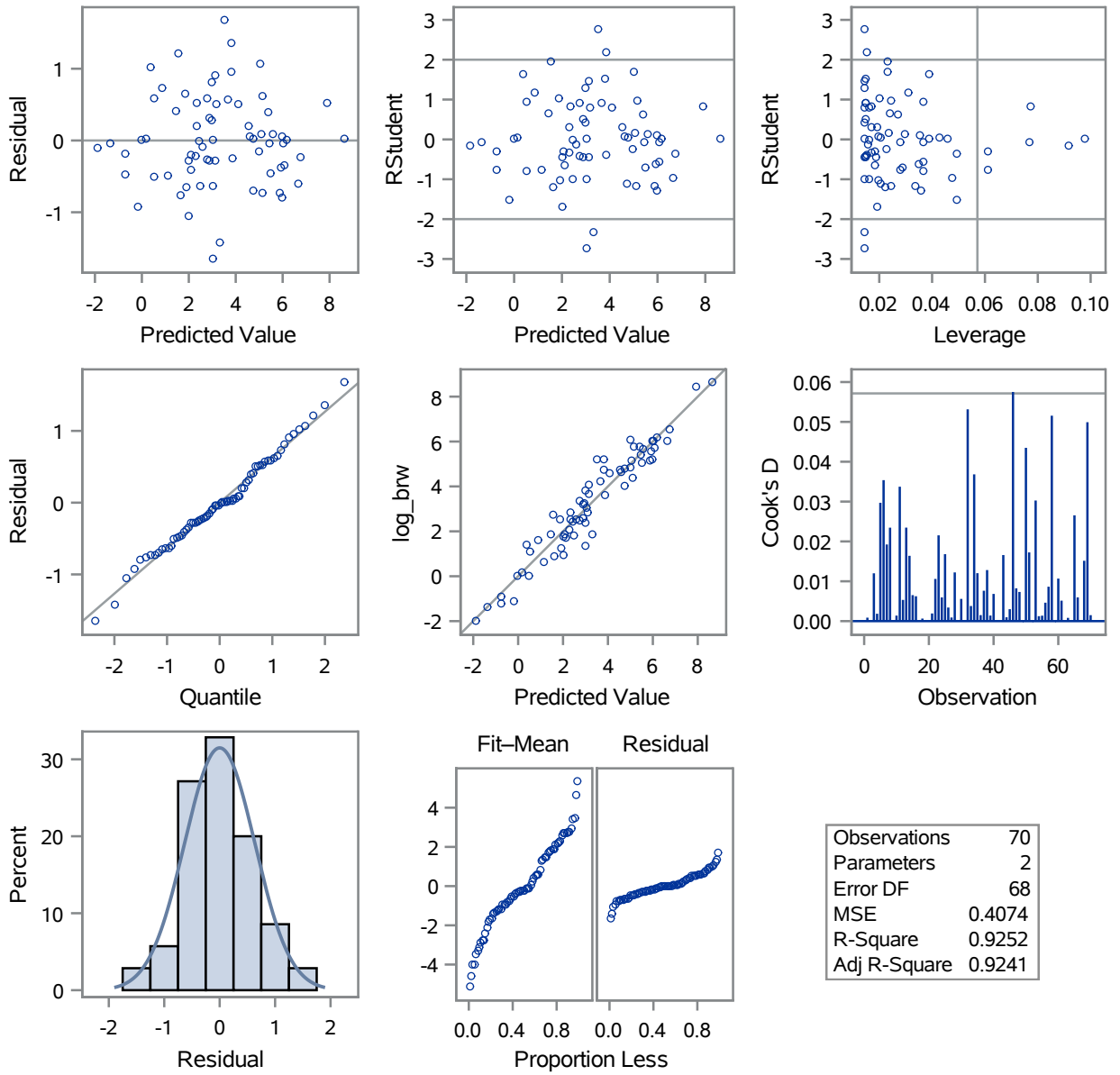
Root MSE	0.63830	R-Square	0.9252
Dependent Mean	3.27817	Adj R-Sq	0.9241
Coeff Var	19.47124		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t
Intercept	1	2.07938	0.08678	23.96	<.0001
log_bow	1	0.74441	0.02568	28.99	<.0001

# Regression Model for Log Data with Fit Diagnostics

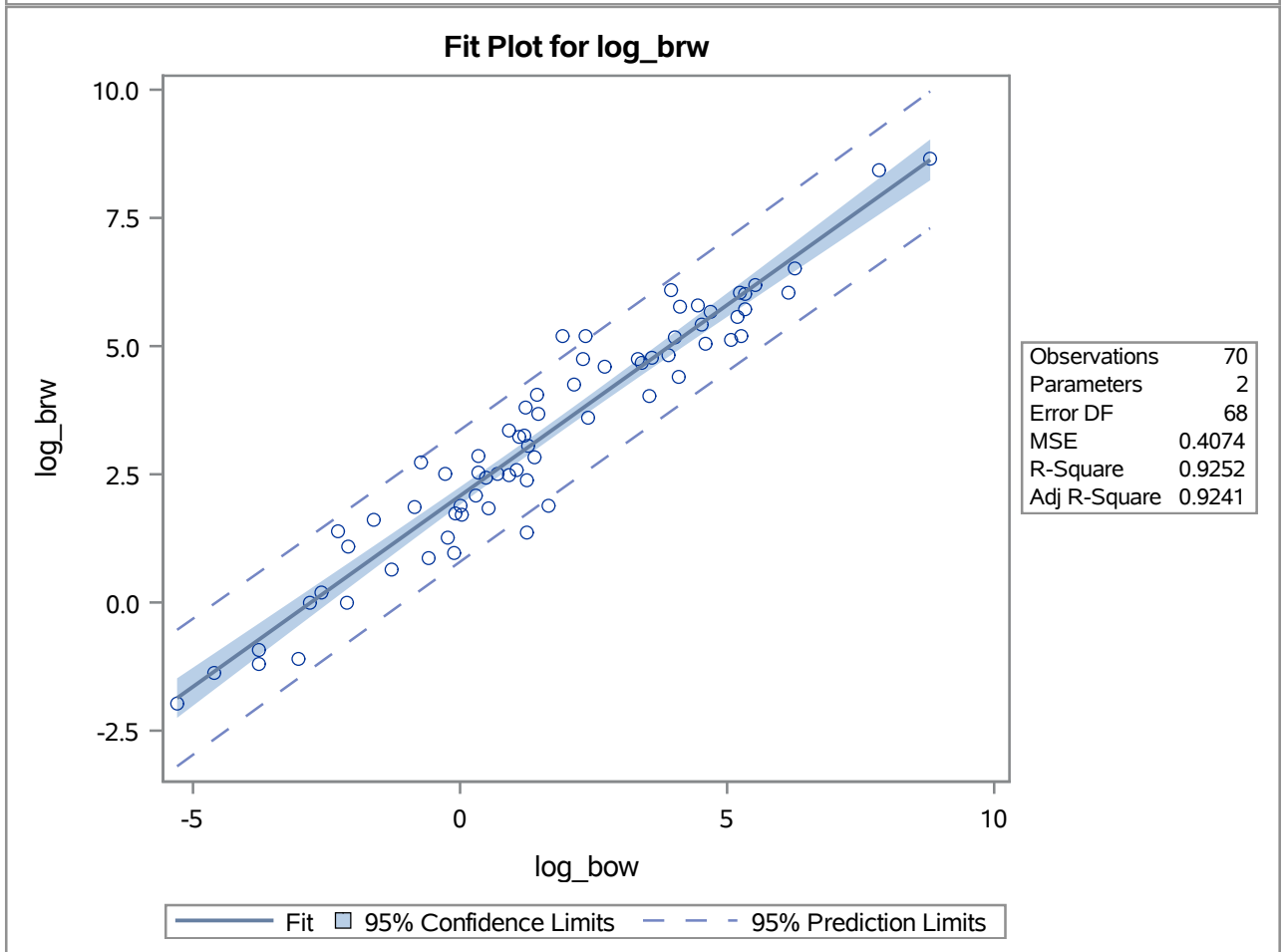
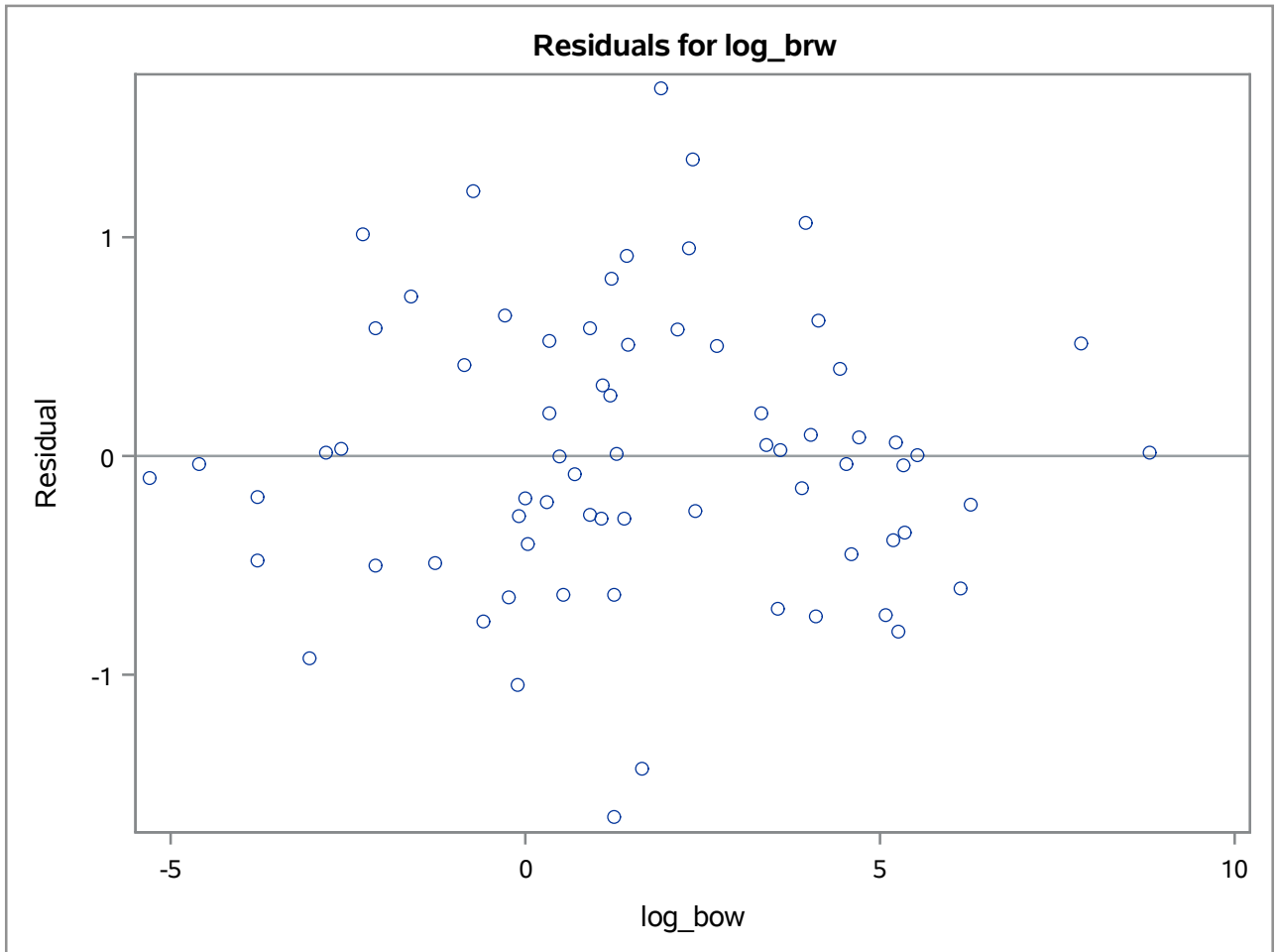
The REG Procedure  
Model: MODEL1  
Dependent Variable: log\_brw

## Fit Diagnostics for log\_brw



# Regression Model for Log Data with Fit Diagnostics

The REG Procedure  
Model: MODEL1  
Dependent Variable: log\_brw



## Check autocorrelation (Log Data)

### The AUTOREG Procedure

Dependent Variable	log_brw
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## Check autocorrelation (Log Data)

### The AUTOREG Procedure

Ordinary Least Squares Estimates			
<b>SSE</b>	27.705092	<b>DFE</b>	68
<b>MSE</b>	0.40743	<b>Root MSE</b>	0.63830
<b>SBC</b>	142.266854	<b>AIC</b>	137.769863
<b>MAE</b>	0.48539617	<b>AICC</b>	137.948968
<b>MAPE</b>	21.9915055	<b>HQC</b>	139.556123
		<b>Total R-Square</b>	0.9252

Durbin-Watson Statistics			
Order	DW	Pr < DW	Pr > DW
1	1.9310	0.3933	0.6067
2	2.1742	0.8036	0.1964
3	2.0444	0.6680	0.3320
4	1.9151	0.5018	0.4982

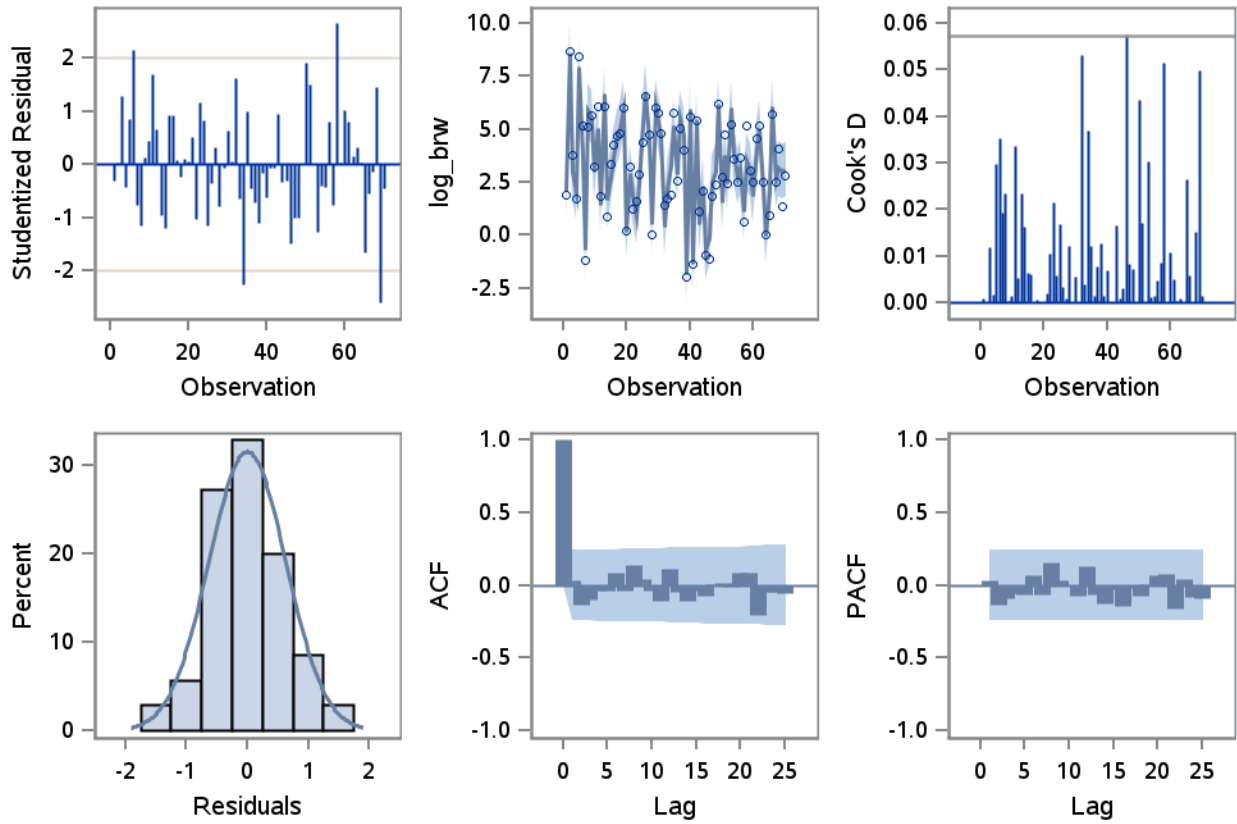
**NOTE:** Pr<DW is the p-value for testing positive autocorrelation, and Pr>DW is the p-value for testing negative autocorrelation.

Parameter Estimates					
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t
<b>Intercept</b>	1	2.0794	0.0868	23.96	<.0001
<b>log_bow</b>	1	0.7444	0.0257	28.99	<.0001

# Check autocorrelation (Log Data)

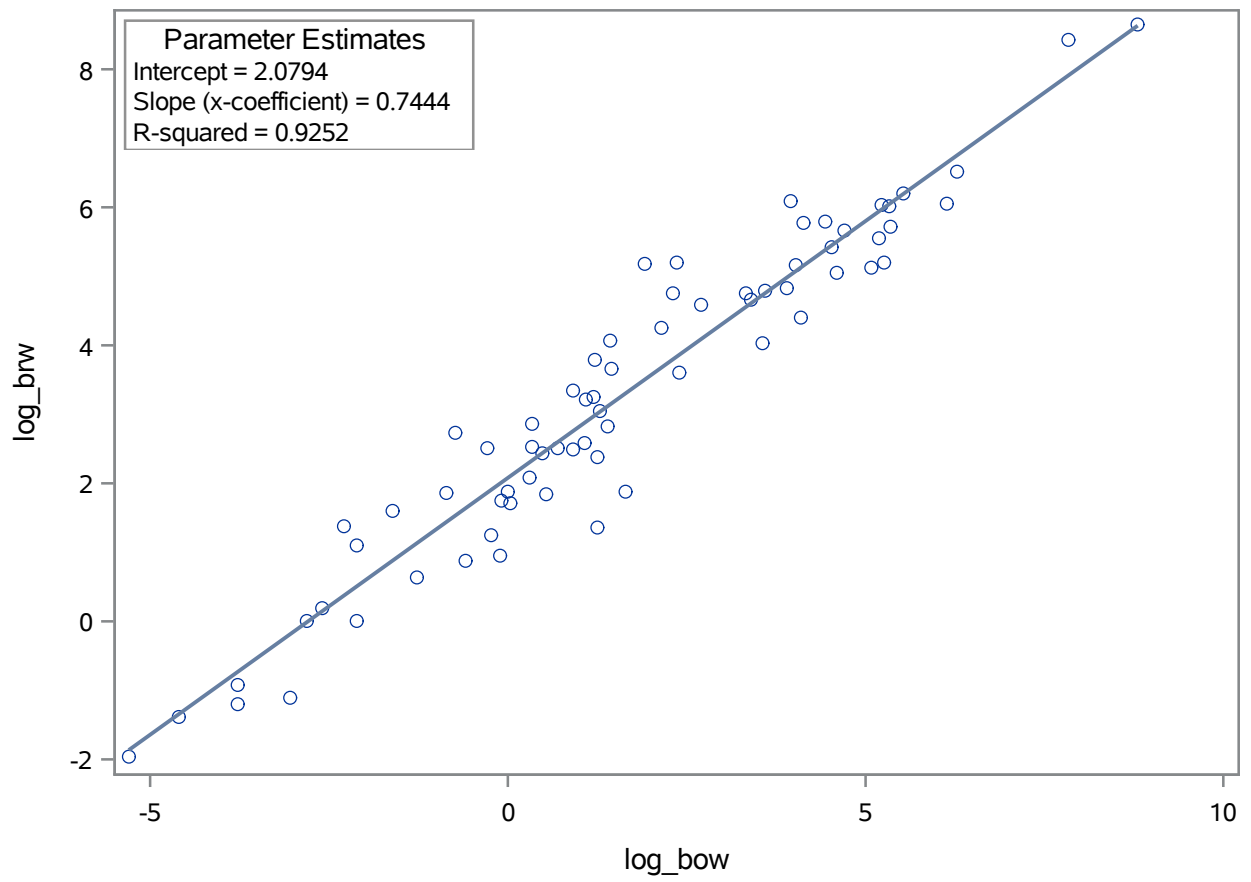
## The AUTOREG Procedure

### Fit Diagnostics for log\_brw



**Observations 70 MSE 0.407428 Model DF 2**

Regression Line with Slope and Intercept





# Regression Line with Slope and Intercept

