Multiple Regression Model to predict Sales

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales

Number of Observations Read	25
Number of Observations Used	25

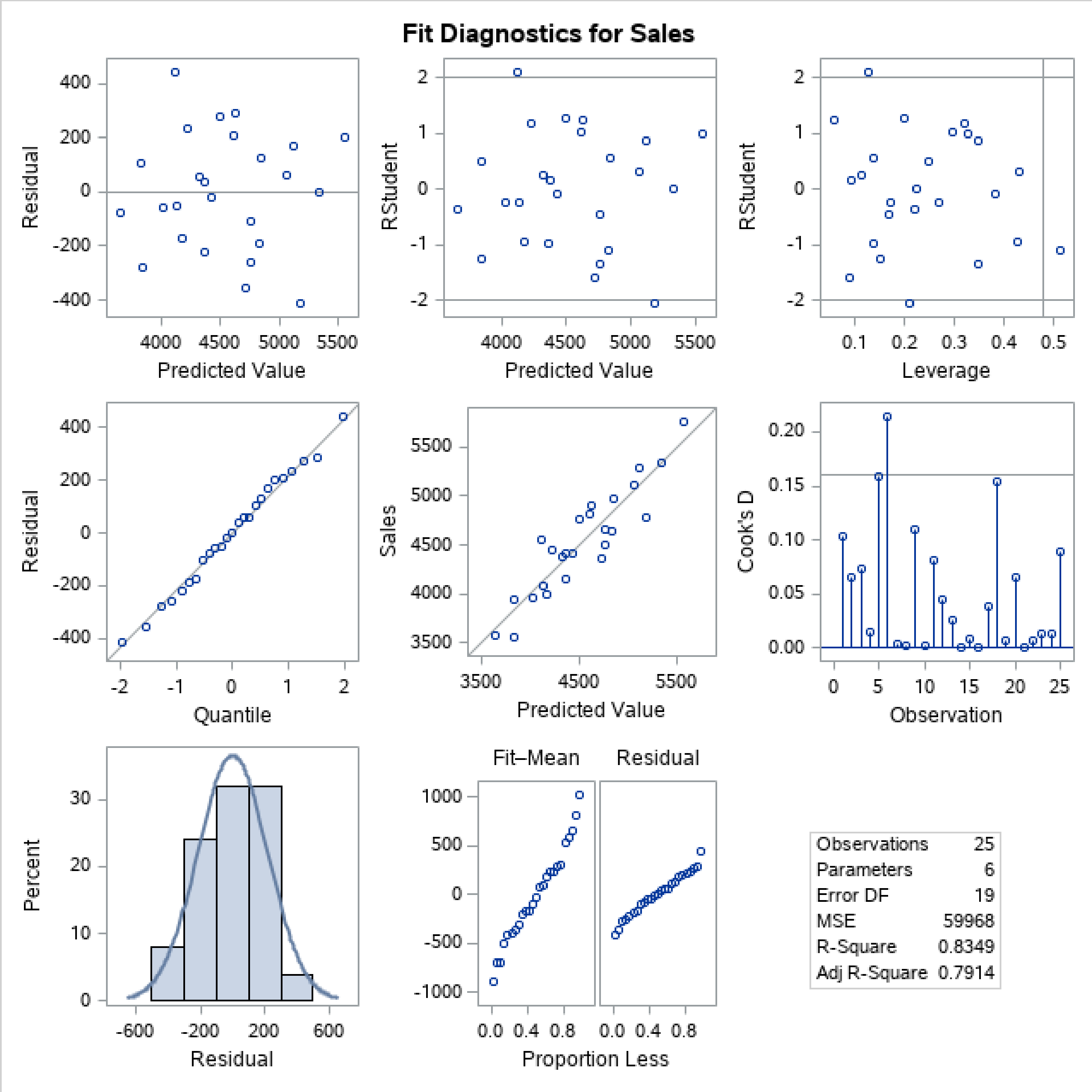
Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	5	5761406	1152281	19.21	<.0001
Error	19	1139390	59968		
Corrected Total	24	6900796			

Root MSE	244.88345	**R-Square**	0.8349
Dependent Mean	4535.48000	**Adj R-Sq**	0.7914
Coeff Var	5.39928		

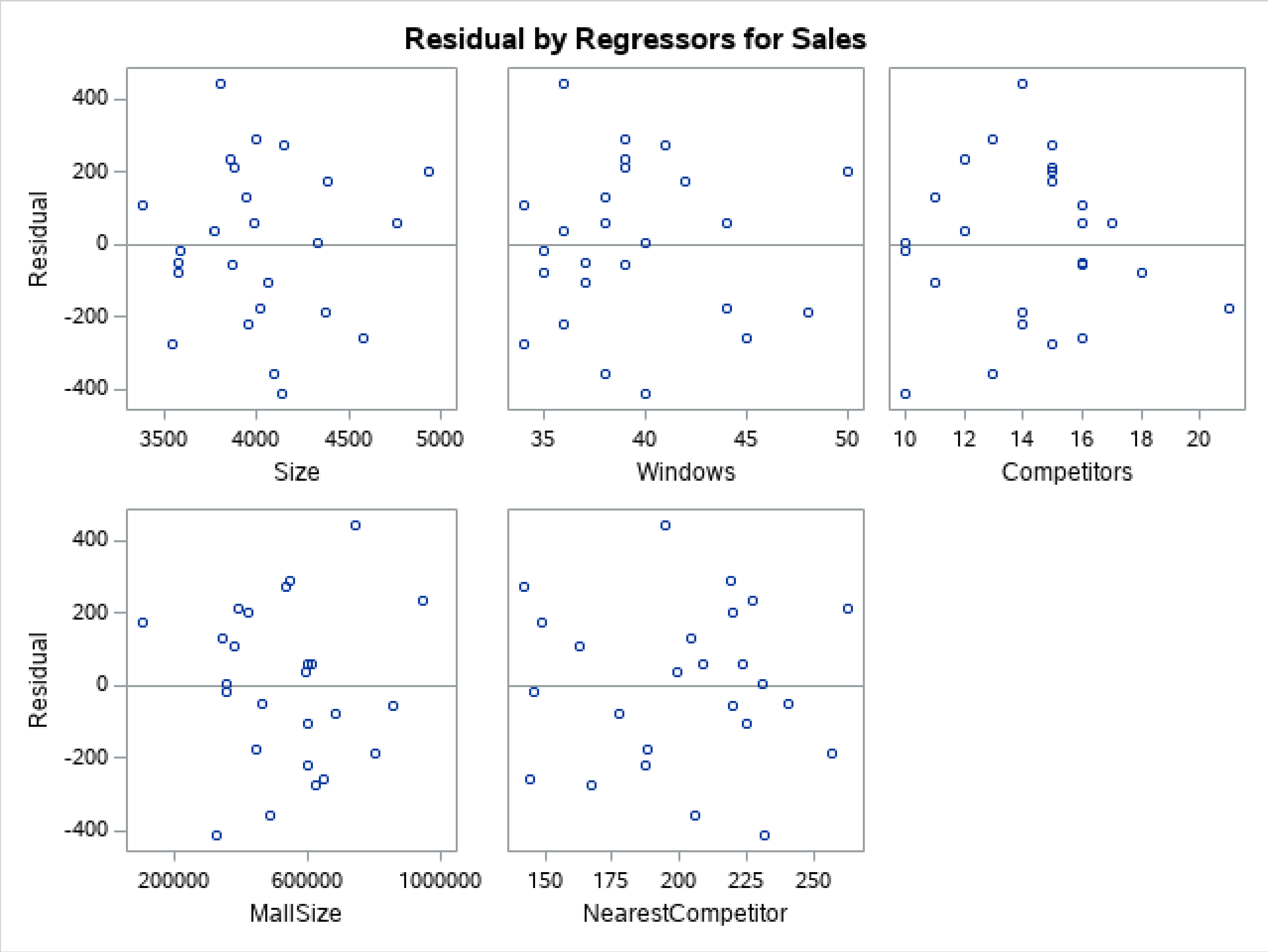
Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	1506.80179	672.18680	2.24	0.0371
Size	Size	1	0.91937	0.30063	3.06	0.0065
Windows	Windows	1	9.07598	28.82343	0.31	0.7563
Competitors	Competitors	1	-67.68553	21.95288	-3.08	0.0061
MallSize	MallSize	1	-0.00090285	0.00028062	-3.22	0.0045
NearestCompetitor	NearestCompetitor	1	2.09589	1.59443	1.31	0.2043

Multiple Regression Model to predict Sales

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales



Observations	25
Parameters	6
Error DF	19
MSE	59968
R-Square	0.8349
Adj R-Square	0.7914



Predicted value of Sales

Obs	Sales	Size	Windows	Competitors	MallSize	NearestCompetitor	SalesPredicted
1	4453	3860	39	12	943700	227	4221.05
2	4770	4150	41	15	532500	142	4495.87
3	4821	3880	39	15	390500	263	4611.29
4	4912	4000	39	13	545500	219	4624.83
5	4774	4140	40	10	329600	232	5187.84
6	4638	4370	48	14	802600	257	4826.51

Obs	Sales	Size	Windows	Competitors	MallSize	NearestCompetitor	SalesPredicted
7	4076	3570	37	16	463300	241	4128.61
8	3967	3870	39	16	855200	220	4024.74
9	4000	4020	44	21	443000	188	4174.68
10	4379	3990	38	16	613400	209	4321.24
11	5761	4930	50	15	420300	220	5559.44
12	3561	3540	34	15	626700	167	3838.87
13	4145	3950	36	14	601500	187	4366.32
14	4406	3770	36	12	593000	199	4369.03
15	4972	3940	38	11	347100	204	4843.65
16	4414	3590	35	10	355900	146	4432.82
17	4363	4090	38	13	490100	206	4721.27
18	4499	4580	45	16	649200	144	4758.64
19	3573	3580	35	18	685900	178	3651.27
20	5287	4380	42	15	106200	149	5115.96
21	5339	4330	40	10	354900	231	5337.59
22	4656	4060	37	11	598700	225	4761.75
23	3943	3380	34	16	381800	163	3836.81
24	5121	4760	44	17	597900	224	5061.36
25	4557	3800	36	14	745300	195	4115.35

Dropping Windows factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales

Number of Observations Read	25
Number of Observations Used	25

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5755460	1438865	25.13	<.0001
Error	20	1145336	57267		
Corrected Total	24	6900796			

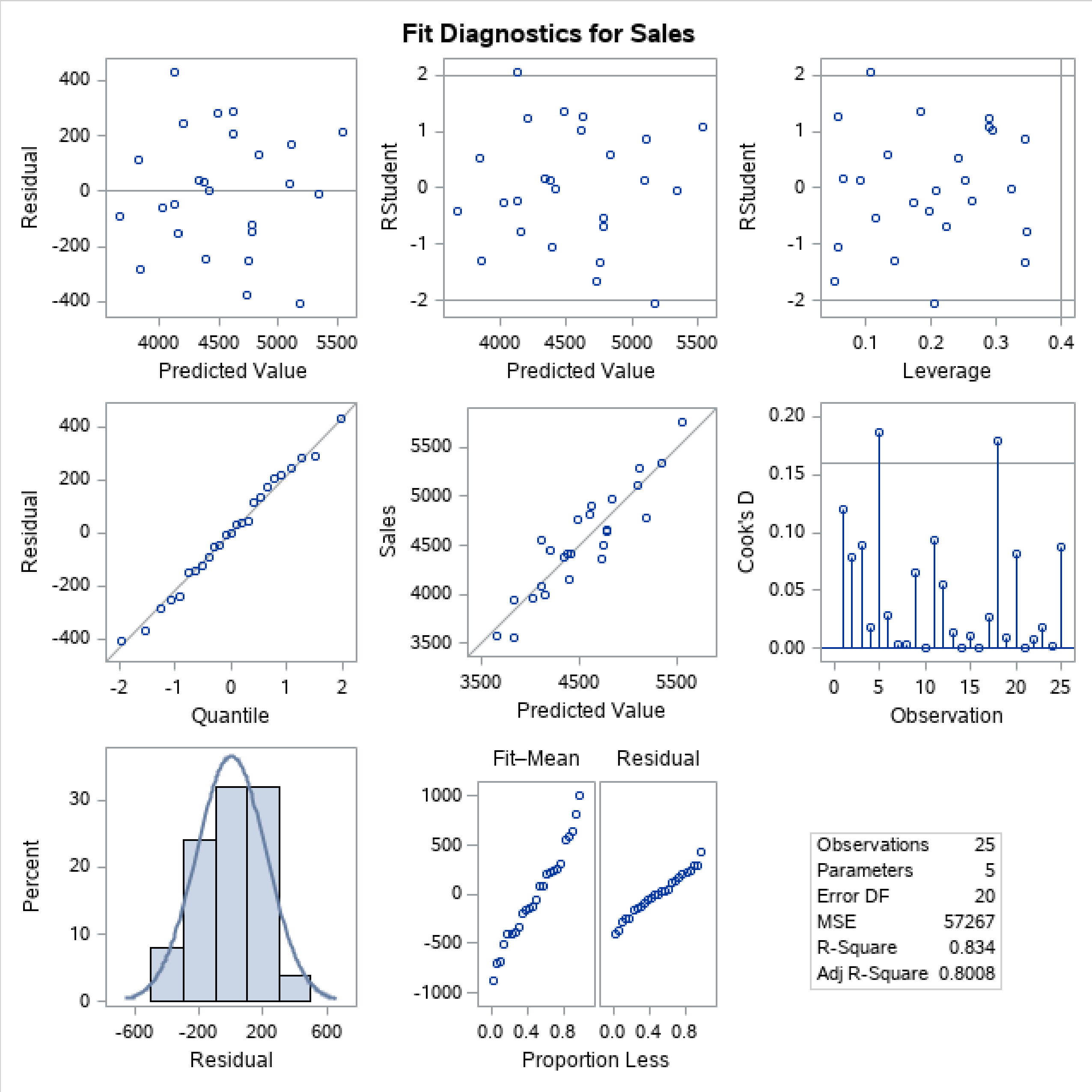
Root MSE	239.30483	R-Square	0.8340

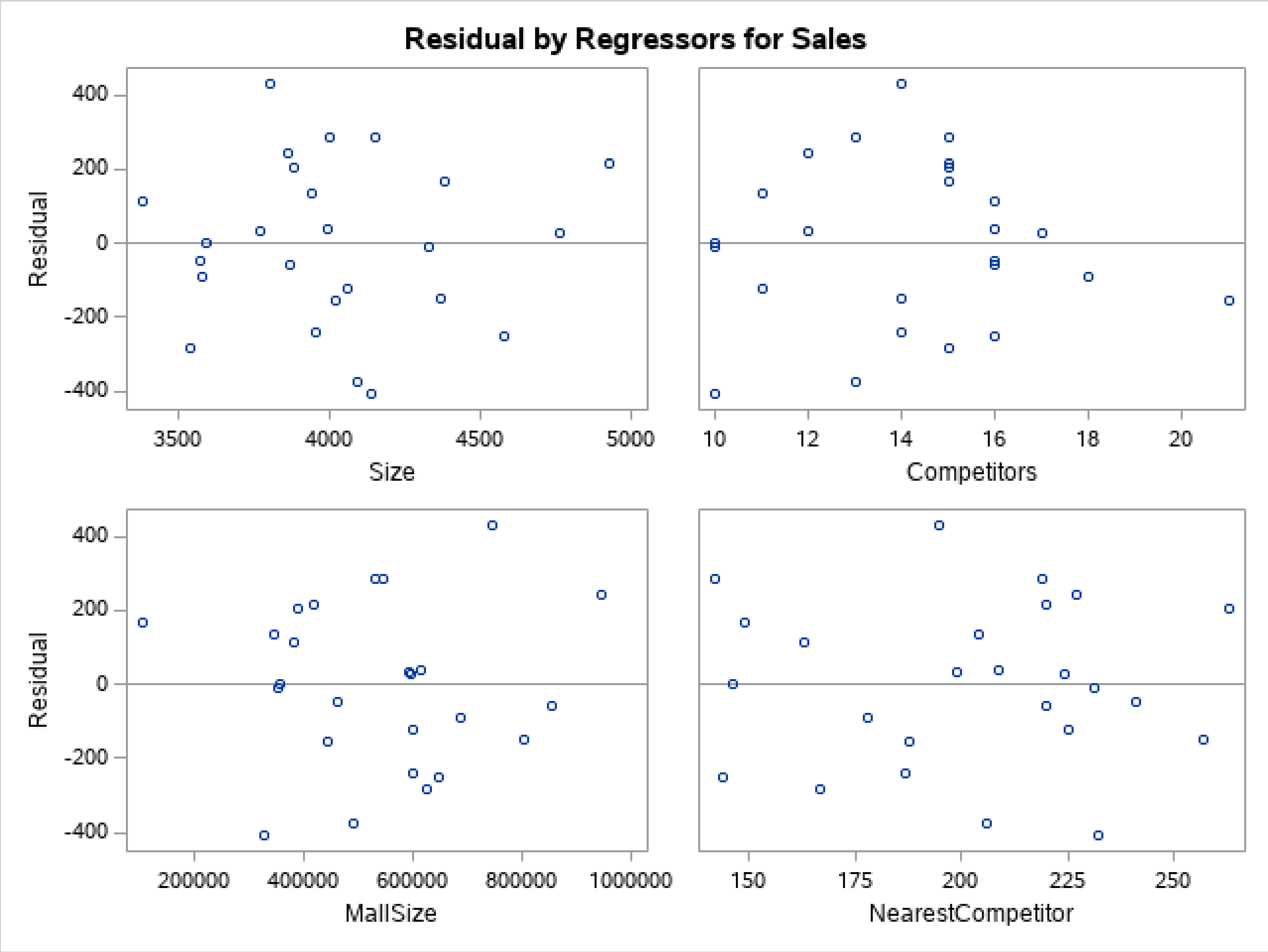
Dependent Mean	4535.48000	**Adj R-Sq**	0.8008
Coeff Var	5.27628		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	1448.60702	631.55793	2.29	0.0328
Size	Size	1	1.00396	0.13189	7.61	<.0001
Competitors	Competitors	1	-64.41386	18.89786	-3.41	0.0028
MallSize	MallSize	1	-0.00090157	0.00027419	-3.29	0.0037
NearestCompetitor	NearestCompetitor	1	2.23558	1.49658	1.49	0.1508

Dropping Windows factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales


Fit Diagnostics for Sales
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Sales
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 25
Parameters 5
Error DF 20
MSE 57267
R-Square 0.834
Adj R-Square 0.8008



Dropping NearestCompetitor factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales

Number of Observations Read	25
Number of Observations Used	25

Analysis of Variance

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5657786	1414446	22.76	<.0001
Error	20	1243011	62151		
Corrected Total	24	6900796			

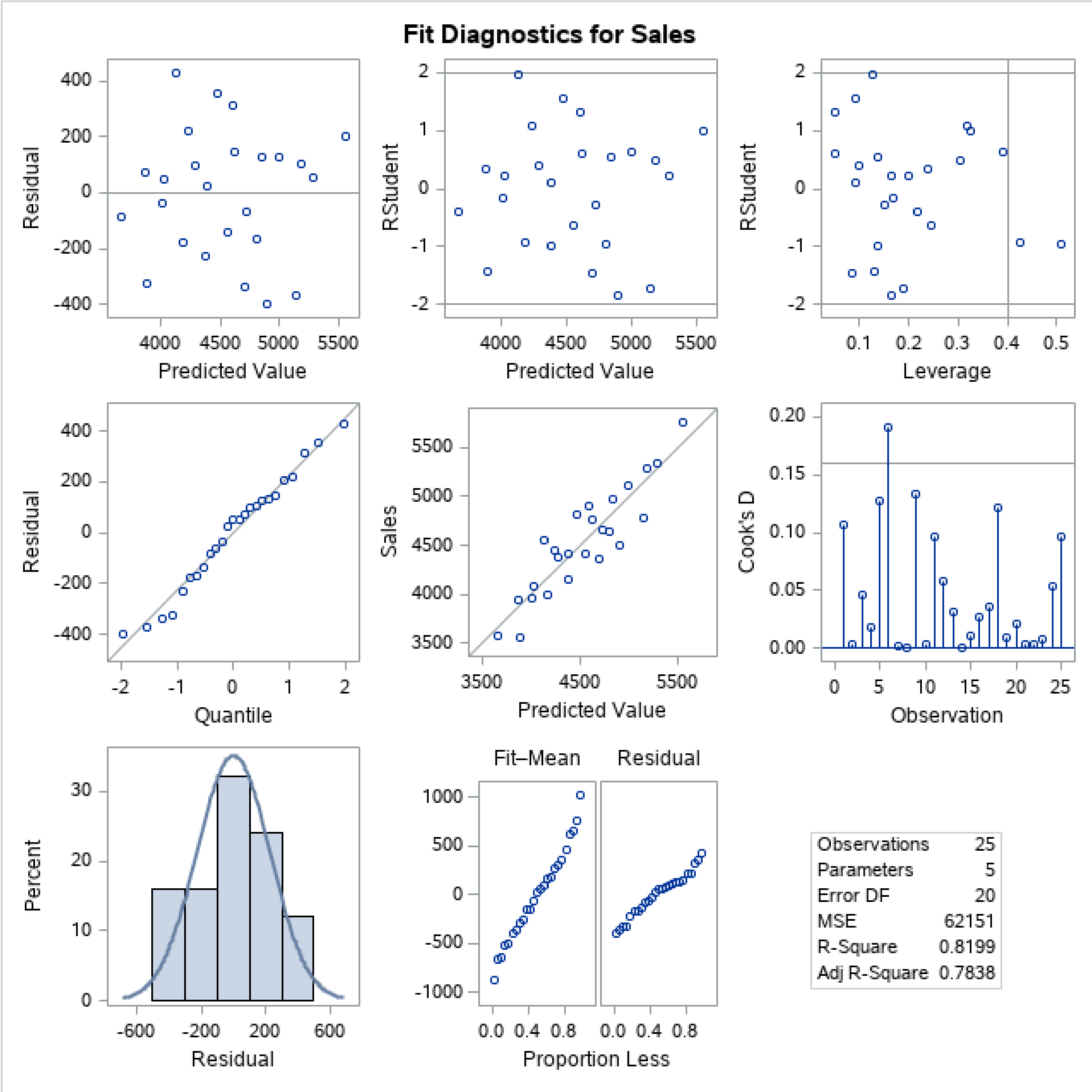
Root MSE	249.30008	**R-Square**	0.8199
Dependent Mean	4535.48000	**Adj R-Sq**	0.7838
Coeff Var	5.49666		

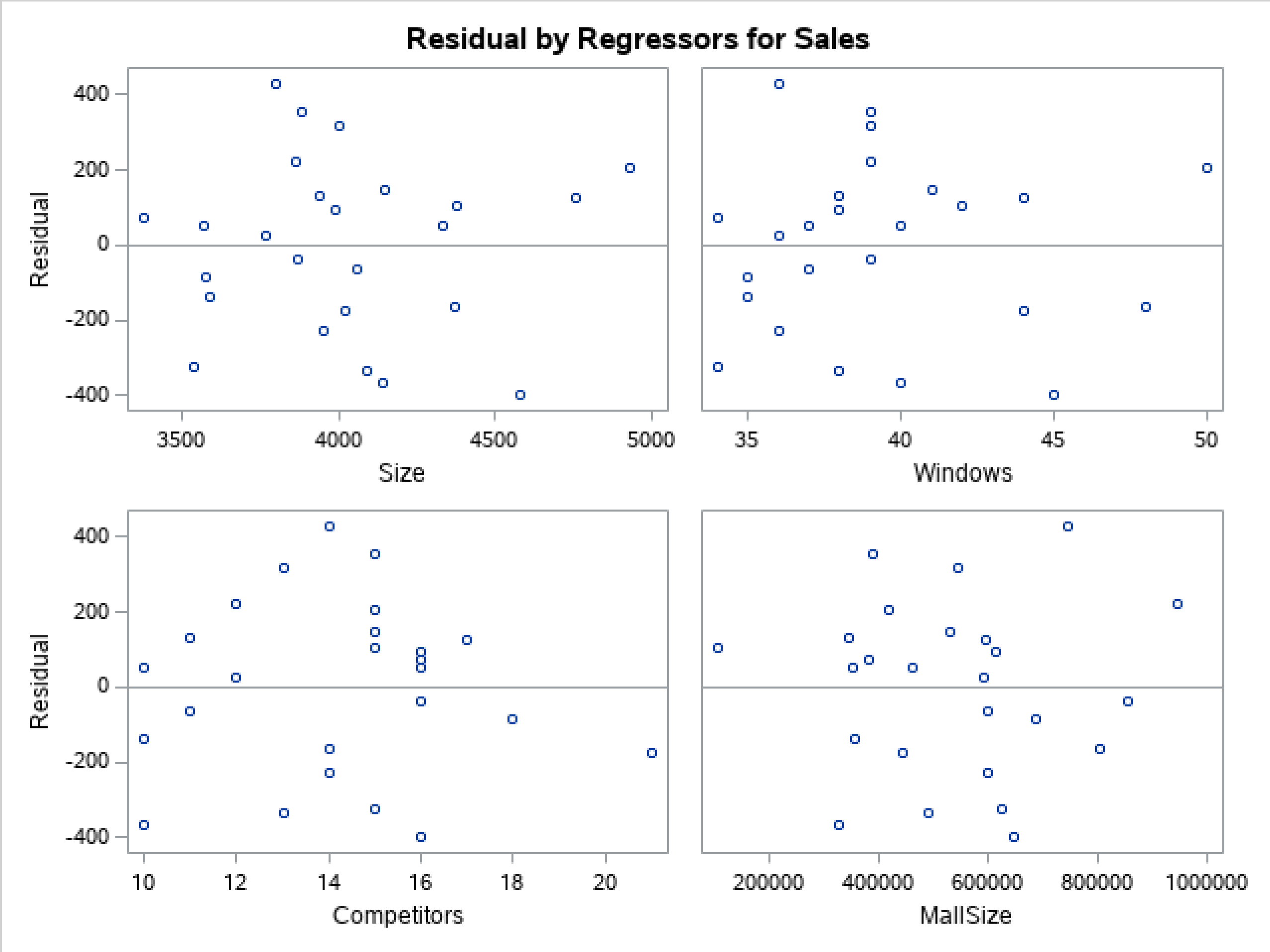
Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1852.04016	629.91401	2.94	0.0081
Size	Size	1	0.85647	0.30215	2.83	0.0102
Windows	Windows	1	19.61793	28.18460	0.70	0.4944
Competitors	Competitors	1	-77.20871	21.09677	-3.66	0.0016
MallSize	MallSize	1	-0.00080972	0.00027642	-2.93	0.0083

Dropping NearestCompetitor factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales


Fit Diagnostics for Sales
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Sales
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 25
Parameters 5
Error DF 20
MSE 62151
R-Square 0.8199
Adj R-Square 0.7838



Dropping NearestCompetitor and Windows factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales

Number of Observations Read	25
Number of Observations Used	25

Analysis of Variance

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	5627674	1875891	30.94	<.0001
Error	21	1273122	60625		
Corrected Total	24	6900796			

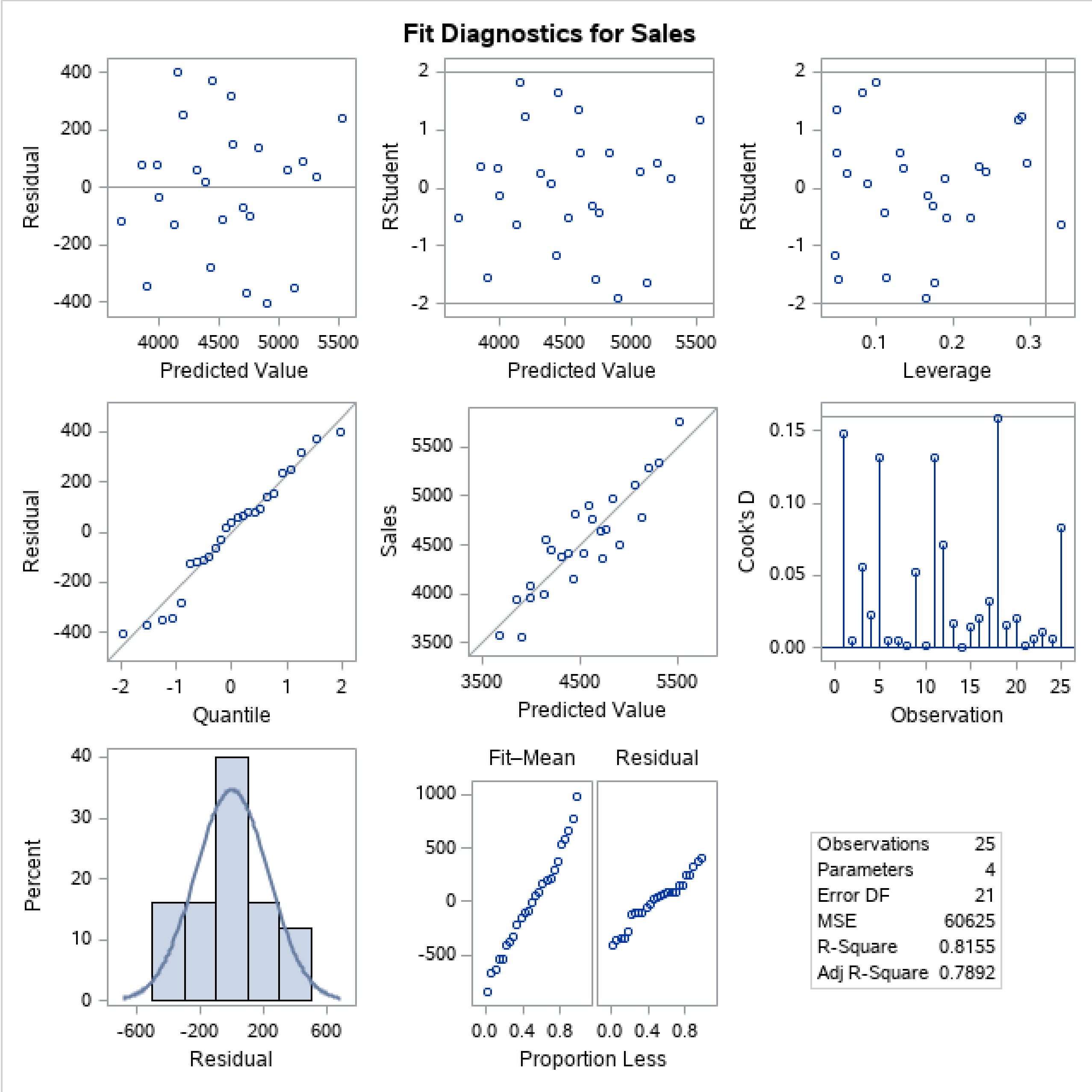
Root MSE	246.22113	R-Square	0.8155
Dependent Mean	4535.48000	Adj R-Sq	0.7892
Coeff Var	5.42878		

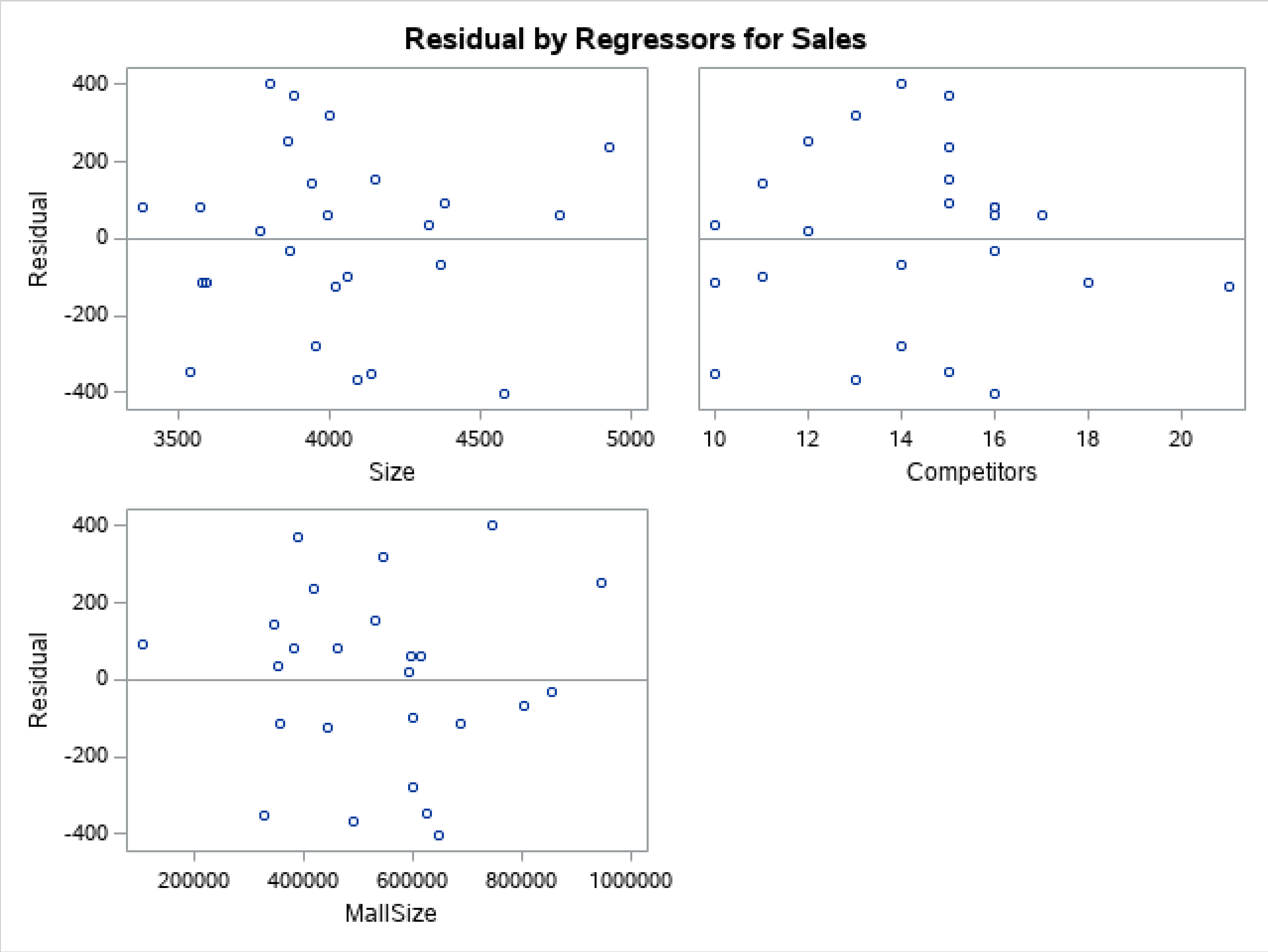
Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1769.60574	611.03962	2.90	0.0086
Size	Size	1	1.04482	0.13276	7.87	<.0001
Competitors	Competitors	1	-71.03060	18.90237	-3.76	0.0012
MallSize	MallSize	1	-0.00079216	0.00027187	-2.91	0.0083

Dropping NearestCompetitor and Windows factor

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales


Fit Diagnostics for Sales
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Sales
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 25
Parameters 4
Error DF 21
MSE 60625
R-Square 0.8155
Adj R-Square 0.7892



Stepwise Regression Model

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales

Number of Observations Read	25
Number of Observations Used	25

Stepwise Selection: Step 1

Variable Size Entered: R-Square = 0.5814 and C(p) = 27.1707

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	4012100	4012100	31.94	<.0001
Error	23	2888696	125595		
Corrected Total	24	6900796			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	222.40809	766.39576	10577	0.08	0.7743
Size	1.07258	0.18977	4012100	31.94	<.0001

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Variable Competitors Entered: R-Square = 0.7409 and C(p) = 10.8132

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	5112961	2556481	31.46	<.0001
Error	22	1787835	81265		
Corrected Total	24	6900796			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	1287.75994	681.05078	290546	3.58	0.0719
Size	1.08865	0.15271	4129796	50.82	<.0001
Competitors	-79.57360	21.61997	1100861	13.55	0.0013

Bounds on condition number: 1.0008, 4.0033

Stepwise Selection: Step 3

Variable MallSize Entered: R-Square = 0.8155 and C(p) = 4.2301

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	5627674	1875891	30.94	<.0001

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Error	21	1273122	60625		
Corrected Total	24	6900796			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	1769.60574	611.03962	508470	8.39	0.0086
Size	1.04482	0.13276	3755185	61.94	<.0001
Competitors	-71.03060	18.90237	856069	14.12	0.0012
MallSize	-0.00079216	0.00027187	514713	8.49	0.0083

Bounds on condition number: 1.0367, 9.2279

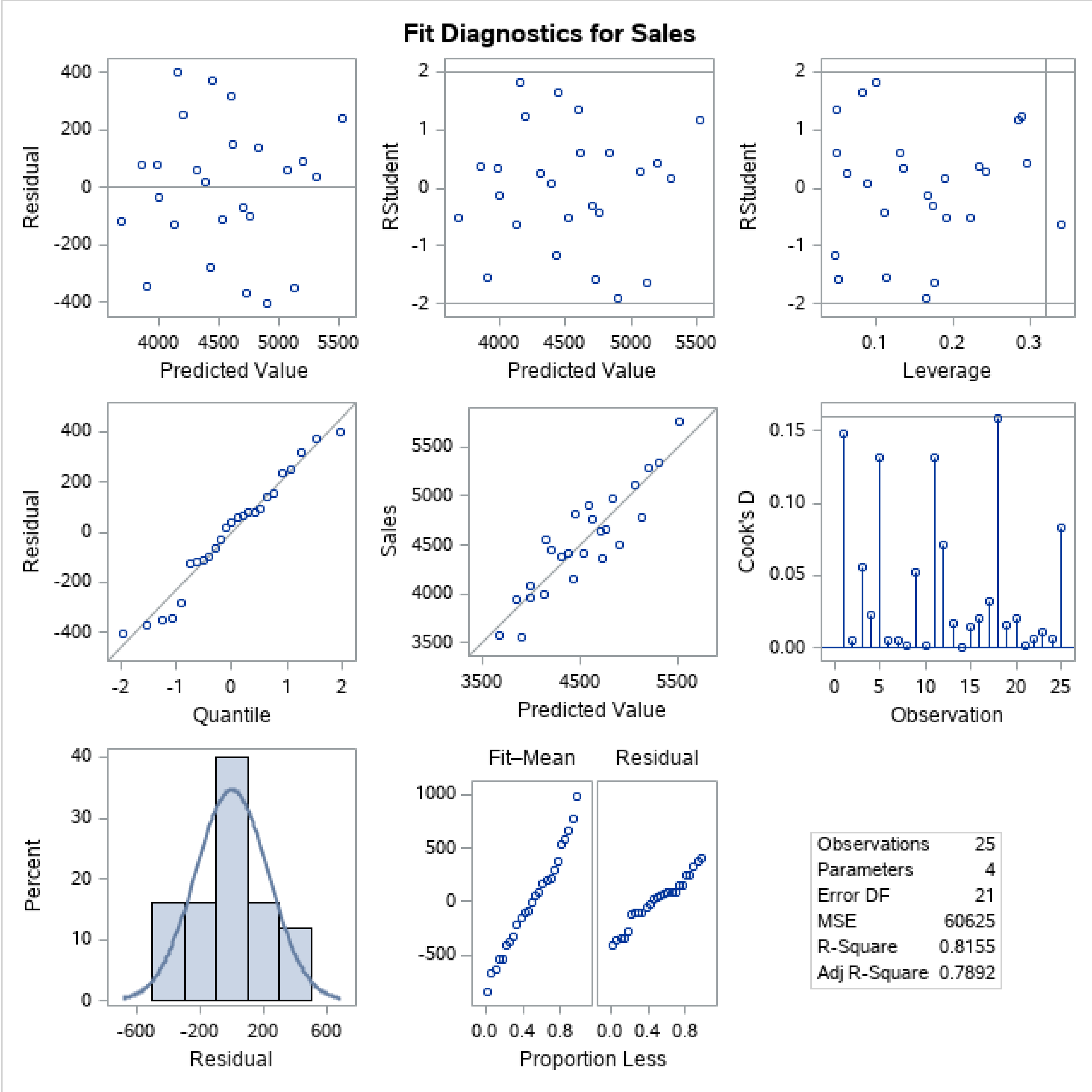
All variables left in the model are significant at the 0.0500 level.

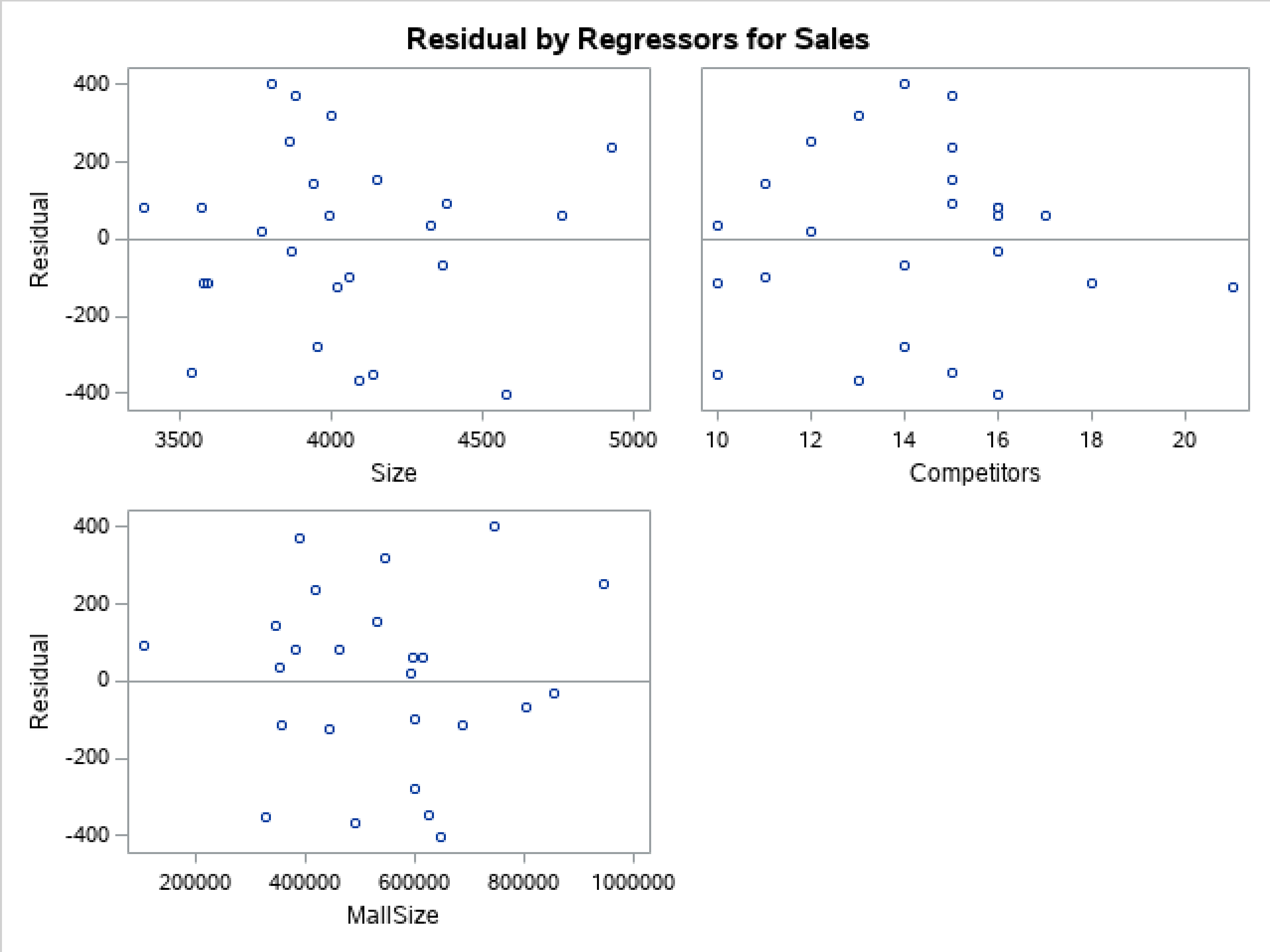
No other variable met the 0.0500 significance level for entry into the model.

Summary of Stepwise Selection									
Step	**Variable Entered**	**Variable Removed**	**Label**	**Number Vars In**	**Partial R-Square**	**Model R-Square**	**C(p)**	**F Value**	**Pr > F**
1	Size		Size	1	0.5814	0.5814	27.1707	31.94	<.0001
2	Competitors		Competitors	2	0.1595	0.7409	10.8132	13.55	0.0013
3	MallSize		MallSize	3	0.0746	0.8155	4.2301	8.49	0.0083

Stepwise Regression Model

The REG Procedure
Model: MODEL1
Dependent Variable: Sales Sales


Fit Diagnostics for Sales
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Sales
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 25
Parameters 4
Error DF 21
MSE 60625
R-Square 0.8155
Adj R-Square 0.7892



Importing the NFL dataset to check the variables of the data

Obs	Team	Revenue	Value
1	Arizona Cardinals	203	914
2	Atlanta Falcons	203	872
3	Baltimore Ravens	226	1062
4	Buffalo Bills	206	885
5	Carolina Panthers	221	1040
6	Chicago Bears	226	1064

Obs	Team	Revenue	Value
7	Cincinnati Bengals	205	941
8	Cleveland Browns	220	1035
9	Dallas Cowboys	269	1612
10	Denver Broncos	226	1061

Scatter Plot between Revenue and Values

The REG Procedure
Model: MODEL1
Dependent Variable: Value Value

Number of Observations Read	32
Number of Observations Used	32

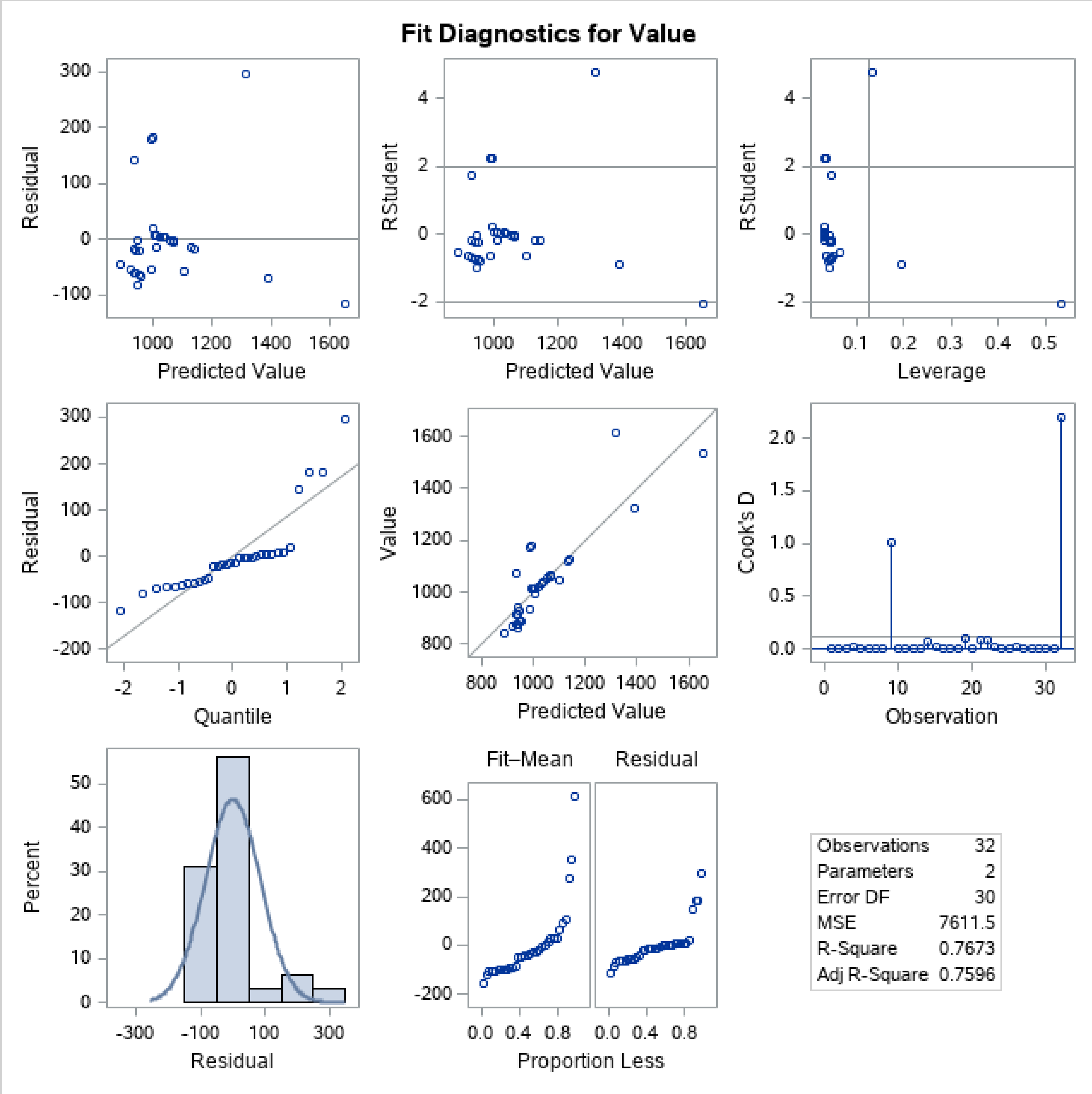
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	753008	753008	98.93	<.0001
Error	30	228346	7611.53579		
Corrected Total	31	981354			

Root MSE	87.24412	R-Square	0.7673
Dependent Mean	1040.00000	Adj R-Sq	0.7596
Coeff Var	8.38886		

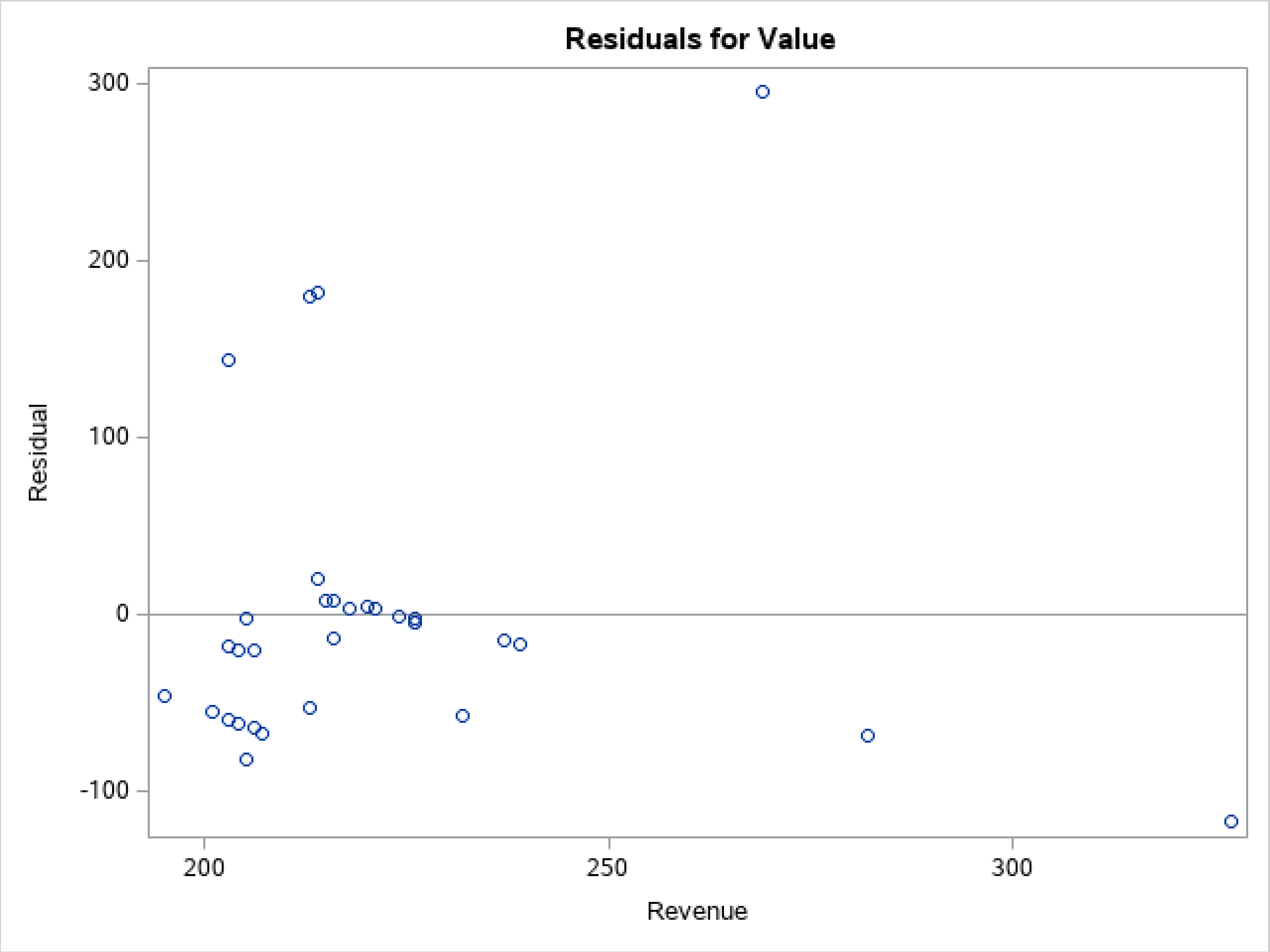
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-252.07830	130.81712	-1.93	0.0635
Revenue	Revenue	1	5.83167	0.58631	9.95	<.0001

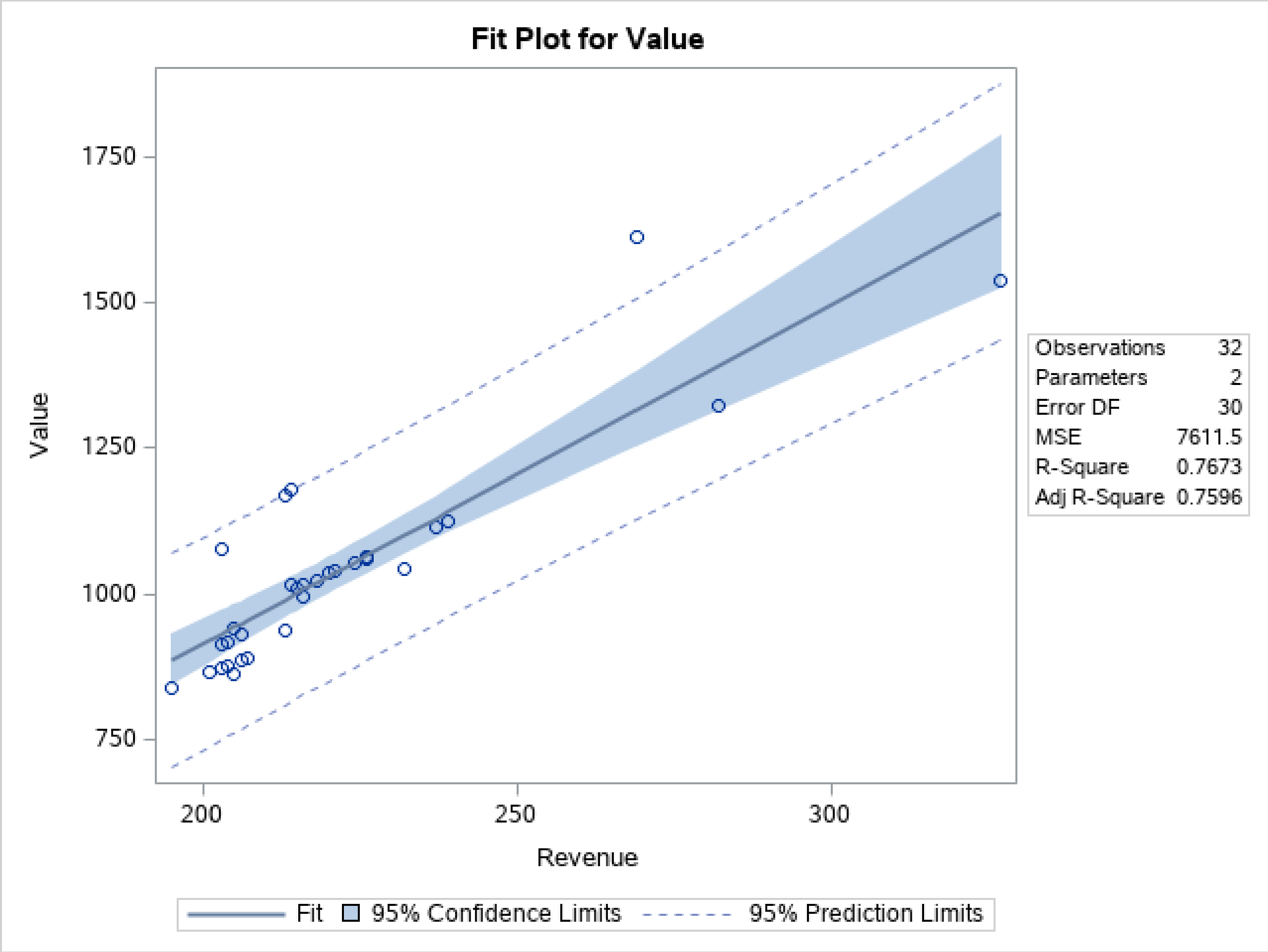
Scatter Plot between Revenue and Values

The REG Procedure
Model: MODEL1
Dependent Variable: Value Value



Fit Diagnostics for Value
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Value
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 32
Parameters 2
Error DF 30
MSE 7611.5
R-Square 0.7673
Adj R-Square 0.7596


Residuals for Value
300
200
100
0
-100
Residual
200
250
300
Revenue



Predicted Value

Obs	Team	Revenue	Value	ValuePredicted
1	Arizona Cardinals	203	914	931.75
2	Atlanta Falcons	203	872	931.75
3	Baltimore Ravens	226	1062	1065.88
4	Buffalo Bills	206	885	949.25
5	Carolina Panthers	221	1040	1036.72
6	Chicago Bears	226	1064	1065.88

Obs	Team	Revenue	Value	ValuePredicted
7	Cincinnati Bengals	205	941	943.41
8	Cleveland Browns	220	1035	1030.89
9	Dallas Cowboys	269	1612	1316.64
10	Denver Broncos	226	1061	1065.88
11	Detroit Lions	204	917	937.58
12	Green Bay Packers	218	1023	1019.23
13	Houston Texans	239	1125	1141.69
14	Indianapolis Colts	203	1076	931.75
15	Jacksonville Jaguars	204	876	937.58
16	Kansas City Chiefs	214	1016	995.90
17	Miami Dolphins	232	1044	1100.87
18	Minnesota Vikings	195	839	885.10
19	New England Patriots	282	1324	1392.45
20	New Orleans Saints	213	937	990.07
21	New York Giants	214	1178	995.90
22	New York Jets	213	1170	990.07
23	Oakland Raiders	205	861	943.41
24	Philadelphia Eagles	237	1116	1130.03
25	Pittsburgh Steelers	216	1015	1007.56
26	San Diego Chargers	207	888	955.08
27	San Francisco 49ers	201	865	920.09
28	Seattle Seahawks	215	1010	1001.73
29	St Louis Rams	206	929	949.25
30	Tampa Bay Buccaneers	224	1053	1054.22
31	Tennessee Titans	216	994	1007.56
32	Washington Redskins	327	1538	1654.88

Plots for Studentized Residual and Cooks D

The REG Procedure
Model: MODEL1
Dependent Variable: Value Value

Number of Observations Read	32
Number of Observations Used	32

Analysis of Variance

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	753008	753008	98.93	<.0001
Error	30	228346	7611.53579		
Corrected Total	31	981354			

Root MSE	87.24412	R-Square	0.7673
Dependent Mean	1040.00000	Adj R-Sq	0.7596
Coeff Var	8.38886		

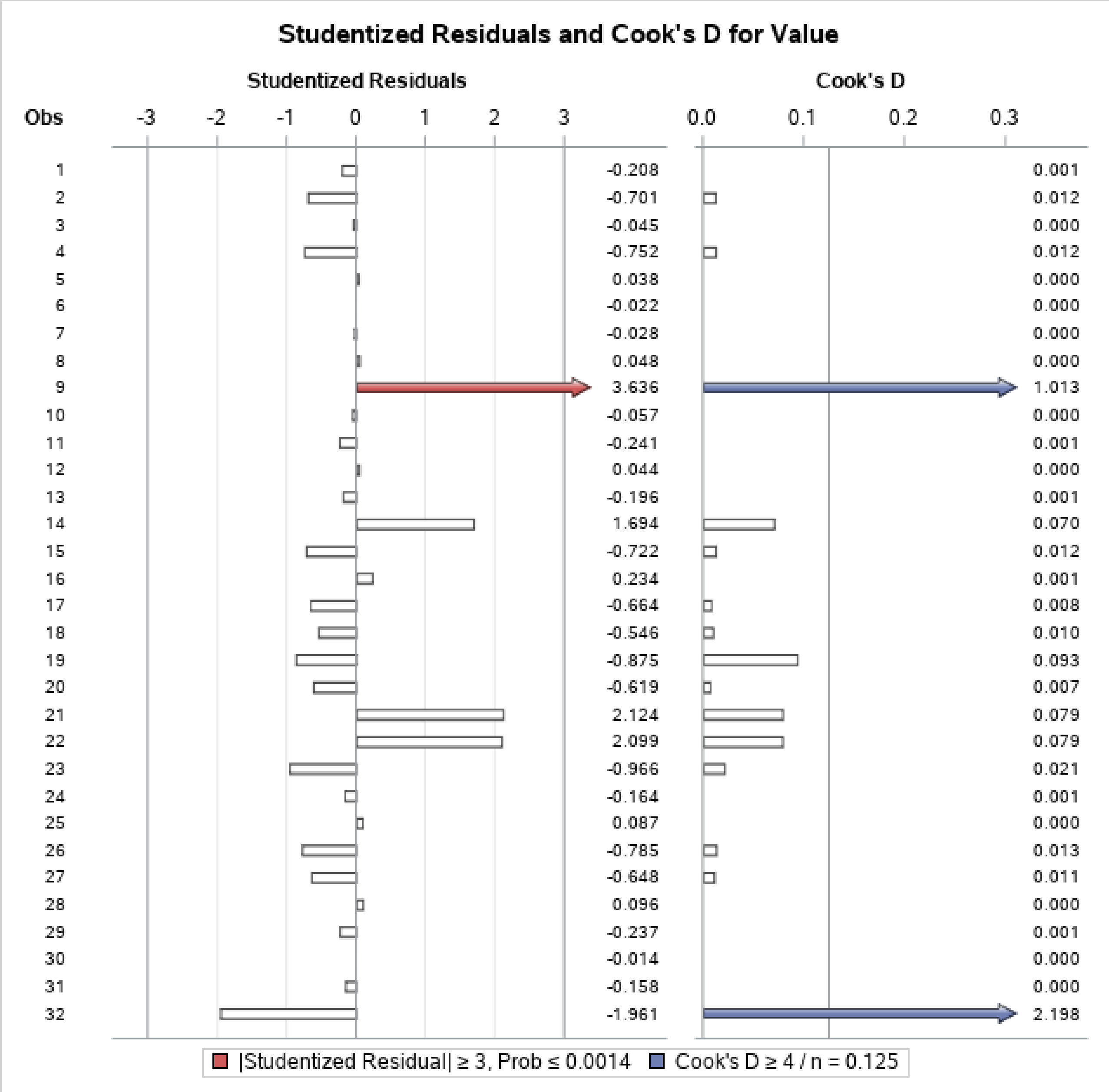
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-252.07830	130.81712	-1.93	0.0635
Revenue	Revenue	1	5.83167	0.58631	9.95	<.0001

Plots for Studentized Residual and Cooks D

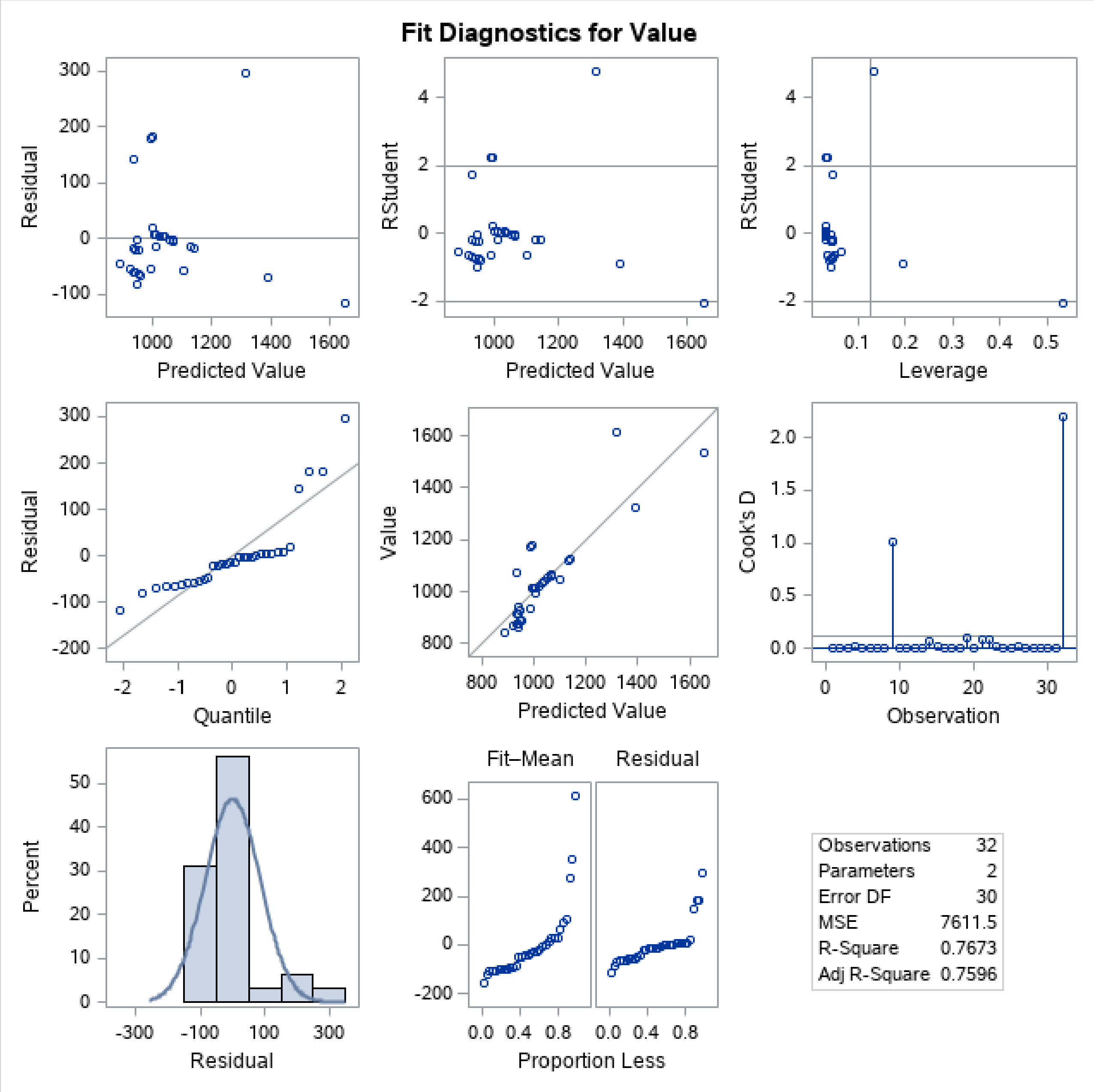
The REG Procedure
Model: MODEL1
Dependent Variable: Value Value

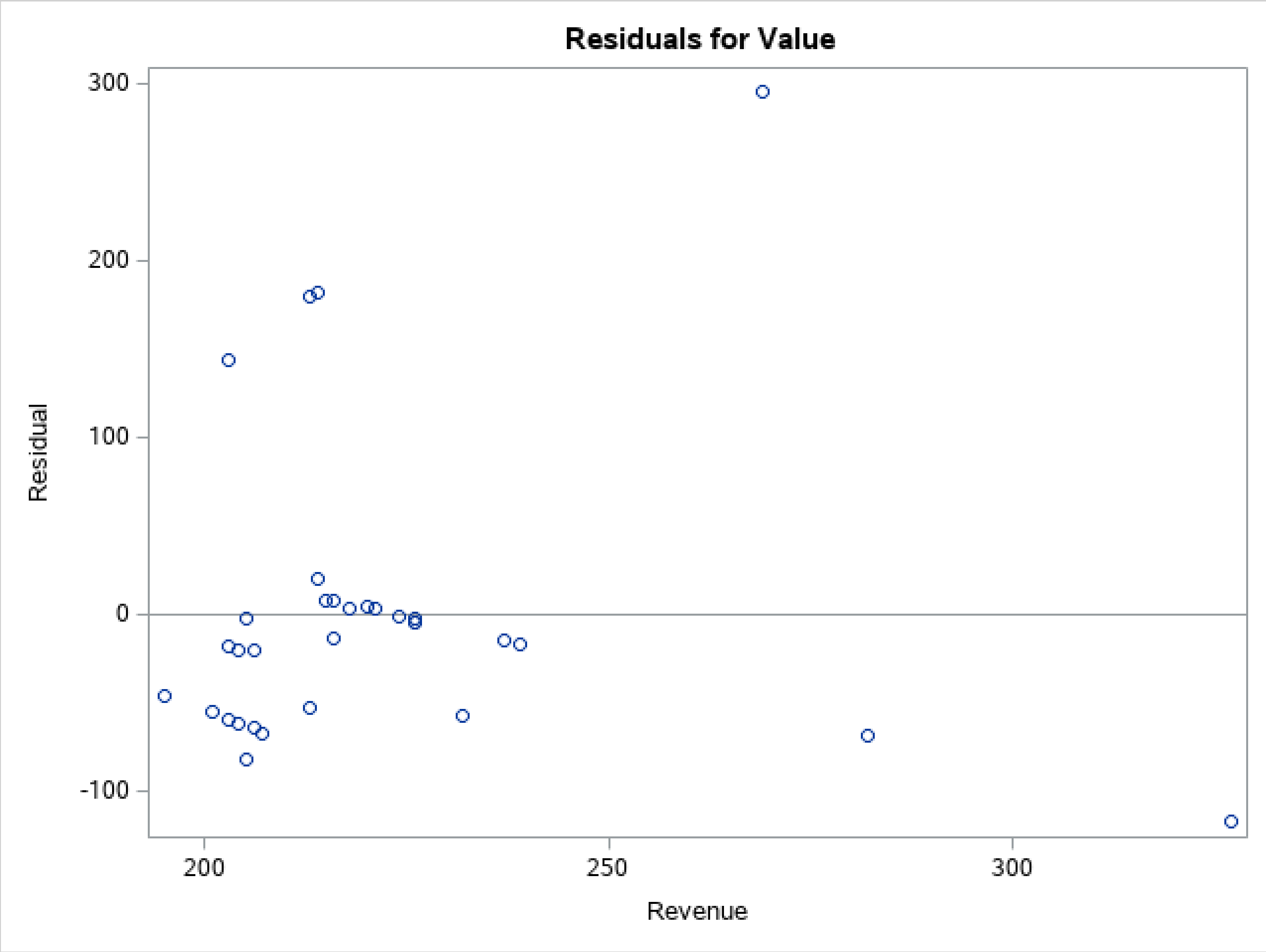
Output Statistics							
Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	Residual	Std Error Residual	Student Residual	Cook's D
1	914	931.7497	18.8762	-17.7497	85.178	-0.208	0.001
2	872	931.7497	18.8762	-59.7497	85.178	-0.701	0.012
3	1062	1066	15.6406	-3.8780	85.831	-0.045	0.000
4	885	949.2447	17.9197	-64.2447	85.384	-0.752	0.012
5	1040	1037	15.4263	3.2803	85.869	0.038	0.000
6	1064	1066	15.6406	-1.8780	85.831	-0.022	0.000
7	941	943.4130	18.2253	-2.4130	85.319	-0.028	0.000
8	1035	1031	15.4499	4.1120	85.865	0.048	0.000
9	1612	1317	31.8030	295.3604	81.241	3.636	1.013
10	1061	1066	15.6406	-4.8780	85.831	-0.057	0.000
11	917	937.5814	18.5443	-20.5814	85.250	-0.241	0.001

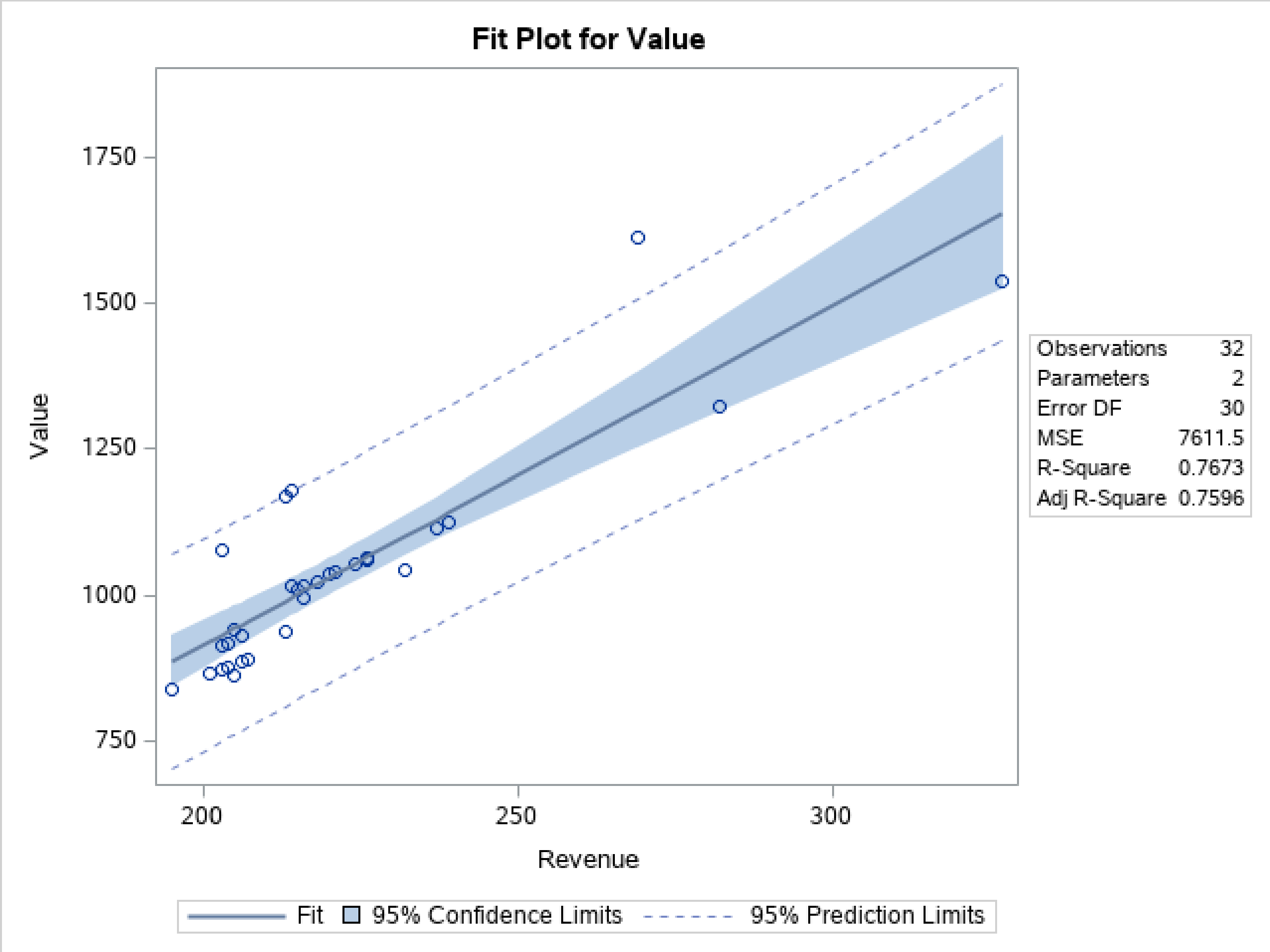
Output Statistics							
Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	Residual	Std Error Residual	Student Residual	Cook's D
12	1023	1019	15.5635	3.7753	85.845	0.044	0.000
13	1125	1142	18.5037	-16.6897	85.259	-0.196	0.001
14	1076	931.7497	18.8762	144.2503	85.178	1.694	0.070
15	876	937.5814	18.5443	-61.5814	85.250	-0.722	0.012
16	1016	995.8980	16.0475	20.1020	85.756	0.234	0.001
17	1044	1101	16.5925	-56.8680	85.652	-0.664	0.008
18	839	885.0964	21.9182	-46.0964	84.446	-0.546	0.010
19	1324	1392	38.6460	-68.4513	78.218	-0.875	0.093
20	937	990.0664	16.2192	-53.0664	85.723	-0.619	0.007
21	1178	995.8980	16.0475	182.1020	85.756	2.124	0.079
22	1170	990.0664	16.2192	179.9336	85.723	2.099	0.079
23	861	943.4130	18.2253	-82.4130	85.319	-0.966	0.021
24	1116	1130	17.8825	-14.0263	85.392	-0.164	0.001
25	1015	1008	15.7638	7.4386	85.808	0.087	0.000
26	888	955.0764	17.6284	-67.0764	85.445	-0.785	0.013
27	865	920.0864	19.5757	-55.0864	85.020	-0.648	0.011
28	1010	1002	15.8954	8.2703	85.784	0.096	0.000
29	929	949.2447	17.9197	-20.2447	85.384	-0.237	0.001
30	1053	1054	15.4888	-1.2147	85.858	-0.014	0.000
31	994	1008	15.7638	-13.5614	85.808	-0.158	0.000
32	1538	1655	63.7141	-116.8762	59.599	-1.961	2.198



Sum of Residuals	0
Sum of Squared Residuals	228346
Predicted Residual SS (PRESS)	318993


Fit Diagnostics for Value
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
Value
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 32
Parameters 2
Error DF 30
MSE 7611.5
R-Square 0.7673
Adj R-Square 0.7596


Residuals for Value
Residual
Revenue
300
200
100
0
-100
200
250
300



Fit Plot for Value
1750
1500
1250
1000
750
Value
200
250
300
Revenue
Observations 32
Parameters 2
Error DF 30
MSE 7611.5
R-Square 0.7673
Adj R-Square 0.7596
Fit
95% Confidence Limits
95% Prediction Limits