Assignment 3

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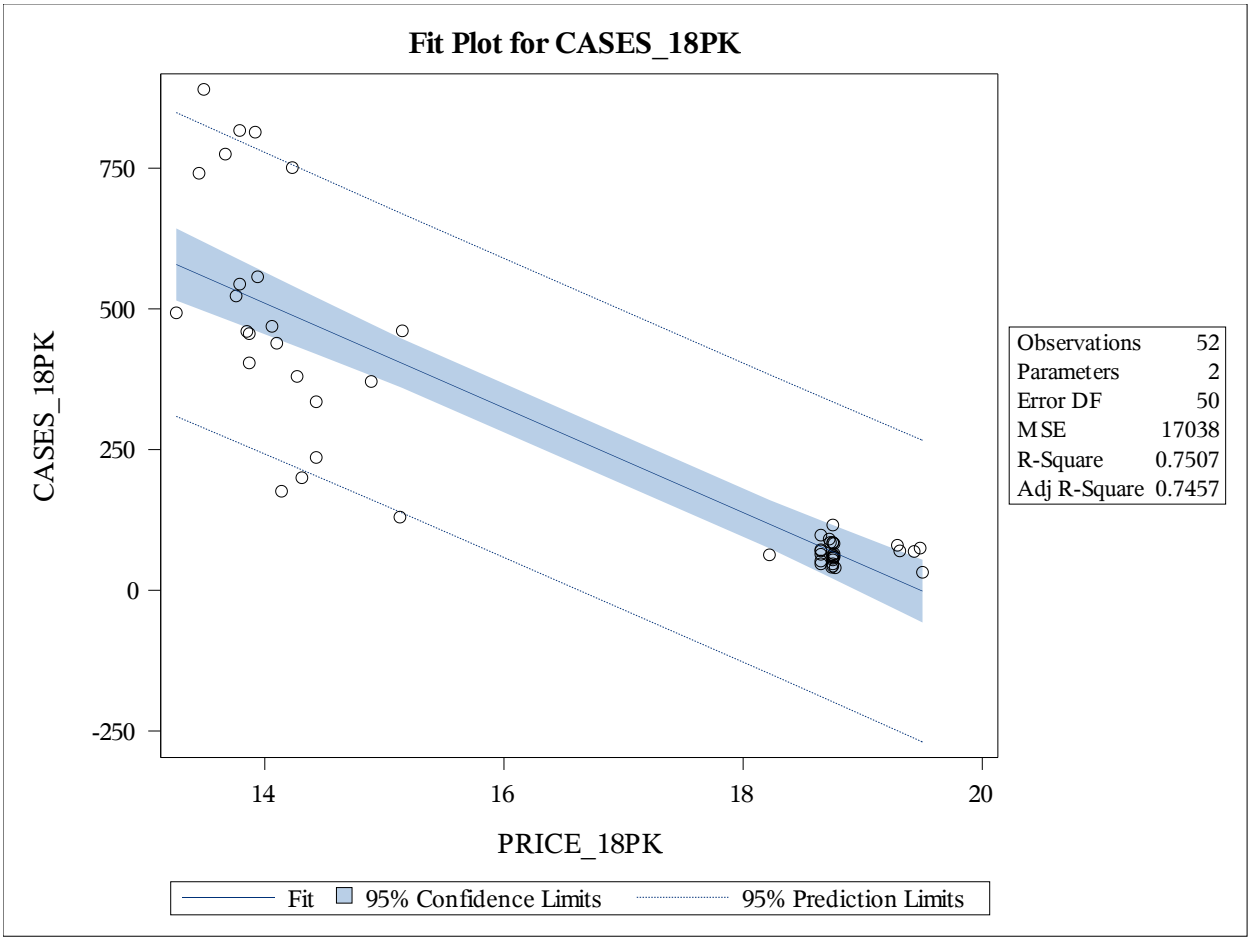
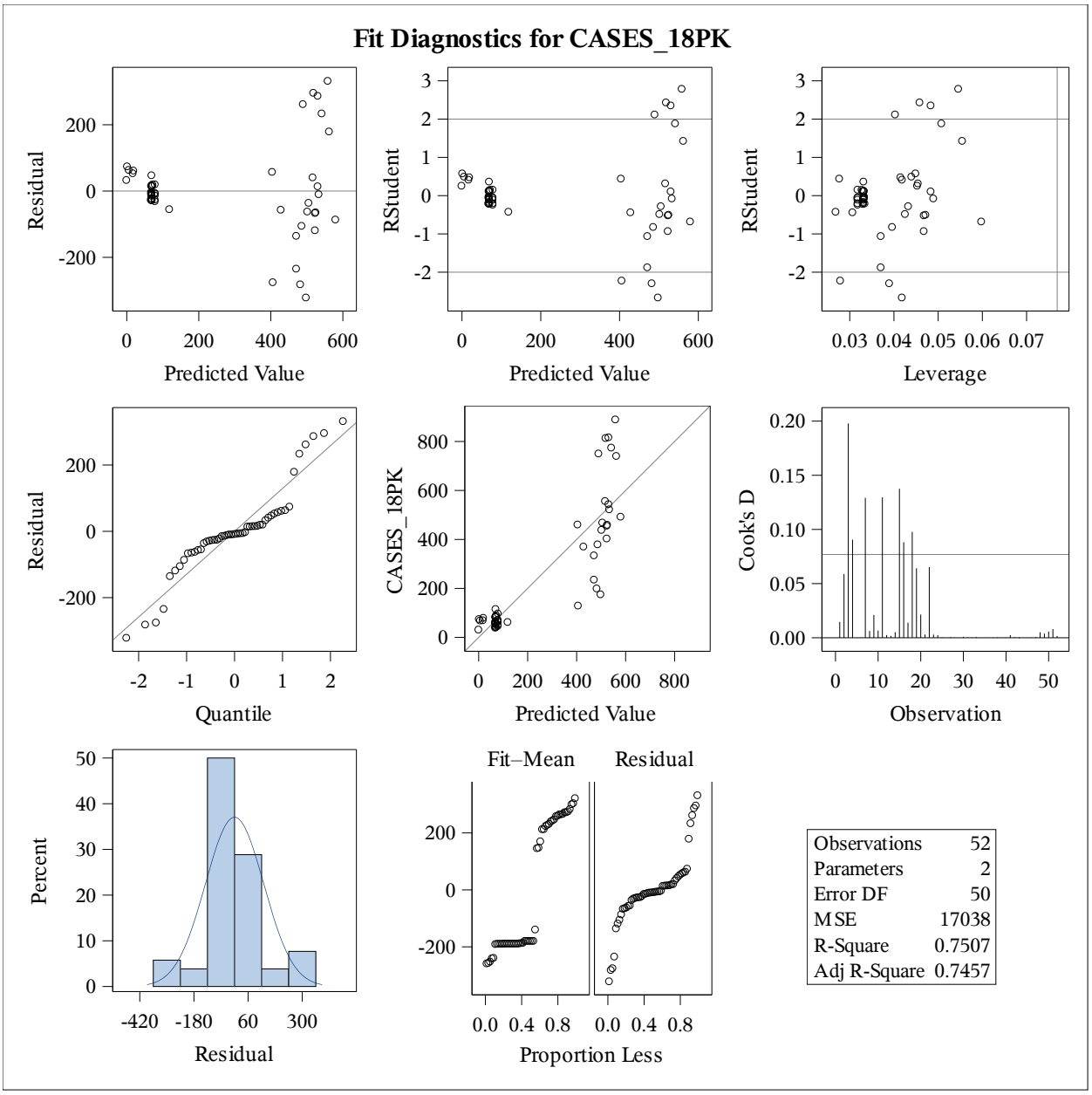
Using the “Duke—Bear sales” dataset in CANVAS, develop price elasticity models for 18 pack (18pk) and
30 pack (30 pk) weekly beer sales.

Solution:

1. Linear Elasticity Model for 18PK





- Here, in Percent v/s Residual plot, Residuals follow Normal distribution, even though not perfect.
- In Residual v/s Quantile plot, residuals **do not** fit the line well.
- In Residuals v/s Predicted value, the **variances or standard deviation of the errors is not constant**. For smaller x, values are tied together, but for larger x, it has spread.

Number of Observations Read	52
Number of Observations Used	52

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	2564637	2564637	150.53	<.0001
Error	50	851885	17038		
Corrected Total	51	3416521			

Root MSE	130.52853	**R-Square**	0.7507
Dependent Mean	256.67308	**Adj R-Sq**	0.7457
Coeff Var	50.85400		

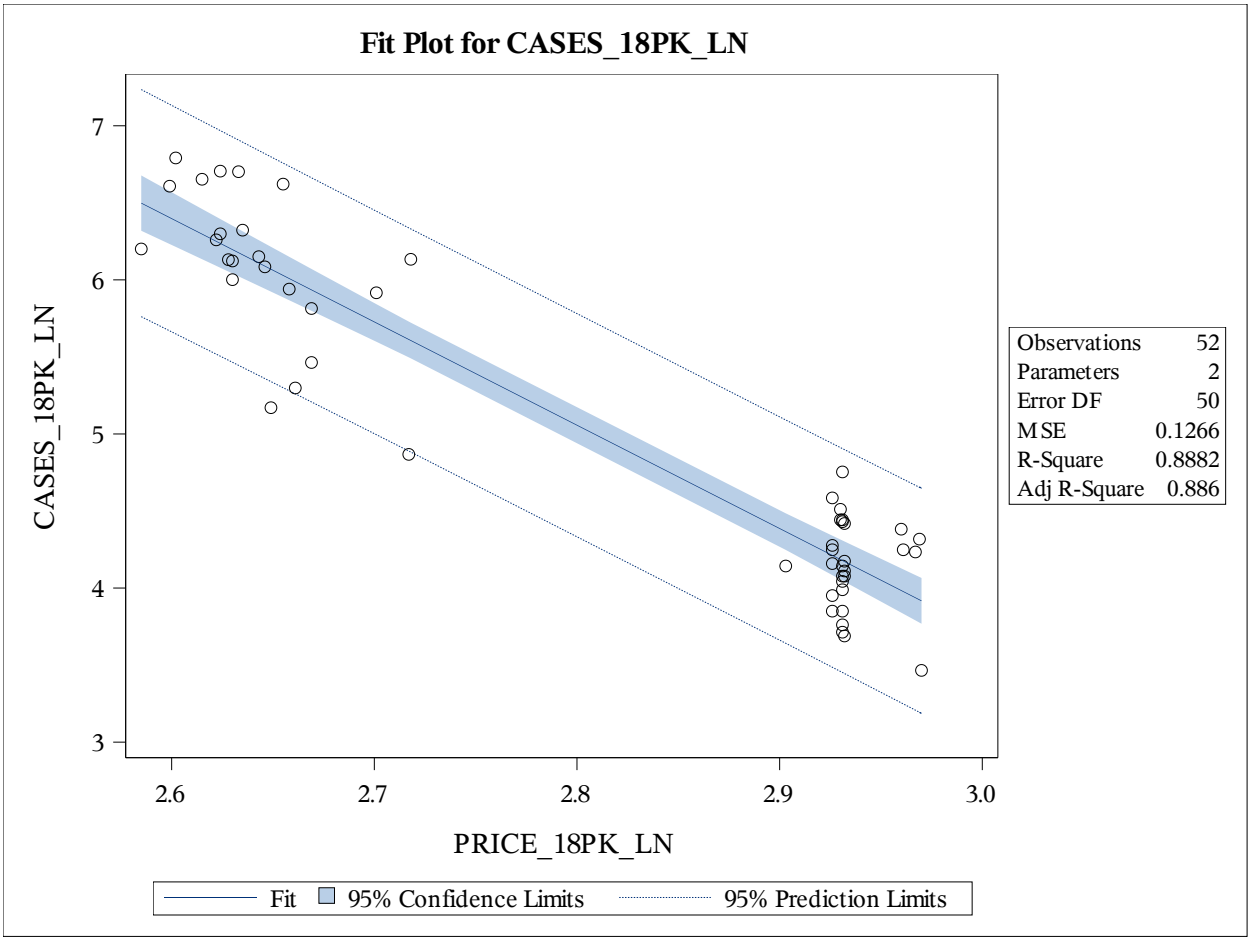
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	1812.18394	128.06995	14.15	<.0001
PRICE_18PK	1	-93.00727	7.58070	-12.27	<.0001

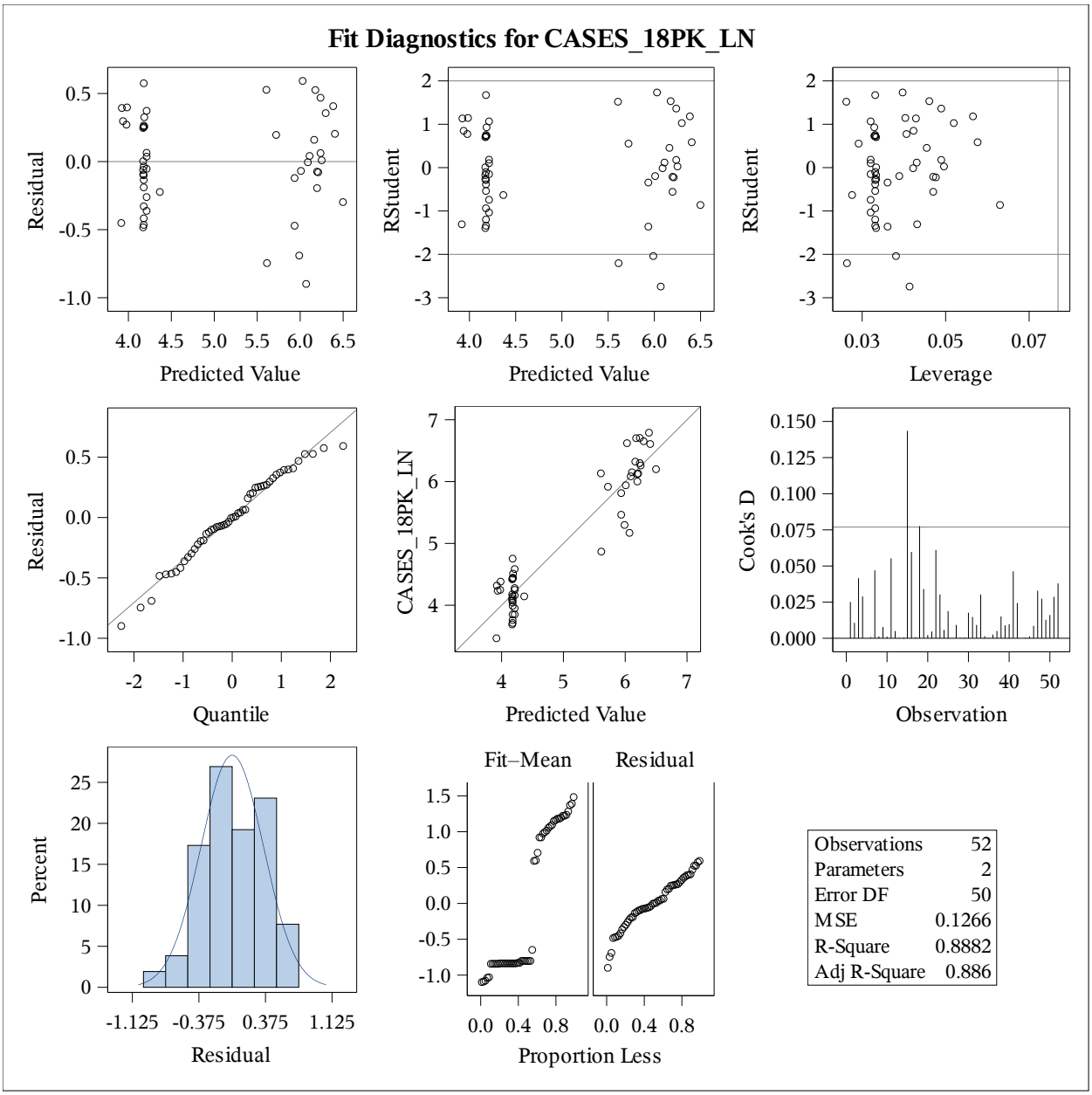
In Analysis of Variance, Probability <0.0001, which means F value is significant, overall model is good.

The regression equation is :

Quantity= 1812.18-93.007*Price

2. Log Elasticity Model for 18PK





- Here, in Percent v/s Residual plot, **Residuals follow Normal distribution better than Linear Model**.
- In Residual v/s Quantile plot, residuals fit the line well.
- In Residuals v/s Predicted value, the **variances or standard deviation of the errors is almost constant.**

Number of Observations Read	52
Number of Observations Used	52

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	50.28521	50.28521	397.19	<.0001
Error	50	6.33017	0.12660		
Corrected Total	51	56.61539			

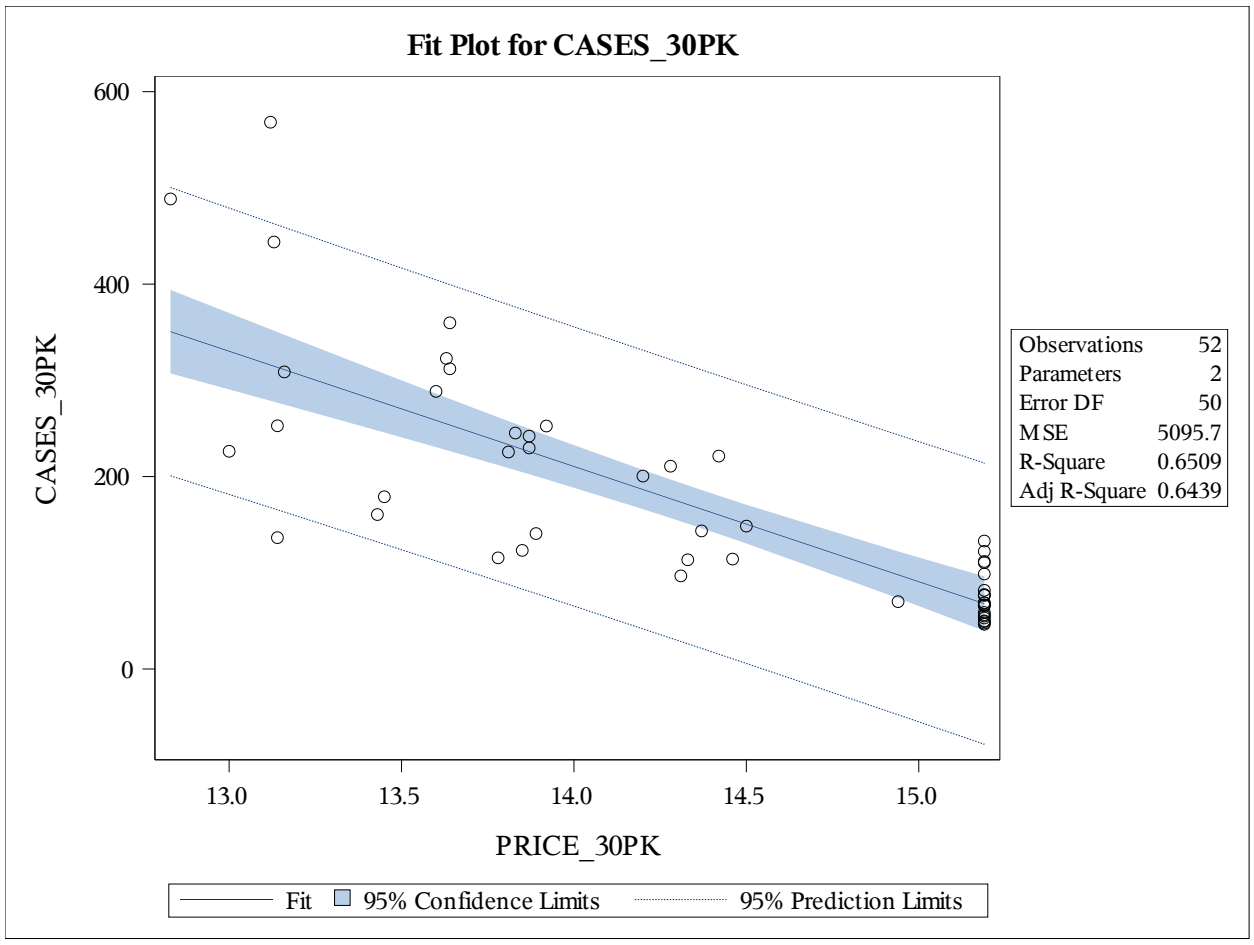
Root MSE	0.35581	**R-Square**	0.8882
Dependent Mean	5.01437	**Adj R-Sq**	0.8860
Coeff Var	7.09589		

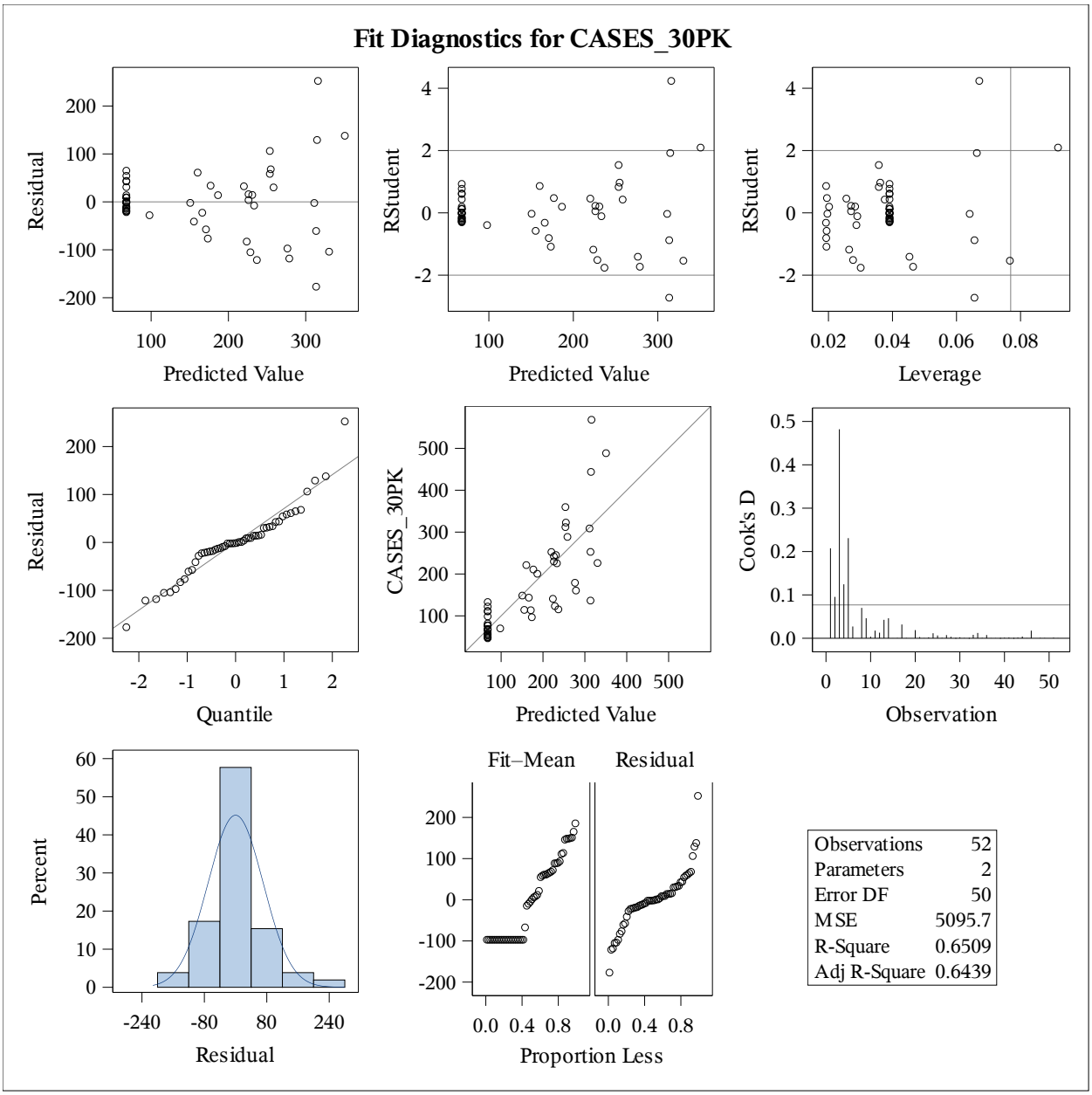
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	23.82853	0.94532	25.21	<.0001
PRICE_18PK_LN	1	-6.70420	0.33639	-19.93	<.0001

In Analysis of Variance, Probability<0.0001, F value is significant, overall model is good.
Log equation for elasticity model:
Log(Quantity)= 23.82-6.70*log(Price_18PK)

Comparing both models, we can say that Log models fits better than Linear model for 18PK

3. Linear Elasticity Model for 30PK





- Here, in Percent v/s Residual plot, Residuals follow Normal distribution.
- In Residual v/s Quantile plot, residuals fit the line well, even though not perfect.
- In Residuals v/s Predicted value, the **variances or standard deviation of the errors is not constant**. For smaller x, values are tied together, but for larger x, it has spread.

Number of Observations Read	52
Number of Observations Used	52

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	475027	475027	93.22	<.0001
Error	50	254786	5095.72617		
Corrected Total	51	729814			

Root MSE	71.38436	**R-Square**	0.6509
Dependent Mean	165.04327	**Adj R-Sq**	0.6439
Coeff Var	43.25190		

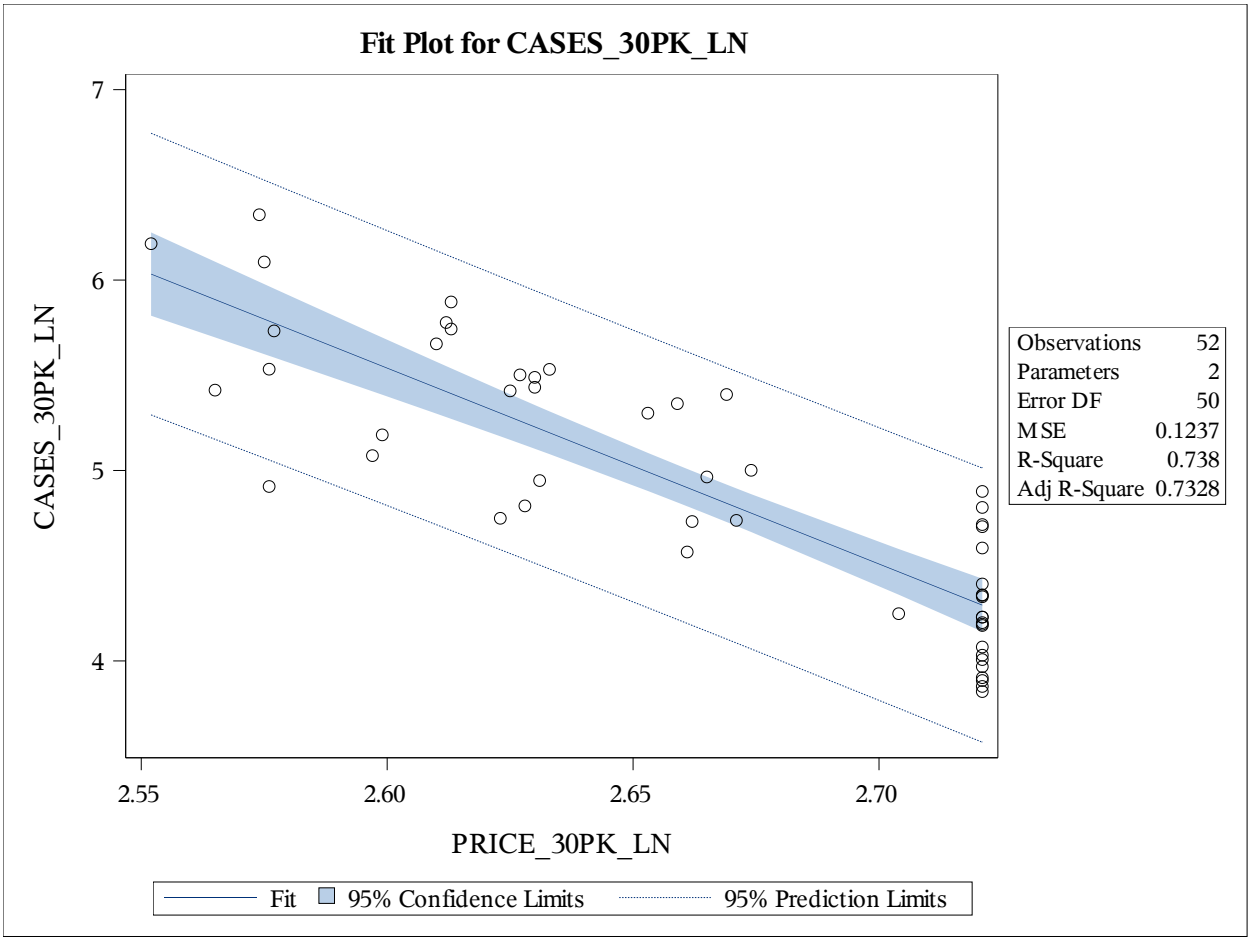
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	1887.25580	178.64803	10.56	<.0001
PRICE_30PK	1	-119.77084	12.40494	-9.66	<.0001

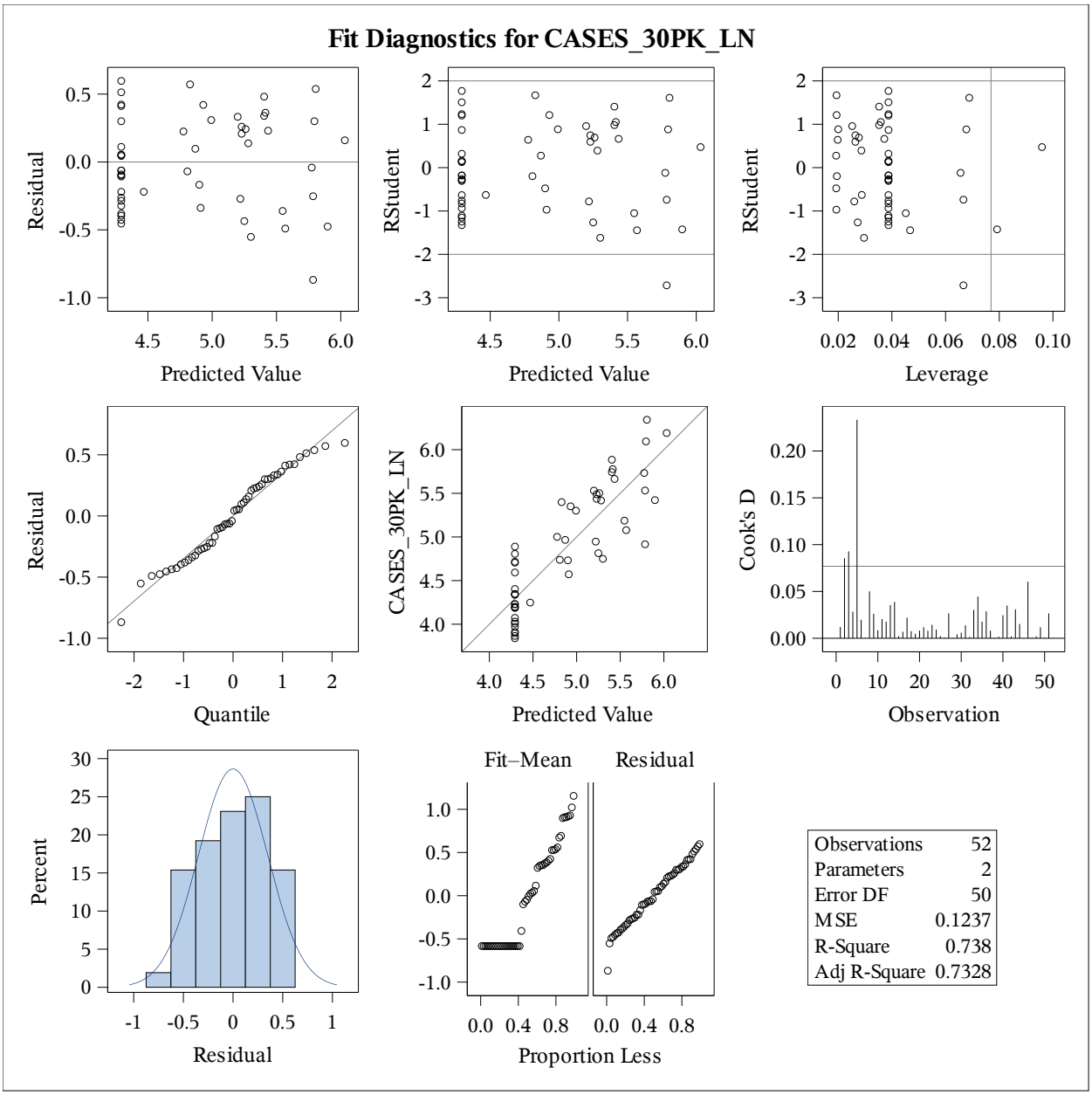
In Analysis of Variance, Probability <0.0001, which means F value is significant, overall model is good.

The regression equation is :

Quantity= 1887.25-119.77*Price_30PK

4. Log Elasticity Model for 30PK





- Here, in Percent v/s Residual plot, **Residuals do not follow Normal distribution well as Linear model**
- In Residual v/s Quantile plot, **residuals do not fit the line** well.
- In Residuals v/s Predicted value, the **variances or standard deviation of the errors is not constant.**

Number of Observations Read	52
Number of Observations Used	52

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	17.41857	17.41857	140.84	<.0001
Error	50	6.18384	0.12368		
Corrected Total	51	23.60241			

Root MSE	0.35168	**R-Square**	0.7380
Dependent Mean	4.87573	**Adj R-Sq**	0.7328
Coeff Var	7.21281		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	32.28454	2.31007	13.98	<.0001
PRICE_30PK_LN	1	-10.28726	0.86684	-11.87	<.0001

In Analysis of Variance, Probability<0.0001, F value is significant, overall model is good.

Log equation for elasticity model:
Log(Quantity)= 32.28-10.28*log(Price_30PK)

Comparing both models, we can say that Linear models fits better than Log model for 30PK