First 10 Rows of User Type Data

Obs	year	residential_status	user_type	inst_cap_mwp	inst_cap_mwac
1	2008	Residential	Residential	0	0
2	2008	Non-Residential	Public Service Agencies	0.2	0.2
3	2008	Non-Residential	Town Councils & Grassroots Units	0	0
4	2008	Non-Residential	Private Sector	0.1	0.1
5	2009	Residential	Residential	0.1	0.1
6	2009	Non-Residential	Public Service Agencies	0.5	0.4
7	2009	Non-Residential	Town Councils & Grassroots Units	0	0
8	2009	Non-Residential	Private Sector	1.4	1.1
9	2010	Residential	Residential	0.1	0.1
10	2010	Non-Residential	Public Service Agencies	0.6	0.5

First 10 Rows of Region Data

Obs	year	ura_planning_region	residential_status	num_solar_pv_inst	inst_cap_kwac	total_inst_cap_percent
1	2008	Central	Non-Residential	4	73.2	30
2	2008	Central	Residential	4	19.9	10
3	2008	East	Non-Residential	1	2.3	0
4	2008	East	Residential	1	6.6	0
5	2008	North-East	Non-Residential	10	65.3	20
6	2008	North-East	Residential	1	6.5	0
7	2008	North	Non-Residential	8	61.6	20
8	2008	North	Residential	0	0	0
9	2008	West	Non-Residential	1	43.2	20
10	2008	West	Residential	0	0	0

Summary Statistics of Installed Capacity by User Type

The MEANS Procedure

year	user_type	N Obs	Variable	Mean	Median	Std Dev	Minimum	Maximum	N	N Miss
2008	Private Sector	1	inst_cap_mwp inst_cap_mwac	0.1000000 0.1000000	0.1000000 0.1000000	. .	0.1000000 0.1000000	0.1000000 0.1000000	1 1	0 0
	Public Service Agencies	1	inst_cap_mwp inst_cap_mwac	0.2000000 0.2000000	0.2000000 0.2000000	. .	0.2000000 0.2000000	0.2000000 0.2000000	1 1	0 0
	Residential	1	inst_cap_mwp inst_cap_mwac	0 0	0 0	. .	0 0	0 0	1 1	0 0
	Town Councils & Grassroots Units	1	inst_cap_mwp inst_cap_mwac	0 0	0 0	. .	0 0	0 0	1 1	0 0
2009	Private Sector	1	inst_cap_mwp inst_cap_mwac	1.4000000 1.1000000	1.4000000 1.1000000	. .	1.4000000 1.1000000	1.4000000 1.1000000	1 1	0 0
	Public Service Agencies	1	inst_cap_mwp inst_cap_mwac	0.5000000 0.4000000	0.5000000 0.4000000	. .	0.5000000 0.4000000	0.5000000 0.4000000	1 1	0 0
	Residential	1	inst_cap_mwp inst_cap_mwac	0.1000000 0.1000000	0.1000000 0.1000000	. .	0.1000000 0.1000000	0.1000000 0.1000000	1 1	0 0
	Town Councils & Grassroots Units	1	inst_cap_mwp inst_cap_mwac	0 0	0 0	. .	0 0	0 0	1 1	0 0
2010	Private Sector	1	inst_cap_mwp inst_cap_mwac	2.6000000 2.0000000	2.6000000 2.0000000	. .	2.6000000 2.0000000	2.6000000 2.0000000	1 1	0 0
	Public Service Agencies	1	inst_cap_mwp inst_cap_mwac	0.6000000 0.5000000	0.6000000 0.5000000	. .	0.6000000 0.5000000	0.6000000 0.5000000	1 1	0 0
	Residential	1	inst_cap_mwp inst_cap_mwac	0.1000000 0.1000000	0.1000000 0.1000000	. .	0.1000000 0.1000000	0.1000000 0.1000000	1 1	0 0
	Town Councils & Grassroots Units	1	inst_cap_mwp inst_cap_mwac	0.5000000 0.4000000	0.5000000 0.4000000	. .	0.5000000 0.4000000	0.5000000 0.4000000	1 1	0 0

year	user_type	N Obs	Variable	Mean	Median	Std Dev	Minimum	Maximum	N	N Miss
2011	Private Sector	1	inst_cap_mwp	3.1000000	3.1000000	.	3.1000000	3.1000000	1	0
			inst_cap_mwac	2.4000000	2.4000000	.	2.4000000	2.4000000	1	0
	Public Service Agencies	1	inst_cap_mwp	1.0000000	1.0000000	.	1.0000000	1.0000000	1	0
			inst_cap_mwac	0.8000000	0.8000000	.	0.8000000	0.8000000	1	0
	Residential	1	inst_cap_mwp	0.3000000	0.3000000	.	0.3000000	0.3000000	1	0
			inst_cap_mwac	0.2000000	0.2000000	.	0.2000000	0.2000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	1.5000000	1.5000000	.	1.5000000	1.5000000	1	0
			inst_cap_mwac	1.2000000	1.2000000	.	1.2000000	1.2000000	1	0
2012	Private Sector	1	inst_cap_mwp	4.1000000	4.1000000	.	4.1000000	4.1000000	1	0
			inst_cap_mwac	3.1000000	3.1000000	.	3.1000000	3.1000000	1	0
	Public Service Agencies	1	inst_cap_mwp	1.8000000	1.8000000	.	1.8000000	1.8000000	1	0
			inst_cap_mwac	1.4000000	1.4000000	.	1.4000000	1.4000000	1	0
	Residential	1	inst_cap_mwp	0.6000000	0.6000000	.	0.6000000	0.6000000	1	0
			inst_cap_mwac	0.5000000	0.5000000	.	0.5000000	0.5000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	3.6000000	3.6000000	.	3.6000000	3.6000000	1	0
			inst_cap_mwac	2.8000000	2.8000000	.	2.8000000	2.8000000	1	0
2013	Private Sector	1	inst_cap_mwp	7.7000000	7.7000000	.	7.7000000	7.7000000	1	0
			inst_cap_mwac	5.9000000	5.9000000	.	5.9000000	5.9000000	1	0
	Public Service Agencies	1	inst_cap_mwp	2.1000000	2.1000000	.	2.1000000	2.1000000	1	0
			inst_cap_mwac	1.6000000	1.6000000	.	1.6000000	1.6000000	1	0
	Residential	1	inst_cap_mwp	1.1000000	1.1000000	.	1.1000000	1.1000000	1	0
			inst_cap_mwac	0.9000000	0.9000000	.	0.9000000	0.9000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	4.4000000	4.4000000	.	4.4000000	4.4000000	1	0
			inst_cap_mwac	3.4000000	3.4000000	.	3.4000000	3.4000000	1	0
2014	Private Sector	1	inst_cap_mwp	18.3000000	18.3000000	.	18.3000000	18.3000000	1	0
			inst_cap_mwac	14.1000000	14.1000000	.	14.1000000	14.1000000	1	0
	Public Service Agencies	1	inst_cap_mwp	3.1000000	3.1000000	.	3.1000000	3.1000000	1	0
			inst_cap_mwac	2.4000000	2.4000000	.	2.4000000	2.4000000	1	0
	Residential	1	inst_cap_mwp	2.0000000	2.0000000	.	2.0000000	2.0000000	1	0
			inst_cap_mwac	1.5000000	1.5000000	.	1.5000000	1.5000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	9.5000000	9.5000000	.	9.5000000	9.5000000	1	0
			inst_cap_mwac	7.3000000	7.3000000	.	7.3000000	7.3000000	1	0
2015	Private Sector	1	inst_cap_mwp	36.7000000	36.7000000	.	36.7000000	36.7000000	1	0
			inst_cap_mwac	28.2000000	28.2000000	.	28.2000000	28.2000000	1	0
	Public Service Agencies	1	inst_cap_mwp	4.0000000	4.0000000	.	4.0000000	4.0000000	1	0
			inst_cap_mwac	3.0000000	3.0000000	.	3.0000000	3.0000000	1	0
	Residential	1	inst_cap_mwp	3.6000000	3.6000000	.	3.6000000	3.6000000	1	0
			inst_cap_mwac	2.8000000	2.8000000	.	2.8000000	2.8000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	15.1000000	15.1000000	.	15.1000000	15.1000000	1	0
			inst_cap_mwac	11.6000000	11.6000000	.	11.6000000	11.6000000	1	0
2016	Private Sector	1	inst_cap_mwp	58.0000000	58.0000000	.	58.0000000	58.0000000	1	0
			inst_cap_mwac	44.7000000	44.7000000	.	44.7000000	44.7000000	1	0
	Public Service Agencies	1	inst_cap_mwp	5.3000000	5.3000000	.	5.3000000	5.3000000	1	0
			inst_cap_mwac	4.1000000	4.1000000	.	4.1000000	4.1000000	1	0
	Residential	1	inst_cap_mwp	5.2000000	5.2000000	.	5.2000000	5.2000000	1	0
			inst_cap_mwac	4.0000000	4.0000000	.	4.0000000	4.0000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	57.0000000	57.0000000	.	57.0000000	57.0000000	1	0
			inst_cap_mwac	43.9000000	43.9000000	.	43.9000000	43.9000000	1	0
2017	Private Sector	1	inst_cap_mwp	77.2000000	77.2000000	.	77.2000000	77.2000000	1	0
			inst_cap_mwac	59.4000000	59.4000000	.	59.4000000	59.4000000	1	0
	Public Service Agencies	1	inst_cap_mwp	6.6000000	6.6000000	.	6.6000000	6.6000000	1	0
			inst_cap_mwac	5.1000000	5.1000000	.	5.1000000	5.1000000	1	0
	Residential	1	inst_cap_mwp	6.9000000	6.9000000	.	6.9000000	6.9000000	1	0
			inst_cap_mwac	5.3000000	5.3000000	.	5.3000000	5.3000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	62.4000000	62.4000000	.	62.4000000	62.4000000	1	0
			inst_cap_mwac	48.1000000	48.1000000	.	48.1000000	48.1000000	1	0
2018	Private Sector	1	inst_cap_mwp	106.1000000	106.1000000	.	106.1000000	106.1000000	1	0
			inst_cap_mwac	81.7000000	81.7000000	.	81.7000000	81.7000000	1	0
	Public Service Agencies	1	inst_cap_mwp	10.0000000	10.0000000	.	10.0000000	10.0000000	1	0
			inst_cap_mwac	7.7000000	7.7000000	.	7.7000000	7.7000000	1	0
	Residential	1	inst_cap_mwp	9.3000000	9.3000000	.	9.3000000	9.3000000	1	0
			inst_cap_mwac	7.1000000	7.1000000	.	7.1000000	7.1000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	82.8000000	82.8000000	.	82.8000000	82.8000000	1	0
			inst_cap_mwac	63.7000000	63.7000000	.	63.7000000	63.7000000	1	0

year	user_type	N Obs	Variable	Mean	Median	Std Dev	Minimum	Maximum	N	N Miss
2019	Private Sector	1	inst_cap_mwp	186.8000000	186.8000000	.	186.8000000	186.8000000	1	0
			inst_cap_mwac	143.8000000	143.8000000	.	143.8000000	143.8000000	1	0
	Public Service Agencies	1	inst_cap_mwp	19.8000000	19.8000000	.	19.8000000	19.8000000	1	0
			inst_cap_mwac	15.2000000	15.2000000	.	15.2000000	15.2000000	1	0
	Residential	1	inst_cap_mwp	12.2000000	12.2000000	.	12.2000000	12.2000000	1	0
			inst_cap_mwac	9.4000000	9.4000000	.	9.4000000	9.4000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	134.4000000	134.4000000	.	134.4000000	134.4000000	1	0
			inst_cap_mwac	103.5000000	103.5000000	.	103.5000000	103.5000000	1	0
2020	Private Sector	1	inst_cap_mwp	226.6000000	226.6000000	.	226.6000000	226.6000000	1	0
			inst_cap_mwac	174.5000000	174.5000000	.	174.5000000	174.5000000	1	0
	Public Service Agencies	1	inst_cap_mwp	24.8000000	24.8000000	.	24.8000000	24.8000000	1	0
			inst_cap_mwac	19.1000000	19.1000000	.	19.1000000	19.1000000	1	0
	Residential	1	inst_cap_mwp	14.9000000	14.9000000	.	14.9000000	14.9000000	1	0
			inst_cap_mwac	11.5000000	11.5000000	.	11.5000000	11.5000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	161.3000000	161.3000000	.	161.3000000	161.3000000	1	0
			inst_cap_mwac	124.2000000	124.2000000	.	124.2000000	124.2000000	1	0
2021	Private Sector	1	inst_cap_mwp	235.5000000	235.5000000	.	235.5000000	235.5000000	1	0
			inst_cap_mwac	181.4000000	181.4000000	.	181.4000000	181.4000000	1	0
	Public Service Agencies	1	inst_cap_mwp	25.4000000	25.4000000	.	25.4000000	25.4000000	1	0
			inst_cap_mwac	19.5000000	19.5000000	.	19.5000000	19.5000000	1	0
	Residential	1	inst_cap_mwp	15.7000000	15.7000000	.	15.7000000	15.7000000	1	0
			inst_cap_mwac	12.1000000	12.1000000	.	12.1000000	12.1000000	1	0
	Town Councils & Grassroots Units	1	inst_cap_mwp	167.0000000	167.0000000	.	167.0000000	167.0000000	1	0
			inst_cap_mwac	128.6000000	128.6000000	.	128.6000000	128.6000000	1	0

Linear Regression Model for Solar PV Capacity Prediction

The REG Procedure
Model: MODEL1
Dependent Variable: user_type_capacity

Number of Observations Read	14
Number of Observations Used	14

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	168324	168324	51.71	<.0001
Error	12	39060	3254.97784		
Corrected Total	13	207384			

Root MSE	57.05241	R-Square	0.8117
Dependent Mean	101.25714	Adj R-Sq	0.7960
Coeff Var	56.34409		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-102.74945	32.20715	-3.19	0.0078
time	1	27.20088	3.78254	7.19	<.0001

Linear Regression Model for Solar PV Capacity Prediction

The REG Procedure
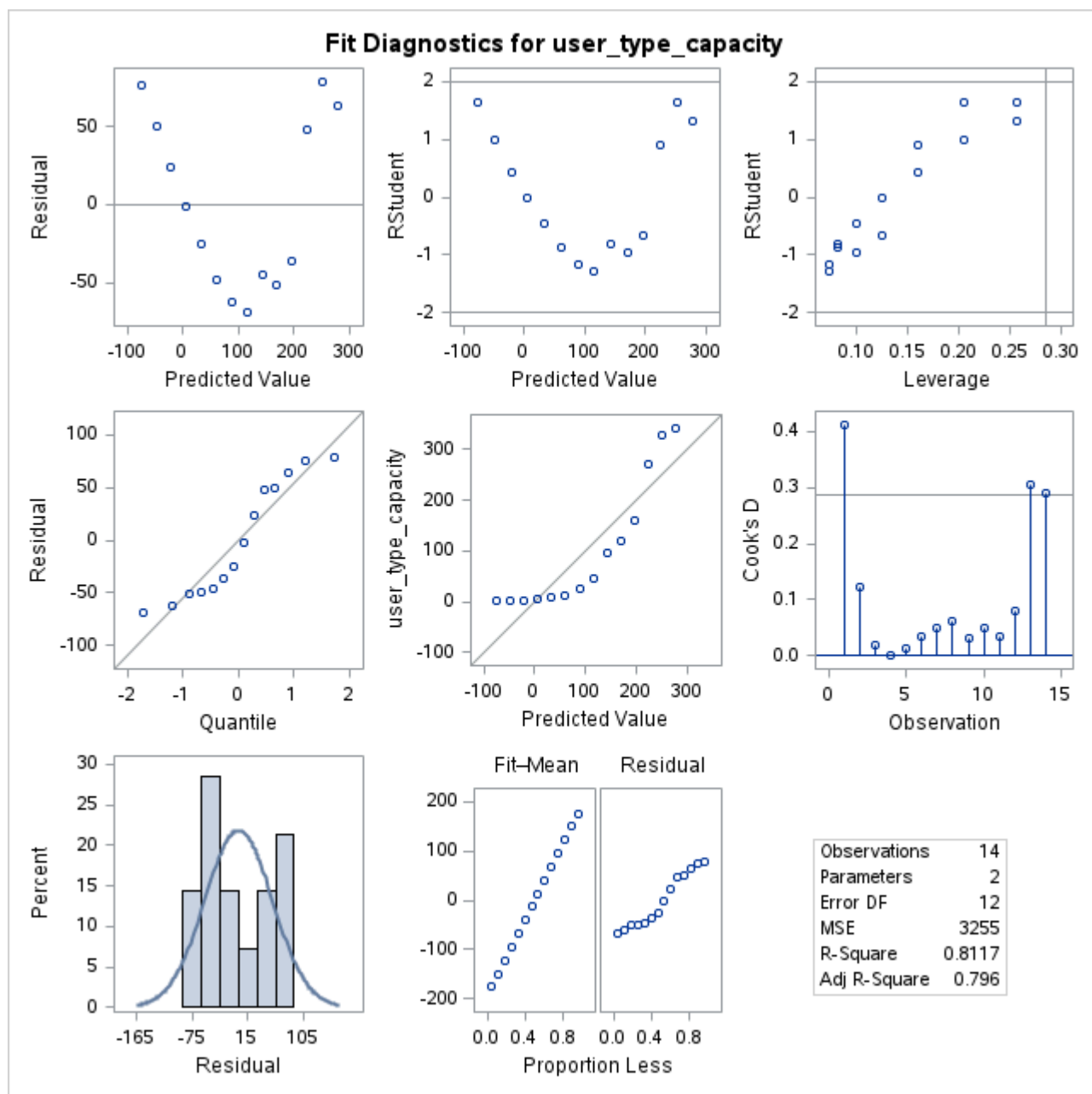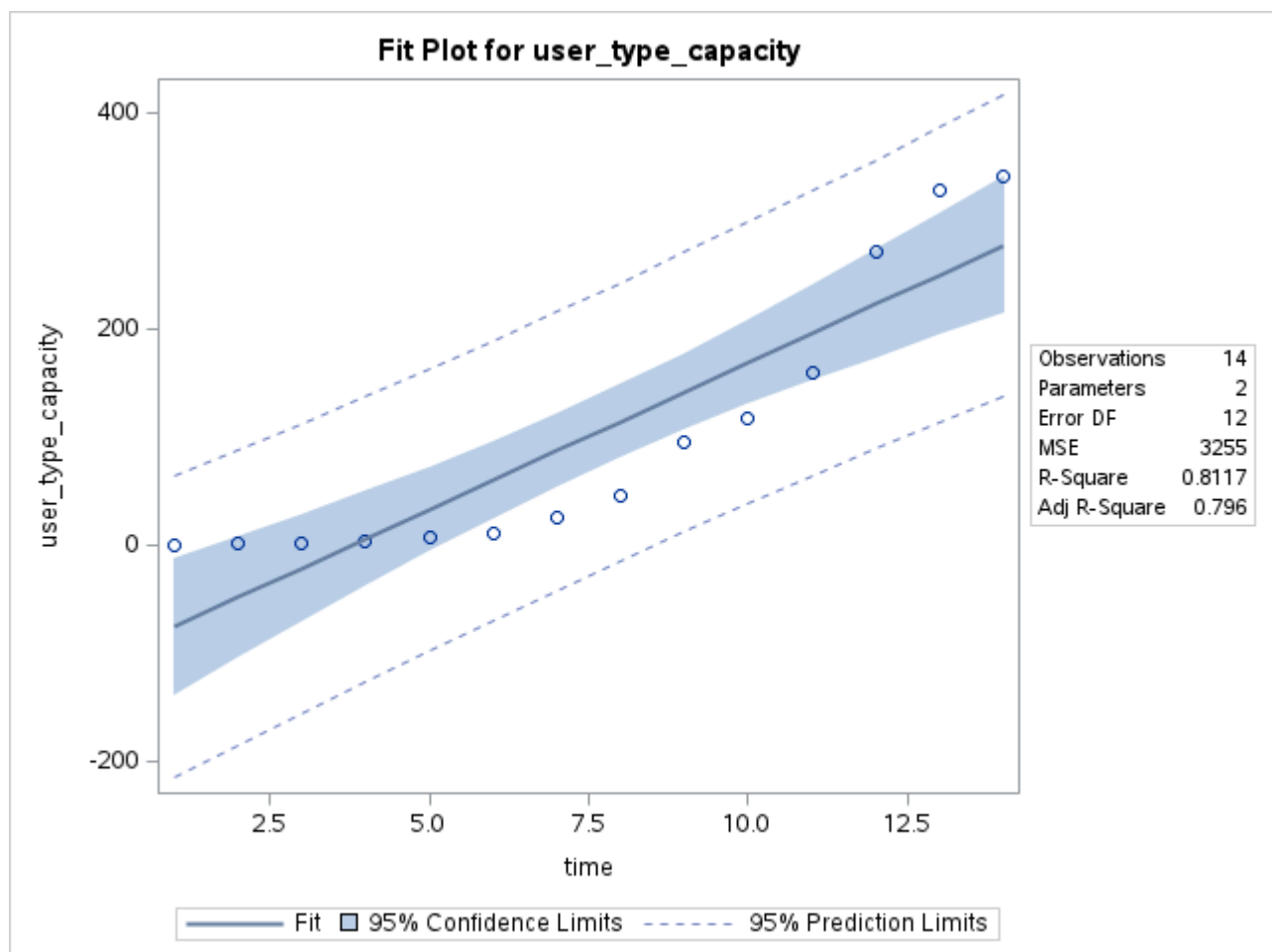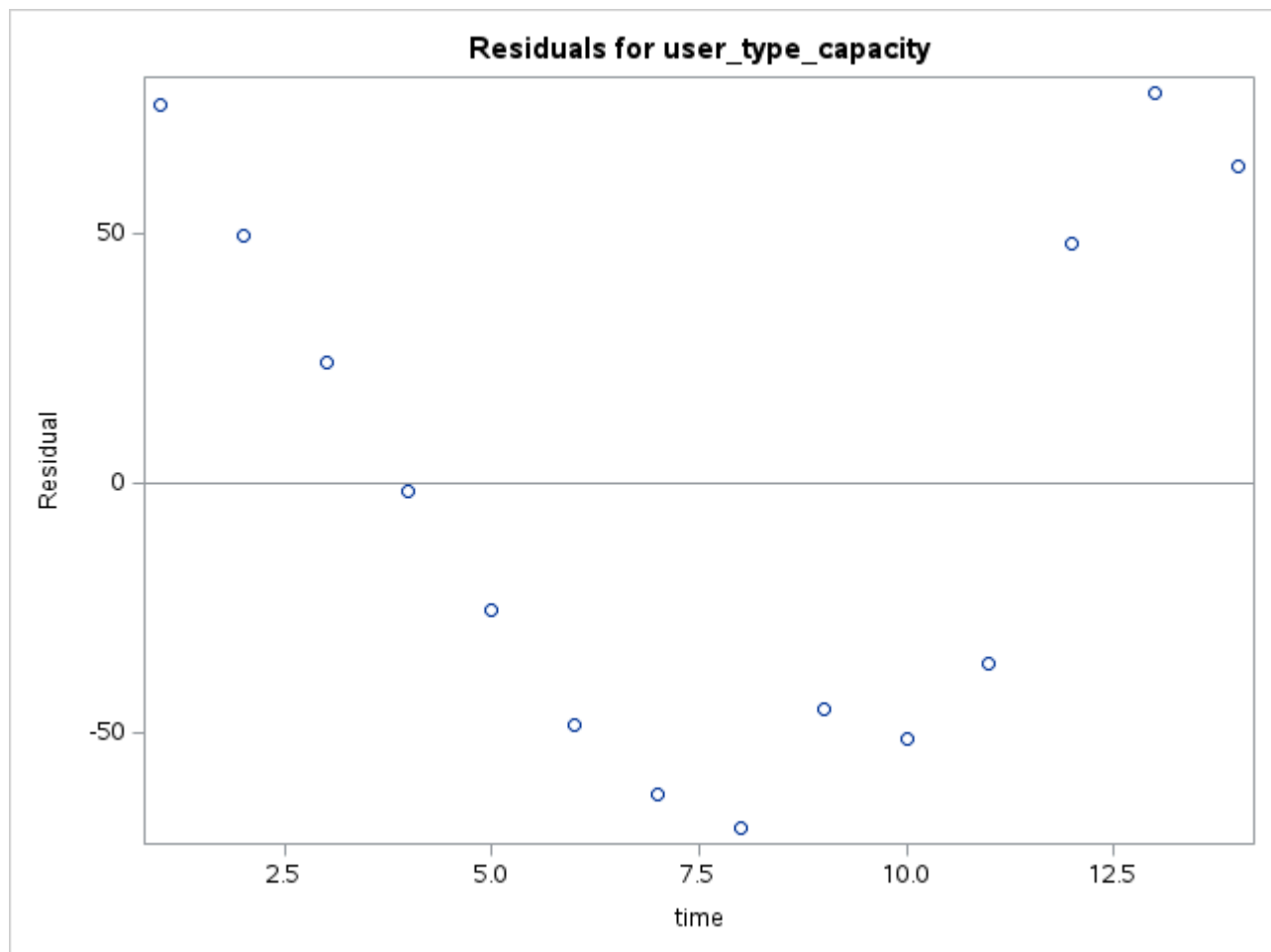**Model: MODEL1**
Dependent Variable: user_type_capacity

Output Statistics

Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	95% CL Mean		95% CL Predict		Residual
1	0.3	-75.5486	28.9309	-138.5835	-12.5137	-214.9240	63.8269	75.8486
2	1.6	-48.3477	25.7935	-104.5468	7.8515	-184.7678	88.0725	49.9477
3	3.0	-21.1468	22.8523	-70.9377	28.6441	-155.0544	112.7608	24.1468
4	4.6	6.0541	20.1932	-37.9432	50.0513	-125.8090	137.9171	-1.4541
5	7.8	33.2549	17.9422	-5.8376	72.3475	-97.0537	163.5636	-25.4549
6	11.8	60.4558	16.2693	25.0080	95.9036	-68.8062	189.7178	-48.6558
7	25.3	87.6567	15.3647	54.1798	121.1336	-41.0787	216.3922	-62.3567
8	45.6	114.8576	15.3647	81.3807	148.3345	-13.8779	243.5930	-69.2576
9	96.7	142.0585	16.2693	106.6107	177.5062	12.7965	271.3204	-45.3585
10	117.9	169.2593	17.9422	130.1667	208.3519	38.9507	299.5680	-51.3593
11	160.2	196.4602	20.1932	152.4630	240.4575	64.5971	328.3233	-36.2602
12	271.9	223.6611	22.8523	173.8702	273.4520	89.7535	357.5687	48.2389
13	329.3	250.8620	25.7935	194.6628	307.0611	114.4418	387.2821	78.4380
14	341.6	278.0629	28.9309	215.0279	341.0978	138.6874	417.4383	63.5371

Sum of Residuals	0
Sum of Squared Residuals	39060
Predicted Residual SS (PRESS)	56637

Fit Diagnostics for user_type_capacity

Observations	14
Parameters	2
Error DF	12
MSE	3255
R-Square	0.8117
Adj R-Square	0.796

Residuals for user_type_capacity

Fit Plot for user_type_capacity

Observations	14
Parameters	2
Error DF	12
MSE	3255
R-Square	0.8117
Adj R-Square	0.796

Fit ☐ 95% Confidence Limits ------ 95% Prediction Limits

Exponential Growth Model (Log-Linear)

The REG Procedure
Model: MODEL1
Dependent Variable: log_capacity

Number of Observations Read	14
Number of Observations Used	14

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	47.07111	47.07111	748.80	<.0001
Error	12	0.75434	0.06286		
Corrected Total	13	47.82546			

Root MSE	0.25072	R-Square	0.9842
Dependent Mean	3.41791	Adj R-Sq	0.9829
Coeff Var	7.33556		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.00640	0.14154	0.05	0.9647
time	1	0.45487	0.01662	27.36	<.0001

Exponential Growth Model (Log-Linear)

The REG Procedure
Model: MODEL1
Dependent Variable: log_capacity

Fit Diagnostics for log_capacity

Observations	14
Parameters	2
Error DF	12
MSE	0.0629
R-Square	0.9842
Adj R-Square	0.9829

Residuals for log_capacity

Fit Plot for log_capacity

Observations	14
Parameters	2
Error DF	12
MSE	0.0629
R-Square	0.9842
Adj R-Square	0.9829

—— Fit   ☐ 95% Confidence Limits   – – – – – 95% Prediction Limits
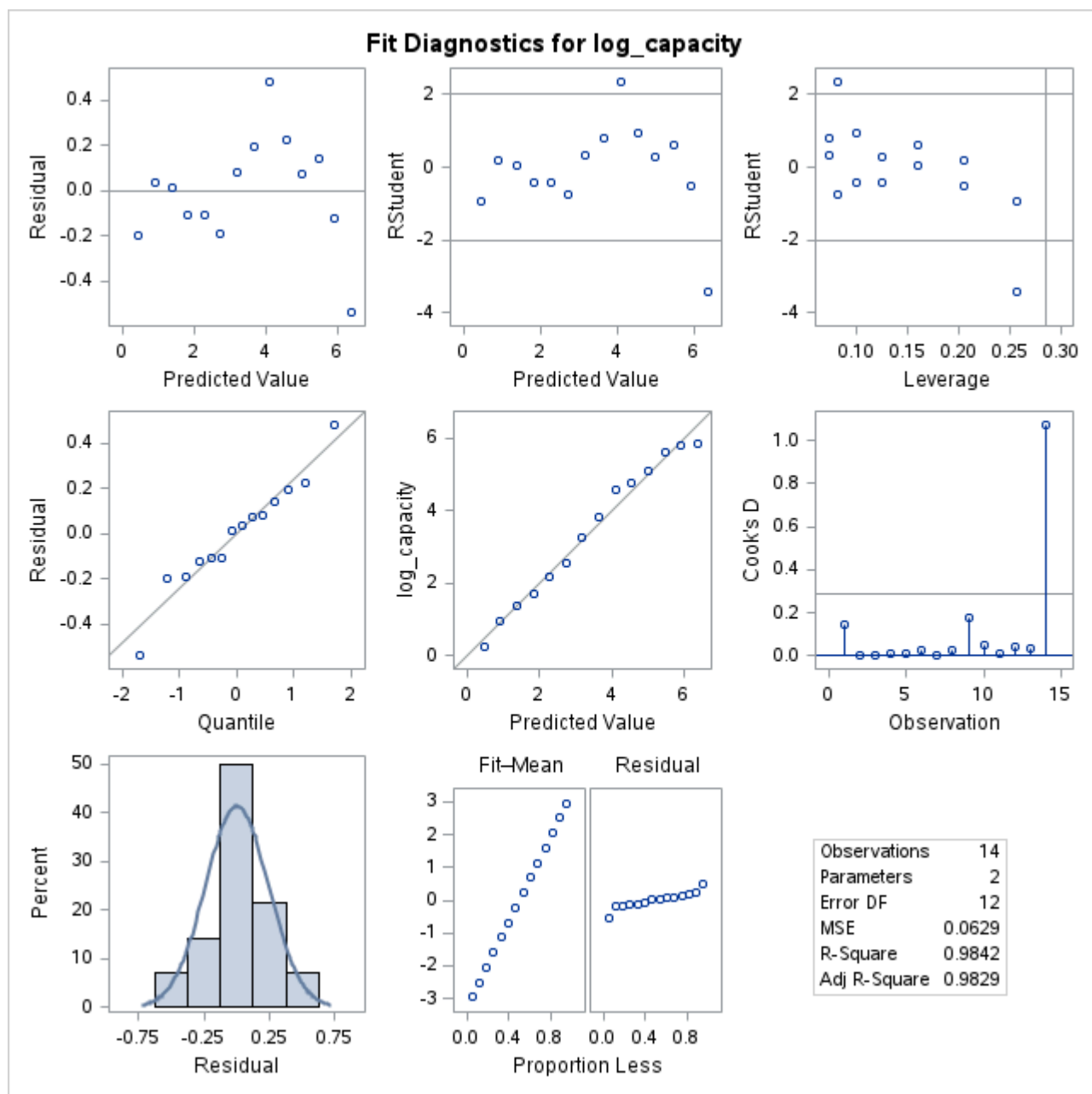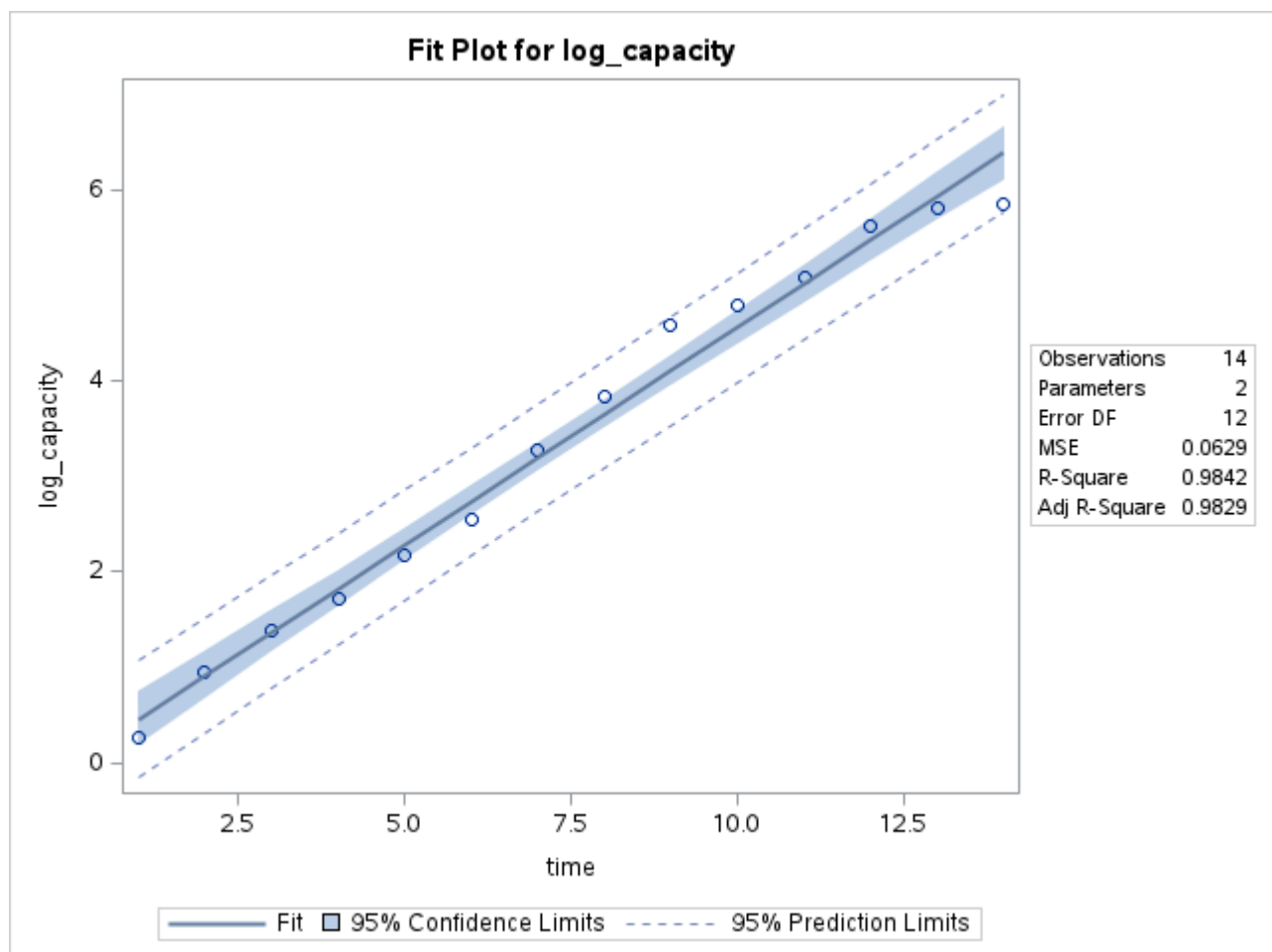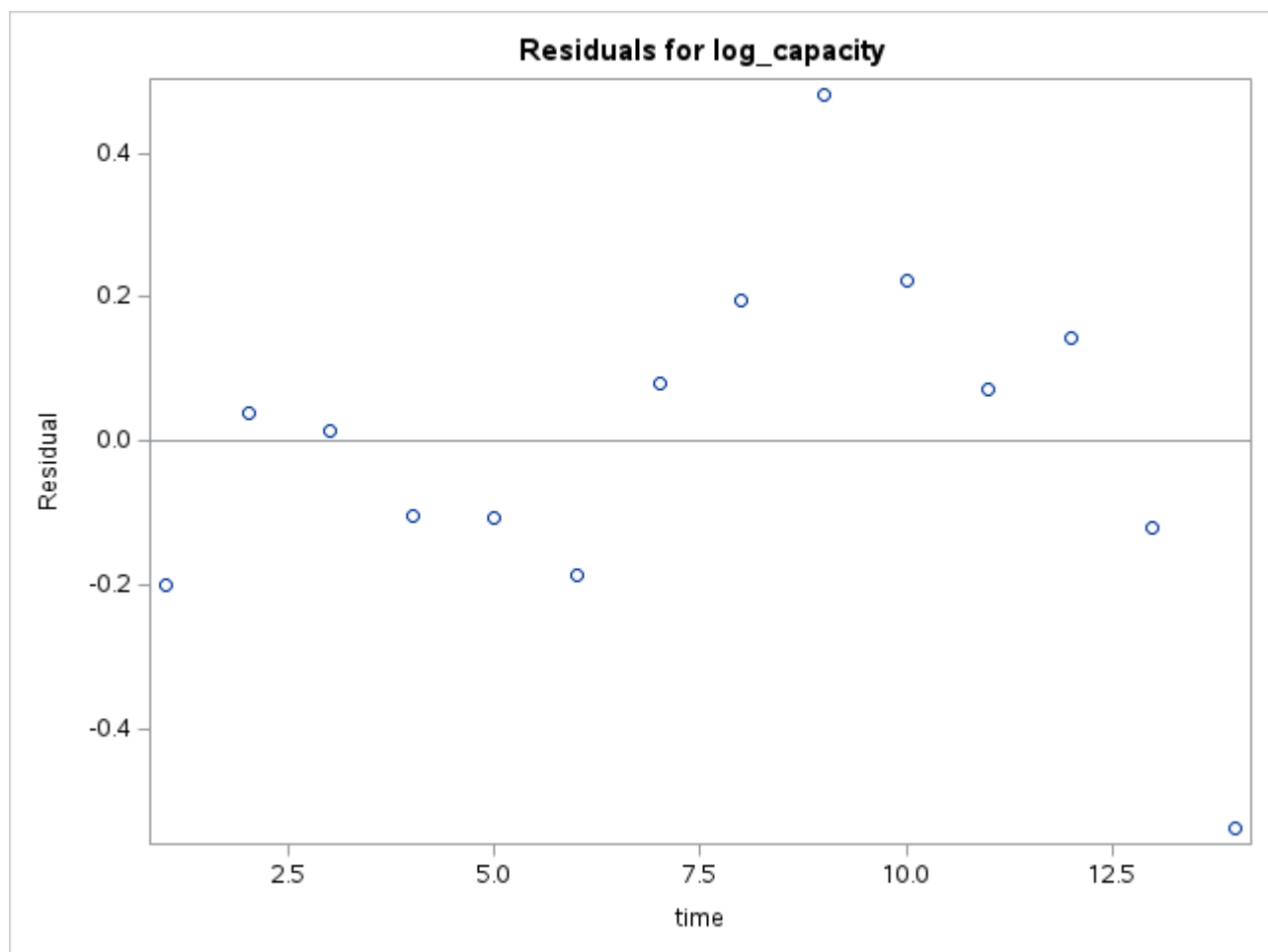
ARIMA Time Series Forecast

The ARIMA Procedure

Name of Variable = user_type_capacity	
Mean of Working Series	101.2571
Standard Deviation	121.7093
Number of Observations	14

Trend and Correlation Analysis for user_type_capacity
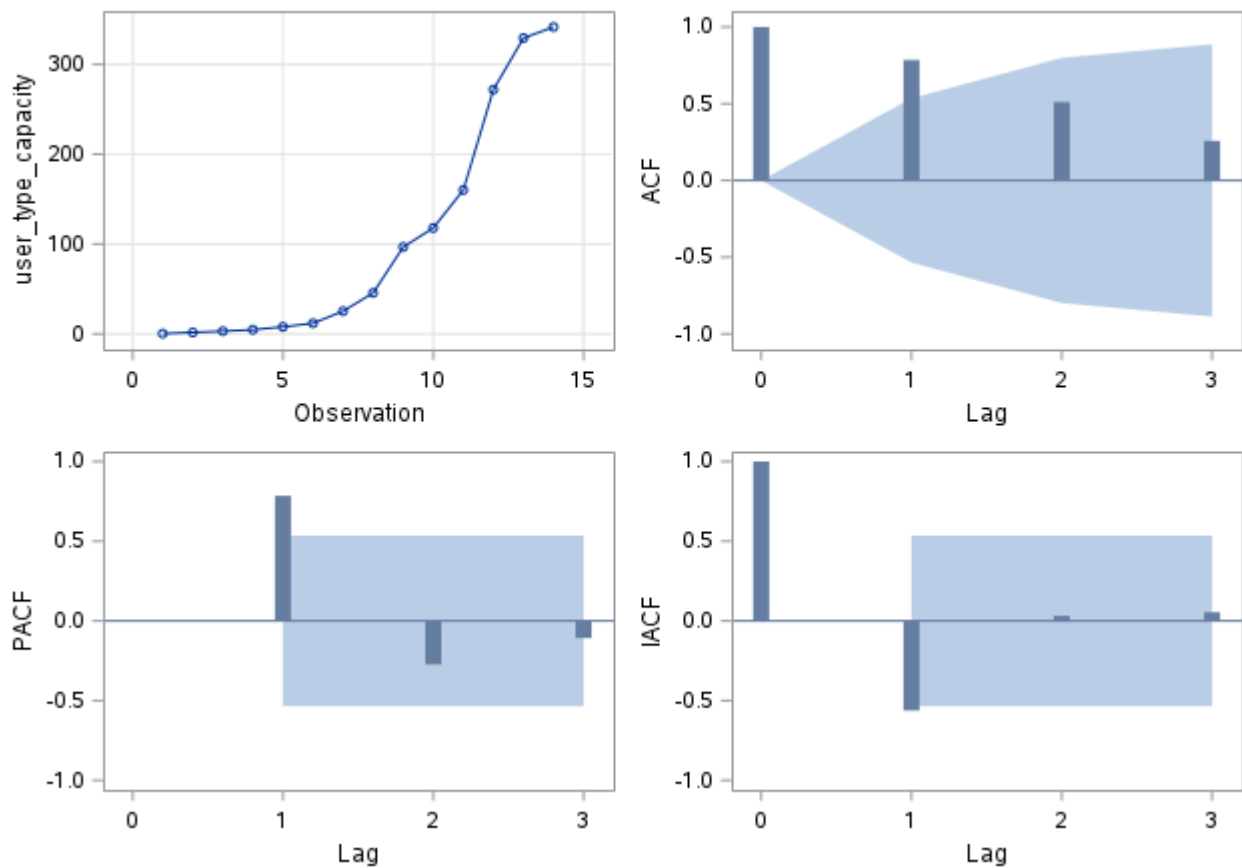
ARIMA Estimation Optimization Summary	
Estimation Method	Conditional Least Squares
Parameters Estimated	3
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	1.251289
Maximum Absolute Value of Gradient	10269.75
R-Square Change from Last Iteration	0.613724
Objective Function	Sum of Squared Residuals
Objective Function Value	14306.44
Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	14
Warning Message	Estimates may not have converged.

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	43.35670	30.80052	1.41	0.1869	0
MA1,1	-0.62806	0.29804	-2.11	0.0588	1

Conditional Least Squares Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
AR1,1	1.00000	0.13580	7.36	<.0001	1

Constant Estimate	0.000058
Variance Estimate	1300.585
Std Error Estimate	36.06363
AIC	142.742
SBC	144.6592
Number of Residuals	14

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates

Parameter	MU	MA1,1	AR1,1
MU	1.000	0.406	0.056
MA1,1	0.406	1.000	0.300
AR1,1	0.056	0.300	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	4.55	4	0.3363	0.186	0.282	0.285	0.138	0.125	-0.014
12	9.93	10	0.4463	0.067	-0.117	0.012	0.029	-0.250	0.002

Residual Correlation Diagnostics for user_type_capacity

Residual Normality Diagnostics for user_type_capacity
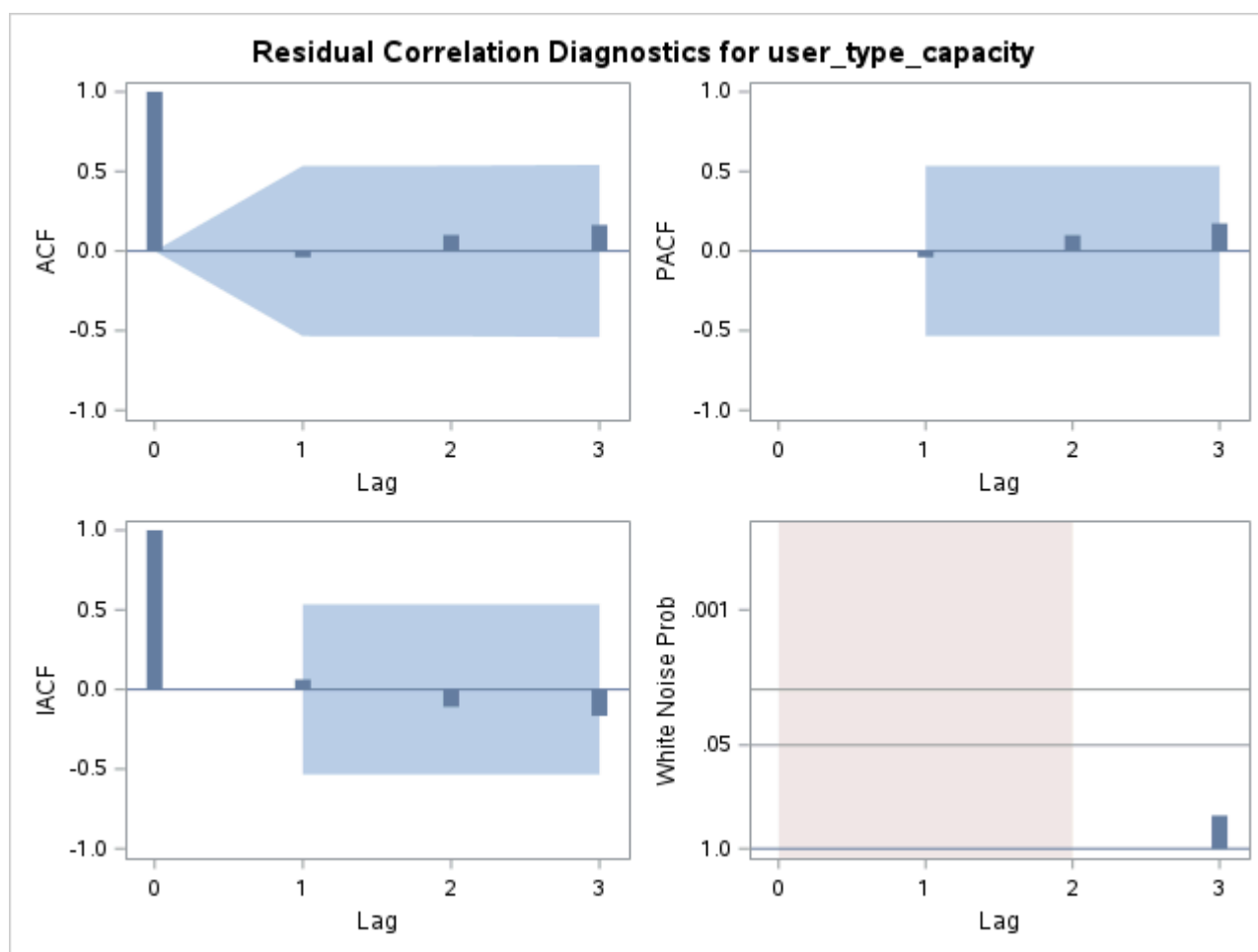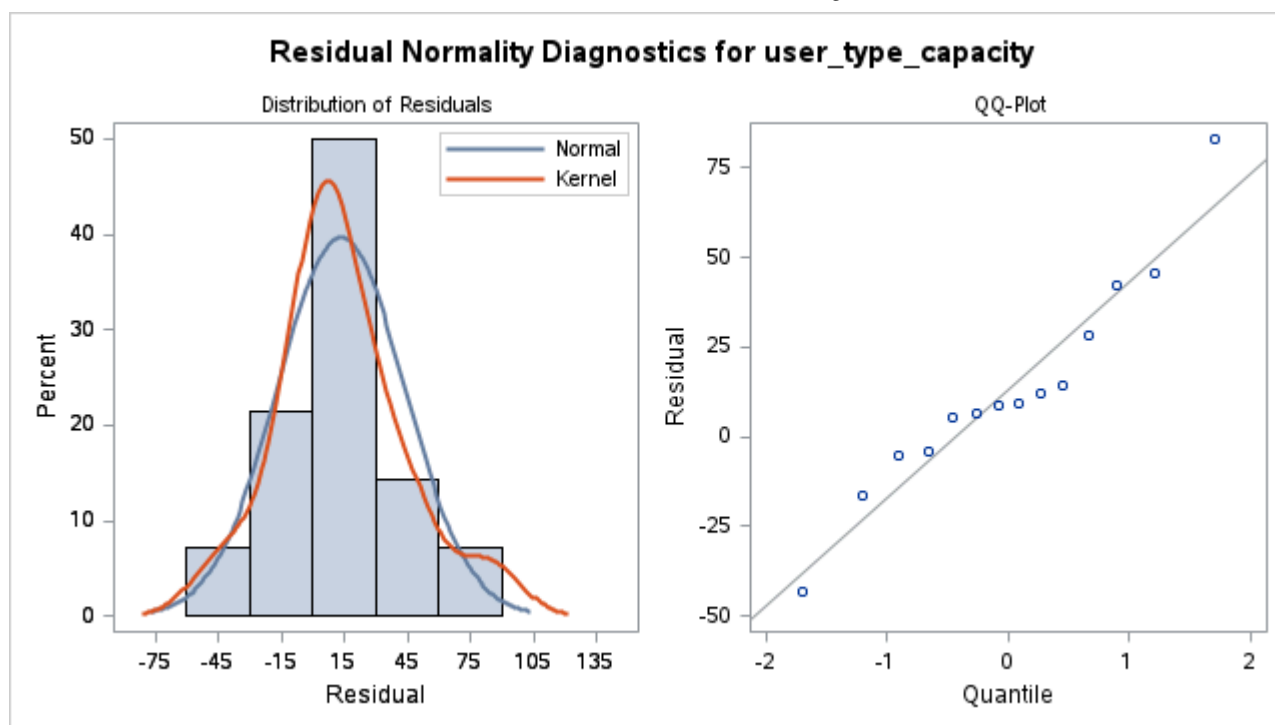
Model for variable user_type_capacity	
Estimated Mean	43.3567

Autoregressive Factors	
Factor 1:	1 - 1 B**(1)

Moving Average Factors	
Factor 1:	1 + 0.62806 B**(1)

Forecasts for variable user_type_capacity				
Obs	Forecast	Std Error	95% Confidence Limits	
15	347.2669	36.0636	276.5835	417.9503
16	347.2665	68.9050	212.2153	482.3178
17	347.2661	90.5273	169.8358	524.6964

Forecasts for user_type_capacity
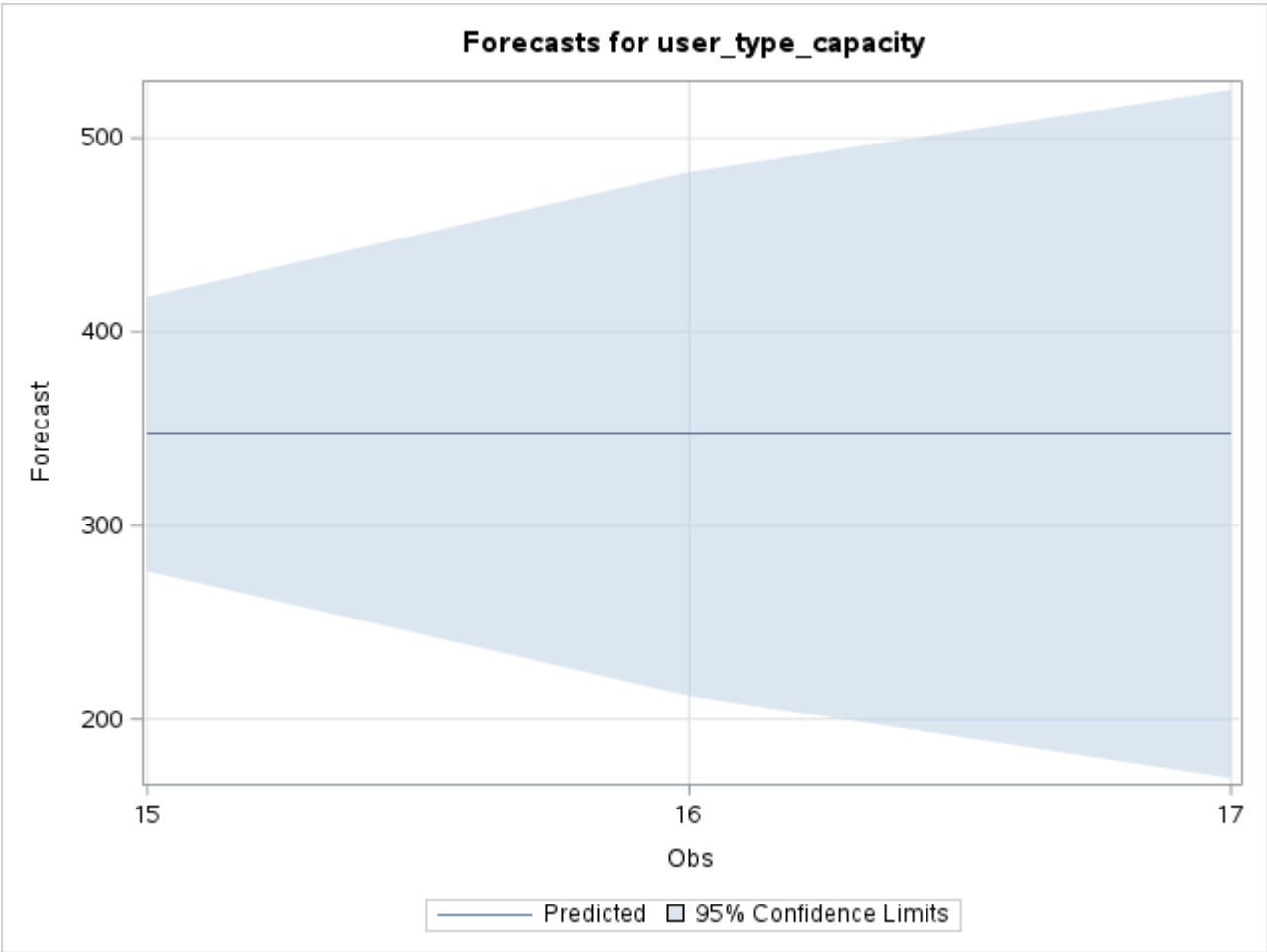
Solar PV Capacity Predictions for 2022-2024 (Linear Model)

Obs	year	time	predicted_capacity_linear	lower_bound	upper_bound
1	2022	15	550.6	553.9	547.3
2	2023	16	589.5	592.8	586.2
3	2024	17	628.4	631.7	625.1

Solar PV Capacity Predictions for 2022-2024 (Polynomial Model)

Obs	year	time	predicted_capacity_poly
1	2022	15	591.3
2	2023	16	701.7
3	2024	17	821.5

Linear Model Forecast with Confidence Bounds

Year	Predicted Capacity	Lower Bound	Upper Bound
6069	1768.4	1778.3	1758.6

Correlation Analysis: Capacity vs Number of Installations

2 Variables:	user_type_capacity total_installations

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
user_type_capacity	14	101.25714	126.30373	1418	0.30000	341.60000
total_installations	14	1583	1692	22161	30.00000	4585

Pearson Correlation Coefficients, N = 14
Prob > |r| under H0: Rho=0

	user_type_capacity	total_installations
user_type_capacity	1.00000	0.99271 <.0001
total_installations	0.99271 <.0001	1.00000

Solar PV Predictive Analysis Complete

year	time	predicted_capacity_linear	lower_bound	upper_bound
2022	15	550.584	553.870	547.297
2023	16	589.481	592.767	586.194
2024	17	628.377	631.664	625.091

Analysis completed on: 19DEC25