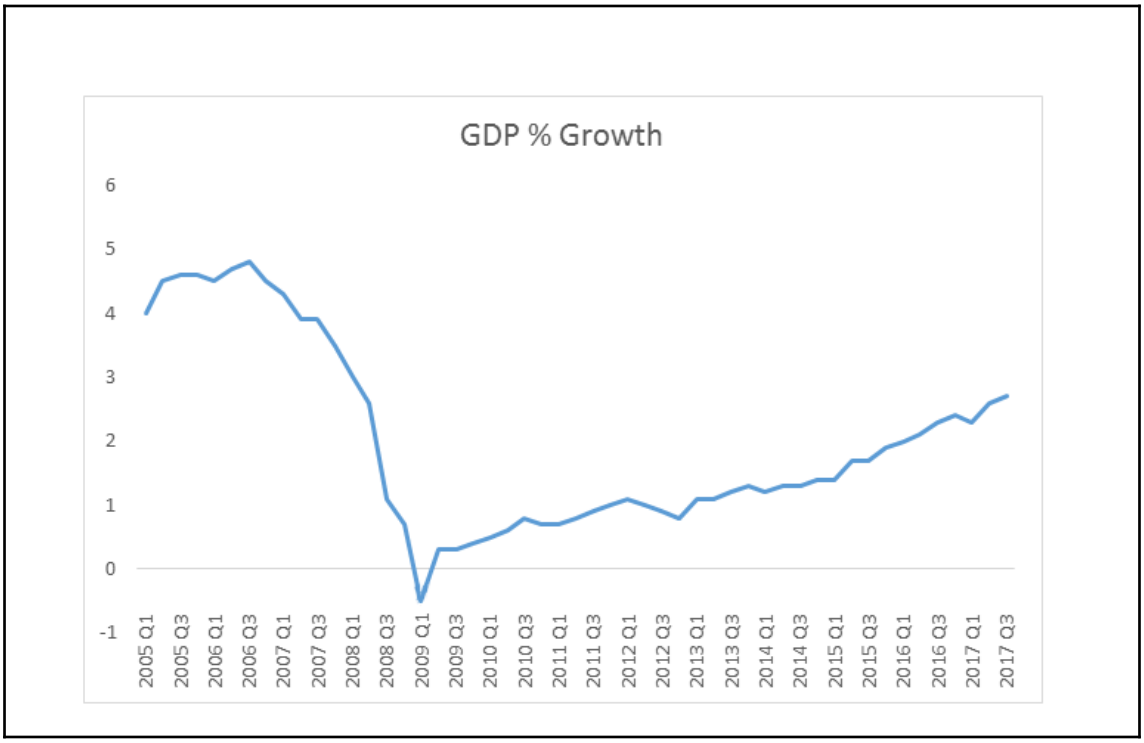
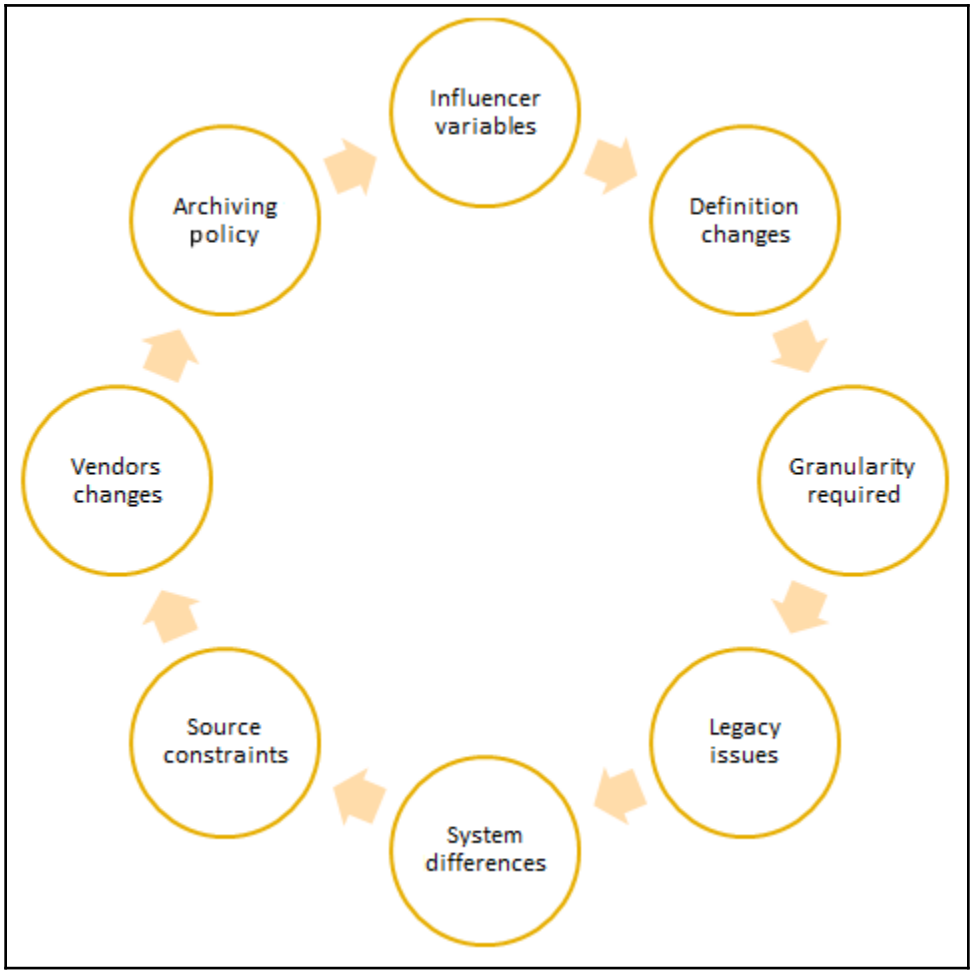
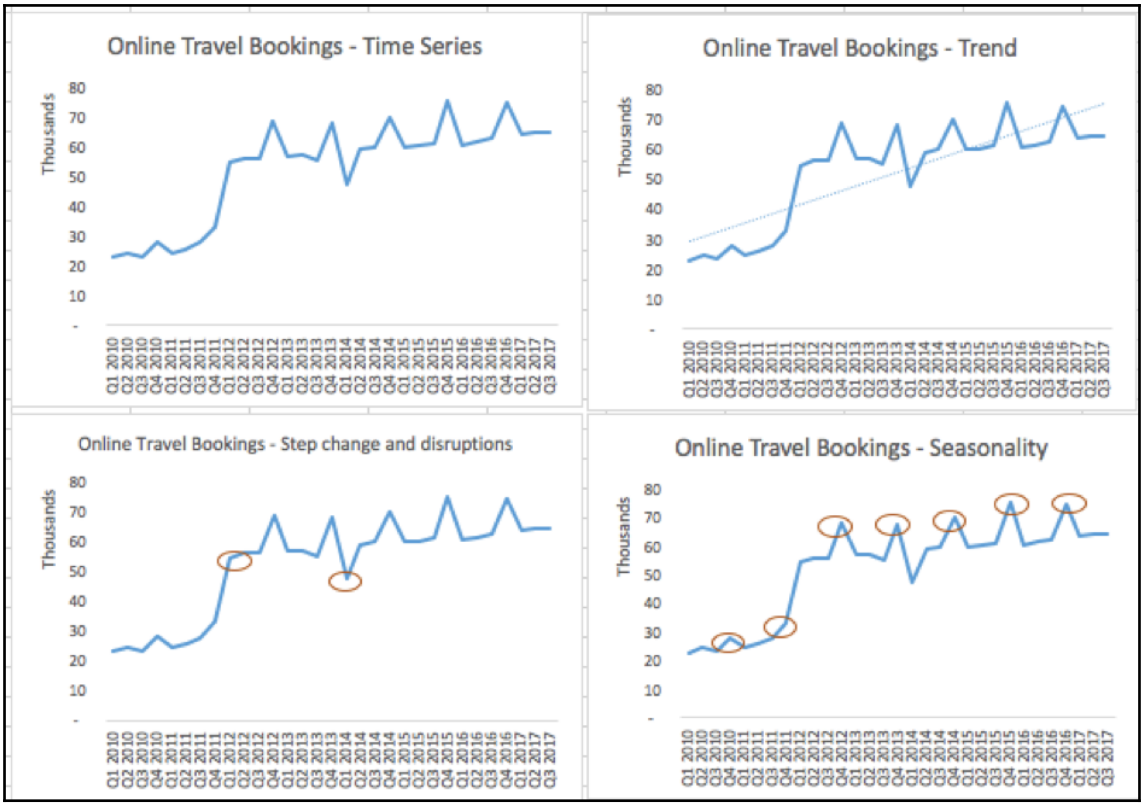
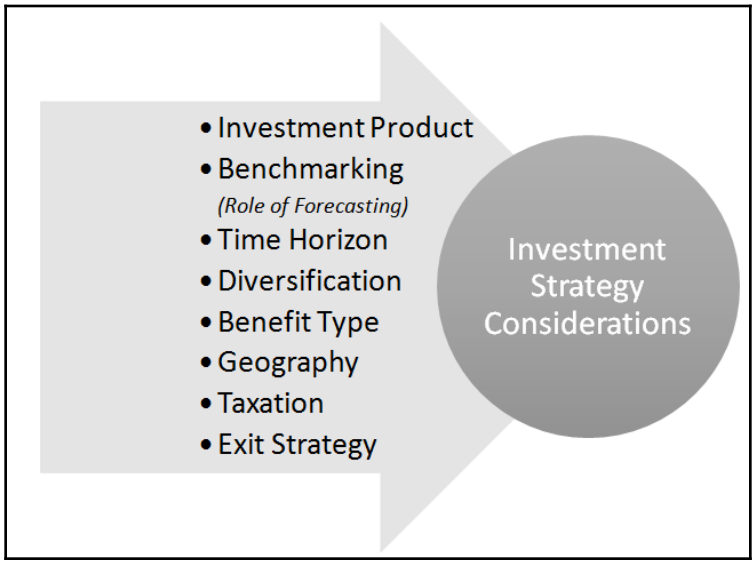
Chapter 1: Time Series Modeling in the Financial Industry

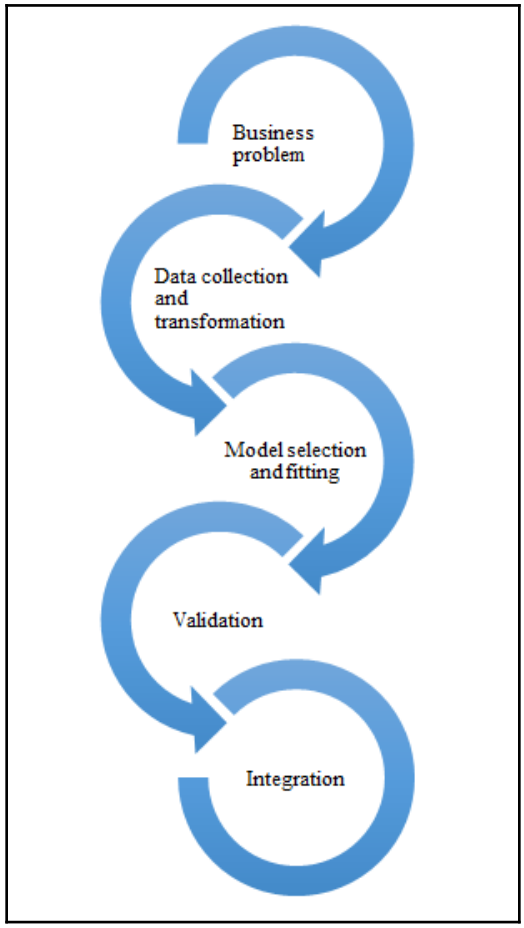


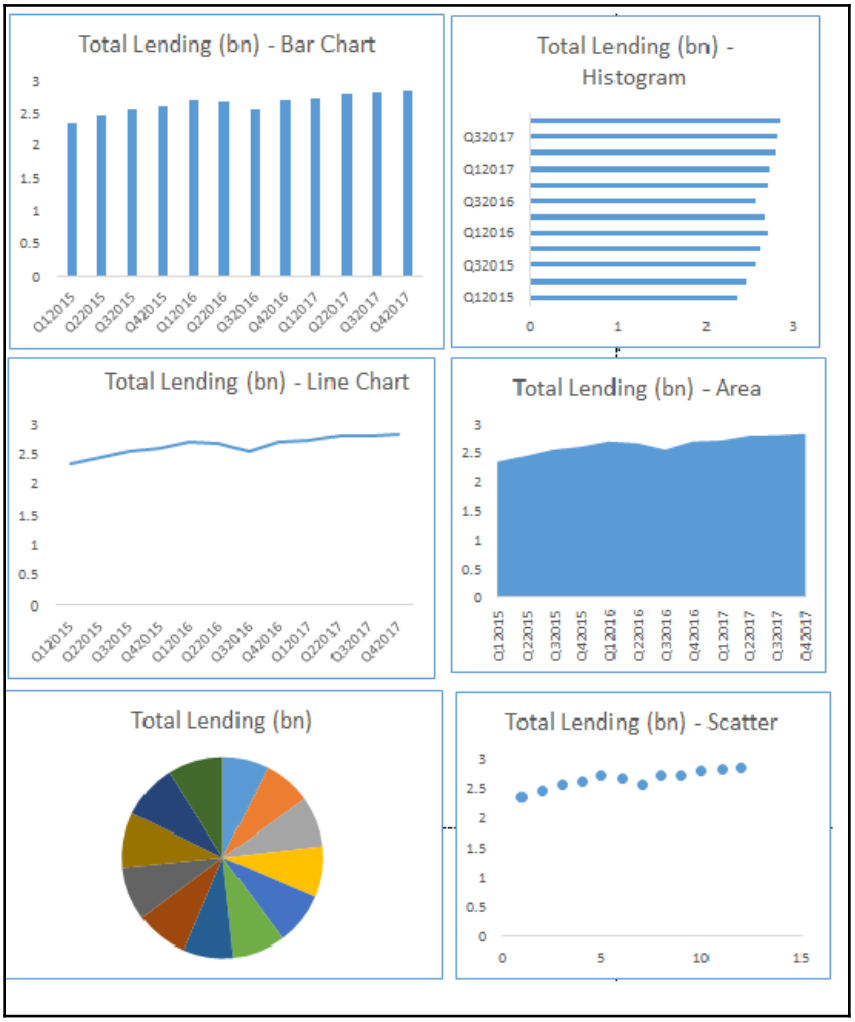

Influencer variables
Definition changes
Granularity required
Legacy issues
System differences
Source constraints
Vendors changes
Archiving policy


Online Travel Bookings - Time Series
Thousands
80
70
60
50
40
30
20
10
-
Q1 2010
Q2 2010
Q3 2010
Q4 2010
Q1 2011
Q2 2011
Q3 2011
Q4 2011
Q1 2012
Q2 2012
Q3 2012
Q4 2012
Q1 2013
Q2 2013
Q3 2013
Q4 2013
Q1 2014
Q2 2014
Q3 2014
Q4 2014
Q1 2015
Q2 2015
Q3 2015
Q4 2015
Q1 2016
Q2 2016
Q3 2016
Q4 2016
Q1 2017
Q2 2017
Q3 2017
Online Travel Bookings - Trend
Thousands
Online Travel Bookings - Step change and disruptions
Thousands
Online Travel Bookings - Seasonality
Thousands

Chapter 2: Forecasting Stock Prices and Portfolio Decisions using Time Series




Business problem
Data collection and transformation
Model selection and fitting
Validation
Integration


Total Lending (bn) - Bar Chart
3
2.5
2
1.5
1
0.5
0
Q12015
Q22015
Q32015
Q42015
Q12016
Q22016
Q32016
Q42016
Q12017
Q22017
Q32017
Q42017
Total Lending (bn) - Histogram
Q32017
Q12017
Q32016
Q12016
Q32015
Q12015
0
1
2
3
Total Lending (bn) - Line Chart
Total Lending (bn) - Area
Total Lending (bn)
Total Lending (bn) - Scatter
5
10
15

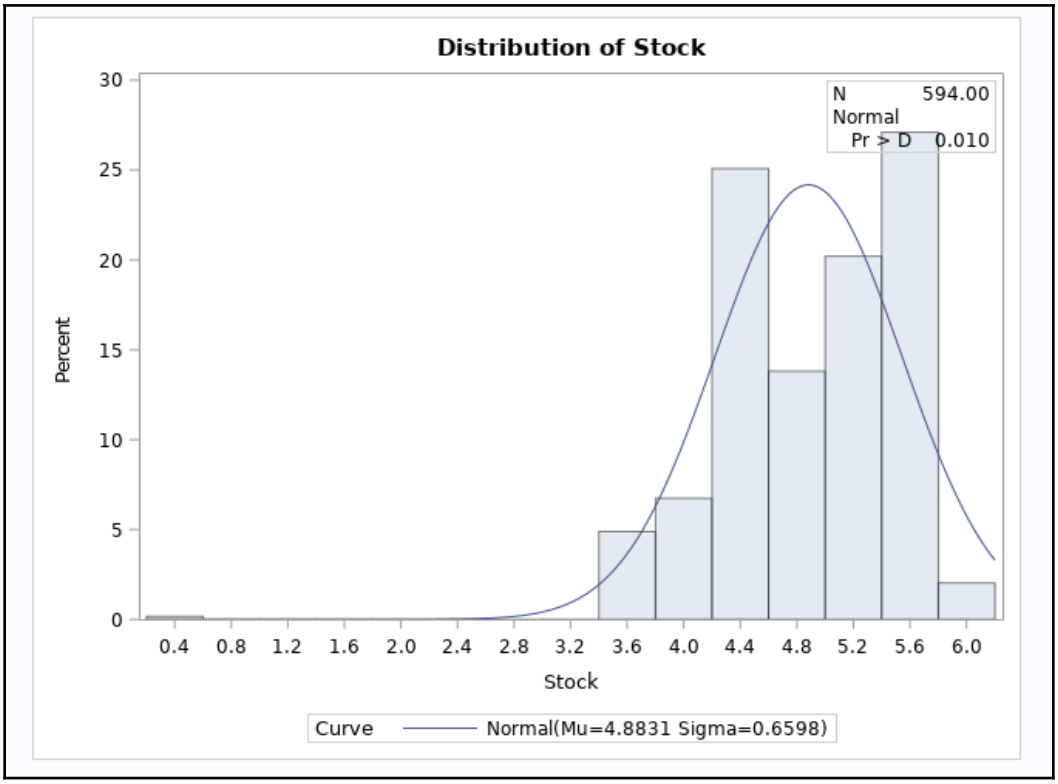
The UNIVARIATE Procedure
Variable: Stock (Stock)

Moments			
N	594	Sum Weights	594
Mean	4.88314815	Sum Observations	2900.59
Std Deviation	0.65984593	Variance	0.43539665
Skewness	-0.8858098	Kurtosis	2.62474774
Uncorrected SS	14422.2009	Corrected SS	258.190213
Coeff Variation	13.5127157	Std Error Mean	0.02707381

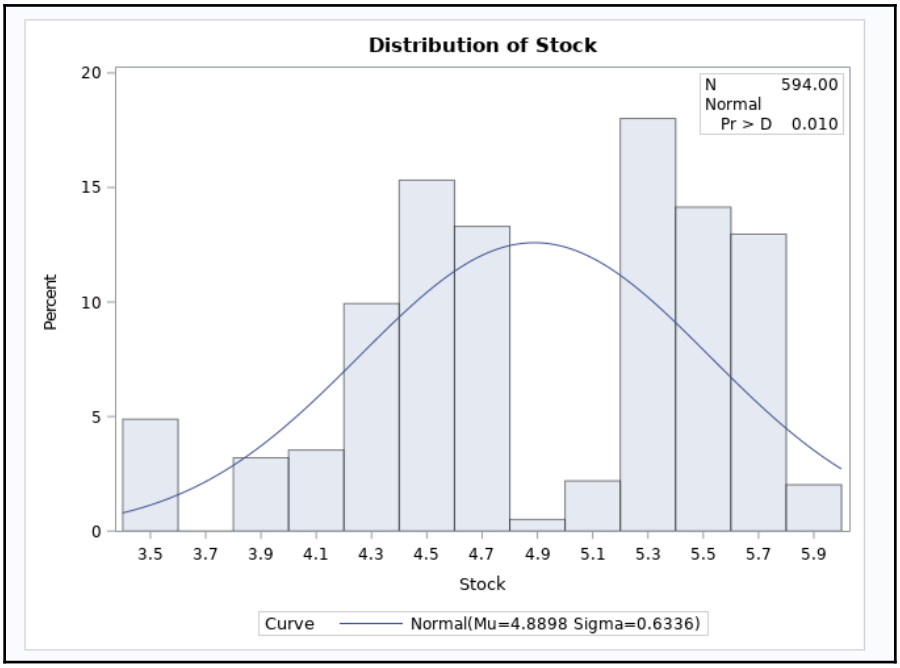
Basic Statistical Measures			
Location		Variability	
Mean	4.883148	Std Deviation	0.65985
Median	4.710000	Variance	0.43540
Mode	4.270000	Range	5.46000
		Interquartile Range	1.02000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	180.3643	Pr > |t|	<.0001
Sign	M	297	Pr >= |M|	<.0001
Signed Rank	S	88357.5	Pr >= |S|	<.0001

Extreme Observations					
Lowest			Highest		
Value	Date	Obs	Value	Date	Obs
0.37	07/13/2016	203	5.81	12/21/2017	585
3.43	11/11/2015	30	5.81	12/24/2017	588
3.43	11/06/2015	27	5.82	12/22/2017	586
3.43	11/03/2015	24	5.82	12/26/2017	589
3.43	11/02/2015	23	5.83	12/23/2017	587



Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
3.43	30	5.81	588
3.43	27	5.82	586
3.43	24	5.82	589
3.43	23	5.83	587
3.44	34	5.96	583

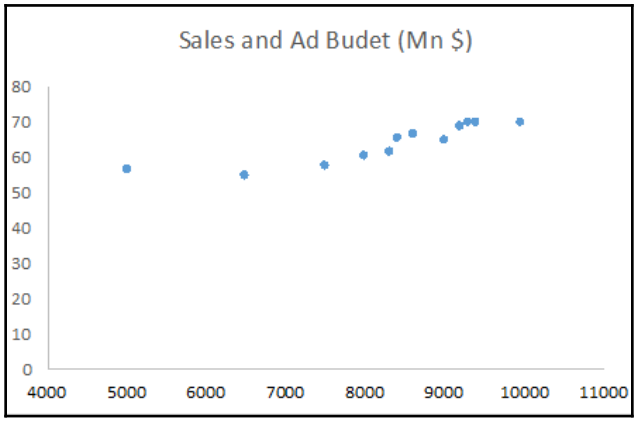


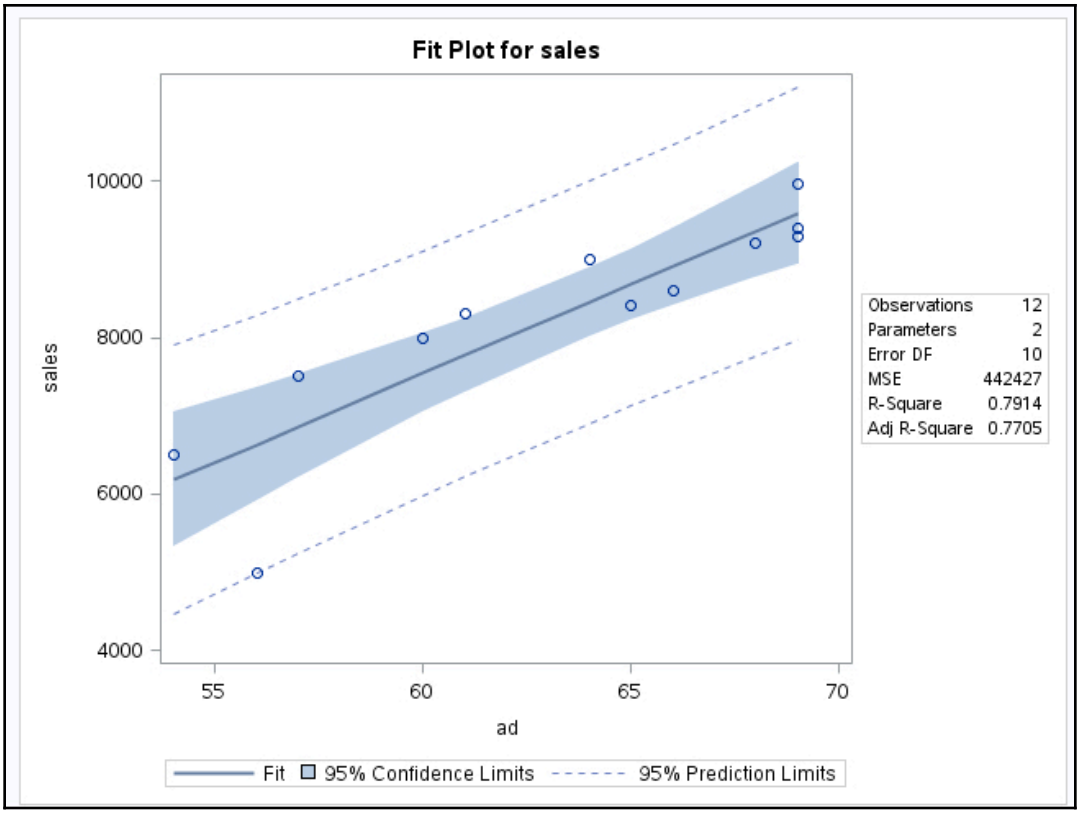
The CORR Procedure

1 With Variables:	Stock
8 Variables:	Basket_index EPS Top_10_GDP Global_mkt_share P_E_ratio Media_analytics_index Top_10_Economy_inflation M1_money_supply_index

Pearson Correlation Coefficients, N = 594
Prob > |r| under H0: Rho=0

	Basket_index	EPS	Top_10_GDP	Global_mkt_share	P_E_ratio	Media_analytics_index	Top_10_Economy_inflation	M1_money_supply_index
Stock	0.72569	0.84060	0.75606	0.67469	0.57810	0.47369	0.87673	-0.84475
Stock	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001


Sales and Ad Budet (Mn $)
80
70
60
50
40
30
20
10
0
4000
5000
6000
7000
8000
9000
10000
11000


Fit Plot for sales
sales
10000
8000
6000
4000
55
60
65
70
ad
Observations 12
Parameters 2
Error DF 10
MSE 442427
R-Square 0.7914
Adj R-Square 0.7705
Fit
95% Confidence Limits
95% Prediction Limits

The REG Procedure
Model: MODEL1
Dependent Variable: Stock Stock

Number of Observations Read	564
Number of Observations Used	564

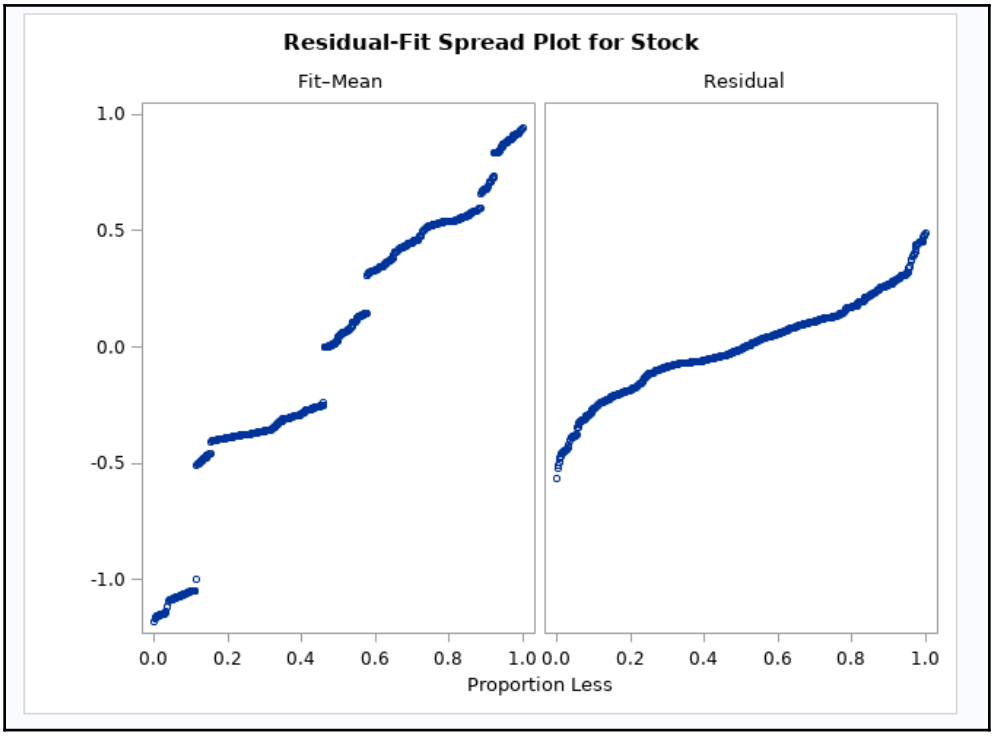
Analysis of Variance

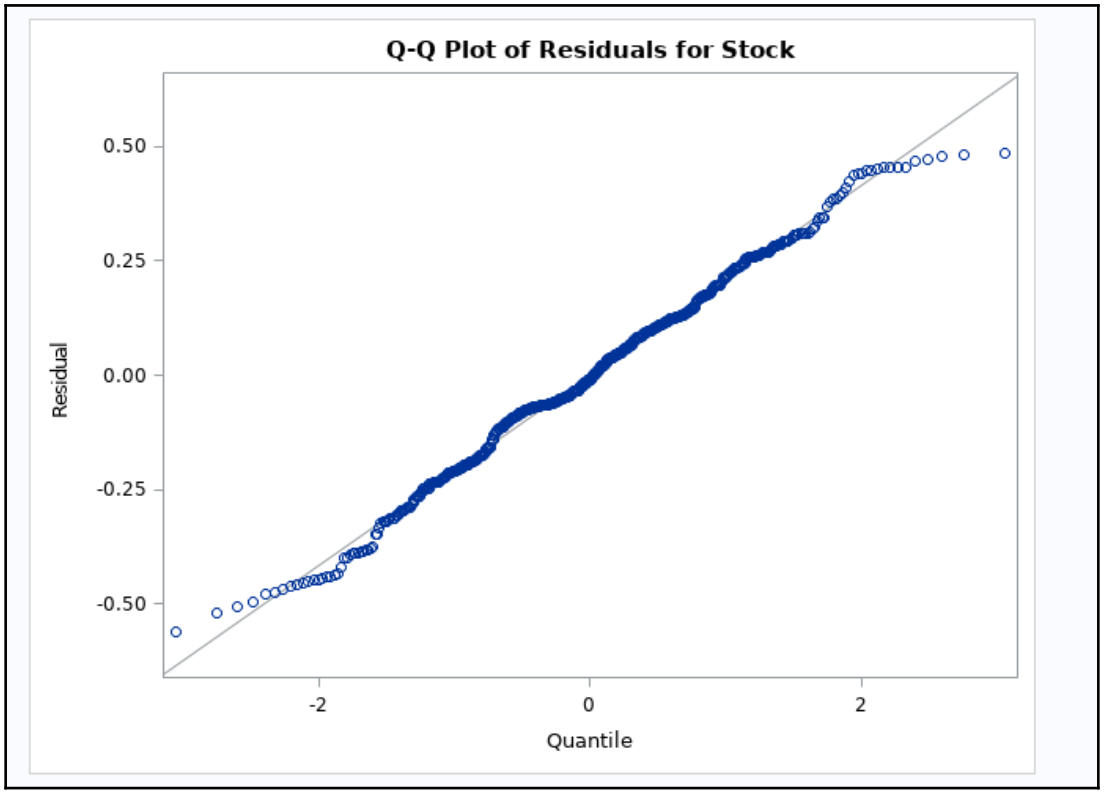
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	188.80094	23.60012	541.20	<.0001
Error	555	24.20194	0.04361		
Corrected Total	563	213.00287			

Root MSE	0.20882	R-Square	0.8864
Dependent Mean	4.84254	Adj R-Sq	0.8847
Coeff Var	4.31227		

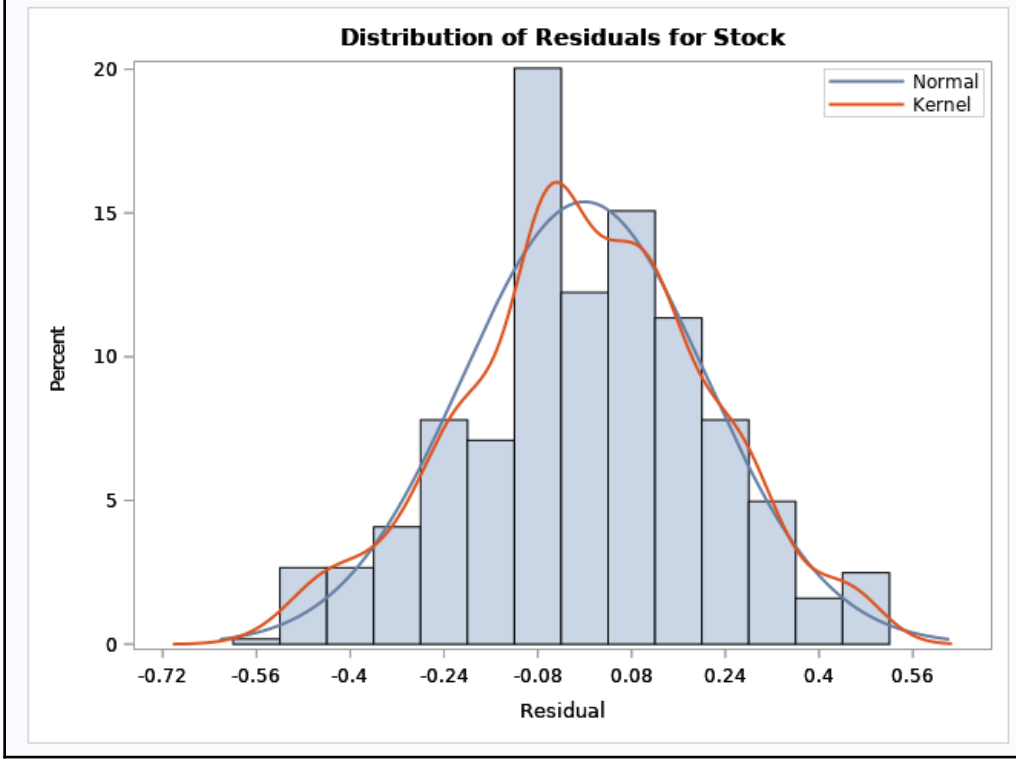
Parameter Estimates

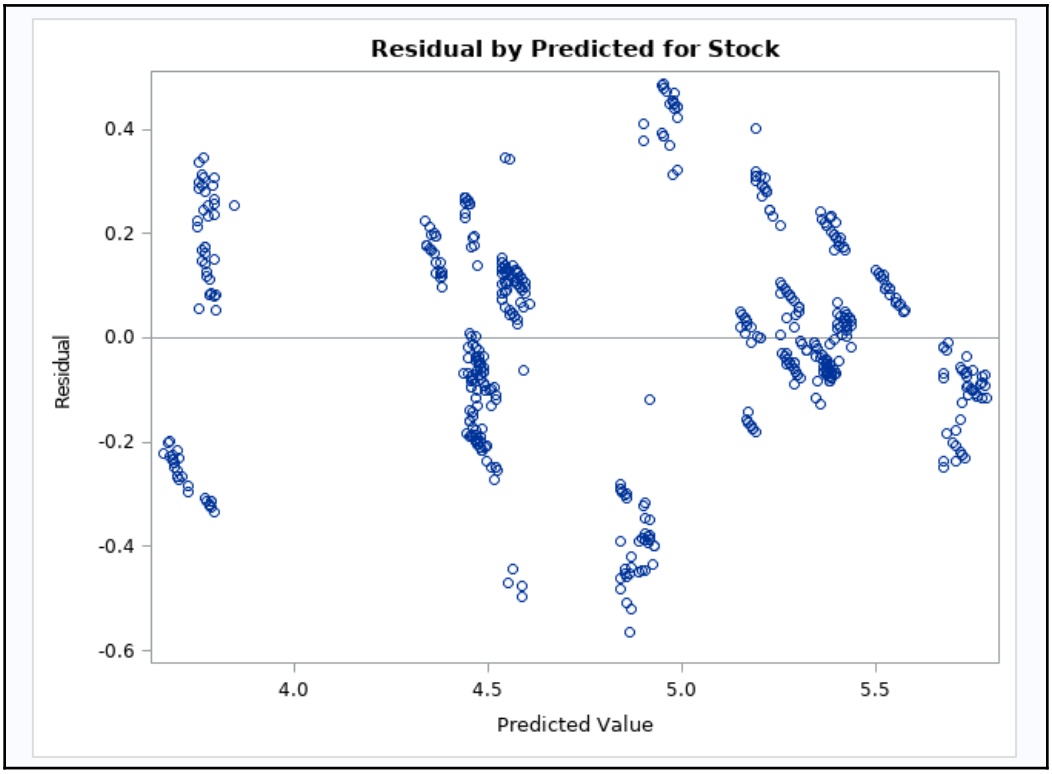
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-2.98841	4.46899	-0.67	0.5040
Basket_index	Basket_index	1	-0.00578	0.00234	-2.47	0.0137
EPS	EPS	1	1.63835	0.16086	10.19	<.0001
Top_10_GDP	Top_10_GDP	1	0.29955	0.11731	2.55	0.0109
Global_mkt_share	Global_mkt_share	1	103.61091	23.89472	4.34	<.0001
P_E_ratio	P_E_ratio	1	-0.12295	0.01067	-11.52	<.0001
Media_analytics_index	Media_analytics_index	1	0.01439	0.00223	6.46	<.0001
Top_10_Economy_inflation	Top_10_Economy_inflation	1	-1.28481	0.28964	-4.44	<.0001
M1_money_supply_index	M1_money_supply_index	1	-0.12957	0.00813	-15.93	<.0001

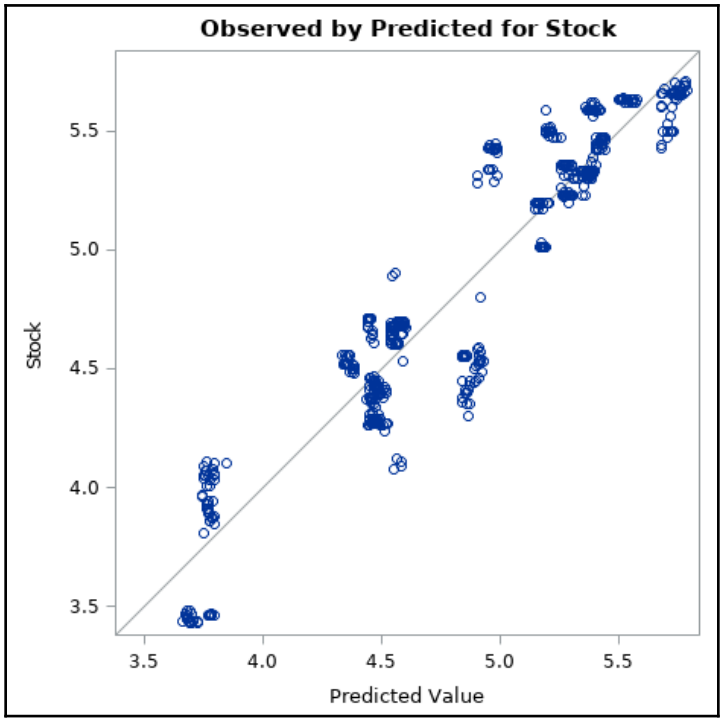

Residual-Fit Spread Plot for Stock
Fit–Mean
Residual
1.0
0.5
0.0
-0.5
-1.0
0.0
0.2
0.4
0.6
0.8
1.0
Proportion Less

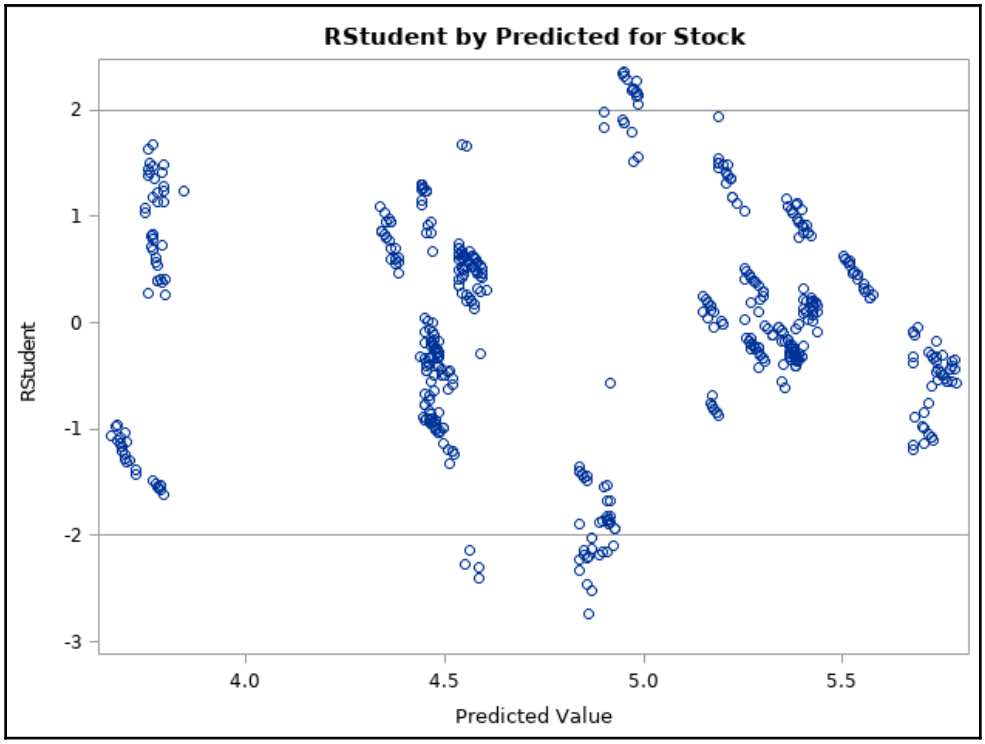

Q-Q Plot of Residuals for Stock
0.50
0.25
0.00
-0.25
-0.50
Residual
-2
0
2
Quantile

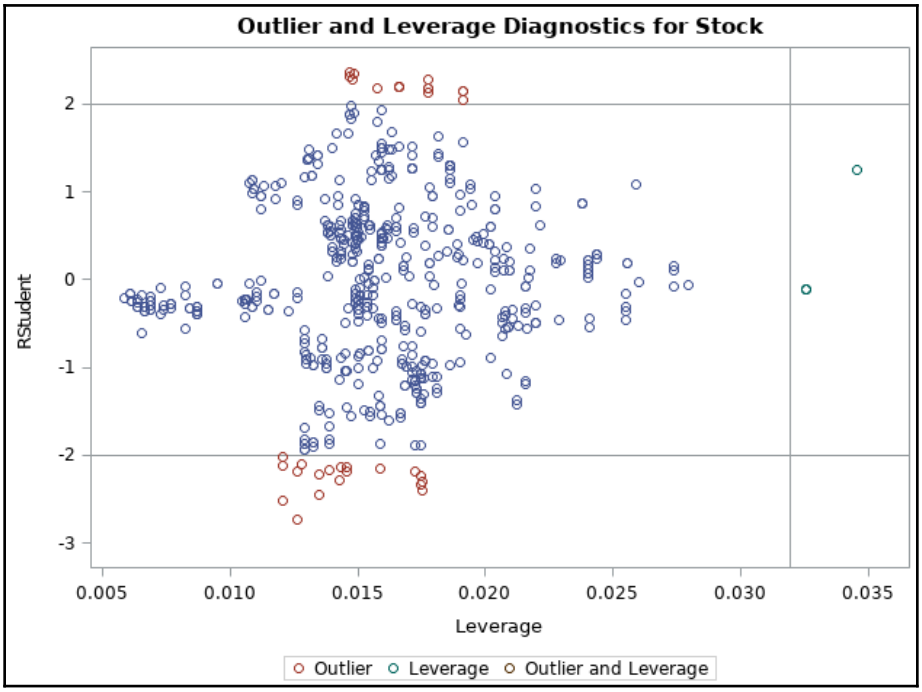
The REG Procedure
Model: MODEL1
Dependent Variable: Stock Stock

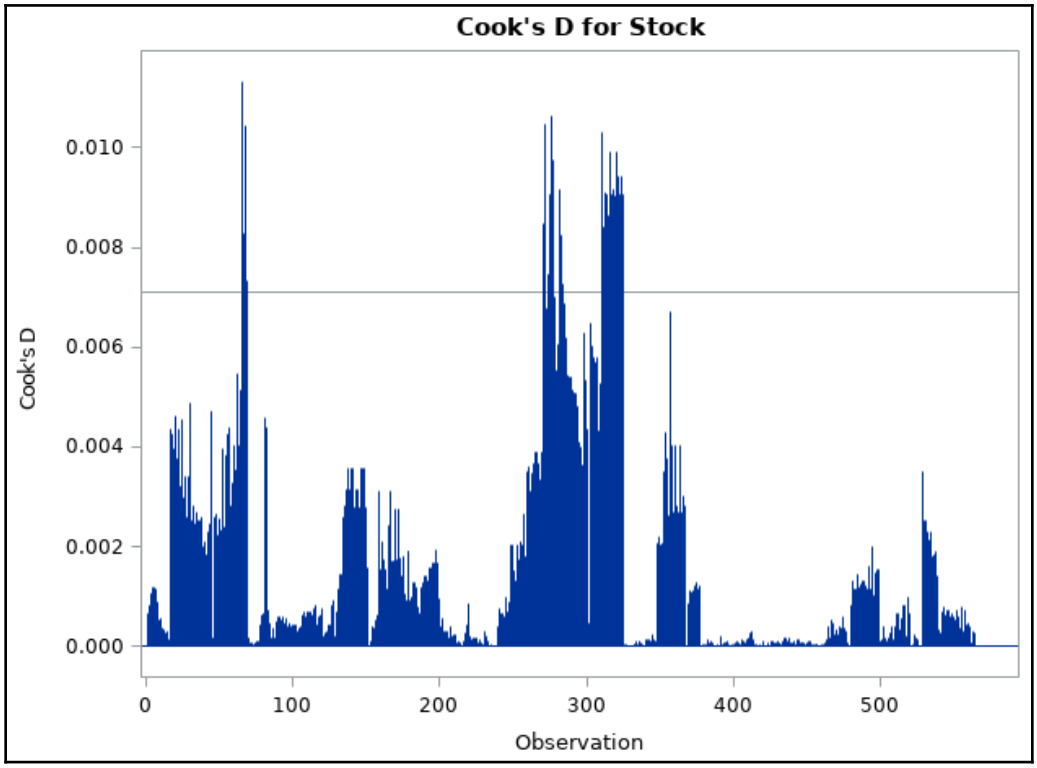


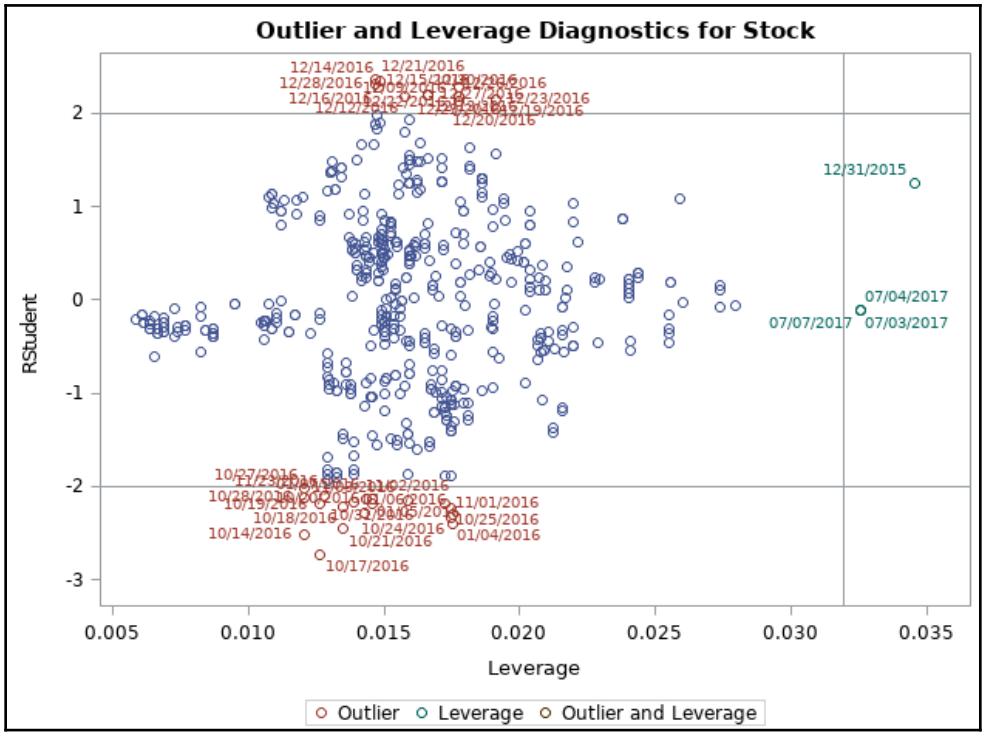

Residual by Predicted for Stock
Residual
0.4
0.2
0.0
-0.2
-0.4
-0.6
4.0
4.5
5.0
5.5
Predicted Value

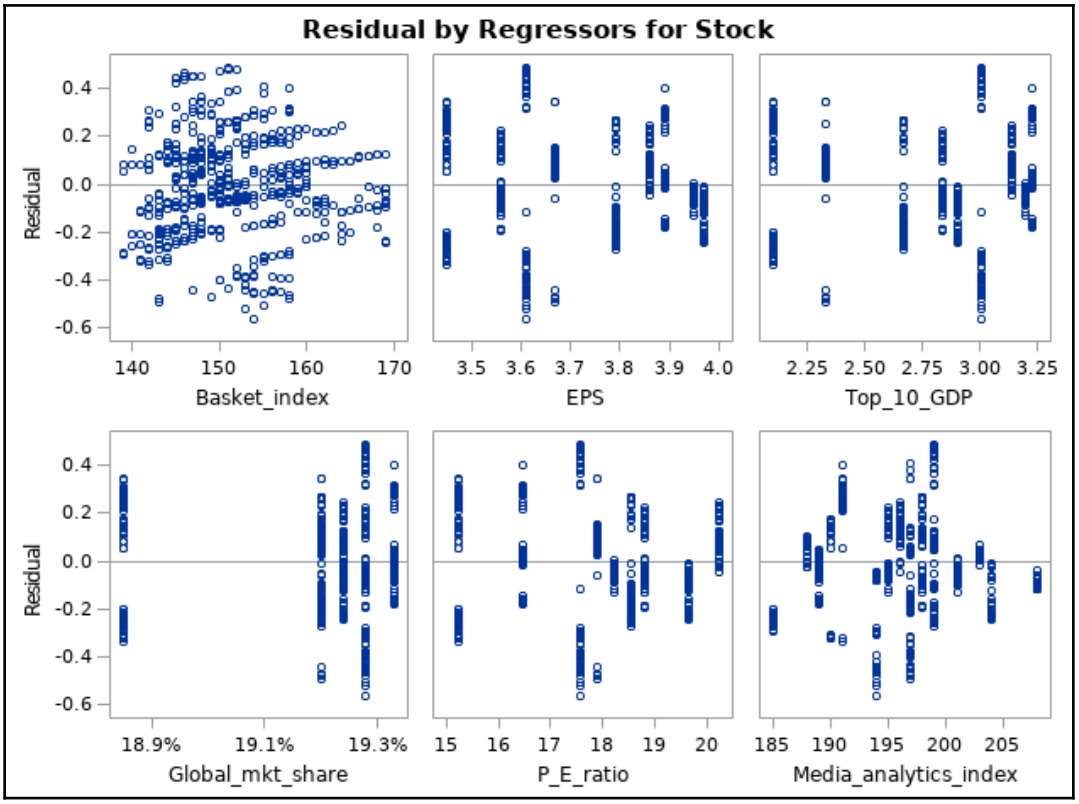

Observed by Predicted for Stock
Stock
5.5
5.0
4.5
4.0
3.5
3.5
4.0
4.5
5.0
5.5
Predicted Value

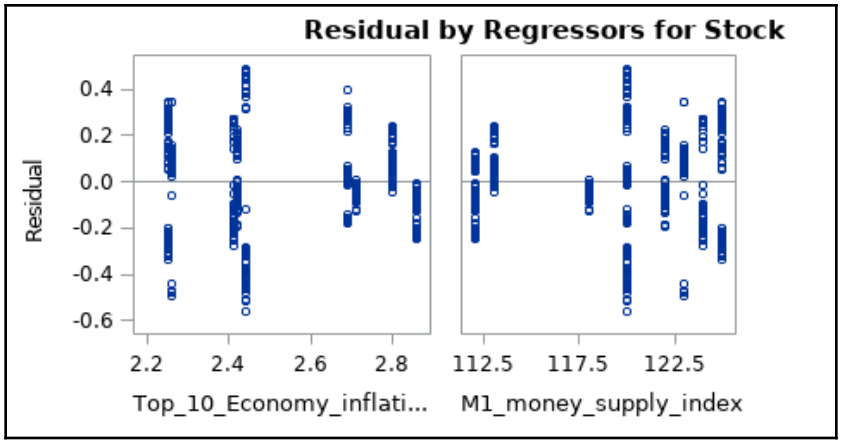

RStudent by Predicted for Stock
RStudent
2
1
0
-1
-2
-3
4.0
4.5
5.0
5.5
Predicted Value


Outlier and Leverage Diagnostics for Stock
RStudent
2
1
0
-1
-2
-3
0.005
0.010
0.015
0.020
0.025
0.030
0.035
Leverage
Outlier
Leverage
Outlier and Leverage


Cook's D for Stock
Cook's D
0.010
0.008
0.006
0.004
0.002
0.000
0
100
200
300
400
500
Observation


Outlier and Leverage Diagnostics for Stock
RStudent
Leverage
12/14/2016
12/21/2016
12/28/2016
12/16/2016
12/20/2016
12/31/2015
07/04/2017
07/07/2017
07/03/2017
10/27/2016
10/28/2016
10/19/2016
10/18/2016
10/14/2016
10/17/2016
10/21/2016
10/24/2016
10/25/2016
11/01/2016
01/04/2016
Outlier
Leverage
Outlier and Leverage


Residual by Regressors for Stock
Residual
0.4
0.2
0.0
-0.2
-0.4
-0.6
140
150
160
170
Basket_index
3.5
3.6
3.7
3.8
3.9
4.0
EPS
2.25
2.50
2.75
3.00
3.25
Top_10_GDP
18.9%
19.1%
19.3%
Global_mkt_share
15
16
17
18
19
20
P_E_ratio
185
190
195
200
205
Media_analytics_index


Residual by Regressors for Stock
Residual
0.4
0.2
0.0
-0.2
-0.4
-0.6
2.2
2.4
2.6
2.8
Top_10_Economy_inflati...
112.5
117.5
122.5
M1_money_supply_index

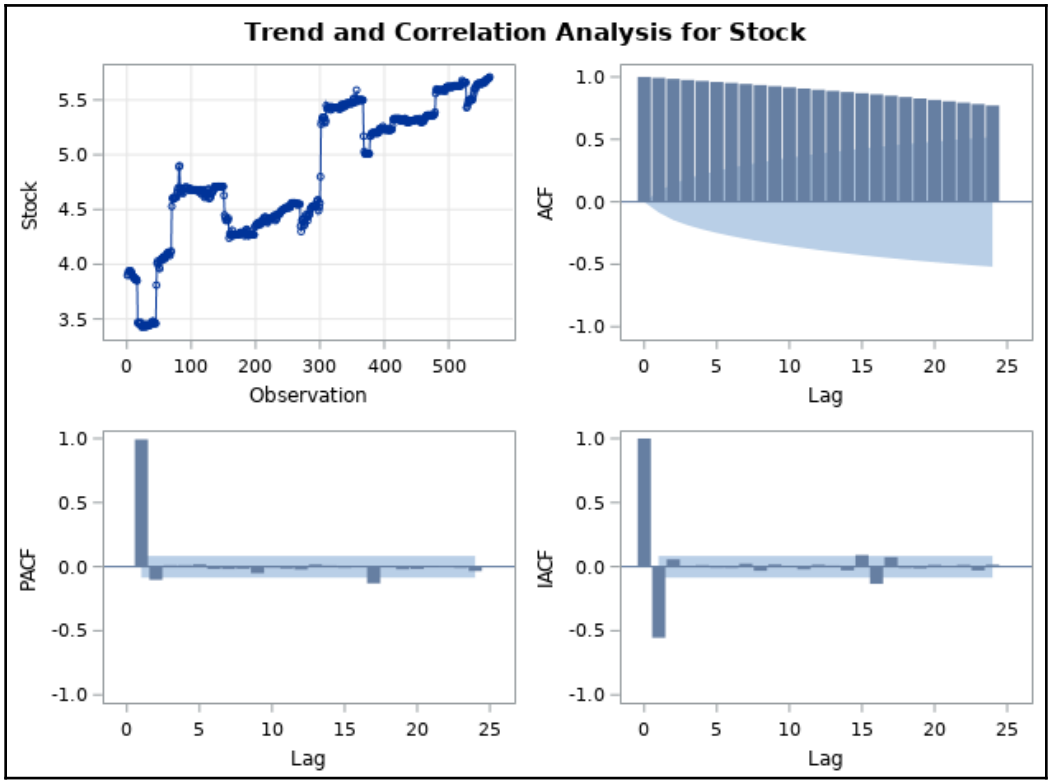
Parameter Estimates								
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Tolerance	Variance Inflation
Intercept	Intercept	1	-2.98841	4.46899	-0.67	0.5040	.	0
Basket_index	Basket_index	1	-0.00578	0.00234	-2.47	0.0137	0.30540	3.27438
EPS	EPS	1	1.63835	0.16086	10.19	<.0001	0.10049	9.95127
Top_10_GDP	Top_10_GDP	1	0.29955	0.11731	2.55	0.0109	0.03968	25.20264
Global_mkt_share	Global_mkt_share	1	103.61091	23.89472	4.34	<.0001	0.06925	14.44052
P_E_ratio	P_E_ratio	1	-0.12295	0.01067	-11.52	<.0001	0.32415	3.08500
Media_analytics_index	Media_analytics_index	1	0.01439	0.00223	6.46	<.0001	0.57829	1.72923
Top_10_Economy_inflation	Top_10_Economy_inflation	1	-1.28481	0.28964	-4.44	<.0001	0.02053	48.70007
M1_money_supply_index	M1_money_supply_index	1	-0.12957	0.00813	-15.93	<.0001	0.06544	15.28155

Parameter Estimates								
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Tolerance	Variance Inflation
Intercept	Intercept	1	-19.14146	2.63381	-7.27	<.0001	.	0
Basket_index	Basket_index	1	-0.00683	0.00236	-2.89	0.0040	0.30855	3.24098
EPS	EPS	1	1.02645	0.08412	12.20	<.0001	0.37976	2.63326
P_E_ratio	P_E_ratio	1	-0.11987	0.01083	-11.07	<.0001	0.32552	3.07200
Global_mkt_share	Global_mkt_share	1	176.10894	17.72143	9.94	<.0001	0.13013	7.68471
Media_analytics_index	Media_analytics_index	1	0.01187	0.00219	5.42	<.0001	0.61854	1.61672
M1_money_supply_index	M1_money_supply_index	1	-0.10408	0.00585	-17.79	<.0001	0.13065	7.65409
Top_10_GDP	Top_10_GDP	1	-0.12292	0.06963	-1.77	0.0780	0.11641	8.59007

The ARIMA Procedure

Name of Variable = Stock	
Mean of Working Series	4.842535
Standard Deviation	0.614544
Number of Observations	564

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	3229.48	6	<.0001	0.993	0.984	0.976	0.968	0.960	0.952
12	6160.10	12	<.0001	0.944	0.935	0.926	0.917	0.907	0.898
18	8770.20	18	<.0001	0.888	0.879	0.870	0.861	0.850	0.839
24	9999.99	24	<.0001	0.828	0.816	0.805	0.794	0.783	0.771

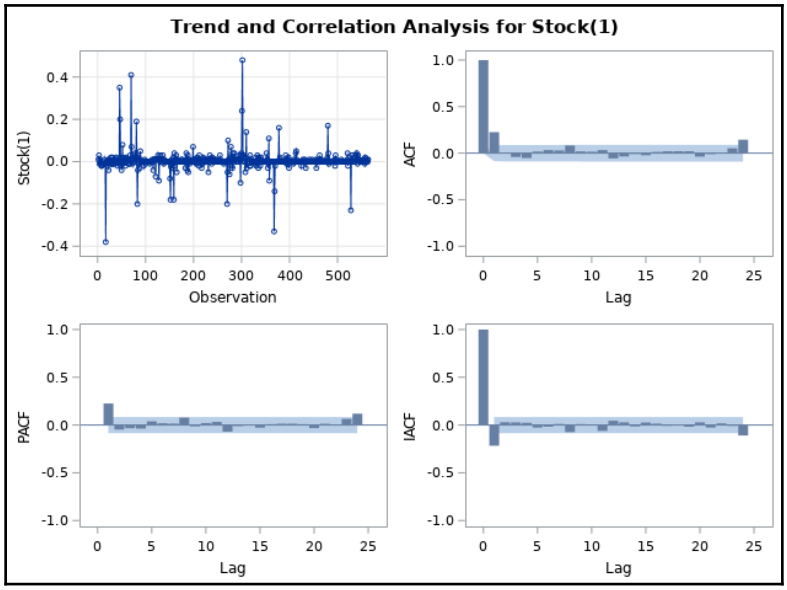


The ARIMA Procedure

Name of Variable = Stock	
Period(s) of Differencing	1
Mean of Working Series	0.003215
Standard Deviation	0.049586
Number of Observations	563
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	32.09	6	<.0001	0.226	0.006	-0.041	-0.052	0.017	0.033
12	39.21	12	<.0001	0.029	0.082	0.019	0.015	0.033	-0.056
18	40.88	18	0.0016	-0.036	-0.009	-0.023	0.013	0.020	0.021
24	55.92	24	0.0002	0.020	-0.037	-0.010	-0.005	0.052	0.144



The ARIMA Procedure

Name of Variable = Stock	
Period(s) of Differencing	1
Mean of Working Series	0.003215
Standard Deviation	0.049586
Number of Observations	563
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	32.09	6	<.0001	0.226	0.006	-0.041	-0.052	0.017	0.033
12	39.21	12	<.0001	0.029	0.082	0.019	0.015	0.033	-0.056
18	40.88	18	0.0016	-0.036	-0.009	-0.023	0.013	0.020	0.021
24	55.92	24	0.0002	0.020	-0.037	-0.010	-0.005	0.052	0.144

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.0032194	0.0025527	1.26	0.2078	0
MA1,1	-0.16718	0.18008	-0.93	0.3536	1
AR1,1	0.06783	0.18220	0.37	0.7098	1

Constant Estimate	0.003001
Variance Estimate	0.002342
Std Error Estimate	0.048394
AIC	-1809.24
SBC	-1796.24
Number of Residuals	563

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates			
Parameter	MU	MA1,1	AR1,1
MU	1.000	0.000	0.000
MA1,1	0.000	1.000	0.973
AR1,1	0.000	0.973	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	2.70	4	0.6099	0.000	-0.002	-0.030	-0.051	0.023	0.026
12	9.86	10	0.4526	0.004	0.081	-0.001	0.005	0.046	-0.062
18	10.92	16	0.8142	-0.023	0.003	-0.027	0.016	0.014	0.012
24	24.72	22	0.3108	0.027	-0.044	0.001	-0.012	0.023	0.142
30	33.33	28	0.2238	-0.008	-0.027	-0.022	0.044	-0.105	-0.017
36	38.43	34	0.2758	-0.015	-0.065	0.047	-0.003	0.029	-0.031
42	41.74	40	0.3953	-0.055	0.026	-0.014	-0.035	0.016	-0.003
48	43.02	46	0.5979	-0.004	0.007	-0.004	-0.014	-0.023	-0.036

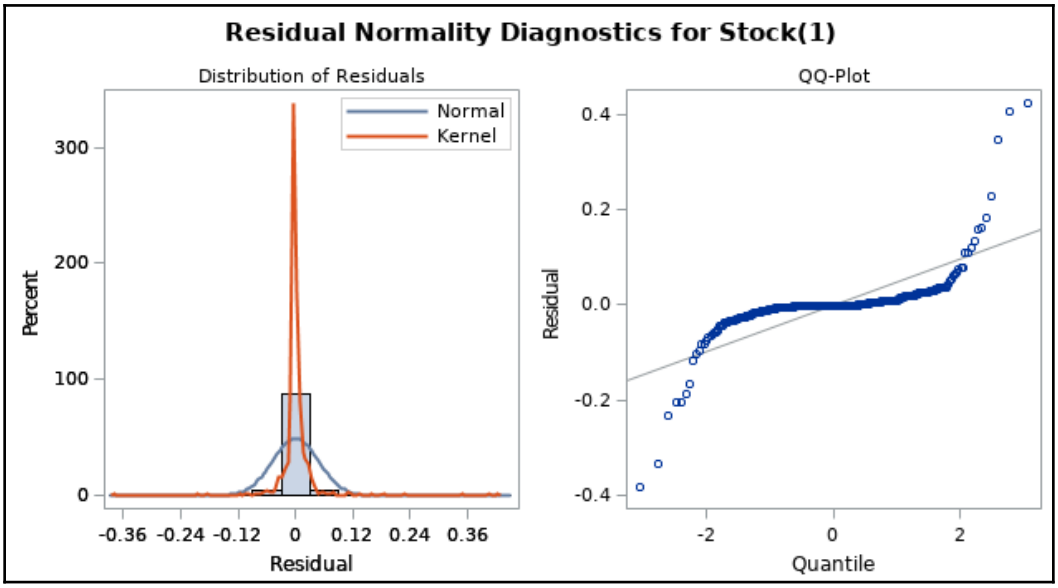
Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.0032230	0.0026320	1.22	0.2213	0
AR1,1	0.22557	0.04113	5.48	<.0001	1

Constant Estimate	0.002496
Variance Estimate	0.002342
Std Error Estimate	0.048394
AIC	-1810.23
SBC	-1801.57
Number of Residuals	563

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates		
Parameter	MU	AR1,1
MU	1.000	0.000
AR1,1	0.000	1.000

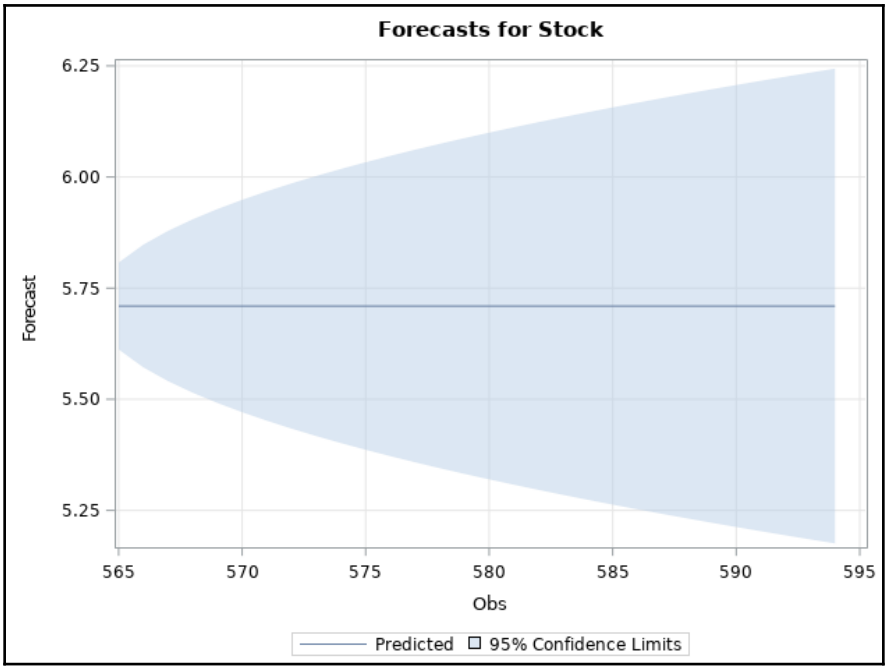
Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	3.75	5	0.5860	0.011	-0.037	-0.034	-0.052	0.023	0.026
12	10.81	11	0.4595	0.005	0.080	-0.002	0.005	0.046	-0.062
18	11.90	17	0.8059	-0.024	0.004	-0.026	0.015	0.014	0.013
24	26.03	23	0.2996	0.026	-0.043	-0.001	-0.015	0.024	0.143
30	34.59	29	0.2185	-0.007	-0.034	-0.018	0.044	-0.103	-0.017
36	39.56	35	0.2737	-0.014	-0.064	0.046	0.002	0.029	-0.033
42	42.95	41	0.3875	-0.056	0.028	-0.013	-0.036	0.017	-0.001
48	44.25	47	0.5871	-0.004	0.007	-0.003	-0.013	-0.023	-0.036

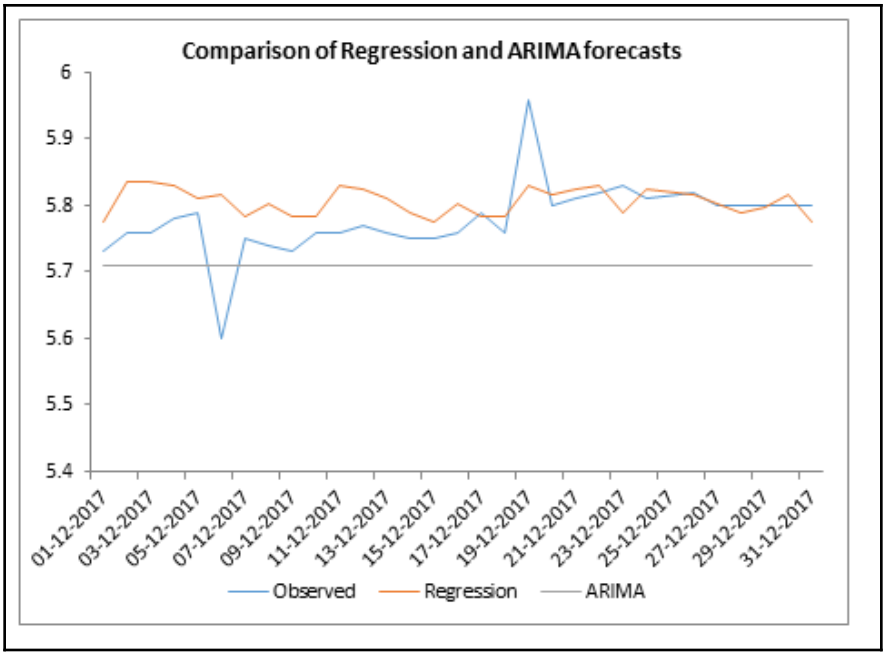


SCAN Chi-Square[1] Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
AR 1	<.0001	0.7628	0.4551	0.3126	0.5938	0.3720
AR 2	0.3163	0.4193	0.4363	0.3563	0.3759	0.7795
AR 3	0.5050	0.8714	0.3428	0.7151	0.4607	0.5666
AR 4	0.4533	0.3888	0.4282	0.4923	0.5699	0.2473
AR 5	0.3054	0.3326	0.4191	0.4243	0.3116	0.3619

ARMA(p+d,q) Tentative Order Selection Tests	
SCAN	
p+d	q
1	1
2	0

(5% Significance Level)


Forecasts for Stock
6.25
6.00
5.75
5.50
5.25
Forecast
565
570
575
580
585
590
595
Obs
Predicted
95% Confidence Limits


Comparison of Regression and ARIMA forecasts
6
5.9
5.8
5.7
5.6
5.5
5.4
01-12-2017
03-12-2017
05-12-2017
07-12-2017
09-12-2017
11-12-2017
13-12-2017
15-12-2017
17-12-2017
19-12-2017
21-12-2017
23-12-2017
25-12-2017
27-12-2017
29-12-2017
31-12-2017
Observed
Regression
ARIMA

	Portfolio Value of $1 Mn Investment			% Gain by Estimated Methodology	
	Observed	Regression	ARIMA	Regression	ARIMA
01/12/2017	5,730,000	5,775,297	5,710,000	-0.79%	1.13%
02/12/2017	5,760,000	5,836,741	5,710,000	-1.33%	2.17%
03/12/2017	5,760,000	5,836,741	5,710,000	-1.33%	2.17%
04/12/2017	5,780,000	5,829,914	5,710,000	-0.86%	2.06%
05/12/2017	5,790,000	5,809,433	5,710,000	-0.34%	1.71%
06/12/2017	5,600,000	5,816,260	5,710,000	-3.86%	1.83%
07/12/2017	5,750,000	5,782,124	5,710,000	-0.56%	1.25%
08/12/2017	5,740,000	5,802,606	5,710,000	-1.09%	1.60%
09/12/2017	5,730,000	5,782,124	5,710,000	-0.91%	1.25%
10/12/2017	5,760,000	5,782,124	5,710,000	-0.38%	1.25%
11/12/2017	5,760,000	5,829,914	5,710,000	-1.21%	2.06%
12/12/2017	5,770,000	5,823,087	5,710,000	-0.92%	1.94%
13/12/2017	5,760,000	5,809,433	5,710,000	-0.86%	1.71%
14/12/2017	5,750,000	5,788,952	5,710,000	-0.68%	1.36%
15/12/2017	5,750,000	5,775,297	5,710,000	-0.44%	1.13%
16/12/2017	5,760,000	5,802,606	5,710,000	-0.74%	1.60%
17/12/2017	5,790,000	5,782,124	5,710,000	0.14%	1.25%
18/12/2017	5,760,000	5,782,124	5,709,999	-0.38%	1.25%
19/12/2017	5,960,000	5,829,914	5,709,999	2.18%	2.06%
20/12/2017	5,800,000	5,816,260	5,709,999	-0.28%	1.83%
21/12/2017	5,810,000	5,823,087	5,709,999	-0.23%	1.94%
22/12/2017	5,820,000	5,829,914	5,709,999	-0.17%	2.06%
23/12/2017	5,830,000	5,788,952	5,709,999	0.70%	1.36%
24/12/2017	5,810,000	5,823,087	5,709,999	-0.23%	1.94%
26/12/2017	5,820,000	5,816,260	5,709,999	0.06%	1.83%
27/12/2017	5,800,000	5,802,606	5,709,999	-0.04%	1.60%
28/12/2017	5,800,000	5,788,952	5,709,999	0.19%	1.36%
29/12/2017	5,800,000	5,795,779	5,709,999	0.07%	1.48%
30/12/2017	5,800,000	5,816,260	5,709,999	-0.28%	1.83%
31/12/2017	5,800,000	5,775,297	5,709,999	0.43%	1.13%

Chapter 3: Credit Risk Management

Link	Customer	Account	Date	Year	Default_date	Cure_date	Re_default_date
5182106	5182106	518225	02.07.2012	2012			
5182106	5182106	51821	03.06.2013	2013			
5182106	5182106	518273	08.06.2014	2014	08.06.2014	13.05.2015	
5182106	5182106	518296	09.06.2015	2015			
5182106	5182106	518263	31.03.2016	2016			
5182106	5182106	518211	30.06.2017	2017			
1608830	1608830	160894	06.02.2012	2012			
1608830	1608830	160818	07.12.2013	2013	07.12.2013	05.01.2014	05.12.2015
1608830	1608830	16089	04.12.2014	2014			
1608830	1608830	160843	05.12.2015	2015	05.12.2015		
1608830	1608830	160846	30.12.2016	2016			
1608830	1608830	160825	5.03.2017	2017			
5182106	6161840	616135	05.01.2014	2014			
5182106	6161840	616134	05.01.2015	2015			
6161840	6161840	616179	02.12.2016	2016			
8603912	8603912	860379	01.07.2009	2009			
8603912	8603912	860347	08.08.2010	2010			

Customer	Date	Utilisation	Limit	Borrowing	LTV	Collateral	Collateral type	Portfolio value	Borrowing portfolio ratio	Postcode index	Customer type	Arrears
5182106	02.07.2012	0.66	1287187	849,543	2.08	407,953	Guarantee	8,655,769	0.10	91	Overseas	1
5182106	03.06.2013	0.24	1545673	365,000	1.97	185,481	Guarantee	8,655,769	0.02	91	Overseas	1
5182106	08.06.2014	1.02	1324381	1,354,004	2.00	675,434	Guarantee	8,655,769	0.10	91	Overseas	0
5182106	09.06.2015	0.68	1545673	1,051,058	1.19	881,034	Guarantee	8,655,769	0.12	91	Overseas	0
5182106	31.03.2016	0.38	1545673	587,356	1.90	309,135	Guarantee	8,655,769	0.07	91	Overseas	0
5182106	30.06.2017	0.71	1545673	1,097,428	1.87	587,356	Guarantee	8,655,769	0.13	91	Overseas	0
1608830	06.02.2012	0.74	247086	182,844	2.85	64,242	Cash	1,823,118	0.10	78	Investor	0
1608830	07.12.2013	0.50	792660	396,330	1.25	317,064	Cash	1,823,118	0.22	78	Investor	0
1608830	04.12.2014	0.81	792660	642,055	2.19	293,284	Cash	1,823,118	0.35	78	Investor	0
1608830	05.12.2015	0.49	792660	388,403	4.08	95,119	Cash	1,823,118	0.21	78	Investor	0
1608830	30.12.2016	0.45	792660	356,697	2.25	158,532	Cash	1,823,118	0.20	78	Investor	0
1608830	5.03.2017	0.56	792660	443,890	2.15	206,092	Cash	1,823,118	0.24	78	Investor	0
6161840	05.01.2014	0.70	1503274	1,052,292	1.92	546,745	Stocks	4,839,078	0.22	71	Investor	1
6161840	05.01.2015	0.70	1237320	866,124	2.00	433,000	Stocks	4,839,078	0.18	71	Investor	1
6161840	02.12.2016	0.70	1385358	969,751	1.94	498,729	Stocks	4,839,078	0.20	71	Investor	0
8603912	01.07.2009	0.72	1813424	1,305,665	2.57	507,759	Cash	6,158,116	0.21	50	Overseas	0
8603912	08.08.2010	0.56	650803	364,450	1.75	208,257	Cash	6,158,116	0.06	50	Overseas	0

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-478.836	1.5438E9	-3.026E9	3.0258E9	0.00	1.0000
Utilisation		1	234.3617	1.212E9	-2.375E9	2.3754E9	0.00	1.0000
LTV		1	7.0403	70429581	-1.38E8	1.3804E8	0.00	1.0000
Collateral_type	1	1	-37.5175	1.337E9	-2.621E9	2.6206E9	0.00	1.0000
Collateral_type	2	1	-22.4757	9.1746E8	-1.798E9	1.7982E9	0.00	1.0000
Collateral_type	3	1	-28.2265	8.6701E8	-1.699E9	1.6993E9	0.00	1.0000
Collateral_type	4	0	0.0000	0.0000	0.0000	0.0000	.	.
Borrowing_portfolio_		1	72.1665	3.131E9	-6.137E9	6.1367E9	0.00	1.0000
Postcode_index		1	2.3862	22576426	-4.425E7	44248984	0.00	1.0000
Customer_type	1	1	-14.9370	9.0421E8	-1.772E9	1.7722E9	0.00	1.0000
Customer_type	2	1	10.4409	6.9651E8	-1.365E9	1.3651E9	0.00	1.0000
Customer_type	3	1	50.0915	7.6202E8	-1.494E9	1.4935E9	0.00	1.0000
Customer_type	4	1	-18.9441	8.313E8	-1.629E9	1.6293E9	0.00	1.0000
Customer_type	5	0	0.0000	0.0000	0.0000	0.0000	.	.
Arrears		1	87.6577	5.2247E8	-1.024E9	1.024E9	0.00	1.0000
Scale		0	1.0000	0.0000	1.0000	1.0000		

The GENMOD Procedure

Model Information	
Data Set	WORK.MODEL_LATEST_RECORD
Distribution	Binomial
Link Function	Logit
Dependent Variable	dflt

Number of Observations Read	139
Number of Observations Used	139
Number of Events	5
Number of Trials	139

Class Level Information		
Class	Levels	Values
Collateral_type	4	1 2 3 4
Customer_type	5	1 2 3 4 5

Response Profile		
Ordered Value	dflt	Total Frequency
1	1	5
2	0	134

The GENMOD Procedure

Model Information	
Data Set	WORK.MODEL_VALIDATION
Distribution	Binomial
Link Function	Logit
Dependent Variable	dflt
Scale Weight Variable	validation_sample

Number of Observations Read	143
Number of Observations Used	132
Sum of Weights	132
Number of Events	14
Number of Trials	132
Missing Values	11

Response Profile			
Ordered Value	dflt	Total Frequency	Total Weight
1	1	14	14
2	0	118	118

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-24.2386	8.0649	-40.0455	-8.4317	9.03	0.0027
Utilisation	1	9.2090	4.8407	-0.2787	18.6966	3.62	0.0571
LTV	1	0.8409	0.5561	-0.2489	1.9308	2.29	0.1305
Borrowing_portfolio_	1	6.2435	4.7283	-3.0237	15.5107	1.74	0.1867
Postcode_index	1	0.0789	0.0505	-0.0201	0.1779	2.44	0.1183
arrears_flag	1	5.9412	2.5582	0.9272	10.9551	5.39	0.0202
relationship_length	1	0.2609	0.2891	-0.3057	0.8274	0.81	0.3668
Scale	0	1.0000	0.0000	1.0000	1.0000		

Customers in validaiton dflt selection

Customer
3342349
6161840
8697888
12095275
35234232

Customers in validaiton non dflt selection

Customer
4232324
7567563
10870633
11228652
24123211

The MEANS Procedure

dflt=0

Variable	Label	N	Mean	Std Dev	Minimum	Maximum
Utilisation	Utilisation	123	0.5621138	0.2131160	0.0300000	0.8900000
LTV	LTV	123	2.0650402	1.3637526	0.0731707	6.5000000
Borrowing_portfolio_ratio	Borrowing_portfolio_ratio	123	0.1288171	0.1058244	0.0010996	0.5503003
Postcode_index	Postcode_index	123	73.6910569	14.0497536	50.0000000	99.0000000
arrears_flag		123	0.1626016	0.3705110	0	1.0000000
relationship_length		123	5.7235772	3.0922982	1.0000000	9.0000000

dflt=1

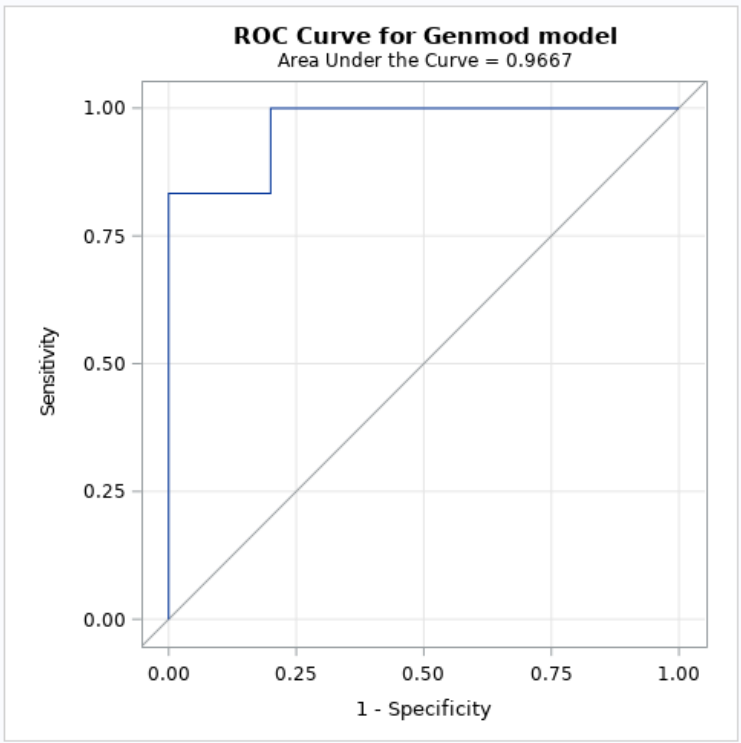
Variable	Label	N	Mean	Std Dev	Minimum	Maximum
Utilisation	Utilisation	20	0.9265674	0.2727838	0.5300000	1.8933874
LTV	LTV	20	9.2794160	17.1847257	0.2445092	67.1443259
Borrowing_portfolio_ratio	Borrowing_portfolio_ratio	20	0.4070063	0.2427159	0.1056738	0.8840264
Postcode_index	Postcode_index	20	82.3000000	11.7791073	55.0000000	98.0000000
arrears_flag		20	0.8000000	0.4103913	0	1.0000000
relationship_length		20	7.4500000	1.9861362	2.0000000	9.0000000

Prediction of validation dataset

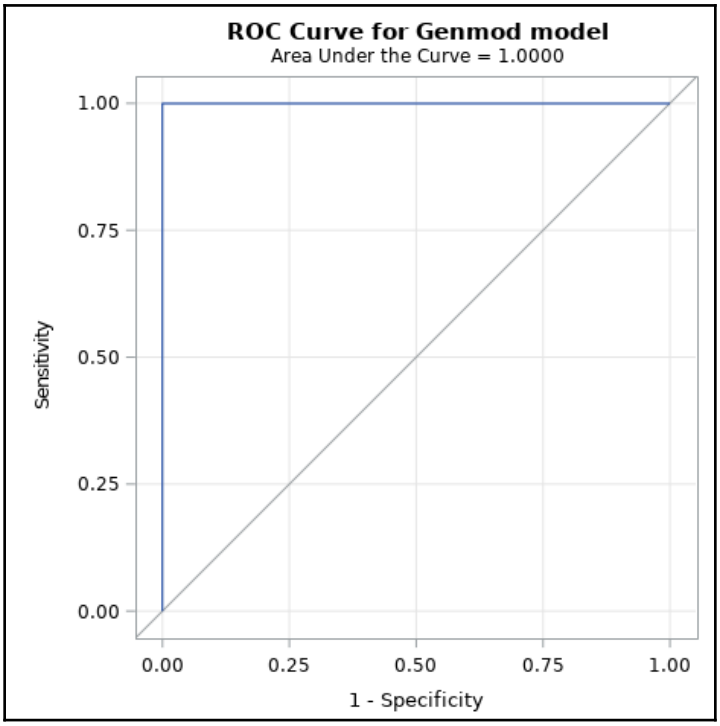
Customer	observed_default_status	Predicted Value
3342349	1	0.04695
4232324	0	0.00436
6161840	1	0.99257
7567563	0	0.00164
8697888	1	1.00000
10870633	0	0.00029
11228652	0	0.00781
12095275	1	0.93004
24123211	0	0.22609
35234232	1	0.89879
35234232	1	0.62372

ROC Model: Genmod model

ROC Model Information		
ROC Contrast Coefficients	pred	Predicted Value



ROC Association Statistics							
	Mann-Whitney						
ROC Model	Area	Standard Error	95% Wald Confidence Limits		Somers' D	Gamma	Tau-a
Genmod model	0.9667	0.0471	0.8743	1.0000	0.9333	0.9333	0.5091


ROC Curve for Genmod model
Area Under the Curve = 1.0000
Sensitivity
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
1 - Specificity

The LOGISTIC Procedure

Model Information	
Data Set	WORK.LOGISTIC
Response Variable	dflt
Number of Response Levels	2
Model	binary logit
Optimization Technique	Fisher's scoring

Number of Observations Read	132
Number of Observations Used	132

Response Profile		
Ordered Value	dflt	Total Frequency
1	0	118
2	1	14

Probability modeled is dflt=0.

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	24.2386	8.0649	9.0327	0.0027
Utilisation	1	-9.2090	4.8407	3.6191	0.0571
LTV	1	-0.8409	0.5561	2.2870	0.1305
Borrowing_portfolio_	1	-6.2435	4.7283	1.7436	0.1867
Postcode_index	1	-0.0789	0.0505	2.4391	0.1183
arrears_flag	1	-5.9412	2.5582	5.3937	0.0202
relationship_length	1	-0.2609	0.2891	0.8145	0.3668

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Utilisation	<0.001	<0.001	1.321
LTV	0.431	0.145	1.283
Borrowing_portfolio_	0.002	<0.001	20.568
Postcode_index	0.924	0.837	1.020
arrears_flag	0.003	<0.001	0.396
relationship_length	0.770	0.437	1.358

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	98.8	Somers' D	0.977
Percent Discordant	1.2	Gamma	0.977
Percent Tied	0.0	Tau-a	0.187
Pairs	1652	c	0.988

The GENMOD Procedure

Model Information	
Data Set	WORK.OVERALL
Distribution	Binomial
Link Function	Probit
Dependent Variable	dflt
Scale Weight Variable	validation_sample

Number of Observations Read	143
Number of Observations Used	132
Sum of Weights	132
Number of Events	14
Number of Trials	132
Missing Values	11

Response Profile			
Ordered Value	dflt	Total Frequency	Total Weight
1	1	14	14
2	0	118	118

Algorithm converged.

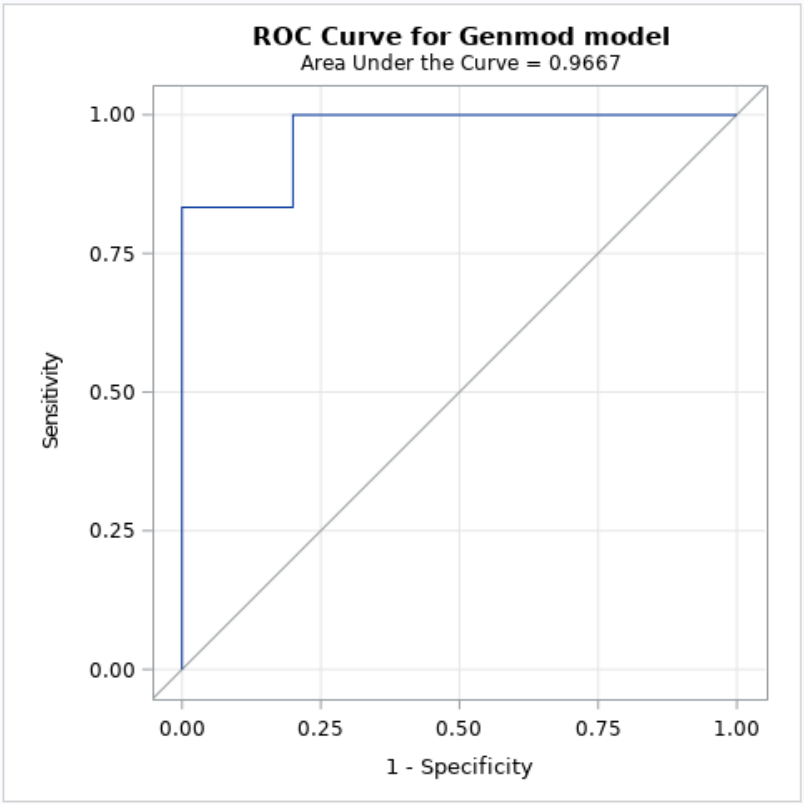
Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-9.9197	2.6782	-15.1689	-4.6705	13.72	0.0002
Utilisation	1	6.2753	2.2933	1.7806	10.7700	7.49	0.0062
Borrowing_portfolio_	1	3.8592	1.9509	0.0355	7.6829	3.91	0.0479
Postcode_index	1	0.0265	0.0221	-0.0168	0.0698	1.44	0.2302
arrears_flag	1	2.3629	0.7564	0.8805	3.8454	9.76	0.0018
Scale	0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

Parameter	Estimate
Intercept	-9.919741832
Utilisation	6.2753186044
Borrowing_portfolio_	3.8591911182
Postcode_index	0.0265093379
arrears_flag	2.3629197893
Scale	1.0000000000

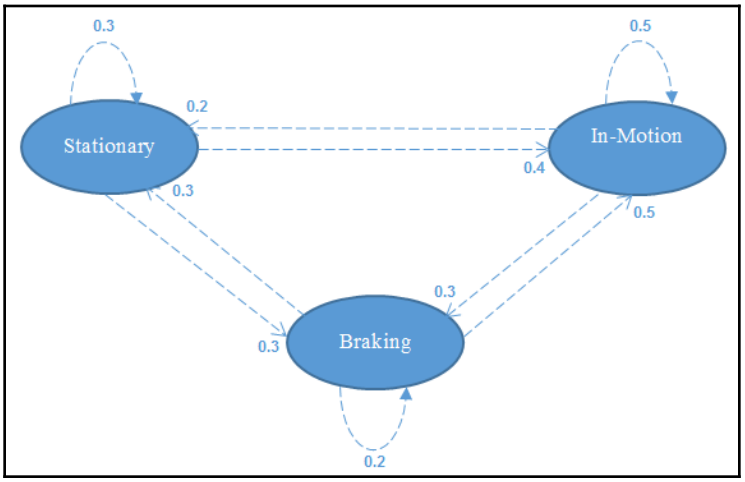
ROC Model: Genmod model

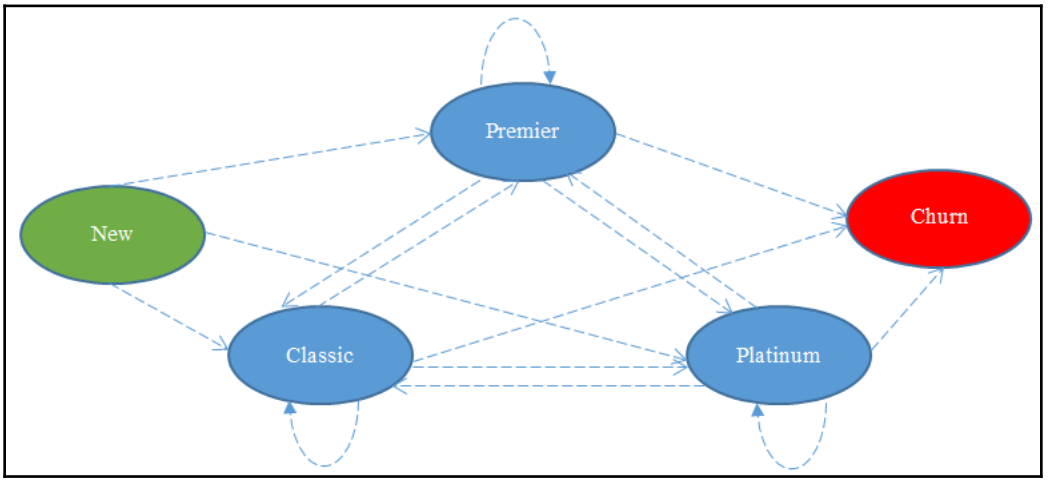
ROC Model Information		
ROC Contrast Coefficients	pred	Predicted Value



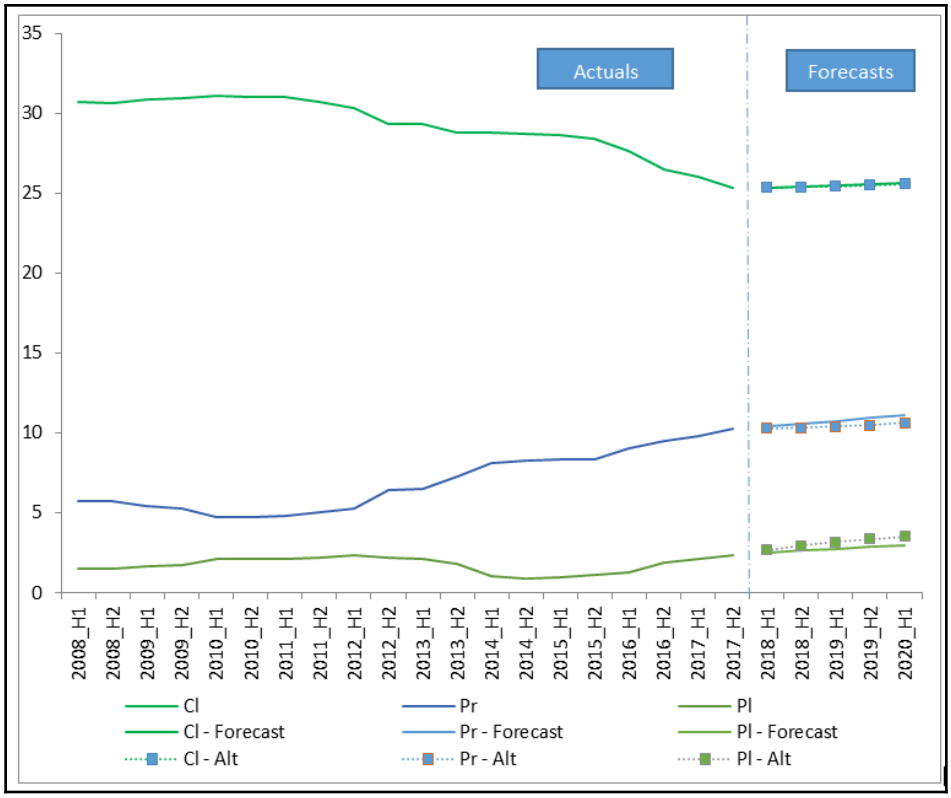
ROC Association Statistics							
	Mann-Whitney						
ROC Model	Area	Standard Error	95% Wald Confidence Limits		Somers' D	Gamma	Tau-a
Genmod model	0.9667	0.0471	0.8743	1.0000	0.9333	0.9333	0.5091

Chapter 4: Budget and Demand Forecasting





Obs	Cl	Pr	Pl
1	25.3492	10.4192	2.51160
2	25.4113	10.5708	2.65792
3	25.4840	10.7431	2.77293
4	25.5655	10.9282	2.86624
5	25.6547	11.1208	2.94442



The ARIMA Procedure

Name of Variable = CI	
Mean of Working Series	29.226
Standard Deviation	1.739035
Number of Observations	20

Squared Canonical Correlation Estimates						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	0.9338	0.7755	0.5202	0.3006	0.1598	0.0606
AR 1	0.3237	0.3821	0.2187	0.1505	0.1163	0.0844
AR 2	0.1666	0.0672	0.0164	0.0010	0.0256	0.0217
AR 3	0.0109	0.0024	0.0102	0.0190	0.0172	0.0014
AR 4	0.0006	0.0137	0.0100	0.0357	<.0001	0.0018
AR 5	0.0196	0.0029	0.0058	0.0512	0.0080	0.0045

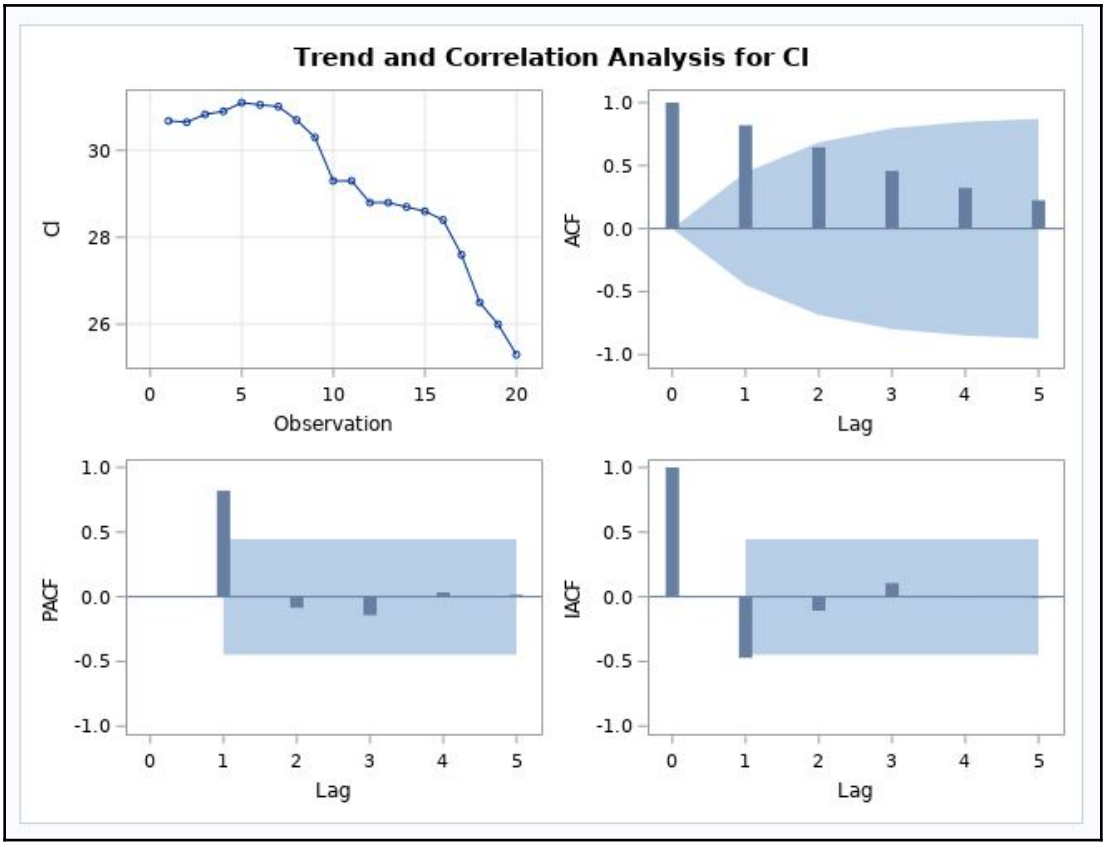
SCAN Chi-Square[1] Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	<.0001	0.0056	0.0671	0.1978	0.3550	0.5676
AR 1	0.0064	0.0098	0.0605	0.1548	0.2790	0.4467
AR 2	0.0701	0.3435	0.6403	0.9240	0.6393	0.6674
AR 3	0.6661	0.8601	0.7281	0.7215	0.6555	0.9133
AR 4	0.9213	0.6749	0.7298	0.6595	0.9861	0.8947
AR 5	0.5857	0.8594	0.8396	0.5174	0.7716	0.8397

Extended Sample Autocorrelation Function						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	0.8201	0.6446	0.4576	0.3224	0.2245	0.1341
AR 1	0.2685	0.3248	0.2347	0.2680	0.0560	-0.1934
AR 2	0.4830	0.2466	0.3743	0.1709	-0.1061	0.0356
AR 3	-0.0419	0.6598	0.0053	0.0833	0.1224	0.0189
AR 4	-0.2556	0.6356	0.3666	0.2567	0.0913	-0.0796
AR 5	0.7310	0.5196	-0.2981	-0.0722	-0.2879	.

ESACF Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	0.0002	0.0598	0.2509	0.4470	0.6067	0.7614
AR 1	0.2419	0.2448	0.4661	0.4438	0.8595	0.5212
AR 2	0.0404	0.3062	0.3171	0.5566	0.7351	0.9344
AR 3	0.8629	0.0076	0.9870	0.8464	0.7893	0.9614
AR 4	0.3067	0.0357	0.4146	0.5951	0.8454	0.8253
AR 5	0.0046	0.0448	0.3918	0.8243	0.3888	.

ARMA(p+d,q) Tentative Order Selection Tests			
SCAN		ESACF	
p+d	q	p+d	q
2	0	1	0
0	2	0	1
		4	2
		5	2

(5% Significance Level)


Trend and Correlation Analysis for CI
CI
30
28
26
0
5
10
15
20
Observation
ACF
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3
4
5
Lag
PACF
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3
4
5
Lag
IACF
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3
4
5
Lag

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	-0.28181	0.14070	-2.00	0.0614	0
AR1,1	0.44193	0.22701	1.95	0.0683	1

Constant Estimate	-0.15727
Variance Estimate	0.130528
Std Error Estimate	0.361286
AIC	17.11912
SBC	19.008
Number of Residuals	19

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates		
Parameter	MU	AR1,1
MU	1.000	-0.053
AR1,1	-0.053	1.000

Autocorrelation Check of Residuals										
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations						
6	4.49	5	0.4811	-0.112	0.332	-0.108	-0.059	-0.209	-0.019	
12	11.10	11	0.4350	-0.197	0.350	-0.020	0.130	0.024	-0.035	
18	18.26	17	0.3726	-0.131	-0.108	-0.194	-0.066	-0.035	-0.037	

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	30.11611	0.40917	73.60	<.0001	0
AR1,1	1.38761	0.25675	5.40	<.0001	1
AR1,2	-0.38762	0.31097	-1.25	0.2295	2

Constant Estimate	0.000047
Variance Estimate	0.189834
Std Error Estimate	0.4357
AIC	26.27507
SBC	29.26227
Number of Residuals	20

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates			
Parameter	MU	AR1,1	AR1,2
MU	1.000	0.119	-0.116
AR1,1	0.119	1.000	-0.973
AR1,2	-0.116	-0.973	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	6.79	4	0.1472	0.086	0.464	0.079	0.135	-0.032	0.145
12	18.80	10	0.0429	-0.019	0.408	-0.116	0.336	-0.033	0.077
18	23.81	16	0.0938	-0.059	-0.025	-0.047	-0.070	-0.162	0.026

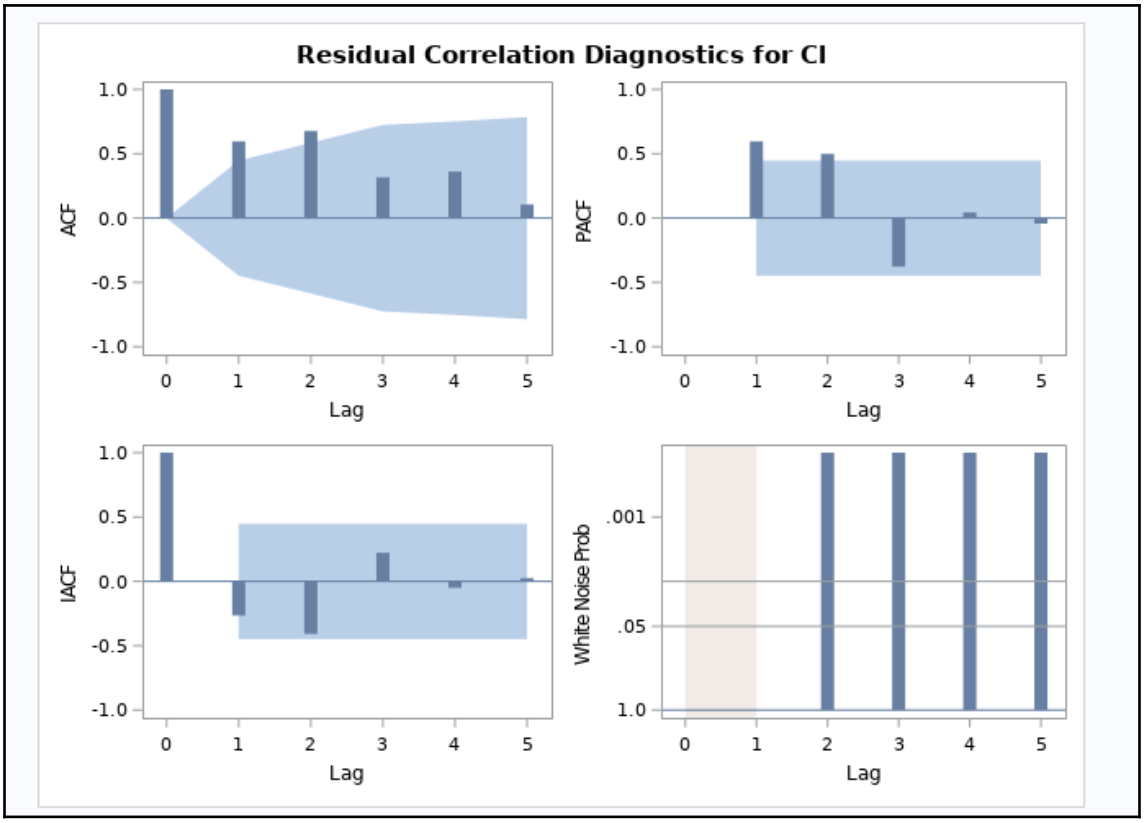
Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	29.29857	0.45005	65.10	<.0001	0
MA1,1	-0.78374	0.17293	-4.53	0.0003	1

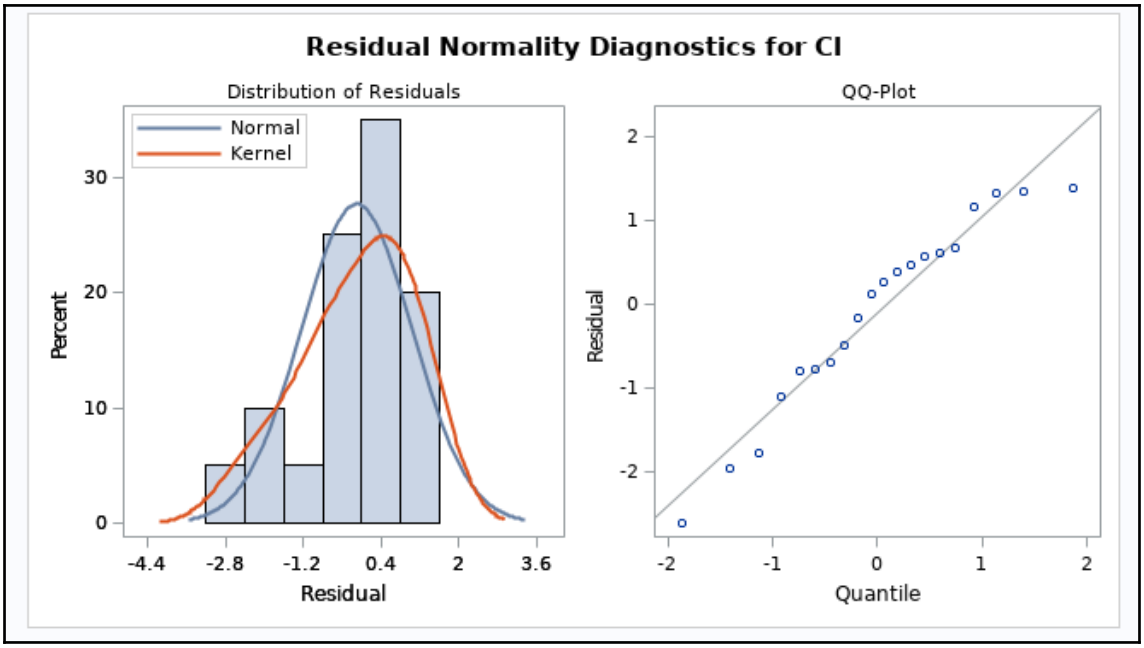
Constant Estimate	29.29857
Variance Estimate	1.413187
Std Error Estimate	1.188775
AIC	65.56728
SBC	67.55874
Number of Residuals	20

* AIC and SBC do not include log determinant.

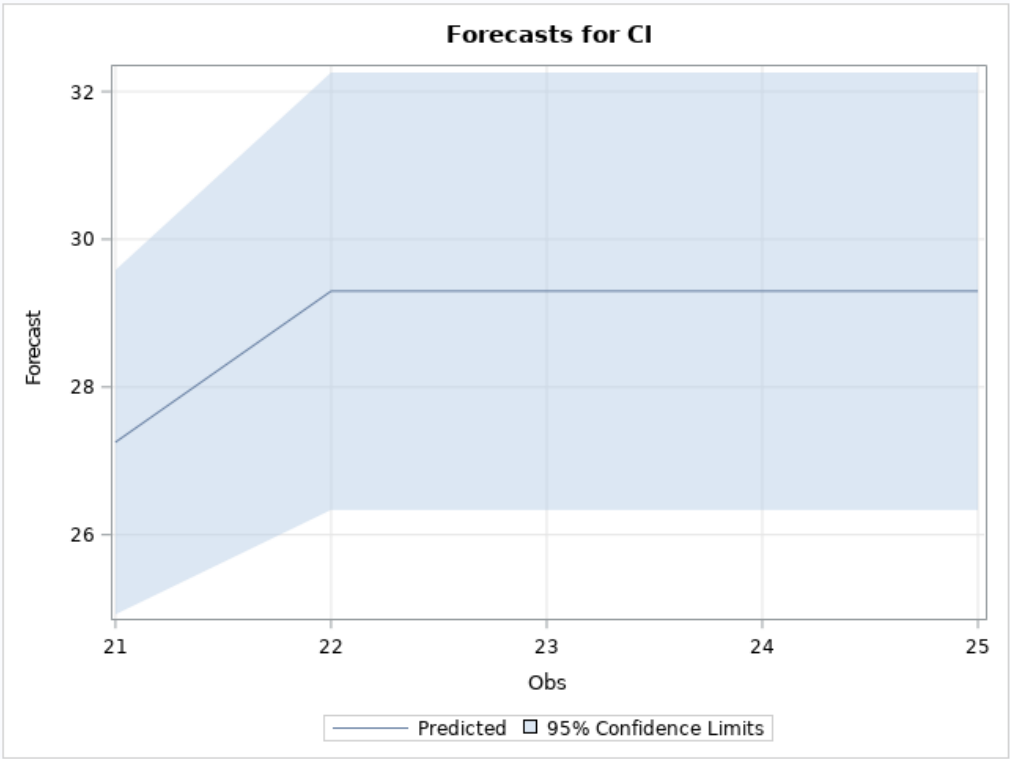
Correlations of Parameter Estimates		
Parameter	MU	MA1,1
MU	1.000	-0.109
MA1,1	-0.109	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	26.61	5	<.0001	0.595	0.669	0.310	0.353	0.101	0.201
12	38.70	11	<.0001	-0.043	0.063	-0.212	-0.106	-0.340	-0.267
18	82.29	17	<.0001	-0.376	-0.281	-0.334	-0.230	-0.260	-0.124


Residual Correlation Diagnostics for CI
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
.001
.05
0
1
2
3
4
5


Residual Normality Diagnostics for CI
Distribution of Residuals
Normal
Kernel
Percent
30
20
10
0
-4.4
-2.8
-1.2
0.4
2
3.6
Residual
QQ-Plot
Residual
2
1
0
-1
-2
-2
-1
0
1
2
Quantile

Forecasts for variable CI				
Obs	Forecast	Std Error	95% Confidence Limits	
21	27.2538	1.1888	24.9238	29.5837
22	29.2986	1.5104	26.3383	32.2589
23	29.2986	1.5104	26.3383	32.2589
24	29.2986	1.5104	26.3383	32.2589
25	29.2986	1.5104	26.3383	32.2589



SCAN Chi-Square[1] Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	<.0001	0.0084	0.0769	0.2132	0.4102	0.7374
AR 1	0.0166	0.0940	0.1925	0.1709	0.2757	0.2773
AR 2	0.4044	0.8951	0.7750	0.8476	0.8097	0.6988
AR 3	0.6271	0.8543	0.8628	0.9255	0.9436	0.8886
AR 4	0.4692	0.8387	0.9231	0.9294	0.9050	0.9745
AR 5	0.6366	0.7941	0.9393	0.9920	0.9476	0.8799

ESACF Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	<.0001	0.0372	0.1682	0.3539	0.5637	0.8041
AR 1	0.2143	0.2912	0.5400	0.8802	0.3206	0.2534
AR 2	0.0289	0.6507	0.5412	0.9893	0.2788	0.9201
AR 3	0.8883	0.0650	0.9469	0.9183	0.1979	0.8688
AR 4	0.0038	0.1339	0.3990	0.6333	0.3454	0.9933
AR 5	0.0299	0.2344	0.7499	0.6051	0.2405	.

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.23759	0.13739	1.73	0.1019	0
AR1,1	0.36623	0.22877	1.60	0.1278	1

Constant Estimate	0.150575
Variance Estimate	0.155262
Std Error Estimate	0.394033
AIC	20.41622
SBC	22.3051
Number of Residuals	19

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates		
Parameter	MU	AR1,1
MU	1.000	0.027
AR1,1	0.027	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	2.40	5	0.7918	-0.078	0.178	0.120	0.013	-0.189	-0.068
12	3.57	11	0.9808	-0.112	-0.025	-0.074	0.006	0.080	-0.059
18	5.94	17	0.9936	-0.027	-0.062	-0.122	-0.019	-0.040	-0.021

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	6.37940	0.50324	12.68	<.0001	0
AR1,1	1.00000	0.06630	15.08	<.0001	1

Constant Estimate	3.952E-6
Variance Estimate	0.253246
Std Error Estimate	0.503236
AIC	31.18247
SBC	33.17393
Number of Residuals	20

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates		
Parameter	MU	AR1,1
MU	1.000	-0.000
AR1,1	-0.000	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	18.53	5	0.0024	0.464	0.493	0.377	0.325	0.118	0.137
12	21.97	11	0.0246	0.107	0.083	-0.117	0.095	-0.073	-0.171
18	28.09	17	0.0439	-0.102	-0.099	-0.111	-0.125	-0.103	-0.042

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	6.73081	0.43755	15.38	<.0001	0
MA1,1	-1.12926	0.16102	-7.01	<.0001	1
MA1,2	-1.00000	0.21588	-4.63	0.0002	2

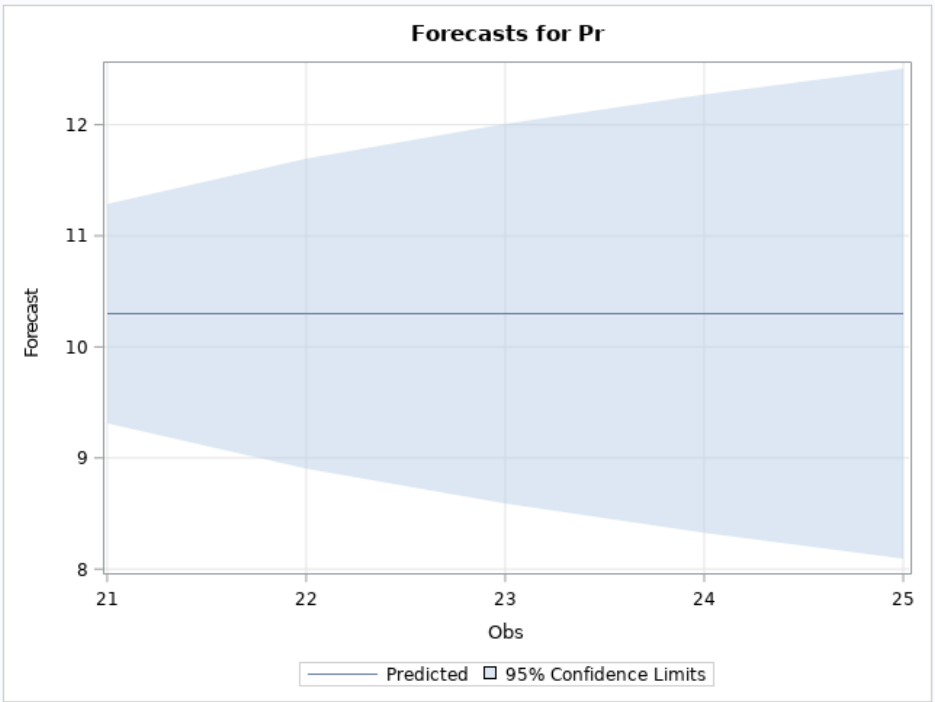
Constant Estimate	6.730812
Variance Estimate	0.611822
Std Error Estimate	0.782191
AIC	49.68089
SBC	52.66809
Number of Residuals	20

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates			
Parameter	MU	MA1,1	MA1,2
MU	1.000	0.436	0.726
MA1,1	0.436	1.000	0.664
MA1,2	0.726	0.664	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	30.12	4	<.0001	0.615	0.575	0.566	0.327	0.231	0.126
12	48.97	10	<.0001	0.061	-0.073	-0.280	-0.187	-0.327	-0.396
18	78.29	16	<.0001	-0.308	-0.297	-0.277	-0.217	-0.149	-0.088

Forecasts for variable Pr				
Obs	Forecast	Std Error	95% Confidence Limits	
21	10.3000	0.5032	9.3137	11.2863
22	10.3000	0.7117	8.9051	11.6949
23	10.3000	0.8716	8.5916	12.0084
24	10.3000	1.0065	8.3273	12.2726
25	10.3000	1.1253	8.0945	12.5055



SCAN Chi-Square[1] Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	<.0001	0.2682	0.7636	0.2429	0.0813	0.0788
AR 1	0.0002	0.0119	0.0360	0.0623	0.0702	0.3162
AR 2	0.1694	0.8862	0.1177	0.1213	0.2428	0.5541
AR 3	0.7905	0.4002	0.1521	0.8311	0.8363	0.7569
AR 4	0.0163	0.0342	0.2683	0.8727	0.7746	0.7680
AR 5	0.6653	0.1089	0.0672	0.6870	0.7857	0.8565

ESACF Probability Values						
Lags	MA 0	MA 1	MA 2	MA 3	MA 4	MA 5
AR 0	0.0005	0.1939	0.9247	0.4204	0.1710	0.1770
AR 1	0.0044	0.1971	0.7647	0.6394	0.1337	0.4190
AR 2	0.0360	0.8998	0.8226	0.5292	0.2109	0.3466
AR 3	0.1044	0.7027	0.6846	0.4673	0.1867	0.8656
AR 4	0.1113	0.3143	0.5780	0.4732	0.2697	0.2787
AR 5	0.0135	0.4266	0.9948	0.2747	0.2538	.

ARMA(p+d,q) Tentative Order Selection Tests			
SCAN		ESACF	
p+d	q	p+d	q
0	3	0	1
2	2	1	1
5	0	3	0
		2	1
		4	0

(5% Significance Level)

Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	1.72510	0.12569	13.73	<.0001	0
MA1,1	-1.10469	0.28524	-3.87	0.0013	1
MA1,2	-1.01996	0.33165	-3.08	0.0072	2
MA1,3	-0.91527	0.46860	-1.95	0.0685	3

Constant Estimate	1.725105
Variance Estimate	0.061174
Std Error Estimate	0.247334
AIC	4.414002
SBC	8.396931
Number of Residuals	20

* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates				
Parameter	MU	MA1,1	MA1,2	MA1,3
MU	1.000	0.230	0.234	0.134
MA1,1	0.230	1.000	0.762	0.675
MA1,2	0.234	0.762	1.000	0.753
MA1,3	0.134	0.675	0.753	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	6.03	3	0.1103	0.116	0.080	0.047	-0.031	-0.377	-0.203
12	12.79	9	0.1722	-0.177	-0.346	0.068	0.029	0.094	0.109
18	17.88	15	0.2689	0.153	0.014	0.093	0.115	-0.093	-0.023

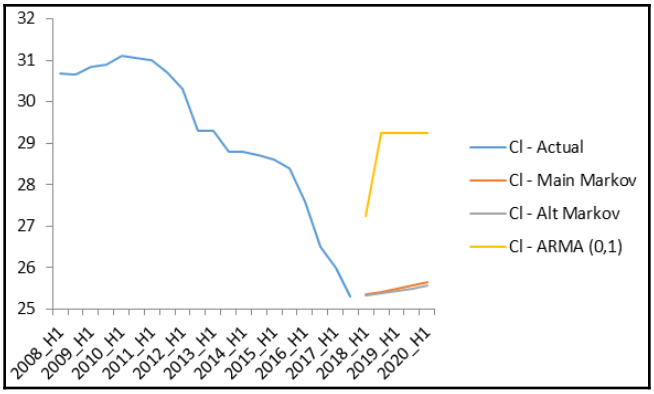
Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	1.76852	0.12366	14.30	<.0001	0
MA1,1	-0.83194	0.21136	-3.94	0.0010	1

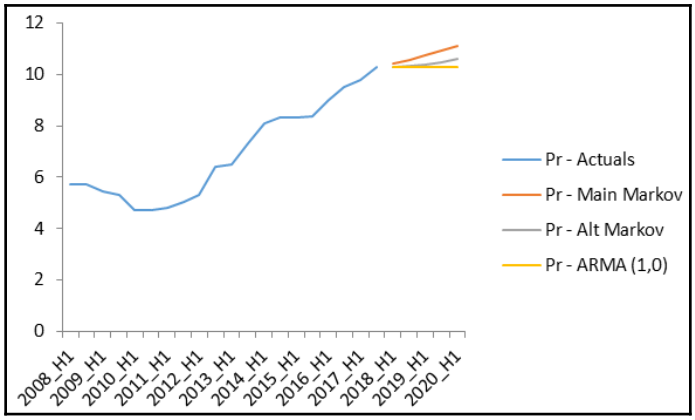
Constant Estimate	1.768515
Variance Estimate	0.105342
Std Error Estimate	0.324565
AIC	13.63952
SBC	15.63099
Number of Residuals	20

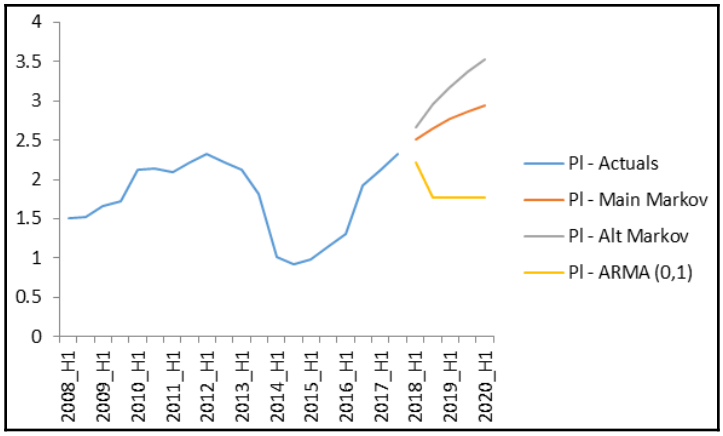
* AIC and SBC do not include log determinant.

Correlations of Parameter Estimates		
Parameter	MU	MA1,1
MU	1.000	-0.021
MA1,1	-0.021	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	22.09	5	0.0005	0.405	0.463	-0.067	-0.188	-0.470	-0.417
12	34.09	11	0.0003	-0.396	-0.343	-0.029	-0.048	0.144	0.148
18	39.79	17	0.0014	0.197	0.123	0.104	0.043	-0.081	-0.009







Missing Data Patterns

Group	cl	pr	pl	Freq	Percent	Group Means cl	Group Means pr	Group Means pl
1	X	X	X	22	55.00	29.475000	6.723182	1.721818
2	X	X	.	1	2.50	30.500000	5.200000	.
3	X	.	X	2	5.00	29.500000	.	1.370000
4	X	.	.	4	10.00	29.162500	.	.
5	.	X	X	3	7.50	.	8.270000	2.150000
6	.	X	.	5	12.50	.	6.108000	.
7	.	.	X	3	7.50	.	.	1.340000

EM (Posterior Mode) Iteration History					
Iteration	-2 Log L	-2 Log Posterior	cl	pr	pl
0	-275.191302	-338.255077	29.379642	6.811634	1.728727
1	-294.520112	-361.918031	29.379641	6.811634	1.728727
2	-314.072897	-385.153015	29.379640	6.811634	1.728727
3	-333.706902	-408.378668	29.379254	6.812047	1.728700
4	-353.357316	-431.605907	29.379049	6.812254	1.728698
5	-373.012100	-454.834889	29.378966	6.812331	1.728702
6	-392.668757	-478.065386	29.378936	6.812358	1.728706
7	-412.326657	-501.297230	29.378926	6.812367	1.728707
8	-431.985534	-524.530223	29.378922	6.812370	1.728708
9	-451.644966	-547.763939	29.378921	6.812371	1.728708

EM (Posterior Mode) Estimates				
TYPE	_NAME_	cl	pr	pl
MEAN		29.378921	6.812371	1.728708
COV	cl	2.660817	-2.697188	0.036371
COV	pr	-2.697188	2.940847	-0.243660
COV	pl	0.036371	-0.243660	0.207289

Initial Parameter Estimates for MCMC					
IMPUTATION	_TYPE_	_NAME_	cl	pr	pl
1	MEAN		29.378921	6.812371	1.728708
1	COV	cl	2.660817	-2.697188	0.036371
1	COV	pr	-2.697188	2.940847	-0.243660
1	COV	pl	0.036371	-0.243660	0.207289

Initial Parameter Estimates for MCMC					
IMPUTATION	_TYPE_	_NAME_	cl	pr	pl
2	MEAN		29.187913	7.034202	1.697886
2	COV	cl	3.034460	-3.119419	0.084959
2	COV	pr	-3.119419	3.527739	-0.408321
2	COV	pl	0.084959	-0.408321	0.323362

Initial Parameter Estimates for MCMC					
IMPUTATION	_TYPE_	_NAME_	cl	pr	pl
3	MEAN		29.301575	6.913311	1.705114
3	COV	cl	3.283471	-3.178922	-0.104550
3	COV	pr	-3.178922	3.289191	-0.110269
3	COV	pl	-0.104550	-0.110269	0.214819

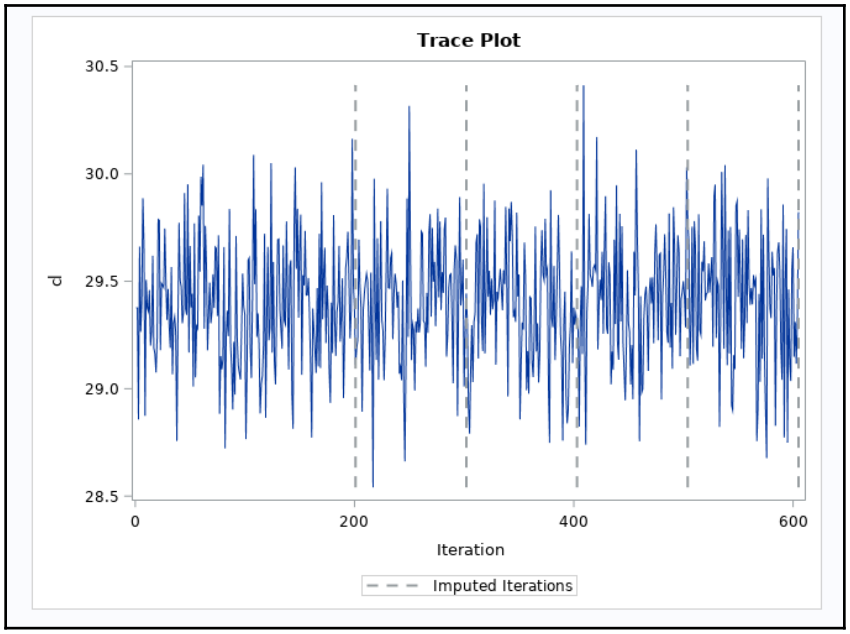
Initial Parameter Estimates for MCMC					
IMPUTATION	_TYPE_	_NAME_	cl	pr	pl
4	MEAN		29.272617	6.982255	1.665128
4	COV	cl	3.028325	-3.077575	0.049251
4	COV	pr	-3.077575	3.344962	-0.267386
4	COV	pl	0.049251	-0.267386	0.218136

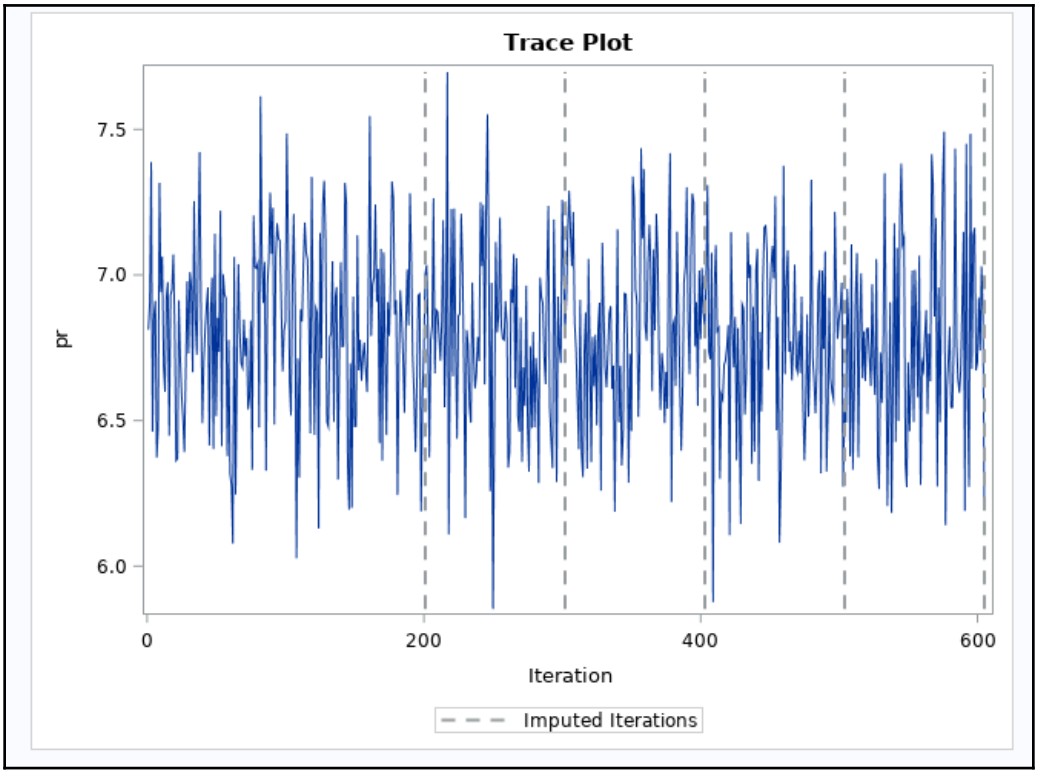
Initial Parameter Estimates for MCMC					
IMPUTATION	_TYPE_	_NAME_	cl	pr	pl
5	MEAN		29.686068	6.493707	1.740226
5	COV	cl	2.637065	-2.399042	-0.238023
5	COV	pr	-2.399042	2.386590	0.012452
5	COV	pl	-0.238023	0.012452	0.225571

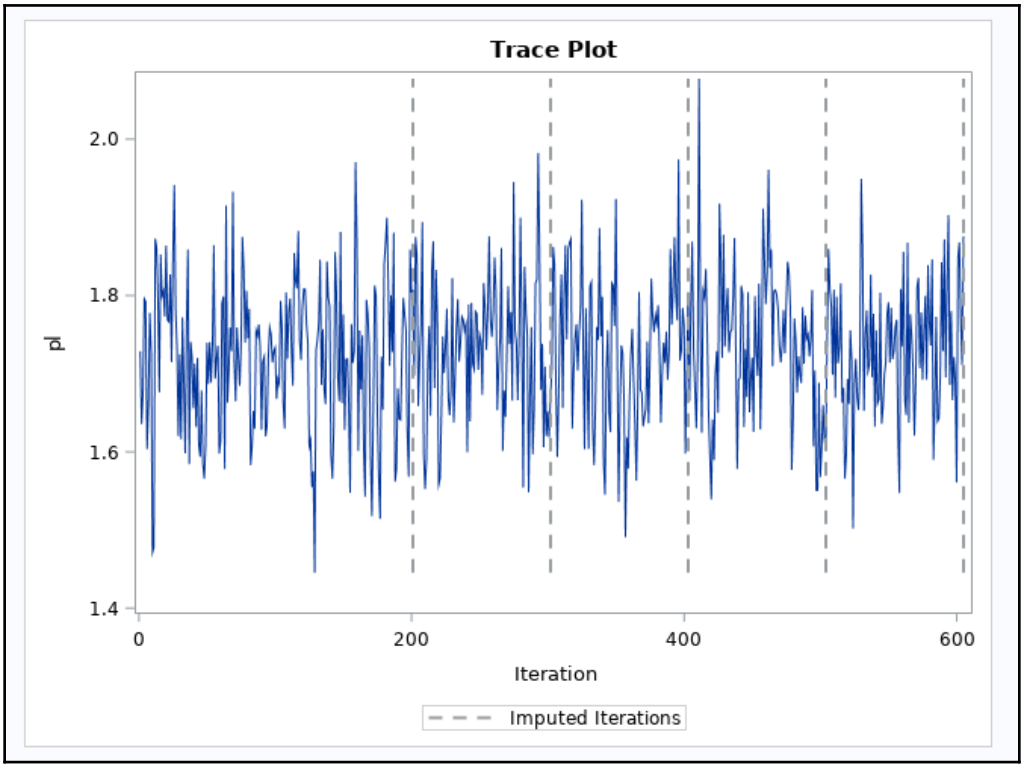
Variance Information (5 Imputations)							
	Variance				Relative Increase in Variance	Fraction Missing Information	Relative Efficiency
Variable	Between	Within	Total	DF			
cl	0.009713	0.074831	0.086487	28.045	0.155760	0.142520	0.972286
pr	0.005852	0.080932	0.087955	32.412	0.086769	0.082760	0.983717
pl	0.001236	0.006403	0.007887	23.81	0.231603	0.202036	0.961162

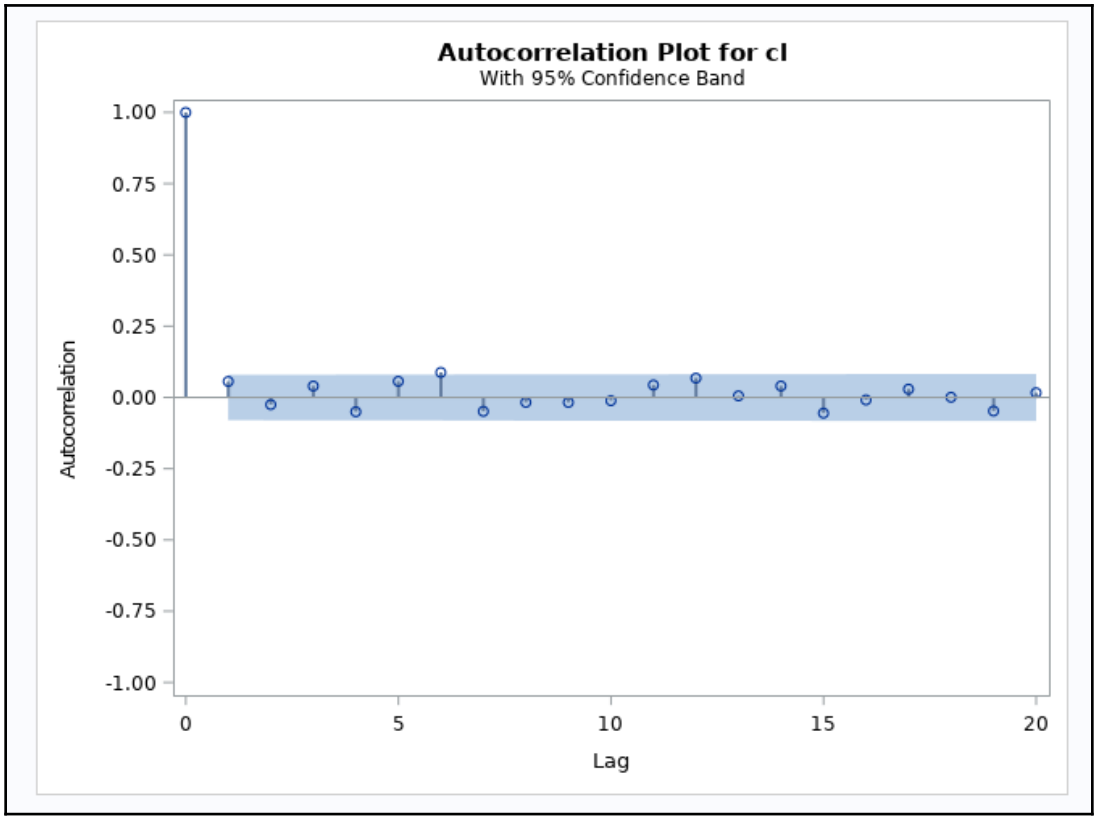
Parameter Estimates (5 Imputations)										
Variable	Mean	Std Error	95% Confidence Limits		DF	Minimum	Maximum	Mu0	t for H0: Mean=Mu0	Pr > |t|
cl	29.452876	0.294087	28.85051	30.05524	28.045	29.329753	29.604468	29.200000	0.86	0.3972
pr	6.717135	0.296571	6.11334	7.32093	32.412	6.592498	6.789329	7.000000	-0.95	0.3473
pl	1.749989	0.088806	1.56662	1.93335	23.81	1.714585	1.800918	1.700000	0.56	0.5788

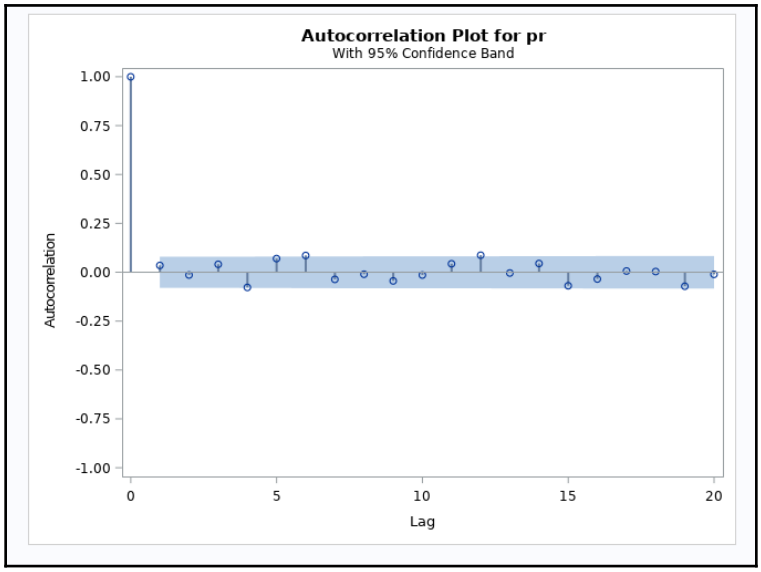
Parameter Estimates (5 Imputations)										
Variable	Mean	Std Error	95% Confidence Limits		DF	Minimum	Maximum	Mu0	t for H0: Mean=Mu0	Pr > |t|
cl	29.452876	0.294087	28.85051	30.05524	28.045	29.329753	29.604468	30.300000	-2.88	0.0075
pr	6.717135	0.296571	6.11334	7.32093	32.412	6.592498	6.789329	5.500000	4.10	0.0003
pl	1.749989	0.088806	1.56662	1.93335	23.81	1.714585	1.800918	2.000000	-2.82	0.0096

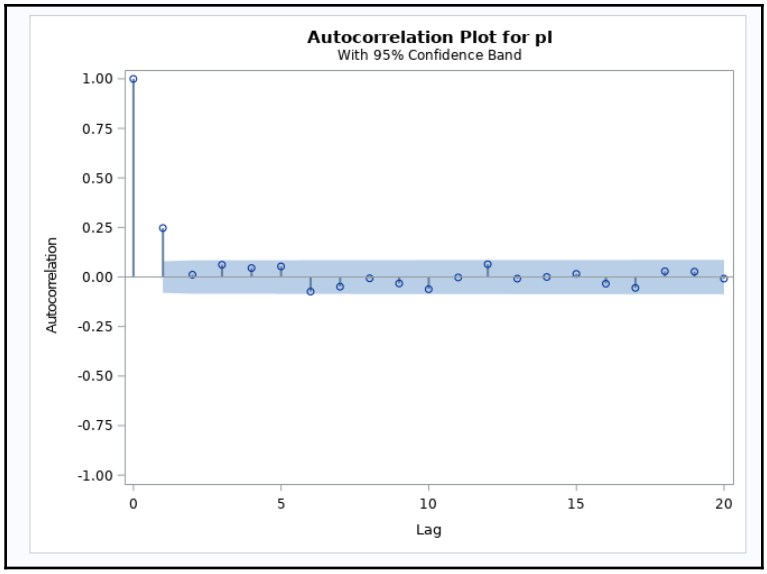



Trace Plot
7.5
7.0
6.5
6.0
pr
0
200
400
600
Iteration
Imputed Iterations

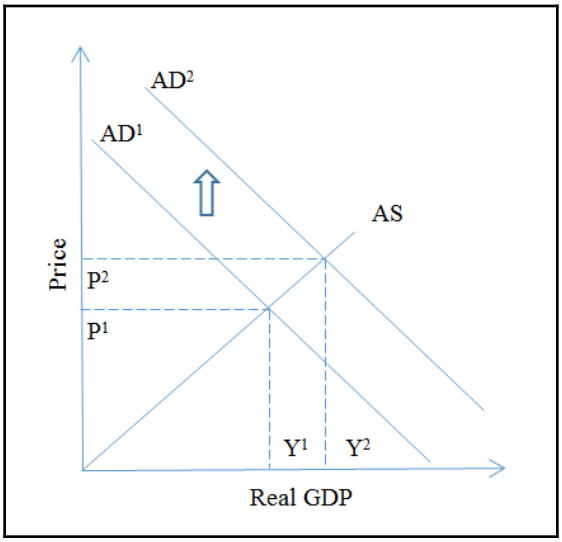

Trace Plot
2.0
1.8
1.6
1.4
pl
0
200
400
600
Iteration
Imputed Iterations

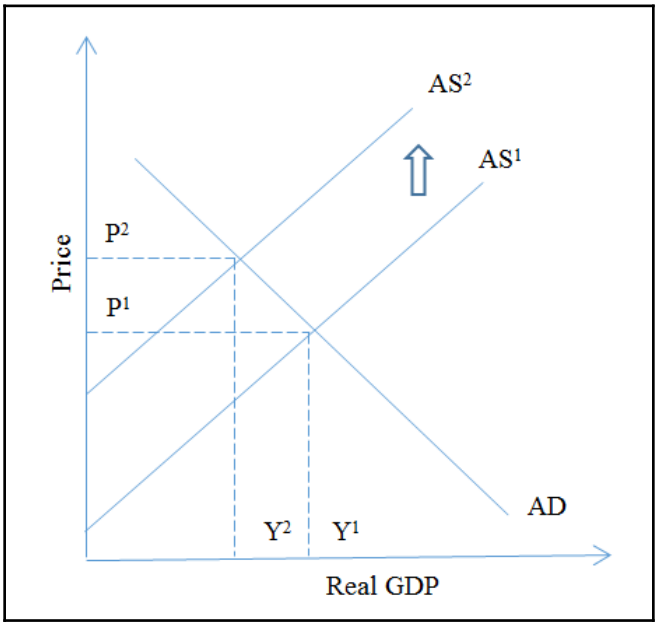

Autocorrelation Plot for cl
With 95% Confidence Band
Autocorrelation
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
0
5
10
15
20
Lag

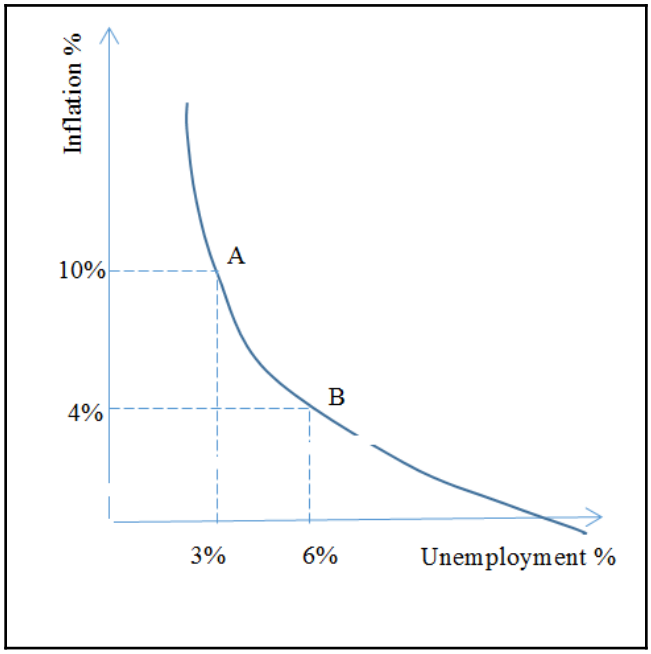

Autocorrelation Plot for pr
With 95% Confidence Band
Autocorrelation
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
0
5
10
15
20
Lag


Autocorrelation Plot for pl
With 95% Confidence Band
Autocorrelation
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
0
5
10
15
20
Lag

Chapter 5: Inflation Forecasting for Financial Planning






Inflation %
10%
4%
A
B
3%
6%
Unemployment %

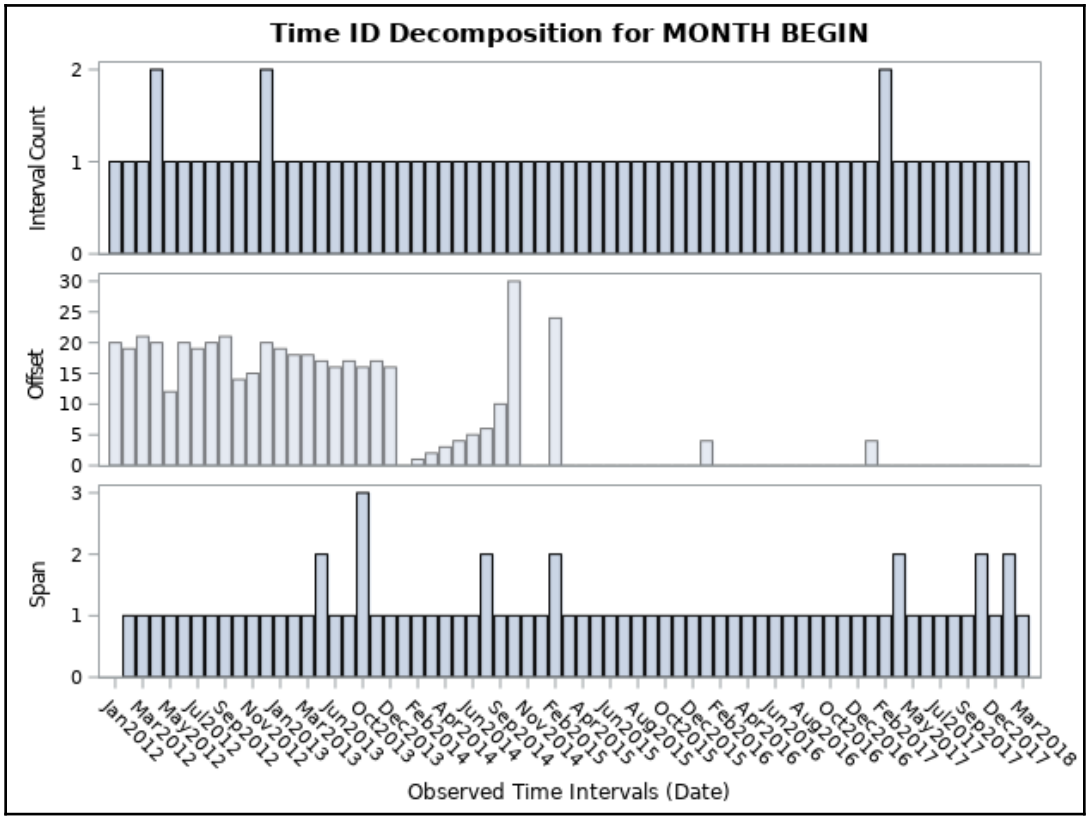
The TIMEID Procedure

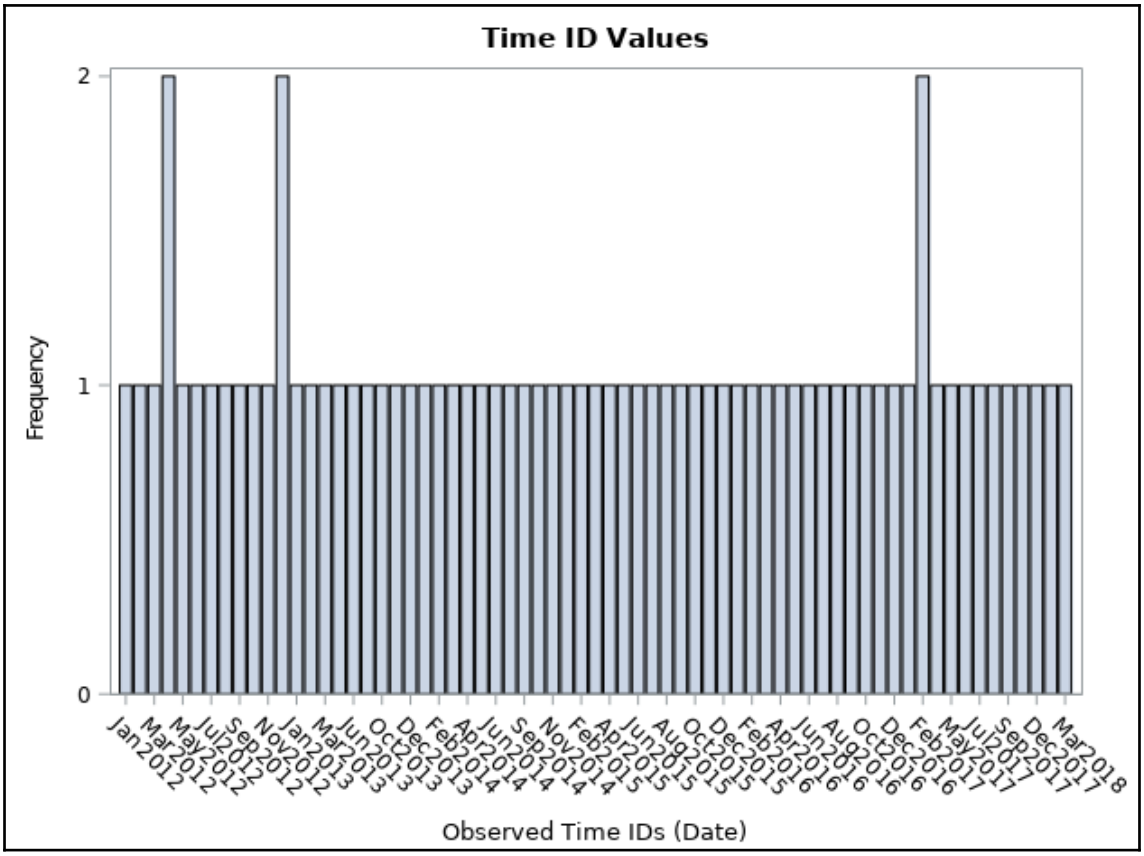
Input Data Set	
Name	WORK.PLAYSTORE
Label	
Time ID Variable	Date
Time Interval	MONTH

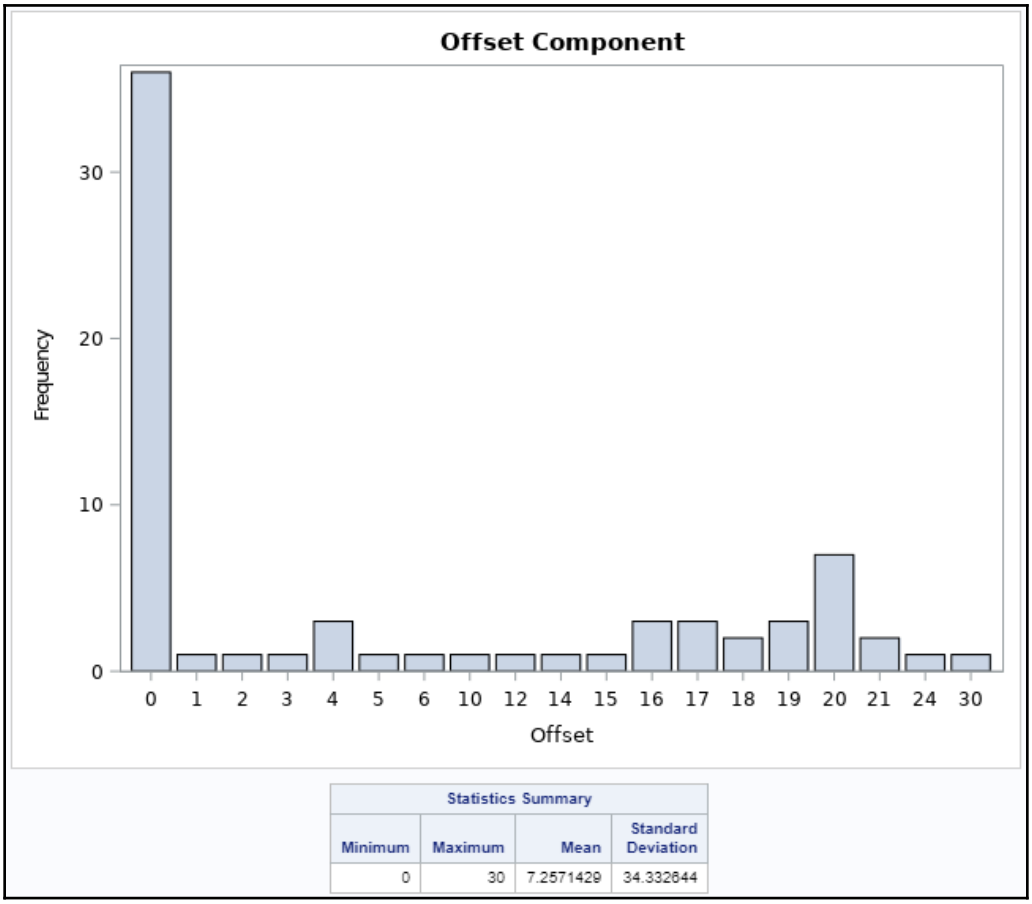
The TIMEID Procedure

Time Component				
Value Index	Date	Offset	Span	Interval Count
1	JAN2012	20	.	1
2	FEB2012	19	1	1
3	MAR2012	21	1	1
4	APR2012	20	1	2
5	MAY2012	12	1	1
6	JUN2012	20	1	1
7	JUL2012	19	1	1
8	AUG2012	20	1	1
9	SEP2012	21	1	1
10	OCT2012	14	1	1
11	NOV2012	15	1	1
12	DEC2012	20	1	2
13	JAN2013	19	1	1
14	FEB2013	18	1	1
15	MAR2013	18	1	1
16	MAY2013	17	2	1
17	JUN2013	16	1	1
18	JUL2013	17	1	1
19	OCT2013	16	3	1
20	NOV2013	17	1	1

50	JUL2016	0	1	1
51	AUG2016	0	1	1
52	SEP2016	0	1	1
53	OCT2016	0	1	1
54	NOV2016	0	1	1
55	DEC2016	0	1	1
56	JAN2017	4	1	1
57	FEB2017	0	1	2
58	APR2017	0	2	1
59	MAY2017	0	1	1
60	JUN2017	0	1	1
61	JUL2017	0	1	1
62	AUG2017	0	1	1
63	SEP2017	0	1	1
64	NOV2017	0	2	1
65	DEC2017	0	1	1
66	FEB2018	0	2	1
67	MAR2018	0	1	1


Time ID Decomposition for MONTH BEGIN
Interval Count
Offset
Span
Observed Time Intervals (Date)
Jan2012
Mar2012
May2012
Jul2012
Sep2012
Nov2012
Jan2013
Mar2013
Jun2013
Oct2013
Dec2013
Feb2014
Apr2014
Jun2014
Sep2014
Nov2014
Feb2015
Apr2015
Jun2015
Aug2015
Oct2015
Dec2015
Feb2016
Apr2016
Jun2016
Aug2016
Oct2016
Dec2016
Feb2017
May2017
Jul2017
Sep2017
Dec2017
Mar2018

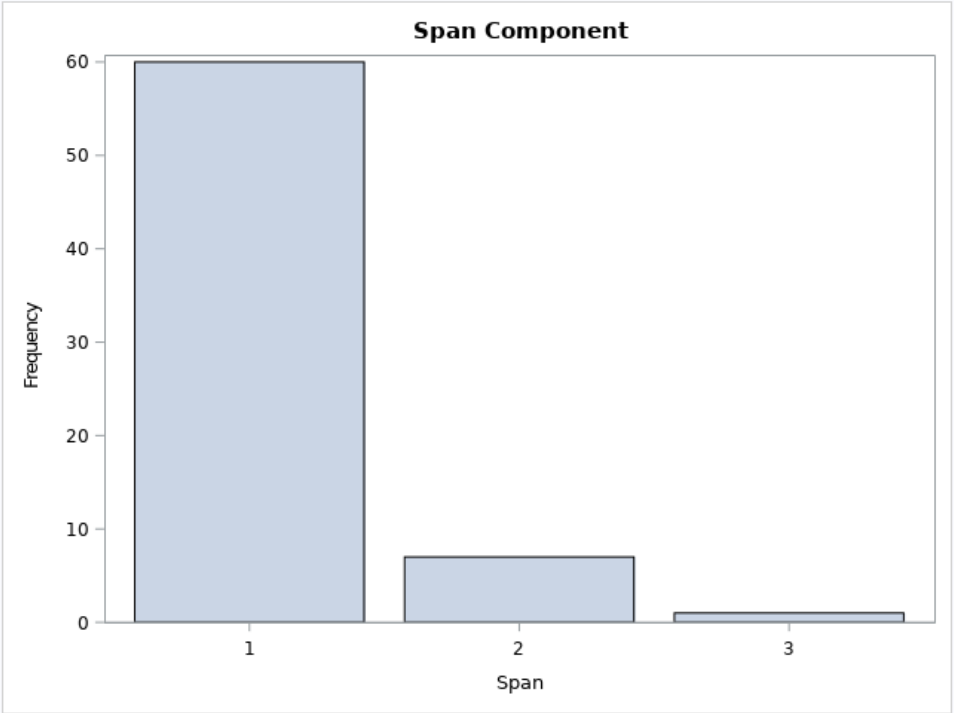

Time ID Values
Frequency
2
1
0
Jan2012
Mar2012
May2012
Jul2012
Sep2012
Nov2012
Jan2013
Mar2013
Jun2013
Oct2013
Dec2013
Feb2014
Apr2014
Jun2014
Sep2014
Nov2014
Feb2014
Apr2015
Jun2015
Aug2015
Oct2015
Dec2015
Feb2015
Apr2016
Jun2016
Aug2016
Oct2016
Dec2016
Feb2016
May2017
Jul2017
Sep2017
Dec2017
Mar2018
Observed Time IDs (Date)



Statistics Summary			
Minimum	Maximum	Mean	Standard Deviation
0	30	7.2571429	34.332644

The TIMEID Procedure

Component			
Value Index	Span	Frequency	Percentage
1	1	60	88.235294
2	2	7	10.294118
3	3	1	1.470588



Statistics Summary			
Minimum	Maximum	Mean	Standard Deviation
1	3	1.1323529	1.2425188

The REG Procedure
Model: MODEL1
Dependent Variable: CPI CPI

Number of Observations Read	75
Number of Observations Used	69
Number of Observations with Missing Values	6

Forward Selection: Step 1

Statistics for Entry DF = 1,67				
Variable	Tolerance	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	1.000000	0.2405	21.21	<.0001
Travel_including_Leisure	1.000000	0.5712	89.27	<.0001
Eating_out	1.000000	0.6670	134.20	<.0001
Entertainment	1.000000	0.4943	65.50	<.0001
Grocery	1.000000	0.6629	131.73	<.0001
Education	1.000000	0.8195	304.24	<.0001
Communication	1.000000	0.0281	1.93	0.1689
Clothing_and_shopping	1.000000	0.8239	313.54	<.0001
Spend_save_quaterly_ratio	1.000000	0.8661	433.27	<.0001

Variable Spend_save_quaterly_ratio Entered: R-Square = 0.8661 and C(p) = 101.1809

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	18.25606	18.25606	433.27	<.0001
Error	67	2.82307	0.04214		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	91.90309	0.64805	847.39683	20111.3	<.0001
Spend_save_quaterly_ratio	0.12923	0.00621	18.25606	433.27	<.0001

Forward Selection: Step 2

Statistics for Entry DF = 1,66				
Variable	Tolerance	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.689061	0.8673	0.59	0.4457
Travel_including_Leisure	0.347601	0.8661	0.02	0.8770
Eating_out	0.265277	0.8674	0.68	0.4133
Entertainment	0.355325	0.8716	2.82	0.0980
Grocery	0.228051	0.8661	0.03	0.8715
Education	0.148517	0.8806	8.06	0.0060
Communication	0.944481	0.8689	1.43	0.2362
Clothing_and_shopping	0.240857	0.9050	27.07	<.0001

Variable Clothing_and_shopping Entered: R-Square = 0.9050 and C(p) = 54.8481

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	19.07714	9.53857	314.46	<.0001
Error	66	2.00199	0.03033		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	85.53920	1.34109	123.40594	4068.34	<.0001
Clothing_and_shopping	0.11089	0.02131	0.82107	27.07	<.0001
Spend_save_quaterly_ratio	0.08058	0.01073	1.70936	56.35	<.0001

Bounds on condition number: 4.1518, 16.607

Forward Selection: Step 3

Statistics for Entry DF = 1,65				
Variable	Tolerance	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.481411	0.9342	28.81	<.0001
Travel_including_Leisure	0.198806	0.9311	24.60	<.0001
Eating_out	0.247564	0.9052	0.15	0.7035
Entertainment	0.285849	0.9374	33.57	<.0001
Grocery	0.186638	0.9152	7.83	0.0068
Education	0.068038	0.9063	0.91	0.3428
Communication	0.940321	0.9066	1.13	0.2920

Variable Entertainment Entered: R-Square = 0.9374 and C(p) = 16.7114

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	19.75898	6.58633	324.29	<.0001
Error	65	1.32016	0.02031		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.43388	1.15596	105.80571	5209.52	<.0001
Entertainment	-0.04118	0.00711	0.68184	33.57	<.0001
Clothing_and_shopping	0.16070	0.01944	1.38735	68.31	<.0001
Spend_save_quaterly_ratio	0.09622	0.00919	2.22716	109.66	<.0001

Bounds on condition number: 5.161, 39.611

Forward Selection: Step 4

Statistics for Entry DF = 1,64				
Variable	Tolerance	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.127589	0.9384	1.08	0.3026
Travel_including_Leisure	0.050971	0.9375	0.16	0.6873
Eating_out	0.239789	0.9377	0.32	0.5757
Grocery	0.101851	0.9381	0.77	0.3833
Education	0.036368	0.9513	18.38	<.0001
Communication	0.938853	0.9385	1.15	0.2885

Variable Education Entered: R-Square = 0.9513 and C(p) = 1.3699

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	20.05357	5.01339	312.86	<.0001
Error	64	1.02556	0.01602		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	84.33993	1.04830	103.72301	6472.84	<.0001
Entertainment	-0.06644	0.00863	0.94870	59.20	<.0001
Education	0.11236	0.02620	0.29460	18.38	<.0001
Clothing_and_shopping	0.09246	0.02349	0.24830	15.50	0.0002
Spend_save_quaterly_ratio	0.06974	0.01024	0.74399	46.43	<.0001

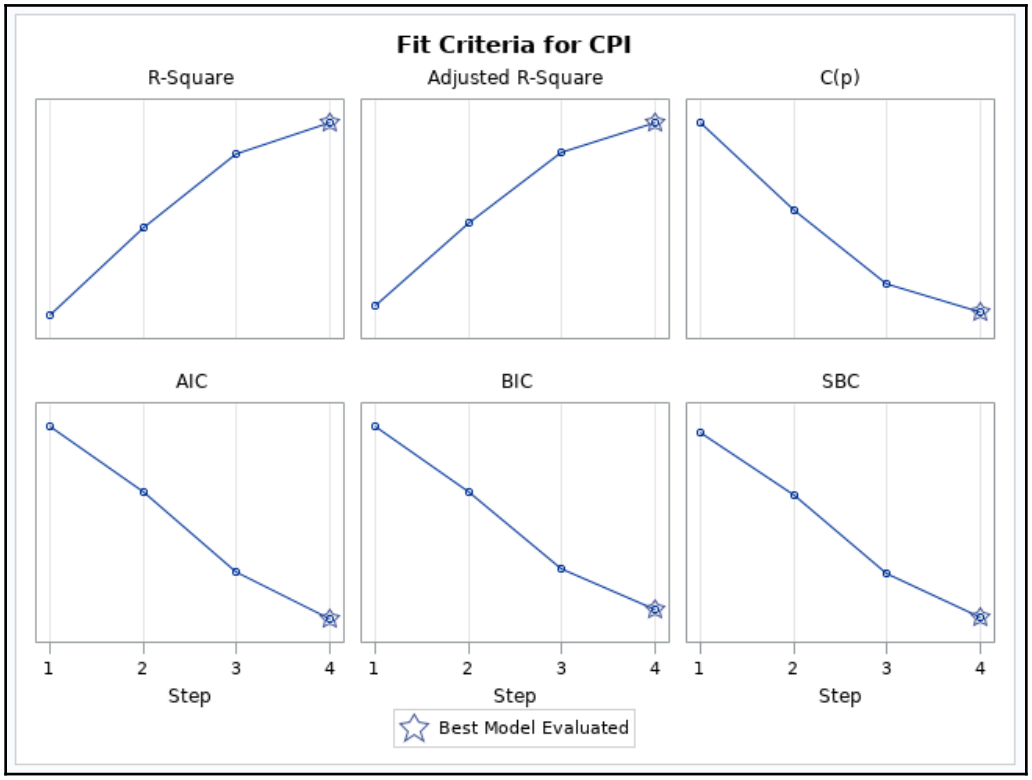
Bounds on condition number: 27.497, 202.93

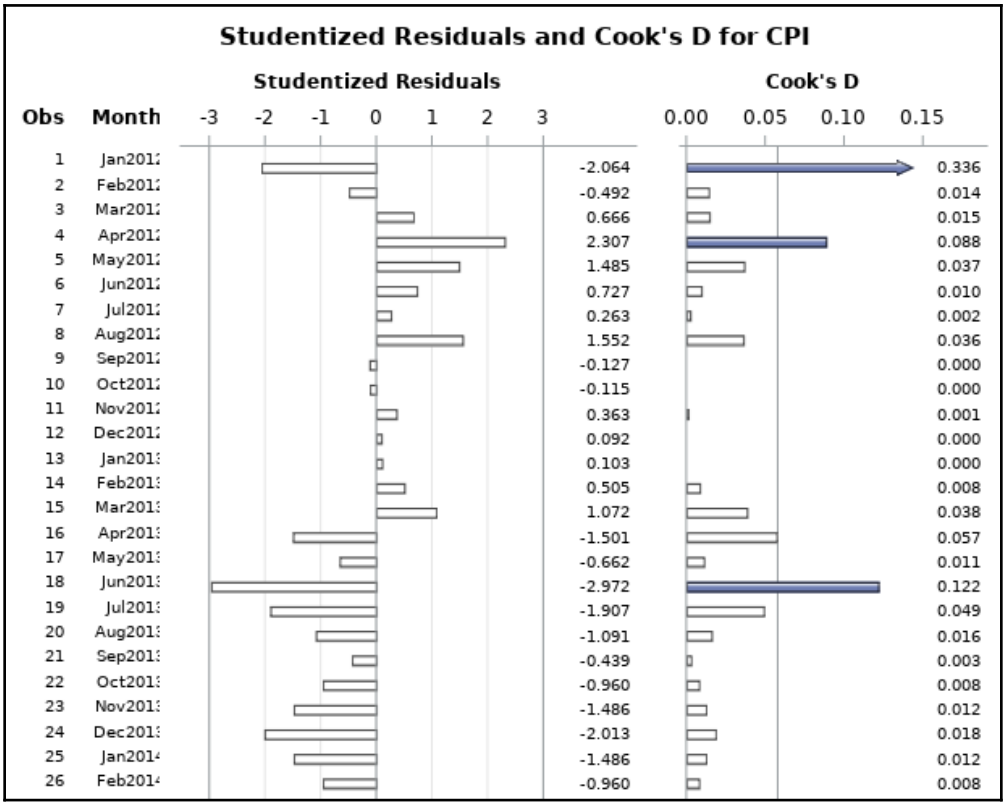
Forward Selection: Step 5

Statistics for Entry DF = 1,63				
Variable	Tolerance	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.105777	0.9517	0.44	0.5117
Travel_including_Leisure	0.050890	0.9516	0.39	0.5330
Eating_out	0.239778	0.9516	0.37	0.5477
Grocery	0.096775	0.9513	0.00	0.9734
Communication	0.918195	0.9516	0.33	0.5701

No other variable met the 0.5000 significance level for entry into the model.

Summary of Forward Selection								
Step	Variable Entered	Label	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	Spend_save_quaterly_ratio	Spend_save_quaterly_ratio	1	0.8661	0.8661	101.181	433.27	<.0001
2	Clothing_and_shopping	Clothing_and_shopping	2	0.0390	0.9050	54.8481	27.07	<.0001
3	Entertainment	Entertainment	3	0.0323	0.9374	16.7114	33.57	<.0001
4	Education	Education	4	0.0140	0.9513	1.3699	18.38	<.0001


Fit Criteria for CPI
R-Square
Adjusted R-Square
C(p)
AIC
BIC
SBC
1
2
3
4
Step
Best Model Evaluated


Studentized Residuals and Cook's D for CPI
Studentized Residuals
Cook's D
Obs
Month
-3
-2
-1
0
1
2
3
0.00
0.05
0.10
0.15
1 Jan201 -2.064 0.336
2 Feb201 -0.492 0.014
3 Mar201 0.666 0.015
4 Apr201 2.307 0.088
5 May201 1.485 0.037
6 Jun201 0.727 0.010
7 Jul201 0.263 0.002
8 Aug201 1.552 0.036
9 Sep201 -0.127 0.000
10 Oct201 -0.115 0.000
11 Nov201 0.363 0.001
12 Dec201 0.092 0.000
13 Jan201 0.103 0.000
14 Feb201 0.505 0.008
15 Mar201 1.072 0.038
16 Apr201 -1.501 0.057
17 May201 -0.662 0.011
18 Jun201 -2.972 0.122
19 Jul201 -1.907 0.049
20 Aug201 -1.091 0.016
21 Sep201 -0.439 0.003
22 Oct201 -0.960 0.008
23 Nov201 -1.486 0.012
24 Dec201 -2.013 0.018
25 Jan201 -1.486 0.012
26 Feb201 -0.960 0.008

The REG Procedure
Model: MODEL2
Dependent Variable: CPI CPI

Number of Observations Read	75
Number of Observations Used	69
Number of Observations with Missing Values	6

Backward Elimination: Step 0

All Variables Entered: R-Square = 0.9525 and C(p) = 10.0000

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	20.07684	2.23076	131.31	<.0001
Error	59	1.00229	0.01699		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.13330	3.04430	12.66819	745.72	<.0001
Furniture_Home_Improvement	0.00911	0.01382	0.00738	0.43	0.5125
Travel_including_Leisure	-0.00750	0.01098	0.00793	0.47	0.4972
Eating_out	-0.00015179	0.01061	0.00000348	0.00	0.9886
Entertainment	-0.06756	0.01989	0.19602	11.54	0.0012
Grocery	0.00123	0.03527	0.00002060	0.00	0.9723
Education	0.11989	0.03200	0.23849	14.04	0.0004
Communication	-0.00094288	0.00152	0.00656	0.39	0.5367
Clothing_and_shopping	0.09299	0.03123	0.15059	8.86	0.0042
Spend_save_quaterly_ratio	0.07273	0.01410	0.45186	26.60	<.0001

Bounds on condition number: 38.673, 1478

Backward Elimination: Step 1

Statistics for Removal DF = 1,59				
Variable	Partial R-Square	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.0004	0.9521	0.43	0.5125
Travel_including_Leisure	0.0004	0.9521	0.47	0.4972
Eating_out	0.0000	0.9525	0.00	0.9886
Entertainment	0.0093	0.9432	11.54	0.0012
Grocery	0.0000	0.9525	0.00	0.9723
Education	0.0113	0.9411	14.04	0.0004
Communication	0.0003	0.9521	0.39	0.5367
Clothing_and_shopping	0.0071	0.9453	8.86	0.0042
Spend_save_quaterly_ratio	0.0214	0.9310	26.60	<.0001

Variable Eating_out Removed: R-Square = 0.9525 and C(p) = 8.0002

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	20.07684	2.50960	150.23	<.0001
Error	60	1.00229	0.01670		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.14480	2.91172	13.62114	815.40	<.0001
Furniture_Home_Improvement	0.00901	0.01205	0.00934	0.56	0.4576
Travel_including_Leisure	-0.00741	0.00878	0.01188	0.71	0.4024
Entertainment	-0.06759	0.01959	0.19883	11.90	0.0010
Grocery	0.00130	0.03461	0.00002364	0.00	0.9701
Education	0.11976	0.03049	0.25767	15.42	0.0002
Communication	-0.00094349	0.00150	0.00657	0.39	0.5328
Clothing_and_shopping	0.09292	0.03056	0.15446	9.25	0.0035
Spend_save_quaterly_ratio	0.07263	0.01205	0.60671	36.32	<.0001

Bounds on condition number: 35.718, 1083.5

Backward Elimination: Step 2

Statistics for Removal DF = 1,60				
Variable	Partial R-Square	Model R-Square	F Value	Pr > F
Furniture_Home_Improvement	0.0004	0.9520	0.56	0.4576
Travel_including_Leisure	0.0006	0.9519	0.71	0.4024
Entertainment	0.0094	0.9430	11.90	0.0010
Grocery	0.0000	0.9524	0.00	0.9701
Education	0.0122	0.9402	15.42	0.0002
Communication	0.0003	0.9521	0.39	0.5328
Clothing_and_shopping	0.0073	0.9451	9.25	0.0035
Spend_save_quaterly_ratio	0.0288	0.9237	36.32	<.0001

Variable Grocery Removed: R-Square = 0.9524 and C(p) = 6.0016

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	20.07682	2.86812	174.55	<.0001
Error	61	1.00231	0.01643		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.23078	1.78902	35.56396	2164.39	<.0001
Furniture_Home_Improvement	0.00901	0.01195	0.00933	0.57	0.4539
Travel_including_Leisure	-0.00739	0.00869	0.01186	0.72	0.3988
Entertainment	-0.06744	0.01901	0.20669	12.58	0.0008
Education	0.11998	0.02969	0.26828	16.33	0.0002
Communication	-0.00094741	0.00149	0.00666	0.41	0.5267
Clothing_and_shopping	0.09286	0.03027	0.15465	9.41	0.0032
Spend_save_quaterly_ratio	0.07274	0.01155	0.65162	39.66	<.0001

Bounds on condition number: 34.431, 850.97

Backward Elimination: Step 6

Statistics for Removal DF = 1,64				
Variable	Partial R-Square	Model R-Square	F Value	Pr > F
Entertainment	0.0450	0.9063	59.20	<.0001
Education	0.0140	0.9374	18.38	<.0001
Clothing_and_shopping	0.0118	0.9396	15.50	0.0002
Spend_save_quaterly_ratio	0.0353	0.9161	46.43	<.0001

All variables left in the model are significant at the 0.1000 level.

Summary of Backward Elimination								
Step	Variable Removed	Label	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	Eating_out	Eating_out	8	0.0000	0.9525	8.0002	0.00	0.9886
2	Grocery	Grocery	7	0.0000	0.9524	6.0016	0.00	0.9701
3	Communication	Communication	6	0.0003	0.9521	4.3937	0.41	0.5267
4	Travel_including_Leisure	Travel_including_Leisure	5	0.0005	0.9517	2.9554	0.59	0.4467
5	Furniture_Home_Improvement	Furniture_Home_Improvement	4	0.0003	0.9513	1.3699	0.44	0.5117

Maximum R-Square Improvement: Step 1

Variable Spend_save_quaterly_ratio Entered: R-Square = 0.8661 and C(p) = 101.1809

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	18.25606	18.25606	433.27	<.0001
Error	67	2.82307	0.04214		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	91.90309	0.64805	847.39683	20111.3	<.0001
Spend_save_quaterly_ratio	0.12923	0.00621	18.25606	433.27	<.0001

Bounds on condition number: 1, 1

The above model is the best 1-variable model found.

Maximum R-Square Improvement: Step 2

Variable Clothing_and_shopping Entered: R-Square = 0.9050 and C(p) = 54.8481

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	19.07714	9.53857	314.46	<.0001
Error	66	2.00199	0.03033		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	85.53920	1.34109	123.40594	4068.34	<.0001
Clothing_and_shopping	0.11089	0.02131	0.82107	27.07	<.0001
Spend_save_quaterly_ratio	0.08058	0.01073	1.70936	56.35	<.0001

Bounds on condition number: 4.1518, 16.607

The above model is the best 2-variable model found.

Maximum R-Square Improvement: Step 3

Variable Entertainment Entered: R-Square = 0.9374 and C(p) = 16.7114

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	19.75898	6.58633	324.29	<.0001
Error	65	1.32016	0.02031		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.43388	1.15596	105.80571	5209.52	<.0001
Entertainment	-0.04118	0.00711	0.68184	33.57	<.0001
Clothing_and_shopping	0.16070	0.01944	1.38735	68.31	<.0001
Spend_save_quaterly_ratio	0.09622	0.00919	2.22716	109.66	<.0001

Bounds on condition number: 5.161, 39.611

Variable Clothing_and_shopping Removed: R-Square = 0.9396 and C(p) = 13.9862
Variable Education Entered

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	19.80527	6.60176	336.86	<.0001
Error	65	1.27386	0.01960		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	87.62491	0.70163	305.66773	15597.0	<.0001
Entertainment	-0.07407	0.00931	1.24195	63.37	<.0001
Education	0.18226	0.02131	1.43365	73.15	<.0001
Spend_save_quaterly_ratio	0.06784	0.01131	0.70560	36.00	<.0001

Bounds on condition number: 14.868, 84.64

The above model is the best 3-variable model found.

Maximum R-Square Improvement: Step 5

Variable Clothing_and_shopping Entered: R-Square = 0.9513 and C(p) = 1.3699

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	20.05357	5.01339	312.86	<.0001
Error	64	1.02556	0.01602		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	84.33993	1.04830	103.72301	6472.84	<.0001
Entertainment	-0.06644	0.00863	0.94870	59.20	<.0001
Education	0.11236	0.02620	0.29460	18.38	<.0001
Clothing_and_shopping	0.09246	0.02349	0.24830	15.50	0.0002
Spend_save_quaterly_ratio	0.06974	0.01024	0.74399	46.43	<.0001

Bounds on condition number: 27.497, 202.93

The above model is the best 4-variable model found.

Maximum R-Square Improvement: Step 6

Variable Furniture_Home_Improvement Entered: R-Square = 0.9517 and C(p) = 2.9554

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	20.06061	4.01212	248.17	<.0001
Error	63	1.01852	0.01617		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	84.40323	1.05731	103.02395	6372.50	<.0001
Furniture_Home_Improvement	0.00767	0.01162	0.00704	0.44	0.5117
Entertainment	-0.07587	0.01671	0.33320	20.61	<.0001
Education	0.12025	0.02891	0.27973	17.30	<.0001
Clothing_and_shopping	0.08254	0.02797	0.14074	8.71	0.0044
Spend_save_quaterly_ratio	0.07275	0.01125	0.67641	41.84	<.0001

Bounds on condition number: 33.167, 444.45

The above model is the best 5-variable model found.

Maximum R-Square Improvement: Step 10

Variable Eating_out Entered: R-Square = 0.9525 and C(p) = 10.0000

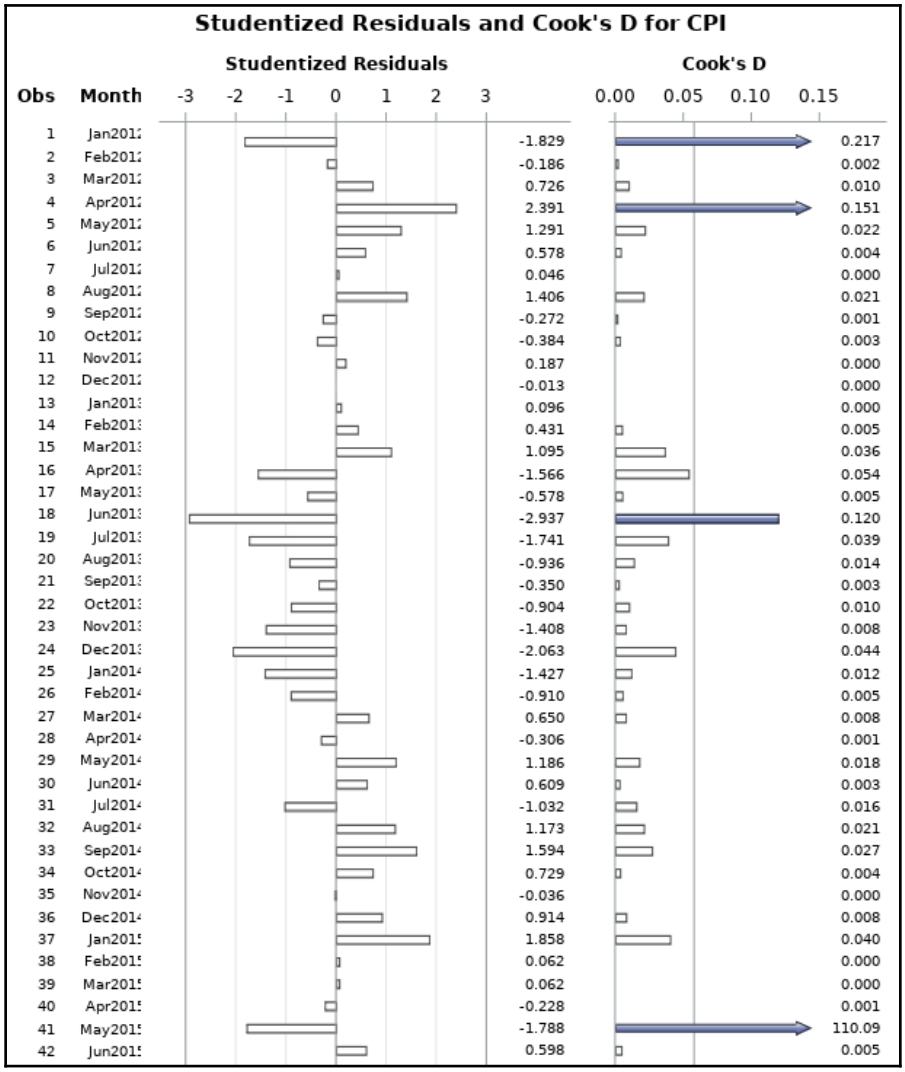
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	20.07684	2.23076	131.31	<.0001
Error	59	1.00229	0.01699		
Corrected Total	68	21.07913			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	83.13330	3.04430	12.66819	745.72	<.0001
Furniture_Home_Improvement	0.00911	0.01382	0.00738	0.43	0.5125
Travel_including_Leisure	-0.00750	0.01098	0.00793	0.47	0.4972
Eating_out	-0.00015179	0.01061	0.00000348	0.00	0.9886
Entertainment	-0.06756	0.01989	0.19602	11.54	0.0012
Grocery	0.00123	0.03527	0.00002060	0.00	0.9723
Education	0.11989	0.03200	0.23849	14.04	0.0004
Communication	-0.00094288	0.00152	0.00656	0.39	0.5367
Clothing_and_shopping	0.09299	0.03123	0.15059	8.86	0.0042
Spend_save_quaterly_ratio	0.07273	0.01410	0.45186	26.60	<.0001

Bounds on condition number: 38.673, 1478

The above model is the best 9-variable model found.

No further improvement in R-Square is possible.


Studentized Residuals and Cook's D for CPI
Studentized Residuals
Cook's D
Obs
Month
-3
-2
-1
0
1
2
3
0.00
0.05
0.10
0.15
1 Jan201 -1.829 0.217
2 Feb201 -0.186 0.002
3 Mar201 0.726 0.010
4 Apr201 2.391 0.151
5 May201 1.291 0.022
6 Jun201 0.578 0.004
7 Jul201 0.046 0.000
8 Aug201 1.406 0.021
9 Sep201 -0.272 0.001
10 Oct201 -0.384 0.003
11 Nov201 0.187 0.000
12 Dec201 -0.013 0.000
13 Jan201 0.096 0.000
14 Feb201 0.431 0.005
15 Mar201 1.095 0.036
16 Apr201 -1.566 0.054
17 May201 -0.578 0.005
18 Jun201 -2.937 0.120
19 Jul201 -1.741 0.039
20 Aug201 -0.936 0.014
21 Sep201 -0.350 0.003
22 Oct201 -0.904 0.010
23 Nov201 -1.408 0.008
24 Dec201 -2.063 0.044
25 Jan201 -1.427 0.012
26 Feb201 -0.910 0.005
27 Mar201 0.650 0.008
28 Apr201 -0.306 0.001
29 May201 1.186 0.018
30 Jun201 0.609 0.003
31 Jul201 -1.032 0.016
32 Aug201 1.173 0.021
33 Sep201 1.594 0.027
34 Oct201 0.729 0.004
35 Nov201 -0.036 0.000
36 Dec201 0.914 0.008
37 Jan201 1.858 0.040
38 Feb201 0.062 0.000
39 Mar201 0.062 0.000
40 Apr201 -0.228 0.001
41 May201 -1.788 110.09
42 Jun201 0.598 0.005

The UCM Procedure

Input Data Set	
Name	WORK.MODEL
Time ID Variable	Month

Estimation Span Summary

Variable	Type	First Obs	Last Obs	NObs	NMiss	Min	Max	Mean	Standard Deviation
CPI	Dependent	JAN2012	MAR2017	63	0	104.40000	106.20000	105.29683	0.50353

Forecast Span Summary

Variable	Type	First Obs	Last Obs	NObs	NMiss	Min	Max	Mean	Standard Deviation
CPI	Dependent	JAN2012	SEP2017	69	0	104.40000	106.40000	105.38261	0.55676

Fixed Parameters in the Model

Component	Parameter	Value
Slope	Error Variance	0

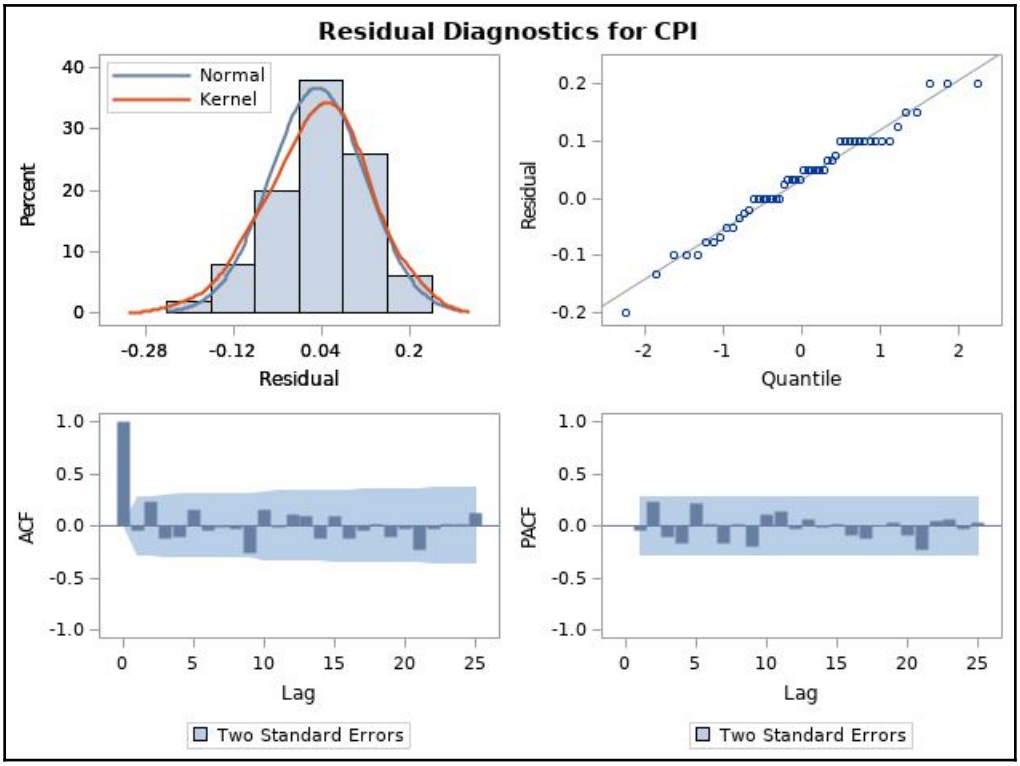
Preliminary Estimates of the Free Parameters

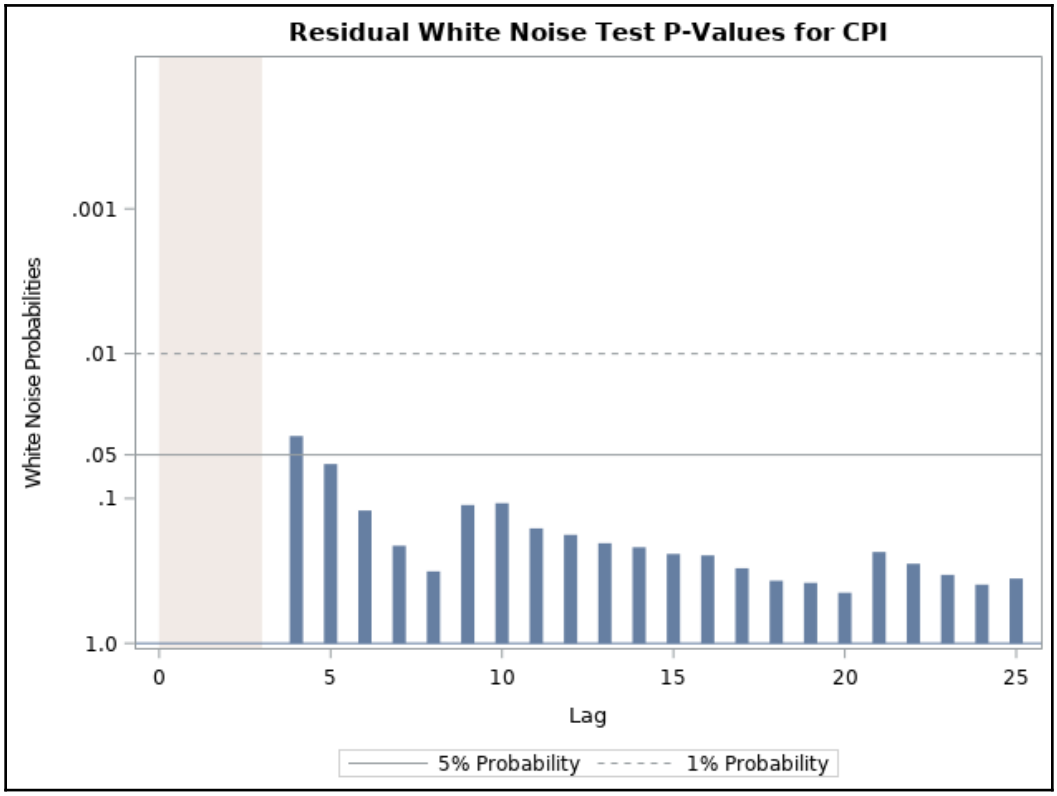
Component	Parameter	Estimate
Irregular	Error Variance	2235.75255
Level	Error Variance	838.40721
Season	Error Variance	996.08045

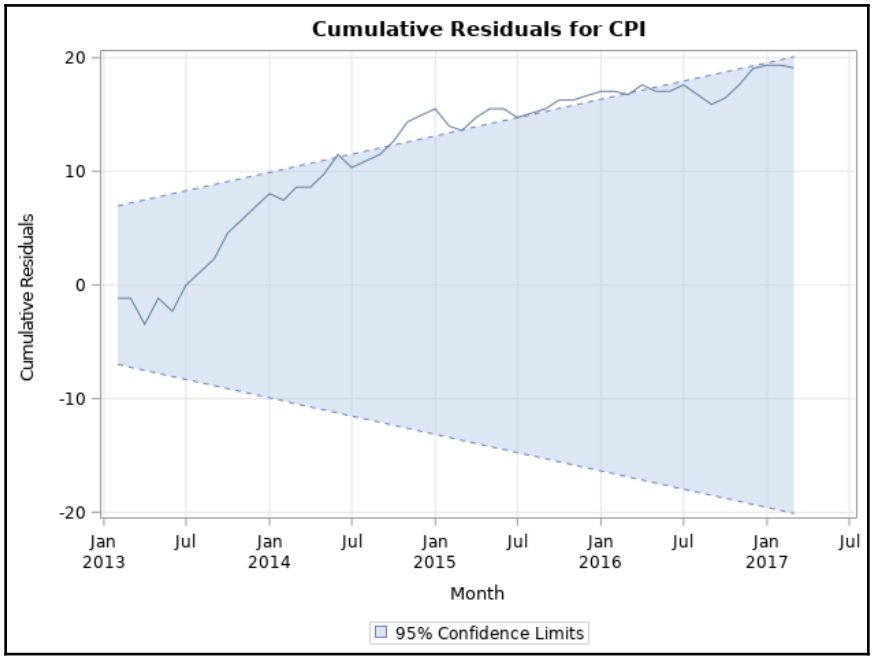
Final Estimates of the Free Parameters					
Component	Parameter	Estimate	Approx Std Error	t Value	Approx Pr > |t|
Irregular	Error Variance	5.94778E-10	6.58962E-7	0.00	0.9993
Level	Error Variance	0.00513	0.0010253	5.00	<.0001
Season	Error Variance	1.25548E-12	2.07609E-9	0.00	0.9995

Fit Statistics Based on Residuals	
Mean Squared Error	0.00852
Root Mean Squared Error	0.09228
Mean Absolute Percentage Error	0.07073
Maximum Percent Error	0.19139
R-Square	0.96825
Adjusted R-Square	0.96690
Random Walk R-Square	-0.71148
Amemiya's Adjusted R-Square	0.96420
Number of non-missing residuals used for computing the fit statistics = 50	

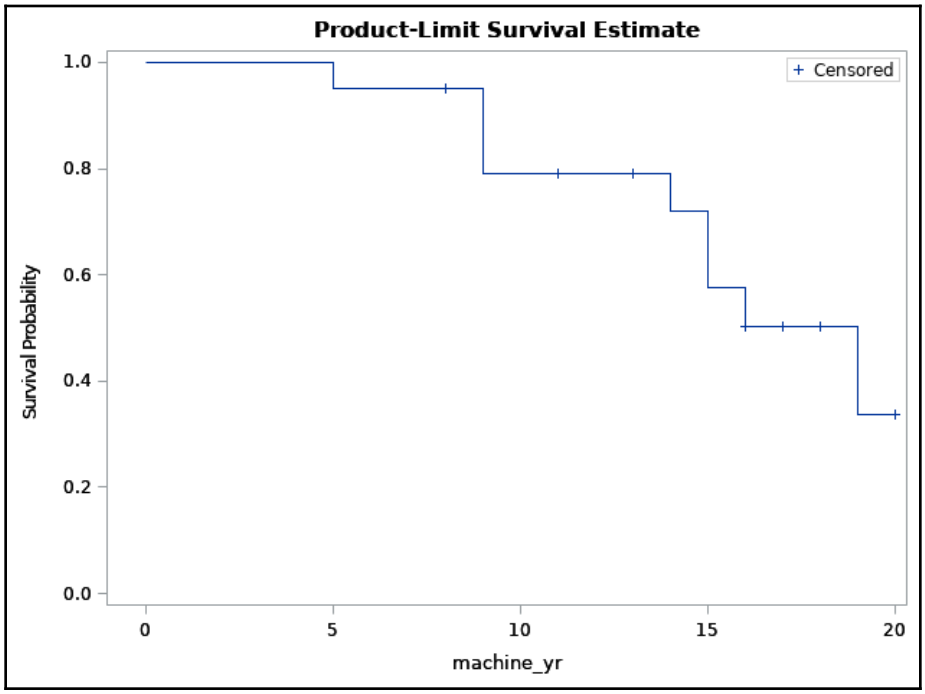
Significance Analysis of Components (Based on the Final State)			
Component	DF	Chi-Square	Pr > ChiSq
Irregular	1	0.00	0.9999
Level	1	1.177E7	<.0001
Slope	1	4.68	0.0305
Season	11	15.69	0.1530

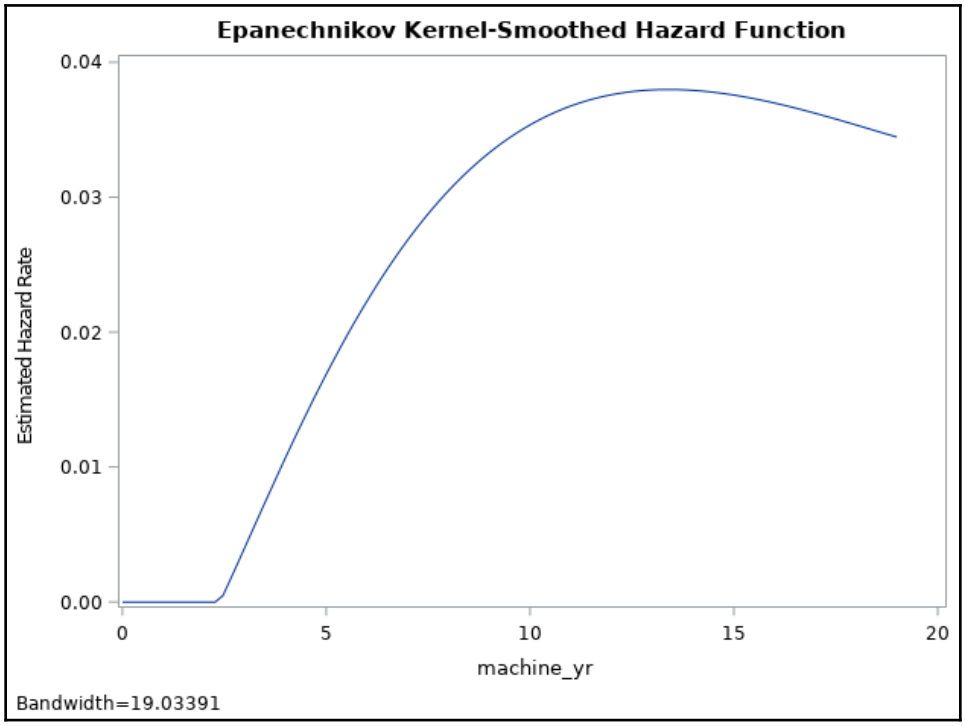

Residual Diagnostics for CPI
Normal
Kernel
Percent
Residual
Residual
Quantile
ACF
Lag
Two Standard Errors
PACF
Lag
Two Standard Errors

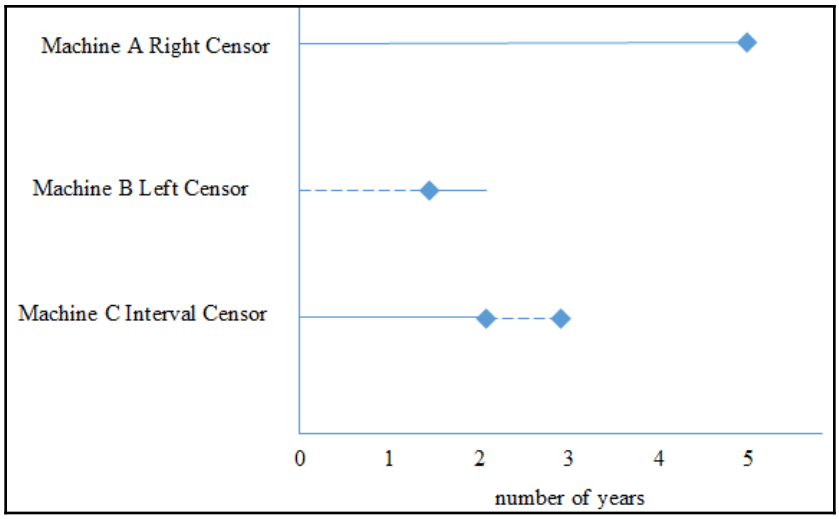

Residual White Noise Test P-Values for CPI
White Noise Probabilities
.001
.01
.05
.1
1.0
0
5
10
15
20
25
Lag
5% Probability
1% Probability


Cumulative Residuals for CPI
20
10
0
-10
-20
Cumulative Residuals
Jan
2013
Jul
Jan
2014
Jul
Jan
2015
Jul
Jan
2016
Jul
Jan
2017
Jul
Month
95% Confidence Limits

Chapter 6: Managing Customer Loyalty Using Time Series Data




Epanechnikov Kernel-Smoothed Hazard Function
Estimated Hazard Rate
0.04
0.03
0.02
0.01
0.00
0
5
10
15
20
machine_yr
Bandwidth=19.03391


Machine A Right Censor
Machine B Left Censor
Machine C Interval Censor
0
1
2
3
4
5
number of years

Obs	Custid	Tenure	AUM	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	Complex_Prod	Complaints	Region	Censor
1	10018	5	2	1	3	1	1	1	1	Yorkshire and Humber	1
2	10025	6	3	3	2	1	1	1	1	Yorkshire and Humber	0
3	10047	15	2	1	1	1	2	1	1	N Ireland	0
4	10050	20	1	3	3	3	3	0	0	N East	1
5	10120	18	2	2	1	2	1	0	1	N West	1
6	10166	2	1	1	1	2	1	0	0	Yorkshire and Humber	0
7	10170	14	3	1	3	2	3	0	1	G London	0
8	10190	14	2	1	1	3	2	0	0	W Midlands	1
9	10191	20	1	3	1	3	3	1	1	E England	1
10	10225	7	1	1	2	1	3	1	1	G London	1
11	10226	10	2	1	1	2	1	0	0	S East	1
12	10276	9	2	2	1	1	2	1	0	S West	1
13	10283	16	2	1	3	1	2	1	0	G London	1
14	10294	7	2	1	2	1	1	1	0	Yorkshire and Humber	0
15	10434	6	2	2	1	1	2	1	1	Yorkshire and Humber	0
16	10436	6	3	2	1	1	1	0	1	Wales	0

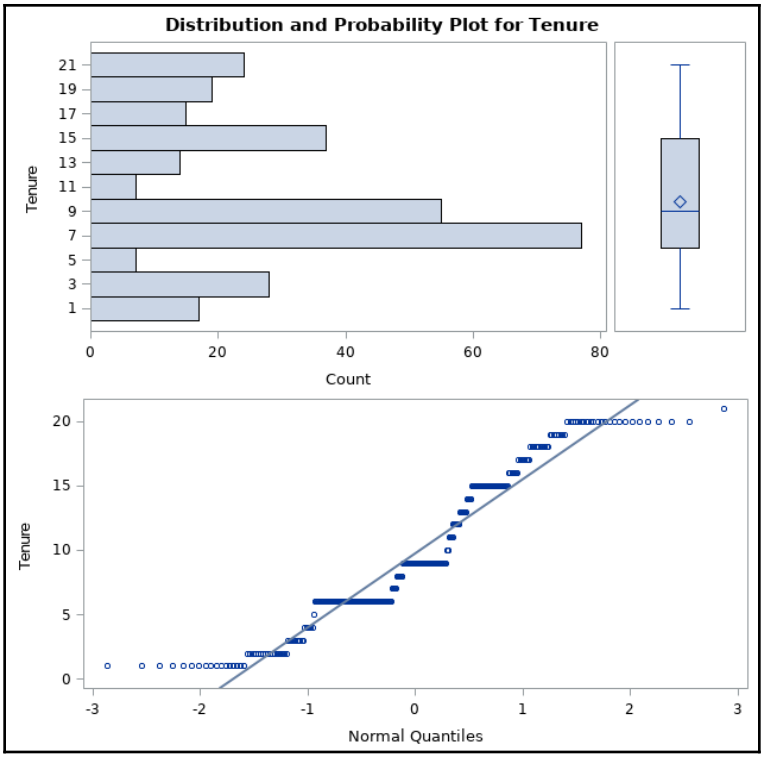
Moments			
N	300	Sum Weights	300
Mean	9.81666667	Sum Observations	2945
Std Deviation	5.75849428	Variance	33.1602564
Skewness	0.33092243	Kurtosis	-1.0416142
Uncorrected SS	38825	Corrected SS	9914.91667
Coeff Variation	58.6603832	Std Error Mean	0.33246682

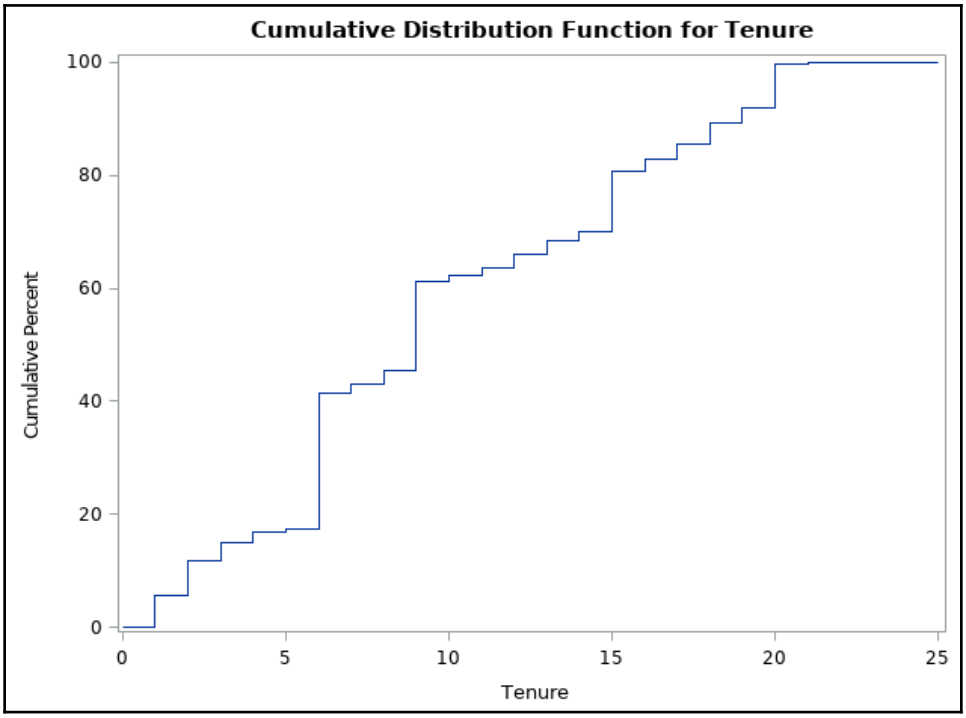
Basic Statistical Measures			
Location		Variability	
Mean	9.816667	Std Deviation	5.75849
Median	9.000000	Variance	33.16026
Mode	6.000000	Range	20.00000
		Interquartile Range	9.00000

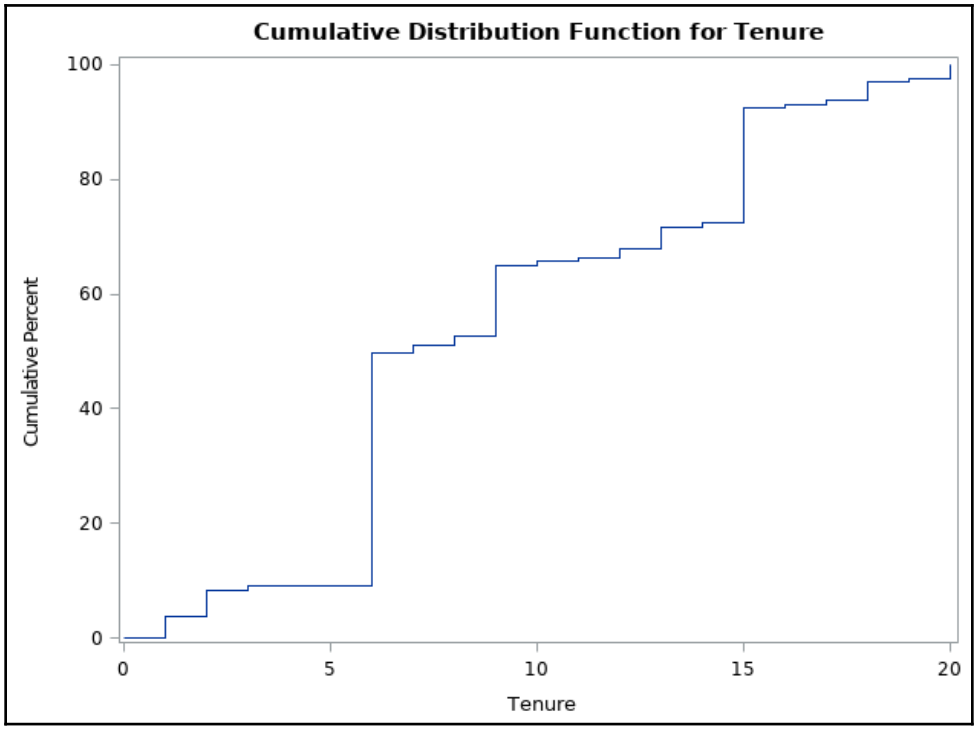
Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	29.52676	Pr > |t|	<.0001
Sign	M	150	Pr >= |M|	<.0001
Signed Rank	S	22575	Pr >= |S|	<.0001

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.926703	Pr < W	<0.0001
Kolmogorov-Smirnov	D	0.169722	Pr > D	<0.0100
Cramer-von Mises	W-Sq	1.392247	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	7.799021	Pr > A-Sq	<0.0050

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
1	247	20	269
1	245	20	281
1	207	20	286
1	205	20	289
1	199	21	74

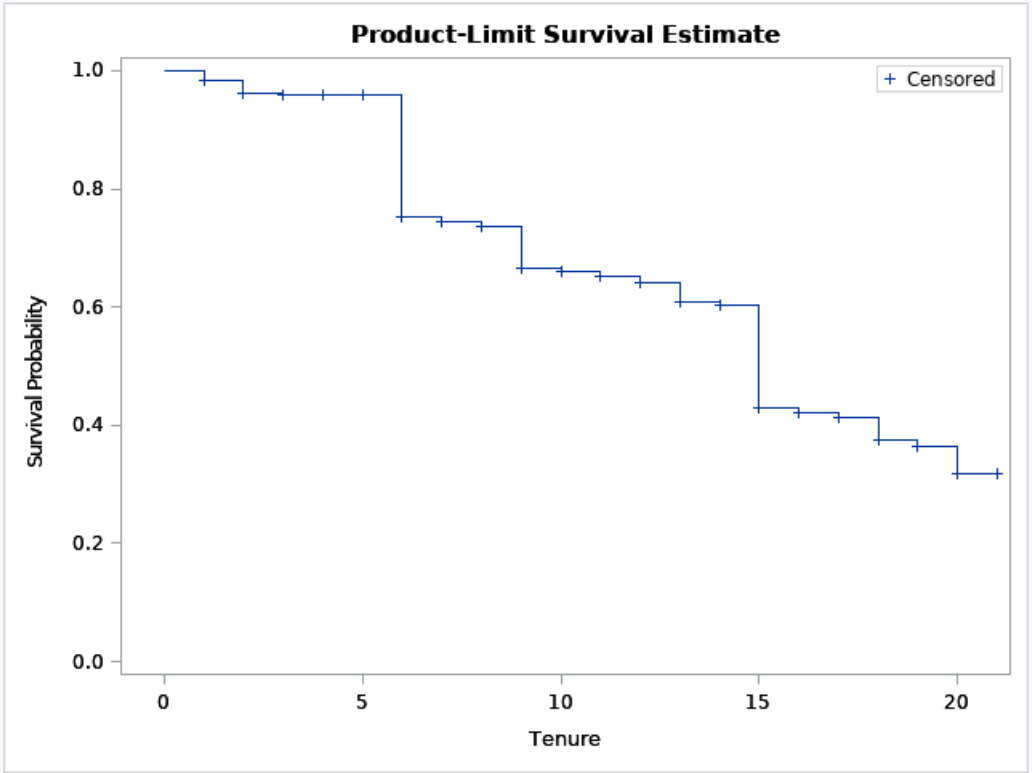



Cumulative Distribution Function for Tenure
Cumulative Percent
100
80
60
40
20
0
0
5
10
15
20
25
Tenure



Pearson Correlation Coefficients, N = 300
Prob > |r| under H0: Rho=0

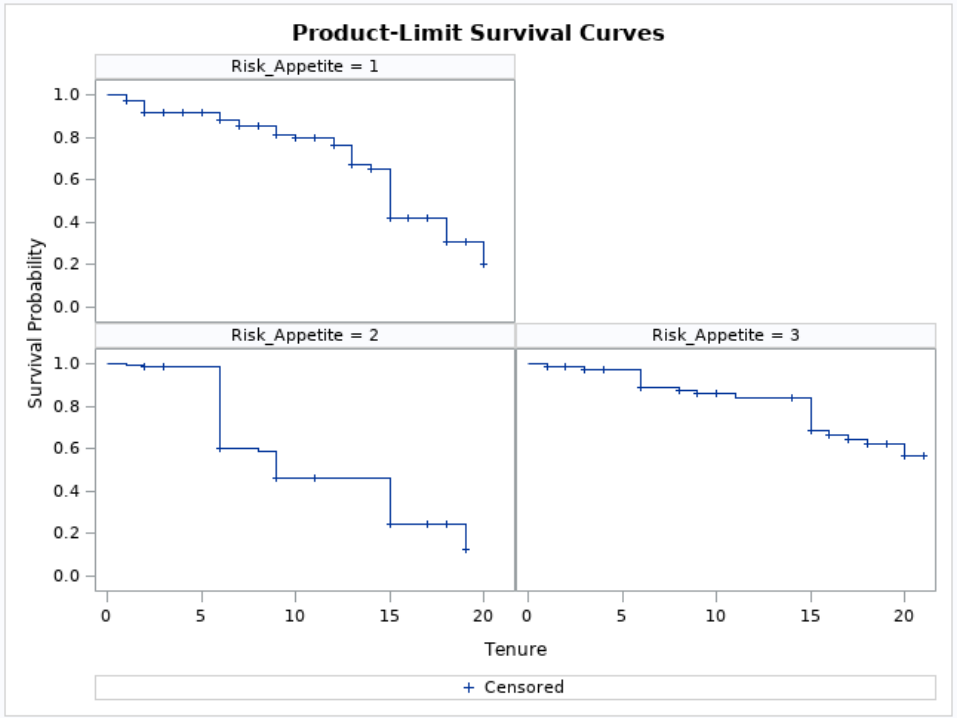
	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	AUM	Complex_Prod	Complaints
Risk_Appetite Risk Appetite	1.00000	0.01994 0.7309	0.14472 0.0121	-0.01345 0.8165	0.06264 0.2795	-0.00551 0.9242	-0.07306 0.2070
Fund_Performance Fund Performance	0.01994 0.7309	1.00000	0.38475 <.0001	0.23188 <.0001	0.12430 0.0314	0.00758 0.8960	-0.15005 0.0092
Inv_Potential Inv Potential	0.14472 0.0121	0.38475 <.0001	1.00000	0.31415 <.0001	0.17964 0.0018	-0.34222 <.0001	-0.10040 0.0825
Inv_Involvement Inv Involvement	-0.01345 0.8165	0.23188 <.0001	0.31415 <.0001	1.00000	0.05550 0.3380	-0.19712 0.0006	-0.00333 0.9542
AUM AUM	0.06264 0.2795	0.12430 0.0314	0.17964 0.0018	0.05550 0.3380	1.00000	-0.00904 0.8761	-0.03256 0.5742
Complex_Prod Complex Prod	-0.00551 0.9242	0.00758 0.8960	-0.34222 <.0001	-0.19712 0.0006	-0.00904 0.8761	1.00000	-0.00053 0.9927
Complaints Complaints	-0.07306 0.2070	-0.15005 0.0092	-0.10040 0.0825	-0.00333 0.9542	-0.03256 0.5742	-0.00053 0.9927	1.00000

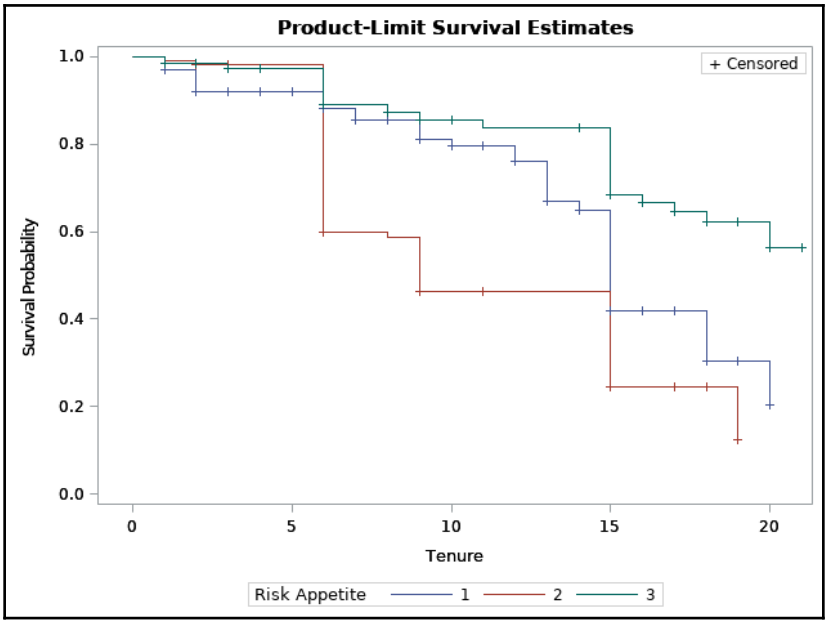


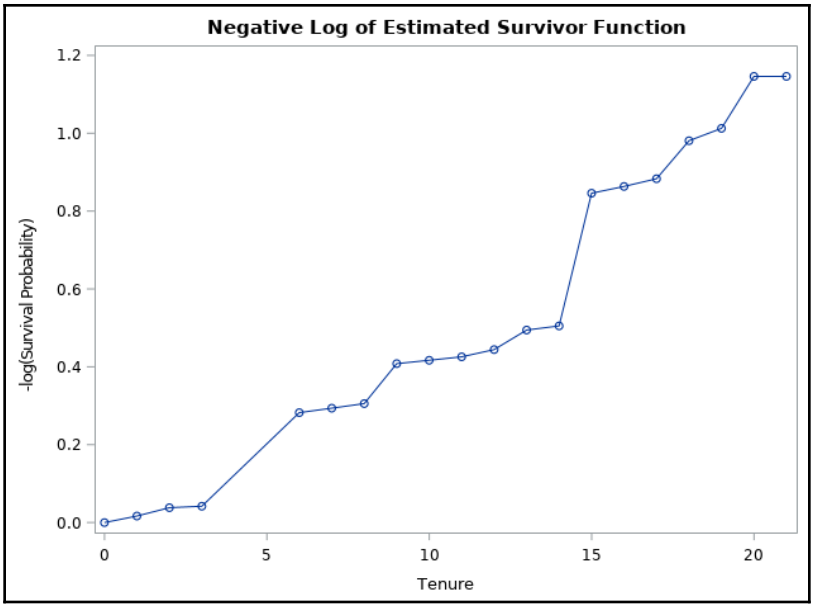
Summary of the Number of Censored and Uncensored Values			
Total	Failed	Censored	Percent Censored
300	131	169	56.33

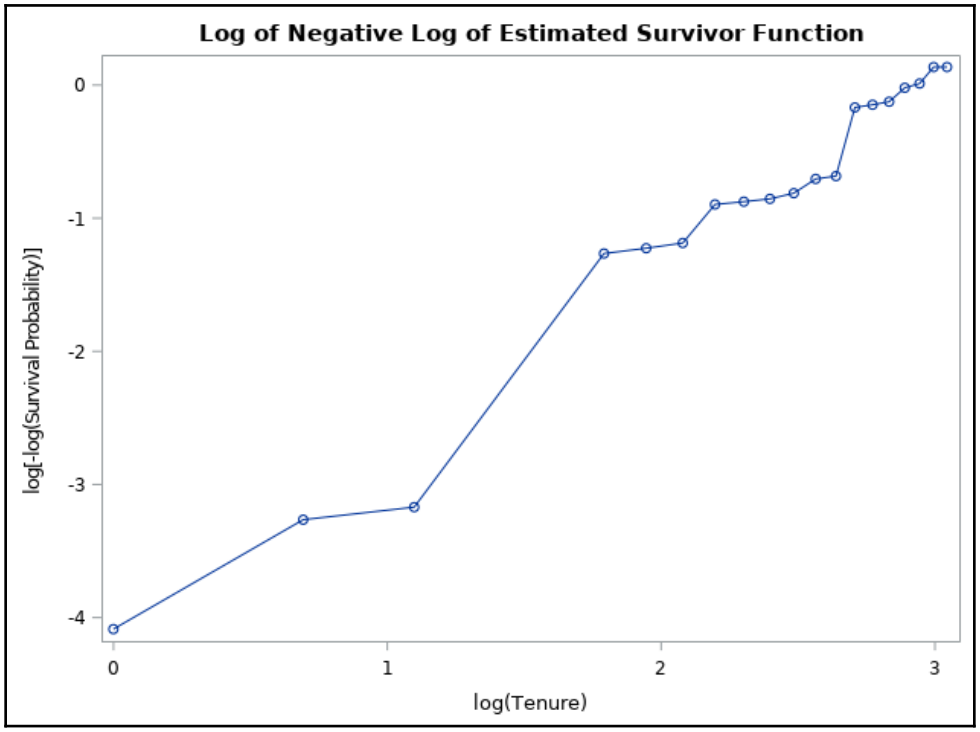
Summary of the Number of Censored and Uncensored Values					
Stratum	Risk_Appetite	Total	Failed	Censored	Percent Censored
1	1	105	40	65	61.90
2	2	121	68	53	43.80
3	3	74	23	51	68.92
Total		300	131	169	56.33

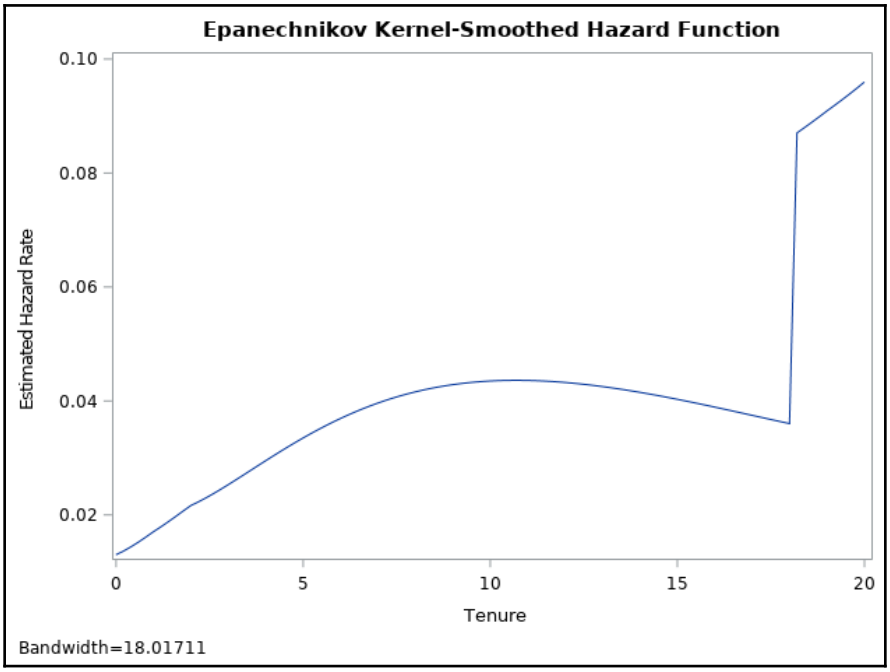
Test of Equality over Strata			
Test	Chi-Square	DF	Pr > Chi-Square
Log-Rank	36.8051	2	<.0001
Wilcoxon	30.4380	2	<.0001
-2Log(LR)	23.3669	2	<.0001




Product-Limit Survival Estimates
+ Censored
Survival Probability
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
Tenure
Risk Appetite
1
2
3


Negative Log of Estimated Survivor Function
-log(Survival Probability)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
Tenure


Log of Negative Log of Estimated Survivor Function
log[-log(Survival Probability)]
0
-1
-2
-3
-4
0
1
2
3
log(Tenure)



Summary of the Number of Censored and Uncensored Values			
Total	Failed	Censored	Percent Censored
300	131	169	56.33

Rank Tests for the Association of Tenure with Covariates

Univariate Chi-Squares for the Wilcoxon Test					
Variable	Test Statistic	Standard Error	Chi-Square	Pr > Chi-Square	Label
Risk_Appetite	12.6805	6.3827	3.9470	0.0470	Risk Appetite
Fund_Performance	36.9483	7.4449	24.6305	<.0001	Fund Performance
Inv_Potential	12.7693	7.3068	3.0540	0.0805	Inv Potential
Inv_Involvement	19.3816	6.5754	8.6884	0.0032	Inv Involvement
AUM	3.4461	8.1878	0.1771	0.6738	AUM
Complex_Prod	13.7158	3.7514	13.3675	0.0003	Complex Prod
Complaints	-5.0054	2.9819	2.8177	0.0932	Complaints

Covariance Matrix for the Wilcoxon Statistics							
Variable	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	AUM	Complex_Prod	Complaints
Risk_Appetite	40.7389	4.0848	6.4707	0.1200	1.4449	-0.4395	-1.8707
Fund_Performance	4.0848	55.4263	24.6492	15.2051	8.0213	-0.7802	-2.7327
Inv_Potential	6.4707	24.6492	53.3900	18.8559	6.4341	-8.9374	-1.4090
Inv_Involvement	0.1200	15.2051	18.8559	43.2354	0.8597	-5.7203	0.0107
AUM	1.4449	8.0213	6.4341	0.8597	67.0406	1.1356	0.5597
Complex_Prod	-0.4395	-0.7802	-8.9374	-5.7203	1.1356	14.0732	-0.4183
Complaints	-1.8707	-2.7327	-1.4090	0.0107	0.5597	-0.4183	8.8915

Forward Stepwise Sequence of Chi-Squares for the Wilcoxon Test						
Variable	DF	Chi-Square	Pr > Chi-Square	Chi-Square Increment	Pr > Increment	Label
Fund_Performance	1	24.6305	<.0001	24.6305	<.0001	Fund Performance
Complex_Prod	2	39.0423	<.0001	14.4118	0.0001	Complex Prod
Inv_Involvement	3	44.9929	<.0001	5.9506	0.0147	Inv Involvement
Risk_Appetite	4	47.8839	<.0001	2.8910	0.0891	Risk Appetite
Complaints	5	48.6108	<.0001	0.7269	0.3939	Complaints
AUM	6	48.7261	<.0001	0.1153	0.7342	AUM
Inv_Potential	7	48.7290	<.0001	0.00282	0.9577	Inv Potential

Univariate Chi-Squares for the Log-Rank Test					
Variable	Test Statistic	Standard Error	Chi-Square	Pr > Chi-Square	Label
Risk_Appetite	21.3570	9.1875	5.4036	0.0201	Risk Appetite
Fund_Performance	49.9318	10.1059	24.4121	<.0001	Fund Performance
Inv_Potential	17.7009	10.1381	3.0484	0.0808	Inv Potential
Inv_Involvement	25.8945	8.6846	8.8903	0.0029	Inv Involvement
AUM	6.7746	11.4894	0.3477	0.5554	AUM
Complex_Prod	17.4102	4.7170	13.6234	0.0002	Complex Prod
Complaints	-6.6492	3.6648	3.2918	0.0696	Complaints

Covariance Matrix for the Log-Rank Statistics							
Variable	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	AUM	Complex_Prod	Complaints
Risk_Appetite	84.410	14.499	18.786	0.710	8.538	-1.694	-3.574
Fund_Performance	14.499	102.129	42.852	22.129	19.304	-1.216	-7.263
Inv_Potential	18.786	42.852	102.782	26.607	11.328	-14.530	-1.803
Inv_Involvement	0.710	22.129	26.607	75.422	2.049	-7.148	-0.330
AUM	8.538	19.304	11.328	2.049	132.007	1.693	-2.065
Complex_Prod	-1.694	-1.216	-14.530	-7.148	1.693	22.250	-0.931
Complaints	-3.574	-7.263	-1.803	-0.330	-2.065	-0.931	13.431

Forward Stepwise Sequence of Chi-Squares for the Log-Rank Test						
Variable	DF	Chi-Square	Pr > Chi-Square	Chi-Square Increment	Pr > Increment	Label
Fund_Performance	1	24.4121	<.0001	24.4121	<.0001	Fund Performance
Complex_Prod	2	38.9911	<.0001	14.5790	0.0001	Complex Prod
Inv_Involvement	3	45.2167	<.0001	6.2256	0.0126	Inv Involvement
Risk_Appetite	4	48.4817	<.0001	3.2650	0.0708	Risk Appetite
Complaints	5	48.8079	<.0001	0.3261	0.5679	Complaints
AUM	6	49.0028	<.0001	0.1949	0.6588	AUM
Inv_Potential	7	49.0598	<.0001	0.0570	0.8113	Inv Potential

The LIFEREG Procedure

Model Information		
Data Set	WORK.SURVIVAL_ANALYSIS	
Dependent Variable	Log(Tenure)	Tenure
Censoring Variable	Censor	Censor
Censoring Value(s)	1	
Number of Observations	300	
Noncensored Values	131	
Right Censored Values	169	
Left Censored Values	0	
Interval Censored Values	0	
Number of Parameters	2	
Name of Distribution	Weibull	
Log Likelihood	-247.3687182	

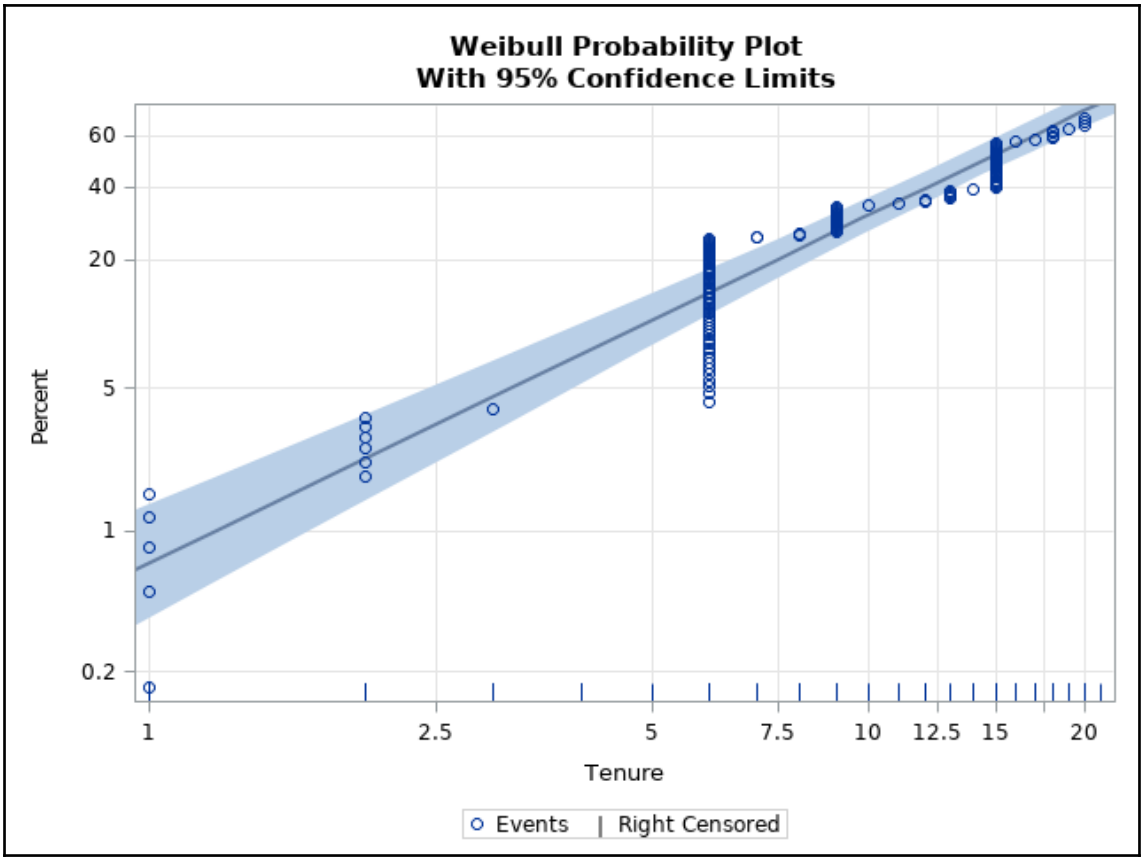
Number of Observations Read	300
Number of Observations Used	300

Fit Statistics	
-2 Log Likelihood	494.737
AIC (smaller is better)	498.737
AICC (smaller is better)	498.778
BIC (smaller is better)	506.145

Fit Statistics (Unlogged Response)	
-2 Log Likelihood	1030.876
Weibull AIC (smaller is better)	1034.876
Weibull AICC (smaller is better)	1034.917
Weibull BIC (smaller is better)	1042.284

Algorithm converged.

Analysis of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept	1	2.8773	0.0537	2.7720	2.9825	2871.52	<.0001
Scale	1	0.5794	0.0412	0.5040	0.6661		
Weibull Scale	1	17.7654	0.9539	15.9908	19.7369		
Weibull Shape	1	1.7258	0.1228	1.5012	1.9840		


Weibull Probability Plot
With 95% Confidence Limits
Percent
60
40
20
5
1
0.2
1
2.5
5
7.5
10
12.5
15
20
Tenure
Events
Right Censored

The LIFEREG Procedure

Model Information		
Data Set	WORK.SURVIVAL_ANALYSIS	
Dependent Variable	Log(Tenure)	Tenure
Censoring Variable	Censor	Censor
Censoring Value(s)	1	
Number of Observations	300	
Noncensored Values	131	
Right Censored Values	169	
Left Censored Values	0	
Interval Censored Values	0	
Number of Parameters	1	
Name of Distribution	Exponential	
Log Likelihood	-270.6899755	

Number of Observations Read	300
Number of Observations Used	300

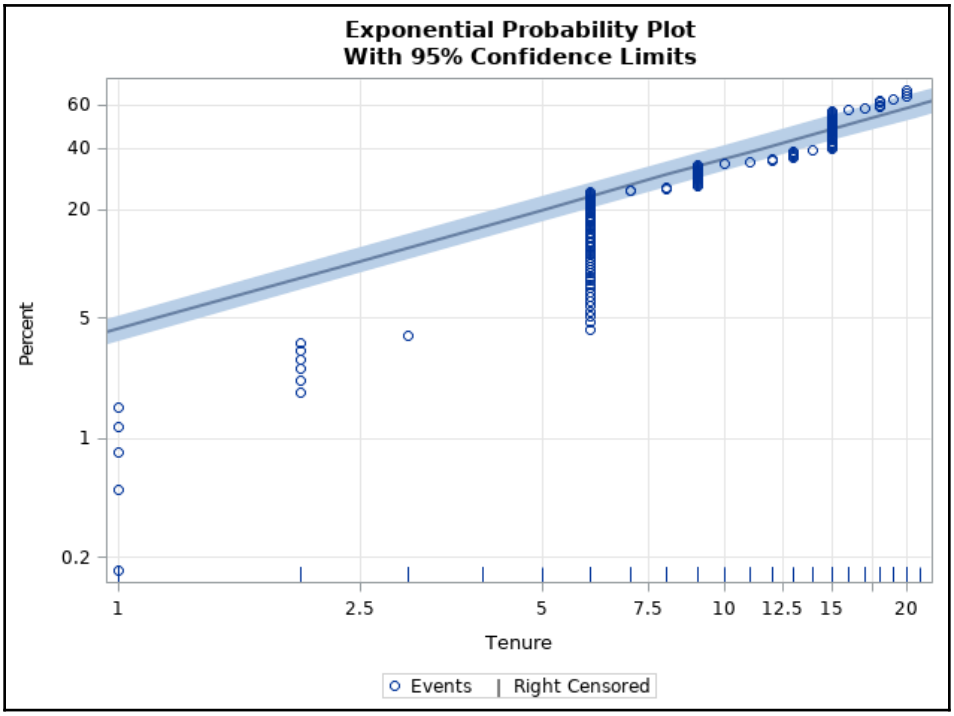
Fit Statistics	
-2 Log Likelihood	541.380
AIC (smaller is better)	543.380
AICC (smaller is better)	543.393
BIC (smaller is better)	547.084

Fit Statistics (Unlogged Response)	
-2 Log Likelihood	1077.519
Exponential AIC (smaller is better)	1079.519
Exponential AICC (smaller is better)	1079.532
Exponential BIC (smaller is better)	1083.222

Algorithm converged.

Analysis of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept	1	3.1127	0.0874	2.9414	3.2839	1269.22	<.0001
Scale	0	1.0000	0.0000	1.0000	1.0000		
Weibull Scale	1	22.4809	1.9642	18.9428	26.6799		
Weibull Shape	0	1.0000	0.0000	1.0000	1.0000		

Lagrange Multiplier Statistics		
Parameter	Chi-Square	Pr > ChiSq
Scale	368.1538	<.0001


Exponential Probability Plot
With 95% Confidence Limits
Percent
60
40
20
5
1
0.2
1
2.5
5
7.5
10
12.5
15
20
Tenure
Events
Right Censored

The LIFEREG Procedure

Model Information		
Data Set	WORK.SURVIVAL_ANALYSIS	
Dependent Variable	Log(Tenure)	Tenure
Censoring Variable	Censor	Censor
Censoring Value(s)	1	
Number of Observations	300	
Noncensored Values	131	
Right Censored Values	169	
Left Censored Values	0	
Interval Censored Values	0	
Number of Parameters	9	
Name of Distribution	Weibull	
Log Likelihood	-221.8754708	

Number of Observations Read	300
Number of Observations Used	300

Fit Statistics	
-2 Log Likelihood	443.751
AIC (smaller is better)	461.751
AICC (smaller is better)	462.372
BIC (smaller is better)	495.085

Analysis of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept	1	1.6526	0.2311	1.1996	2.1057	51.12	<.0001
Risk_Appetite	1	0.0973	0.0597	-0.0198	0.2144	2.65	0.1033
Fund_Performance	1	0.2390	0.0716	0.0986	0.3793	11.13	0.0008
Inv_Potential	1	0.0337	0.0712	-0.1058	0.1732	0.22	0.6356
Inv_Involvement	1	0.1609	0.0721	0.0196	0.3023	4.98	0.0257
AUM	1	-0.0350	0.0537	-0.1402	0.0703	0.42	0.5150
Complex_Prod	1	0.4376	0.1133	0.2156	0.6597	14.92	0.0001
Complaints	1	-0.0367	0.1354	-0.3021	0.2287	0.07	0.7863
Scale	1	0.5543	0.0394	0.4822	0.6372		
Weibull Shape	1	1.8041	0.1282	1.5694	2.0738		

Bayesian Analysis

Model Information		
Data Set	WORK.SURVIVAL_ANALYSIS	
Dependent Variable	Log(Tenure)	Tenure
Censoring Variable	Censor	Censor
Censoring Value(s)	1	
Number of Observations	300	
Noncensored Values	131	
Right Censored Values	169	
Left Censored Values	0	
Interval Censored Values	0	
Number of Parameters	9	
Burn-In Size	2000	
MC Sample Size	10000	
Thinning	1	
Name of Distribution	Weibull	
Log Likelihood	-221.8754708	

Number of Observations Read	300
Number of Observations Used	300

Algorithm converged.

Analysis of Maximum Likelihood Parameter Estimates					
Parameter	DF	Estimate	Standard Error	95% Confidence Limits	
Intercept	1	1.6526	0.2311	1.1996	2.1057
Risk_Appetite	1	0.0973	0.0597	-0.0198	0.2144
Fund_Performance	1	0.2390	0.0716	0.0986	0.3793
Inv_Potential	1	0.0337	0.0712	-0.1058	0.1732
Inv_Involvement	1	0.1609	0.0721	0.0196	0.3023
AUM	1	-0.0350	0.0537	-0.1402	0.0703
Complex_Prod	1	0.4376	0.1133	0.2156	0.6597
Complaints	1	-0.0367	0.1354	-0.3021	0.2287
Scale	1	0.5543	0.0394	0.4822	0.6372
Weibull Shape	1	1.8041	0.1282	1.5694	2.0738

The LIFEREG Procedure

Bayesian Analysis

Uniform Prior for Regression Coefficients	
Parameter	Prior
Intercept	Constant
Risk_Appetite	Constant
Fund_Performance	Constant
Inv_Potential	Constant
Inv_Involvement	Constant
AUM	Constant
Complex_Prod	Constant
Complaints	Constant

Independent Prior Distributions for Model Parameters					
Parameter	Prior Distribution	Hyperparameters			
Weibull Shape	Gamma	Shape	0.001	Inverse Scale	0.001

Initial Values of the Chain										
Chain	Seed	Intercept	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	AUM	Complex_Prod	Complaints	WeibShape
1	874689739	1.649072	0.097506	0.240244	0.033715	0.16163	-0.03512	0.439321	-0.03685	1.794935

Fit Statistics	
DIC (smaller is better)	461.888
pD (effective number of parameters)	8.808

Posterior Correlation Matrix									
Parameter	Intercept	Risk_Appetite	Fund_Performance	Inv_Potential	Inv_Involvement	AUM	Complex_Prod	Complaints	WeibShape
Intercept	1.0000	-.4267	-.1093	-.3113	-.4127	-.3298	-.4665	-.2881	0.2177
Risk_Appetite	-.4267	1.0000	-.0469	-.0835	0.0397	-.0256	-.0171	0.1164	-.0529
Fund_Performance	-.1093	-.0469	1.0000	-.3385	-.1273	-.2140	-.0787	0.1201	-.2786
Inv_Potential	-.3113	-.0835	-.3385	1.0000	-.1341	-.0191	0.3386	-.0218	-.0030
Inv_Involvement	-.4127	0.0397	-.1273	-.1341	1.0000	-.0534	0.0979	0.0638	-.1293
AUM	-.3298	-.0256	-.2140	-.0191	-.0534	1.0000	-.0473	0.0094	0.0492
Complex_Prod	-.4665	-.0171	-.0787	0.3386	0.0979	-.0473	1.0000	0.1532	-.2153
Complaints	-.2881	0.1164	0.1201	-.0218	0.0638	0.0094	0.1532	1.0000	-.0007
WeibShape	0.2177	-.0529	-.2786	-.0030	-.1293	0.0492	-.2153	-.0007	1.0000

The LIFEREG Procedure

Bayesian Analysis

Posterior Autocorrelations

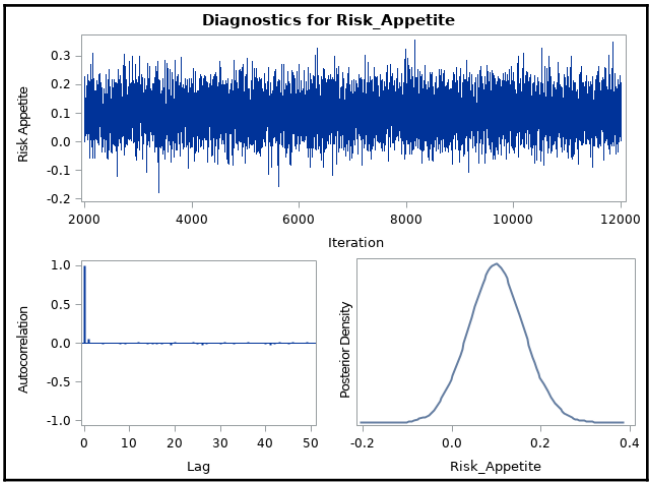
Parameter	Lag 1	Lag 5	Lag 10	Lag 50
Intercept	0.1694	0.0203	0.0092	0.0177
Risk_Appetite	0.0597	0.0013	0.0013	-0.0021
Fund_Performance	0.4277	0.0081	-0.0002	0.0017
Inv_Potential	0.3856	-0.0048	0.0021	0.0025
Inv_Involvement	0.2514	0.0085	-0.0150	-0.0052
AUM	0.1872	0.0022	-0.0105	0.0035
Complex_Prod	0.2756	0.0037	-0.0037	0.0152
Complaints	0.5010	0.0594	-0.0132	0.0020
Weib Shape	0.2747	0.0178	0.0012	0.0074

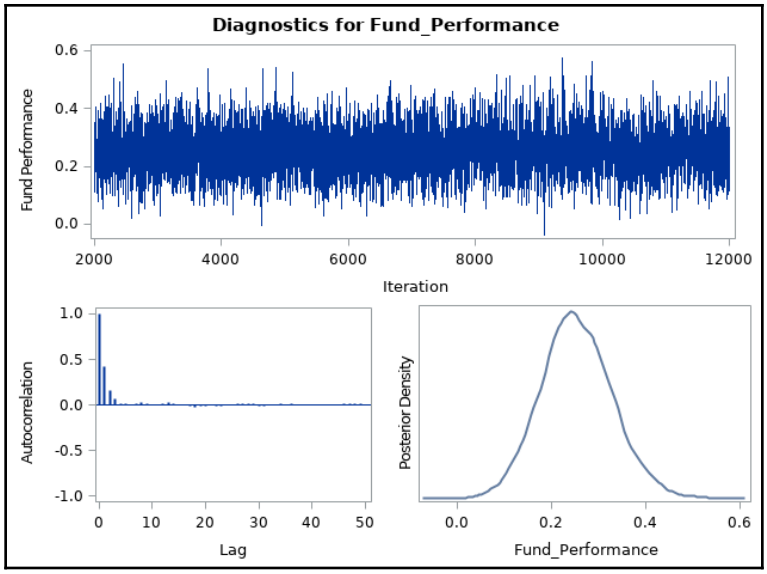
Geweke Diagnostics

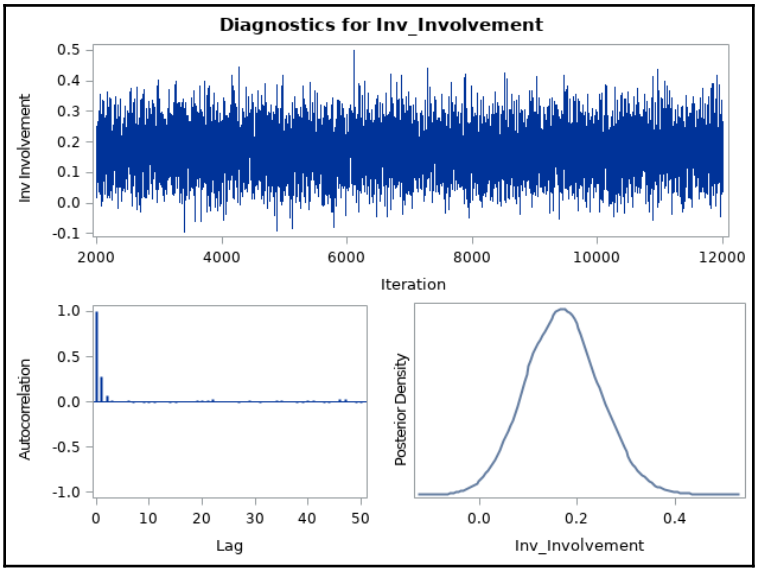
Parameter	z	Pr > |z|
Intercept	1.8932	0.0583
Risk_Appetite	-0.6224	0.5337
Fund_Performance	-1.0738	0.2829
Inv_Potential	-0.1164	0.9073
Inv_Involvement	-0.2338	0.8151
AUM	-1.4728	0.1408
Complex_Prod	-1.0482	0.2946
Complaints	-1.2882	0.1977
Weib Shape	1.5412	0.1233

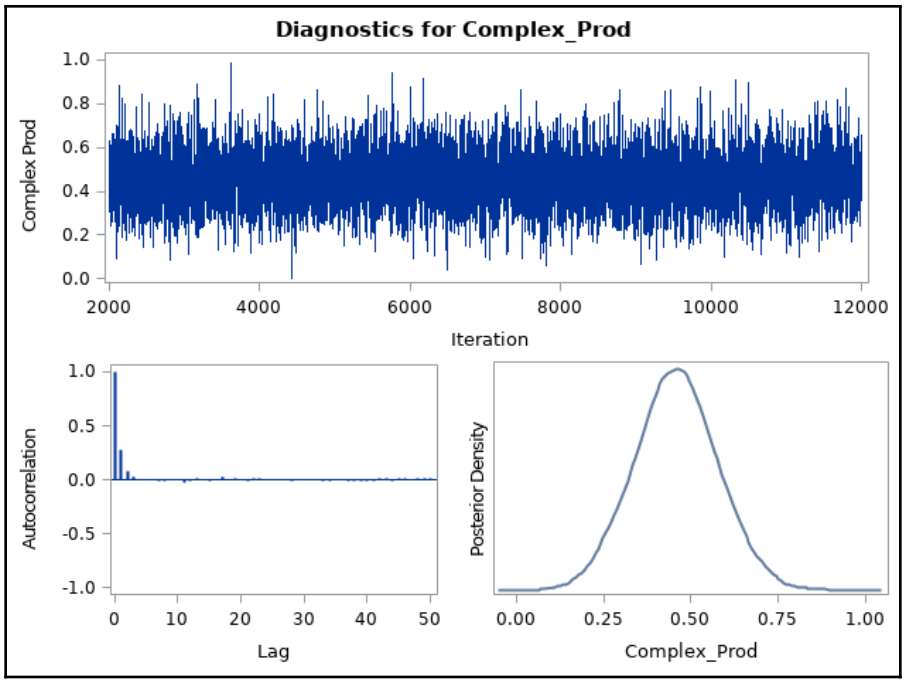
Effective Sample Sizes

Parameter	ESS	Autocorrelation Time	Efficiency
Intercept	6949.8	1.4389	0.6950
Risk_Appetite	8933.2	1.1194	0.8933
Fund_Performance	4277.0	2.3381	0.4277
Inv_Potential	4990.6	2.0038	0.4991
Inv_Involvement	6614.8	1.5118	0.6615
AUM	7132.6	1.4020	0.7133
Complex_Prod	5618.4	1.7799	0.5618
Complaints	3098.2	3.2276	0.3098
Weib Shape	5243.3	1.9072	0.5243


Diagnostics for Risk_Appetite
Risk Appetite
0.3
0.2
0.1
0.0
-0.1
-0.2
2000
4000
6000
8000
10000
12000
Iteration
Autocorrelation
1.0
0.5
0.0
-0.5
-1.0
0
10
20
30
40
50
Lag
Posterior Density
-0.2
0.0
0.2
0.4
Risk_Appetite


Diagnostics for Fund_Performance
Fund Performance
0.6
0.4
0.2
0.0
2000
4000
6000
8000
10000
12000
Iteration
Autocorrelation
1.0
0.5
0.0
-0.5
-1.0
0
10
20
30
40
50
Lag
Posterior Density
0.0
0.2
0.4
0.6
Fund_Performance


Diagnostics for Inv_Involvement
Inv Involvement
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
2000
4000
6000
8000
10000
12000
Iteration
Autocorrelation
1.0
0.5
0.0
-0.5
-1.0
0
10
20
30
40
50
Lag
Posterior Density
0.0
0.2
0.4
Inv_Involvement


Diagnostics for Complex_Prod
Complex Prod
1.0
0.8
0.6
0.4
0.2
0.0
2000
4000
6000
8000
10000
12000
Iteration
Autocorrelation
1.0
0.5
0.0
-0.5
-1.0
0
10
20
30
40
50
Lag
Posterior Density
0.00
0.25
0.50
0.75
1.00
Complex_Prod

The PHREG Procedure

Model Information		
Data Set	WORK.SURVIVAL_ANALYSIS	
Dependent Variable	Tenure	Tenure
Censoring Variable	Censor	Censor
Censoring Value(s)	1	
Ties Handling	BRESLOW	

Number of Observations Read	300
Number of Observations Used	300

Summary of the Number of Event and Censored Values			
Total	Event	Censored	Percent Censored
300	131	169	56.33

Analysis of Effects Eligible for Entry				
Effect	DF	Score Chi-Square	Pr > ChiSq	Effect Label
Risk_Appetite	1	5.4036	0.0201	Risk Appetite
Fund_Performance	1	24.4121	<.0001	Fund Performance
Inv_Potential	1	3.0484	0.0808	Inv Potential
Inv_Involvement	1	8.8903	0.0029	Inv Involvement
AUM	1	0.3477	0.5554	AUM
Complex_Prod	1	13.6234	0.0002	Complex Prod
Complaints	1	3.2918	0.0696	Complaints

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
49.0598	7	<.0001

Step 1. Effect Fund_Performance is entered. The model contains the following effects:

Fund_Performance

Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Without Covariates	With Covariates
-2 LOG L	1323.959	1299.034
AIC	1323.959	1301.034
SBC	1323.959	1303.909

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	24.9255	1	<.0001
Score	24.4121	1	<.0001
Wald	23.0332	1	<.0001

Analysis of Maximum Likelihood Estimates							
Parameter	DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	Label
Fund_Performance	1	-0.51172	0.10662	23.0332	<.0001	0.599	Fund Performance

Analysis of Effects Eligible for Entry				
Effect	DF	Score Chi-Square	Pr > ChiSq	Effect Label
Risk_Appetite	1	2.7017	0.1002	Risk Appetite
Inv_Potential	1	0.1441	0.7042	Inv Potential
Inv_Involvement	1	3.1591	0.0755	Inv Involvement
AUM	1	0.1223	0.7266	AUM
Complex_Prod	1	14.5333	0.0001	Complex Prod
Complaints	1	0.5591	0.4546	Complaints

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
23.4874	6	0.0006

Step 4. Effect Risk_Appetite is entered. The model contains the following effects:

Risk_Appetite Fund_Performance Inv_Involvement Complex_Prod

Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Without Covariates	With Covariates
-2 LOG L	1323.959	1277.867
AIC	1323.959	1285.867
SBC	1323.959	1297.368

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	46.0921	4	<.0001
Score	48.4817	4	<.0001
Wald	46.3784	4	<.0001

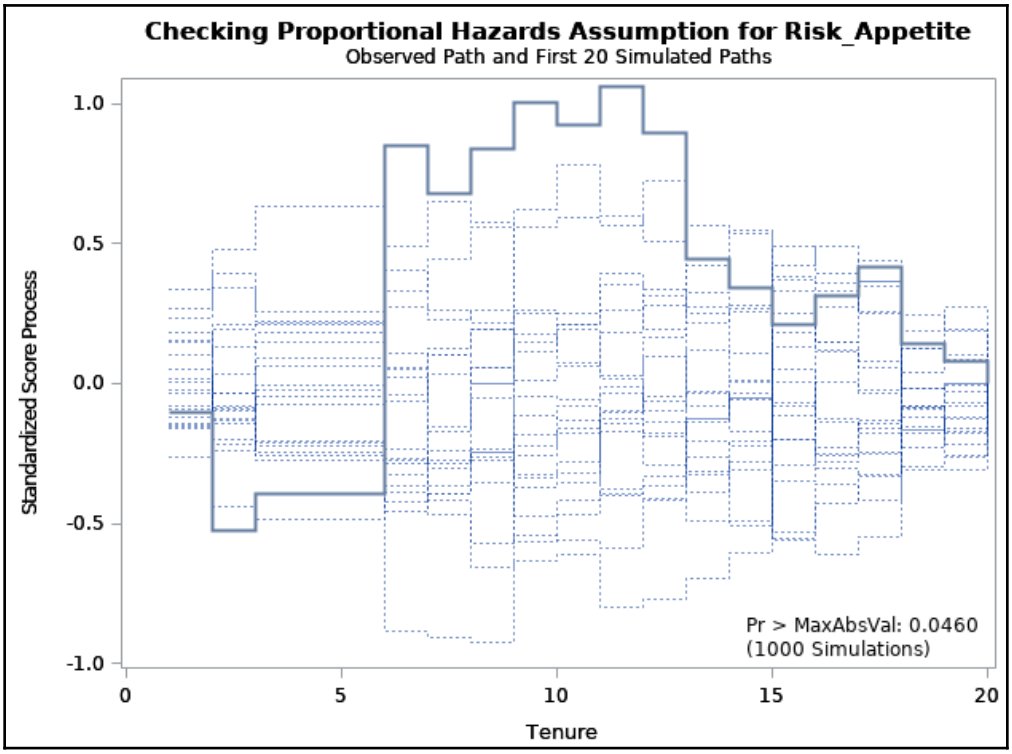
Analysis of Maximum Likelihood Estimates							
Parameter	DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	Label
Risk_Appetite	1	-0.19761	0.11223	3.1002	0.0783	0.821	Risk Appetite
Fund_Performance	1	-0.41953	0.11211	14.0036	0.0002	0.657	Fund Performance
Inv_Involvement	1	-0.28450	0.12643	5.0633	0.0244	0.752	Inv Involvement
Complex_Prod	1	-0.74868	0.18567	16.2596	<.0001	0.473	Complex Prod

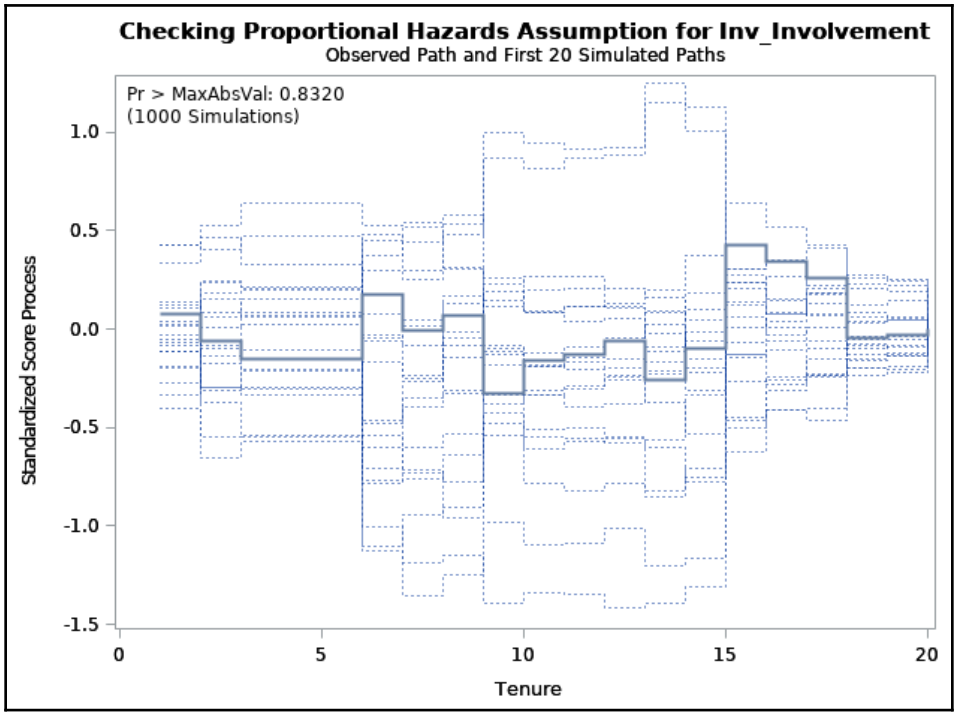
Analysis of Effects Eligible for Entry				
Effect	DF	Score Chi-Square	Pr > ChiSq	Effect Label
Inv_Potential	1	0.0664	0.7967	Inv Potential
AUM	1	0.3246	0.5688	AUM
Complaints	1	0.0550	0.8145	Complaints

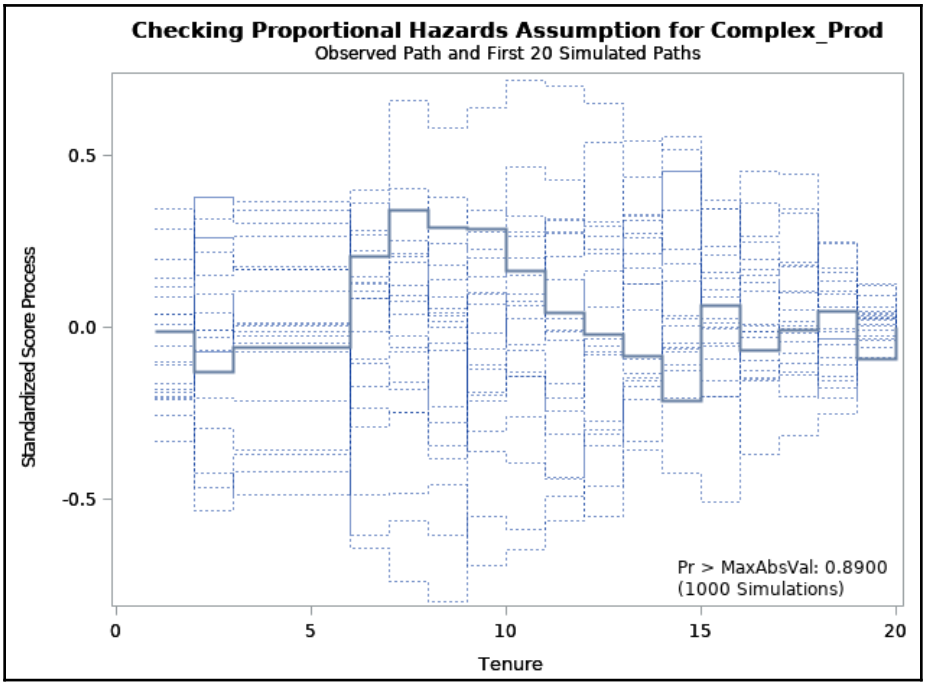
Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
0.4544	3	0.9288

Note: No (additional) effects met the 0.25 level for entry into the model.

Summary of Stepwise Selection								
Step	Effect Entered	Effect Removed	DF	Number In	Score Chi-Square	Wald Chi-Square	Pr > ChiSq	Effect Label
1	Fund_Performance		1	1	24.4121		<.0001	Fund Performance
2	Complex_Prod		1	2	14.5333		0.0001	Complex Prod
3	Inv_Involvement		1	3	5.0234		0.0250	Inv Involvement
4	Risk_Appetite		1	4	3.1181		0.0774	Risk Appetite


Checking Proportional Hazards Assumption for Risk_Appetite
Observed Path and First 20 Simulated Paths
Standardized Score Process
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
Tenure
Pr > MaxAbsVal: 0.0460
(1000 Simulations)


Checking Proportional Hazards Assumption for Inv_Involvement
Observed Path and First 20 Simulated Paths
Pr > MaxAbsVal: 0.8320
(1000 Simulations)
Standardized Score Process
1.0
0.5
0.0
-0.5
-1.0
-1.5
0
5
10
15
20
Tenure



Supremum Test for Functional Form				
Variable	Maximum Absolute Value	Replications	Seed	Pr > MaxAbsVal
Risk_Appetite	11.2957	1000	240078360	<.0001
Fund_Performance	2.2044	1000	240078360	0.3530
Inv_Involvement	8.1274	1000	240078360	0.0010
Complex_Prod	0.0000	1000	240078360	<.0001

Supremum Test for Proportionals Hazards Assumption				
Variable	Maximum Absolute Value	Replications	Seed	Pr > MaxAbsVal
Risk_Appetite	1.0622	1000	240078360	0.0460
Fund_Performance	0.6833	1000	240078360	0.3470
Inv_Involvement	0.4299	1000	240078360	0.8320
Complex_Prod	0.3422	1000	240078360	0.8900

Chapter 7: Transforming Time Series – Market Basket and Clustering

Obs	PRODUCTS	FREQ_CO_OCCUR
1	BTL_Mortgage	157
2	Business_Current_Account	94
3	Credit_Card	147
4	Currency_Services	9
5	Insurance	97
6	Locker	84
7	Personal_Current_Account	60
8	Personal_Loans	53
9	Premium_Current_Account	46
10	Residential_Mortgage	43
11	Savings_Account	110
12	Trading_Account	17

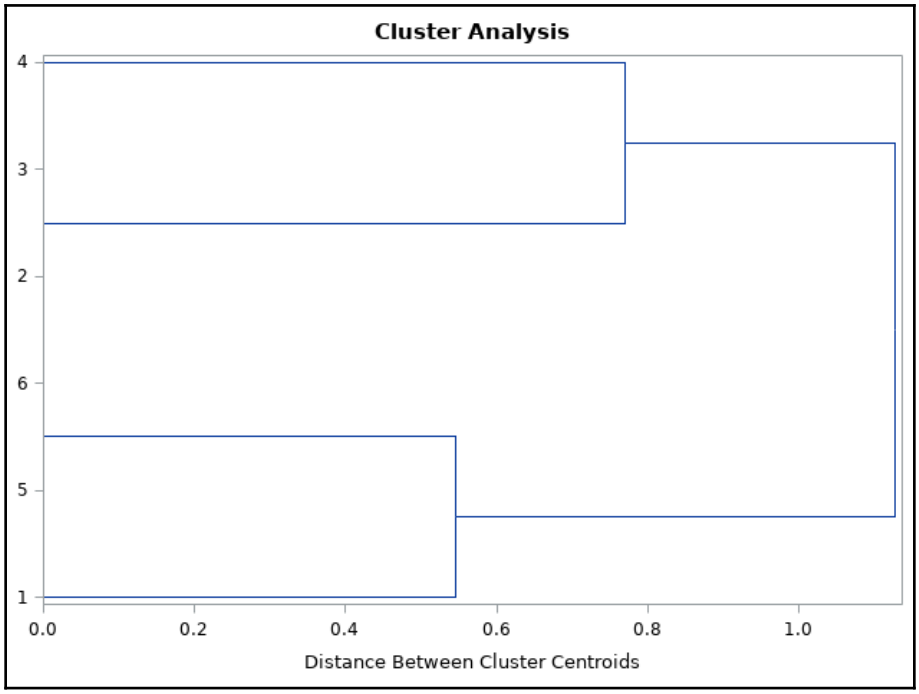
Obs	LHS	RHS	FREQ_CO_OCCUR	CONFIDENCE	SUPPORT	EXPECTED_CONFIDENCE	LIFT	CHISQ	P
1	Premium_Current_Account	Personal_Loans	93	70.45	18.60	43.60	1.62	9.78	.0018
2	Premium_Current_Account	Business_Current_Account	93	70.45	18.60	44.40	1.59	9.17	.0025
3	Premium_Current_Account	Locker	106	80.30	21.20	52.40	1.53	11.87	.0006
4	Personal_Loans	Personal_Current_Account	158	72.48	31.60	57.60	1.26	11.07	.0009
5	Savings_Account	Personal_Current_Account	244	71.98	48.80	57.60	1.25	43.48	.0000
6	Personal_Current_Account	Savings_Account	244	84.72	48.80	67.80	1.25	43.48	.0000
7	Business_Current_Account	Locker	145	65.32	29.00	52.40	1.25	7.74	.0054
8	Savings_Account	Locker	208	61.36	41.60	52.40	1.17	14.09	.0002
9	Locker	Savings_Account	208	79.39	41.60	67.80	1.17	14.09	.0002
10	Savings_Account	Credit_Card	321	94.69	64.20	91.40	1.04	9.31	.0023
11	Credit_Card	Savings_Account	321	70.24	64.20	67.80	1.04	9.31	.0023

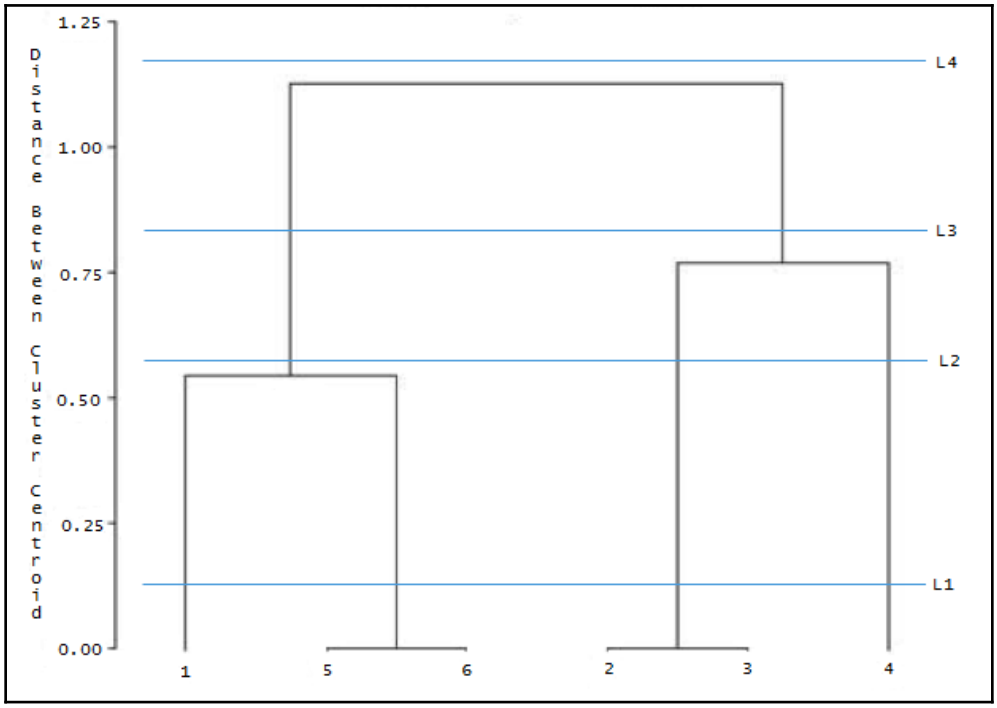
Obs	LHS	RHS	FREQ_CO_OCCUR	CONFIDENCE	SUPPORT	EXPECTED_CONFIDENCE	LIFT	CHISQ	P
1	Premium_Current_Account	Personal_Loans	93	70.45	18.60	43.60	1.62	9.78	.0018
2	Premium_Current_Account	Business_Current_Account	93	70.45	18.60	44.40	1.59	9.17	.0025
3	Premium_Current_Account	Locker	106	80.30	21.20	52.40	1.53	11.87	.0006
4	Business_Current_Account	Locker	145	65.32	29.00	52.40	1.25	7.74	.0054

Obs	LHS	RHS	ANALYSIS_UNIT_FREQ	freq_co_occur	CONFIDENCE	SUPPORT	EXPECTED_CONFIDENCE	LIFT	CHISQ	P
1	Personal_Current_Account|Savings_Account	Credit_Card	121	56	46.28	11.20	91.40	0.51	46.30	.0000
2	Insurance|Business_Current_Account	Credit_Card	57	11	19.30	2.20	91.40	0.21	9.36	.0022
3	Residential_Mortgage|Insurance	Credit_Card	71	47	66.20	9.40	91.40	0.72	6.29	.0122
4	Locker|Savings_Account	Credit_Card	55	31	56.36	6.20	91.40	0.62	5.98	.0144
5	Insurance|Trading_Account	Credit_Card	42	12	28.57	2.40	91.40	0.31	5.53	.0187
6	BTL_Mortgage|Insurance	Credit_Card	46	22	47.83	4.40	91.40	0.52	5.38	.0203
7	Business_Current_Account|Locker	Savings_Account	91	13	14.29	2.60	67.80	0.21	3.79	.0514
8	Personal_Loans|Insurance	Credit_Card	45	4	8.89	0.80	91.40	0.10	3.43	.0642
9	Premium_Current_Account|Business_Current_Account	Locker	40	40	100.0	8.00	52.40	1.91	3.16	.0755
10	Savings_Account|Residential_Mortgage	Credit_Card	39	22	56.41	4.40	91.40	0.62	2.90	.0886

Obs	LHS	RHS	ANALYSIS_UNIT_FREQ	freq_co_occur	CONFIDENCE	SUPPORT	EXPECTED_CONFIDENCE	LIFT
1	Premium_Current_Account|Business_Current_Account	Locker	40	40	100.0	8.00	52.40	1.91
2	Personal_Loans|Premium_Current_Account	Business_Current_Account	51	40	78.43	8.00	44.40	1.77
3	Insurance|Personal_Current_Account	Savings_Account	55	51	92.73	10.20	67.80	1.37
4	Savings_Account|Credit_Card	BTL_Mortgage	117	50	42.74	10.00	31.40	1.36
5	Locker|Insurance	Business_Current_Account	42	29	69.05	5.80	44.40	1.56
6	Insurance|Business_Current_Account	Personal_Loans	57	29	50.88	5.80	43.60	1.17
7	Savings_Account|Personal_Current_Account	Credit_Card	43	41	95.35	8.20	91.40	1.04
8	Credit_Card|BTL_Mortgage	Business_Current_Account	52	26	50.00	5.20	44.40	1.13

Obs	id	female	tall	grade
1	1	1	1	3
2	2	0	3	1
3	3	0	3	1
4	4	0	1	1
5	5	1	2	4
6	6	1	2	4


Cluster Analysis
4
3
2
6
5
1
0.0
0.2
0.4
0.6
0.8
1.0
Distance Between Cluster Centroids



Oblique Principal Component Cluster Analysis

Observations	300	**Proportion**	0
Variables	7	**Maxeigen**	1

Clustering algorithm converged.

Cluster Summary for 1 Cluster

Cluster	Members	Cluster Variation	Variation Explained	Proportion Explained	Second Eigenvalue
1	7	7	2.708771	0.3870	1.1475

Total variation explained = 2.708771 Proportion = 0.3870

Cluster 1 will be split because it has the largest second eigenvalue, 1.147541, which is greater than the MAXEIGEN=1 value.

Clustering algorithm converged.

Clustering algorithm converged.

Cluster Summary for 2 Clusters					
Cluster	Members	Cluster Variation	Variation Explained	Proportion Explained	Second Eigenvalue
1	5	5	2.560532	0.5121	0.9845
2	2	2	1.126536	0.5633	0.8735

Total variation explained = 3.687068 Proportion = 0.5267

2 Clusters		R-squared with			
Cluster	Variable	Own Cluster	Next Closest	1-R**2 Ratio	Variable Label
Cluster 1	AUM	0.1048	0.0019	0.8970	AUM
	Fund_Performance	0.5926	0.0027	0.4085	Fund Performance
	Investment_Potential	0.7995	0.0159	0.2037	Investment Potential
	Investment_Involvement	0.6861	0.0056	0.3157	Investment Involvement
	Complex_Product	0.3776	0.0023	0.6239	Complex Product
Cluster 2	Age	0.5633	0.0224	0.4467	Age
	Risk_Appetite	0.5633	0.0810	0.4752	Risk Appetite

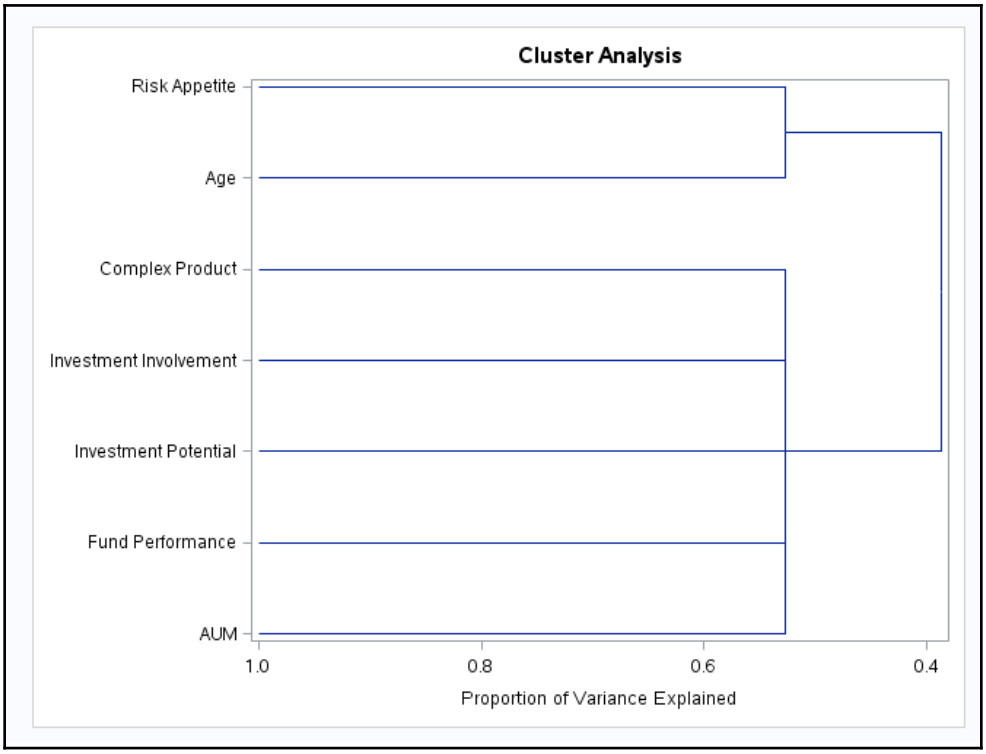
Standardized Scoring Coefficients			
Cluster		1	2
Age	Age	0.000000	0.666212
AUM	AUM	0.126406	0.000000
Risk_Appetite	Risk Appetite	0.000000	-.666212
Fund_Performance	Fund Performance	0.300638	0.000000
Investment_Potential	Investment Potential	0.349211	0.000000
Investment_Involvement	Investment Involvement	0.323490	0.000000
Complex_Product	Complex Product	-.239975	0.000000

Cluster Structure			
Cluster		**1**	**2**
Age	Age	0.149639	0.750512
AUM	AUM	0.323666	0.043886
Risk_Appetite	Risk Appetite	0.284528	-.750512
Fund_Performance	Fund Performance	0.769794	-.051853
Investment_Potential	Investment Potential	0.894165	-.125996
Investment_Involvement	Investment Involvement	0.828308	-.074868
Complex_Product	Complex Product	-.614463	0.048361

Inter-Cluster Correlations		
Cluster	**1**	**2**
1	1.00000	-0.08987
2	-0.08987	1.00000

No cluster meets the criterion for splitting.

Number of Clusters	Total Variation Explained by Clusters	Proportion of Variation Explained by Clusters	Minimum Proportion Explained by a Cluster	Maximum Second Eigenvalue in a Cluster	Minimum R-squared for a Variable	Maximum 1-R**2 Ratio for a Variable
1	2.708771	0.3870	0.3870	1.147541	0.0373	
2	3.687068	0.5267	0.5121	0.984464	0.1048	0.8970



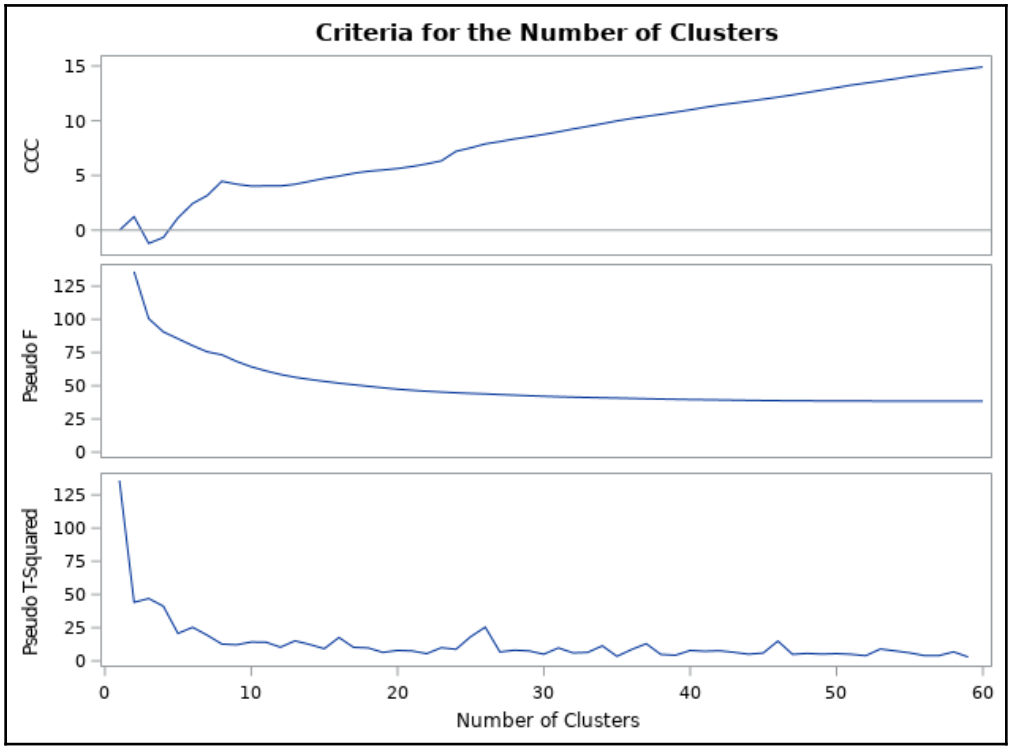
The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

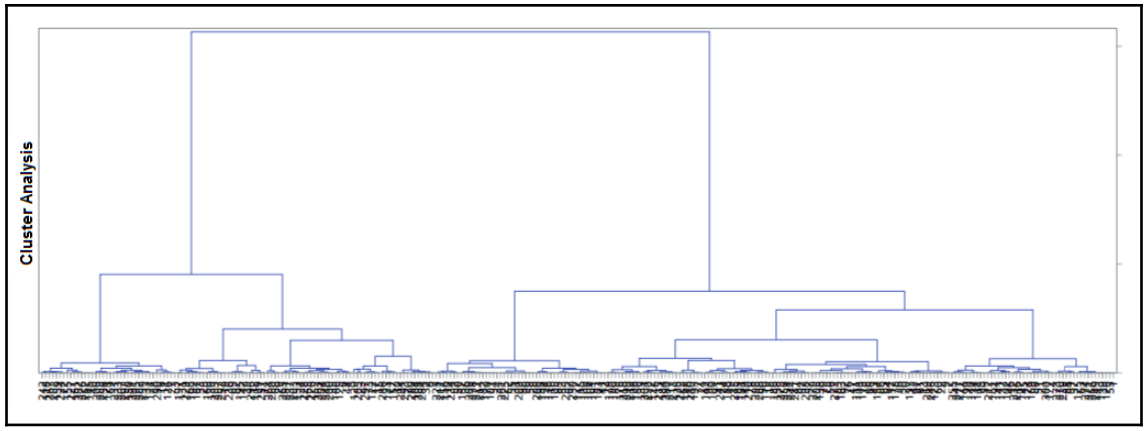
Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	1.79942928	0.82292074	0.3916	0.3916
2	0.97650854	0.30676673	0.2125	0.6041
3	0.66974182	0.24944813	0.1458	0.7499
4	0.42029369	0.03629643	0.0915	0.8413
5	0.38399726	0.18238716	0.0836	0.9249
6	0.20161009	0.05812945	0.0439	0.9688
7	0.14348064		0.0312	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.810208

Root-Mean-Square Distance Between Observations	3.031522

Cluster History										
Number of Clusters	Clusters Joined		Freq	Semipartial R-Square	R-Square	Approximate Expected R-Square	Cubic Clustering Criterion	Pseudo F Statistic	Pseudo t-Squared	Tie
25	CL81	CL63	17	0.0059	.794	.754	7.53	44.3	18.2	
24	CL51	CL41	20	0.0059	.789	.749	7.21	44.7	8.8	
23	CL56	CL34	27	0.0059	.783	.744	6.34	45.3	10.0	
22	CL66	CL35	13	0.0064	.776	.739	6.06	45.9	5.5	
21	CL27	CL45	29	0.0065	.770	.733	5.83	46.6	7.5	
20	CL42	CL29	23	0.0066	.763	.727	5.64	47.5	7.9	
19	CL30	CL57	24	0.0066	.757	.721	5.51	48.5	6.4	
18	CL50	CL90	11	0.0069	.750	.714	5.39	49.7	9.8	
17	CL23	CL40	38	0.0078	.742	.707	5.20	50.8	10.3	
16	CL26	CL67	28	0.0088	.733	.700	4.95	52.0	17.6	
15	CL20	CL28	38	0.0091	.724	.691	4.74	53.4	9.2	
14	CL58	CL17	50	0.0103	.714	.682	4.47	54.8	12.4	
13	CL31	CL16	48	0.0112	.702	.673	4.20	56.4	15.1	
12	CL18	CL32	25	0.0114	.691	.662	4.05	58.5	10.4	
11	CL33	CL47	26	0.0115	.679	.650	4.05	61.3	14.2	
10	CL25	CL21	46	0.0131	.666	.636	4.04	64.4	14.2	
9	CL11	CL24	46	0.0136	.653	.621	4.21	68.4	12.2	
8	CL43	CL22	23	0.0153	.638	.604	4.48	73.4	12.7	
7	CL8	CL19	47	0.0300	.608	.583	3.18	75.6	19.4	
6	CL14	CL9	96	0.0304	.577	.558	2.44	80.3	25.3	
5	CL7	CL12	72	0.0404	.537	.527	1.13	85.5	20.7	
4	CL10	CL6	142	0.0579	.479	.486	-.66	90.6	41.2	
3	CL4	CL13	190	0.0750	.404	.418	-1.2	101	47.0	
2	CL5	CL15	110	0.0906	.313	.297	1.24	136	44.2	
1	CL3	CL2	300	0.3133	.000	.000	0.00	.	136	


Criteria for the Number of Clusters
CCC
15
10
5
0
Pseudo F
125
100
75
50
25
0
Pseudo T-Squared
125
100
75
50
25
0
0
10
20
30
40
50
60
Number of Clusters


Cluster Analysis

Obs	Custid	Age	AUM	Risk_Appetite	Fund_Performance	Investment_Potential	Investment_Involvement	Complex_Product	CLUSTER
1	11	2	4	2	2	3	2	0	1
2	16	2	4	2	2	3	2	0	1
3	9	1	1	1	1	1	1	1	2
4	22	1	1	1	1	1	1	1	2
5	3	2	4	2	2	3	3	0	1
6	27	2	4	2	2	3	3	0	1
7	8	3	2	3	3	3	3	0	3
8	32	3	2	3	3	3	3	0	3
9	12	1	2	3	1	2	1	1	4
10	41	1	2	3	1	2	1	1	4
11	21	1	3	2	1	1	1	1	5
12	51	1	3	2	1	1	1	1	5
13	1	1	3	1	1	1	1	1	5
14	53	1	3	1	1	1	1	1	5
15	34	1	1	3	1	1	1	1	4
16	54	1	1	3	1	1	1	1	4
17	31	1	2	2	1	1	1	1	4
18	55	1	2	2	1	1	1	1	4
19	28	1	1	2	1	1	1	1	4
20	58	1	1	2	1	1	1	1	4

Oblique Principal Component Cluster Analysis

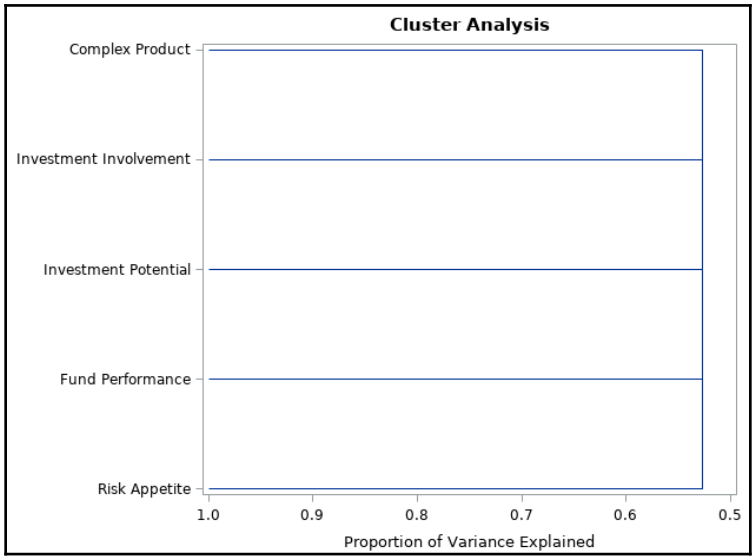
Observations	300	Proportion	0
Variables	5	Maxeigen	1

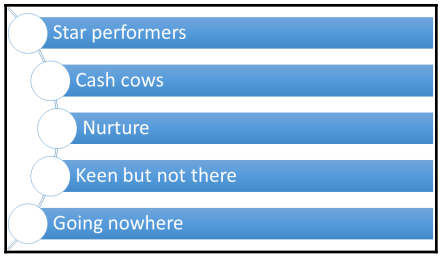
Clustering algorithm converged.

Cluster Summary for 1 Cluster

Cluster	Members	Cluster Variation	Variation Explained	Proportion Explained	Second Eigenvalue
1	5	5	2.637075	0.5274	0.8725

Total variation explained = 2.637075 Proportion = 0.5274


Cluster Analysis
Complex Product
Investment Involvement
Investment Potential
Fund Performance
Risk Appetite
1.0
0.9
0.8
0.7
0.6
0.5
Proportion of Variance Explained


Star performers
Cash cows
Nurture
Keen but not there
Going nowhere