

```

1      OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
NOTE: ODS statements in the SAS Studio environment may disable some output features.
73
74      *****
75      *   TITLE :           SAS GRAIN PRICE PROJECT ANALYSIS
76      *
77      *   DESCRIPTION: Final project for BIOS 7400 with Xiao Song, UGA, Spring 2022.
78      *                   Simple analysis of grain price data.
79      *
80      *-----
81      *   JOB NAME:        analysis.SAS
82      *   LANGUAGE:       SAS v9.4 (on demand for academics)
83      *
84      *   NAME:           Zane Billings
85      *   DATE:           2022-04-22
86      *
87      *****;
88
89      FOOTNOTE "Job run by Zane Billings on &SYSDATE at &SYSTIME.";
90
91      TITLE 'ANALYSIS OF USDA HISTORICAL GRAIN PRICE DATA';
92
93      OPTIONS NODATE LS=95 PS=42;
94
95      LIBNAME HOME '/home/u59465388/SAS-Grain-Prices';
NOTE: Libref HOME refers to the same physical library as _TEMP1.
NOTE: Libref HOME was successfully assigned as follows:
      Engine:           V9
      Physical Name: /home/u59465388/SAS-Grain-Prices
96
97      ODS GRAPHICS / WIDTH = 6in HEIGHT = 6in;
98
99      *****;
100     * Show the descriptor portion of the dataset;
101     *****;
102
103     TITLE2 "CONTENTS OF GRAINS DATASET";
104
105     PROC CONTENTS DATA = HOME.GRAINS;
106     RUN;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.10 seconds
      user cpu time       0.10 seconds
      system cpu time     0.00 seconds
      memory              4338.15k
      OS Memory           178856.00k
      Timestamp           04/23/2022 01:01:52 AM
      Step Count          2004   Switch Count   0
      Page Faults         0
      Page Reclaims       964
      Page Swaps          0
      Voluntary Context Switches 6
      Involuntary Context Switches 0
      Block Input Operations 0
      Block Output Operations 56

107
108     *****;
109     * Plot outcome time series;
110     *****;
111
112     FOOTNOTE;
113
114     TITLE2 "PRICE PER BUSHEL OF GRAINS OVER TIME";
115     PROC SGPLOT DATA = HOME.GRAINS;

```

```
116     SERIES X = YEAR Y = LPE / GROUP = GRN;  
117     RUN;
```

NOTE: PROCEDURE SGPLOT used (Total process time):

real time	0.31 seconds
user cpu time	0.17 seconds
system cpu time	0.03 seconds
memory	20111.56k
OS Memory	180084.00k
Timestamp	04/23/2022 01:01:52 AM
Step Count	2005 Switch Count 1
Page Faults	0
Page Reclaims	1929
Page Swaps	0
Voluntary Context Switches	2039
Involuntary Context Switches	1
Block Input Operations	0
Block Output Operations	1208

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```
118  
119     TITLE2 "GRAIN PRICES AND PRESIDENT'S POLITICAL PARTY OVER TIME";  
120     PROC SGPPANEL DATA = HOME.GRAINS;  
121     PANELBY GRN;  
122     SERIES X = YEAR Y = LPE / LINEATTRS = (COLOR = "GRAY") SMOOTHCONNECT;  
123     SCATTER X = YEAR Y = LPE / GROUP = PARTY  
124     MARKERATTRS = (SYMBOL = CIRCLEFILLED);  
125     RUN;
```

NOTE: PROCEDURE SGPPANEL used (Total process time):

real time	0.62 seconds
user cpu time	0.23 seconds
system cpu time	0.01 seconds
memory	6774.37k
OS Memory	182312.00k
Timestamp	04/23/2022 01:01:53 AM
Step Count	2006 Switch Count 2
Page Faults	0
Page Reclaims	1860
Page Swaps	0
Voluntary Context Switches	3750
Involuntary Context Switches	0
Block Input Operations	0
Block Output Operations	2008

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```
126  
127     TITLE2 "PERCENT CHANGE DISTRIBUTION BY PRESIDENT'S POLITICAL PARTY";  
128     PROC SGPPANEL DATA = HOME.GRAINS;  
129     PANELBY GRN;  
130     HBOX PCT / GROUP = PARTY;  
131     RUN;
```

NOTE: PROCEDURE SGPPANEL used (Total process time):

real time	0.37 seconds
user cpu time	0.17 seconds
system cpu time	0.02 seconds
memory	4424.71k
OS Memory	180604.00k
Timestamp	04/23/2022 01:01:53 AM
Step Count	2007 Switch Count 26
Page Faults	0
Page Reclaims	1611
Page Swaps	0
Voluntary Context Switches	1379
Involuntary Context Switches	0
Block Input Operations	0

Block Output Operations 2320

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```
132
133     ODS GRAPHICS / WIDTH = 6in HEIGHT = 9in;
134
135     TITLE2 "SCATTERPLOTS OF PRICE VS COVARIATES";
136     PROC SGSCATTER DATA = HOME.GRAINS;
137     PLOT LPE * (ACR HVT LNR PRD YLD) / REG
138     COLUMNS = 2 GROUP = GRN;
139     RUN;
```

NOTE: PROCEDURE SGSCATTER used (Total process time):

real time	0.63 seconds
user cpu time	0.31 seconds
system cpu time	0.03 seconds
memory	8148.34k
OS Memory	185208.00k
Timestamp	04/23/2022 01:01:54 AM
Step Count	2008 Switch Count 1
Page Faults	0
Page Reclaims	2746
Page Swaps	0
Voluntary Context Switches	2379
Involuntary Context Switches	2
Block Input Operations	0
Block Output Operations	5824

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```
140
141     PROC SGSCATTER DATA = HOME.GRAINS;
142     PLOT LPE * (INFL PWR TEMP VALUE) / REG
143     COLUMNS = 2;
144     RUN;
```

NOTE: PROCEDURE SGSCATTER used (Total process time):

real time	0.60 seconds
user cpu time	0.41 seconds
system cpu time	0.02 seconds
memory	6982.21k
OS Memory	186232.00k
Timestamp	04/23/2022 01:01:55 AM
Step Count	2009 Switch Count 1
Page Faults	0
Page Reclaims	2608
Page Swaps	0
Voluntary Context Switches	435
Involuntary Context Switches	0
Block Input Operations	0
Block Output Operations	4816

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```
145
146     *****;
147     * Plots of covariates across time;
148     *****;
149
150     TITLE2 "CHANGE IN COVARIATES ACROSS TIME";
151     PROC SGSCATTER DATA = HOME.GRAINS;
152     PLOT (ACR HVT LNR PRD YLD) * YEAR /
153     COLUMNS = 2 GROUP = GRN JOIN MARKERATTRS = (SIZE = 0);
154     RUN;
```

NOTE: PROCEDURE SGSCATTER used (Total process time):

real time	0.51 seconds
user cpu time	0.27 seconds

```

system cpu time      0.02 seconds
memory               5522.25k
OS Memory            186744.00k
Timestamp            04/23/2022 01:01:55 AM
Step Count           2010   Switch Count   1
Page Faults          0
Page Reclaims        2393
Page Swaps           0
Voluntary Context Switches 2070
Involuntary Context Switches 0
Block Input Operations 0
Block Output Operations 1952

```

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```

155
156      PROC SGSCATTER DATA = HOME.GRAINS;
157      PLOT (INFL PWR TEMP VALUE) * YEAR /
158      COLUMNS = 2 JOIN MARKERATTRS = (SIZE = 0);
159      RUN;

```

NOTE: PROCEDURE SGSCATTER used (Total process time):

```

real time           0.28 seconds
user cpu time       0.12 seconds
system cpu time     0.01 seconds
memory              4263.78k
OS Memory            183084.00k
Timestamp            04/23/2022 01:01:55 AM
Step Count           2011   Switch Count   1
Page Faults          0
Page Reclaims        1100
Page Swaps           0
Voluntary Context Switches 331
Involuntary Context Switches 0
Block Input Operations 0
Block Output Operations 1064

```

NOTE: There were 571 observations read from the data set HOME.GRAINS.

```

160
161      *****;
162      * Univariate analyses;
163      *****;
164
165      * Univariate analysis of main outcome by grain type;
166      TITLE2 "UNIVARIATE SUMMARY OF GRAIN DATA OVER TIME";
167
168      ODS GRAPHICS / WIDTH = 4in HEIGHT = 4in;
169
170      PROC UNIVARIATE DATA = HOME.GRAINS PLOTS;
171      VAR LPE;
172      CLASS GRN;
173      RUN;

```

NOTE: PROCEDURE UNIVARIATE used (Total process time):

```

real time           0.96 seconds
user cpu time       0.64 seconds
system cpu time     0.04 seconds
memory              5235.62k
OS Memory            182148.00k
Timestamp            04/23/2022 01:01:56 AM
Step Count           2012   Switch Count   0
Page Faults          0
Page Reclaims        6609
Page Swaps           0
Voluntary Context Switches 1374
Involuntary Context Switches 4
Block Input Operations 0
Block Output Operations 3264

```

```
174
175 *****;
176 * Bivariate analyses of price and covariates, ignoring time;
177 *****;
178
179 * Correlations;
180 PROC CORR PEARSON SPEARMAN DATA = HOME.GRAINS;
181 VAR LPE ACR HVT LNR PRD YLD INFL PWR TEMP VALUE;
182 BY GRN;
183 RUN;
```

NOTE: PROCEDURE CORR used (Total process time):

real time	1.47 seconds
user cpu time	1.48 seconds
system cpu time	0.00 seconds
memory	3529.78k
OS Memory	182980.00k
Timestamp	04/23/2022 01:01:58 AM
Step Count	2013 Switch Count 0
Page Faults	0
Page Reclaims	3568
Page Swaps	0
Voluntary Context Switches	4
Involuntary Context Switches	2
Block Input Operations	0
Block Output Operations	600

```
184
185 * Mean difference in LPE by party;
186 PROC MEANS DATA = HOME.GRAINS MEAN STDERR MEDIAN RANGE NWAY;
187 VAR LPE;
188 CLASS PARTY;
189 BY GRN;
190 RUN;
```

NOTE: There were 571 observations read from the data set HOME.GRAINS.

NOTE: PROCEDURE MEANS used (Total process time):

real time	0.06 seconds
user cpu time	0.06 seconds
system cpu time	0.00 seconds
memory	2993.75k
OS Memory	184524.00k
Timestamp	04/23/2022 01:01:58 AM
Step Count	2014 Switch Count 4
Page Faults	0
Page Reclaims	1179
Page Swaps	0
Voluntary Context Switches	14
Involuntary Context Switches	0
Block Input Operations	0
Block Output Operations	104

```
191
192 *****;
193 * Simple and multiple OLS regression models;
194 *****;
195
196 %MACRO ALLSIMPLE(DAT = , RESP = , PRED = );
197 %LET N = %SYSFUNC(COUNTW(&DAT));
198 %DO I = 1 %TO &N;
199 PROC GLM DATA = &DAT PLOTS = ALL;
200 CLASS GRN;
201 MODEL &RESP = %SCAN(&PRED, &I) | GRN / NOINT;
202 RUN;
203 %END;
```

```

204      %MEND;
205
206      %ALLSIMPLE(
207      DAT = HOME.GRAINS,
208      RESP = LPE,
209      PRED = ACR PRD INFL TEMP PWR YEAR
210      );

```

NOTE: Due to the presence of CLASS variables, an intercept is implicitly fitted. R-Square has been corrected for the mean.

NOTE: PROCEDURE GLM used (Total process time):

real time	1.36 seconds
user cpu time	0.82 seconds
system cpu time	0.05 seconds
memory	10334.37k
OS Memory	189884.00k
Timestamp	04/23/2022 01:01:59 AM
Step Count	2015 Switch Count 23
Page Faults	0
Page Reclaims	15635
Page Swaps	0
Voluntary Context Switches	2478
Involuntary Context Switches	1
Block Input Operations	0
Block Output Operations	9392

NOTE: Due to the presence of CLASS variables, an intercept is implicitly fitted. R-Square has been corrected for the mean.

211

NOTE: PROCEDURE GLM used (Total process time):

real time	1.60 seconds
user cpu time	1.02 seconds
system cpu time	0.07 seconds
memory	10486.25k
OS Memory	191424.00k
Timestamp	04/23/2022 01:02:01 AM
Step Count	2016 Switch Count 23
Page Faults	0
Page Reclaims	15553
Page Swaps	0
Voluntary Context Switches	3017
Involuntary Context Switches	3
Block Input Operations	0
Block Output Operations	12944

```

212      PROC GLM DATA = HOME.GRAINS PLOTS = ALL;
213      CLASS GRN PARTY;
214      MODEL LPE = GRN | PARTY;
215      RUN;

```

```

216
217      * 1866 FULL MODEL;

```

NOTE: PROCEDURE GLM used (Total process time):

real time	1.45 seconds
user cpu time	0.89 seconds
system cpu time	0.07 seconds
memory	10345.71k
OS Memory	191424.00k
Timestamp	04/23/2022 01:02:02 AM
Step Count	2017 Switch Count 23
Page Faults	0
Page Reclaims	15098
Page Swaps	0

```
Voluntary Context Switches      4512
Involuntary Context Switches    0
Block Input Operations           0
Block Output Operations         10392
```

```
218      PROC MIXED DATA = HOME.GRAINS PLOTS = ALL;
219      CLASS GRN PARTY;
220      MODEL LPE =
221      GRN HVT PRD INFL PWR YEAR PARTY
222      GRN*HVT GRN*PRD GRN*INFL GRN*PWR GRN*YEAR GRN*PARTY /
223      NOINT SOLUTION
224      ;
225      RUN;
```

NOTE: 10 observations are not included because of missing values.

NOTE: PROCEDURE MIXED used (Total process time):

```
real time      1.95 seconds
user cpu time   1.21 seconds
system cpu time 0.11 seconds
memory         12037.43k
OS Memory      194500.00k
Timestamp      04/23/2022 01:02:04 AM
Step Count     2018   Switch Count   44
Page Faults    0
Page Reclaims  26137
Page Swaps     0
Voluntary Context Switches      3462
Involuntary Context Switches    4
Block Input Operations           0
Block Output Operations         11512
```

```
226
227      * FULL MODEL WITH TEMP (1880 MODEL);
228      PROC MIXED DATA = HOME.GRAINS PLOTS = ALL;
229      CLASS PARTY GRN;
230      MODEL LPE =
231      GRN HVT PRD INFL PWR YEAR
232      GRN*HVT GRN*PRD GRN*INFL GRN*PWR GRN*YEAR GRN*PARTY /
233      NOINT SOLUTION
234      ;
235      RUN;
```

NOTE: 10 observations are not included because of missing values.

NOTE: PROCEDURE MIXED used (Total process time):

```
real time      1.74 seconds
user cpu time   1.02 seconds
system cpu time 0.11 seconds
memory         11031.28k
OS Memory      195532.00k
Timestamp      04/23/2022 01:02:06 AM
Step Count     2019   Switch Count   44
Page Faults    0
Page Reclaims  24658
Page Swaps     0
Voluntary Context Switches      3031
Involuntary Context Switches    4
Block Input Operations           0
Block Output Operations         10800
```

```
236
237      *****;
238      * GLS multiple regression analysis;
239      *****;
240
241      PROC MIXED DATA = HOME.GRAINS PLOTS = ALL;
242      CLASS PARTY GRN;
```

```
243      MODEL LPE = HVT PRD INFL PWR YEAR GRN GRN*HVT GRN*PRD /
244      NOINT SOLUTION CHISQ;
245      REPEATED;
246      RUN;
```

NOTE: 10 observations are not included because of missing values.

NOTE: Convergence criteria met.

NOTE: PROCEDURE MIXED used (Total process time):

real time	1.56 seconds		
user cpu time	0.92 seconds		
system cpu time	0.08 seconds		
memory	10345.21k		
OS Memory	196300.00k		
Timestamp	04/23/2022 01:02:08 AM		
Step Count	2020	Switch Count	42
Page Faults	0		
Page Reclaims	24747		
Page Swaps	0		
Voluntary Context Switches	2239		
Involuntary Context Switches	5		
Block Input Operations	0		
Block Output Operations	10088		

```
247
248      *****;
249      * Simple forecasting;
250      *****;
251
252      DATA TS_DAT;
253      SET HOME.GRAINS;
254      T = MDY(1, 1, YEAR);
255      RUN;
```

NOTE: There were 571 observations read from the data set HOME.GRAINS.

NOTE: The data set WORK.TS_DAT has 571 observations and 17 variables.

NOTE: DATA statement used (Total process time):

real time	0.00 seconds		
user cpu time	0.01 seconds		
system cpu time	0.00 seconds		
memory	852.31k		
OS Memory	190624.00k		
Timestamp	04/23/2022 01:02:08 AM		
Step Count	2021	Switch Count	2
Page Faults	0		
Page Reclaims	155		
Page Swaps	0		
Voluntary Context Switches	16		
Involuntary Context Switches	0		
Block Input Operations	0		
Block Output Operations	272		

```
256
257      PROC ARIMA DATA = TS_DAT;
258      IDENTIFY VAR = LPE NLAG = 30 SCAN STATIONARITY = (RW = 10);
259      RUN;

260
```

NOTE: PROCEDURE ARIMA used (Total process time):

real time	0.43 seconds		
user cpu time	0.25 seconds		
system cpu time	0.02 seconds		
memory	5398.28k		
OS Memory	192424.00k		
Timestamp	04/23/2022 01:02:08 AM		
Step Count	2022	Switch Count	0
Page Faults	0		

Page Reclaims	2313
Page Swaps	0
Voluntary Context Switches	420
Involuntary Context Switches	0
Block Input Operations	0
Block Output Operations	1800

```
261      PROC ARIMA DATA = TS_DAT;  
262      IDENTIFY VAR = LPE(1);  
263      RUN;
```

264

```
NOTE: PROCEDURE ARIMA used (Total process time):  
real time          0.36 seconds  
user cpu time      0.20 seconds  
system cpu time    0.01 seconds  
memory            4819.81k  
OS Memory         192424.00k  
Timestamp         04/23/2022 01:02:09 AM  
Step Count        2023  Switch Count  0  
Page Faults       0  
Page Reclaims     1527  
Page Swaps        0  
Voluntary Context Switches 417  
Involuntary Context Switches 2  
Block Input Operations 0  
Block Output Operations 1880
```

```
265      PROC ARIMA DATA = TS_DAT;  
266      IDENTIFY VAR = LPE;  
267      ESTIMATE P = 1;  
268      ESTIMATE Q = 1;  
269      ESTIMATE P = 1 Q = 1;  
270      ESTIMATE P = 2;  
271      RUN;
```

272

```
NOTE: PROCEDURE ARIMA used (Total process time):  
real time          2.73 seconds  
user cpu time      1.58 seconds  
system cpu time    0.18 seconds  
memory            10925.50k  
OS Memory         198096.00k  
Timestamp         04/23/2022 01:02:11 AM  
Step Count        2024  Switch Count  48  
Page Faults       0  
Page Reclaims     37729  
Page Swaps        0  
Voluntary Context Switches 3706  
Involuntary Context Switches 6  
Block Input Operations 0  
Block Output Operations 13120
```

```
273      PROC ARIMA DATA = TS_DAT;  
274      IDENTIFY VAR = LPE;  
275      ESTIMATE P = 1;  
276      OUTLIER;  
277      FORECAST LEAD = 10 INTERVAL = YEAR ID = T OUT = GRAIN_FC;  
278      RUN;
```

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```
OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
```