

data project;

input Month \$ Formulary_Status Comp_DTC_TV Nov_Ind Dec_Ind TV PDEs DTC_Display UR
Sales @@;

Sales=Sales*300;

Comp_DTC_TV=log(Comp_DTC_TV);

DTC_Display=log(DTC_Display);

PDEs=log(PDEs);

cards;

01Jan2011 5 150 0 0 75 25.7 1.505594371 5.6 8.14
01Feb2011 5.1 450 0 0 125 13.8 1.645746172 5.1 7.952
01Mar2011 5.1 150 0 0 20 15.3 0.61681864 4.4 5.883
01Apr2011 5.2 300 0 0 10 19.7 1.122074228 5.7 6.059
01May2011 5.4 510 0 0 120 12 0.926028619 4.1 7.346
01Jun2011 5.4 450 0 0 100 11.6 0.742634918 6 7.367
01Jul2011 5.3 150 0 0 50 9.4 1.278152746 5.2 6.777
01Aug2011 5 225 0 0 15 18.4 0.820908922 4.1 6.129
01Sep2011 4.8 150 0 0 40 22.6 0.964507806 5.1 7.153
01Oct2011 4.6 150 0 0 0 18.2 1.040427503 5 6.355
01Nov2011 4.2 750 1 0 200 13.2 1.791742017 3.6 9.118
01Dec2011 4.1 600 0 1 150 24.6 1.366356679 5.4 8.982
01Jan2012 4 150 0 0 0 22.3 1.301996718 5.2 6.441
01Feb2012 4 375 0 0 75 7.6 1.634923826 4.2 7.165
01Mar2012 4 450 0 0 10 17 1.213442258 3.1 6.177
01Apr2012 3.5 450 0 0 100 19.7 1.697367261 6.8 7.797
01May2012 3.7 510 0 0 20 20.7 1.306341973 4.8 6.244
01Jun2012 3.5 270 0 0 40 6.4 1.255019404 4.1 5.918
01Jul2012 4.6 150 0 0 0 20.7 0.804678511 6.6 6.229
01Aug2012 4.2 150 0 0 10 12.6 0.750211641 4.4 6.037
01Sep2012 4.1 600 0 0 150 12 0.972954659 4.6 7.586
01Oct2012 4 150 0 0 0 24.1 0.494539573 4 6.346
01Nov2012 4 600 1 0 150 24.5 1.645918277 6 9.35
01Dec2012 4 750 0 1 20 10.1 1.217580147 3.7 6.748
01Jan2013 3.5 240 0 0 30 22.5 1.823837736 5.7 6.687
01Feb2013 5 150 0 0 0 20.8 0.701993413 4.9 6.601
01Mar2013 5.4 300 0 0 50 19 1.851489159 5.3 7.375
01Apr2013 6.1 300 0 0 50 5.2 1.181353005 6.5 6.42
01May2013 6.8 150 0 0 0 18.1 1.235798507 4.8 6.73
01Jun2013 7 150 0 0 85 18.4 0.678308788 4.5 8.011
01Jul2013 7.4 150 0 0 25 22.3 1.570813666 5.6 7.348
01Aug2013 7.3 375 0 0 75 6.8 0.902261884 3.8 7.389
01Sep2013 7.5 150 0 0 0 26.2 1.667311405 5 6.942

```
01Oct2013 7.2 525 0 0 125 25.5 1.488846866 3.9 8.786
01Nov2013 8 450 1 0 100 8.8 1.069203721 3.6 9.05
01Dec2013 8.4 450 0 1 100 25.9 0.931868705 6.6 9.899
01Jan2014 8.3 300 0 0 50 13.6 1.142174138 3.4 7.416
01Feb2014 8.5 150 0 0 30 21.4 0.646969463 5.8 7.168
01Mar2014 8.8 150 0 0 10 15.9 1.581222375 6.6 6.928
01Apr2014 8.5 675 0 0 175 9.2 0.913013018 6.8 7.968
01May2014 8.2 150 0 0 10 24.2 1.577213107 4.1 7.296
01Jun2014 8 690 0 0 180 22.7 1.438843328 3.6 8.784
01Jul2014 8.1 150 0 0 50 13 0.825130443 6 7.193
01Aug2014 7.9 450 0 0 25 21.8 1.61587515 4.8 6.904
01Sep2014 8.2 450 0 0 125 7.3 1.033628615 4.8 7.884
01Oct2014 8.4 750 0 0 185 20.2 1.793132756 4.4 8.595
01Nov2014 8.3 600 1 0 150 17.8 0.707572304 6.1 9.464
01Dec2014 8.5 600 0 1 190 8.1 1.626550155 4.5 9.628
```

```
;
```

```
run;
```

```
proc summary data=project min max mean std print;
```

```
var
```

```
  Formulary_Status
```

```
  Comp_DTC_TV
```

```
  TV
```

```
  PDEs
```

```
  DTC_Display
```

```
  UR
```

```
  Sales
```

```
  Nov_Ind
```

```
  Dec_Ind
```

```
;
```

```
run;
```

```
title "Liner Regression Model";
```

```
proc reg data=project;
```

```
model
```

```
Sales=
```

```
  Formulary_Status
```

```
  Comp_DTC_TV
```

```
  TV
```

```
  PDEs
```

```
  DTC_Display
```

```
  UR
```

```
  Nov_Ind
```

```

Dec_Ind
/VIF DW
;
output out=project_out
predicted=yhat
residual=resid
;
run;
proc NLIN data=project
BEST=10
MAXITER=200
METHOD=Gauss
CONVERGE=1.0E-6
LIST
ALPHA=0.10
;
ID
Month
;
parms
B_INT=1863.90310
B_Formulary_Status=43.26734
B_Comp_DTC_TV=-87.65018

B_TV=6.0 to 354.9 by 50
P_TV=0.1 to 0.9 by 0.2

B_PDEs=157.11785
B_DTC_Display=81.87863
B_UR=-0.32584
B_Nov_Ind=344.91789
B_Dec_Ind=335.92041
;
model
Sales=
B_INT+
B_Formulary_Status*Formulary_Status+
B_Comp_DTC_TV*Comp_DTC_TV+
B_TV*(TV+0.01)**P_TV+
B_PDEs*PDEs+
B_DTC_Display*DTC_Display+

```

```

B_UR*UR+
B_Nov_Ind*Nov_Ind+
B_Dec_Ind*Dec_Ind
;
output
out=project_NLIN_out
p=yhat
r=resid
stdr=std_dev_r
;
run;
title "output from original data";
proc print data=project_NLIN_out;
run;
data project_NLIN_out;
set project_NLIN_out;
label std_residual="standardized residuals";
std_residual=resid/std_dev_r;
run;
proc rank data=project_NLIN_out normal=blom out=project_NLIN_out;
var std_residual;
ranks rresid;
run;
goptions reset=all border;
symbol1 color=blue value=dot;
symbol2 color=red interpol=join;
proc GPLOT data=project_NLIN_out;
plot std_residual*rresid rresid*rresid/overlay
;
run;
quit;
goptions reset=all border;
symbol1 color=blue value=dot;
proc GPLOT data=project_NLIN_out;
plot resid*yhat
;
run;
quit;
goption reset=all border;
symbol1 color=blue value=dot;
symbol2 color=red interpol=join;

```

```

proc GPLOT data=project_NLIN_out;
plot yhat*sales sales*sales/overlay;
run;
quit;
proc reg data=project_NLIN_out;
model resid=/dw dwprob;
run;
quit;
data holdout;
input Month $ Formulary_Status Comp_DTC_TV Nov_Ind Dec_Ind TV PDEs DTC_Display UR
Sales @@;
Sales=Sales*300;
Comp_DTC_TV=log(Comp_DTC_TV);
DTC_Display=log(DTC_Display);
PDEs=log(PDEs);
cards;
01Jan2011 5 150 0 0 75 25.7 1.505594371 5.6 8.14
01Feb2011 5.1 450 0 0 125 13.8 1.645746172 5.1 7.952
01Mar2011 5.1 150 0 0 20 15.3 0.61681864 4.4 5.883
01Apr2011 5.2 300 0 0 10 19.7 1.122074228 5.7 6.059
01May2011 5.4 510 0 0 120 12 0.926028619 4.1 7.346
01Jun2011 5.4 450 0 0 100 11.6 0.742634918 6 7.367
01Jul2011 5.3 150 0 0 50 9.4 1.278152746 5.2 6.777
01Aug2011 5 225 0 0 15 18.4 0.820908922 4.1 6.129
01Sep2011 4.8 150 0 0 40 22.6 0.964507806 5.1 7.153
01Oct2011 4.6 150 0 0 0 18.2 1.040427503 5 6.355
01Nov2011 4.2 750 1 0 200 13.2 1.791742017 3.6 9.118
01Dec2011 4.1 600 0 1 150 24.6 1.366356679 5.4 8.982
01Jan2012 4 150 0 0 0 22.3 1.301996718 5.2 6.441
01Feb2012 4 375 0 0 75 7.6 1.634923826 4.2 7.165
01Mar2012 4 450 0 0 10 17 1.213442258 3.1 6.177
01Apr2012 3.5 450 0 0 100 19.7 1.697367261 6.8 7.797
01May2012 3.7 510 0 0 20 20.7 1.306341973 4.8 6.244
01Jun2012 3.5 270 0 0 40 6.4 1.255019404 4.1 5.918
01Jul2012 4.6 150 0 0 0 20.7 0.804678511 6.6 6.229
01Aug2012 4.2 150 0 0 10 12.6 0.750211641 4.4 6.037
01Sep2012 4.1 600 0 0 150 12 0.972954659 4.6 7.586
01Oct2012 4 150 0 0 0 24.1 0.494539573 4 6.346
01Nov2012 4 600 1 0 150 24.5 1.645918277 6 9.35
01Dec2012 4 750 0 1 20 10.1 1.217580147 3.7 6.748
01Jan2013 3.5 240 0 0 30 22.5 1.823837736 5.7 6.687

```

01Feb2013 5 150 0 0 0 20.8 0.701993413 4.9 6.601
01Mar2013 5.4 300 0 0 50 19 1.851489159 5.3 7.375
01Apr2013 6.1 300 0 0 50 5.2 1.181353005 6.5 6.42
01May2013 6.8 150 0 0 0 18.1 1.235798507 4.8 6.73
01Jun2013 7 150 0 0 85 18.4 0.678308788 4.5 8.011
01Jul2013 7.4 150 0 0 25 22.3 1.570813666 5.6 7.348
01Aug2013 7.3 375 0 0 75 6.8 0.902261884 3.8 7.389
01Sep2013 7.5 150 0 0 0 26.2 1.667311405 5 6.942
01Oct2013 7.2 525 0 0 125 25.5 1.488846866 3.9 8.786
01Nov2013 8 450 1 0 100 8.8 1.069203721 3.6 9.05
01Dec2013 8.4 450 0 1 100 25.9 0.931868705 6.6 9.899
01Jan2014 8.3 300 0 0 50 13.6 1.142174138 3.4 .
01Feb2014 8.5 150 0 0 30 21.4 0.646969463 5.8 .
01Mar2014 8.8 150 0 0 10 15.9 1.581222375 6.6 .
01Apr2014 8.5 675 0 0 175 9.2 0.913013018 6.8 .
01May2014 8.2 150 0 0 10 24.2 1.577213107 4.1 .
01Jun2014 8 690 0 0 180 22.7 1.438843328 3.6 .
01Jul2014 8.1 150 0 0 50 13 0.825130443 6 .
01Aug2014 7.9 450 0 0 25 21.8 1.61587515 4.8 .
01Sep2014 8.2 450 0 0 125 7.3 1.033628615 4.8 .
01Oct2014 8.4 750 0 0 185 20.2 1.793132756 4.4 .
01Nov2014 8.3 600 1 0 150 17.8 0.707572304 6.1 .
01Dec2014 8.5 600 0 1 190 8.1 1.626550155 4.5 .

run;

proc print data=holdout;

run;

proc NLIN data=holdout

MAXITER=200

BEST=10

METHOD=Gauss

CONVERGE=1.0E-6

LIST

ALPHA=0.10

;

ID

Month

;

parms

B_INT=1863.90310

B_Formulary_Status=43.26734

B_Comp_DTC_TV=-87.65018

B_TV=6.0 to 354.9 by 50

P_TV=0.1 to 0.9 by 0.2

B_PDEs=157.11785

B_DTC_Display=81.87863

B_UR=-0.32584

B_Nov_Ind=344.91789

B_Dec_Ind=335.92041

;

model

Sales =

B_INT+

B_Formulary_Status*Formulary_Status+

B_Comp_DTC_TV*Comp_DTC_TV+

B_TV*(TV+0.01)**P_TV+

B_PDEs*PDEs+

B_DTC_Display*DTC_Display+

B_UR*UR+

B_Nov_Ind*Nov_Ind+

B_Dec_Ind*Dec_Ind

;

output out=pridicted_out

p=yhat

residual=resid

stdr=stdresidual;

run;

proc print data=pridicted_out;

run;