A SAS Macro for Univariate Logistic Regression

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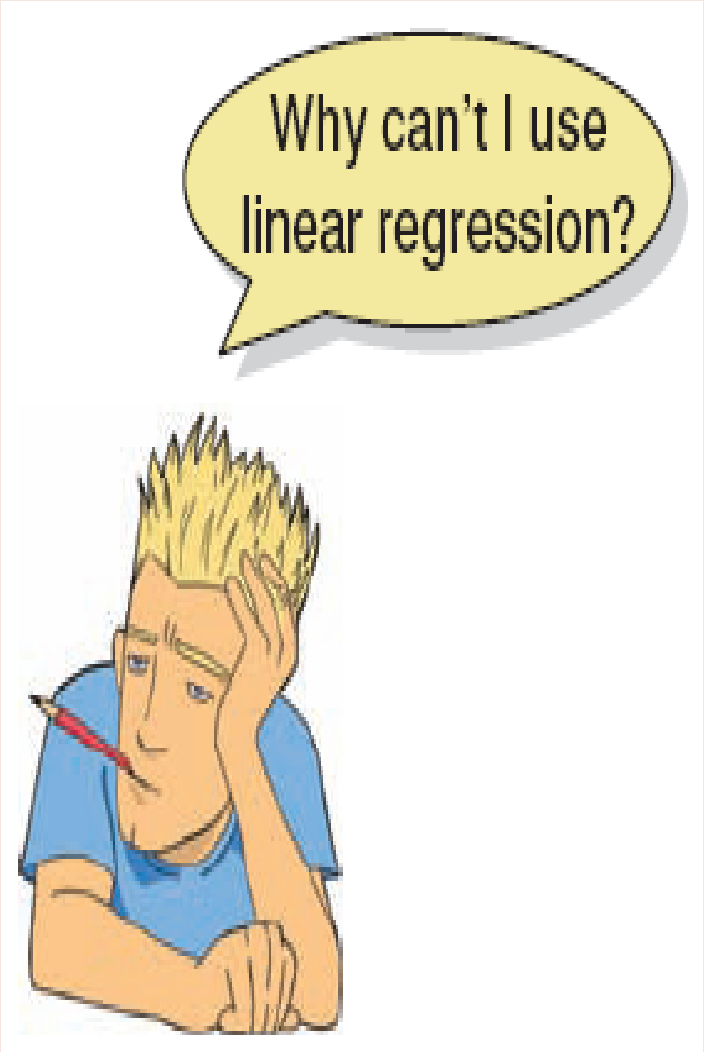
Outline

1. Logistic Regression
2. Macro
3. Example

When & Why

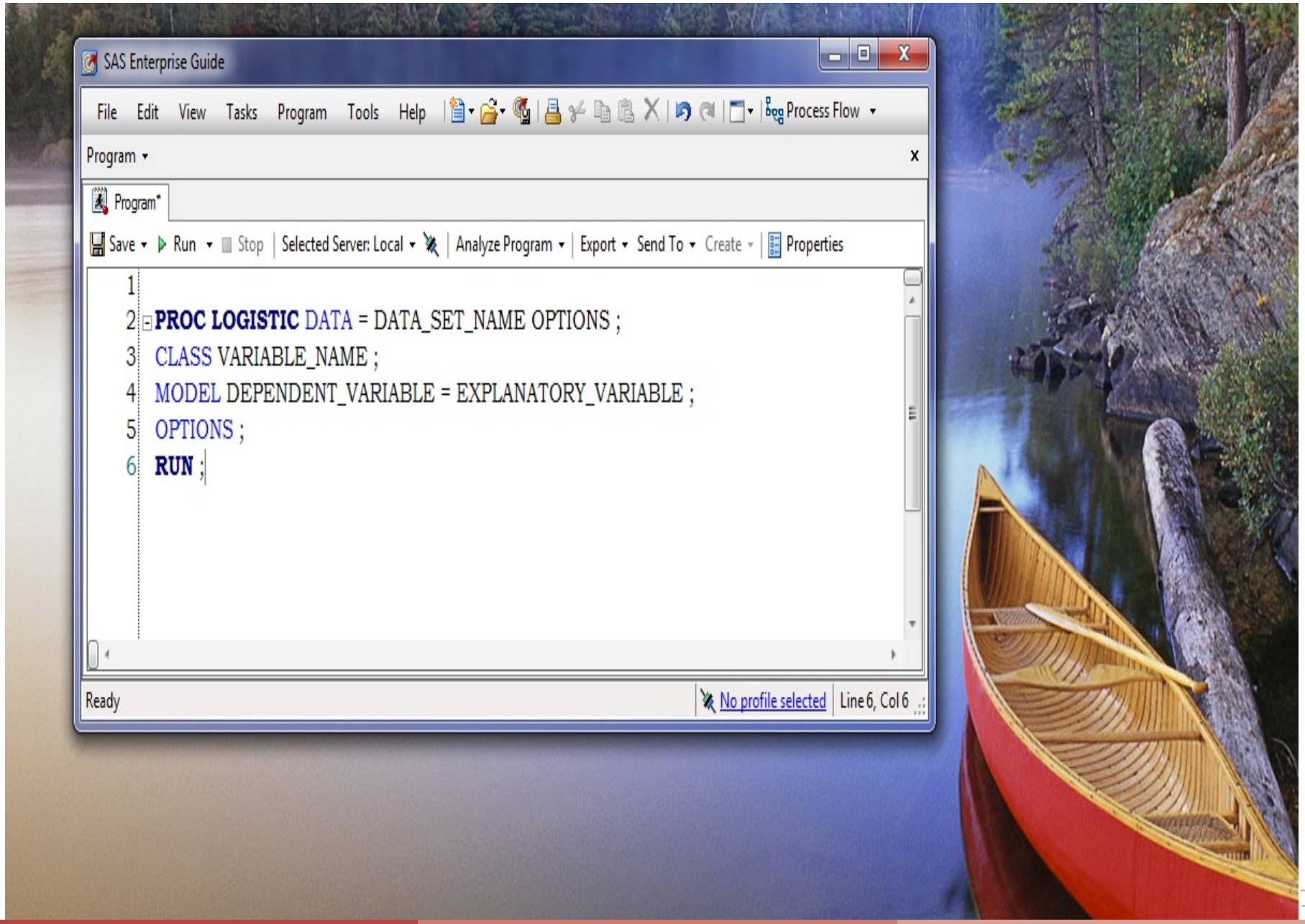


- Response variable is categorical, often binary:
  Yes/No
  Acceptable/Not acceptable
  Phenomena takes place/does not take place
- Violates the assumption of linearity in normal regression.
- Error terms are heteroscedastic and not normal.

Area of Application

- *Health Sciences:* questions about disease: yes or no?
- *Social Sciences:* deals with great deal of dichotomous variables: employed vs unemployed, married vs unmarried, etc.
- Used in economics and marketing to study consumer choice.
- Banks use it to assess credit rating of customers
- Public Opinion Polls
- Used in demand forecasting

PROC LOGISTIC



What is SAS Macro

A macro is a larger piece of a program that can contain complex logic including complete DATA and PROC steps, and macro statements such as *%IF-%THEN -%ELSE* and *%DO-%END*. Macros often - but not always - contain macro variables.[1]

Why use Macro

1. With macros you can make one small change in your program and have SAS echo that change throughout your program.[1]
2. Macros can allow you to write a piece of code and use it over and over again in the same or different program.[1]
3. You can make your program data driven, letting SAS decide what to do based on actual data.[1]

Data

Alphabetic List of Variables and Attributes					
#	Variable	Type	Len	Format	Label
9	Cylinders	Num	8		
5	DriveTrain	Char	5		
8	EngineSize	Num	8		Engine Size (L)
10	Horsepower	Num	8		
7	Invoice	Num	8	DOLLAR8.	
15	Length	Num	8		Length (IN)
11	MPG_City	Num	8		MPG (City)
12	MPG_Highway	Num	8		MPG (Highway)
6	MSRP	Num	8	DOLLAR8.	
1	Make	Char	13		
2	Model	Char	40		
4	Origin	Char	6		
3	Type	Char	8		
13	Weight	Num	8		Weight (LBS)
14	Wheelbase	Num	8		Wheelbase (IN)

Data (Contd.)

SAS Enterprise Guide

File Edit View Tasks Program Tools Help Process Flow

Code

Program* Log

Save Run Stop Selected Server: Local (Connected) Analyze Program Export Send To Create

```
DATA CARS ;
SET SASHELP.CARS ;
IF (MSRP LE 32700) THEN Price = 'Cheap';
ELSE Price= 'Costly' ;
IF (MPG_City  LE 20) THEN Efficiency = 'No';
ELSE Efficiency= 'Yes' ;
IF (EngineSize  LE 3) THEN Size = 'Small';
ELSE Size= 'Big' ;
IF (Type  EQ 'Sedan') THEN Sedan = 'Yes' ;
ELSE Sedan= 'No' ;
IF (Origin  EQ 'USA') THEN USA = 'Yes';
ELSE USA= 'No' ;
IF (Origin  EQ 'Asia') THEN Asia = 'Yes';
ELSE Asia= 'No' ;
IF (Origin  EQ 'Europe') THEN Europe = 'Yes';
ELSE Europe= 'No' ;
IF (DriveTrain  EQ 'Front') THEN FrontWheel = 'Yes';
ELSE FrontWheel='No' ;
DROP MSRP MPG_City EngineSize Make Model Type DriveTrain Origin ;
RUN ;
```

Ready No profile selected Line 37, Col 20

What predicts what?

- *Costly or Not*
- *Efficient or Not*
- *Big or Small*
- *Front Wheel Drive or Not*

- *Response Variable:* 4
- *Explanatory Variable:* 11
- *Total Model:* 44

Macro Code

```
/*
This macro runs univariate logistic regression for any number of
outcomes and predictors.It summarizes parameter estimates from
different models into two data files: one for numeric and one
for character variables. Arguments are:
DS=Input Dataset
Outcome=Output Variable(s)
Numvar=One numeric variable name to generate summary data file
CHARVAR=One Character Variable to generate summary data file
Outvar=One output variable name if there are more than one Outcomes
*/

%MACRO LOGIS(DS=, OUTCOME=,NUMVAR=,
                    CHARVAR=, OUTVAR=) ;
DATA _null_;
%* Count number of variables in the ConvertVars parameter ;
CALL SYMPUTX("novars", count("&OUTCOME", "") + 1, "G");
RUN;
%PUT Number of Outcome Variables Count is &novars;
DATA _DSin (DROP=&OUTCOME) ;
SET &DS ;
RUN ;
%INCLUDE 'Z:\SAS Work\Macro\Variable_List.sas' ;
%LST(_DSin) ;
%PUT X=&X ;
%PUT Y=&Y ;
%LET Outvars=1 ;
%DO %WHILE(&Outvars LT (&novars + 1));
%LET newvar = %SCAN(&OUTCOME, &Outvars);
%PUT Processing variable is &newvar;
ODS OUTPUT ParameterEstimates = _SUMMARYC ;
PROC LOGISTIC DATA=&DS  DESCENDING ;
CLASS &CHARVAR ;
MODEL &OUTVAR = &CHARVAR /
RSQUARE LACKFIT ;
RUN;
QUIT;
ODS OUTPUT CLOSE ;
DATA _SUMMARYC ;
LENGTH VARIABLE $ 32 ;
SET _SUMMARYC ;
DELETE  ;
RUN ;
ODS OUTPUT ParameterEstimates = _SUMMARYN ;
```

Macro Code (Contd.)

```
PROC LOGISTIC DATA=&DS  DESCENDING ;
MODEL &OUTVAR = &NUMVAR /
RSQUARE LACKFIT ;
RUN;
QUIT;
ODS OUTPUT CLOSE ;
DATA _SUMMARYN ;
LENGTH VARIABLE $ 32 ;
SET _SUMMARYN ;
DELETE ;
RUN ;
%LET DSID=%SYSFUNC(OPEN(_DSin, i));
%LET K=1 ;
%LET VAR = %SCAN(&X, &K) ;
%LET L=1 ;
%LET VART = %SCAN(&Y, &L) ;
%DO %WHILE ("&VAR" NE "") ;
%IF ("&VART" EQ "C")
%THEN %DO ;
ODS OUTPUT ParameterEstimates = _peC&Outvars&K
                OddsRatios = _orC&Outvars&K ;
PROC LOGISTIC DATA=&DS  DESCENDING ;
CLASS &VAR ;
MODEL &newvar = &VAR /
RSQUARE LACKFIT ;
TITLE1 "Logistic Regression for Predicting &newvar with &VAR (Character) " ;
RUN;
QUIT;
ODS OUTPUT CLOSE ;
DATA _peC&Outvars&K ;
LENGTH VARIABLE $ 32 ;
SET _peC&Outvars&K ;
RUN ;
PROC APPEND BASE = _SUMMARYC DATA = _peC&Outvars&K FORCE ;
RUN ;
%END ;
%ELSE %IF ("&VART" EQ "N")
%THEN %DO ;
ODS OUTPUT ParameterEstimates = _peN&Outvars&K
                OddsRatios = _orN&Outvars&K ;
PROC LOGISTIC DATA=&DS  DESCENDING ;
MODEL &newvar = &VAR /
RSQUARE LACKFIT ;
TITLE1 "Logistic Regression for Predicting &newvar with &var (Numeric) " ;
```

Macro Code (Contd.)

```
RUN;
QUIT;
ODS OUTPUT CLOSE ;
DATA _peN&Outvars&K ;
LENGTH VARIABLE $ 32 ;
SET _peN&Outvars&K ;
RUN ;
PROC APPEND BASE = _SUMMARYN DATA = _peN&Outvars&K FORCE ;
RUN ;
%END ;
%LET K = %EVAL(&K + 1) ;
%LET VAR = %SCAN(&X, &K) ;
%LET L = %EVAL(&L + 1) ;
%LET VART = %SCAN(&Y, &L) ;
%END ;
TITLE1 "Summary of Parameter Estimates for &newvar for Numeric
Variables" ;
PROC PRINT DATA=_SUMMARYN ;
RUN ;
TITLE1 "Summary of Parameter Estimates for &newvar for Character
Variables" ;
PROC PRINT DATA=_SUMMARYC ;
RUN ;
PROC DATASETS LIB=WORK NOLIST ;
DELETE _SUMMARYC _SUMMARYN ;
QUIT ;
RUN ;
%LET Outvars = %EVAL(&Outvars +1);
%PUT Updated vars loop count &Outvars;
%END;
%LET RC=%SYSFUNC(CLOSE(&DSID)) ;
%MEND LOGIS ;
```

Macro Code (Contd.)

SAS Enterprise Guide

File Edit View Tasks Program Tools Help

Code

Program* Log

Save Run Stop | Selected Server: Local (Connected) | Analyze Program

```
%LOGIS(
        DS=CARS,
        OUTCOME= Price Efficiency Size FrontWheel ,
        NUMVAR=Cylinders,
        CHARVAR=Sedan,
        OUTVAR=Price
        );
```

Ready | No profile selected | Line 25, Col 23

References

Susan J. Slaughter and Lora D. Delwiche
SAS Macro Programming for Beginners.
SUGI 29.


THANK YOU