

>SPSS Complex Samples[™] 15.0



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Preface

SPSS 15.0 is a comprehensive system for analyzing data. The SPSS Complex Samples optional add-on module provides the additional analytic techniques described in this manual. The Complex Samples add-on module must be used with the SPSS 15.0 Base system and is completely integrated into that system.

Installation

To install the SPSS Complex Samples add-on module, run the License Authorization Wizard using the authorization code that you received from SPSS Inc. For more information, see the installation instructions supplied with the SPSS Complex Samples add-on module.

Compatibility

SPSS is designed to run on many computer systems. See the installation instructions that came with your system for specific information on minimum and recommended requirements.

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The SPSS Statistical Procedures Companion, by Marija Norušis, has been published by Prentice Hall. A new version of this book, updated for SPSS 15.0, is planned. The SPSS Advanced Statistical Procedures Companion, also based on SPSS 15.0, is forthcoming. The SPSS Guide to Data Analysis for SPSS 15.0 is also in development. Announcements of publications available exclusively through Prentice Hall will be available on the SPSS Web site at http://www.spss.com/estore (select your home country, and then click Books).

Tell Us Your Thoughts

Your comments are important. Please let us know about your experiences with SPSS products. We especially like to hear about new and interesting applications using the SPSS Complex Samples add-on module. Please send e-mail to *suggest@spss.com* or write to SPSS Inc., Attn.: Director of Product Planning, 233 South Wacker Drive, 11th Floor, Chicago, IL 60606-6412.

About This Manual

This manual documents the graphical user interface for the procedures included in the SPSS Complex Samples add-on module. Illustrations of dialog boxes are taken from SPSS for Windows. Dialog boxes in other operating systems are similar. Detailed information about the command syntax for features in the SPSS Complex Samples add-on module is available in two forms: integrated into the overall Help system and as a separate document in PDF form in the *SPSS 15.0 Command Syntax Reference*, available from the Help menu.

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Part I: User's Guide

Introduction to SPSS Complex Samples Procedures

An inherent assumption of analytical procedures in traditional software packages is that the observations in a data file represent a simple random sample from the population of interest. This assumption is untenable for an increasing number of companies and researchers who find it both cost-effective and convenient to obtain samples in a more structured way.

The SPSS Complex Samples option allows you to select a sample according to a complex design and incorporate the design specifications into the data analysis, thus ensuring that your results are valid.

Properties of Complex Samples

A complex sample can differ from a simple random sample in many ways. In a simple random sample, individual sampling units are selected at random with equal probability and without replacement (WOR) directly from the entire population. By contrast, a given complex sample can have some or all of the following features:

Stratification. Stratified sampling involves selecting samples independently within non-overlapping subgroups of the population, or strata. For example, strata may be socioeconomic groups, job categories, age groups, or ethnic groups. With stratification, you can ensure adequate sample sizes for subgroups of interest, improve the precision of overall estimates, and use different sampling methods from stratum to stratum.

Clustering. Cluster sampling involves the selection of groups of sampling units, or clusters. For example, clusters may be schools, hospitals, or geographical areas, and sampling units may be students, patients, or citizens. Clustering is common in multistage designs and area (geographic) samples.

Multiple stages. In multistage sampling, you select a first-stage sample based on clusters. Then you create a second-stage sample by drawing subsamples from the selected clusters. If the second-stage sample is based on subclusters, you can then add a third stage to the sample. For example, in the first stage of a survey, a sample of cities could be drawn. Then, from the selected cities, households could be sampled. Finally, from the selected households, individuals could be polled. The Sampling and Analysis Preparation wizards allow you to specify three stages in a design.

Nonrandom sampling. When selection at random is difficult to obtain, units can be sampled systematically (at a fixed interval) or sequentially.

Unequal selection probabilities. When sampling clusters that contain unequal numbers of units, you can use probability-proportional-to-size (PPS) sampling to make a cluster's selection probability equal to the proportion of units it contains. PPS sampling can also use more general weighting schemes to select units.

Unrestricted sampling. Unrestricted sampling selects units with replacement (WR). Thus, an individual unit can be selected for the sample more than once.

Sampling weights. Sampling weights are automatically computed while drawing a complex sample and ideally correspond to the "frequency" that each sampling unit represents in the target population. Therefore, the sum of the weights over the sample should estimate the population size. Complex Samples analysis procedures require sampling weights in order to properly analyze a complex sample. Note that these weights should be used entirely within the Complex Samples option and should not be used with other analytical procedures via the Weight Cases procedure, which treats weights as case replications.

Usage of Complex Samples Procedures

Your usage of Complex Samples procedures depends on your particular needs. The primary types of users are those who:

- Plan and carry out surveys according to complex designs, possibly analyzing the sample later. The primary tool for surveyors is the Sampling Wizard.
- Analyze sample data files previously obtained according to complex designs. Before using the Complex Samples analysis procedures, you may need to use the Analysis Preparation Wizard.

Regardless of which type of user you are, you need to supply design information to Complex Samples procedures. This information is stored in a **plan file** for easy reuse.

Introduction to SPSS Complex Samples Procedures

Plan Files

A plan file contains complex sample specifications. There are two types of plan files:

Sampling plan. The specifications given in the Sampling Wizard define a sample design that is used to draw a complex sample. The sampling plan file contains those specifications. The sampling plan file also contains a default analysis plan that uses estimation methods suitable for the specified sample design.

Analysis plan. This plan file contains information needed by Complex Samples analysis procedures to properly compute variance estimates for a complex sample. The plan includes the sample structure, estimation methods for each stage, and references to required variables, such as sample weights. The Analysis Preparation Wizard allows you to create and edit analysis plans.

There are several advantages to saving your specifications in a plan file, including:

- A surveyor can specify the first stage of a multistage sampling plan and draw first-stage units now, collect information on sampling units for the second stage, and then modify the sampling plan to include the second stage.
- An analyst who doesn't have access to the sampling plan file can specify an analysis plan and refer to that plan from each Complex Samples analysis procedure.
- A designer of large-scale public use samples can publish the sampling plan file, which simplifies the instructions for analysts and avoids the need for each analyst to specify his or her own analysis plans.

Further Readings

For more information on sampling techniques, see the following texts:

Cochran, W. G. 1977. Sampling Techniques, 3rd ed. New York: John Wiley and Sons.

Kish, L. 1965. Survey Sampling. New York: John Wiley and Sons.

Kish, L. 1987. Statistical Design for Research. New York: John Wiley and Sons.

Murthy, M. N. 1967. *Sampling Theory and Methods*. Calcutta, India: Statistical Publishing Society.

Särndal, C., B. Swensson, and J. Wretman. 1992. *Model Assisted Survey Sampling*. New York: Springer-Verlag.

Sampling from a Complex Design

Figure 2-1 Sampling Wizard, Welcome step

Sampling Wizard		
Welcome to the Sampling Wizard The Sampling Wizard helps you design analysis time to indicate how the data v You can also use the wizard to modify .	and select a complex sample. Your selections will be s vere sampled. a sampling plan or draw a sample according to an existi	aved to a plan file that you can use at ing plan.
	What would you like to do?	z:\property_assess.csplan Browse
	Choose this option if you want to add, remove, or modify stages of an existing plan. You will have the option to draw the sample.	Browse
x +(z)	Choose this option if you already have File:	Browse
	< <u>B</u> ack Next>	Finish Cancel Help

The Sampling Wizard guides you through the steps for creating, modifying, or executing a sampling plan file. Before using the Wizard, you should have a well-defined target population, a list of sampling units, and an appropriate sample design in mind.

Sampling from a Complex Design

Creating a New Sample Plan

- From the menus choose:
 Analyze
 Complex Samples
 Select a Sample...
- Select Design a sample and choose a plan filename to save the sample plan.
- Click Next to continue through the Wizard.
- Optionally, in the Define Variables step, you can define strata, clusters, and input sample weights. After you define these, click Next.
- Optionally, in the Sampling Method step, you can choose a method for selecting items.

If you select PPS Brewer or PPS Murthy, you can click Finish to draw the sample. Otherwise, click Next and then:

▶ In the Sample Size step, specify the number or proportion of units to sample.

You can now click Finish to draw the sample. Optionally, in further steps, you can:

- Choose output variables to save.
- Add a second or third stage to the design.
- Set various selection options, including which stages to draw samples from, the random number seed, and whether to treat user-missing values as valid values of design variables.
- Choose where to save output data.
- Paste your selections as command syntax.

Sampling Wizard: Design Variables

Figure 2-2

Sampling Wizard, Design Variables step

Stage 1: Design Variables In this panel you can stratify your sar If sampling weights exist from a prior	nple or define clusters. You can also provid stage of the sample design you can use the	le a label for the stage that will be used in the output. em as input to the current stage.
 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion 	Variables: Property ID [propid] Neighborhood (nbrh Years since last appr ✓ Value at last apprais	Stratify By: County [county] <u> Clusters:</u> <u> Input Sample Weight:</u>
		Stage Label:
	< <u>B</u> ack Nex	t> Finish Cancel Help

This step allows you to select stratification and clustering variables and to define input sample weights. You can also specify a label for the stage.

Stratify By. The cross-classification of stratification variables defines distinct subpopulations, or strata. Separate samples are obtained for each stratum. To improve the precision of your estimates, units within strata should be as homogeneous as possible for the characteristics of interest.

Clusters. Cluster variables define groups of observational units, or clusters. Clusters are useful when directly sampling observational units from the population is expensive or impossible; instead, you can sample clusters from the population and then sample observational units from the selected clusters. However, the use of clusters can introduce correlations among sampling units, resulting in a loss of precision. To minimize this effect, units within clusters should be as heterogeneous as possible for the

Sampling from a Complex Design

characteristics of interest. You must define at least one cluster variable in order to plan a multistage design. Clusters are also necessary in the use of several different sampling methods. For more information, see Sampling Wizard: Sampling Method on p. 8.

Input Sample Weight. If the current sample design is part of a larger sample design, you may have sample weights from a previous stage of the larger design. You can specify a numeric variable containing these weights in the first stage of the current design. Sample weights are computed automatically for subsequent stages of the current design.

Stage Label. You can specify an optional string label for each stage. This is used in the output to help identify stagewise information.

Note: The source variable list has the same content across steps of the Wizard. In other words, variables removed from the source list in a particular step are removed from the list in all steps. Variables returned to the source list appear in the list in all steps.

Tree Controls for Navigating the Sampling Wizard

On the left side of each step in the Sampling Wizard is an outline of all the steps. You can navigate the Wizard by clicking on the name of an enabled step in the outline. Steps are enabled as long as all previous steps are valid—that is, if each previous step has been given the minimum required specifications for that step. See the Help for individual steps for more information on why a given step may be invalid.

Sampling Wizard: Sampling Method

Figure 2-3

Sampling Wizard, Method step

 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion 	Variables:	Method Jupe: Simple Random Sampling
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------	--------------------------------------

This step allows you to specify how to select cases from the active dataset.

Method. Controls in this group are used to choose a selection method. Some sampling types allow you to choose whether to sample with replacement (WR) or without replacement (WOR). See the type descriptions for more information. Note that some probability-proportional-to-size (PPS) types are available only when clusters have been defined and that all PPS types are available only in the first stage of a design. Moreover, WR methods are available only in the last stage of a design.

- Simple Random Sampling. Units are selected with equal probability. They can be selected with or without replacement.
- **Simple Systematic.** Units are selected at a fixed interval throughout the sampling frame (or strata, if they have been specified) and extracted without replacement. A randomly selected unit within the first interval is chosen as the starting point.

- **Simple Sequential.** Units are selected sequentially with equal probability and without replacement.
- **PPS.** This is a first-stage method that selects units at random with probability proportional to size. Any units can be selected with replacement; only clusters can be sampled without replacement.
- **PPS Systematic.** This is a first-stage method that systematically selects units with probability proportional to size. They are selected without replacement.
- **PPS Sequential**. This is a first-stage method that sequentially selects units with probability proportional to cluster size and without replacement.
- PPS Brewer. This is a first-stage method that selects two clusters from each stratum with probability proportional to cluster size and without replacement. A cluster variable must be specified to use this method.
- PPS Murthy. This is a first-stage method that selects two clusters from each stratum with probability proportional to cluster size and without replacement. A cluster variable must be specified to use this method.
- PPS Sampford. This is a first-stage method that selects more than two clusters from each stratum with probability proportional to cluster size and without replacement. It is an extension of Brewer's method. A cluster variable must be specified to use this method.
- Use WR estimation for analysis. By default, an estimation method is specified in the plan file that is consistent with the selected sampling method. This allows you to use with-replacement estimation even if the sampling method implies WOR estimation. This option is available only in stage 1.

Measure of Size (MOS). If a PPS method is selected, you must specify a measure of size that defines the size of each unit. These sizes can be explicitly defined in a variable or they can be computed from the data. Optionally, you can set lower and upper bounds on the MOS, overriding any values found in the MOS variable or computed from the data. These options are available only in stage 1.

Sampling Wizard: Sample Size

Figure 2-4

Sampling Wizard, Sample Size step

Sampling Wizard		8
Stage 1: Sample Size In this panel you specify the number or pro- it can vary for different strata. If you specify sample sizes as proportions y Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion	portion of units to be sampled in the curr you can also set the minimum or maximur <u>Variables:</u> Property ID [propid] Neighborhood [nbrh Years since last appr Value at last apprais	tent stage. The sample size can be fixed across strata or m number of units to draw. Units: Counts Value: The size value applies Value: The size value applies Unequal values for strata: Define Define Eead values from variable: Minimum Maximum Minimum Maximum
	<u>≺B</u> ack <u>N</u> ext >	Finish Cancel Help

This step allows you to specify the number or proportion of units to sample within the current stage. The sample size can be fixed or it can vary across strata. For the purpose of specifying sample size, clusters chosen in previous stages can be used to define strata.

Units. You can specify an exact sample size or a proportion of units to sample.

Value. A single value is applied to all strata. If Counts is selected as the unit metric, you should enter a positive integer. If Proportions is selected, you should enter a non-negative value. Unless sampling with replacement, proportion values should also be no greater than 1.

- Unequal values for strata. Allows you to enter size values on a per-stratum basis via the Define Unequal Sizes dialog box.
- Read values from variable. Allows you to select a numeric variable that contains size values for strata.

If Proportions is selected, you have the option to set lower and upper bounds on the number of units sampled.

Define Unequal Sizes

Figure 2-5

Define Unequal Sizes dialog box

D	efine	e Unequal Sizes			
	<u>6</u> ize S	pecifications:	Labels	<u>V</u> alues	E <u>x</u> clude:
		county		Count	
	1	Central		4	
	2	Eastern		5	
	3	Northern		3	
	4	Southern		4	
	5	Western		3	
	6				
	7				
	8				
	9				
	М	ove Left Move Right	Refresh S	itrata	
				Continue	Cancel Help

The Define Unequal Sizes dialog box allows you to enter sizes on a per-stratum basis.

Size Specifications grid. The grid displays the cross-classifications of up to five strata or cluster variables—one stratum/cluster combination per row. Eligible grid variables include all stratification variables from the current and previous stages and all cluster variables from previous stages. Variables can be reordered within the grid or moved to the Exclude list. Enter sizes in the rightmost column. Click Labels or Values to toggle the display of value labels and data values for stratification and cluster variables in the grid cells. Cells that contain unlabeled values always show values. Click Refresh Strata to repopulate the grid with each combination of labeled data values for variables in the grid.

Exclude. To specify sizes for a subset of stratum/cluster combinations, move one or more variables to the Exclude list. These variables are not used to define sample sizes.

Sampling Wizard: Output Variables

```
Figure 2-6
```

Sampling Wizard, Output Variables step

mpling Wizard		
Stage 1: Output Variables In this panel you can choose variab population for the current stage. If th	les to be saved when the sample is dra ne sample is stratified the variables con	awn. The variables contain information about the sample or tain data for each stratum.
Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample	Which variables do you wa	nt to save? Sample proportion Sample <u>w</u> eight
Selection Options Output Files Completion	Inclusion probabilities, c always saved. Duplication indexes are with replacement.	rumulative sample weights, and final sample weights are created automatically when the plan requests sampling
1	< <u>B</u> ack	Next > Finish Cancel Help

This step allows you to choose variables to save when the sample is drawn.

Population size. The estimated number of units in the population for a given stage. The root name for the saved variable is *PopulationSize*.

Sample proportion. The sampling rate at a given stage. The root name for the saved variable is *SamplingRate_*.

Sample size. The number of units drawn at a given stage. The root name for the saved variable is *SampleSize_*.

Sample weight. The inverse of the inclusion probabilities. The root name for the saved variable is *SampleWeight_*.

Some stagewise variables are generated automatically. These include:

Inclusion probabilities. The proportion of units drawn at a given stage. The root name for the saved variable is *InclusionProbability*.

Cumulative weight. The cumulative sample weight over stages previous to and including the current one. The root name for the saved variable is *SampleWeightCumulative*.

Index. Identifies units selected multiple times within a given stage. The root name for the saved variable is *Index*_.

Note: Saved variable root names include an integer suffix that reflects the stage number—for example, *PopulationSize_1* for the saved population size for stage 1.

Sampling Wizard: Plan Summary

Figure 2-7

Sampling Wizard, Plan Summary step

Sampling Wizard Stage 1: Plan Summary This panel summarizes the sampling plan If you choose not to add a stage the new	ı so far. Yo ıt step is to	u can add ano set options for	ther stage to drawing you	the design. sample.		
Welcome	<u>S</u> umma	y:				
Design Variables	Stage	Label	Strata	Clusters	Size	Method
Method Sample Size	1	(None)	county	town	4	Simple Random Sampling (VVOR)
 Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion 	File: c: ¹ Do you () <u>re</u> CP ww da	property_asse: want to add st s, add stage 2 noose this optio orking data file ta for stage 2.	ss.csplan age 2? now n if the contains		No, do no Choose th data are r design ha	t add another stage now nis option if stage 2 not available yet or your is only one stage.
		< <u>B</u> ack	: <u>N</u> e:	(t≻	Finish	Cancel Help

This is the last step within each stage, providing a summary of the sample design specifications through the current stage. From here, you can either proceed to the next stage (creating it, if necessary) or set options for drawing the sample.

Sampling Wizard: Draw Sample Selection Options

Figure 2-8

Sampling Wizard, Draw Sample Selection Options step

Sampling Wizard	×
Draw Sample: Selection Options In this panel you can choose whether to seed used for random number generatio	o draw a sample. You can pick which stages to extract and set other sampling options such as the n.
Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion	O you want to draw a sample? O Yes Stages: All (1) No No What type of seed value do you want to use? O A randomly-chosen number O Custom value: Enter a custom seed value if you want to reproduce the sample later.
	□ Include in the sample frame cases with user-missing values of stratification or clustering variables □ Working data are sorted by stratification variables (presorted data may speed processing) < <u>Keack</u> Next > Finish Cancel Help

This step allows you to choose whether to draw a sample. You can also control other sampling options, such as the random seed and missing-value handling.

Draw sample. In addition to choosing whether to draw a sample, you can also choose to execute part of the sampling design. Stages must be drawn in order—that is, stage 2 cannot be drawn unless stage 1 is also drawn. When editing or executing a plan, you cannot resample locked stages.

Seed. This allows you to choose a seed value for random number generation.

Include user-missing values. This determines whether user-missing values are valid. If so, user-missing values are treated as a separate category.

Data already sorted. If your sample frame is presorted by the values of the stratification variables, this option allows you to speed the selection process.

Sampling Wizard: Draw Sample Output Files

Figure 2-9

Sampling Wizard, Draw Sample Output Files step

mpling Wizard		
Draw Sample: Output Files In this panel you can choose where to replacement. The selected cases are	o save sample output data. You must save sampled cases to an external file if sampling is a saved along with the variables if the destination is a new dataset or file.	done with
Velcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Method Sample Size Output Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion	uess PPS sampling without replacement. They are needed for work estimation of PPS de Where do you want to save sample data? Active dataset New dataset: External file: Where do you want to save joint probabilities? File: Save case selection rules File:	Srowse
	< Back Next > Finish Cancel	Help

This step allows you to choose where to direct sampled cases, weight variables, joint probabilities, and case selection rules.

Sample data. These options let you determine where sample output is written. It can be added to the active dataset, written to a new dataset, or saved to an external SPSS-format data file. Datasets are available during the current session but are not available in subsequent sessions unless you explicitly save them as data files. Dataset names must adhere to SPSS variable naming rules. If an external file or new dataset is specified, the sampling output variables and variables in the active dataset for the selected cases are written.

Sampling from a Complex Design

Joint probabilities. These options let you determine where joint probabilities are written. They are saved to an external SPSS-format data file. Joint probabilities are produced if the PPS WOR, PPS Brewer, PPS Sampford, or PPS Murthy method is selected and WR estimation is not specified.

Case selection rules. If you are constructing your sample one stage at a time, you may want to save the case selection rules to a text file. They are useful for constructing the subframe for subsequent stages.

Sampling Wizard: Finish

Figure 2-10

Sampling Wizard, Finish step

Sampling Wizard	
Completing the Sampling Wizard You have provided all of the informatio You can return to the Sampling Wizard plan file in any Complex Samples analy Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion	n needed to create a sample design and draw a sample. later if you need to add or modify stages. After all the stages have been sampled you can use the sis procedure to indicate how the sample was drawn. What do you want to do? Save the design to a plan file and draw the sample Paste the syntax generated by the Wizard into a syntax window To close this wizard, click Finish.
,	< Back Next > Finish Cancel Help

This is the final step. You can save the plan file and draw the sample now or paste your selections into a syntax window.

When making changes to stages in the existing plan file, you can save the edited plan to a new file or overwrite the existing file. When adding stages without making changes to existing stages, the Wizard automatically overwrites the existing plan file. If you want to save the plan to a new file, select Paste the syntax generated by the Wizard into a syntax window and change the filename in the syntax commands.

Modifying an Existing Sample Plan

► From the menus choose:

Analyze Complex Samples Select a Sample...

- ▶ Select Edit a sample design and choose a plan file to edit.
- Click Next to continue through the Wizard.
- Review the sampling plan in the Plan Summary step, and then click Next.

Subsequent steps are largely the same as for a new design. See the Help for individual steps for more information.

Navigate to the Finish step, and specify a new name for the edited plan file or choose to overwrite the existing plan file.

Optionally, you can:

- Specify stages that have already been sampled.
- Remove stages from the plan.

Sampling from a Complex Design

Sampling Wizard: Plan Summary

Figure 2-11

Sampling Wizard, Plan Summary step

Sampling Wizard							
Plan Summary							
This panel summarizes the sampling pla to prevent accidental changes. They ca You can also delete existing stages from	n. Indicate annot be re n the plan.	any stages t sampled unle	hat have already ess you unlock ti	y been sampled hem.	d. These stag	es will be locked in the Wizard	
Velcome	<u>S</u> umma	ry:					
Stage 1	Stage	Label	Strata	Clusters	Size	Method	
Design Variables Method	1	(None)	county	town	4	Simple Random Sampling (WOR)	
Sample Size	2	(None)	nbrhood		0.2	Simple Random Sampling (WOR)	
Summary Stage 2							
Method Sample Size	File: C:\Program Files\SPSS\Tutorial\sample_files\property_assess.csplan						
Output Variables	Which stages have already been sampled?						
Add Stage 3			Stag	es: None	*		
Selection Options	Bemove stages from the plan: Stages: 2						
Completion							
		(<u> </u>	ack <u>N</u> ex	(t >	Finish	Cancel Help	

This step allows you to review the sampling plan and indicate stages that have already been sampled. If editing a plan, you can also remove stages from the plan.

Previously sampled stages. If an extended sampling frame is not available, you will have to execute a multistage sampling design one stage at a time. Select which stages have already been sampled from the drop-down list. Any stages that have been executed are locked; they are not available in the Draw Sample Selection Options step, and they cannot be altered when editing a plan.

Remove stages. You can remove stages 2 and 3 from a multistage design.

Running an Existing Sample Plan

- From the menus choose:
 Analyze
 Complex Samples
 Select a Sample...
- Select Draw a sample and choose a plan file to run.
- Click Next to continue through the Wizard.
- ▶ Review the sampling plan in the Plan Summary step, and then click Next.
- ► The individual steps containing stage information are skipped when executing a sample plan. You can now go on to the Finish step at any time.

Optionally, you can:

■ Specify stages that have already been sampled.

CSPLAN and CSSELECT Commands Additional Features

The SPSS command language also allows you to:

- Specify custom names for output variables.
- Control the output in the Viewer. For example, you can suppress the stagewise summary of the plan that is displayed if a sample is designed or modified, suppress the summary of the distribution of sampled cases by strata that is shown if the sample design is executed, and request a case processing summary.
- Choose a subset of variables in the active dataset to write to an external sample file or to a different dataset.

See the SPSS Command Syntax Reference for complete syntax information.
Preparing a Complex Sample for Analysis

Figure 3-1

Analysis Preparation Wizard, Welcome step

Analysis Preparation Wizard	
Welcome to the Analysis Preparation Wi The Analysis Preparation Wizard helps y sample weights and other information ne Your selections will be saved to a plan fil	zard ou describe your complex sample and choose an estimation method. You will be asked to provide eded for accurate estimation of standard errors. Ie that you can use in any of the analysis procedures in the Complex Samples Option.
	What would you like to do? Image: Choose this option if you have sample data but have not created a plan file. File: c:\bankloan.csaplan Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Choose this option if you want to add, remove, or modify stages of an existing plan. Image: Plan file Image: Plan
	< <u>Back</u> <u>N</u> ext > Finish Cancel Help

The Analysis Preparation Wizard guides you through the steps for creating or modifying an analysis plan for use with the various Complex Samples analysis procedures. Before using the Wizard, you should have a sample drawn according to a complex design.

Creating a new plan is most useful when you do not have access to the sampling plan file used to draw the sample (recall that the sampling plan contains a default analysis plan). If you do have access to the sampling plan file used to draw the sample, you can use the default analysis plan contained in the sampling plan file or override the default analysis specifications and save your changes to a new file.

Creating a New Analysis Plan

► From the menus choose:

Analyze Complex Samples Prepare for Analysis...

- Select Create a plan file, and choose a plan filename to which you will save the analysis plan.
- ► Click Next to continue through the Wizard.
- Specify the variable containing sample weights in the Design Variables step, optionally defining strata and clusters.

You can now click Finish to save the plan. Optionally, in further steps you can:

- Select the method for estimating standard errors in the Estimation Method step.
- Specify the number of units sampled or the inclusion probability per unit in the Size step.
- Add a second or third stage to the design.
- Paste your selections as command syntax.

Analysis Preparation Wizard: Design Variables



Analysis Preparation Wizard, Design Variables step

Analysis Preparation Wizard Stage 1: Design Variables			
In this panel you can select variables You can also provide a label for the st	hat define strata or clusters. A sample wei age that will be used in the output.	ight variable mu	ist be selected in the first stage.
 Welcome Stage 1 Design Variables Estimation Method Summary Completion 	Variables: ✓ Number of customer ✓ Customer ID [custom ✓ Age in years [age] I Level of education [✓ Years with current e ✓ Years at current add ✓ Household income i ✓ Debt to income ratio ✓ Debt to income ratio ✓ Debt to debt in th ✓ Dither debt in thousa ✓ Previously defaulted ✓ inclprob_s1 [inclprob	>	Strata: Clusters:
	< Back Next	:> F	inish Cancel Help

This step allows you to identify the stratification and clustering variables and define sample weights. You can also provide a label for the stage.

Strata. The cross-classification of stratification variables defines distinct subpopulations, or strata. Your total sample represents the combination of independent samples from each stratum.

Clusters. Cluster variables define groups of observational units, or clusters. Samples drawn in multiple stages select clusters in the earlier stages and then subsample units from the selected clusters. When analyzing a data file obtained by sampling clusters with replacement, you should include the duplication index as a cluster variable.

Sample Weight. You must provide sample weights in the first stage. Sample weights are computed automatically for subsequent stages of the current design.

Stage Label. You can specify an optional string label for each stage. This is used in the output to help identify stagewise information.

Note: The source variable list has the same contents across steps of the Wizard. In other words, variables removed from the source list in a particular step are removed from the list in all steps. Variables returned to the source list show up in all steps.

Tree Controls for Navigating the Analysis Wizard

At the left side of each step of the Analysis Wizard is an outline of all the steps. You can navigate the Wizard by clicking on the name of an enabled step in the outline. Steps are enabled as long as all previous steps are valid—that is, as long as each previous step has been given the minimum required specifications for that step. For more information on why a given step may be invalid, see the Help for individual steps.

Preparing a Complex Sample for Analysis

Analysis Preparation Wizard: Estimation Method

Figure 3-3

Analysis Preparation Wizard, Estimation Method step



This step allows you to specify an estimation method for the stage.

WR (sampling with replacement). WR estimation does not include a correction for sampling from a finite population (FPC) when estimating the variance under the complex sampling design. You can choose to include or exclude the FPC when estimating the variance under simple random sampling (SRS).

Choosing not to include the FPC for SRS variance estimation is recommended when the analysis weights have been scaled so that they do not add up to the population size. The SRS variance estimate is used in computing statistics like the design effect. WR estimation can be specified only in the final stage of a design; the Wizard will not allow you to add another stage if you select WR estimation.

Equal WOR (equal probability sampling without replacement). Equal WOR estimation includes the finite population correction and assumes that units are sampled with equal probability. Equal WOR can be specified in any stage of a design.

Unequal WOR (unequal probability sampling without replacement). In addition to using the finite population correction, Unequal WOR accounts for sampling units (usually clusters) selected with unequal probability. This estimation method is available only in the first stage.

Analysis Preparation Wizard: Size

Figure 3-4

Analysis Preparation Wizard, Size step

Analysis Preparation Wizard	
Stage 1: Size In this panel you specify inclusion probabilitie You can provide a size that is fixed across st Welcome Stage 1 • Design Variables • Estimation Method • Size Summary Add Stage 2 Completion	ss or population sizes for the current stage. rata or specify sizes on a per-stratum basis.
	<pre></pre>

This step is used to specify inclusion probabilities or population sizes for the current stage. Sizes can be fixed or can vary across strata. For the purpose of specifying sizes, clusters specified in previous stages can be used to define strata. Note that this step is necessary only when Equal WOR is chosen as the Estimation Method.

Units. You can specify exact population sizes or the probabilities with which units were sampled.

- Value. A single value is applied to all strata. If Population Sizes is selected as the unit metric, you should enter a non-negative integer. If Inclusion Probabilities is selected, you should enter a value between 0 and 1, inclusive.
- Unequal values for strata. Allows you to enter size values on a per-stratum basis via the Define Unequal Sizes dialog box.
- Read values from variable. Allows you to select a numeric variable that contains size values for strata.

Define Unequal Sizes

Figure 3-5

Define Unequal Sizes dialog box

Def	ine	Unequal Sizes	_		
<u>S</u> i:	ze S	pecifications:	<u>V</u> alues		E <u>x</u> clude:
		county	Count		
	1	Central	4		
	2	Eastern	5		
	3	Northern	3		
	4	Southern	4		
	5	Western	3	•	
	6				
	7				
	8				
	9				
	М	ove Le <u>í</u> t Move <u>Right</u> Refresh	Strata		
			Continue		Cancel Help

The Define Unequal Sizes dialog box allows you to enter sizes on a per-stratum basis.

Size Specifications grid. The grid displays the cross-classifications of up to five strata or cluster variables—one stratum/cluster combination per row. Eligible grid variables include all stratification variables from the current and previous stages and all cluster variables from previous stages. Variables can be reordered within the grid or moved to the Exclude list. Enter sizes in the rightmost column. Click Labels or Values to toggle the display of value labels and data values for stratification and cluster variables in

the grid cells. Cells that contain unlabeled values always show values. Click Refresh Strata to repopulate the grid with each combination of labeled data values for variables in the grid.

Exclude. To specify sizes for a subset of stratum/cluster combinations, move one or more variables to the Exclude list. These variables are not used to define sample sizes.

Analysis Preparation Wizard: Plan Summary

Figure 3-6

Analysis Preparation Wizard, Plan Summary step

Analysis Preparation Wizard							X
Stage 1: Plan Summary This panel summarizes the plan so far. If you choose not to add a stage the ne	You can ad	d another stag	e to the plan. panel				
Welcome	Summar	y:	F				
Design Variables Estimation Method	Stage 1	Label (None)	Strata	Clusters branch	Weights finalweight	Size (Read from	Method Equal WC
 Estimation Method Size Summary Add Stage 2 Completion Completion File: c:\bankloan.csaplan Do you want to add stage 2? Yes, add stage 2 now Choose this option if the sample contains another stage. Ng, do not add another stage now Choose this option if the sample contains another stage. 					ge now the		
1		< <u>B</u> ack	<u>N</u> ext	> F	ïnish	Cancel	Help

This is the last step within each stage, providing a summary of the analysis design specifications through the current stage. From here, you can either proceed to the next stage (creating it if necessary) or save the analysis specifications.

If you cannot add another stage, it is likely because:

■ No cluster variable was specified in the Design Variables step.

- You selected WR estimation in the Estimation Method step.
- This is the third stage of the analysis, and the Wizard supports a maximum of three stages.

Analysis Preparation Wizard: Finish

```
Figure 3-7
```

Analysis Preparation Wizard, Finish step

nalysis Preparation Wizard	
Completing the Analysis Wizard You have provided all of the information r You can use the plan file in any Complex	needed to create a plan. Samples analysis procedure when you are ready to analyze the data.
 Design Variables Estimation Method Size Summary Add Stage 2 Completion 	What do you want to do?
	To close this wizard, click Finish.
,	< <u>B</u> ack <u>N</u> ext > Finish Cancel Help

This is the final step. You can save the plan file now or paste your selections to a syntax window.

When making changes to stages in the existing plan file, you can save the edited plan to a new file or overwrite the existing file. When adding stages without making changes to existing stages, the Wizard automatically overwrites the existing plan file. If you want to save the plan to a new file, choose to Paste the syntax generated by the Wizard into a syntax window and change the filename in the syntax commands.

Modifying an Existing Analysis Plan

- From the menus choose:
 Analyze
 Complex Samples
 Prepare for Analysis...
- Select Edit a plan file, and choose a plan filename to which you will save the analysis plan.
- ► Click Next to continue through the Wizard.
- Review the analysis plan in the Plan Summary step, and then click Next.

Subsequent steps are largely the same as for a new design. For more information, see the Help for individual steps.

 Navigate to the Finish step, and specify a new name for the edited plan file, or choose to overwrite the existing plan file.

Optionally, you can:

■ Remove stages from the plan.

Analysis Preparation Wizard: Plan Summary

Figure 3-8

Analysis Preparation Wizard, Plan Summary step

Analysis Preparation Wizard							
Plan Summary This panel summarizes the plan. You	ı can delete st	ages before	proceeding.				
Welcome Plan Summary	Summar	iy:					
Stage 1	Stage	Label	Strata	Clusters	Weights	Size	Method
Design Variables	1	(None)		branch	finalweight	(Read from inclprob_s1)	Equal WC
Size	2	(None)				(Read from inclprob_s2)	Equal VVC
Stage 2 Design Variables Estimation Method Size Summary Add Stage 3 Completion	Image: Second						
,		< <u>B</u> a	ack <u>N</u> e	xt>	Finish	Cancel	Help

This step allows you to review the analysis plan and remove stages from the plan.

Remove Stages. You can remove stages 2 and 3 from a multistage design. Since a plan must have at least one stage, you can edit but not remove stage 1 from the design.

Complex Samples Plan

Complex Samples analysis procedures require analysis specifications from an analysis or sample plan file in order to provide valid results.

Figure 4-1

Complex Samples Plan dialog box

Complex Sa	mples Plan 🛛 📓
- Plan	
<u>F</u> ile:	ial\sample_files\nhis2000_subset.csaplan <u>B</u> rowse
If you do the Analy Analysis f	not have a plan file for your complex sample you can use vsis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.
Joint Proba	bilities
Joint prot WOR esti	babilities are required if the plan requests unequal probability imation. Otherwise they are ignored.
💿 Use de	fault file (C:\Program Fi00_subset.sav)
O An ope	n dataset
	nhis2000_subset.sav []
◯ <u>C</u> uston	n file
File:	Browse
	Continue Cancel Help

Plan. Specify the path of an analysis or sample plan file.

Complex Samples Plan

Joint Probabilities. In order to use Unequal WOR estimation for clusters drawn using a PPS WOR method, you need to specify a separate file or an open dataset containing the joint probabilities. This file or dataset is created by the Sampling Wizard during sampling.

Complex Samples Frequencies

The Complex Samples Frequencies procedure produces frequency tables for selected variables and displays univariate statistics. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Example. Using the Complex Samples Frequencies procedure, you can obtain univariate tabular statistics for vitamin usage among U.S. citizens, based on the results of the National Health Interview Survey (NHIS) and with an appropriate analysis plan for this public-use data.

Statistics. The procedure produces estimates of cell population sizes and table percentages, plus standard errors, confidence intervals, coefficients of variation, design effects, square roots of design effects, cumulative values, and unweighted counts for each estimate. Additionally, chi-square and likelihood-ratio statistics are computed for the test of equal cell proportions.

Data. Variables for which frequency tables are produced should be categorical. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Frequencies

► From the menus choose:

```
Analyze
Complex Samples
Frequencies...
```

- ► Select a plan file and optionally select a custom joint probabilities file.
- Click Continue.

Complex Samples Frequencies



► Select at least one frequency variable.

Optionally, you can:

• Specify variables to define subpopulations. Statistics are computed separately for each subpopulation.

Complex Samples Frequencies Statistics

Figure 5-2

Frequencies Statistics dialog box

Complex Samples Frequencies:	Statistics	X
Cells Population size	I able percent	Continue Cancel
C Statistics		Help
✓ Standard error	Unweighted count	
Confidence interval	Design effect	
Le <u>v</u> el (%): 95	Sguare root of design effect	
Coefficient of variation		
Test of equal cell proportions		

Cells. This group allows you to request estimates of the cell population sizes and table percentages.

Statistics. This group produces statistics associated with the population size or table percentage.

- **Standard error.** The standard error of the estimate.
- **Confidence interval.** A confidence interval for the estimate, using the specified level.
- **Coefficient of variation.** The ratio of the standard error of the estimate to the estimate.
- **Unweighted count.** The number of units used to compute the estimate.
- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- **Cumulative values.** The cumulative estimate through each value of the variable.

Test of equal cell proportions. This produces chi-square and likelihood-ratio tests of the hypothesis that the categories of a variable have equal frequencies. Separate tests are performed for each variable.

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Complex Samples Missing Values

Figure 5-3

Missing Values dialog box



Tables. This group determines which cases are used in the analysis.

- Use all available data. Missing values are determined on a table-by-table basis. Thus, the cases used to compute statistics may vary across frequency or crosstabulation tables.
- Use consistent case base. Missing values are determined across all variables. Thus, the cases used to compute statistics are consistent across tables.

Categorical Design Variables. This group determines whether user-missing values are valid or invalid.

Complex Samples Options

Figure 5-4 Options dialog box

Complex Samples : Options	
Subpopulation Display Subpopulation Display Image: All in the same table	Continue Cancel
○ <u>E</u> ach in a separate table	Help

Subpopulation Display. You can choose to have subpopulations displayed in the same table or in separate tables.

Complex Samples Descriptives

The Complex Samples Descriptives procedure displays univariate summary statistics for several variables. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Example. Using the Complex Samples Descriptives procedure, you can obtain univariate descriptive statistics for the activity levels of U.S. citizens, based on the results of the National Health Interview Survey (NHIS) and with an appropriate analysis plan for this public use data.

Statistics. The procedure produces means and sums, plus *t* tests, standard errors, confidence intervals, coefficients of variation, unweighted counts, population sizes, design effects, and square roots of design effects for each estimate.

Data. Measures should be scale variables. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Descriptives

From the menus choose:

Analyze Complex Samples Descriptives...

- Select a plan file, and optionally select a custom joint probabilities file.
- Click Continue.



► Select at least one measure variable.

Optionally, you can:

• Specify variables to define subpopulations. Statistics are computed separately for each subpopulation.

Complex Samples Descriptives Statistics

Figure 6-2

Descriptives Statistics dialog box		
Complex Samples Descriptives: Statistic	s	
Summaries	□ S <u>u</u> m	Continue Cancel
Test Value:	t-t <u>e</u> st Test value:	Help
Statistics		
Standard error	Unweighted count	
Confidence interval	Population size	
Le <u>v</u> el (%): 95	Design effect	
Coefficient of variation	Sguare root of design effect	

Summaries. This group allows you to request estimates of the means and sums of the measure variables. Additionally, you can request *t* tests of the estimates against a specified value.

Statistics. This group produces statistics associated with the mean or sum.

- **Standard error.** The standard error of the estimate.
- **Confidence interval.** A confidence interval for the estimate, using the specified level.
- **Coefficient of variation.** The ratio of the standard error of the estimate to the estimate.
- **Unweighted count.** The number of units used to compute the estimate.
- **Population size.** The estimated number of units in the population.
- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.

Complex Samples Descriptives Missing Values

Figure 6-3

Descriptives Missing Values dialog box



Statistics for Measure Variables. This group determines which cases are used in the analysis.

- Use all available data. Missing values are determined on a variable-by-variable basis, thus the cases used to compute statistics may vary across measure variables.
- Ensure consistent case base. Missing values are determined across all variables, thus the cases used to compute statistics are consistent.

Categorical Design Variables. This group determines whether user-missing values are valid or invalid.

Complex Samples Options

Figure 6-4

Options dialog box

Complex Samples : Options	
Subpopulation Display	Continue
All in the same table	Cancel
\bigcirc <u>E</u> ach in a separate table	Help

Complex Samples Descriptives

Subpopulation Display. You can choose to have subpopulations displayed in the same table or in separate tables.

Complex Samples Crosstabs

The Complex Samples Crosstabs procedure produces crosstabulation tables for pairs of selected variables and displays two-way statistics. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Example. Using the Complex Samples Crosstabs procedure, you can obtain cross-classification statistics for smoking frequency by vitamin usage of U.S. citizens, based on the results of the National Health Interview Survey (NHIS) and with an appropriate analysis plan for this public-use data.

Statistics. The procedure produces estimates of cell population sizes and row, column, and table percentages, plus standard errors, confidence intervals, coefficients of variation, expected values, design effects, square roots of design effects, residuals, adjusted residuals, and unweighted counts for each estimate. The odds ratio, relative risk, and risk difference are computed for 2-by-2 tables. Additionally, Pearson and likelihood-ratio statistics are computed for the test of independence of the row and column variables.

Data. Row and column variables should be categorical. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Crosstabs

► From the menus choose:

Analyze Complex Samples Crosstabs...

▶ Select a plan file and, optionally, select a custom joint probabilities file.

Click Continue.
 Figure 7-1

Crosstabs dialog box	
Complex Samples Crosstabs	
Variables: Unit [unit] Age in years [age] Marital status [m Years at current Price of primary v Primary vehicle p Level of educati Years with curre Partired [retire] Years with curre Gender [gender] Number of peopl Wireless service Missing Value	Bows: OK

• Select at least one row variable and one column variable.

Optionally, you can:

• Specify variables to define subpopulations. Statistics are computed separately for each subpopulation.

Complex Samples Crosstabs Statistics

Figure 7-2 Crosstabs Statistics dialog box

Complex Samples Crosstabs: Statistics		
Cells Population size Bow percent	<u>Column percent</u> <u>I</u> able percent	Continue Cancel Help
Statistics		
✓ Standard error	Unweighted count	
Con <u>f</u> idence interval	Design effect	
Le <u>v</u> el (%): 95	Sguare root of design effect	
Coefficient of variation	Residua <u>l</u> s	
Expected values	Adjusted residuals	
Summaries for 2-by-2 Tables		
Odds ratio	Risk differe <u>n</u> ce	
Relative ris <u>k</u>		
Test of independence of rows and columns		

Cells. This group allows you to request estimates of the cell population size and row, column, and table percentages.

Statistics. This group produces statistics associated with the population size and row, column, and table percentages.

- **Standard error.** The standard error of the estimate.
- **Confidence interval.** A confidence interval for the estimate, using the specified level.
- **Coefficient of variation.** The ratio of the standard error of the estimate to the estimate.
- **Expected values.** The expected value of the estimate, under the hypothesis of independence of the row and column variable.
- **Unweighted count.** The number of units used to compute the estimate.

- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Residuals. The expected value is the number of cases that you would expect in the cell if there were no relationship between the two variables. A positive residual indicates that there are more cases in the cell than there would be if the row and column variables were independent.
- Adjusted residuals. The residual for a cell (observed minus expected value) divided by an estimate of its standard error. The resulting standardized residual is expressed in standard deviation units above or below the mean.

Summaries for 2-by-2 Tables. This group produces statistics for tables in which the row and column variable each have two categories. Each is a measure of the strength of the association between the presence of a factor and the occurrence of an event.

- **Odds ratio.** The odds ratio can be used as an estimate of relative risk when the occurrence of the factor is rare.
- **Relative risk.** The ratio of the risk of an event in the presence of the factor to the risk of the event in the absence of the factor.
- **Risk difference.** The difference between the risk of an event in the presence of the factor and the risk of the event in the absence of the factor.

Test of independence of rows and columns. This produces chi-square and likelihood-ratio tests of the hypothesis that a row and column variable are independent. Separate tests are performed for each pair of variables.

Complex Samples Missing Values

Figure 7-3

Missing Values dialog box



Tables. This group determines which cases are used in the analysis.

- Use all available data. Missing values are determined on a table-by-table basis. Thus, the cases used to compute statistics may vary across frequency or crosstabulation tables.
- Use consistent case base. Missing values are determined across all variables. Thus, the cases used to compute statistics are consistent across tables.

Categorical Design Variables. This group determines whether user-missing values are valid or invalid.

Complex Samples Options

Figure 7-4 Options dialog box

Complex Samples : Options	
Subpopulation Display	Continue
\bigcirc Each in a separate table	Cancel

Complex Samples Crosstabs

Subpopulation Display. You can choose to have subpopulations displayed in the same table or in separate tables.

Complex Samples Ratios

The Complex Samples Ratios procedure displays univariate summary statistics for ratios of variables. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Example. Using the Complex Samples Ratios procedure, you can obtain descriptive statistics for the ratio of current property value to last assessed value, based on the results of a statewide survey carried out according to a complex design and with an appropriate analysis plan for the data.

Statistics. The procedure produces ratio estimates, *t* tests, standard errors, confidence intervals, coefficients of variation, unweighted counts, population sizes, design effects, and square roots of design effects.

Data. Numerators and denominators should be positive-valued scale variables. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Ratios

From the menus choose:

Analyze Complex Samples Ratios...

- Select a plan file and, optionally, select a custom joint probabilities file.
- Click Continue.

Complex Samples Ratios



► Select at least one numerator variable and denominator variable.

Optionally, you can:

• Specify variables to define subgroups for which statistics are produced.

Complex Samples Ratios Statistics

Figure 8-2

Ratios Statistics dialog box

Complex Samples Ratios: Statistics		X
Statistics ✓ Standard error ✓ Confidence interval Level (%): 95 Coefficient of variation	 ✓ Unweighted count ✓ Population size Design effect Sguare root of design effect 	Continue Cancel Help
✓ <u>t</u> -test Test value: 1.3		

Statistics. This group produces statistics associated with the ratio estimate.

- **Standard error.** The standard error of the estimate.
- **Confidence interval.** A confidence interval for the estimate, using the specified level.
- **Coefficient of variation.** The ratio of the standard error of the estimate to the estimate.
- **Unweighted count.** The number of units used to compute the estimate.
- **Population size.** The estimated number of units in the population.
- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.

t-test. You can request t tests of the estimates against a specified value.

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Complex Samples Ratios

Complex Samples Ratios Missing Values

Figure 8-3

Ratios Missing Values dialog box

Complex Samples Ratios: Missing Values	×
Ratios Image: Use all available data (ratio-bu-ratio deletion) Image: Ensure consistent case base (listwise deletion) Categorical Design Variables Image: User-missing values are invalid Image: User-missing values are valid Cases with invalid data for any categorical design variable are excluded from the analysis.	Continue Cancel Help

Ratios. This group determines which cases are used in the analysis.

- Use all available data. Missing values are determined on a ratio-by-ratio basis. Thus, the cases used to compute statistics may vary across numerator-denominator pairs.
- **Ensure consistent case base.** Missing values are determined across all variables. Thus, the cases used to compute statistics are consistent.

Categorical Design Variables. This group determines whether user-missing values are valid or invalid.

Complex Samples Options

Figure 8-4

Complex Samples : Options	
Subpopulation Display	Continue
All in the same table	Cancel
<u>Each in a separate table </u>	Help

Subpopulation Display. You can choose to have subpopulations displayed in the same table or in separate tables.

9

Complex Samples General Linear Model

The Complex Samples General Linear Model (CSGLM) procedure performs linear regression analysis, as well as analysis of variance and covariance, for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Example. A grocery store chain surveyed a set of customers concerning their purchasing habits, according to a complex design. Given the survey results and how much each customer spent in the previous month, the store wants to see if the frequency with which customers shop is related to the amount they spend in a month, controlling for the gender of the customer and incorporating the sampling design.

Statistics. The procedure produces estimates, standard errors, confidence intervals, *t* tests, design effects, and square roots of design effects for model parameters, as well as the correlations and covariances between parameter estimates. Measures of model fit and descriptive statistics for the dependent and independent variables are also available. Additionally, you can request estimated marginal means for levels of model factors and factor interactions.

Data. The dependent variable is quantitative. Factors are categorical. Covariates are quantitative variables that are related to the dependent variable. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining a Complex Samples General Linear Model

From the menus choose: Analyze Complex Samples General Linear Model...

- Select a plan file and, optionally, select a custom joint probabilities file.
- ► Click Continue.

Figure 9-1 *General Linear Model dialog box*

► Subpopul	Dependent Variable: Amount spent [amts Factors: Who shopping for [s Use coupons [useco Covariates: Vgriable: Category:	<u>M</u> odel <u>S</u> tatistics <u>Hypothesis Tests</u> Estimated Means Sav <u>e</u> <u>O</u> ptions
<u>R</u> eset	Category:	
	Subpopul P	Dependent Variable: Image: Amount spent [amts] Eactors: Image: Who shopping for [s] Image: Use coupons [useco] Image: Use coupons [useco] Subpopulation Variable: Image: Category: Image: Eactor State Image: Package Image: Package

► Select a dependent variable.
Optionally, you can:

- Select variables for factors and covariates, as appropriate for your data.
- Specify a variable to define a subpopulation. The analysis is performed only for the selected category of the subpopulation variable.

Figure 9-2 Model dialog box

Complex Samples General Linear Model: Model 🛛 🛛 🛛				
⊂ Specify Model I	Effects			
	ots			
 Custom 				
<u>F</u> actors a	nd Covariates:		M <u>o</u> del:	
<u>111</u> shop <u>111</u> used	ofor coup	Build Term(s)	shopfor usecoup shopfor"usecoup	▲ ▼
		Lype:		
Nested	Term			
l <u>e</u> rm:	Interaction	Nesting	Add to Model Clear	
Intercept Include in Display st	model atistics		Continue Cancel H	elp

Specify Model Effects. By default, the procedure builds a main-effects model using the factors and covariates specified in the main dialog box. Alternatively, you can build a custom model that includes interaction effects and nested terms.

Non-Nested Terms

For the selected factors and covariates:

Interaction. Creates the highest-level interaction term for all selected variables.

Main effects. Creates a main-effects term for each variable selected.

All 2-way. Creates all possible two-way interactions of the selected variables.

All 3-way. Creates all possible three-way interactions of the selected variables.

All 4-way. Creates all possible four-way interactions of the selected variables.

All 5-way. Creates all possible five-way interactions of the selected variables.

Nested Terms

You can build nested terms for your model in this procedure. Nested terms are useful for modeling the effect of a factor or covariate whose values do not interact with the levels of another factor. For example, a grocery store chain may follow the spending habits of its customers at several store locations. Since each customer frequents only one of these locations, the *Customer* effect can be said to be **nested within** the *Store location* effect.

Additionally, you can include interaction effects, such as polynomial terms involving the same covariate, or add multiple levels of nesting to the nested term.

Limitations. Nested terms have the following restrictions:

- All factors within an interaction must be unique. Thus, if A is a factor, then specifying A*A is invalid.
- All factors within a nested effect must be unique. Thus, if A is a factor, then specifying A(A) is invalid.
- No effect can be nested within a covariate. Thus, if A is a factor and X is a covariate, then specifying A(X) is invalid.

Intercept. The intercept is usually included in the model. If you can assume the data pass through the origin, you can exclude the intercept. Even if you include the intercept in the model, you can choose to suppress statistics related to it.

Complex Samples General Linear Model Statistics

Figure 9-3 General Linear Model Statistics dialog box				
Complex Samples General Linear Model: Statistics 🛛 🛛 🛛 🔀				
Model Parameters				
✓ Estimate	Covariances of parameter estimates			
✓ Standard error	Correlations of parameter estimates			
Confidence interval	✓ Design effect			
t-test	Sguare root of design effect			
Population means of dep	endent variable and covariates			
Sample design information				
Continue Cancel Help				

Model Parameters. This group allows you to control the display of statistics related to the model parameters.

- **Estimate.** Displays estimates of the coefficients.
- **Standard error.** Displays the standard error for each coefficient estimate.
- **Confidence interval.** Displays a confidence interval for each coefficient estimate. The confidence level for the interval is set in the Options dialog box.
- **t-test.** Displays a *t* test of each coefficient estimate. The null hypothesis for each test is that the value of the coefficient is 0.
- **Covariances of parameter estimates.** Displays an estimate of the covariance matrix for the model coefficients.
- **Correlations of parameter estimates.** Displays an estimate of the correlation matrix for the model coefficients.

- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- **Square root of design effect.** This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.

Model fit. Displays R^2 and root mean squared error statistics.

Population means of dependent variable and covariates. Displays summary information about the dependent variable, covariates, and factors.

Sample design information. Displays summary information about the sample, including the unweighted count and the population size.

Complex Samples Hypothesis Tests

Complex Samples : Hypothes	sis Tests
Test Statistic	Sampling Degrees of Freedom
⊙E	 Based on sample design
○ <u>A</u> djusted F	
O <u>C</u> hi-square	
🔿 Adjusted Chi-square	
Adjustment for Multiple Compariso	ons a
○ Sequential Sidak	
🔘 Seguential Bonferroni	
🔿 Si <u>d</u> ak	
O Bonferroni	

Test Statistic. This group allows you to select the type of statistic used for testing hypotheses. You can choose between F, adjusted F, chi-square, and adjusted chi-square.

Sampling Degrees of Freedom. This group gives you control over the sampling design degrees of freedom used to compute p values for all test statistics. If based on the sampling design, the value is the difference between the number of primary sampling units and the number of strata in the first stage of sampling. Alternatively, you can set a custom degrees of freedom by specifying a positive integer.

Adjustment for Multiple Comparisons. When performing hypothesis tests with multiple contrasts, the overall significance level can be adjusted from the significance levels for the included contrasts. This group allows you to choose the adjustment method.

- Least significant difference. This method does not control the overall probability of rejecting the hypotheses that some linear contrasts are different from the null hypothesis values.
- Sequential Sidak. This is a sequentially step-down rejective Sidak procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- **Sequential Bonferroni.** This is a sequentially step-down rejective Bonferroni procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- **Sidak.** This method provides tighter bounds than the Bonferroni approach.
- **Bonferroni.** This method adjusts the observed significance level for the fact that multiple contrasts are being tested.

Complex Samples General Linear Model Estimated Means

Figure 9-5

shopfor usecoup shopfor [*] usecoup	Term	Contrast	Defense of the second
usecoup shopfor ^a usecoup			Reference Category
Shoptot Usecoup	shopfor	Simple	3
shopfor asceoup	usecoup	Simple	×
	shopfor*usecoup		1 No
			2 From newspaper
			3 From mailings
			4 From both
	J		
	Display mean for over	all population	

General Linear Model Estimated Means dialog box

The Estimated Means dialog box allows you to display the model-estimated marginal means for levels of factors and factor interactions specified in the Model subdialog box. You can also request that the overall population mean be displayed.

Term. Estimated means are computed for the selected factors and factor interactions.

Contrast. The contrast determines how hypothesis tests are set up to compare the estimated means.

- **Simple.** Compares the mean of each level to the mean of a specified level. This type of contrast is useful when there is a control group.
- **Deviation.** Compares the mean of each level (except a reference category) to the mean of all of the levels (grand mean). The levels of the factor can be in any order.
- **Difference.** Compares the mean of each level (except the first) to the mean of previous levels. They are sometimes called reverse Helmert contrasts.
- Helmert. Compares the mean of each level of the factor (except the last) to the mean of subsequent levels.

- Repeated. Compares the mean of each level (except the last) to the mean of the subsequent level.
- Polynomial. Compares the linear effect, quadratic effect, cubic effect, and so on. The first degree of freedom contains the linear effect across all categories; the second degree of freedom, the quadratic effect; and so on. These contrasts are often used to estimate polynomial trends.

Reference Category. The simple and deviation contrasts require a reference category, or factor level against which the others are compared.

Complex Samples General Linear Model Save

Figure 9-6

General	Linear Model Save dialog box	
Complex	Samples General Linear Model: Save	6
SaveVa	ariables	
En En	redicted Values	
<u>□</u> <u>B</u> ∈	esiduals	
Export N	Model as SPSS Data	
<u>F</u> ile:	Browse	
	• Parameter estimates and covariance matrix	
	O Parameter estimates and correlation matrix	
Export N	Model as XML	
File:	Browse	
	 Parameter estimates and covariance matrix 	
	○ Parameter <u>e</u> stimates only	
	Continue Cancel Help	

Save Variables. This group allows you to save the model predicted values and residuals as new variables in the working file.

Export Model as SPSS data. Writes an SPSS data file containing a covariance (or correlation, if selected) matrix of the parameter estimates in the model. Also, for each dependent variable, there will be a row of parameter estimates, a row of standard errors, a row of significance values for the *t* statistics corresponding to the parameter estimates, and a row of sampling design degrees of freedom. You can use this matrix file in other procedures that read an SPSS matrix file.

Export Model as XML. Saves the parameter estimates and the parameter covariance matrix, if selected, in XML (PMML) format. SmartScore and the server version of SPSS (a separate product) can use this model file to apply the model information to other data files for scoring purposes.

Complex Samples General Linear Model Options

```
Figure 9-7
General Linear Model Options dialog box
Complex Samples General Linear Model: Opti... 
User-Missing Values

Treat as invalid

Treat as yalid

This setting applies to factors, subpopulation variables,

and categorical design variables.

Confidence Interval(%): 95

Continue

Cancel

Help
```

User-Missing Values. All design variables, as well as the dependent variable and any covariates, must have valid data. Cases with invalid data for any of these variables are deleted from the analysis. These controls allow you to decide whether user-missing values are treated as valid among the strata, cluster, subpopulation, and factor variables.

Confidence Interval. This is the confidence interval level for coefficient estimates and estimated marginal means. Specify a value greater than or equal to 50 and less than 100.

CSGLM Command Additional Features

The SPSS command language also allows you to:

- Specify custom tests of effects versus a linear combination of effects or a value (using the CUSTOM subcommand).
- Fix covariates at values other than their means when computing estimated marginal means (using the EMMEANS subcommand).
- Specify a metric for polynomial contrasts (using the EMMEANS subcommand).
- Specify a tolerance value for checking singularity (using the CRITERIA subcommand).
- Create user-specified names for saved variables (using the SAVE subcommand).
- Produce a general estimable function table (using the PRINT subcommand).

See the SPSS Command Syntax Reference for complete syntax information.

Complex Samples Logistic Regression

The Complex Samples Logistic Regression procedure performs logistic regression analysis on a binary or multinomial dependent variable for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Example. A loan officer has collected past records of customers given loans at several different branches, according to a complex design. While incorporating the sample design, the officer wants to see if the probability with which a customer defaults is related to age, employment history, and amount of credit debt.

Statistics. The procedure produces estimates, exponentiated estimates, standard errors, confidence intervals, *t* tests, design effects, and square roots of design effects for model parameters, as well as the correlations and covariances between parameter estimates. Pseudo R^2 statistics, classification tables, and descriptive statistics for the dependent and independent variables are also available.

Data. The dependent variable is categorical. Factors are categorical. Covariates are quantitative variables that are related to the dependent variable. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Logistic Regression

From the menus choose: Analyze Complex Samples Logistic Regression...

- Select a plan file and, optionally, select a custom joint probabilities file.
- Click Continue.

Figure 10-1 *Logistic Regression dialog box*

Complex Samples Logistic Regression 🛛 🛛 🛛 🛛 🔊			
Complex Samples Logis	Subpopu	ion Dependent Variable: Previously defaulted Reference Category Eactors: Covariates: Years with current e Years with current e Yariable: Category:	Model Statistics Hypothesis Tests Odds Ratios Savg Options
OK <u>P</u> aste	<u>R</u> eset	Cancel Help	

► Select a dependent variable.

Optionally, you can:

- Select variables for factors and covariates, as appropriate for your data.
- Specify a variable to define a subpopulation. The analysis is performed only for the selected category of the subpopulation variable.

Complex Samples Logistic Regression Reference Category

Figure 10-2

Logistic Regression Reference Category dialog box

Complex Samples Logistic Regression: Reference Category 🛛 🛛 🛛 🛛
Reference Category
● Highest value
◯ Lowest value
○ <u>C</u> ustom
⊻alue;
Continue Cancel Help

By default, the Complex Samples Logistic Regression procedure makes the highest-valued category the reference category. This dialog box allows you to specify the highest, lowest, or a custom category as the reference category.

Complex Samples Logistic Regression Model

Figure 10-3

Logistic Regression Model dialog box

Complex Samples Logistic Regression: Model	×
Specify Model Effects Main effects Custom	
Eactors and Covariates: Age age address debtinc creddebt othdebt Type: Main effects Main ef	*
Nested Term Tgrm: Interaction Nesting Add to Model Qear	
Continue Cancel He	۱p

Specify Model Effects. By default, the procedure builds a main-effects model using the factors and covariates specified in the main dialog box. Alternatively, you can build a custom model that includes interaction effects and nested terms.

Non-Nested Terms

For the selected factors and covariates:

Interaction. Creates the highest-level interaction term for all selected variables.

Main effects. Creates a main-effects term for each variable selected.

All 2-way. Creates all possible two-way interactions of the selected variables.

All 3-way. Creates all possible three-way interactions of the selected variables.

All 4-way. Creates all possible four-way interactions of the selected variables.

All 5-way. Creates all possible five-way interactions of the selected variables.

Nested Terms

You can build nested terms for your model in this procedure. Nested terms are useful for modeling the effect of a factor or covariate whose values do not interact with the levels of another factor. For example, a grocery store chain may follow the spending habits of its customers at several store locations. Since each customer frequents only one of these locations, the *Customer* effect can be said to be **nested within** the *Store location* effect.

Additionally, you can include interaction effects, such as polynomial terms involving the same covariate, or add multiple levels of nesting to the nested term.

Limitations. Nested terms have the following restrictions:

- All factors within an interaction must be unique. Thus, if A is a factor, then specifying A*A is invalid.
- All factors within a nested effect must be unique. Thus, if A is a factor, then specifying A(A) is invalid.
- No effect can be nested within a covariate. Thus, if A is a factor and X is a covariate, then specifying A(X) is invalid.

Intercept. The intercept is usually included in the model. If you can assume the data pass through the origin, you can exclude the intercept. Even if you include the intercept in the model, you can choose to suppress statistics related to it.

Complex Samples Logistic Regression Statistics

Figure 10-4

Complex Samples Logistic R	egression: Statistics	×	
⊂ Model Fit			
✓ Pseudo R-square			
Classification table			
Parameters			
✓ Estimate	Covariances of parameter estimates		
Exponentiated estimate	Correlations of parameter estimates		
✓ Standard error	Design effect		
Confidence interval	Sguare root of design effect		
t-test			
✓ Summary statistics for model variables			
✓ Sample design information			
	Continue Cancel Help		

Model Fit. Controls the displays of statistics that measure the overall model performance.

- Pseudo R-square. The R² statistic from linear regression does not have an exact counterpart among logistic regression models. There are, instead, multiple measures that attempt to mimic the properties of the R² statistic.
- **Classification table.** Displays the tabulated cross-classifications of the observed category by the model-predicted category on the dependent variable.

Parameters. This group allows you to control the display of statistics related to the model parameters.

- **Estimate.** Displays estimates of the coefficients.
- Exponentiated estimate. Displays the base of the natural logarithm raised to the power of the estimates of the coefficients. While the estimate has nice properties for statistical testing, the exponentiated estimate, or exp(B), is easier to interpret.
- **Standard error.** Displays the standard error for each coefficient estimate.

- **Confidence interval.** Displays a confidence interval for each coefficient estimate. The confidence level for the interval is set in the Options dialog box.
- t-test. Displays a *t* test of each coefficient estimate. The null hypothesis for each test is that the value of the coefficient is 0.
- **Covariances of parameter estimates.** Displays an estimate of the covariance matrix for the model coefficients.
- **Correlations of parameter estimates.** Displays an estimate of the correlation matrix for the model coefficients.
- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.

Summary statistics for model variables. Displays summary information about the dependent variable, covariates, and factors.

Sample design information. Displays summary information about the sample, including the unweighted count and the population size.

Complex Samples Hypothesis Tests

Complex Samples : Hypothesis Tests		
Test Statistic	Sampling Degrees of Freedom ③ Based on sample design ④ Fixed ⊻alue:	
Continue Cancel Help		

Test Statistic. This group allows you to select the type of statistic used for testing hypotheses. You can choose between F, adjusted F, chi-square, and adjusted chi-square.

Sampling Degrees of Freedom. This group gives you control over the sampling design degrees of freedom used to compute p values for all test statistics. If based on the sampling design, the value is the difference between the number of primary sampling units and the number of strata in the first stage of sampling. Alternatively, you can set a custom degrees of freedom by specifying a positive integer.

Adjustment for Multiple Comparisons. When performing hypothesis tests with multiple contrasts, the overall significance level can be adjusted from the significance levels for the included contrasts. This group allows you to choose the adjustment method.

Least significant difference. This method does not control the overall probability of rejecting the hypotheses that some linear contrasts are different from the null hypothesis values. Figure 10-6

- Sequential Sidak. This is a sequentially step-down rejective Sidak procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- Sequential Bonferroni. This is a sequentially step-down rejective Bonferroni procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- **Sidak.** This method provides tighter bounds than the Bonferroni approach.
- **Bonferroni.** This method adjusts the observed significance level for the fact that multiple contrasts are being tested.

Complex Samples Logistic Regression Odds Ratios

```
Logistic Regression Odds Ratios dialog box
 Complex Samples Logistic Regression: Odds Ratios
                                                                                                       ×
  Factors:
                                         Odds Ratios for Comparing Factor Levels:
   Level of education [...
                                                     Factor
                                                                            Reference Category
                                                                        (Highest value)
                                         Level of education [ed]
                                  4
  Covariates:
                                         Odds Ratios for Change in Covariate Values:
    🔗 Age in years [age]  🔺
                                                   Covariate
                                                                               Units of Change
   Nears with current e
                                         Years with current employer [e
    Nears at current ad
                                         Debt to income ratio (x100) [deb 1
    Nousehold income
    🔗 Debt to income ratid 🐷
   <
  One set of odds ratios is produced for each variable in the Odds Ratios grids. For each set, all other factors in
  the model are evaluated at their highest levels; all other covariates are evaluated at their means.
                                                            Continue
                                                                            Cancel
                                                                                            Help
```

The Odds Ratios dialog box allows you to display the model-estimated odds ratios for specified factors and covariates. A separate set of odds ratios is computed for each category of the dependent variable except the reference category.

Complex Samples Logistic Regression

Factors. For each selected factor, displays the ratio of the odds at each category of the factor to the odds at the specified reference category.

Covariates. For each selected covariate, displays the ratio of the odds at the covariate's mean value plus the specified units of change to the odds at the mean.

When computing odds ratios for a factor or covariate, the procedure fixes all other factors at their highest levels and all other covariates at their means. If a factor or covariate interacts with other predictors in the model, then the odds ratios depend not only on the change in the specified variable but also on the values of the variables with which it interacts. If a specified covariate interacts with itself in the model (for example, age^*age), then the odds ratios depend on both the change in the covariate and the value of the covariate.

Complex Samples Logistic Regression Save

Figure 10-7

Logistic Regression Save dialog box

Complex Samples Logistic Regression: Save 🛛 🛛 🛛				
Save Variables				
Predicted category				
Predicted probabilities (one per category of the dependent variable)				
-Export M	fodel as SPSS Data			
<u>F</u> ile:	Browse			
	• Parameter estimates and covariance matrix			
	O Parameter estimates and correlation matrix			
Export M	fodel as XML			
File:	Browse			
	• Parameter estimates and <u>c</u> ovariance matrix			
	O Parameter <u>e</u> stimates only			
	Continue Cancel Help			

Save Variables. This group allows you to save the model-predicted category and predicted probabilities as new variables in the active dataset.

Export Model as SPSS data. Writes an SPSS data file containing a covariance (or correlation, if selected) matrix of the parameter estimates in the model. Also, for each dependent variable, there will be a row of parameter estimates, a row of standard errors, a row of significance values for the *t* statistics corresponding to the parameter estimates, and a row of sampling design degrees of freedom. You can use this matrix file in other procedures that read an SPSS matrix file.

Export Model as XML. Saves the parameter estimates and the parameter covariance matrix, if selected, in XML (PMML) format. SmartScore and the server version of SPSS (a separate product) can use this model file to apply the model information to other data files for scoring purposes.

Complex Samples Logistic Regression Options

Figure 10-8

Logistic Regression Options dialog box

Complex Samples Logistic Regression: Options	×
Estimation <u>Maximum Iterations</u> : 100 Maximum <u>S</u> tep-Halving: 5 <u>Limit iterations based on change in parameter estimates</u>	 User-Missing Values ● Treat as invalid ● Treat as <u>valid</u> ■ Treat as <u>valid</u> This setting applies to categorical design and model variables.
Minimum Change: 0.000001 Type: Relative Limit iterations based on change in log-likelihood Minimum Change: Type: Relative	<u>C</u> onfidence Interval (%): 95
Check for complete separation of data points Starting Iteration: 20 Display iteration history Increment: 1	
	Continue Cancel Help

Estimation. This group gives you control of various criteria used in the model estimation.

- **Maximum Iterations.** The maximum number of iterations the algorithm will execute. Specify a non-negative integer.
- Maximum Step-Halving. At each iteration, the step size is reduced by a factor of 0.5 until the log-likelihood increases or maximum step-halving is reached. Specify a positive integer.
- Limit iterations based on change in parameter estimates. When selected, the algorithm stops after an iteration in which the absolute or relative change in the parameter estimates is less than the value specified, which must be non-negative.
- Limit iterations based on change in log-likelihood. When selected, the algorithm stops after an iteration in which the absolute or relative change in the log-likelihood function is less than the value specified, which must be non-negative.

- Check for complete separation of data points. When selected, the algorithm performs tests to ensure that the parameter estimates have unique values. Separation occurs when the procedure can produce a model that correctly classifies every case.
- **Display iteration history.** Displays parameter estimates and statistics at every *n* iterations beginning with the 0th iteration (the initial estimates). If you choose to print the iteration history, the last iteration is always printed regardless of the value of *n*.

User-Missing Values. All design variables, as well as the dependent variable and any covariates, must have valid data. Cases with invalid data for any of these variables are deleted from the analysis. These controls allow you to decide whether user-missing values are treated as valid among the strata, cluster, subpopulation, and factor variables.

Confidence Interval. This is the confidence interval level for coefficient estimates, exponentiated coefficient estimates, and odds ratios. Specify a value greater than or equal to 50 and less than 100.

CSLOGISTIC Command Additional Features

The SPSS command language also allows you to:

- Specify custom tests of effects versus a linear combination of effects or a value (using the CUSTOM subcommand).
- Fix values of other model variables when computing odds ratios for factors and covariates (using the ODDSRATIOS subcommand).
- Specify a tolerance value for checking singularity (using the CRITERIA subcommand).
- Create user-specified names for saved variables (using the SAVE subcommand).
- Produce a general estimable function table (using the PRINT subcommand).

See the SPSS Command Syntax Reference for complete syntax information.

Complex Samples Ordinal Regression

The Complex Samples Ordinal Regression procedure performs regression analysis on a binary or ordinal dependent variable for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Example. Representatives considering a bill before the legislature are interested in whether there is public support for the bill and how support for the bill is related to voter demographics. Pollsters design and conduct interviews according to a complex sampling design. Using Complex Samples Ordinal Regression, you can fit a model for the level of support for the bill based upon voter demographics.

Data. The dependent variable is ordinal. Factors are categorical. Covariates are quantitative variables that are related to the dependent variable. Subpopulation variables can be string or numeric but should be categorical.

Assumptions. The cases in the data file represent a sample from a complex design that should be analyzed according to the specifications in the file selected in the Complex Samples Plan dialog box.

Obtaining Complex Samples Ordinal Regression

From the menus choose: Analyze Complex Samples Ordinal Regression...

- ► Select a plan file and, optionally, select a custom joint probabilities file.
- Click Continue.

Figure 11-1

Complex Samples Ordinal Regression dialog box			
Complex Samples Ordinal Regression			
Variables: Voter ID [voteid] Neighborhood [nbrh Township [town] County [county] Inclusion (Selection) Cumulative Sampling Cumulative Sampling	Subpoput	Dependent Variable: The legislature shoul Response Probabilities Factors: Gender [gender] Voted in last elec Covariates: Link Function: Logit Variable: Category: Cancel Help	Model Statistics Hypothesis Tests Odds Ratjos Save Options

► Select a dependent variable.

Optionally, you can:

- Select variables for factors and covariates, as appropriate for your data.
- Specify a variable to define a subpopulation. The analysis is performed only for the selected category of the subpopulation variable, although variances are still properly estimated based on the entire dataset.
- Select a link function.

Complex Samples Ordinal Regression

Link Function. The link function is a transformation of the cumulative probabilities that allows estimation of the model. Five link functions are available, summarized in the following table.

Function	Form	Typical application
Logit	$\log(\xi / (1-\xi))$	Evenly distributed categories
Complementary log-log	$\log(-\log(1-\xi))$	Higher categories more probable
Negative log-log	$-\log(-\log(\xi))$	Lower categories more probable
Probit	$\Phi^{-1}(\xi)$	Latent variable is normally distributed
Cauchit (inverse Cauchy)	$\tan(\pi(\xi=0.5))$	Latent variable has many extreme values

Complex Samples Ordinal Regression Response Probabilities

Figure 11-2

Complex Samples Ordinal Regression Response Probabilities dialog box

Complex Samples Ordinal Regression: Response Probabilities 🛛 🛛 👔	8	
Cumulative Response Probabilities		
_ /······		
Accumulate from lowest value of dependent variable to highest value		
O Accumulate from highest value of dependent variable to lowest value		
Continue Cancel Help		

The Response Probabilities dialog box allows you to specify whether the cumulative probability of a response (that is, the probability of belonging up to and including a particular category of the dependent variable) increases with increasing or decreasing values of the dependent variable.

Complex Samples Ordinal Regression Model

Figure 11-3

Complex Samples Ordinal Regression Model dialog box

Complex Samples Ordinal Regression: Model	
Specify Model Effects	
O <u>M</u> ain effects	
⊙ C <u>u</u> stom	
Eactors and Covariates: Model:	
Image: Image	* •
<u>Ivpe:</u> Main effects ▼	
Term: Interaction Nesting Add to Model Clear	
Continue Cancel H	lelp

Specify Model Effects. By default, the procedure builds a main-effects model using the factors and covariates specified in the main dialog box. Alternatively, you can build a custom model that includes interaction effects and nested terms.

Non-Nested Terms

For the selected factors and covariates:

Interaction. Creates the highest-level interaction term for all selected variables.

Main effects. Creates a main-effects term for each variable selected.

All 2-way. Creates all possible two-way interactions of the selected variables.

All 3-way. Creates all possible three-way interactions of the selected variables.

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Complex Samples Ordinal Regression

All 4-way. Creates all possible four-way interactions of the selected variables.

All 5-way. Creates all possible five-way interactions of the selected variables.

Nested Terms

You can build nested terms for your model in this procedure. Nested terms are useful for modeling the effect of a factor or covariate whose values do not interact with the levels of another factor. For example, a grocery store chain may follow the spending habits of its customers at several store locations. Since each customer frequents only one of these locations, the *Customer* effect can be said to be **nested within** the *Store location* effect.

Additionally, you can include interaction effects, such as polynomial terms involving the same covariate, or add multiple levels of nesting to the nested term.

Limitations. Nested terms have the following restrictions:

- All factors within an interaction must be unique. Thus, if A is a factor, then specifying A*A is invalid.
- All factors within a nested effect must be unique. Thus, if A is a factor, then specifying A(A) is invalid.
- No effect can be nested within a covariate. Thus, if A is a factor and X is a covariate, then specifying A(X) is invalid.

Complex Samples Ordinal Regression Statistics

Figure 11-4

Complex Samples Ordinal Regression Statistics dialog box

Complex Samples Ordinal Regression: Statistics 🛛 🛛 🛛 🔀		
Model Fit		
Pseudo R-square		
Classification table		
Parameters		
Estimate	Covariances of parameter estimates	
Exponentiated estimate	Correlations of parameter estimates	
Standard error	Design effect	
✓ Confidence interval	Square root of design effect	
t-test		
Parallel Lines		
✓ Wald test of equal slopes		
Parameter estimates for generalized (unequal slopes) model		
$\hfill\square$ Covariances of parameter estimates for generalized (unequal slopes) model		
Summary statistics for model	variables	
Sample design information		
	Continue Cancel Help	

Model Fit. Controls the displays of statistics that measure the overall model performance.

- Pseudo R-square. The R² statistic from linear regression does not have an exact counterpart among ordinal regression models. There are, instead, multiple measures that attempt to mimic the properties of the R² statistic.
- **Classification table.** Displays the tabulated cross-classifications of the observed category by the model-predicted category on the dependent variable.

Parameters. This group allows you to control the display of statistics related to the model parameters.

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- **Estimate.** Displays estimates of the coefficients.
- **Exponentiated estimate.** Displays the base of the natural logarithm raised to the power of the estimates of the coefficients. While the estimate has nice properties for statistical testing, the exponentiated estimate, or exp(B), is easier to interpret.
- **Standard error.** Displays the standard error for each coefficient estimate.
- **Confidence interval.** Displays a confidence interval for each coefficient estimate. The confidence level for the interval is set in the Options dialog box.
- **t-test.** Displays a *t* test of each coefficient estimate. The null hypothesis for each test is that the value of the coefficient is 0.
- **Covariances of parameter estimates.** Displays an estimate of the covariance matrix for the model coefficients.
- **Correlations of parameter estimates.** Displays an estimate of the correlation matrix for the model coefficients.
- Design effect. The ratio of the variance of the estimate to the variance obtained by assuming that the sample is a simple random sample. This is a measure of the effect of specifying a complex design, where values further from 1 indicate greater effects.
- Square root of design effect. This is a measure, expressed in units comparable to those of the standard error, of the effect of specifying a complex design, where values further from 1 indicate greater effects.

Parallel Lines. This group allows you to request statistics associated with a model with non-parallel lines where a separate regression line is fitted for each response category (except the last).

- Wald test. Produces a test of the null hypothesis that regression parameters are equal for all cumulative responses. The model with non-parallel lines is estimated and the Wald test of equal parameters is applied.
- Parameter estimates. Displays estimates of the coefficients and standard errors for the model with non-parallel lines.
- **Covariances of parameter estimates.** Displays an estimate of the covariance matrix for the coefficients of the model with non-parallel lines.

Summary statistics for model variables. Displays summary information about the dependent variable, covariates, and factors.

Sample design information. Displays summary information about the sample, including the unweighted count and the population size.

Complex Samples Hypothesis Tests

omplex samples: mypornesis	Tests
Test Statistic ▲djusted F _Ehi-square Adjusted Chi-square Adjusted Chi-square Adjusted Chi-square Adjusted Chi-square Adjusted I Statistic Sequential Sidak Seguential Bonferroni Siglak Bonferroni	Sampling Degrees of Freedom ● Based on sample design ● Fixed ⊻alue:

Test Statistic. This group allows you to select the type of statistic used for testing hypotheses. You can choose between F, adjusted F, chi-square, and adjusted chi-square.

Sampling Degrees of Freedom. This group gives you control over the sampling design degrees of freedom used to compute p values for all test statistics. If based on the sampling design, the value is the difference between the number of primary sampling units and the number of strata in the first stage of sampling. Alternatively, you can set a custom degrees of freedom by specifying a positive integer.

Adjustment for Multiple Comparisons. When performing hypothesis tests with multiple contrasts, the overall significance level can be adjusted from the significance levels for the included contrasts. This group allows you to choose the adjustment method.

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- Least significant difference. This method does not control the overall probability of rejecting the hypotheses that some linear contrasts are different from the null hypothesis values.
- Sequential Sidak. This is a sequentially step-down rejective Sidak procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- Sequential Bonferroni. This is a sequentially step-down rejective Bonferroni procedure that is much less conservative in terms of rejecting individual hypotheses but maintains the same overall significance level.
- **Sidak.** This method provides tighter bounds than the Bonferroni approach.
- **Bonferroni.** This method adjusts the observed significance level for the fact that multiple contrasts are being tested.

Complex Samples Ordinal Regression Odds Ratios

Figure 11-6

Complex Samples Ordinal Regression Odds Ratios dialog box

Complex Samples Ordinal Regression: Odds Ratios			
Eactors: Age category [agecat] Gender [gender] Voted in last election Driving frequency [dr	•	Cumulative Odds Ratios for Compa Factor Age category [agecat] Driving frequency [drivefreq]	aring Factor Levels: Reference Category (Highest value) 10-14,999 miles/year
<u>C</u> ovariates:	es: Cumulative Odds <u>R</u> atios for Change in Covariate Values:		
		Covariate	Units of Change
	Þ		
])	
One set of cumulative odds ratios is produced for each variable in the Odds Ratios grids. For each set, all other factors in the model are evaluated at their highest levels; all other covariates are evaluated at their means.			
		Continue	Cancel Help

The Odds Ratios dialog box allows you to display the model-estimated cumulative odds ratios for specified factors and covariates. This feature is only available for models using the Logit link function. A single cumulative odds ratio is computed for all categories of the dependent variable except the last; the proportional odds model postulates that they are all equal.

Factors. For each selected factor, displays the ratio of the cumulative odds at each category of the factor to the odds at the specified reference category.

Covariates. For each selected covariate, displays the ratio of the cumulative odds at the covariate's mean value plus the specified units of change to the odds at the mean.

When computing odds ratios for a factor or covariate, the procedure fixes all other factors at their highest levels and all other covariates at their means. If a factor or covariate interacts with other predictors in the model, then the odds ratios depend not only on the change in the specified variable but also on the values of the variables with which it interacts. If a specified covariate interacts with itself in the model (for example, age^*age), then the odds ratios depend on both the change in the covariate and the value of the covariate.

Complex Samples Ordinal Regression Save

Figure 11-7

Complex Samples Ordinal Regression Save dialog box

omplex Samples Ordinal Regression: Save		
Save Variables		
Predicted category	N <u>a</u> me:	PredictedValue
Probability of predicted category	Nam <u>e</u> :	PredictedValueProbability
Probability of observed category	Na <u>m</u> e:	ObservedValueProbability
Cumulative probabilities (one variable per category)	Root <u>N</u> ame:	CumulativeProbability
Predicted probabilities (one variable per category)	R <u>o</u> ot Name:	PredictedProbability
Replace existing variables that have the same name or re	oot name	
~ Export Model		
Export model as data	Export	model as XML
① Create a new dataset	F	Fjle
Dataset Name:		
⊖ <u>W</u> rite a new data file	Param	eter estimates and co <u>v</u> ariance matrix
<u>File</u>	🔿 Param	eter <u>e</u> stimates only
Parameter estimates and covariance matrix		
Parameter estimates and correlation matrix		
	(Continue Cancel Help

Save Variables. This group allows you to save the model-predicted category, probability of predicted category, probability of observed category, cumulative probabilities, and predicted probabilities as new variables in the active dataset.

Export model as data. Writes an SPSS data file containing a covariance (or correlation, if selected) matrix of the parameter estimates in the model. Also, for each dependent variable, there will be a row of parameter estimates, a row of standard errors, a row of

significance values for the *t* statistics corresponding to the parameter estimates, and a row of sampling design degrees of freedom.

Export model as XML. Saves the parameter estimates and the parameter covariance matrix, if selected, in XML (PMML) format. SmartScore and the server version of SPSS (a separate product) can use this model file to apply the model information to other data files for scoring purposes.

Complex Samples Ordinal Regression Options

Figure 11-8

Complex Samples Ordinal Regression Options dialog box

Complex Samples Ordinal Regression: Options	
Estimation Method Newton-Raphson Eisher scoring Fisher scoring then Newton-Raphson Maximum Numbers of Iterations Before Switching: 	Estimation Maximum Iterations: 100 Maximum Step-Halving: 5 Ujunit iterations based on change in parameter estimates Minimum Change: 0.000001 Type: Relative
User-Missing Values Treat as invalid Treat as valid This setting applies to categorical design and model variables.	Limit iterations based on change in log-likelihood Minimum Tyte: Change: Tyte: ✓ Check for complete separation of data points Starting Iteration: 20 Display iteration history Increment: 1
Confidence Interval (%): 95	Continue Cancel Help

Estimation Method. You can select a parameter estimation method; choose between Newton-Raphson, Fisher scoring, or a hybrid method in which Fisher scoring iterations are performed before switching to the Newton-Raphson method. If convergence is achieved during the Fisher scoring phase of the hybrid method before

the maximum number of Fisher iterations is reached, the algorithm continues with the Newton-Raphson method.

Estimation. This group gives you control of various criteria used in the model estimation.

- **Maximum Iterations.** The maximum number of iterations the algorithm will execute. Specify a non-negative integer.
- Maximum Step-Halving. At each iteration, the step size is reduced by a factor of 0.5 until the log-likelihood increases or maximum step-halving is reached. Specify a positive integer.
- Limit iterations based on change in parameter estimates. When selected, the algorithm stops after an iteration in which the absolute or relative change in the parameter estimates is less than the value specified, which must be non-negative.
- Limit iterations based on change in log-likelihood. When selected, the algorithm stops after an iteration in which the absolute or relative change in the log-likelihood function is less than the value specified, which must be non-negative.
- Check for complete separation of data points. When selected, the algorithm performs tests to ensure that the parameter estimates have unique values. Separation occurs when the procedure can produce a model that correctly classifies every case.
- **Display iteration history.** Displays parameter estimates and statistics at every *n* iterations beginning with the 0th iteration (the initial estimates). If you choose to print the iteration history, the last iteration is always printed regardless of the value of *n*.

User-Missing Values. Scale design variables, as well as the dependent variable and any covariates, should have valid data. Cases with invalid data for any of these variables are deleted from the analysis. These controls allow you to decide whether user-missing values are treated as valid among the strata, cluster, subpopulation, and factor variables.

Confidence Interval. This is the confidence interval level for coefficient estimates, exponentiated coefficient estimates, and odds ratios. Specify a value greater than or equal to 50 and less than 100.

CSORDINAL Command Additional Features

The SPSS command language also allows you to:

- Specify custom tests of effects versus a linear combination of effects or a value (using the CUSTOM subcommand).
- Fix values of other model variables at values other than their means when computing cumulative odds ratios for factors and covariates (using the ODDSRATIOS subcommand).
- Use unlabeled values as custom reference categories for factors when odds ratios are requested (using the ODDSRATIOS subcommand).
- Specify a tolerance value for checking singularity (using the CRITERIA subcommand).
- Produce a general estimable function table (using the PRINT subcommand).
- Save more than 25 probability variables (using the SAVE subcommand).

See the SPSS Command Syntax Reference for complete syntax information.
Part II: Examples

Complex Samples Sampling Wizard

The Sampling Wizard guides you through the steps for creating, modifying, or executing a sampling plan file. Before using the wizard, you should have a well-defined target population, a list of sampling units, and an appropriate sample design in mind.

Obtaining a Sample from a Full Sampling Frame

A state agency is charged with ensuring fair property taxes from county to county. Taxes are based on the appraised value of the property, so the agency wants to survey a sample of properties by county to be sure that each county's records are equally up to date. However, resources for obtaining current appraisals are limited, so it's important that what is available is used wisely. The agency decides to employ complex sampling methodology to select a sample of properties.

A listing of properties is collected in *property_assess_cs.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. Use the Complex Samples Sampling Wizard to select a sample.

Using the Wizard

► To run the Complex Samples Sampling Wizard, from the menus choose:

Analyze

Complex Samples Select a Sample...

Figure 12-1 Sampling Wizard, Welcome step

Sampling Wizard		×
Welcome to the Sampling Wizard The Sampling Wizard helps you design analysis time to indicate how the data w	and select a complex sample. Your selections will be saved to a plan file that you can use at ere sampled.	
	Sampling plan or draw a sample according to an existing plan. What would you like to do? Design a sample Choose this option if you have not created a plan file. You will have the option to draw the sample. File: c:\property_assess.csplan Browse)
	Edit a sample design Choose this option if you want to add, remove, or modify stages of an existing plan. You will have the option to draw the sample. Browse	
X 4(2)	Draw a sample Choose this option if you already have a plan file and want to draw a sample. Files Browse	
	< <u>Back</u> <u>N</u> ext → Finish Cancel Help	,

- Select Design a sample, and type c:\property_assess.csplan as the name of the plan file.
- ► Click Next.

Sampling Wizard, Design Variables step (stage 1) Sampling Wizard Stage 1: Design Variables In this panel you can stratify your sample or define clusters. You can also provide a label for the stage that will be used in the output. If sampling weights exist from a prior stage of the sample design you can use them as input to the current stage. Welcome Variables: Stratify By: 🕕 Stage 1 💑 Property ID (propid) 💑 County [county] Design Variables 💑 Neighborhood (nbrh... Method ◀ Years since last appr... Sample Size 🔗 Value at last apprais... Output Variables Summary Clusters: Add Stage 2 💑 Township [town] Draw Sample Selection Options Output Files Completion Input Sample Weight: Stage <u>L</u>abel: Incomplete section < <u>B</u>ack <u>N</u>ext > Cancel Help

Figure 12-2

- ► Select *County* as a stratification variable.
- ► Select *Township* as a cluster variable.
- Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each county. In this stage, townships are drawn as the primary sampling unit using the default method, simple random sampling.

Stage 1: Sample Size In this panel you specify the number or p it can vary for different strata. If you specify sample sizes as proportions	roportion of units to be sampled in the c s you can also set the minimum or maxin	eurrent stage. num number o	The sample size can be fixed across strata or of units to draw.
 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Add Stage 2 Draw Sample Selection Options Output Files Completion 	Variables:	Units: ⊙\ ○ I Mini Cou	Counts Image: Counts Value: The size value applies to each stratum. Unequal values for strata: Define Bead values from variable: Image: Count: imum Maximum ant: Count:

Figure 12-3 Sampling Wizard, Sample Size step (stage 1)

- Type 4 as the value for the number of clusters to select in this stage.
- Click Next, and then click Next in the Output Variables step.

Figure 12-4 Sampling Wizard, Plan Summary step (stage 1)

Sampling Wizard						
Stage 1: Plan Summary This panel summarizes the sampling pla If you choose not to add a stage the ne	n sofar. Yo xxt step is to	u can add and	other stage to r drawing you	the design. r sample.		
Velcome	<u>S</u> umma	ıy:				
Design Variables	Stage	Label	Strata	Clusters	Size	Method
Method Sample Size	1	(None)	county	town	4	Simple Random Sampling (WOR)
Add Stage 2 Draw Sample Selection Options Output Files Completion	File: c: Do you O You Ch ww da	property_asse want to add s s, add stage 2 noose this option orking data file ta for stage 2.	ess.csplan etage 2? 2 now on if the contains		No, do no Choose ti data are n design ha	at add another stage now his option if stage 2 not available yet or your as only one stage.
		< <u>B</u> ac	k <u>N</u> e	xt >	Finish	Cancel Help

- ► Select Yes, add stage 2 now.
- ► Click Next.

pling Wizard		
tage 2: Design Variables hthis panel you can stratify your sar sampling weights exist from a prior	nple or define clusters. You can also provide stage of the sample design you can use ther	a label for the stage that will be used in the output. n as input to the current stage.
Stage 1	<u>V</u> ariables:	<u>S</u> tratify By:
Design Variables	Roperty ID [propid]	🚴 Neighborhood (nbrh
Method	Years since last appr	•
Sample Size	✓ Value at last apprais	
Output Variables		
Summary		<u>C</u> lusters:
Design Variables		
Method		
Sample Size		
Output Variables		
Summary		
Add Stage 3		
Selection Ontions		
Output Files		
Completion		Stage Label:

Figure 12-5 Sampling Wizard, Design Variables step (stage 2)

- ► Select *Neighborhood* as a stratification variable.
- Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each neighborhood of the townships drawn in stage 1. In this stage, properties are drawn as the primary sampling unit using simple random sampling.

Sampling Wizard × Stage 2: Sample Size In this panel you specify the number or proportion of units to be sampled in the current stage. The sample size can be fixed across strata or it can vary for different strata. If you specify sample sizes as proportions you can also set the minimum or maximum number of units to draw. Welcome Variables: Stage 1 Units: Proportions Y Roperty ID [propid] Design Variables Years since last appr.. Method 🔗 Value at last apprais... Sample Size Value: Output Variables The size value applies 0.2 Summary to each stratum. Stage 2 Design Variables Unequal values for strata: Method Define.. Sample Size Output Variables <u>Read values from variable</u>: Summary Add Stage 3 Draw Sample Selection Options Output Files Minimum Maximum Completion Count: Count: Finish Cancel Help < <u>B</u>ack <u>N</u>ext >

Figure 12-6 Sampling Wizard, Sample Size step (stage 2)

- ► Select Proportions from the Units drop-down list.
- ▶ Type 0.2 as the value of the proportion of units to sample from each stratum.
- Click Next, and then click Next in the Output Variables step.

ig plan sofar. Yo ne next step is to)u can add a) set options	nother stage to for drawing you	the design. r sample.			
Summa	ry:					
Stage	Label	Strata	Clusters	Size	Method	
1	(None)	county	town	4	Simple Random Sampling (WOR)	
2	(None)	nbrhood		0.2	Simple Random Sampling (WOR)	
File: c:	File: c:\property_assess.csplan					
Do you	i want to add	l stage 3?				
<u>O Y</u> e	es, add stage	e 3 now		💿 N <u>o</u> , do n	ot add another stage now	
CI w da	Choose this option if the working data file contains data for stage 3.			Choose this option if stage 3 data are not available yet or your design has only two stages.		
	ig plan so far. Yo ne next step is to <u>Summa</u> Stage 1 2 File: c: Do you <u>O Y</u> e Cl W W	ig plan so far. You can add a ne next step is to set options Stage Label (None) 2 (None) File: c:\property_as Do you want to add Yes, add stage Choose this op working data f data for stage	ig plan so far. You can add another stage to ne next step is to set options for drawing you <u>Summary:</u> <u>Stage Label Strata</u> <u>1 (None) county</u> <u>2 (None) nbrhood</u> File: c:\property_assess.csplan Do you want to add stage 3? <u>Y</u> es, add stage 3 now Choose this option if the working data file contains data for stage 3.	ig plan so far. You can add another stage to the design. ne next step is to set options for drawing your sample. <u>Summary:</u> <u>Stage Label Strata Clusters</u> <u>1</u> (None) county town 2 (None) nbrhood File: c:\property_assess.csplan Do you want to add stage 3? <u>Y</u> es, add stage 3 now Choose this option if the working data file contains data for stage 3.	Ig plan so far. You can add another stage to the design. ne next step is to set options for drawing your sample. <u>Summary:</u> <u>Stage Label Strata Clusters Size</u> <u>1</u> (None) county town 4 2 (None) nbrhood 0.2 File: c:\property_assess.csplan Do you want to add stage 3? <u>Y</u> es, add stage 3 now <u>Choose this option if the</u> working data file contains data for stage 3.	

Figure 12-7 Sampling Wizard, Plan Summary step (stage 2)

• Look over the sampling design, and then click Next.

Figure 12-8

Sampling Wizard, Draw Sample, Selection Options step

Draw Sample: Selection Options In this panel you can choose whether to draw a sample. You can pick which stages to extract and set other sampling options such as the seed used for random number generation. Image: Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Method Sample Size Output Variables Method Sample Size Output Variables Sample Size Output Variables Sample Size Output Variables Sample Size Output Variables Sample Size Summary Add Stage 3 Draw Sample Selection Options Output Files Output Files Completion	ampling Wizard	
 Welcome Stage 1 Design Variables Method Sample Size Output Variables Method Sample Size Output Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion 	Draw Sample: Selection Options In this panel you can choose whether seed used for random number general	to draw a sample. You can pick which stages to extract and set other sampling options such as the ion.
piocessing)	 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Summary Stage 2 Design Variables Summary Stage 2 Design Variables Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion 	Do you want to draw a sample? • Yes

- Select Custom value for the type of random seed to use, and type 241972 as the value.
 Using a custom value allows you to replicate the results of this example exactly.
- Click Next, and then click Next in the Draw Sample, Output Files step.

Figure 12	-9	
Sampling	Wizard,	Finish step

Sampling Wizard		×
Completing the Sampling Wizard You have provided all of the informatio You can return to the Sampling Wizard plan file in any Complex Samples analy Welcome Stage 1	n needed to create a sample design and draw a sample. I later if you need to add or modify stages. After all the stages have been sampled you can use the sis procedure to indicate how the sample was drawn.	
Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3	What do you want to do? Save the design to a plan file and draw the sample Paste the syntax generated by the Wizard into a syntax window 	
Draw Sample Selection Options Output Files Completion	To close this wizard, click Finish. < <u>B</u> ack <u>N</u> ext> Finish Cancel Help	

► Click Finish.

These selections produce the sampling plan file *property_assess.csplan* and draw a sample according to that plan.

Plan Summary

Figure 12-10

Plan summary

			Stage 1	Stage 2
Design Variables	Stratification	1	County	Neighborho od
	Cluster	1	Township	
Sample Information	Selection Method		Simple random sampling without replacement	Simple random sampling without replacement
	Number of Units S	Sampled	4	
	Variables Created or Modified	Stagewise Inclusion (Selection) Probability	Inclusion Probability_1_	Inclusion Probability_ 2_
		Stagewise Cumulative Sample Weight	Sample Weight Cumulative_ 4	Sample Weight Cumulative_ 2
	Proportion of Unit:	s Sampled	'_	22
Analysis Information	Estimator Assumption		Equal probability sampling without replacement	Equal probability sampling without replacement
	Inclusion Probabili	Obtained from variable Inclusion Probability_1_	Obtained from variable Inclusion Probability_ 2_	

Plan File: c:\property_assess.csplan

Weight Variable: Sample/Veight_Final_

The summary table reviews your sampling plan, and it is useful for making sure that the plan represents your intentions.

Sampling Summary

Figure 12-11

Stage summary

			Proportion	n of Units
	Number of U	nits Sampled	Sam	pled
County	Requested	Actual	Requested	Actual
Eastern	4	4	44.4%	44.4%
Central	4	4	57.1%	57.1%
Western	4	4	25.0%	25.0%
Northern	4	4	44.4%	44.4%
Southern	4	4	50.0%	50.0%

Plan File: c:\property_assess.csplan

This summary table reviews the first stage of sampling, and it is useful for checking that the sampling went according to plan. Four townships were sampled from each county, as requested.

Figure 12-12 Stage summary

			Number of Units Sampled		Proportion Sam	n of Units bled
County	Township	Neighborhood	Requested	Actual	Requested	Actual
Eastern	2	8	4	4	20.0%	19.0%
		9	14	14	20.0%	20.6%
		10	7	7	20.0%	18.9%
		11	14	14	20.0%	20.0%
	6	36	13	13	20.0%	20.3%
		37	14	14	20.0%	20.6%
		38	13	13	20.0%	20.6%
	7	43	12	12	20.0%	20.7%
		44	11	11	20.0%	19.6%
		45	11	11	20.0%	20.8%
		46	13	13	20.0%	20.0%
	9	57	13	13	20.0%	20.6%
		58	5	5	20.0%	18.5%
		59	11	11	20.0%	19.3%
		60	13	13	20.0%	19.4%
Central	22	148	9	9	20.0%	19.6%
		149	8	8	20.0%	20.0%

This summary table (the top part of which is shown here) reviews the second stage of sampling. It is also useful for checking that the sampling went according to plan. Approximately 20% of the properties were sampled from each neighborhood from each township sampled in the first stage, as requested.

Sample Results

Figure 12-13 *Data Editor with sample results*

😨 *pro	perty_a	ssess_cs.	sav [Da	taSet3]	- SPSS	5 Data Ed	itor				-0	
<u>Eile E</u> di	t <u>V</u> iew	<u>D</u> ata <u>T</u> ran	sform <u>4</u>	Analyze	<u>G</u> raphs	Utilities	Add- <u>o</u> ns <u>W</u> in	idow <u>H</u> elp				
🖻 🔒	ê 🗉	• •	۵ 🖿	?	•≣ ₫	1) 🖗 🛲 🧯	2 •				
1 : prop	id	1								N	√isible: 11 of	11
	propid	nbrhood	town	county	time	lastval	InclusionPr obability_1_	SampleWei ghtCumulati	InclusionPr obability_2_	SampleWei ghtCumulati	SampleWei ght_Final_	^
273	577.0	8	2	1	4	181.70						
274	578.0	8	2	1	5	189.60						
275	579.0	8	2	1	4	200.10						
276	580.0	8	2	1	5	211.50						
277	581.0	8	2	1	4	181.50						
278	641.0	9	2	1	7	192.40						
279	642.0	9	2	1	6	236.70	.44	2.25	.21	10.93	10.93	
280	643.0	9	2	1	6	150.40	.44	2.25	.21	10.93	10.93	
281	644.0	9	2	1	8	204.80						
282	645.0	9	2	1	6	225.40						
283	646.0	9	2	1	7	180.80	.44	2.25	.21	10.93	10.93	
284	647.0 ata View	9 Variabl	2 e View	1	5	176.90	(ľ
					SPS	55 Processo	or is ready					

You can see the sampling results in the Data Editor. Five new variables were saved to the working file, representing the inclusion probabilities and cumulative sampling weights for each stage, plus the final sampling weights.

- Cases with values for these variables were selected to the sample.
- Cases with system-missing values for the variables were not selected.

The agency will now use its resources to collect current valuations for the properties selected in the sample. Once those valuations are available, you can process the sample with Complex Samples analysis procedures, using the sampling plan *property_assess.csplan* to provide the sampling specifications.

Obtaining a Sample from a Partial Sampling Frame

A company is interested in compiling and selling a database of high-quality survey information. The survey sample should be representative but efficiently carried out, so complex sampling methods are used. The full sampling design calls for the following structure:

Stage	Strata	Clusters
1	Region	Province
2	District	City
3	Subdivision	

In the third stage, households are the primary sampling unit, and selected households will be surveyed. However, since information is easily available only to the city level, the company plans to execute the first two stages of the design now and then collect information on the numbers of subdivisions and households from the sampled cities. The available information to the city level is collected in *demo_cs_1.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. Note that this file contains a variable *Subdivision* that contains all 1's. This is a placeholder for the "true" variable, whose values will be collected after the first two stages of the design are executed, that allows you to specify the full three-stage sampling design now. Use the Complex Samples Sampling Wizard to specify the full complex sampling design, and then draw the first two stages.

Using the Wizard to Sample from the First Partial Frame

► To run the Complex Samples Sampling Wizard, from the menus choose:

Analyze Complex Samples Select a Sample...

Figure 12-14 Sampling Wizard, Welcome step

Sampling Wizard			8
Welcome to the Sampling Wizard			
The Sampling Wizard helps you design a analysis time to indicate how the data w	and select a complex sample. Your selections	will be saved to a plan file that you o	an use at
You can also use the wizard to modify a	sampling plan or draw a sample according to	an existing plan.	
	 What would you like to do? ● Design a sample Choose this option if you have not created a plan file. You will have the option to draw the sample. ● Edit a sample design Choose this option if you want to add, remove, or modify stages of an existing 	File: c:\demo.csplan	Browse
X 4(2)	plan. You will have the option to draw the sample. O Draw a <u>s</u> ample Choose this option if you already have a plan file and want to draw a sample.	File	Bro <u>w</u> se
	< <u>₿</u> ack <mark>Next</mark> >	Finish Cancel	Help

- Select Design a sample, and type c:\demo.csplan as the name of the plan file.
- ► Click Next.

age 1: Design Variables this panel you can stratify your sar	nple or define clusters. You can also provide a	a label for the stage that will be used in the output.
sampling weights exist from a prior	stage of the sample design you can use them	as input to the current stage. Stratify By: Clusters: Input Sample Weight:
= incomplete section		

Figure 12-15 Sampling Wizard, Design Variables step (stage 1)

- ► Select *Region* as a stratification variable.
- Select *Province* as a cluster variable.
- Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each region. In this stage, provinces are drawn as the primary sampling unit using the default method, simple random sampling.

Sampling Wizard, Sample Size step (stage 1) Sampling Wizard Stage 1: Sample Size In this panel you specify the number or proportion of units to be sampled in the current stage. The sample size can be fixed across strata or it can vary for different strata. If you specify sample sizes as proportions you can also set the minimum or maximum number of units to draw. Welcome Variables: Stage 1 Units: Counts \mathbf{v} 💦 District [district] Design Variables 💑 City [city] Method Sample Size 💑 Subdivision [subdivis.. O Value: Output Variables The size value applies 3 Summary to each stratum. Add Stage 2 Draw Sample O Unequal values for strata: Selection Options Define.. Output Files Completion <u>Read values from variable</u>: b < <u>B</u>ack <u>N</u>ext > Finish Cancel Help

Figure 12-16

- ► Select Counts from the Units drop-down list.
- Type 3 as the value for the number of clusters to select in this stage. ►
- Click Next, and then click Next in the Output Variables step.

pling Wizard						
tage 1: Plan Summary						
his panel summarizes the samplin	g plan so far. Yo	u can add a	nother stage to	the design.		
you choose not to add a stage th	ie next step is to	set options I	for drawing you	ır sample.		
Velcome	Summar	ur.				
Stage 1	Stage	Label	Strata	Clusters	Size	Method
Method Sample Size	1	(None)	region	province	3	Simple Random Sampling (WOR)
Output Variables						
Summary Add Stage 2						
Draw Sample						
Selection Options Output Files	File: c:\	.demo_1.csp	olan			
Completion						
	Do you	want to add	stage 2?			
	⊙Ye	s, add stage	2 now		🔘 N <u>o</u> , do n	ot add another stage now
	Cł wo da	oose this op orking data fi ta for stage i	tion if the le contains 2.		Choose data are design h	this option if stage 2 not available yet or your as only one stage.

Figure 12-17 Sampling Wizard, Plan Summary step (stage 1)

- ► Select Yes, add stage 2 now.
- ► Click Next.

Figure 12-18 Sampling Wizard, Design Variables step (stage 2)

Stage 2: Design Variables n this panel you can stratify your sar f sampling weights exist from a prior	nple or define clusters. You can also provide a lab	el for the stage that will be used in the output. nout to the current stage
 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Method Sample Size Output Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options 	Variables:	Stratify By: Stratify By: City [district] City [city]
Output Files Completion		Stage <u>L</u> abel:

- ► Select *District* as a stratification variable.
- ► Select *City* as a cluster variable.
- ► Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each district. In this stage, cities are drawn as the primary sampling unit using the default method, simple random sampling.

moling Wizard		
Stage 2: Sample Size In this panel you specify the number it can varv for different strata.	or proportion of units to be sampled in the o	current stage. The sample size can be fixed across strata or
If you specify sample sizes as propor Welcome	tions you can also set the minimum or maxii	mum number of units to draw.
Stage 1		Units: Proportions
Design Variables		
Sample Size		
Output Variables		O Value: ▼ The size value are line
Summary		0.1 The size value applies
Stage 2		
Design Variables		O Unequal values for <u>s</u> trata:
Method		Define
Sample Size		<u>D</u> enne
Output variables		Read values from variable:
Add Stage 3		
Draw Sample		
Selection Options		
Output Files		
Completion		Minimum Maximum Countr
		Count.
,		
	< <u>B</u> ack <u>N</u> ex	<t> Finish Cancel Help</t>

Figure 12-19 Sampling Wizard, Sample Size step (stage 2)

- ► Select Proportions from the Units drop-down list.
- ▶ Type 0.1 as the value of the proportion of units to sample from each strata.
- Click Next, and then click Next in the Output Variables step.

Figure 12-20 Sampling Wizard, Plan Summary step (stage 2)

age 2: Plan Summary						
nis panel summarizes the sampling you choose not to add a stage th	g plan so far. Yo e next step is to	ou can add ai o set options I	nother stage to for drawing you	the design. Ir sample.		
Welcome Share 1		ry:				
Diaye I Design Variables	Stage	Label	Strata	Clusters	Size	Method
Method Sample Size	1	(None)	region	province	3	Simple Random Sampling (WOR)
Output Variables Summary	2	(None)	district	city	0.1	Simple Random Sampling (WOR)
Stage 2 Design Variables Method						
Sample SizeOutput Variables	File: de	emo.csplan				
Summary Add Stage 3	Do you	want to add	stage 3?		O N- 4	- t - d d th t
Draw Sample	• <u>⊥</u> e	es, add stage	3 now		0 N <u>o</u> , do n	ot add another stage now
Selection Options Output Files Completion	Ci wi da	noose this op orking data fi ata for stage :	tion if the le contains 3.		Choose data are design h	this option if stage 3 not available yet or your as only two stages.

- ► Select Yes, add stage 3 now.
- ► Click Next.

pling Wizard				
tage 3: Design Variables h this panel you can stratify y	our sample or i	define clusters. You can als	so provide a label for the s	stage that will be used in the output.
sampling weights exist from a	a prior stage o	f the sample design you car	n use them as input to the	e current stage.
Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Stage 3 Design Variables Design Variab		Variables:	•	Stratify By:
Pesigi Variables Method Sample Size Output Variables Summary Draw Sample	 Image: A state of the state of		Stage <u>L</u> ab	et

Figure 12-21

- Select *Subdivision* as a stratification variable.
- ► Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each subdivision. In this stage, household units are drawn as the primary sampling unit using the default method, simple random sampling.

Figure 12-22 Sampling Wizard, Sample Size step (stage 3)

Sampling Wizard	
Stage 3: Sample Size In this panel you specify the n it can vary for different strata. If you specify sample sizes as Stage 1 Design Variables Method	mber or proportion of units to be sampled in the current stage. The sample size can be fixed across strata or proportions you can also set the minimum or maximum number of units to draw.
 Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Stage 3 Design Variables Method Sample Size 	 ♥ Value: 0.2 The size value applies to each stratum. ♥ Unequal values for strata:
Output Variables Summary Draw Sample	Minimum Maximum Count: Count: ✓ Back Minimum Count: ✓ Back ✓ Finish Cancel Help

- ► Select Proportions from the Units drop-down list.
- ▶ Type 0.2 as the value for the proportion of units to select in this stage.
- Click Next, and then click Next in the Output Variables step.

ıg Wizard		_					
3: Plan Summary an el summarizes the sam 5tage 1	ipling plan s	so far. Th Summa	ie next step i: ru:	s to set options fo	or drawing you	ır sample.	
Design Variables		Stage	Label	Strata	Clusters	Size	Method
Sample Size		1	(None)	region	province	3	Simple Random Sampling (WOR)
Summary		2	(None)	district	city	0.1	Simple Random Sampling (WOR)
Design Variables Method		3	(None)	subdivision		0.2	Simple Random Sampling (WOR)
Sample Size Output Variables Summary tage 3 Design Variables Method Sample Size Output Variables Summary raw Sample		 File: de	mo.csplan				

Figure 12-23

• Look over the sampling design, and then click Next.

Figure 12-24

Sampling Wizard, Draw Sample, Selection Options step

Sampling Wizard	
Draw Sample: Selection Options In this panel you can choose whe seed used for random number ger	ther to draw a sample. You can pick which stages to extract and set other sampling options such as the eration.
 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Stage 3 Design Variables Method Sample Size Output Variables Summary Design Variables Summary Draw Sample Selection Options 	 Do you want to draw a sample? Yes Stages: 1.2 No What type of seed value do you want to use? A randomly-chosen number Gustom value: 241972 Enter a custom seed value if you want to reproduce the sample later.
	< <u>B</u> ack <u>N</u> ext > Finish Cancel Help

- ► Select 1, 2 as the stages to sample now.
- Select Custom value for the type of random seed to use, and type 241972 as the value.
 Using a custom value allows you to replicate the results of this example exactly.
- Click Next, and then click Next in the Draw Sample, Output Files step.



Sampling Wizard	
Completing the Sampling Wizard You have provided all of the inform You can return to the Sampling Wi plan file in any Complex Samples a	ation needed to create a sample design and draw a sample. zard later if you need to add or modify stages. After all the stages have been sampled you can use the nalysis procedure to indicate how the sample was drawn.
 Output Variables Summary 	What do you want to do?
Stage 2 Design Variables Method Sample Size Output Variables Summary Stage 3 Design Variables Method Sample Size Output Variables Summary Draw Sample Selection Options	 Save the design to a plan file and draw the sample Paste the syntax generated by the Wizard into a syntax window
Completion	To close this wizard, click Finish. ✓
	< <u>B</u> ack Next > Finish Cancel Help

► Click Finish.

These selections produce the sampling plan file *demo.csplan* and draw a sample according to the first two stages of that plan.

Sample Results

Figure 12-26 Data Editor with sample results

• 🖬	dem	o_cs_1	.sav [Dat	aSet4] ·	SPSS	Data Editor				-	
Eile	<u>E</u> dit	⊻iew	<u>D</u> ata <u>T</u> ran	nsform <u>A</u>	Inalyze	<u>G</u> raphs <u>U</u> til	ities Add- <u>o</u> ns	<u>W</u> indow <u>H</u> e	lp		
ß		ê 🗉	• 🔿	1	/	ME 👘 🗄	1 🕂 🕂 🖞	🍑 🔕 💊			
1:1	regio	n	1							Visible: 9	9 of 9
		region	province	district	city	InclusionPr obability_1_	SampleWei ghtCumulati ve_1_	InclusionPr obability_2_	SampleWei ghtCumulati ve_2_	SampleWei ght_Final_	
	295	1	2	10	295						
	296	1	2	10	296						
	297	1	2	10	297						
	298	1	2	10	298	.20	5.00	.10	50.00	50.00	
	299	1	2	10	299						
	300	1	2	10	300	.20	5.00	.10	50.00	50.00	
	301	1	2	11	301						
	302	1	2	11	302						
	303	1	2	11	303						
	304	1	2	11	304						
	305	1	2	11	305						
	306	1	2	11	306						
	307	1	2	11	307	.20	5.00	.10	50.00	50.00	
	308	1	2	11	308						
••]∖[Da	ata View	🖌 Variab	le View	/ ```			<		>	Ĩ
						SPSS Pro	ocessor is ready	/			

You can see the sampling results in the Data Editor. Five new variables were saved to the working file, representing the inclusion probabilities and cumulative sampling weights for each stage, plus the "final" sampling weights for the first two stages.

- Cities with values for these variables were selected to the sample.
- Cities with system-missing values for the variables were not selected.

For each city selected, the company acquired subdivision and household unit information and placed it in *demo_cs_2.sav*. Use this file and the Sampling Wizard to sample the third stage of this design.

Using the Wizard to Sample from the Second Partial Frame

- ▶ To run the Complex Samples Sampling Wizard, from the menus choose:
 - Analyze Complex Samples

Select a Sample...

Figure 12-27 Sampling Wizard, Welcome step

Sampling Wizard		- ×
Welcome to the Sampling Wizard The Sampling Wizard helps you design analysis time to indicate how the data v	and select a complex sample. Your selections will be saved to a plan file that you can use at vere sampled.	
You can also use the wizard to modify	a sampling plan or draw a sample according to an existing plan.	
	What would you like to do? Design a sample Choose this option if you have not created a plan file. You will have the option to draw the sample.	
	○ Edit a sample design Choose this option if you want to add, remove, or modify stages of an existing plan. You will have the option to draw the sample.	
5 H-17 5 \$ 4(2)	Draw a sample Choose this option if you already have a plan file and want to draw a sample. File: c:\demo.csplan Browse	
	< <u>B</u> ack <u>N</u> ext > Finish Cancel Help	

- Select Draw a sample, and select the c:\demo.csplan plan file that you created.
- ► Click Next.

Figure 12-28		
Sampling Wizard,	Plan Summary step	(stage 3)

ampling Wizard Plan Summary This panel summarizes the sampling) plan. Indicate	any stages t	hat have already	been drawn	and should n	ot be resampled.
Velcome	Summar	y:				
Draw Sample	Stage	Label	Strata	Clusters	Size	Method
Selection Options	1	(None)	region	province	3	Simple Random Sampling (WOR)
Completion	2	(None)	district	city	0.1	Simple Random Sampling (WOR)
	3	(None)	subdivision		0.2	Simple Random Sampling (WOR)
	File: c:\	.demo.csplar	n Which stage S <u>t</u> age:	s have alread	ly been samp 💌	led?
		< <u>B</u> a	ick <u>N</u> ext		Finish	Cancel Help

- ► Select 1, 2 as stages already sampled.
- ► Click Next.

ampling Wizard	
Draw Sample: Selection Options In this panel you can choose which a	stages to extract and set other sampling options such as the seed used for random number generation.
Welcome Plan Summary Draw Sample Selection Options Output Files Completion	Which stages do you want to sample? Stages: 3
	What type of seed value do you want to use?
	<u>Custom value:</u> <u>4231946</u> Enter a custom seed value if you want to reproduce the sample later.
	☐ Include in the sample frame cases with user-missing values of stratification or clustering variables
	working data are sorted by stratification variables (presorted data may speed processing)
	<pre>< Back Next > Finish Cancel Help</pre>

Figure 12-29 Sampling Wizard, Draw Sample, Selection Options step

- ► Select Custom value for the type of random seed to use and type 4231946 as the value.
- Click Next, and then click Next in the Draw Sample, Output Files step.

Figure 12-30 Sampling Wizard, Finish step

Sampling Wizard	
Completing the Sampling Wizard You have provided all of the information You can return to the Sampling Wizard I plan file in any Complex Samples analysi	needed to draw a sample. ater if you need to add or modify stages. After all the stages have been sampled you can use the is procedure to indicate how the sample was drawn.
Plan Summary Draw Sample Selection Options	What do you want to do?
Selection Options Output Files Completion	 Draw the sample Paste the syntax generated by the Wizard into a syntax window
	To close this wizard, click Finish.

- Select Paste the syntax generated by the Wizard into a syntax window.
- ► Click Finish.

The following syntax is generated:

```
* Sampling Wizard.
CSSELECT
/PLAN FILE='c:\demo.csplan'
/CRITERIA STAGES = 3 SEED = 4231946
/CLASSMISSING EXCLUDE
/DATA RENAMEVARS
/PRINT SELECTION.
```

Printing the sampling summary in this case produces a cumbersome table that causes problems in the Output Viewer. To turn off display of the sampling summary, replace SELECTION with CPS in the PRINT subcommand. Then run the syntax within the syntax window.

These selections draw a sample according to the third stage of the *demo.csplan* sampling plan.

Sample Results

Figure 12-31

Data Editor with sample result	S

🔛 *dem	o_cs_	2.sav [] - SF	PSS Data	Editor						-	
<u>File E</u> dit	⊻iew	Data Iransi	form <u>A</u> nal	yze <u>G</u> raphs	Utilities Add-	ons <u>W</u> indow	Help				
🗁 🔒	4	🗄 🔶 🖶	🏪 🕼	M 📲 👘	🗄 🤹 🖪	👒 🥥 (
1 : regio	n	1								Visible: 13 d	of 13 \
	city	subdivision	unit	InclusionPr obability_1_	SampleVVei ghtCumulati ve_1_	InclusionPr obability_2_	SampleWei ghtCumulati ve_2_	InclusionPr obability_3_	SampleWei ghtCumulati ve_3_	SampleVVei ght_Final_	<
14	190	946	94514	.20	5.00	.10	50.00				
15	190	946	94515	.20	5.00	.10	50.00				
16	190	946	94516	.20	5.00	.10	50.00	.20	244.44	244.44	
17	190	946	94517	.20	5.00	.10	50.00				
18	190	946	94518	.20	5.00	.10	50.00				
19	190	946	94519	.20	5.00	.10	50.00				
20	190	946	94520	.20	5.00	.10	50.00				
21	190	946	94521	.20	5.00	.10	50.00				
22	190	946	94522	.20	5.00	.10	50.00				
23	190	946	94523	.20	5.00	.10	50.00				
24	190	946	94524	.20	5.00	.10	50.00	.20	244.44	244.44	
25	190	946	94525	.20	5.00	.10	50.00				
26	190	946	94526	.20	5.00	.10	50.00				
27	190	946	94527	.20	5.00	.10	50.00				
28	190	946	94528	.20	5.00	.10	50.00				
29	190	946	94529	.20	5.00	.10	50.00	.20	244.44	244.44	
30	190	946	94530	.20	5.00	.10	50.00				_
	ata Vie	w 🖌 Variable	view 71		7.00	40	Ĩ₹Î				>
					SPSS F	rocessor is rea	idy				

You can see the sampling results in the Data Editor. Three new variables were saved to the working file, representing the inclusion probabilities and cumulative sampling weights for the third stage, plus the final sampling weights. These new weights take into account the weights computed during the sampling of the first two stages.

- Units with values for these variables were selected to the sample.
- Units with system-missing values for these variables were not selected.

The company will now use its resources to obtain survey information for the housing units selected in the sample. Once the surveys are collected, you can process the sample with Complex Samples analysis procedures, using the sampling plan *demo.csplan* to provide the sampling specifications.

Sampling With Probability Proportional to Size (PPS)

Representatives considering a bill before the legislature are interested in whether there is public support for the bill and how support for the bill is related to voter demographics. Pollsters design and conduct interviews according to a complex sampling design.

A list of registered voters is collected in *poll_cs.sav*. Use the Complex Samples Sampling Wizard to select a sample for further analysis.

Using the Wizard

► To run the Complex Samples Sampling Wizard, from the menus choose:

Analyze Complex Samples Select a Sample...

Figure 12-32 Sampling Wizard, Welcome step

Sampling Wizard		×
Welcome to the Sampling Wizard The Sampling Wizard helps you design analysis time to indicate how the data v	and select a complex sample. Your selections will be saved to a plan file that you can use a vere sampled.	at
You can also use the wizard to modify	a sampling plan or draw a sample according to an existing plan.	
	What would you like to do? ● Design a sample Choose this option if you have not created a plan file. You will have the option to draw the sample. ● Edit a sample design	æ
	Choose this option if you want to add, remove, or modify stages of an existing plan. You will have the option to draw the sample.	:e
Σ H.	Draw a sample Choose this option if you already have a plan file and want to draw a sample. File: Brows	:e
	< <u>B</u> ack Next > Finish Cancel	Help

- Select Design a sample, and type c:\poll.csplan as the name of the plan file.
- ► Click Next.

pling Wizard age 1: Design Variables this panel you can stratify your sar	nple or define clusters. You can also provid	ie a label for the stage that will be used in the o	utput.
sampling weights exist from a prior	stage of the sample design you can use the	em as input to the current stage. Stratiív Bv:	
Design Variables Method Sample Size Output Variables	Coter ID [voteid]	County [county]	
Summary Add Stage 2 Draw Sample Selection Options Output Files		<u>C</u> lusters: Township [town]	
Completion		Input Sample Weight:	
		Stage <u>L</u> abel:	

Figure 12-33

- Select *County* as a stratification variable.
- ► Select *Township* as a cluster variable.
- ► Click Next.

This design structure means that independent samples are drawn for each county. In this stage, townships are drawn as the primary sampling unit.
Complex Samples Sampling Wizard

npling Wizard		
Stage 1: Sampling Method n this panel you can choose how to method you must also specify a mea	select items from the working data file sure of size (MDS).	. If you choose a PPS (probability proportional to size) sampling
welcome Stage 1	<u>V</u> ariables:	Method
 Design Variables Method 	Voter ID [voteid]	Iype: PPS
Sample Size	••••••	<u> </u>
Output Variables Summary		◯ With re <u>p</u> lacement (WR)
Add Stage 2 Draw Sample		Use WR estimation for analysis
Selection Options		N (C: (UCO)
Output Files Completion		Measure or size (MUS)
		<u>Nead from variable:</u>
		 Count <u>d</u>ata records
		Minimum: Ma <u>x</u> imum:
• · · · ·		

Figure 12-34

- Select PPS as the sampling method. ►
- ► Select Count data records as the measure of size.
- ► Click Next.

Within each county, townships are drawn without replacement with probability proportional to the number of records for each township. Using a PPS method generates joint sampling probabilities for the townships; you will specify where to save these values in the Output Files step.

Sampling Wizard × Stage 1: Sample Size In this panel you specify the number or proportion of units to be sampled in the current stage. The sample size can be fixed across strata or it can vary for different strata. If you specify sample sizes as proportions you can also set the minimum or maximum number of units to draw Welcome Variables: Stage 1 Units: Proportions ~ 💑 Voter ID [voteid] Design Variables \Lambda Neighborhood (nbrh.. Method Sample Size Value: Output Variables The size value applies 0.3 Summarv to each stratum. Add Stage 2 Draw Sample O Unequal values for strata: Selection Options Define. Output Files Completion O Read values from variable: Minimum Ma<u>x</u>imum 3 5 Count: Count: Finish < <u>B</u>ack <u>N</u>ext> Cancel Help

Figure 12-35 Sampling Wizard, Sample Size step (stage 1)

- ► Select Proportions from the Units drop-down list.
- ▶ Type 0.3 as the value for the proportion of townships to select per county in this stage.

Legislators from the Western county point out that there are fewer townships in their county than in others. In order to ensure adequate representation, they would like to establish a minimum of 3 townships sampled from each county.

- ▶ Type 3 as the minimum number of townships to select and 5 as the maximum.
- ► Click Next, and then click Next in the Output Variables step.

Complex Samples Sampling Wizard

וויז אוצמים						
Stage 1: Plan Summary This panel summarizes the samplin If you choose not to add a stage th	ng plan so far. Yo ne next step is to	u can add a set options	nother stage to for drawing you	the design. Ir sample.		
Welcome	Summa	y:				
Design Variables	Stage	Label	Strata	Clusters	Size	Method
Method	1	(None)	county	town	0.3	PPS (WOR)
 Summary Add Stage 2 Draw Sample Selection Options Output Files Completion 	File: c:* Do you	File: c:\poll.csplan Do you want to add stage 2?				
		⊙ Yes, add stage 2 now				ot add another stage now
	Cł wo da	noose this op orking data fi Ita for stage	otion if the ile contains 2.		Choose data are design h	this option if stage 2 not available yet or your ias only one stage.

Figure 12-36 Sampling Wizard, Plan Summary step (stage 1)

- ► Select Yes, add stage 2 now.
- ► Click Next.

Figure 12-37 Sampling Wizard, Design Variables step (stage 2)

Stage 2: Design Variables n this panel you can stratify your sa f sampling weights exist from a prior	mple or define clusters. You can also provide stage of the sample design you can use them	a label for the stage that will be used in the output. • as input to the current stage.
 Welcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion 	Variables: ♣ Voter ID [voteid]	Stratify By: Neighborhood [nbrh Clusters: Stage Labet

- ► Select *Neighborhood* as a stratification variable.
- ► Click Next, and then click Next in the Method step.

This design structure means that independent samples are drawn for each neighborhood of the townships drawn in stage 1. In this stage, voters are drawn as the primary sampling unit using simple random sampling without replacement.

Complex Samples Sampling Wizard

ndung wizaro		
Stage 2: Sample Size In this panel you specify the number of it can vary for different strata. If you specify sample sizes as proporti Welcome	or proportion of units to be sampled in the	e current stage. The sample size can be fixed across strata o aximum number of units to draw.
Stage 1		Units: Proportions
 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion 		Value: 0.2 Value: 0.2 Values for strata: Perine Bead values from variable: Minimum Count: Magimum Count:

Figure 12-38 Sampling Wizard, Sample Size step (stage 2)

- ► Select Proportions from the Units drop-down list.
- ► Type 0.2 as the value of the proportion of units to sample from each strata.
- Click Next, and then click Next in the Output Variables step.

Figure 12-39 Sampling Wizard, Plan Summary step (stage 2)

age 2: Plan Summary						
is panel summarizes the samplir	ng plan so far. Yi	ou can add a	nother stage to	the design.		
		t. antiana		-		
you choose not to add a stage t	ne next step is ti) set options	ioi urawing you	sampie.		
Welcome						
Stage 1	snet2	l abel	Strata	Clusters	Size	Method
Design Variables	1	(None)	county	town	0.3	PPS (WOR)
Sample Size	2	(None)	nbrhood		0.2	Simple Random Sampling (WOR)
Stage 2 Design Variables Method	File: c:	File: c:\poll.csplan				
 Sample Size Output Variables Summary 	Deue	Do you want to add stage 3?				
 Sample Size Output Variables Summary Add Stage 3 	Do yo	u want to add	rotago o :			
 Sample Size Output Variables Summary Add Stage 3 Draw Sample 	Do you 이번	u want to ado es, add stage	3 now		💿 N <u>o</u> , do n	ot add another stage now

► Look over the sampling design, and then click Next.

Complex Samples Sampling Wizard

npling Wizard	
Draw Sample: Selection Options In this panel you can choose whethe seed used for random number genera Welcome	r to draw a sample. You can pick which stages to extract and set other sampling options such as the stion.
Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3	O you want to draw a sample? • Yes Stages: All (1, 2) • No • What type of seed value do you want to use? • A randomly-chosen number • Qustom value: 592004
Add Stage 3 Draw Sample Selection Options Output Files Completion	Include in the sample frame cases with user-missing values of stratification or clustering variables Working data are sorted by stratification variables (presorted data may speed processing)

Figure 12-40 Sampling Wizard, Draw Sample, Selection Options step

- Select Custom value for the type of random seed to use, and type 592004 as the value.
 Using a custom value allows you to replicate the results of this example exactly.
- ► Click Next.

Figure 12-41 Sampling Wizard, Draw Sample, Selection Options step

ampling Wizard	
Draw Sample: Output Files In this panel you can choose where to replacement. The selected cases are Joint probabilities are saved if you requ Netcome Stane 1	save sample output data. You must save sampled cases to an external file if sampling is done with saved along with the variables if the destination is a new dataset or file. lest PPS sampling without replacement. They are needed for WOR estimation of PPS designs. Where do you want to save sample data?
 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Completion 	 Active dataset New dataset: poll_cs_sample Egternal file:
-	< <u>B</u> ack <u>N</u> ext > Finish Cancel Help

- Choose to save the sample to a new dataset, and type c:\poll_cs_sample as the name of the dataset.
- ► Type c:\poll_jointprob.sav as the name of the joint probabilities file.
- ► Click Next.

Complex Samples Sampling Wizard

Figure 12-42 Sampling Wizard, Finish step

Sampling Wizard		×
Completing the Sampling Wizard You have provided all of the information neede You can return to the Sampling Wizard later if plan file in any Complex Samples analysis proc	ed to create a sample design and draw a sample. you need to add or modify stages. After all the stages have been sampled you can use the edure to indicate how the sample was drawn.	1
Velcome Stage 1 Design Variables Method Sample Size Output Variables Summary Stage 2 Design Variables Method Sample Size Output Variables Summary Add Stage 3 Draw Sample Selection Options Output Files Output Files	What do you want to do? Save the design to a plan file and draw the sample Paste the syntax generated by the Wizard into a syntax window	
- Compission	To close this wizard, click Finish.	
	< <u>₿</u> ack <u>N</u> ext > Finish Cancel Help	

► Click Finish.

These selections produce the sampling plan file *poll.csplan* and draw a sample according to that plan, save the sample results to the new dataset *poll_cs_sample*, and save the joint probabilities file to the external data file *poll_jointprob.sav*.

Plan Summary

Figure 12-43

Plan summary

			Stage 1	Stage 2
Design	Stratification	1	County	Neighborhood
Variables	Cluster	1	Township	
Sample	Selection Method		PPS sampling	Simple random
Information			without	sampling without
			replacement	replacement
	Measure of Size		Obtained from data	
	Proportion of Units Samp	led	.3	.2
	Minimum Number of Units	Sampled	3	
	Maximum Number of Unit:	s Sampled	5	
	Variables Created or	Stagewise Inclusion	Inclusion	Inclusion
	Modified	(Selection) Probability	Probability_1_	Probability_2_
		Stagewise Cumulative	Sample/Veight	SampleWeight
		Sample Weight	Cumulative_1_	Cumulative_2_
Analysis	Estimator Assumption		Unequal probability	
Information			sampling without	Equal probability
			replacement (using	sampling without
			probabilities)	replacement
	Inclusion Probability		Obtained from variable	Obtained from variable
			Inclusion	Inclusion
			Probability_1_	Probability_2_

Plan File: c:\poll.csplan

Weight Variable: SampleWeight_Final_

The summary table reviews your sampling plan, and it is useful for making sure that the plan represents your intentions.

Sampling Summary

Figure 12-44

Stage summary

	Number of U	nits Sampled	Proportion Sam	n of Units pled
County	Requested	Actual	Requested	Actual
Eastern	4	4	30.0%	30.8%
Central	4	4	30.0%	30.8%
Western	3	3	30.0%	50.0%
Northern	5	5	30.0%	33.3%
Southern	3	3	30.0%	50.0%

Plan File: c:\poll.csplan

This summary table reviews the first stage of sampling, and it is useful for checking that the sampling went according to plan. Recall that you requested a 30% sample of townships by county; the actual proportions sampled are close to 30%, except in the Western and Southern counties. This is because these counties each have only six townships, and you also specified that a minimum of three townships should be selected per county.

Figure 12-45 Stage summary

					Proportion	n of Units
			Number of Ur	nits Sampled	Sam	pled
County	Township	Neighborhood	Requested	Actual	Requested	Actual
Eastern	9	1	49	49	20.0%	19.9%
		2	143	143	20.0%	20.0%
		3	113	113	20.0%	20.0%
		4	77	77	20.0%	20.0%
		5	139	139	20.0%	20.0%
		6	120	120	20.0%	20.0%
	10	1	149	149	20.0%	20.1%
		2	117	117	20.0%	20.0%
		3	116	116	20.0%	20.0%
		4	69	69	20.0%	19.9%
	11	1	65	65	20.0%	19.9%
		2	72	72	20.0%	19.9%
		3	109	109	20.0%	20.0%
		4	140	140	20.0%	20.0%
		5	42	42	20.0%	19.8%
		6	142	142	20.0%	20.0%
	12	1	145	145	20.0%	20.1%
		2	69	69	20.0%	20.1%
		3	98	98	20.0%	20.1%
		4	134	134	20.0%	20.0%
		5	114	114	20.0%	20.0%
		6	137	137	20.0%	19.9%
Central	2	1	119	119	20.0%	20.1%
		2	153	153	20.0%	19.9%
		3	101	101	20.0%	20.0%
		4	52	52	20.0%	19.8%
		5	144	144	20.0%	20.0%

Plan File: c:\poll.csplan

This summary table (the top part of which is shown here) reviews the second stage of sampling. It is also useful for checking that the sampling went according to plan. Approximately 20% of the voters were sampled from each neighborhood from each township sampled in the first stage, as requested.

Sample Results

Figure 12-46 *Data Editor with sample results*

• 🔝	🚰 *Untitled3 [poll_cs_sample] - SPSS Data Editor 🔤 🗔 🔯											
Eile	<u>E</u> dit	<u>V</u> iew	<u>D</u> ata <u>T</u> r	ansform	<u>A</u> nalyze	<u>G</u> raphs <u>U</u> tilit	ies Add- <u>o</u> ns	<u>W</u> indow <u>H</u> elp				
642	:									Visible:	9 of	f9
		voteid	nbrhoo	id town	county	InclusionPr obability_1_	SampleWei ghtCumulat ve_1_	InclusionPr obability_2_	SampleWei ghtCumulati ve_2_	SampleVVei ght_Final_		
	376	368		4 9	1	.44	2.26	.20	11.28	11.28		
	377	369		4 9	1	.44	2.26	.20	11.28	11.28		
	378	374		4 9	1	.44	2.26	.20	11.28	11.28		
	379	376		4 9	1	.44	2.26	.20	11.28	11.28		
	380	379		4 9	1	.44	2.26	.20	11.28	11.28		
	381	380		4 9	1	.44	2.26	.20	11.28	11.28		
	382	382		4 9	1	.44	2.26	.20	11.28	11.28		
	383	13		5 9	1	.44	2.26	.20	11.26	11.26		
	384	18		5 9	1	.44	2.26	.20	11.26	11.26		
	385	23		5 9	1	.44	2.26	.20	11.26	11.26		
	386	38		5 9	1	.44	2.26	.20	11.26	11.26		
	387	39		5 9	1	.44	2.26	.20	11.26	11.26		
	388	40		5 9	1	.44	2.26	.20	11.26	11.26		
	389	41		5 9	1	.44	2.26	.20	11.26	11.26		
••	390)]\ D a	43 ata Viev	v 🖌 Varia	5 9 able View	1	44	2 26	20	11.26	11 26	>	~
						SPSS Proc	essor is ready					

You can see the sampling results in the newly created dataset. Five new variables were saved to the working file, representing the inclusion probabilities and cumulative sampling weights for each stage, plus the final sampling weights. Voters who were not selected to the sample are excluded from this dataset.

The final sampling weights are identical for voters within the same neighborhood because they are selected according to a simple random sampling method within neighborhoods. However, they are different across neighborhoods within the same township because the sampled proportions are not exactly 20% in all neighborhoods.

Complex Samples Sampling Wizard

Figur	e 12-4	7		
Data	Editor	with	sample	results

• 🔝	🚰 *Untitled3 [poll_cs_sample] - SPSS Data Editor 🛛 🖃 💷 🔯										
Eile	<u>E</u> dit	<u>V</u> iew	<u>D</u> ata <u>T</u> rar	nsform	<u>A</u> nalyze	<u>G</u> raphs <u>U</u> tiliti	es Add- <u>o</u> ns	<u>W</u> indow <u>H</u> elp			
642	:									Visible:	9 of 9
		voteid	nbrhood	town	county	InclusionPr obability_1_	SampleWei ghtCumulati ve_1_	InclusionPr obability_2_	SampleWei ghtCumulati ve_2_	SampleVVei ght_Final_	
	635	577	6	9	1	.44	2.26	.20	11.30	11.30	
	636	578	6	9	1	.44	2.26	.20	11.30	11.30	
	637	582	6	9	1	.44	2.26	.20	11.30	11.30	
	638	590	6	9	1	.44	2.26	.20	11.30	11.30	
	639	594	6	9	1	.44	2.26	.20	11.30	11.30	
	640	597	6	9	1	.44	2.26	.20	11.30	11.30	
	641	600	6	9	1	.44	2.26	.20	11.30	11.30	
	642	4	1	10	1	.31	3.21	.20	16.00	16.00	
	643	5	1	10	1	.31	3.21	.20	16.00	16.00	
	644	9	1	10	1	.31	3.21	.20	16.00	16.00	
	645	10	1	10	1	.31	3.21	.20	16.00	16.00	
	646	12	1	10	1	.31	3.21	.20	16.00	16.00	
	647	16	1	10	1	.31	3.21	.20	16.00	16.00	
	648	17	1	10	1	.31	3.21	.20	16.00	16.00	
••	649 \\ D a	19 ata Viev	1 Variab	10 le View	1	31	321	20	16.00	16.00	>
	SPSS Processor is ready										

Unlike voters in the second stage, the first-stage sampling weights are not identical for townships within the same county because they are selected with probability proportional to size.

	poll	jointprob.	sav [DataSe	et3] - SP9	SS Da	ta Editor					-
Eile	<u>E</u> dit	<u>V</u> iew <u>D</u> ata	<u>T</u> ransform	<u>A</u> nalyze	Graph	s <u>U</u> tilities	Add- <u>o</u> ns	<u>W</u> in	dow <u>H</u> elp		
1:	count	ty	1								Visible:
		county	town	Unit_N	0_ J	pint_Prob_ 1_	Joint_P 2_	rob_	Joint_Prob_ 3_	Joint_Prob_ 4_	Joint_Prob_ 5_
	1	1	10		1	.31		.10	.11	.12	
	2	1	11		2	.10		.39	.15	.16	
	3	1	9		3	.11		.15	.44	.21	
	4	1	12		4	.12		.16	.21	.48	
	5	2	12		1	.22		.04	.07	.08	
	6	2	6		2	.04		.23	.07	.08	
	- 7	2	7		3	.07		.07	.41	.19	
	8	2	2		4	.08		.08	.19	.45	
	9	3	5		1	.58		.31	.32		
	10	3	3		2	.31		.61	.36		
	11	3	4		3	.32		.36	.63		
	12	4	14		1	.26		.06	.06	.07	.09
	13	4	8		2	.06		.29	.07	.08	.10
	14	4	4		3	.06		.07	.29	.08	.10
	- 15	4	2		4	.07		.08	.08	.33	.12
	16	4	13		5	.09		.10	.10	.12	.43
	17	5	3		1	.74		.25	.27		
	18	5	6		2	.25		.41	.13		
	19	5	4		3	.27		.13	.43		
		4-3 from ()	/orioble \/iou	. /			_	121			

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8 of 8

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Figure 12-48

The file *poll_jointprob.sav* contains first-stage joint probabilities for selected townships within counties. *County* is a first-stage stratification variable, and *Township* is a cluster variable. Combinations of these variables identify all first-stage PSUs uniquely. *Unit_No_* labels PSUs within each stratum and is used to match up with *Joint_Prob_1_, Joint_Prob_2_, Joint_Prob_3_, Joint_Prob_4_*, and *Joint_Prob_5_*. The first two strata each have 4 PSUs; therefore, the joint inclusion probability matrices are 4×4 for these strata, and the *Joint_Prob_5_* column is left empty for these rows. Similarly, strata 3 and 5 have 3×3 joint inclusion probability matrices, and stratum 4 has a 5×5 joint inclusion probability matrix.

SPSS Processor is ready

The need for a joint probabilities file is seen by perusing the values of the joint inclusion probability matrices. When the sampling method is not a PPS WOR method, the selection of a PSU is independent of the selection of another PSU, and their joint inclusion probability is simply the product of their inclusion probabilities. In contrast,

Chapter 12

Complex Samples Sampling Wizard

the joint inclusion probability for Townships 9 and 10 of County 1 is approximately 0.11 (see the first case of *Joint_Prob_3_* or the third case of *Joint_Prob_1_*), or less than the product of their individual inclusion probabilities (the product of the first case of *Joint_Prob_1_* and the third case of *Joint_Prob_3_* is $0.31 \times 0.44 = 0.1364$).

The pollsters will now conduct interviews for the selected sample. Once the results are available, you can process the sample with Complex Samples analysis procedures, using the sampling plan *poll.csplan* to provide the sampling specifications and *poll_jointprob.sav* to provide the needed joint inclusion probabilities.

Related Procedures

The Complex Samples Sampling Wizard procedure is a useful tool for creating a sampling plan file and drawing a sample.

• To ready a sample for analysis when you do not have access to the sampling plan file, use the Analysis Preparation Wizard.

Complex Samples Analysis Preparation Wizard

The Analysis Preparation Wizard guides you through the steps for creating or modifying an analysis plan for use with the various Complex Samples analysis procedures. It is most useful when you do not have access to the sampling plan file used to draw the sample.

Using the Complex Samples Analysis Preparation Wizard to Ready NHIS Public Data

The National Health Interview Survey (NHIS) is a large, population-based survey of the U.S. civilian population. Interviews are carried out face-to-face in a nationally representative sample of households. Demographic information and observations about health behavior and status are obtained for members of each household.

A subset of the 2000 survey is collected in *nhis2000_subset.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. Use the Complex Samples Analysis Preparation Wizard to create an analysis plan for this data file so that it can be processed by Complex Samples analysis procedures.

Using the Wizard

► To prepare a sample using the Complex Samples Analysis Preparation Wizard, from the menus choose:

Analyze Complex Samples Prepare for Analysis...

Complex Samples Analysis Preparation Wizard

Figure 13-1		
Analysis Preparation	Wizard,	Welcome step

Analysis Preparation Wizard
Welcome to the Analysis Preparation Wizard The Analysis Preparation Wizard helps you describe your complex sample and choose an estimation method. You will be asked to provide sample weights and other information needed for accurate estimation of standard errors. Your selections will be saved to a plan file that you can use in any of the analysis procedures in the Complex Samples Option.
 What would you like to do? Greate a plan file Choose this option if you have sample data but have not created a plan file. File: <a href="mailto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shifto:shi</td>
< <u>Back</u> <u>Next</u> > Finish Cancel Help

- Enter c:\nhis2000_subset.csaplan as the name for the analysis plan file.
- ► Click Next.

sis Preparation Wizard			
ge 1: Design Variables			
his panel you can select variables	that define strata or clusters. A sample we	eight variable mu	st be selected in the first stage.
u can also provide a label for the s	tage that will be used in the output.		
Welcome			
Stage 1	<u>V</u> ariables:		<u>Strata:</u>
Design Variables	Sex [SEX]		🖋 Stratum for variance
Estimation Method	Age [AGE_P]	•	
Summary	Region [REGION]		
Completion	Smoking frequency [
	Vitamin/mineral supp		<u>Clusters:</u>
	V lake any multi-vitam		PSU for variance est
	I ake herbal supple	•	
	Freq vigorous activit		
	Freq strength potivity		
	Pregisteriginaciwicy		Sample Weight:
	Daily activities movi	•	💉 Weight - Final Annu
	Daily activities, lifting		
	Age category [age		
		Chanala	hali 🗌
		Stage La	

The data are obtained using a complex multistage sample. However, for end users, the original NHIS design variables were transformed to a simplified set of design and weight variables whose results approximate those of the original design structures.

- Select *Stratum for variance estimation* as a strata variable.
- Select *PSU for variance estimation* as a cluster variable.
- ► Select *Weight Final Annual* as the sample weight variable.
- ► Click Finish.

Complex Samples Analysis Preparation Wizard

Summary

Figure 13-3 Summary

			Stage 1
Design Variables	Stratification	1	Stratum for variance estimation
	Cluster	1	PSU for variance estimation
Analysis Information	Estimator Assumption		Sampling with replacement

Plan File: c:\nhis2000_subset.csaplan Weight Variable: Weight - Final Annual SRS Estimator: Sampling without replacement

The summary table reviews your analysis plan. The plan consists of one stage with a design of one stratification variable and one cluster variable. With-replacement (WR) estimation is used, and the plan is saved to *c:/nhis2000_subset.csaplan*. You can now use this plan file to process *nhis2000_subset.sav* with Complex Samples analysis procedures.

Preparing for Analysis When Sampling Weights Are Not in the Data File

A loan officer has a collection of customer records, taken according to a complex design; however, the sampling weights are not included in the file. This information is contained in *bankloan_cs_noweights.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. Starting with what she knows about the sampling design, the officer wants to use the Complex Samples Analysis Preparation Wizard to create an analysis plan for this data file so that it can be processed by Complex Samples analysis procedures.

The loan officer knows that the records were selected in two stages, with 15 out of 100 bank branches selected with equal probability and without replacement in the first stage. One hundred customers were then selected from each of those banks with equal probability and without replacement in the second stage, and information on the number of customers at each bank is included in the data file. The first step to creating an analysis plan is to compute the stagewise inclusion probabilities and final sampling weights.

Computing Inclusion Probabilities and Sampling Weights

 To compute the inclusion probabilities for the first stage, from the menus choose: Transform

Compute Variable...

Figure 13-4 Compute Variable dialog box

🗖 Compute Variable 🛛			3
Compute Variable Iarget Variable: inclprob_s1 Type & Label Branch (branch) Number of customers Customer ID (custome Age in years (age) Level of education (ec Years with current emp Years at current addre Household income in t Debt to income ratio (s Credit card debt in thousand Other debt in thousand Previously defaulted [c		Numeric Expression: 0.15	
]
	OK	<u>Paste</u> <u>R</u> eset Cancel Help	

Fifteen out of one hundred bank branches were selected without replacement in the first stage; thus, the probability that a given bank was selected is 15/100 = 0.15.

- ► Type inclprob_s1 as the target variable.
- Type 0.15 as the numeric expression.
- ► Click OK.

Complex Samples Analysis Preparation Wizard

Figure 13	-5	
Compute	Variable	dialog box

🔲 Compute Variable			
Target Variable:		Numeric Expression:	
inclprob_s2	=	100/ncust	~
Tura & Labal			
			\sim
🔗 Branch (branch)		Eurotion aroup:	
Number of customers			
🛛 💑 Customer ID [custome		Arithmetic	H
🔗 🖉 Age in years [age]		CDF & Noncentral CDF	≣
Level of education [ec		Current Date/Time	
Years with current emp		Date Arithmetic	
Years at current addre		Date Creation	
Household income in t			×
Ø Debt to income ratio ()		Eunctions and Special Variab	les:
Credit card debt in the			
Other debt in thousand			
Previously defaulted [c			
inclprob_s1			
[f] (optional case sele	ection c	ondition)	
	OK	Paste <u>R</u> eset Cancel Help	

One hundred customers were selected from each branch in the second stage; thus, the stage 2 inclusion probability for a given customer at a given bank is 100/the number of customers at that bank.

- ▶ Recall the Compute Variable dialog box.
- ► Type inclprob_s2 as the target variable.
- ► Type 100/ncust as the numeric expression.
- ► Click OK.

Figure	13	-6	
Compu	te	Vari	iab

	Compute	Variable	dialog	box
--	---------	----------	--------	-----

🔲 Compute Variable 🗌		
<u>T</u> arget Variable: finalweight	=	Numeric Expression: 1/(inclprob_s1 * inclprob_s2)
Type & Label Type & Label Branch [branch] Number of customers] Customer ID [custome Age in years [age] Level of education [ec Years with current em; Years at current addre Household income in t Debt to income ratio (> Credit card debt in thousand Detto in thousand Previously defaulted [c inclprob_s1	ection c	Image: Second Secon
	OK	Paste Reset Cancel Help

Now that you have the inclusion probabilities for each stage, it's easy to compute the final sampling weights.

- ► Recall the Compute Variable dialog box.
- ► Type finalweight as the target variable.
- ► Type 1/(inclprob_s1 * inclprob_s2) as the numeric expression.
- ► Click OK.

You are now ready to create the analysis plan.

Complex Samples Analysis Preparation Wizard

Using the Wizard

• To prepare a sample using the Complex Samples Analysis Preparation Wizard, from the menus choose:

Analyze Complex Samples Prepare for Analysis...

```
Figure 13-7
```

Analysis Preparation Wizard, Welcome step

nalysis Preparation Wizard	
Welcome to the Analysis Preparation W The Analysis Preparation Wizard helps ; sample weights and other information ne Your selections will be saved to a plan f	izard you describe your complex sample and choose an estimation method. You will be asked to provide seded for accurate estimation of standard errors. ile that you can use in any of the analysis procedures in the Complex Samples Option.
	What would you like to do? • <u>C</u> reate a plan file Choose this option if you have sample data but have not created a plan file. File: c:\bankloan.csaplan Browse • <u>E</u> dit a plan file Choose this option if you want to add, remove, or modify stages of an existing plan. • If you already have a plan file you can skip the Analysis Preparation Wizard and go directly to any of the analysis procedures in the Complex Samples Option to analyze your sample.
	< <u>Back</u> Next > Finish Cancel Help

- Enter c:\bankloan.csaplan as the name for the analysis plan file.
- ► Click Next.

lysis Preparation Wizard			
tage 1: Design Variables			
n this panel you can select variables	that define strata or clusters. A sample we	ight variable mu	ust be selected in the first stage.
ou can also provide a label for the s	tage that will be used in the output.		
Welcome			
Stage 1	Variables:		<u>S</u> trata:
Design Variables	Vumber of customer		
Estimation Method	Age in years [age]	•	
Completion	Level of education [
	Years with current e		Clusters:
	Years at current add		Rianch [branch]
	Household income i		end for the former of
	Debt to income ratio	· · · ·	
	Credit card debt in th		
	Wither debt in thousa		Sample Weight:
	Previously deraulted	•	finalweight [finalweig
	inclored s2 finclored		
	•		
		Stage La	abel
		Stago <u>E</u> t	

Figure 13-8

- ► Select *Branch* as a cluster variable.
- Select *finalweight* as the sample weight variable.
- ► Click Next.

Complex Samples Analysis Preparation Wizard



- ▶ Select Equal WOR as the first stage estimation method.
- ► Click Next.

Itysis Preparation Wizard Stage 1: Size In this panel you specify inclusion pro You can provide a size that is fixed ar	pabilities or population sizes for the currer	nt stage. um basis.
 Welcome Stage 1 Design Variables Estimation Method Size Summary Add Stage 2 Completion 	Variables: ✓ Number of customer ✓ Customer ID [custom ✓ Age in years [age] ↓ Level of education [✓ Years with current add ✓ Years at current add ✓ Household income i ✓ Debt to income ratio ✓ Credit card debt in th ✓ Other debt in thousa ✓ Previously defaulted ✓ inclprob_s2 [inclprob	Units: Inclusion Probabilities Value: Unequal values for strata: Define Eed values from variable: inclprob_s1 [inclprob]

Figure 13-10

- Select Read values from variable and select *inclprob_s1* as the variable containing the first stage inclusion probabilities.
- ► Click Next.

Complex Samples Analysis Preparation Wizard

lysis Preparation Wizard							
)tage 1: Plan Summary Fhis panel summarizes the plan so f you choose not to add a stage th	far. You can ad ne next panel is t	d another st he Completi	age to the plar on panel.	ı.			
Welcome	<u>S</u> ummar	y:					
Design Variables	Stage	Label	Strata	Clusters	Weights	Size	Method
 Estimation Method Size Summary Add Stage 2 Completion 	1	(None)		branch	finalweight	(Read from inclprob_s1)	Equal VVC
	<	hand da an a		1111			>
		want to add s, add stage oose this op mple contai	sapian 1 stage 2? e 2 now otion if the ns another		○ N <u>o</u> , do not a Choose this last stage o	add another sta s option if this is if the sample.	ge now the

Figure 13-11

- ► Select Yes, add stage 2 now.
- ► Click Next, and then click Next in the Design step.

Figure 13-12 Analysis Preparation Wizard, Estimation Method step (stage 2)

Analysis Preparation Wizard	
Stage 2: Estimation Method In this panel you select a method for The estimation method depends on a	estimating standard errors. assumptions about how the sample was drawn.
Stage 1 Design Variables Estimation Method Size Summary Stage 2 Design Variables Estimation Method	Which of the following sample designs should be assumed for estimation? <u>W</u> R (sampling with replacement) If you choose this option you will not be able to add additional stages. Any sample stages after the current stage will be ignored when the data are analyzed.
Summary Add Stage 3	Equal WOR (equal probability sampling without replacement) The next panel will ask you to specify inclusion probabilities or population sizes
Completion	Unequal WOR (unequal probability sampling without replacement) Joint probabilities will be required to analyze sample data. This option is available in stage 1 only.
incomplete section	< <u>B</u> ack <u>N</u> ext > Finish Cancel Help

- ► Select Equal WOR as the second stage estimation method.
- ► Click Next.

Complex Samples Analysis Preparation Wizard

Alysis Preparation Wizard Stage 2: Size In this panel you specify inclusion prob You can provide a size that is fixed acr	abilities or population sizes for the curren oss strata or specify sizes on a per-stratu	ıt stage. ım basis.
Welcome Stage 1 Design Variables Estimation Method Size Summary Stage 2 Design Variables Estimation Method Size Summary Add Stage 3 Completion	Variables: Number of customer Customer ID [custom Age in years [age] Level of education [Years with current e Years at current add Years at current add Debt to income ratio Credit card debt in th Ditter debt in thousa Previously defaulted	Units: Inclusion Probabilities Value: Unequal values for strata: Perine Bead values from variable: inclprob_s2 [inclprob]

Figure 13-13

- ► Select Read values from variable and select *inclprob_s2* as the variable containing the second stage inclusion probabilities.
- ► Click Finish.

Summary

Figure 13-14

Summary table

			Stage 1	Stage 2
Design Variables	Cluster	1	Branch	
Analysis Information	Estimator Assumption		Equal probability sampling without replacement	Equal probability sampling without replacement
	Inclusion Probability		Obtained from variable inclprob_s1	Obtained from variable inclprob_ s2

Plan File: c:\bankloan.csaplan

Weight Variable: finalweight SRS Estimator: Sampling without replacement

The summary table reviews your analysis plan. The plan consists of two stages with a design of one cluster variable. Equal probability without replacement (WOR) estimation is used, and the plan is saved to *c:/bankloan.csaplan*. You can now use this plan file to process *bankloan_noweights.sav* (with the inclusion probabilities and sampling weights you've computed) with Complex Samples analysis procedures.

Related Procedures

The Complex Samples Analysis Preparation Wizard procedure is a useful tool for readying a sample for analysis when you do not have access to the sampling plan file.

• To create a sampling plan file and draw a sample, use the Sampling Wizard.

Complex Samples Frequencies

The Complex Samples Frequencies procedure produces frequency tables for selected variables and displays univariate statistics. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Using Complex Samples Frequencies to Analyze Nutritional Supplement Usage

A researcher wants to study the use of nutritional supplements among U.S. citizens, using the results of the National Health Interview Survey (NHIS) and a previously created analysis plan. For more information, see Using the Complex Samples Analysis Preparation Wizard to Ready NHIS Public Data in Chapter 13 on p. 144.

A subset of the 2000 survey is collected in *nhis2000_subset.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. The analysis plan is stored in *nhis2000_subset.csaplan*. Use Complex Samples Frequencies to produce statistics for nutritional supplement usage.

Running the Analysis

▶ To run a Complex Samples Frequencies analysis, from the menus choose:

Analyze Complex Samples Frequencies...

Figure 14-1

Complex Samples Plan dialog box

Complex Sa	mples Plan 🛛 🛛 🛛 🛛 🛛 🛛 🛛
- Plan	
Eile:	ial\sample_files\nhis2000_subset.csaplan
If you do the Analy Analysis f	not have a plan file for your complex sample you can use rsis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.
Joint Proba	bilities
Joint prot WOR esti	pabilities are required if the plan requests unequal probability mation. Otherwise they are ignored.
💿 Use de	fault file (C:\Program Fi00_subset.sav)
🔵 An ope	n dataset
	nhis2000_subset.sav []
○ <u>C</u> uston	n file
File:	Browse
	Continue Cancel Help

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select *nhis2000_subset.csaplan*.
- ► Click Continue.

Complex Samples Frequencies



- ▶ Select *Vitamin/mineral supplmnts-past 12 m* as a frequency variable.
- Select *Age category* as a subpopulation variable.
- Click Statistics.

Figure 14-3

Frequencies Statistics dialog box

Complex Samples Frequencies: Statistics 🛛 🛛 🔀					
Cells Population size	☑ Iable percent	Continue			
Statistics	Unweighted count	Help			
✓ Confidence interval Level (%): 95	Design effect Square root of design effect				
Coefficient of variation	<u>Cumulative values</u>				
Test of equal cell proportions					

- ► Select Table percent in the Cells group.
- Select Confidence interval in the Statistics group.
- Click Continue.
- ► Click OK in the Frequencies dialog box.

Frequency Table

Figure 14-4

Frequency table for variable/situation

				95% Confide	ence Interval
		Estimate	Standard Error	Lower	Upper
Population Size	Yes	102767095	1185126.709	100435967	105098223
	No	90794234	1094401.949	88641560	92946908
	Total	193561329	1789098.713	190042196	197080462
% of Total	Yes	53.1%	.4%	52.4%	53.8%
	No	46.9%	.4%	46.2%	47.6%
	Total	100.0%	.0%	100.0%	100.0%

Each selected statistic is computed for each selected cell measure. The first column contains estimates of the number and percentage of the population that do or do not take vitamin/mineral supplements. The confidence intervals are nonoverlapping; thus, you can conclude that, overall, more Americans take vitamin/mineral supplements than not.

Complex Samples Frequencies

Frequency by Subpopulation

Figure 14-5

Frequency table by subpopulation

Age					95% Confide	nce Interval
category			Estimate	Standard Error	Lower	Upper
18-24	Population	Yes	10018312	350602.352	9328681.9	10707942
	Size	No	15472368	499182.391	14490483	16454253
		Total	25490680	680732.812	24151688	26829672
	% of Total	Yes	39.3%	1.0%	37.4%	41.2%
		No	60.7%	1.0%	58.8%	62.6%
		Total	100.0%	.0%	100.0%	100.0%
25-44	Population	Yes	39163840	660855.719	37863946	40463734
	Size	No	39503150	645934.187	38232606	40773694
		Total	78666990	961114.325	76776491	80557489
	% of Total	Yes	49.8%	.6%	48.7%	50.9%
		No	50.2%	.6%	49.1%	51.3%
		Total	100.0%	.0%	100.0%	100.0%
45-64	Population	Yes	34154952	598603.728	32977507	35332397
	Size	No	24005512	497723.833	23026496	24984528
		Total	58160464	814680.415	56557999	59762929
	% of Total	Yes	58.7%	.6%	57.5%	60.0%
		No	41.3%	.6%	40.0%	42.5%
		Total	100.0%	.0%	100.0%	100.0%
65+	Population	Yes	19429991	439459.793	18565580	20294402
	Size	No	11813204	314238.078	11195102	12431306
		Total	31243195	587623.439	30087348	32399042
	% of Total	Yes	62.2%	.7%	60.7%	63.6%
		No	37.8%	.7%	36.4%	39.3%
		Total	100.0%	.0%	100.0%	100.0%

When computing statistics by subpopulation, each selected statistic is computed for each selected cell measure by value of *Age category*. The first column contains estimates of the number and percentage of the population of each category that do or do not take vitamin/mineral supplements. The confidence intervals for the table percentages are all nonoverlapping; thus, you can conclude that the use of vitamin/mineral supplements increases with age.

Summary

Using the Complex Samples Frequencies procedure, you have obtained statistics for the use of nutritional supplements among U.S. citizens.

- Overall, more Americans take vitamin/mineral supplements than not.
- When broken down by age category, greater proportions of Americans take vitamin/mineral supplements with increasing age.

Related Procedures

The Complex Samples Frequencies procedure is a useful tool for obtaining univariate descriptive statistics of categorical variables for observations obtained via a complex sampling design.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to set analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples Crosstabs procedure provides descriptive statistics for the crosstabulation of categorical variables.
- The Complex Samples Descriptives procedure provides univariate descriptive statistics for scale variables.
Complex Samples Descriptives

The Complex Samples Descriptives procedure displays univariate summary statistics for several variables. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Using Complex Samples Descriptives to Analyze Activity Levels

A researcher wants to study the activity levels of U.S. citizens, using the results of the National Health Interview Survey (NHIS) and a previously created analysis plan. For more information, see Using the Complex Samples Analysis Preparation Wizard to Ready NHIS Public Data in Chapter 13 on p. 144.

A subset of the 2000 survey is collected in *nhis2000_subset.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. The analysis plan is stored in *nhis2000_subset.csaplan*. Use Complex Samples Descriptives to produce univariate descriptive statistics for activity levels.

Running the Analysis

► To run a Complex Samples Descriptives analysis, from the menus choose:

Analyze Complex Samples Descriptives...

Figure 15-1 DIC

ingulo io i			
Complex Samples	Plan	dialog box	

Complex Sa	mples Plan 🛛 🛛 🖾
Plan	
<u>F</u> ile:	ial\sample_files\nhis2000_subset.csaplan Browse
If you do the Analy Analysis I	not have a plan file for your complex sample you can use vsis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.
Joint Proba	bilities
Joint prol WOR est	babilities are required if the plan requests unequal probability imation. Otherwise they are ignored.
💿 Use de	fault file (C:\Program Fi00_subset.sav)
🔵 An ope	n dataset
	nhis2000_subset.sav []
◯⊆uston	n file
File;	Browse
	Continue Cancel Help

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS, and select *nhis2000_subset.csaplan*.
- ► Click Continue.

Complex Samples Descriptives



- Select Freq vigorous activity (times per wk) through Freq strength activity (times per wk) as measure variables.
- Select *Age category* as a subpopulation variable.
- Click Statistics.

Figure 15-3 *Descriptives Statistics dialog box*

Complex Samples Descriptives: Statistic	CS	×
Summaries		Continue
<u>₩</u> ean	Sum	Cancel
test Test vajue;	t-t <u>e</u> st Test value:	Help
Statistics		
✓ Standard error	Unweighted count	
Con <u>f</u> idence interval	Population size	
Le <u>v</u> el (%): 95	Design effect	
Coefficient of variation	Sguare root of design effect	

- ► Select Confidence interval in the Statistics group.
- Click Continue.
- ► Click OK in the Complex Samples Descriptives dialog box.

Univariate Statistics

Figure 15-4

Univariate statistics

			Standard	95% Con Inter	fidence val
		Estimate	Error	Lower	Upper
Mean	Freq vigorous activity (times per wk)	3.73	.033	3.66	3.79
	Freq moderate activity (times per wk)	4.90	.041	4.82	4.98
	Freq strength activity (times per wk)	3.52	.042	3.43	3.60

Each selected statistic is computed for each measure variable. The first column contains estimates of the average number of times per week that a person engages in a particular type of activity. The confidence intervals for the means are nonoverlapping. Thus, you can conclude that, overall, Americans engage in a strength activity less often

than vigorous activity, and they engage in vigorous activity less often than moderate activity.

Univariate Statistics by Subpopulation

Figure 15-5

Univariate statistics by subpopulation

				Oten devel	95% Con	fidence
Age category			Estimate	Error	Lower	Upper
18-24	Mean	Freq vigorous activity (times per wk)	3.92	.087	3.75	4.09
		Freq moderate activity (times per wk)	5.18	.137	4.91	5.45
		Freq strength activity (times per wk)	3.45	.085	3.28	3.62
25-44	Mean	Freq vigorous activity (times per wk)	3.55	.048	3.46	3.65
		Freq moderate activity (times per wk)	4.73	.056	4.62	4.84
		Freq strength activity (times per wk)	3.28	.052	3.18	3.38
45-64	Mean	Freq vigorous activity (times per wk)	3.79	.063	3.66	3.91
		Freq moderate activity (times per wk)	4.88	.070	4.74	5.02
		Freq strength activity (times per wk)	3.65	.092	3.47	3.84
65+	Mean	Freq vigorous activity (times per wk)	4.18	.111	3.96	4.39
		Freq moderate activity (times per wk)	5.22	.084	5.06	5.39
		Freq strength activity (times per wk)	4.66	.155	4.36	4.97

Each selected statistic is computed for each measure variable by values of *Age category*. The first column contains estimates of the average number of times per week that people of each category engage in a particular type of activity. The confidence intervals for the means allow you to make some interesting conclusions.

- In terms of vigorous and moderate activities, 25–44-year-olds are less active than those 18–24 and 45–64, and 45–64-year-olds are less active than those 65 or older.
- In terms of strength activity, 25–44-year-olds are less active than those 45–64, and 18–24 and 45–64-year-olds are less active than those 65 or older.

Summary

Using the Complex Samples Descriptives procedure, you have obtained statistics for the activity levels of U.S. citizens.

- Overall, Americans spend varying amounts of time at different types of activities.
- When broken down by age, it roughly appears that post-collegiate Americans are initially less active than they were while in school but become more conscientious about exercising as they age.

Related Procedures

The Complex Samples Descriptives procedure is a useful tool for obtaining univariate descriptive statistics of scale measures for observations obtained via a complex sampling design.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to set analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples Ratios procedure provides descriptive statistics for ratios of scale measures.
- The Complex Samples Frequencies procedure provides univariate descriptive statistics of categorical variables.



Complex Samples Crosstabs

The Complex Samples Crosstabs procedure produces crosstabulation tables for pairs of selected variables and displays two-way statistics. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Using Complex Samples Crosstabs to Measure the Relative Risk of an Event

A company that sells magazine subscriptions traditionally sends monthly mailings to a purchased database of names. The response rate is typically low, so you need to find a way to better target prospective customers. One suggestion is to focus mailings on people with newspaper subscriptions, on the assumption that people who read newspapers are more likely to subscribe to magazines.

Use the Complex Samples Crosstabs procedure to test this theory by constructing a two-by-two table of *Newspaper subscription* by *Response* and computing the relative risk that a person with a newspaper subscription will respond to the mailing. This information is collected in *demo_cs.sav* and should be analyzed using the sampling plan file *demo.csplan*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS.

Running the Analysis

 To run a Complex Samples Crosstabs analysis, from the menus choose: Analyze Complex Samples

Crosstabs...

Figure 16-1	
Complex Samples Plan	dialog box

mplex Sa	Imples Plan for Crosstabs Analysis
Plan	
FIGH	
<u>F</u> ile:	\SPSS\Tutorial\sample_files\demo.csplan
If you do the Anal Analysis	not have a plan file for your complex sample you can use ysis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.
Joint Proba	abilities
Joint pro WOR est	babilities are required if the plan requests unequal probability imation. Otherwise they are ignored.
💿 Use de	fault file (C:\Program Fiiles\demo.sav)
🔵 An ope	en dataset
	demo_cs.sav []
<u>○</u> ⊆ustor	n file
Fi[e;	Browse
	Continue Cancel Help

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select *demo.csplan*.
- ► Click Continue.

Complex Samples Crosstabs



- ► Select *Newspaper subscription* as a row variable.
- ► Select *Response* as a column variable.
- ► There is also some interest in seeing the results broken down by income categories, so select *Income category in thousands* as a subpopulation variable.
- Click Statistics.

Figure 16-3

Crosstabs Statistics dialog box

Complex Samples Crosstabs: Sta	atistics	
Cells Population size Population size	Column percent Iable percent	Continue
Statistics	<u>U</u> nweighted count	Help
Confidence interval	Design effect	
Coefficient of variation	Residuals	
Expected values	Adjusted residuals	
Odds ratio Relative risk	Risk differe <u>n</u> ce	
Test of independence of rows ar	nd columns	

- Deselect Population size and select Row percent in the Cells group.
- ▶ Select Odds ratio and Relative risk in the Summaries for 2-by-2 Tables group.
- Click Continue.
- ► Click OK in the Complex Samples Crosstabs dialog box.

These selections produce a crosstabulation table and risk estimate for *Newspaper subscription* by *Response*. Separate tables with results split by *Income category in thousands* are also created.

Crosstabulation

Figure 16-4

Crosstabulation for newspaper subscription by response

Newspaper				Response	
subscription			Yes	No	Total
Yes	% within Newspaper	Estimate	17.2%	82.8%	100.0%
	subscription	Standard Error	1.0%	1.0%	.0%
No	% within Newspaper	Estimate	10.3%	89.7%	100.0%
	subscription	Standard Error	.7%	.7%	.0%
Total	% within Newspaper	Estimate	12.8%	87.2%	100.0%
	subscription	Standard Error	.7%	.7%	.0%

The crosstabulation shows that, overall, few people responded to the mailing. However, a greater proportion of newspaper subscribers responded.

Risk Estimate

Figure 16-5

Risk estimate for newspaper subscription by response

			Estimate
Newspaper subscription	Odds Ratio		1.812
* Response	Relative	For cohort Response = Yes	1.673
	Risk	For cohort Response = No	.923

Statistics are computed only for 2-by-2 tables with all cells observed.

The relative risk is a ratio of event probabilities. The relative risk of a response to the mailing is the ratio of the probability that a newspaper subscriber responds to the probability that a nonsubscriber responds. Thus, the estimate of the relative risk is simply 17.2%/10.3% = 1.673. Likewise, the relative risk of nonresponse is the ratio of the probability that a subscriber does not respond to the probability that a nonsubscriber does not respond to the probability that a nonsubscriber does not respond to the probability that a nonsubscriber does not respond. Your estimate of this relative risk is 0.923. Given these results, you can estimate that a newspaper subscriber is 1.673 times as likely to respond to the mailing as a nonsubscriber, or 0.923 times as likely as a nonsubscriber not to respond.

The odds ratio is a ratio of event odds. The odds of an event is the ratio of the probability that the event occurs to the probability that the event does not occur. Thus, the estimate of the odds that a newspaper subscriber responds to the mailing is 17.2%/82.8% = 0.208. Likewise, the estimate of the odds that a nonsubscriber responds is 10.3%/89.7% = 0.115. The estimate of the odds ratio is therefore 0.208/0.115 = 1.812 (note there is some rounding error in the intervening steps). The

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odds ratio is also the ratio of the relative risk of responding to the relative risk of not responding, or 1.673/0.923 = 1.812.

Odds Ratio versus Relative Risk

Since it is a ratio of ratios, the odds ratio is very difficult to interpret. The relative risk is easier to interpret, so the odds ratio alone is not very helpful. However, there are certain commonly occurring situations in which the estimate of the relative risk is not very good, and the odds ratio can be used to approximate the relative risk of the event of interest. The odds ratio should be used as an approximation of the relative risk of the event of interest when both of the following conditions are met:

- The probability of the event of interest is small (< 0.1). This condition guarantees that the odds ratio will make a good approximation to the relative risk. In this example, the event of interest is a response to the mailing.
- The design of the study is case control. This condition signals that the usual estimate of the relative risk will likely not be good. A case-control study is retrospective, most often used when the event of interest is unlikely or when the design of a prospective experiment is impractical or unethical.

Neither condition is met in this example, since the overall proportion of respondents was 12.8% and the design of the study was not case control, so it's safer to report 1.673 as the relative risk, rather than the value of the odds ratio.

Complex Samples Crosstabs

Risk Estimate by Subpopulation

Figure 16-6

Risk estimate for newspaper subscription by response, controlling for income category

Income category				Estimate
Under \$25	Newspaper	Odds Ratio		2.712
	subscription *	Relative	For cohort Response = Yes	2.241
	Response	Risk	For cohort Response = No	.826
\$25 - \$49	Newspaper	Odds Ratio		1.794
	subscription *	Relative	For cohort Response = Yes	1.645
	Response	Risk	For cohort Response = No	.917
\$50 - \$74	Newspaper	Odds Ratio		1.168
	subscription *	Relative	For cohort Response = Yes	1.152
	Response	Risk	For cohort Response = No	.986
\$75+	Newspaper	Odds Ratio		1.242
	subscription *	Relative	For cohort Response = Yes	1.227
	Response	Risk	For cohort Response = No	.988

Statistics are computed only for 2-by-2 tables with all cells observed.

Relative risk estimates are computed separately for each income category. Note that the relative risk of a positive response for newspaper subscribers appears to gradually decrease with increasing income, which indicates that you may be able to further target the mailings.

Summary

Using Complex Samples Crosstabs risk estimates, you found that you can increase your response rate to direct mailings by targeting newspaper subscribers. Further, you found some evidence that the risk estimates may not be constant across *Income category*, so you may be able to increase your response rate even more by targeting lower-income newspaper subscribers.

Related Procedures

The Complex Samples Crosstabs procedure is a useful tool for obtaining descriptive statistics of the crosstabulation of categorical variables for observations obtained via a complex sampling design.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to set analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples Frequencies procedure provides univariate descriptive statistics of categorical variables.

Complex Samples Ratios

The Complex Samples Ratios procedure displays univariate summary statistics for ratios of variables. Optionally, you can request statistics by subgroups, defined by one or more categorical variables.

Using Complex Samples Ratios to Aid Property Value Assessment

A state agency is charged with ensuring that property taxes are fairly assessed from county to county. Taxes are based on the appraised value of the property, so the agency wants to track property values across counties to be sure that each county's records are equally up-to-date. Since resources for obtaining current appraisals are limited, the agency chose to employ complex sampling methodology to select properties.

The sample of properties selected and their current appraisal information is collected in *property_assess_cs_sample.sav*, found in the *tutorial**sample_files*\ subdirectory of the directory in which you installed SPSS. Use Complex Samples Ratios to assess the change in property values across the five counties since the last appraisal.

Running the Analysis

 To run a Complex Samples Ratios analysis, from the menus choose: Analyze Complex Samples

Ratios...

Figure 17-1 Complex Samples Plan dialog box

omplex Sa	mples Plan for Ratios Analysis
Plan	
<u>F</u> ile:	rial\sample_files\property_assess.csplan
If you do the Analy Analysis f	not have a plan file for your complex sample you can use sis Preparation Wizard to create one. Choose Prepare For rom the Complex Samples menu to access the wizard.
Joint Proba	bilities
Joint prof WOR esti	pabilities are required if the plan requests unequal probability mation. Otherwise they are ignored. fault file (based on name of plan file) n dataset
An ope	
	LJ
○ <u>C</u> uston	file
File:	Browse

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select property_assess.csplan.
- ► Click Continue.

Complex Samples Ratios





- ▶ Select *Current value* as a numerator variable.
- ▶ Select *Value at last appraisal* as the denominator variable.
- Select *County* as a subpopulation variable.
- Click Statistics.

Figure 17-3 Ratios Statistics dialog box

Complex Samples Ratios: Statistics		
Statistics ✓ Standard error ✓ Confidence interval Level (%): 95 Coefficient of variation	 ✓ Unweighted count ✓ Population size Design effect Sguare root of design effect 	Continue Cancel Help
⊻ <u>t</u> -test Test vajue: 1.3		

- ► Select Confidence interval, Unweighted count, and Population size in the Statistics group.
- Select t-test and enter 1.3 as the test value.
- Click Continue.
- Click OK in the Complex Samples Ratios dialog box.

Ratios

Figure 17-4 Ratios table

			Ratio	Standard	95% Confidence Interval		
County	Numerator	Denominator	Estimate	Error	Lower	Upper	Τe
Eastern	Current value	Value at last appraisal	1.381	.068	1.236	1.525	
Central	Current value	Value at last appraisal	1.364	.064	1.227	1.502	
Western	Current value	Value at last appraisal	1.524	.053	1.410	1.638	
Northern	Current value	Value at last appraisal	1.277	.032	1.208	1.346	
Southern	Current value	Value at last appraisal	1.195	.029	1.134	1.256	

The default display of the table is very wide, so you will need to pivot it for a better view.

Pivoting the Ratios Table

► Double-click the table to activate it.

Complex Samples Ratios

- From the Viewer menus choose:
 Pivot
 Pivoting Trays
- Drag *Numerator* and then *Denominator* from the row to the layer.
- ▶ Drag *County* from the row to the column.
- ▶ Drag *Statistics* from the column to the row.
- ► Close the pivoting trays window.

Pivoted Ratios Table

Figure 17-5

Pivoted ratios table

Numerator: Current value

Denominator: Value at last appraisal

		County				
		Eastern	Central	Western	Northern	Southern
Ratio Estimate		1.381	1.364	1.524	1.277	1.195
Standard Error		.068	.064	.053	.032	.029
95% Confidence	Lower	1.236	1.227	1.410	1.208	1.134
Interval	Upper	1.525	1.502	1.638	1.346	1.256
Hypothesis Test	Test Value	1.3	1.3	1.3	1.3	1.3
	t	1.191	.997	4.201	702	-3.646
	df	15	15	15	15	15
	Sig.	.252	.334	.001	.493	.002
Unweighted Count		168	179	202	205	220

The ratios table is now pivoted so that statistics are easier to compare across counties.

- The ratio estimates range from a low of 1.195 in the Southern county to a high of 1.524 in the Western county.
- There is also quite a bit of variability in the standard errors, which range from a low of 0.029 in the Southern county to 0.068 in the Eastern county.
- Some of the confidence intervals do not overlap; thus, you can conclude that the ratios for the Western county are higher than the ratios for the Northern and Southern counties.

Finally, as a more objective measure, note that the significance values of the *t* tests for the Western and Southern counties are less than 0.05. Thus, you can conclude that the ratio for the Western county is greater than 1.3 and the ratio for the Southern county is less than 1.3.

Summary

Using the Complex Samples Ratios procedure, you have obtained various statistics for the ratios of *Current value* to *Value at last appraisal*. The results suggest that there may be certain inequities in the assessment of property taxes from county to county, namely:

- The ratios for the Western county are high, indicating that their records are not as up-to-date as other counties with respect to the appreciation of property values. Property taxes are probably too low in this county.
- The ratios for the Southern county are low, indicating that their records are more up-to-date than the other counties with respect to the appreciation of property values. Property taxes are probably too high in this county.
- The ratios for the Southern county are lower than those of the Western county but are still within the objective goal of 1.3.

Resources used to track property values in the Southern county will be reassigned to the Western county to bring these counties' ratios in line with the others and with the goal of 1.3.

Related Procedures

The Complex Samples Ratios procedure is a useful tool for obtaining univariate descriptive statistics of the ratio of scale measures for observations obtained via a complex sampling design.

The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.

- The Complex Samples Analysis Preparation Wizard is used to set analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples Descriptives procedure provides descriptive statistics for scale variables.



Complex Samples General Linear Model

The Complex Samples General Linear Model (CSGLM) procedure performs linear regression analysis, as well as analysis of variance and covariance, for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Using Complex Samples General Linear Model to Fit a Two-Factor ANOVA

A grocery store chain surveyed a set of customers concerning their purchasing habits, according to a complex design. Given the survey results and how much each customer spent in the previous month, the store wants to see if the frequency with which customers shop is related to the amount they spend in a month, controlling for the gender of the customer and incorporating the sampling design.

This information is collected in *grocery_lmonth_sample.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. Use the Complex Samples General Linear Model procedure to perform a two-factor (or two-way) ANOVA on the amounts spent.

Running the Analysis

 To run a Complex Samples General Linear Model analysis, from the menus choose: Analyze Complex Samples

General Linear Model...

Complex Samples General Linear Model

Figure 18-1	
Complex Samples Plan dialog box	

Complex Sa	imples Plan for General Linear Model 🛛 🛛 🛛					
- Plan						
<u>F</u> ile:	PSS\Tutorial\sample_files\grocery.csplan					
If you do the Analy Analysis) not have a plan file for your complex sample you can use ysis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.					
Joint Proba	abilities					
Joint pro WOR est	Joint probabilities are required if the plan requests unequal probability WOR estimation. Otherwise they are ignored.					
💿 Use de	fault file (C:\Program Files\SPSS\Tutorial\sample_files\grocery.:					
◯ An open dataset						
	n file					
File;	Browse					
	Continue Cancel Help					

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select grocery.csplan.
- ► Click Continue.

Figure 18-2	
General Linear	Model dialog box

Complex Samples General Linear Model 🛛 🛛 🛛 🖉					
Complex Samples Gene Variables: Store ID [storeid] Health food store [hlt Size of store [size] Store organization [o Number of customer Customer ID [custid] Gender [gender] Vegetarian [veg] Shopping style [style] Inclusion (Selection) Cumulative Sampling	ral Linear A	Model Dependent Variable: Amount spent [amts Eactors: Who shopping for [s Use coupons [useco Covariates:	Model Statistics Hypothesis Tests Estimated Means Sav <u>e</u> Options		
	Subpopul	lation Vgriable: Category:			
OK <u>P</u> aste	<u>R</u> eset	Cancel Help			

- Select *Amount spent* as the dependent variable.
- ► Select *Who shopping for* and *Use coupons* as factors.
- ► Click Model.

Complex Samples General Linear Model



Complex Samples General Linear Model: Model	×
Specify Model Effects	
◯ <u>M</u> ain effects	
⊙ Custom	
Eactors and Covariates:	•
Term:	
Continue Cancel H	elp

- Choose to build a Custom model.
- Select Main effects as the type of term to build and select *shopfor* and *usecoup* as model terms.
- Select Interaction as the type of term to build and add the *shopfor*usecoup* interaction as a model term.
- ► Click Continue.
- Click Statistics in the General Linear Model dialog box.

Figure 18-4

General Linear Mod	el Statistics	dialog box
--------------------	---------------	------------

C	Complex Samples General Linear Model: Statistics 🛛 🛛 🛛 🛛				
ſ	Model Parameters				
	✓ Estimate	Covariances of parameter estimates			
	Standard error	Correlations of parameter estimates			
	Confidence interval	Design effect			
	t-test	Sguare root of design effect			
	<u>M</u> odel fit <u>P</u> opulation means of depend S <u>a</u> mple design information	lent variable and covariates			
		Continue Cancel Help			

- Select Estimate, Standard error, Confidence interval, and Design effect in the Model Parameters group.
- ► Click Continue.
- ► Click Estimated Means in the General Linear Model dialog box.

Complex Samples General Linear Model

actors and mitoractions.	Display Means For:			
shopfor	Term	Contrast	Reference Catego	лу
usecoup	shopfor	Simple	3	_
shoptor"usecoup	usecoup	Simple		~
	shopfor*usecoup		1 No	
	•		2 From newspaper 3 From mailings 4 From both	
	Display mean for over	all population		

Figure 18-5 General Linear Model Estimated Means dialog box

- ▶ Choose to display means for *shopfor*, *usecoup*, and the *shopfor*usecoup* interaction.
- ► Select a Simple contrast and 3 Self and family as the reference category for *shopfor*. Note that, once selected, the category appears as "3" in the dialog box.
- Select a Simple contrast and 1 No as the reference category for *usecoup*.
- ► Click Continue.
- Click OK in the General Linear Model dialog box.

Model Summary

Figure 18-6 R-square statistic



R Square, the coefficient of determination, is a measure of the strength of the model fit. It shows that about 60% of the variation in *Amount spent* is explained by the model, which gives you good explanatory ability. You may still want to add other predictors to the model to further improve the fit.

Tests of Model Effects

Figure 18-7

Tests of between-subjects effects

Source	df1	df2	Wald F	Sig.
(Corrected Model)	11.000	3.000	127.231	.001
(Intercept)	1.000	13.000	6321.597	.000
shopfor	2.000	12.000	643.593	.000
usecoup	3.000	11.000	87.453	.000
shopfor * usecoup	6.000	8.000	10.688	.002

 a. Model: Amount spent = (Intercept) + shopfor + usecoup + shopfor * usecoup

Each term in the model, plus the model as a whole, is tested for whether the value of its effect equals 0. Terms with significance values of less than 0.05 have some discernible effect. Thus, all model terms contribute to the model.

Complex Samples General Linear Model

Parameter Estimates

Figure 18-8

Parameter estimates

		544	95% Cor Inte	nfidence rval	Design
Parameter	Estimate	Error	Lower	Upper	Effect
(Intercept)	518.249	11.731	492.905	543.592	1.387
[shopfor=1]	-174.757	10.762	-198.0	-151.51	.950
[shopfor=2]	-129.443	11.455	-154.2	-104.70	.925
[shopfor=3]	.000 ^a				
[usecoup=1]	-140.838	10.180	-162.8	-118.85	.649
[usecoup=2]	-63.026	13.195	-91.531	-34.520	.940
[usecoup=3]	-31.375	9.726	-52.387	-10.363	.564
[usecoup=4]	.000 ^a				
[shopfor=1] * [usecoup=1]	41.693	11.170	17.562	65.824	.606
[shopfor=1] * [usecoup=2]	44.505	18.068	5.471	83.539	1.413
[shopfor=1] * [usecoup=3]	9.204	11.057	-14.684	33.092	.594
[shopfor=1] * [usecoup=4]	.000 ^a				
[shopfor=2] * [usecoup=1]	89.211	10.967	65.518	112.903	.533
[shopfor=2] * [usecoup=2]	54.267	14.949	21.972	86.562	.836
[shopfor=2] * [usecoup=3]	17.884	13.753	-11.828	47.595	.797
[shopfor=2] * [usecoup=4]	.000ª				
[shopfor=3] * [usecoup=1]	.000 ^a				
[shopfor=3] * [usecoup=2]	.000 ^a				
[shopfor=3] * [usecoup=3]	.000 ^a				
[shopfor=3] * [usecoup=4]	.000 ^a				

a. Set to zero because this parameter is redundant.

b. Model: Amount spent = (Intercept) + shopfor + usecoup + shopfor * usecoup

The parameter estimates show the effect of each predictor on *Amount spent*. The value of 518.249 for the intercept term indicates that the grocery chain can expect a shopper with a family who uses coupons from the newspaper and targeted mailings to spend \$518.25, on average. You can tell that the intercept is associated with these factor levels because those are the factor levels whose parameters are redundant.

- The shopfor coefficients suggest that among customers who use both mailed coupons and newspaper coupons, those without family tend to spend less than those with spouses, who in turn spend less than those with dependents at home. Since the tests of model effects showed that this term contributes to the model, these differences are not due to chance.
- The usecoup coefficients suggest that spending among customers with dependents at home decreases with decreased coupon usage. There is a moderate amount of uncertainty in the estimates, but the confidence intervals do not include 0.

- The interaction coefficients suggest that customers who do not use coupons or only clip from the newspaper and do not have dependents tend to spend more than you would otherwise expect. If any portion of an interaction parameter is redundant, the interaction parameter is redundant.
- The deviation in the values of the design effects from 1 indicate that some of the standard errors computed for these parameter estimates are larger than those you would obtain if you assumed that these observations came from a simple random sample, while others are smaller. It is vitally important to incorporate the sampling design information in your analysis because you might otherwise infer, for example, that the *usecoup=3* coefficient is not different from 0!

The parameter estimates are useful for quantifying the effect of each model term, but the estimated marginal means tables can make it easier to interpret the model results.

Estimated Marginal Means

Figure 18-9

Estimated marginal means by levels of Who shopping for

			95% Confidence Interval		
Who shopping for	Mean	Std. Error	Lower	Upper	
Self	308.5326	3.94286	300.0145	317.0506	
Self and spouse	370.3361	4.87908	359.7955	380.8767	
Self and family	459.4392	7.19769	443.8895	474.9888	

This table displays the model-estimated marginal means and standard errors of *Amount spent* at the factor levels of *Who shopping for*. This table is useful for exploring the differences between the levels of this factor. In this example, a customer who shops for him- or herself is expected to spend about \$308.53, while a customer with a spouse is expected to spend \$370.33, and a customer with dependents will spend \$459.44. To see whether this represents a real difference or is due to chance variation, look at the test results.

Figure 18-10)					
Individual tes	st results	for e	stimated	marginal	means d	of gender

Who shopping for Simple Contrast ^a	Contrast Estimate	Hypothesized Value	Difference (Estimate - Hypothesized)	Std. Error	df1	df2	Wald F	Sig.
Level Self vs. Level Self and family	-150.907	.000	-150.907	4.903	1.000	13.00	947.41	.000
Level Self and spouse vs. Level Self and family	-89.103	.000	-89.103	5.903	1.000	13.00	227.84	.000

a. Reference Category = Self and family

The individual tests table displays two simple contrasts in spending.

- The contrast estimate is the difference in spending for the listed levels of Who shopping for.
- The hypothesized value of 0.00 represents the belief that there is no difference in spending.
- The Wald *F* statistic, with the displayed degrees of freedom, is used to test whether the difference between a contrast estimate and hypothesized value is due to chance variation.
- Since the significance values are less than 0.05, you can conclude that there are differences in spending.

The values of the contrast estimates are different from the parameter estimates. This is because there is an interaction term containing the *Who shopping for* effect. As a result, the parameter estimate for *shopfor=1* is a simple contrast between the levels *Self* and *Self and Family* at the level *From both* of the variable *Use coupons*. The contrast estimate in this table is averaged over the levels of *Use coupons*.

Figure 18-11 *Overall test results for estimated marginal means of gender*

df1	df2	Wald F	Sig.
2.000	12.000	643.593	.000

The overall test table reports the results of a test of all of the contrasts in the individual test table. Its significance value of less than 0.05 confirms that there is a difference in spending among the levels of *Who shopping for*.

Figure 18-12	
Estimated marginal means by levels of shopping st	yle

			95% Confidence Interval		
Use coupons	Mean	Std. Error	Lower	Upper	
No	319.6455	6.51429	305.5722	333.7188	
From newspaper	386.7469	4.32295	377.4077	396.0861	
From mailings	394.5028	5.54218	382.5297	406.4760	
From both	416.8486	6.51260	402.7790	430.9182	

This table displays the model-estimated marginal means and standard errors of *Amount spent* at the factor levels of *Use coupons*. This table is useful for exploring the differences between the levels of this factor. In this example, a customer who does not use coupons is expected to spend about \$319.65, and those who do use coupons are expected to spend considerably more.

Figure 18-13

Individual test results for estimated marginal means of shopping style

Use coupons Simple Contrast ^a	Contrast Estimate	Hypothesized Value	Difference (Estimate - Hypothesized)	Std. Error	df1	df2	Wald F	Sig.
Level From newspaper vs. Level No	67.101	.000	67.101	6.537	1.000	13.000	105.35	.000
Level From mailings vs. Level No	74.857	.000	74.857	5.875	1.000	13.000	162.33	.000
Level From both vs. Level No	97.203	.000	97.203	5.603	1.000	13.000	300.92	.000

a. Reference Category = No

The individual tests table displays three simple contrasts, comparing the spending of customers who do not use coupons to those who do.

Since the significance values of the tests are less than 0.05, you can conclude that customers who use coupons tend to spend more than those who don't.

Figure 18-14

Overall test results for estimated marginal means of shopping style

df1	df2	Wald F	Sig.
3.000	11.000	87.453	.000

The overall test table reports the results of a test of all the contrasts in the individual test table. Its significance value of less than 0.05 confirms that there is a difference in spending among the levels of *Use coupons*. Note that the overall tests for *Use*

Complex Samples General Linear Model

coupons and *Who shopping for* are equivalent to the tests of model effects because the hypothesized contrast values are equal to 0.

95% Confidence Interval Who shopping for Use coupons Mean Std. Error Lower Upper Self No 244.3471 6.00949 231.3644 257.3298 From newspaper 324,9708 5.94134 312,1353 337.8063 From mailings 312.4410 321.3207 4.11028 330.2005 From both 343.4916 6.57845 329.2797 357.7034 Self and spouse No 337.1783 7.12181 321.7925 352.5640 From newspaper 380.0468 7.91038 362.9574 397.1361 From mailings 375.3141 6.22468 361.8665 388.7617 From both 388.8054 7.12101 373.4214 404.1894 Self and family No 377.4111 11.58215 352.3894 402.4328 From newspaper 455.2232 6.14420 441.9494 468.4969 From mailings 486.8736 10.76529 463.6166 510.1306 From both 518.2488 11.73120 492,9050 543,5925

Estimated marginal means by levels of gender by shopping style

This table displays the model-estimated marginal means, standard errors, and confidence intervals of *Amount spent* at the factor combinations of *Who shopping for* and *Use coupons*. This table is useful for exploring the interaction effect between these two factors that was found in the tests of model effects.

Summary

In this example, the estimated marginal means revealed differences in spending between customers at varying levels of Who shopping for and Use coupons. The tests of model effects confirmed this, as well as the fact that there appears to be a Who shopping for *Use coupons interaction effect. The model summary table revealed that the present model explains somewhat more than half of the variation in the data and could likely be improved by adding more predictors.

Related Procedures

Figure 18-15

The Complex Samples General Linear Model procedure is a useful tool for modeling a scale variable when the cases have been drawn according to a complex sampling scheme.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to specify analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples Logistic Regression procedure allows you to model a categorical response.
- The Complex Samples Ordinal Regression procedure allows you to model an ordinal response.



Complex Samples Logistic Regression

The Complex Samples Logistic Regression procedure performs logistic regression analysis on a binary or multinomial dependent variable for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Using Complex Samples Logistic Regression to Assess Credit Risk

If you are a loan officer at a bank, you want to be able to identify characteristics that are indicative of people who are likely to default on loans and then use those characteristics to identify good and bad credit risks.

Suppose that a loan officer has collected past records of customers given loans at several different branches, according to a complex design. This information is contained in *bankloan_cs.sav*, found in the *\tutorial\sample_files* subdirectory of the directory in which you installed SPSS. The officer wants to see if the probability with which a customer defaults is related to age, employment history, and amount of credit debt, incorporating the sampling design.

Running the Analysis

 To create the logistic regression model, from the menus choose: Analyze Complex Samples Logistic Regression...

199

Figure 19-1			
Complex Samples	Plan	dialog	box

	1 0	
Complex Sa	mples Plan for Logistic Regression	•
- Plan		
Eile:	SS\Tutorial\sample_files\bankloan.csplan Browse	
If you do the Analy: Analysis fr	not have a plan file for your complex sample you can use sis Preparation Wizard to create one. Choose Prepare For rom the Complex Samples menu to access the wizard.	
Joint Probat	bilities	
Joint prob WOR estir	abilities are required if the plan requests unequal probability mation. Otherwise they are ignored.	
⊙ Use <u>d</u> ef	ault file (based on name of plan file)	
🔿 An oper	n dataset	
	[]	
<u>○</u> custom	file	
File:	Browse	
	Continue Cancel Help	

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select *bankloan.csaplan*.
- ► Click Continue.
Complex Samples Logistic Regression

Figure 19-2 *Logistic Regression dialog box*

omplex Samples Logis	tic Regress	ion	
⊻ariables:		Dependent Variable:	
💑 Branch [branch]	•	💑 Previously defaulted	Model
Number of customer Sustomer ID [custom		Reference Category	<u>S</u> tatistics
		Eactors:	Hypothesis Tests
		Level of education [Odds Ratios
			Sav <u>e</u>
			Options
		Lovariates:	
	4	Years with current e	
	Subpopu	lation	٦
		V <u>a</u> riable:	
		Category:	
OK Paste	<u>R</u> eset	Cancel Help	

- ► Select *Previously defaulted* as the dependent variable.
- ► Select *Level of education* as a factor.
- Select *Age in years* through *Other debt in thousands* as covariates.
- ► Select *Previously defaulted* and click Reference Category.

Figure 19-3 Logistic Regression Reference Category dialog box

Complex Samples Logistic Regression: Reference Category	· · · · · · · · · · · · · · · · · · ·
Reference Category	
◯ <u>H</u> ighest value	
<u>○</u> <u>C</u> ustom	
⊻alue:	
Continue Cancel Help	

► Select Lowest value as the reference category.

This sets the "did not default" category as the reference category; thus, the odds ratios reported in the output will have the property that increasing odds ratios correspond to increasing probability of default.

- ► Click Continue.
- Click Statistics in the Logistic Regression dialog box.

Complex Samples Logistic Regression

Figure 19-4

ΟХ

Complex Samples Logistic Reg	gression: Statistics	×
← Model Fit		
✓ Pseudo R-square		
Classification table		
Parameters		
	Covariances of parameter estimates	
Exponentiated estimate	Correlations of parameter estimates	
✓ Standard error	Design effect	
Confidence interval	Sguare root of design effect	
t-test		
Summary statistics for model v	ariables	
Sample design information		
	Continue Cancel Help]

- ► Select Classification table in the Model Fit group
- Select Estimate, Exponentiated estimate, Standard error, Confidence interval, and Design effect in the Parameters group.
- ► Click Continue.
- ► Click Odds Ratios in the Logistic Regression dialog box.

Figure 19-5

Complex Samples Logist	tic Regress	ion: Odds Ratios	
<u>Factors:</u>		Odds Ratios for Comparing Factor	Levels:
Level of education [Factor	Reference Category
		Level of education [ed]	(Highest value)
	•		
<u>C</u> ovariates:		Odds <u>R</u> atios for Change in Covaria	ate Values:
🛛 🔗 Age in years [age] 📐		Covariate	Units of Change
Years with current ϵ		Years with current employer [e	1
Years at current ad		Debt to income ratio (x100) [deb	1
🖉 Household income 🦳			
🔹 🔗 Debt to income ratio 🗸			
<pre></pre>			
		,	
One set of odds ratios is prod the model are evaluated at th	luced for eacl ieir highest let	n variable in the Odds Ratios grids. vels; all other covariates are evalu	. For each set, all other factors in ated at their means.
		Continue	Cancel Help

Logistic Regression Odds Ratios dialog box

- Choose to create odds ratios for the factor *ed* and the covariates *employ* and *debtinc*.
- ► Click Continue.
- ► Click OK in the Logistic Regression dialog box.

Pseudo R-Squares

Figure 19-6 Pseudo R-square statistics

Cox and Snell	.330
Nagelkerke	.451
McFadden	.304

Dependent Variable: Previously defautted (reference category = No) Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

Complex Samples Logistic Regression

In the linear regression model, the coefficient of determination, R^2 , summarizes the proportion of variance in the dependent variable associated with the predictor (independent) variables, with larger R^2 values indicating that more of the variation is explained by the model, to a maximum of 1. For regression models with a categorical dependent variable, it is not possible to compute a single R^2 statistic that has all of the characteristics of R^2 in the linear regression model, so these approximations are computed instead. The following methods are used to estimate the coefficient of determination.

- Cox and Snell's R²(Cox and Snell, 1989) is based on the log likelihood for the model compared to the log likelihood for a baseline model. However, with categorical outcomes, it has a theoretical maximum value of less than 1, even for a "perfect" model.
- Nagelkerke's R²(Nagelkerke, 1991) is an adjusted version of the Cox & Snell *R*-square that adjusts the scale of the statistic to cover the full range from 0 to 1.
- McFadden's R²(McFadden, 1974) is another version, based on the log-likelihood kernels for the intercept-only model and the full estimated model.

What constitutes a "good" R^2 value varies between different areas of application. While these statistics can be suggestive on their own, they are most useful when comparing competing models for the same data. The model with the largest R^2 statistic is "best" according to this measure.

Classification

Figure 19-7 Classification table

	Predicted					
Observed	No	Yes	Percent Correct			
No	188289.667	31871.267	85.5%			
Yes	49970.600	77675.133	60.9%			
Overall Percent	68.5%	31.5%	76.5%			

Dependent Variable: Previously defaulted (reference category = No) Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt The classification table shows the practical results of using the logistic regression model. For each case, the predicted response is *Yes* if that case's model-predicted logit is greater than 0. Cases are weighted by *finalweight*, so that the classification table reports the expected model performance in the population.

- Cells on the diagonal are correct predictions.
- Cells off the diagonal are incorrect predictions.

Based upon the cases used to create the model, you can expect to correctly classify 85.5% of the non-defaulters in the population using this model. Likewise, you can expect to correctly classify 60.9% of the defaulters. Overall, you can expect to classify 76.5% of the cases are classified correctly; however, because this table was constructed with the cases used to create the model, these estimates are likely to be overly optimistic.

Tests of Model Effects

Figure 19-8

Tests of between-subjects effects

Source	df1	df2	Wald F	Sig.
(Corrected Model)	11.000	4.000	14.669	.010
(Intercept)	1.000	14.000	5.777	.031
ed	4.000	11.000	1.683	.224
age	1.000	14.000	5.352	.036
employ	1.000	14.000	88.244	.000
address	1.000	14.000	1.123	.307
income	1.000	14.000	.007	.932
debtinc	1.000	14.000	27.632	.000
creddebt	1.000	14.000	33.402	.000
othdebt	1.000	14.000	.709	.414

Dependent Variable: Previously defaulted (reference category = No)

Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

Each term in the model, plus the model as a whole, is tested for whether its effect equals 0. Terms with significance values less than 0.05 have some discernable effect. Thus, *age*, *employ*, *debtinc*, and *creddebt* contribute to the model, while the other main effects do not. In a further analysis of the data, you would probably remove *ed*, *address*, *income*, and *othdebt* from model consideration.

Complex Samples Logistic Regression

Parameter Estimates

Figure 19-9

Parameter estimates

Previously			Std.	95% Cor Inte	nfidence rval	Design		95% Cor Interv Exp	nfidence al for (B)
defaulted	Parameter	в	Error	Lower	Upper	Effect	Exp(B)	Lower	Upper
Yes	(Intercept)	-1.140	.399	-1.995	284	.665	.320	.136	.753
	[ed=1]	.720	.340	010	1.449	.862	2.054	.990	4.259
	[ed=2]	.684	.371	112	1.481	1.247	1.983	.894	4.397
	[ed=3]	.518	.307	140	1.177	.813	1.679	.869	3.244
	[ed=4]	.789	.302	.142	1.437	.817	2.202	1.152	4.208
	[ed=5]	.000 ^a					1.000		
	age	023	.010	043	002	.418	.978	.958	.998
	employ	225	.024	277	174	1.200	.798	.758	.840
	address	028	.026	085	.029	.651	.972	.919	1.029
	income	.000	.003	007	.006	1.410	1.000	.993	1.006
	debtinc	.095	.018	.056	.134	1.222	1.100	1.058	1.143
	creddebt	.493	.085	.310	.676	1.373	1.637	1.363	1.966
	othdebt	.026	.031	041	.094	1.219	1.027	.960	1.098

Dependent Variable: Previously defaulted (reference category = No)

Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

a. Set to zero because this parameter is redundant.

The parameter estimates table summarizes the effect of each predictor. Note that parameter values affect the likelihood of the "did default" category relative to the "did not default" category. Thus, parameters with positive coefficients increase the likelihood of default, while parameters with negative coefficients decrease the likelihood of default.

The meaning of a logistic regression coefficient is not as straightforward as that of a linear regression coefficient. While *B* is convenient for testing the model effects, Exp(B) is easier to interpret. Exp(B) represents the ratio change in the odds of the event of interest attributable to a one-unit increase in the predictor for predictors that are not part of interaction terms. For example, Exp(B) for *employ* is equal to 0.798, which means that the odds of default for people who have been with their current employer for two years are 0.798 times the odds of default for those who have been with their current employer for one year, all other things being equal.

The design effects indicate that some of the standard errors computed for these parameter estimates are larger than those you would obtain if you assumed that these observations came from a simple random sample, while others are smaller. It is vitally important to incorporate the sampling design information in your analysis because you might otherwise infer, for example, that the age coefficient is no different from 0!

Odds Ratios

Figure 19-10

Odds ratios for level of education

		Previously		95% Cor Inter	nfidence rval
		defaulted	Odds Ratio	Lower	Upper
Level of education	Did not complete high school vs. Post-undergraduate degree	Yes	2.054	.990	4.259
	High school degree vs.	Yes	1.983	.894	4.397
	Some college vs.	Yes	1.679	.869	3.244
	College degree vs.	Yes	2.202	1.152	4.208

Dependent Variable: Previously defaulted (reference category = No) Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

a. Factors and covariates used in the computation are fixed at the following values: Level of education=Post-undergraduate degree; Age in years=34.19; Years with current employer=6.99; Years at current address=6.32; Household income in thousands=60.1581; Debt to income ratio (x100)=9.9341; Credit card debt in thousands=1.9764; Other debt in thousands=3.9164

This table displays the odds ratios of *Previously defaulted* at the factor levels of *Level* of education. The reported values are the ratios of the odds of default for *Did not* complete high school through *College degree*, compared to the odds of default for *Post-undergraduate degree*. Thus, the odds ratio of 2.054 in the first row of the table means that the odds of default for a person who did not complete high school are 2.054 times the odds of default for a person who has a post-undergraduate degree.

Figure 19-11

Odds ratios for years with current employer

				95% Confidence	
				Interval	
		Previously			
Units of Change		defaulted	Odds Ratio	Lower	Upper
Years with current employer	1.000	Yes	.798	.758	.840

Dependent Variable: Previously defaulted (reference category = No) Model: (intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

a. Factors and covariates used in the computation are fixed at the following values: Level of education=Post-undergraduate degree; Age in years=34.19; Years with current employer=6.99; Years at current address=6.32; Household income in thousands=60.1581; Debt to income ratio (x100)=9.9341; Credit card debt in thousands=1.9764; Other debt in thousands=3.9164

This table displays the odds ratio of *Previously defaulted* for a unit change in the covariate *Years with current employer*. The reported value is the ratio of the odds of default for a person with 7.99 years at their current job compared to the odds of default for a person with 6.99 years (the mean).

Complex Samples Logistic Regression

Figure 19-12

Odds ratios for debt to income ratio

				95% Con	fidence
		Previously		Inter	vai
Units of Change		defaulted	Odds Ratio	Lower	Upper
Debt to income ratio (x100)	1.000	Yes	1.100	1.058	1.143

Dependent Variable: Previously defaulted (reference category = No) Model: (Intercept), ed, age, employ, address, income, debtinc, creddebt, othdebt

a. Factors and covariates used in the computation are fixed at the following values: Level of education=Post-undergraduate degree; Age in years=34.19; Years with current employer=6.99; Years at current address=6.32; Household income in thousands=60.1581; Debt to income ratio (x100)=9.9341; Credit card debt in thousands=1.9764; Other debt in thousands=3.9164

This table displays the odds ratio of *Previously defaulted* for a unit change in the covariate *Debt to income ratio*. The reported value is the ratio of the odds of default for a person with a debt/income ratio of 10.9341 compared to the odds of default for a person with 9.9341 (the mean).

Note that because none of these predictors are part of interaction terms, the values of the odds ratios reported in these tables are equal to the values of the exponentiated parameter estimates. When a predictor is part of an interaction term, its odds ratio as reported in these tables will also depend on the values of the other predictors that make up the interaction.

Summary

Using the Complex Samples Logistic Regression Procedure, you have constructed a model for predicting the probability that a given customer will default on a loan.

A critical issue for loan officers is the cost of Type I and Type II errors. That is, what is the cost of classifying a defaulter as a non-defaulter (Type I)? What is the cost of classifying a non-defaulter as a defaulter (Type II)? If bad debt is the primary concern, then you want to lower your Type I error and maximize your **sensitivity**. If growing your customer base is the priority, then you want to lower your Type II error and maximize your **specificity**. Usually, both are major concerns, so you have to choose a decision rule for classifying customers that gives the best mix of sensitivity and specificity.

Related Procedures

The Complex Samples Logistic Regression procedure is a useful tool for modeling a categorical variable when the cases have been drawn according to a complex sampling scheme.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to specify analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples General Linear Model procedure allows you to model a scale response.
- The Complex Samples Ordinal Regression procedure allows you to model an ordinal response.



Complex Samples Ordinal Regression

The Complex Samples Ordinal Regression procedure creates a predictive model for an ordinal dependent variable for samples drawn by complex sampling methods. Optionally, you can request analyses for a subpopulation.

Using Complex Samples Ordinal Regression to Analyze Survey Results

Representatives considering a bill before the legislature are interested in whether there is public support for the bill and how support for the bill is related to voter demographics. Pollsters design and conduct interviews according to a complex sampling design.

The survey results are collected in *poll_cs_sample.sav*. The sampling plan used by the pollsters is contained in *poll.csplan*; because it makes use of a probability-proportional-to-size (PPS) method, there is also a file containing the joint selection probabilities (*poll_jointprob.sav*). Use Complex Samples Ordinal Regression to fit a model for the level of support for the bill based upon voter demographics.

Running the Analysis

 To run a Complex Samples Ordinal Regression analysis, from the menus choose: Analyze Complex Samples

Ordinal Regression...

Figure 20-1

Complex Samples Plan dialog box

Complex Sa	mples Plan 🛛 🛛 🛛 🛛 🛛
- Plan	
<u>F</u> ile:	les\SPSS\Tutorial\sample_files\poll.csplan <u>B</u> rowse
If you do the Analy Analysis I	not have a plan file for your complex sample you can use rsis Preparation Wizard to create one. Choose Prepare For from the Complex Samples menu to access the wizard.
Joint Proba	bilities
Joint prol WOR est	pabilities are required if the plan requests unequal probability mation. Otherwise they are ignored.
⊖Use de	fault file (C:\Program Files\SPSS\Tutorial\sample_files\poll.sav)
🔵 An ope	n dataset
	poll_cs_sample.sav [DataSet1]
⊙ <u>C</u> uston	n file
Fi <u>l</u> e:	S\Tutorial\sample_files\poll_jointprob.sav Browse
	Continue Cancel Help

- ► Browse to the *tutorial*\sample_files\ subdirectory of the directory in which you installed SPSS and select *poll.csplan* as the plan file.
- Select *poll_jointprob.sav* as the joint probabilities file.
- ► Click Continue.

Complex Samples Ordinal Regression

Complex Samples Ordinal Regression × Variables: Dependent Variable: Noter ID [voteid] ▶ The legislature shoul... Model... 💑 Neighborhood (nbrh... Response Probabilities.. Statistics.. 💑 Township [town] 💑 County [county] Hypothesis Tests. Eactors: Inclusion (Selection) ... 📶 Age category [ag... 🔨 Odds Ratios.. 🔗 Cumulative Sampling... \delta Gender [gender] Cumulative Sampling.. Sav<u>e</u>.. Voted in last elec... ~ Options.. <u>C</u>ovariates: Link Function: Logit Y Subpopulation Variable: Category: V <u>P</u>aste 0K <u>R</u>eset Cancel Help

Figure 20-2 Complex Samples Ordinal Regression main dialog box

- Select *The legislature should enact a gas tax* as the dependent variable.
- Select *Age category* through *Driving frequency* as factors.
- Click Statistics.

Figure 20-3 Statistics dialog box

Complex Samples Ordinal Re	gression: Statistics	×
Model Fit		
✓ Pseudo R-square		
Classification table		
Parameters		
Estimate	Covariances of parameter estimates	
Exponentiated estimate	Correlations of parameter estimates	
Standard error	Design effect	
Confidence interval	Square root of design effect	
<u>t</u> -test		
Parallel Lines		
✓ Wald test of equal slopes		
Parameter estimates for gen	eralized (unequal slopes) model	
Covariances of parameter es	stimates for generalized (unequal slopes) model	
Summary statistics for model	l variables	
Sample design information		
	Continue Cancel Help	2

- ► Select Classification table in the Model Fit group.
- Select Estimate, Exponentiated estimate, Standard error, Confidence interval, and Design effect in the Parameters group.
- Select Wald test of equal slopes and Parameter estimates for generalized (unequal slopes) model.
- ► Click Continue.
- ► Click Hypothesis Tests in the Complex Samples Ordinal Regression dialog box.

Complex Samples Ordinal Regression

Sampling Degrees of Freedom Image: Based on sample design Image: Fixed Value:
s

Even for a moderate number of predictors and response categories, the Wald F test statistic can be inestimable for the test of parallel lines.

- ► Select Adjusted F in the Test Statistic group.
- Select Sequential Sidak as the adjustment method for multiple comparisons.
- ► Click Continue.
- Click Odds Ratios in the Complex Samples Ordinal Regression dialog box.



- Choose to produce cumulative odds ratios for *Age category* and *Driving frequency*.
- Select 10-14,999 miles/year, a more "typical" yearly mileage than the maximum, as the reference category for *Driving frequency*.
- Click Continue.
- ▶ Click OK in the Complex Samples Ordinal Regression dialog box.

Complex Samples Ordinal Regression

Pseudo R-Squares

Figure 20-6 Pseudo R-Squares

Cox and Snell	.179
Nagelkerke	.191
McFadden	.071

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

In the linear regression model, the coefficient of determination, R^2 , summarizes the proportion of variance in the dependent variable associated with the predictor (independent) variables, with larger R^2 values indicating that more of the variation is explained by the model, to a maximum of 1. For regression models with a categorical dependent variable, it is not possible to compute a single R^2 statistic that has all of the characteristics of R^2 in the linear regression model, so these approximations are computed instead. The following methods are used to estimate the coefficient of determination.

- Cox and Snell's R²(Cox and Snell, 1989) is based on the log likelihood for the model compared to the log likelihood for a baseline model. However, with categorical outcomes, it has a theoretical maximum value of less than 1, even for a "perfect" model.
- Nagelkerke's R²(Nagelkerke, 1991) is an adjusted version of the Cox & Snell *R*-square that adjusts the scale of the statistic to cover the full range from 0 to 1.
- McFadden's R^2 (McFadden, 1974) is another version, based on the log-likelihood kernels for the intercept-only model and the full estimated model.

What constitutes a "good" R^2 value varies between different areas of application. While these statistics can be suggestive on their own, they are most useful when comparing competing models for the same data. The model with the largest R^2 statistic is "best" according to this measure.

Tests of Model Effects

Figure 20-7

Tests of model effects

Source	df1	df2	Adjusted Wald F	Sig.	Sequential Sidak Sig.
agecat	2.283	31.966	6.215	.004	.003
gender	1.000	14.000	.046	.834	.834
votelast	1.000	14.000	.076	.787	.787
drivefreq	3.785	52.987	228.015	.000	.000

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

Each term in the model is tested for whether its effect equals 0. Terms with significance values less than 0.05 have some discernable effect. Thus, *agecat* and *drivefreq* contribute to the model, while the other main effects do not. In a further analysis of the data, you would consider removing *gender* and *votelast* from the model.

Parameter Estimates

The parameter estimates table summarizes the effect of each predictor. While interpretation of the coefficients in this model is difficult due to the nature of the link function, the signs of the coefficients for covariates and relative values of the coefficients for factor levels can give important insights into the effects of the predictors in the model.

- For covariates, positive (negative) coefficients indicate positive (inverse) relationships between predictors and outcome. An increasing value of a covariate with a positive coefficient corresponds to an increasing probability of being in one of the "higher" cumulative outcome categories.
- For factors, a factor level with a greater coefficient indicates a greater probability of being in one of the "higher" cumulative outcome categories. The sign of a coefficient for a factor level is dependent upon that factor level's effect relative to the reference category.

Complex Samples Ordinal Regression

Figure 20-8

Parameter estimates

				95% Cor	nfidence			95% Cor Interv	nfidence al for
			Std.	Inter	rval	Design		Exp(B)	
Parameter		в	Error	Lower	Upper	Effect	Exp(B)	Lower	Upper
Threshold	[opinion_gastax=1]	-3.343	.104	-3.566	-3.120	1.132	.035	.028	.044
	[opinion_gastax=2]	-1.910	.098	-2.120	-1.700	1.058	.148	.120	.183
	[opinion_gastax=3]	674	.090	866	482	.915	.510	.421	.618
Regression	[agecat=1]	324	.079	494	154	1.793	.723	.610	.858
	[agecat=2]	138	.054	255	022	1.158	.871	.775	.978
	[agecat=3]	095	.076	257	.068	2.206	.909	.773	1.070
	[agecat=4]	.000ª					1.000		
	[gender=0]	008	.035	084	.068	.949	.992	.920	1.071
	[gender=1]	.000ª					1.000		
	[votelast=0]	011	.039	095	.073	1.103	.989	.909	1.076
	[votelast=1]	.000ª					1.000		
	[drivefreq=1]	-3.751	.153	-4.079	-3.423	1.117	.023	.017	.033
	[drivefreq=2]	-3.003	.116	-3.251	-2.755	1.226	.050	.039	.064
	[drivefreq=3]	-2.295	.114	-2.540	-2.050	1.585	.101	.079	.129
	[drivefreq=4]	-1.570	.092	-1.769	-1.372	1.078	.208	.171	.254
	[drivefreq=5]	812	.089	-1.003	621	.941	.444	.367	.537
	[drivefreq=6]	.000ª					1.000		

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Loait

a. Set to zero because this parameter is redundant.

You can make the following interpretations based on the parameter estimates:

- Those in lower age categories show greater support for the bill than those in the highest age category.
- Those who drive less frequently show greater support for the bill than those who drive more frequently.
- The coefficients for the variables gender and votelast, in addition to not being statistically significant, appear to be small compared to other coefficients.

The design effects indicate that some of the standard errors computed for these parameter estimates are larger than those you would obtain if you used a simple random sample, while others are smaller. It is vitally important to incorporate the sampling design information in your analysis because you might otherwise infer, for example, that the coefficient for the third level of *Age category*, *[agecat=3]*, is significantly different from 0!

Classification

Figure 20-9

	•		
Categorical	variable	informatior)

			Weighted
		Weighted Count	Percent
The legislature	Strongly agree	25132.955	21.3%
should enact a	Agree	32261.425	27.3%
gas tax	Disagree	29477.417	24.9%
	Strongly disagree	31314.203	26.5%
Age category	18-30	20509.504	17.4%
	31-45	35380.506	29.9%
	46-60	34865.792	29.5%
	>60	27430.198	23.2%
Gender	Male	61424.547	52.0%
	Female	56761.453	48.0%
Voted in last	No	70607.216	59.7%
election	Yes	47578.784	40.3%
Driving	Do not own car	3437.137	2.9%
frequency	<10,000 miles/year	10816.349	9.2%
	10-14,999 miles/year	32539.364	27.5%
	15-19,999 miles/year	39179.814	33.2%
	20-29,999 miles/year	25617.804	21.7%
	>=30,000 miles/year	6595.532	5.6%
Population Size		118186.000	100.0%

a. Dependent variable values are sorted in ascending order.

Given the observed data, the "null" model (that is, one without predictors) would classify all customers into the modal group, *Agree*. Thus, the null model would be correct 27.3% of the time.

Complex Samples Ordinal Regression

			Predicted		
	Strongly			Strongly	Percent
Observed	agree	Agree	Disagree	disagree	Correct
Strongly agree	7067.567	12130.814	3875.825	2058.750	28.1%
Agree	4271.234	14464.286	7320.767	6205.137	44.8%
Disagree	2024.816	11703.368	7108.487	8640.746	24.1%
Strongly disagree	889.869	8169.109	6946.522	15308.703	48.9%
Overall Percent	12.1%	39.3%	21.4%	27.3%	37.2%

Dependent Variable: The legislature should enact a gas tax (Ascending)

Figure 20-10 Classification table

Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

The classification table shows the practical results of using the model. For each case, the predicted response is the response category with the highest model-predicted probability. Cases are weighted by Final Sampling Weight, so that the classification table reports the expected model performance in the population.

- Cells on the diagonal are correct predictions.
- Cells off the diagonal are incorrect predictions.

The model correctly classifies 9.9% more, or 37.2% of the cases. In particular, the model does considerably better at classifying those who Agree or Strongly disagree, and slightly worse with those who Disagree.

Odds Ratios

Cumulative odds are defined as the ratio of the probability that the dependent variable takes a value less than or equal to a given response category to the probability that it takes a value greater than that response category. The cumulative odds ratio is the ratio of cumulative odds for different predictor values, and is closely related to the exponentiated parameter estimates. Interestingly, the cumulative odds ratio itself does not depend upon the response category.

Figure 20-11

Cumulative odds ratios for Age category

			95% Cor	nfidence		
		Cumulative	Inte	rval	Design	Square Root
		Odds Ratio	Lower	Upper	Effect	Design Effect
Age	18-30 vs. ≻60	1.383	1.166	1.639	1.793	1.339
category	31-45 vs. >60	1.148	1.022	1.290	1.158	1.076
	46-60 vs. ≻60	1.100	.935	1.294	2.206	1.485

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

 Factors and covariates used in the computation are fixed at the following values: Age category=>>60; Gender=Female; Voted in last election=Yes; Driving frequency=>=30,000 miles/year

This table displays cumulative odds ratios for the factor levels of *Age category*. The reported values are the ratios of the cumulative odds for 18-30 through 46-60, compared to the cumulative odds for >60. Thus, the odds ratio of 1.383 in the first row of the table means that the cumulative odds for a person aged 18–30 are 1.383 times the cumulative odds for a person older than 60. Note that because *Age category* is not involved in any interaction terms, the odds ratios are merely the ratios of the exponentiated parameter estimates. For example, the cumulative odds ratio for 18-30 vs. >60 is 1.00 / 0.723 = 1.383.

Figure 20-12

Odds ratios for driving frequency

		Cumulative	95% Cor Inter	ifidence rval	Design	Square Root
		Odds Ratio	Lower	Upper	Effect	Design Effect
Driving frequency	Do not own car vs. 10-14,999 miles/year	4.288	2.878	6.390	2.345	1.531
	<10,000 miles/year vs. 10-14,999 miles/year	2.030	1.656	2.488	1.838	1.356
	15-19,999 miles/year vs. 10-14,999 miles/year	.484	.430	.546	1.450	1.204
	20-29,999 miles/year vs. 10-14,999 miles/year	.227	.193	.267	2.095	1.448
	>=30,000 miles/year vs. 10-14.999 miles/vear	.101	.079	.129	1.585	1.259

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

a. Factors and covariates used in the computation are fixed at the following values: Age category=>60; Gender=Female; Voted in last election=Yes; Driving frequency=>=30,000 miles/year This table displays the cumulative odds ratios for the factor levels of *Driving frequency*, using 10-14,999 *miles/year* as the reference category. Since *Driving frequency* is not involved in any interaction terms, the odds ratios are merely the ratios of the exponentiated parameter estimates. For example, the cumulative odds ratio for 20-29,999 miles/year vs. 10-14,999 miles/year is 0.101 / 0.444 = 0.227.

Generalized Cumulative Model

Figure 20-13 Test of parallel lines

df1	df2	Adjusted Wald F	Sig.	Sequential Sidak Sig.
8.769	122.767	1.894	.061	.392

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

The test of parallel lines can help you assess whether the assumption that the parameters are the same for all response categories is reasonable. This test compares the estimated model with one set of coefficients for all categories to a generalized model with a separate set of coefficients for each category.

The Wald F test is an omnibus test of the contrast matrix for the parallel lines assumption that provides asymptotically correct p values; for small to mid-sized samples, the adjusted Wald F statistic performs well. The significance value is near 0.05, suggesting that the generalized model may give an improvement in the model fit; however, the Sequential Sidak adjusted test reports a significance value high enough (0.392) that, overall, there is no clear evidence for rejecting the parallel lines assumption. The Sequential Sidak test starts with individual contrast Wald tests to provide an overall p value, and these results should be comparable to the omnibus Wald test result. The fact that they are so different in this example is somewhat surprising but could be due to the existence of many contrasts in the test and a relatively small design degrees of freedom.

Figure 20-14

Parameter estimates for generalized cumulative model (shown in part)

The legislature should		514	95% Confidence Interval		
enact a gas tax	Parameter	в	Error	Lower	Upper
Strongly agree	(Threshold)	-3.681	.221	-4.155	-3.207
	[agecat=1]	320	.096	525	115
	[agecat=2]	075	.071	227	.077
	[agecat=3]	022	.073	180	.135
	[agecat=4]	.000 ^a			
	[gender=0]	082	.054	197	.033
	[gender=1]	.000 ^a	.000ª .		
	[votelast=0]	.008	.052	104	.120
	[votelast=1]	.000 ^a			
	[drivefreq=1]	-4.096	.267	-4.669	-3.523
	[drivefreq=2]	-3.367	.237	-3.876	-2.857
	[drivefreq=3]	-2.678	.224	-3.158	-2.199
	[drivefreq=4]	-1.928	.213	-2.384	-1.471
	[drivefreq=5]	-1.015	.252	-1.555	476
	[drivefreq=6]	.000 ^a			
Agree	(Threshold)	-1.963	.153	-2.291	-1.635
	[agecat=1]	385	.095	587	182
	[agecat=2]	130	.069	279	.018
	[agecat=3]	139	.101	356	.077
	[agecat=4]	.000 ^a			
	[gender=0]	004	.040	090	.082
	[gender=1]	.000 ^a			
	[votelast=0]	.009	.059	117	.135
	[votelast=1]	.000 ^a			
	[drivefreq=1]	-3.867	.318	-4.549	-3.185
	[drivefreq=2]	-3.005	.175	-3.380	-2.630
	[drivefreq=3]	-2.290	.187	-2.691	-1.888
	[drivefreq=4]	-1.633	.166	-1.988	-1.278
	[drivefreq=5]	909	.137	-1.204	615
	[drivefreq=6]	.000 ^a			

Moreover, the estimated values of the generalized model coefficients don't appear to differ much from the estimates under the parallel lines assumption.

Dropping Non-Significant Predictors

The tests of model effects showed that the model coefficients for *Gender* and *Voted in last election* are not statistically significantly different from 0. To produce a reduced model, recall the Complex Samples Ordinal Regression dialog box.

► Click Continue in the Plan dialog box.

Figure 20-15

Complex Samples Ordinal Regression main dialog box

Complex Samples Ordinal Regression 🛛 🛛 🛛						
Complex Samples Ordin	hal Regress	ion Dependent Variable: The legislature shoul Response Probabilities Factors: Diving frequency [agecat] Diving frequency [dr Covariates:	Model Statistics Hypothesis Tests Odds Ratios Savg Options			
OK Paste	Subpopu	Link Fonction.				

- Deselect *Gender* and *Voted in last election* as factors.
- ► Click Options.

Figure 20-16

Options dialog box

Complex Samples Ordinal Regression: Options 🛛 🛛 🛛 🛛					
Estimation Method Newton-Raphson Eisher scoring Fisher scoring then Newton-Raphson Maximum Number of Iteration Before Switching:	Estimation Criteria Maximum Iterations: 100 Maximum Step-Halving: 5 Limit iterations based on change in parameter estimates Minimum Change: 0.000001 Type: Relative				
User-Missing Values Treat as invalid Treat as <u>v</u> alid This setting applies to categorical design and model variables.	Limit iterations based on change in log-likelihood Minimum Change; Type: ♥ Check for complete separation of data points Starting Iteration: 20 ♥ Display iteration history Increment: 1				
⊆onfidence Interval (%): 95	Continue Cancel Help				

► Select Display iteration history.

The iteration history is useful for diagnosing problems encountered by the estimation algorithm.

- ► Click Continue.
- Click OK in the Complex Samples Ordinal Regression dialog box.

Complex Samples Ordinal Regression

Warnings

Figure 20-17 Warnings for reduced model



The warnings note that estimation of the reduced model ended before the parameter estimates reached convergence because the log-likelihood could not be increased with any change, or "step," in the current values of the parameter estimates.

Figure 20-18 Warnings for reduced model

			Threshold						Regre	ession			
	N	Pseudo -2	[opinion	[opinion	[opinion				[drive	[drive	[drive	[drive	[drive
Iteration	Step-h	Log	_gastax	_gastax	_gastax	[agec	[agec	[agec	freq=	freq=	freq=	freq=	freq=
Number	alving	Likelihood	=1]	=2]	=3]	at=1]	at=2]	at=3]	1]	2]	3]	4]	5]
0	0	326640.3	-1.309	058	1.020	.000	.000	.000	.000	.000	.000	.000	.000
1	0	303567.5	-3.242	-1.881	704	323	137	094	-3.841	-2.970	-2.248	-1.563	835
2	0	303336.3	-3.327	-1.897	664	325	139	095	-3.740	-2.998	-2.291	-1.568	811
3	0	303335.9	-3.333	-1.900	664	326	139	096	-3.750	-3.003	-2.295	-1.570	812
4	0	303335.9	-3.333	-1.900	664	326	139	096	-3.750	-3.003	-2.295	-1.570	812
5ª	5	303335.9	-3.333	-1.900	664	326	139	096	-3.750	-3.003	-2.295	-1.570	812

Redundant parameters are not displayed. Their values are always zero in all iterations.

Dependent Variable: The legislature should enact a gas tax (Ascending)

Model: (Threshold), agecat, drivefreq Link function: Logit

a. The log-likelihood value cannot be increased after the maximum number of steps in the step-halving method.

b. Newton-Raphson method was used to estimate the parameters.

Looking at the iteration history, the changes in the parameter estimates over the last few iterations are slight enough that you're not terribly concerned about the warning message.

Comparing Models

Figure 20-19 Pseudo R-Squares for reduced model

Cox and Snell	.179
Nagelkerke	.191
McFadden	.071

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, gender, votelast, drivefreq Link function: Logit

The R^2 values for the reduced model are identical to those for the original model. This is evidence in favor of the reduced model.

Figure 20-20

Classification table for reduced model

	Predicted							
	Strongly			Strongly	Percent			
Observed	agree	Agree	Disagree	disagree	Correct			
Strongly agree	7067.567	12823.258	3183.380	2058.750	28.1%			
Agree	4271.234	15684.090	6100.963	6205.137	48.6%			
Disagree	2024.816	13157.809	5654.047	8640.746	19.2%			
Strongly disagree	889.869	9226.578	5889.053	15308.703	48.9%			
Overall Percent	12.1%	43.1%	17.6%	27.3%	37.0%			

Dependent Variable: The legislature should enact a gas tax (Ascending) Model: (Threshold), agecat, drivefreq Link function: Logit

The classification table somewhat complicates matters. The overall classification rate of 37.0% for the reduced model is comparable to the original model, which is evidence in favor of the reduced model. However, the reduced model shifts the predicted response of 3.8% of the voters from *Disagree* to *Agree*, more than half of whom were observed to respond *Disagree* or *Strongly disagree*. This is a very important distinction that deserves careful consideration before choosing the reduced model.

Summary

Using the Complex Samples Ordinal Regression Procedure, you have constructed competing models for the level of support for the proposed bill based on voter demographics. The test of parallel lines shows that a generalized cumulative model is not necessary. The tests of model effects suggest that *Gender* and *Voted in last election* could be dropped from the model, and the reduced model performs well in terms of

pseudo- R^2 and overall classification rate compared to the original model. However, the reduced model misclassifies more voters across the *Agree/Disagree* split, so the legislators prefer to keep the original model for now.

Related Procedures

The Complex Samples Ordinal Regression procedure is a useful tool for modeling an ordinal variable when the cases have been drawn according to a complex sampling scheme.

- The Complex Samples Sampling Wizard is used to specify complex sampling design specifications and obtain a sample. The sampling plan file created by the Sampling Wizard contains a default analysis plan and can be specified in the Plan dialog box when you are analyzing the sample obtained according to that plan.
- The Complex Samples Analysis Preparation Wizard is used to specify analysis specifications for an existing complex sample. The analysis plan file created by the Sampling Wizard can be specified in the Plan dialog box when you are analyzing the sample corresponding to that plan.
- The Complex Samples General Linear Model procedure allows you to model a scale response.
- The Complex Samples Logistic Regression procedure allows you to model a categorical response.

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