Exercises

Introduction

Working with household data sets requires a solid mastery of appropriate statistical and data management software, such as Stata or SPSS. This mastery comes from learning by doing. We have found that students who work though the exercises in this appendix acquire the necessary mastery, and are ready to tackle almost any challenge in working with household data. The exercises build on one another, so they should be done in the order given, and each completed fully before proceeding to the next one.

Before beginning these exercises, it is important to prepare the data as set out in appendix 2. If you are new to Stata, you will want to work though appendix 2; if you once knew Stata, and have forgotten the details, a quick skim of Appendix 2 should suffice to bring back the fond memories.

Exercise 1. Chapter 2, Measuring Poverty

We first need to construct the data set that will be used in the later exercises.

Household Characteristics

Open `c:\intropov\data\hh.dta`, which consists of household-level variables. Answer the following questions:

1. How many variables are there? ______
2. How many observations (households) are there? ______

3. There are four regions. Household characteristics may vary by regions. Fill in the following table (Hint: use the `table` command).

	Dhaka	Chittagong	Khulna	Rajshahi
Total number of households	________	________	________	________
Total number of population	________	________	________	________
Average distance to paved road	________	________	________	________
Average distance to nearest bank	________	________	________	________
% Household has electricity	________	________	________	________
% Household has sanitary toilet	________	________	________	________
Average household assets	________	________	________	________
Average household land holding	________	________	________	________
Average household size	________	________	________	________

4. Are the sampled households very different across regions?

____

____

____

5. The gender of the head of household may also be associated with different household characteristics:

	Male-headed households	Female-headed households	
Average household size	________	________	
Average years of schooling of head	________	________	
Average age (years) of head	________	________	
Average household assets (taka)	________	________	
Average household land holding (acres)	________	________	(CAREFUL!)

(*For consideration:* How many decimal places should one report? As a general rule, do not provide spurious precision. Reporting the average household size as 5.35368 gives a false impression of accuracy; but reporting the size as 5 is too blunt. In such cases, 5.4 or 5.35 would be more appropriate, and is accurate enough for almost all uses.)

6. Are the sampled households headed by males very different from those headed by females?

____

____

____

Individual Characteristics

Now open `c:\intropov\data\ind.dta`. This file consists of information on household members. Merge this data with the household level data (`hh.dta`) (see appendix 2 if you need a refresher on merging) and answer the following questions for individuals *who are 15 years old or older*:

1. Regional variation

	Dhaka	Chittagong	Khulna	Rajshahi
Average years of schooling	______	______	______	______
Gender ratio (% of household that is female)	______	______	______	______
% Working population (with positive working hours)	______	______	______	______
% Working population working on a farm	______	______	______	______

2. Are the sampled individuals very different across regions?

____

____

____

3. We now examine some gender differences:

	For males	For females
Average schooling years (age $\geq$ 5)	______	______
Average schooling years (age < 15)	______	______
Average age	______	______
% Working population (with positive working hours)	______	______
% Working population working on a farm	______	______
Average working hours per month	______	______
Average working hours on farm, per month	______	______
Average working hours off farm, per month	______	______

4. Are the characteristics of the sampled women very different from those of the sampled men?

____

____

____

Expenditure

Open `c:\intropov\data\consume.dta`. It has household level consumption expenditure information. Merge it with `hh.dta`.

1. Create three variables: per capita food expenditure (call it `pcfood`), per capita nonfood expenditure (call it `pcnfood`), and per capita total expenditure (call it `pcexp`). Now let's look at the consumption patterns.

Average per capita expenditure

	pcfood	pcexp
By region	______	______
Whole	______	______
Dhaka region	______	______
Chittagong region	______	______
Khulna region	______	______
Rajshahi region	______	______
By gender of head	______	______
Male-headed households	______	______
Female-headed households	______	______
By education level of head	______	______
Head has some education	______	______
Head has no education	______	______
By household size	______	______
Large house hold (>5)	______	______
Small household (≤5)	______	______
By land ownership	______	______
Large land ownership (>0.5 acres/person)	______	______
Small land ownership or landless	______	______

Summarize your findings on per capita expenditure comparison.

____

____

____

2. Now add another measure of household size, which takes into account the fact that children consume less than adults. Assume that a child (age < 15) will be weighted as 0.75 of an adult. For instance, a household consisting of a couple with one child age 7 is worth 2.75 on this adult-equivalence scale, instead of 3. Go back to the `ind.dta` and create this variable (call it `famsize2`), then merge the revised file with the household data and the consumption data files. Create per-adult-equivalent expenditure variables (let's call them `pafood` and `paexp`) and repeat the exercise above.

Average per capita expenditure

	pcfood	pcexp
By region	______	______
Whole	______	______
Dhaka region	______	______
Chittagong region	______	______
Khulna region	______	______
Rajshahi region	______	______
By gender of head	______	______
Male-headed households	______	______
Female-headed households	______	______
By education level of head	______	______
Head has some education	______	______
Head has no education	______	______
By household size	______	______
Large household (>5)	______	______
Small household (<=5)	______	______
By land ownership	______	______
Large land ownership (>0.5 acres/person)	______	______
Small land ownership or landless	______	______

Compare your new results with those of per capita expenditure. In analyzing poverty, is it better to use adult equivalents?

____

____

____

3. Besides looking at the mean or the median value of consumption, we can also easily look at the whole distribution of consumption using `scatter`. The following plots the cumulative distribution function curve of per capita total expenditure.

```
. cumul pcexp, gen(pcexpcdf)
. twoway scatter pcexpcdf pcexp if pcexp<20000,
  ytitle("Cumulative Distribution of pcexp") xtitle
  ("Per Capita total expenditure") title("CDF of
  Per Capita Total Expenditure") subtitle ("Exercise
  1.3") saving (cdf1, replace)
```

The `cumul` command creates a variable called `pcexpcdf` that is defined as the empirical cumulative distribution function (cdf) of `pcexp`; in effect, it sorts the data by `pcexp`, and creates a new variable that accumulates and normalizes `pcexp`, so that its maximum value is 1. To explore the variable, try

```
list pcexp pcexpcdf in 1/10
sort pcexp
list pcexp pcexpcdf in 1/10
list pcexp pcexpcdf in -10/-1
```

Then use the code shown here to graph the cdf. Feel free to experiment with the `scatter` command. The graph is also saved in a file called `cdf1.gph`. When you want to look at the graph later, just type "`graph use cdf1`".

The cumulative distribution function curve of a welfare indicator can reveal much information about poverty and inequality. For example, if we know the value of a poverty line, we can easily find the corresponding percentage value of people below the line. Suppose the poverty line is 5,000. Then the command

```
sum pcexpcdf if pcexp<5000
```

will give the poverty rate (under the "max" heading).
(*For consideration:* Why is the mean not the appropriate measure of poverty here?)

4. Keep `pcfood pcexp pafood paexp famsize2 hhcode`, merge with `hh.dta`, sort by `hhcode`, and save as `pce.dta` in the `c:\intropov\data` directory.

Household Weights

In most household surveys, observations are selected through a random process, but different observations may have different probabilities of selection. Therefore, we need to use weights that are equal to the inverse of the probability of being sampled. A weight of w_j for the jth observation means, roughly speaking, that the jth observation represents w_j elements in the population from which the sample was drawn. Omitting sampling weights in the analysis usually gives biased estimates, which may be far from the true values (see chapter 2).

Various postsampling adjustments to the weights are sometimes necessary. A household sampling weight is provided in the `hh.dtafile`. This is the right weight to use when summarizing data that relate to households.

However, we are often interested in the individual, rather than the household, as the unit of analysis. Consider a village with 60 households; 30 households have 5 individuals each (with income per capita of 2,100), while the other 30 households have 10 individuals each (with income per capita of 1,200). The total population of the village is 450. Now suppose we take a 10 percent random sample of households, picking three 5-person households and three 10-person households. We would estimate the mean income per capita to be 1,650. While this properly reflects the nature of *households* in the village, it does not give information that is representative of *individuals*: the village has 150 people in 5-person households and 300 people in 10-person households. Weighted by individuals, per capita income in this village is in fact 1,500. (Try the calculation!) Such computations can be done easily in Stata.

In estimating individual-level parameters such as per capita expenditure, we need to transform the *household* sample weights into *individual* sample weights, using the following Stata commands:

```
. gen weighti = weight*famsize
. table region [pweight=weighti], c(mean pcexp)
```

Stata has four types of weights: `fweight, pweight, aweight,` and `iweight`. Of these, frequency weights and analytic weights are most important.

- ***Frequency weights*** (`fweight`) indicate how many observations in the population are represented by each observation in the sample. It takes integer values.
- ***Analytic weights*** (`aweight`) are especially useful when working with data that contain averages (for example, average income per capita in a household). The weighting variable is proportional to the number of persons over which the average was computed (number of members of a household, for instance). Technically, analytic weights are in inverse proportion to the variance of an observation (that is, a higher weight means that the observation was based on more information and so is more reliable in the sense of having less variance).

Further information on weights may be obtained by typing `help weight`. Now let's repeat some previous estimations with the newly created weights:

	Dhaka	Chittagong	Khulna	Rajshahi
Average household size	________	________	________	________
Average per capita food expenditure:	________	________	________	________
Average per capita total expenditure:	________	________	________	________

Are the weighted averages very different from unweighted ones?

____

____

____

The Effects of Clustering and Stratification

If the survey under consideration has a complex sampling design, the standard errors of estimates (and sometimes even the means) will be biased if clustering and stratification are ignored.

Consider the following typical case of a multistage stratified random sample with clustering.

- First, the country is divided into regions (the ***strata***), and a sample size is selected for each region. Note that it is perfectly legitimate to sample some regions more heavily than others; indeed, one would typically want to sample a sparsely populated heterogeneous region more heavily (for example, one person per 300) than a densely populated, homogeneous region (for example, one person per 1,000).
- Within each region, communes are randomly picked, where the probability that a commune is picked depends on the population of the commune; in this case the commune is the primary sampling unit (the ***psu***). One may survey households in a cluster within the commune—for instance, picking 20 households in a single village. Cluster sampling is widespread because it is much cheaper than taking a simple random sample of the population. Let us assume that someone has also computed a weight variable (***wt***) that represents the number of households that each representative household "represents"; thus, the weight will be small for oversampled areas, and larger for undersampled areas.

Stata has a very useful set of commands designed to deal with data that have been collected from multistage and cluster sample surveys. Information must be provided on the structure of the survey using the `svyset` commands. Using our example we would have

```
svyset [pweight=weighti], strata(region) psu(thana)
clear(all)
```

where `region` is a variable that indicates the regions.[1] Having set out the structure of the survey, `svymean` can be used to give estimates of population means and their correct standard errors; and `svyreg` can be used to perform linear regression, taking survey design into account. Other commands include `svytest` (to test whether a set of coefficients are statistically significantly different from zero) and `svylc` (to test linear combinations, such as the differences between the means of two variables). Repeat the exercise from "Household Weights" and compare the results.

	Dhaka	Chittagong	Khulna	Rajshahi
Average household size	________	________	________	________
Average per capita food expenditure:	________	________	________	________
Standard deviation of per capita food expenditure:	________	________	________	________
Average per capita total expenditure:	________	________	________	________

Are the new weighted averages, adjusted for clustering and stratification, very different from the unweighted ones?

____

____

____

Exercise 2. Chapter 3, Poverty Lines

To compare poverty measures over time, it is important that the poverty line itself represent similar levels of well-being over time and across groups. Three methods have been used to derive poverty lines for Bangladesh: direct caloric intake, food-energy intake, and cost of basic needs.

The following table gives a nutritional basket, in per capita terms, considered minimal for the healthy survival of a typical adult in a family in rural Bangladesh.

Direct Caloric Intake

The direct caloric intake method considers any household not meeting the nutritional requirement of 2,112 Calories per day per person as poor.[2] For this method, we need to know the quantity of every food item consumed by households and its calorie content. With that information, we calculate the total calorie content of the food actually consumed and derive an equivalent daily caloric intake per capita for each household. The data set `c:\intropov\data\consume.dta` includes the quantity of 10 food items consumed. ("Potatoes" and "other vegetables" listed in the table are combined into one item called "vegetables" in the survey; assume that the total per capita daily calorie provision of this combined item is 62 and the quantity is 177 grams.)

1. Use the quantity information from the data set and the calorie content information from the above table to calculate each household's per capita caloric intake (in Calories per day). (Hint: The unit in the data set is kilograms per week, and this needs to be converted into grams per day.)

Table A3.1 Bangladesh Nutritional Basket

Food items	Per capita normative daily requirements		Average rural consumer price (taka/kilogram)
	Calories	Quantity (gram)	
Rice	1,386	397	15.19
Wheat	139	40	12.81
Pulses	153	40	30.84
Milk (cow)	39	58	15.90
Oil (mustard)	180	20	58.24
Meat (beef)	14	12	66.39
Fish	51	48	46.02
Potatoes	26	27	8.18
Other vegetables	36	150	38.30
Sugar	82	20	30.49
Fruit	6	20	28.86
Total	2,112	832	

Source: Wodon 1997, 93.

2. Create a new variable `cpcap` to store this caloric intake variable. Now identify the households for which `cpcap` is less than 2,112. These households are considered "poor" based on the `direct` caloric intake method. Create a variable `directp` that equals 1 if the household is poor and 0 otherwise. What percentage of people are poor by this method?

	Bangladesh	Dhaka	Other regions
% poor using direct caloric intake method	58.8	____	________

Food-Energy Intake

The food-energy intake method finds the value of per capita total consumption expenditures at which a household can be expected to fulfill its caloric requirement, and determines poverty based on that expenditure. Note that this expenditure automatically includes an allowance for both food and nonfood items, thus avoiding the tricky problem of determining the basic needs for those goods. This method does not need price data either, but as explained in chapter 3, it can also give very misleading results.

A simple way to implement this method is to rank households by their per capita caloric intakes and calculate the mean expenditure for the group of households that consume approximately the stipulated per capita caloric intake requirement. Proceed as follows:

1. Merge `cpcap` with `hh.dta` and calculate the average `pcexp` for the households whose per capita caloric intake is within 10 percent of 2,112, either above or below (see code in following box).

2. Call the average value `feipline` and identify the households for whom `pcexp` is less than `feipline`. These households are considered "poor" based on the food-energy intake method. Create a variable `feip` that equals 1 if the household is poor and 0 otherwise.

```
. sum pcexp [aw=weighti] if cpcap<2112*1.1 &
  cpcap>2112*.9
. gen feipline = r(mean)
. gen feip = (pcexp <= feipline)
```

Technical note: Stata commands that report results also save the results so that other commands can subsequently use those results; "r-class" commands, such as `summarize`, save results in `r()` in version 6.0 or higher. After any r-class commands, if you type "`return list`", Stata will list what was saved. (Try it!)

Another group—“e-class” commands such as `regress`—save results in `e()` and estimates list will list saved results. For example, `e(b)` and `e(V)` store the estimates of coefficients and the variance-covariance matrix, respectively. There is an easier way to access coefficients and standard errors: either `_b(varname)` or `_coef(varname)` contains the coefficient on `varname`, and `_se(varname)` refers to the standard error of the coefficient.

3. What percentage of people are poor by this method?

	Bangladesh	Dhaka	Other regions
% poor using food intake method	______	_____	67.9

4. *Challenge:* A more sophisticated method is to regress per capita total expenditure on per capita caloric intake and then predict the expected per capita expenditure at the 2,112 Calorie level. Try this!

```
. regress pcexp cpcap [aw=weighti]
. gen feipline=_b[_cons] + _b[cpcap]*2112
```

5. Should there be separate regression for each region?

____

____

____

Cost of Basic Needs

The idea behind the cost of basic needs method is to find the value of consumption necessary to meet minimum subsistence needs. Usually it involves a basket of food items based on nutritional requirements and consumption patterns, and a reasonable allowance for nonfood consumption.

1. According to the basket in table A3.1 and the average rural consumer prices, how much money does a household of four need each day to meet its caloric requirements?

2. One way to derive the nonfood allowance is simply to assume a certain percentage of the value of minimum food consumption. How much annual total expenditure does a family of four need if it is to avoid being poor, assuming that nonfood expenses amount to 30 percent of food expenses?

3. `vprice.dta` gives village-level price information on all 11 food items. Therefore, we can actually calculate a food poverty line (call it `foodline`) and a total poverty line (call it `cbnpline`) for each village using the cost of basic needs

method and merge this variable with `pce.dta.` (Hint: Here we need to `sort` both data sets and merge by `thana vill.`) Do this, and create a variable `cbnp` that equals 1 for the poor and 0 for the nonpoor.

4. What percentage of people are poor by this method?

	Bangladesh	Dhaka	Other regions
% poor by cost of basic needs method	______	______	______

5. The percentage of people in poverty varies according to the three methods. Which method do you consider to be most suitable here? Why?

   ____

   ____

   ____

6. Keep all imputed poverty lines and poverty indicators, merge with `pce.dta`, and save the file as `final.dta.`

Exercise 3. Chapter 4, Measures of Poverty

A Simple Example

In Stata, open the data file `example.dta` and browse the data using Stata "Data Browser" or type in the numbers shown here. You should see a spreadsheet listing information exactly as presented in the following table.

Stata Editor

y_a[1] = 110

	y_a	y_b	y_c
1	110	110	120
2	115	120	121
3	119	120	122
4	120	124	123
5	125	125	123
6	127	127	125
7	138	138	135
8	141	141	140
9	178	178	171
10	222	222	215

The data consist of information on consumption by all the individuals in three countries (A, B, and C). Each country has just 10 residents.

1. Summarize the consumption level for each of the three countries:

   ____

2. Assuming a poverty line of 125, calculate the following poverty rates for each country:

Country	A	B	C
a. Using the headcount index	______	______	______
b. Using the poverty gap index	______	______	______
c. Using the squared poverty gap index	______	______	______

(Hint: The relevant formulas are provided in chapter 4. Try programming the results in Stata rather than doing the computations by hand or using Excel.)

3. Which country has the highest incidence of poverty? Justify your answer.

   ____

   ____

   ____

Poverty Measures for Rural Bangladesh 1999

Now let's work with the per capita food expenditure and the per capita total expenditure (`pcfood` and `pcexp` in `c:\intropov\data\final.dta`) created in Exercise 1, and use `cbnpline` (the cost of basic needs poverty line derived in Exercise 2).

> **Technical note:** Although it is possible to program the calculation of different measures of poverty, it is simpler to use programs that have been written by others. In Stata these programs are known as `.ado` programs. The basic version of Stata comes with a large library of such programs, but for specialized work (such as computing poverty rates) it is usually necessary to install `.ado` programs that have been provided on a diskette or obtained on the Web.
>
> For computing poverty rates and their accompanying standard errors, a useful program is `FGT.ado` , which is based on `poverty.ado` written by Philippe Van Kerm; the standard error calculation follows Deaton (1997). The `FGT.ado` file should be put in your working directory; or into a directory given by `c:\ado\plus\f` (which you may need to create for this purpose). Two other useful `.ado` programs are `SST.ado` (for computing the Sen-Shorrocks-Thon poverty measure) and `Sen.ado` (for computing the Sen index of poverty). These files are available at: http://mail.beaconhill.org/~j_haughton. Other `.ado` programs are available on the Internet; for an example, and how to access them, see "Finding and Using `.ado` Files" below.

`FGT.ado` can calculate the headcount index (or FGT(0)), the poverty gap index (or FGT(1)), and the squared poverty gap index (or FGT(2)). For example,

```
. FGT y, line(1000) fgt0 fgt1 fgt2
```

will calculate the headcount ratio, the poverty gap ratio, and squared poverty gap index using a poverty line of 1,000 and welfare indicator `y`. Be careful: the command is case sensitive, and in this case `FGT` must be written in capital letters. After `line`, the brackets must contain a number. Instead of typing all three measures, one could specify the *`all`* option, or just some of the measures. If `sd` is typed, the command will also give standard errors for the estimates, which is very useful in determining the size of sampling error.

The command above works when there is a single poverty line. However, some researchers prefer to compute different poverty lines for each household (as a function of household size, local price levels, and the like). Assume that these tailor-made poverty lines are in a variable called `povlines`. Now the appropriate command becomes

```
. FGT y, vline(povlines) fgt0 fgt1 fgt2 sd
```

You can specify conditions, range, and weights with these commands. For example, the following command calculates the headcount ratio for the Dhaka region based on a poverty line of 3,000.

```
. FGT pcexp [aw=weighti] if region==1, line(3000)
  fgt0
```

`Sen.ado` and `SST.ado` calculate the Sen index and the SST index, respectively. The syntax follows the same format, but does not compute standard errors. So, for example, one could use

```
. Sen y, line(1000)
. SST y, line(1000)
```

An ambitious attempt to create a suite of programs to measure poverty and inequality within Stata has been undertaken by Abdelkrim Araar and Jean-Yves Duclos of Université Laval. After first creating stand-alone software for measuring poverty and inequality—the DAD (Distributive Analysis/Analyse Distributive) program—they then produced *DASP: Distributive Analysis Stata Package*; version 1.4 was published in December 2007, and may be downloaded from the DASP Web site (http://132.203.59.36/DASP/dmodules/madds14.htm). DASP is an add-in to Stata; once the program has been downloaded, every time Stata is opened it is possible to click on the User button at the top of the screen and then to click on DASP, which in turn provides a set of menu-driven options. In addition to basic measures of poverty and inequality, DASP can check for dominance, decompose inequality into components, and generate the Lorenz curve and other graphs; further details are given in the manual (Araar and Duclos 2007). By way of illustration, here are a couple of commands that can be used within Stata once DASP has been downloaded; the first measures the headcount index, producing the standard error of the estimate of the poverty rate, and lower and upper bounds of a 95 percent confidence interval, while the second computes the Gini index of inequality, again with a standard error and confidence interval.

Command

```
ifgt pcexp, alpha(0) pline(3000)
```

Output

```
Poverty index  : FGT index
Sampling weight : weighti
Parameter alpha : 0.00
----------------------------------------------------------------------------
Variable |  Estimate    STD       LB        UB       Pov. line
----------+-----------------------------------------------------------------
pcexp    |  0.037168  0.011489  0.014597  0.059739  3000.00
---------------------------------------------------------------------
```

Command

```
igini pcexp
```

Output

```
Index : Gini index
Sampling weight : weighti
---------------------------------------------------------------------
Variable        | Estimate   STD       LB        UB
----------------+----------------------------------------------------
1: GINI_pcexp   | 0.266652  0.015956  0.235305  0.297999
---------------------------------------------------------------------
```

Now we are ready to turn to the measurement of poverty using the data from the Bangladesh Household and Expenditure Survey 1991/92.

1. Compute the five main measures of poverty (headcount, poverty gap, squared poverty gap, Sen index, and Sen-Shorrocks-Thon index) for per capita expenditure, using both the food poverty line and the total poverty line derived by the cost of basic needs method in the previous exercise.

	Food poverty line	Total poverty line
Headcount index	________	________
Poverty gap index	________	________
Squared poverty gap index	________	________
Sen index	________	________
Sen-Shorrocks-Thon index	________	________

2. Compute the headcount and poverty gap indexes for specific subgroups using the food poverty line.

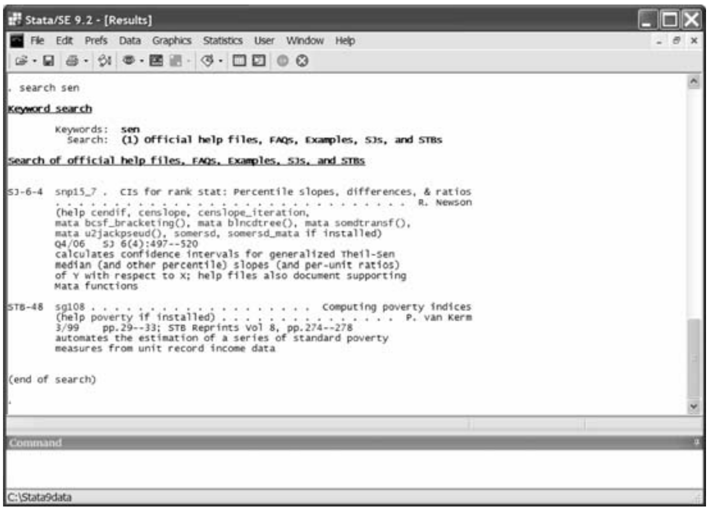
	Headcount index	Poverty gap index
Dhaka region	________	________
Other three regions	________	________
Households headed by men	________	________
Households headed by women	________	________
Large households (>5)	________	________
Small households (≤5)	________	________

3. Repeat exercise 2 above using the total poverty line.

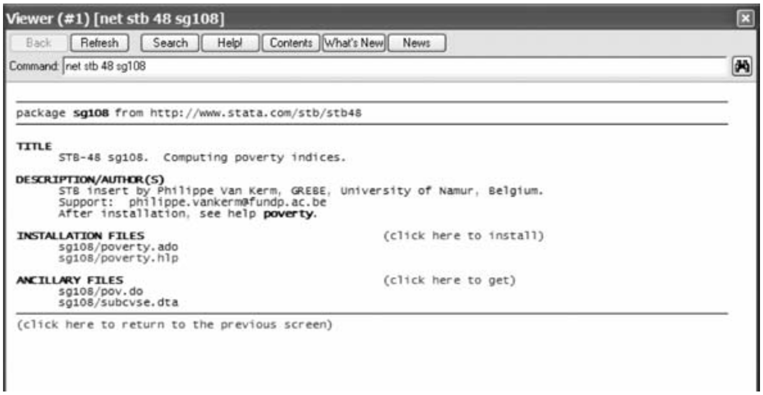
	Headcount index	Poverty gap index
Dhaka region	________	________
Other three regions	________	________
Households headed by men	________	________
Households headed by women	________	________
Large households (>5)	________	________
Small households (≤5)	________	________

Finding and Using `.ado` Files

There are a wealth of `.ado` files on the Web, and some of them are fairly easy to locate. For example, suppose one wants to compute the Sen index of poverty. From within Stata, type `search Sen`, which will yield the following:



Now by double-clicking on `sg108`, you will obtain the following page, assuming that your computer is connected to the Internet.



Double-click again, this time on `click here to install`, and the relevant `.ado` file will be found, downloaded, and placed in the appropriate folder on your computer. Once this has been done successfully, you will get a screen like this one:

This file is called `poverty.ado`. To find out more about it, simply type `help poverty`. This program generates many measures of poverty (but not, unfortunately, their standard errors). For a sampling of the output, try

```
. poverty pcexp [aw=weighti], line(5000) all
```

Exercise 4. Chapter 5, Poverty Indexes: Checking for Robustness

The robustness of poverty measures is important because if poverty measures are not accurate, many conclusions about poverty comparisons between groups and over time may not be warranted.

Sampling Error

For example, the fact that poverty calculations are based on a sample of households rather than the population implies that calculated measures carry a margin of error. When the standard errors of poverty measures are large, small changes in poverty may well be statistically insignificant and should not be interpreted for policy purposes.

As noted above, `FGT` also computes the standard errors of its poverty measures if option *sd* is specified:

```
. FGT y, line(1000) fgt0 fgt1 sd
```

1. Now let's recompute the headcount index and poverty gap index for Dhaka, and for the rest of the country, using the total poverty line, and compute the standard errors of the two measures as well.

	Headcount index	Poverty gap index
Dhaka region: Poverty rate	________	________
Standard error of poverty rate	________	________
Other three regions: Poverty rate	________	________
Standard error of poverty rate	________	________

2. Does the factor of standard errors change any conclusion about the poverty comparison between Dhaka and other regions?

____

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____

Measurement Error

Another reason we need to be very careful in poverty comparisons is because the data collected are measured incorrectly. This could be due to recall error on the part of respondents while answering survey questions, or because of enumerator error when entering the data into specific formats. Let us simulate measurement error in per capita expenditure, and then investigate what effect this error has on basic poverty measures. Try the following:

```
. sum pcexp [aw=weighti]
. gen mu = r(sd)*invnorm(uniform())/10
. gen pcexp_n1 = pcexp + mu
```

Here we assume that the measurement error is a random normal variable with a standard error as big as one-tenth of the standard error of observed per capita expenditure. Let us assume that the measurement error, `mu`, is additive to observed per capita expenditure. Note that, by design, this error is independent of observed per capita expenditure and of any other household or community characteristics.

1. Now recompute the headcount ratio and poverty gap ratio using this new per capita expenditure.

	pcexp	pcexp_n1
Headcount index	________	________
Poverty gap index	________	________

2. Are these measures different for the headcount index? For the poverty gap index?

____

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3. Now consider the following situation. If the measurement error is correlated with a household characteristic—for example, if subsistence farmers usually underreport their consumption of own production—will the measurement error problem be more or less severe?

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Sensitivity Analysis

Apart from taking standard errors into account, it is also important to test the sensitivity of poverty measures to alternative definitions of consumption aggregates and alternative ways of setting the poverty line. For example, some nonfood items are excluded from the expenditure aggregate on the basis that those items are irregular and do not reflect a household's command over resources on average. Also, a 30 percent allowance for nonfood expenditure is arbitrary.

1. Create a new measure of total expenditure that includes the previously excluded irregular nonfood expenditure (`expnfd2`), compute the three FGT poverty measures of per capita expenditure (`pcexp_n2`), and compare the results with those based on the original definition of expenditure (`pcexp`).

	pcexp	pcexp_n2
Headcount index	________	________
Poverty gap index	________	________
Squared poverty gap index	________	________

The nonfood allowance can be estimated from data. Two methods have been considered (see chapter 4).

- The first finds the average nonfood expenditure for households whose *total* expenditure is equal (or close) to the food poverty line. The nonfood expenditure for this group of households must be necessities because the households are giving up part of minimum food consumption to buy nonfood items.

- The second finds the nonfood expenditure for households whose *food* expenditure is equal (or close) to the food poverty line.

Because the second is more generous than the first, the two are usually referred to as the "lower" and the "upper" allowances and the poverty lines constructed using them are called "lower" and "upper" poverty lines, respectively.

2. Try the following, then compare the results of using the two poverty lines:

```
. sum pcnfood [aw=weighti] if pcfood<foodline*1.1
  & pcfood>foodline*.9
. gen line_u = foodline + r(mean)
. sum pcnfood [aw=weighti] if pcexp<foodline*1.1
  & pcexp>foodline*.9
. gen line_l = foodline + r(mean)
```

Poverty line	lower	upper
Headcount index	________	________
Poverty gap index	________	________

3. ***Challenge:*** Compare poverty measures when using per-adult-equivalence scale expenditure (`paeexp`), with those of using per capita expenditure.

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Stochastic Dominance

One may also explore the robustness of poverty comparisons by using stochastic dominance tests. The first-order stochastic dominance test compares the cumulative distribution functions of per capita expenditure. Let's compare the cumulative distributions for Dhaka with those of the rest of Bangladesh.

1. First, generate the cumulative distribution function for Dhaka region. (Note: You may need to use the `hh.dta` file and merge it with the `consume.dta` file; you might also need to create `weighti` as the product of `weight` and `famsize`.)

```
. * Note the double equal signs to represent
the identity
. keep if region == 1
. sort pcexp
. * Now create a running sum of the weighti
variable
```

```
. gen cump1 = sum(weighti)
. * This normalizes cump1 so it varies between 0
and 1
. replace cump1 = cump1/cump1[_N]
. keep cump1 pcexp
. save temp, replace
```

2. Now generate the cumulative distribution `cump2` for the rest of Bangladesh. Keep `cump2` and `pcexp`, and append `temp.dta` by

```
. append using temp
. label variable cump1 "Dhaka"
. label variable cump2 "other regions"
. scatter cumpl cump2 pcexp if pcexpscatter
  intcump1 intcump2 pcexp if pcexp<20000, c(l l)
  m(i i) title("CDFs for Dhaka and other
  regions") clwidth(medthick thin)
```

3. Does one distribution dominate another?

 ____

 ____

 ____

4. If the two lines cross at least once, then we may need to test for second-order stochastic dominance. The *poverty deficit curve* is the integral of the cumulative distribution up to every per capita expenditure value. After creating `cump1`, it may be obtained by

```
. gen intcump1 = sum(cump1)
. keep intcump1 pcexp
. save temp, replace
```

Create `intcump2` for the rest of Bangladesh. After combining variables and labeling them properly,

```
. label variable intcump1 "Dhaka"
. label variable intcump2 "Other regions"
. scatter intcump1 intcump2 pcexp if pcexp<20000,
  c(l l) m(i i) title("Poverty Deficit Curves for
  Dhaka and other regions") clwidth(medthick thin)
```

5. Does one distribution dominate another here?

___

___

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Challenge: Bootstrapping Standard Error for the SST Index

The bootstrapping technique can be used to calculate standard errors of poverty measures, and is especially helpful in cases where the standard errors are impossible to solve analytically (for example, with the SST index of poverty). The idea is quite simple. Repeat the calculation of the poverty measure many times, each time using a new random sample drawn from the original one with replacement. For this purpose, it is necessary to use macros and loops in Stata. The following code is an example; it could be copied or typed into the do-file editor and executed.

```
set more 1
local i = 1
while ‘i’<=100 {
      use c:\intropov\data\final.dta, clear
      keep pcexp weighti cbnpline
      bsample _N
 SST pcexp [aw=weighti], line(5000)
      drop _all
      set obs 1
      gen sst = $S_6
      if ‘i’ ==1 {
            save temp, replace
       }
      else {
            append using temp
            save temp, replace
       }
 local i = ‘i’ + 1
}
sum sst
```

The code above repeats the calculation of the SST index 100 times; the `sum` command provides the standard error of these 100 estimates.

Exercise 5. Chapter 6, Inequality Measures

Lorenz Curve

The Lorenz curve can give a clear graphic interpretation of the Gini coefficient. Let's make the Lorenz curve of per capita expenditure distribution for rural Bangladesh.

First, we need to calculate the cumulative shares of per capita expenditure and population: (Reminder: information on `pcexp` is in `consume.dta.`)

```
. sort pcexp
. gen cumy = sum(pcexp*weight)
. gen cump = sum(weight)
. quietly replace cumy = cumy/cumy[_N]
. quietly replace cump = cump/cump[_N]
```

Second, we need to plot the cumulative share of expenditure against the cumulative share of population. It is also helpful to have a 45-degree line (the line of perfect equality) as a point of reference. Some of the following commands are not strictly necessary, but they do help produce a nice graph.

```
. sort pcexp
. gen equal = cump
. label variable equal "Line of Perfect Equality"
. label variable cump "Cumulative proportion
  of population"
. label variable cumy "Lorenz curve"
. scatter cumy equal cump, c(l l) m(i i)
  title("Lorenz Curve for Bangladesh")
  clwidth(medthick thin) ytitle("Cumulative
  proportion of income per capita")
```

Now repeat this exercise for Dhaka region and compare its Lorenz curve with the Lorenz curve for the whole rural area. What conclusions emerge?

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Inequality Measures for Rural Bangladesh

There is a very useful program called `ineqdeco.ado` that computes the Gini coefficient, generalized entropy family, and Atkinson family of inequality measures. By typing `search ineqdeco` within Stata and following the instructions it is straightforward to load this `.ado` file onto your computer. As in Exercise 3, you can use these programs just like other Stata commands. The syntax is

```
. ineqdeco y [if...][w=weight], [by(...)]
```

When the `by` option is used, this program decomposes inequality into the within-group and between-group components, which is often very helpful. Here is a more concrete example of the command at work:

```
. ineqdeco rlpcex1 [w=hhsizewt], by(urban98)
```

In this example, we get several measures of inequality for real per capita expenditure (`rlpcex1`), adjusted for weights (given by `hhsizewt`), and separated into urban and rural components.

Another helpful program is `fastgini`, which calculates the Gini coefficient along with jackknife standard errors. For example, the command `fastgini rlpcex1 [w=hhsizewt], jk` would generate the Gini coefficient and its standard error for real per capita expenditure `rlpcex1`.

Let's continue using per capita total expenditure to calculate inequality measures:

1. Compute the Gini coefficient, the Theil index, and the Atkinson index with inequality aversion parameter equal to 1 for the four regions.

	Gini	Theil	Atkinson
All regions	________	________	________
Dhaka region	________	________	________
Other three regions	________	________	________

2. Now repeat the above exercise using decile dispersion ratios, and the share of consumption of the poorest 25 percent. Stata command `xtile` is good for dividing the sample by ranking. For example, to calculate the consumption expenditure ratio between the richest 20 percent and the poorest 20 percent, you need to identify those two groups.

```
. xtile group = y, nq(5)
```

The command `xtile` will generate a new variable `group` that splits the sample into five groups according to the ranking of `y` (from smallest to largest, that is, the poorest 20 percent will have `group==1`, while the richest 20 percent will have `group==5`). Similarly, to identify the poorest 25 percent, you need to split the sample into four groups.

	top 20% ÷ bottom 20%	top 10% ÷ bottom 10%	Percentage of consumption of poorest 25%
All Bangladesh	________	________	________
Dhaka region	________	________	________
Other regions of Bangladesh	________	________	________

3. ***Challenge*:** Many inequality indexes can be decomposed by subgroups. Decompose the Theil index by region and comment on the results.

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Exercise 6. Chapter 7, Describing Poverty: Poverty Profiles

In the previous exercises we computed poverty measures for various subgroups, such as regions, gender of head of household, household size, and so on. Another way to present a poverty profile is by comparing the characteristics of the "poor" with those of the "nonpoor."

Characteristics of the Poor

Complete the following table, where "poor" and "nonpoor" are defined by `cbnp` in Exercise 2.

	poor	nonpoor
% of all households	______	______
% of total population	______	______
Average distance to paved road	______	______
Average distance to nearest bank	______	______
% of households with electricity	______	______
% of households with a sanitary toilet	______	______
Average household assets (taka)	______	______
Average household land holding (decimals)	______	______
[Reminder: a decimal is 0.01 of an acre.]		
Average household size	______	______
% of households headed by men	______	______
Average schooling of head of household (years)	______	______
Average age of head (years)	______	______
Average head of household working hours on nonfarm activities (per year)	______	______

More Poverty Comparisons across Subgroups

Calculate the headcount and poverty gap measures of poverty for the following subgroups, using `cbnpline` to define poverty.

	Headcount index	Poverty gap index
Household head has no education		
Household head has a primary education only		
Head had secondary or higher education		
Large land ownership (>0.5 ha/person)		
Small land ownership or landless		
Large asset ownership (>50,000 taka)		
Small asset ownership (≤50,000 taka)		

Combined with the poverty measures computed in Exercise 3, describe the most significant poverty patterns in Bangladesh.

____

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____

Exercise 7. Chapter 8, Understanding the Determinants of Poverty

Develop and estimate a model that explains `log(pcexp/cbnpline)` using available data. The regressors may include demographic characteristics such as gender of head and family structure; access to public services such as distance to a paved road; household members' employment such as working hours on farm and off farm; human capital such as average education of working members of the household; asset positions such as land holding; and so forth. You need to identify potentially relevant variables and the direction of their effect. Then put all those variables together and run the regression. Report the result and discuss whether it matches your hypothesis. If not, give possible reasons.

```
. gen y = log(pcexp/cbnpline)
. reg y age age2 workhour x1-x3 [aw=weighti]
```

The expression `x1-x3` represents other explanatory variables that you want to include; don't feel confined to just three variables!

Note that if you want to include categorical variables, you need to convert them into dummy ("binary") variables if the ranking of categorical values does not have any meaning. For example,

```
. tab region, gen(reg)
```

will generate four variables, labeled `reg1`, `reg2`, `reg3`, and `reg4`. The variable `reg1` takes on a value of 1 for Dhaka and zero otherwise, and so on. When using a set of such dummy variables in a regression, one must be left out, to serve as a reference area. So, for instance,

```
. reg y age age2 workhour x1-x3 reg2-reg4
  [aw=weighti]
```

would include dummy variables for the regions, with Dhaka serving as the point of reference.

After the regression, it is usually a good idea to plot the residuals against the fitted values to ensure that the pattern appears sufficiently random. This could be done by adding, right after the regression command,

```
. predict yhat, xb
. predict e, residuals
. scatter e yhat
```

Exercise 8. Chapter 10, International Poverty Comparisons

The World Bank estimates the extent and evolution of world poverty with the help of PovcalNet, a software interface that is available on line at http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp. This exercise represents an exploration of world poverty using PovcalNet. To answer this exercise you will need to use a browser such as Explorer and log in to PovcalNet.

1. Assume a poverty line of $1.25 per person per day (in 2005 prices). Create a table that shows the headcount poverty rate for the six main regions (East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, South Asia, and Sub-Saharan Africa) for 1981, 1993, and 2005.
2. Repeat 1, but for a poverty line of $2 per person per day.
3. Based on 1 and 2, which are the world's poorest regions? And which regions have seen the biggest reduction in poverty over the past two decades?
4. Pick a country. Graph the evolution of its headcount poverty rate over time (that is, for every year available: 1981, 1984, 1987, 1990, 1993, 1996, 1999, 2002, and 2005). On the same graph, show the headcount poverty rate for the region in which the country is located. Relative to the region, has the country you chose done relatively well, or poorly, in reducing poverty over time?

5. Pick any two countries. Compute the headcount poverty rate for each country at a dozen different poverty lines ($1.00 a day, $1.25 a day, $1.50 a day, and so on) and graph these curves. The horizontal axis will show the poverty line and the vertical axis will show the headcount poverty rate. These are poverty incidence curves. Which country has the higher poverty rate? Explain

Exercise 9. Chapter 11, Panel Data

The goal in this exercise is to create a panel of data. The Bangladeshi data come from a panel of households surveyed in 1991 and 1998. The relevant data are hh91.dta, hh98.dta, etc. (or hh91v7s.dta, and so on, if one is using Stata version 7). Each household has a single id called `nh` ("number of household").

1. Download the household data for 1998 and rename the variables (except for nh). For instance:

   ```
   rename sexhead sexhead98
   ```

   This is done so that when the data from the two surveys are merged, it will still be possible to distinguish the 1998 numbers from the 1991 numbers.

2. Sort the file using `nh` and save it with a name like hh98newlabels.dta.
3. Now open the household data file for 1991, sort it by `nh`, and merge it with hh98newlabels.dta.
4. Check that the villages are comparable (for example, using `compare vill vill98`).
5. Use a paired t-test to determine whether there was a significant change in the education level of heads of household between 1991 and 1998. Do the same for land holdings and access to toilets.
6. Repeat step 5, but use an unpaired t-test.

Exercise 10. Chapter 11, Transition Matrix

In this exercise, you will create a transition matrix that shows the extent to which households moved into or out of poverty.

1. Open consume98.dta, rename the expenditures by suffixing 98. Merge with consume91.dta (using `nh` to link the files). Save as consume9198.dta.
2. Create poverty lines for 1991 and 1998 using the vprice91.dta and vprice98.dta files, as set out in the Exercise 2 for chapter 3. Food needs are as shown in

table A3.1; assume the cost of basic needs poverty line is the food poverty line times 1.3. Call the poverty lines `foodline91`, `cbnpline91`, `foodline98`, and `cbnpline98`. Merge this information using thana and vill to create a single file with all the poverty lines. Call it povlines91and98.dta.

Remember:
```
gen fpovline = pveg*3.4 + pfish*8.7 + ...
gen cbnpline = 1.3*fpovline
```

3. Construct a poverty indicator (1=poor) for 1991 and for 1998, and show the poverty transition matrix—that is, a simple table showing who was poor in both years, in neither year, in 1991 only, or in 1998 only.

Exercise 11. Chapter 11, Quintile Transition Matrix

In this exercise, you will construct a quintile transition matrix and generate measures of chronic, persistent, and transient poverty using data from Bangladesh.

Preparatory Steps

1. Open consume98.dta, keep `nh hhexpfd hhexpnfd` and `hhexpnfd2`, rename each of these by appending `98`, sort by `nh`, and save under a new name such as rconsume98.dta.
2. Open consume91.dta, keep the same variables, sort by `nh`, merge with rconsume98, check that the merge has worked (using `tab _merge`), drop the `_merge` variable, sort by `nh`, and save as rconsume9198.dta.
3. If you have not already done so, open hh98big7bs.dta and rename each variable (except `nh`) by suffixing 98. For example:

   ```
   rename vill vill98.
   ```

   This file has information on income. Sort using `nh` and save under a new name such as revhh98.dta.
4. Now open hh91.dta, sort by `nh`, and merge using revhh98.dta. As usual, check that the two files have merged, by examining `_merge`, and then delete this variable.
5. Sort by `nh` and merge using rconsume9198.dta. Save this file, which is the file with which you will now work.

Note that prices in 1998 were 47 percent higher than in 1991, so before incomes or expenditures can be compared, they must be adjusted for the price difference. We will do this in the following exercises.

Exercises

1. Construct a measure of household expenditure per capita for 1991 and multiply it by 1.47 to get the equivalent in 1998 prices. Call it pce91in98.
2. Use the `xtile` command to create quintiles for this variable and call them qex91in98. [You may need to look up the `xtile` command from within Stata to get the precise syntax.]
3. Construct a measure of household expenditure per capita for 1998. Call it `pce98`.
4. Use the `xtile` command to create quintiles for this variable and call them `qex98`.
5. Construct a transition matrix (using a simple tabulation) to show how people moved from quintile to quintile between 1991 and 1998.
6. Let the poverty line be 5,500. Work out the proportions of the households in the sample who are
   a. Chronically poor (that is, average expenditure per capita is below the poverty line)
   b. Persistently poor (that is, expenditure per capita is always below the poverty line)
   c. Transiently poor (that is, were poor in one of the two years, but have average expenditure per capita above the poverty line)
   d. Never poor.

Exercise 12. Chapter 12, Basic Measurement of Vulnerability

In this exercise, you will calculate the basic measurement of vulnerability. For this exercise, the following information is available on the income of five households.

To complete this exercise, fill in the blanks. [Hint: Use Excel for this.]

Income	Poverty line	SD of income	Probability of poverty next year	Vulnerability[a]	Probability of poverty at least once in next two years
100	125	10			
120	125	12			
130	125	22			
160	125	20			
220	125	30			

- Highly vulnerable: 1. If probability of poverty next year is >0.5.
- Somewhat vulnerable: 2. If probability of poverty next year is > P_0 but <=0.5
- Not vulnerable: 3. If probability of poverty next year is <=P_0.

Note: SD = standard deviation.

a. Indicate here whether individual is highly vulnerable, somewhat vulnerable, or not vulnerable.

Exercise 13. Chapter 12, Measuring Vulnerability in Bangladesh

In this exercise, you will measure the proportion of households in Bangladesh who were "highly vulnerable to poverty" in 1998. Complete the following steps:

1. Use the 1998 Bangladesh data to construct and estimate a regression model where the dependent variable is the log of consumption per capita. [Use `final.dta or pce.dta` for the numbers.]
2. Keep the predicted output (`yhat`) and residuals (`resid`).
3. Regress the square of the residuals on the same variables as in step 1 and save the predicted value (`estvar`).
4. Construct a variable (call it `flessc`) that is (log of food poverty line – estimated log of consumption)/(square root of estimated variance).
5. Compute the probability of poverty for each household using `norm(flessc).`
6. Construct a variable called vul1 that is equal to 1 if the household has at least a 50 percent probability of being poor next year.
7. Time permitting, redo the exercise on the assumption that the age of the household head has risen by five years and the household assets have increased by 20 percent.

Exercise 14. Chapter 13, Simple Impact of Thai Village Fund

In this exercise, you will determine the impact of the Thailand Village Fund. The 2004 socioeconomic survey undertaken in Thailand included a module that asked questions about who borrowed funds from the Thailand Village Fund—a program that provides 1 million baht (US$25,000) per village, which villagers administer in the form of loans.

1. Open Stata and open the data file, which is called tvf.dta (available at http://mail.beaconhill.org/~j_haughton). This is a fairly large file, but is only a subset of the full data from the 2004 socioeconomic survey (and so cannot be used to make inferences about the effect of the program in Thailand; we are using it for teaching purposes only). The questions, and responses to them, are fairly well labeled, so you should be able to navigate your way through this data set without too much difficulty.
2. Answer the following questions based on the data in tvf.dta. [Note: the variable a30 is a weight variable and should be used when answering these questions.]

a. What proportion of households participated as borrowers?
b. Why reasons did people give for not participating? In what proportions?
c. How large was the average loan requested? Received?
d. What interest rates were charged?
e. For what purposes did people say they used the loans?
f. What was the default rate on the loans?
g. What fraction of borrowers had to borrow money from elsewhere in order to repay their Village Fund loan?
h. How did the Village Fund affect households "economic situation"?
i. What changes would households like to see in the Village Fund? Distinguish between the responses of participants and nonparticipants. Summarize the data.

3. How would you evaluate the impact of the Village Fund? Write a 200-word proposal. [This may seem like a narrow question, but it is really asking you to think about how you might go about measuring the impact of any program or project.]

Exercise 15. Chapter 13, Impact of Agricultural Extension

In this exercise, you will determine the impact of agricultural extension. Download `hh98big7bs.dta.` This file has familiar data from Bangladesh, but we have now added a new variable called `agextend` that indicates whether a household was chosen to participate in a program of agricultural extension that provides advice and support. [Note: The variable is invented, but the rest of the data set is real.] We now want to ask a basic question: what was the impact of the agricultural extension program?

1. First, let us look at the raw numbers.

   a. Load `hh98big7bs.dta`, sort by the variable nh, and save.
   b. Now load `consume98v72.dta` (or equivalent), sort by `nh`, and merge `nh` using `hh98big7bs`.
   c. Check that the merge worked correctly by looking at the `_merge` variable.

2. Now compare income and consumption levels for households that did, and did not, get agricultural extension help.

   a. Hint 1. First create measures of total income per capita, and total consumption per capita.
   b. Hint 2. Sort by `agextend` and then use the syntax `by agextend: sum hh*` or equivalent.

c. Specifically, are households that got agricultural extension poorer? Richer? Larger? Are they more reliant on farm income?

3. Next, let us assume that agricultural extension was provided randomly, once other variables are held constant, and then ask what effect the program had.
   a. Create dummy variables for each district ("thana"). The `tab thana, gen(than)` command will do this nicely.
   b. Run a regression of per capita income (or consumption or farm income) on the `agextend`, individual variables (such as gender, age, education, family size), and district dummy variables. The coefficient on the `agextend` variable measures the impact of the program. You will probably want to run a few regressions, one for each output variable (such as income per capita) that is of interest.
   c. Are the effects measured in 3(b) larger or smaller than in 2?

4. Finally, let us run a propensity score analysis. The idea is first to create a "propensity score" that measures the probability that a household will get agricultural extension; and then to use this score to match each "treated" household (that is, a household that gets agricultural extension) with an untreated household that is otherwise similar (that is, has a similar propensity score). Here is how it might work:
   a. From within Stata, use the search command to find "pscore" and "attnd" and download the relevant *.ado files. This is mainly an issue of following the instructions.
   b. Estimate the propensity score equation. This will look something like this:

```
pscore agextend sexhead ... [other variables, including
      district dummies] ... , pscore(fhat1) comsup
```

   c. Now make the comparison, using nearest-neighbor matching, using

```
attnd xxx agextend, pscore(fhat1) comsup
```

   where xxx refers to the outcome variable (for example, consumption per capita) that is of interest.

Notes

1. These commands were substantially revised in Stata version 8, and the syntax differs significantly from earlier versions of Stata.
2. A calorie is the energy required to heat one gram of water by one degree Celsius. A Calorie is 1,000 calories.

References

Araar, Abdelkrim, and Jean-Yves Duclos. 2007. *USER MANUAL: DASP version 1.4.* Université Laval, PEP, CIRPÉE, and World Bank. [DASP stands for Distributive Analysis Stata Package.]

Deaton, Angus. 1997. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Baltimore, MD: Johns Hopkins University Press for the World Bank.

Wodon, Quentin T. 1997. "Food Energy Intake and Cost of Basic Needs: Measuring Poverty in Bangladesh." *Journal of Development Studies* 34 (2): 66–101.