Lecture (extra): Sample weights

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U N I V E R S I T Y.

Using sample weights

Name	Number of observations collected in the survey	Weight to expand to population size	Weight to maintain sample size
José	1	4	0.8
Maria	1	6	1.2
Total	2	10	2

Sample weight =
Population weight * (Sum of sample weights / Sum of population weights)

Frequency weight in Stata

- **FWEIGHT**

  – Expands survey size to the population size

  – Indicates the number of duplicated observations

  – Used on tables to generate frequencies

  – Can be used in frequency distributions only when weight variable is discrete (no fractional numbers)

```
tab x [fweight = weight]
```

"Importance" weight in Stata

- **IWEIGHT**

  – Indicates the "importance" of the observation in some vague sense

  – Has no formal statistical definition

  – Any command that supports iweights will define exactly how they are treated

  – Is intended for use by programmers who want to produce a certain computation

  – Can be used in frequency distributions even when weight variable is continuous (fractional numbers)

```
tab x [iweight = weight]
```

Analytic weight in Stata

- **AWEIGHT**

  - Inversely proportional to the variance of an observation

  - Variance of the jth observation is assumed to be σ^2/w_j, where w_j are the weights

  - For most Stata commands, the recorded scale of aweights is irrelevant

  - Stata internally rescales frequencies, so sum of weights equals sample size

```
tab x [aweight = weight]
```

More about analytic weight

- Observations represent averages and weights are the number of elements that gave rise to the average

group	x	y	n
1	3.5	26.0	2
2	5.0	20.0	3

- Instead of

group	x	y
1	3	22
1	4	30
2	8	25
2	2	19
2	5	16

- Usually, survey data is collected from individuals and households (not as averages)
  - Thus, aweights are not appropriate for most cases

Sampling weight in Stata

- **PWEIGHT**

  – Denote the inverse of the probability that the observation is included due to the sampling design

  – Indicated for statistical regressions

  – Variances, standard errors, and confidence intervals are estimated with a more precise procedure

    - Estimates robust standard errors

```
regress y x1 x2 [pweight = weight]
```

Summary of Stata weights

WEIGHTS IN FREQUENCY DISTRIBUTIONS		
Weight unit of measurement	**Expand to population size**	**Maintain sample size**
Discrete	**fweight**	**aweight**
Continuous	**iweight**	

WEIGHTS IN STATISTICAL REGRESSIONS should maintain sample size	
Robust standard error	**Adjusted R^2, TSS, ESS, RSS**
pweight	**aweight**
reg y x, robust	**outreg2**

General Social Survey

- GSS targets the adult population (18+) living in households in the United States

- Due to the adoption of the sub-sampling design of non-respondents, a weight must be employed when using the GSS 2004 and after

- There are three continuous weight variables
  - WTSS
  - WTSSNR
  - WTSSALL

- They all maintain the original sample size, even in frequency distributions with "iweight"

WTSS

- WTSS variable takes into consideration

    – Sub-sampling of non-respondents

    – Number of adults in the household

- In years prior to 2004, a one is assigned to all cases, so they are effectively unweighted

    – Number of adults can be utilized to make this adjustment for years prior to 2004

WTSSNR

- WTSSNR variable takes into consideration

  – Sub-sampling of non-respondents

  – Number of adults in the household

  – Differential non-response across areas

- In years prior to 2004, a one is assigned to all cases, so they are effectively unweighted

  – Number of adults can be utilized to make this adjustment for years prior to 2004

  – No area non-response adjustment is possible

WTSSALL

- WTSSALL takes WTSS and applies an adult weight to years before 2004

- The weight value of WTSSALL is the same as WTSS for 2004 and after

- Researchers who use the GSS data before or after 2004 may consider using the WTSSALL weight variable

```
tab x [aweight = wtssall]

sum x [aweight = wtssall]
```

GSS has a cluster sample

(https://gssdataexplorer.norc.org/pages/show?page=gss%2Fstandard_error)

- First- and second-stage units are selected with probabilities proportional to size

    – Size is defined by number of housing units

- Third-stage units (housing units) are selected to be an equal-probability sample

    – This results in roughly the same number of housing units selected per second-stage sampling unit

- To calculate standard errors correctly, sample design variables must be used

    – Without design variables, Stata will assume a simple random sample and underestimate standard errors

Complex survey design in GSS

(https://gssdataexplorer.norc.org/pages/show?page=gss%2Fstandard_error)

- There are two design variables
  - VSTRAT
  - VPSU

- First-stage unit
  - VSTRAT: Variance Stratum
  - National Frame Areas (NFAs): one or more counties

- Second-stage unit
  - VPSU: Variance Primary Sampling Unit
  - Segments: block, group of blocks, or census tract

Complex survey design in Stata

(https://gssdataexplorer.norc.org/pages/show?page=gss%2Fstandard_error)

- Declare survey design for dataset

```
svyset [weight=wtssall], strata(vstrat) psu(vpsu) singleunit(scaled)
```

- After "svyset," you should indicate survey design with the option "svy" for each table and regression

```
svy: tab x
svy: mean y
svy: reg y x1 x2
```

Strata with single sampling unit

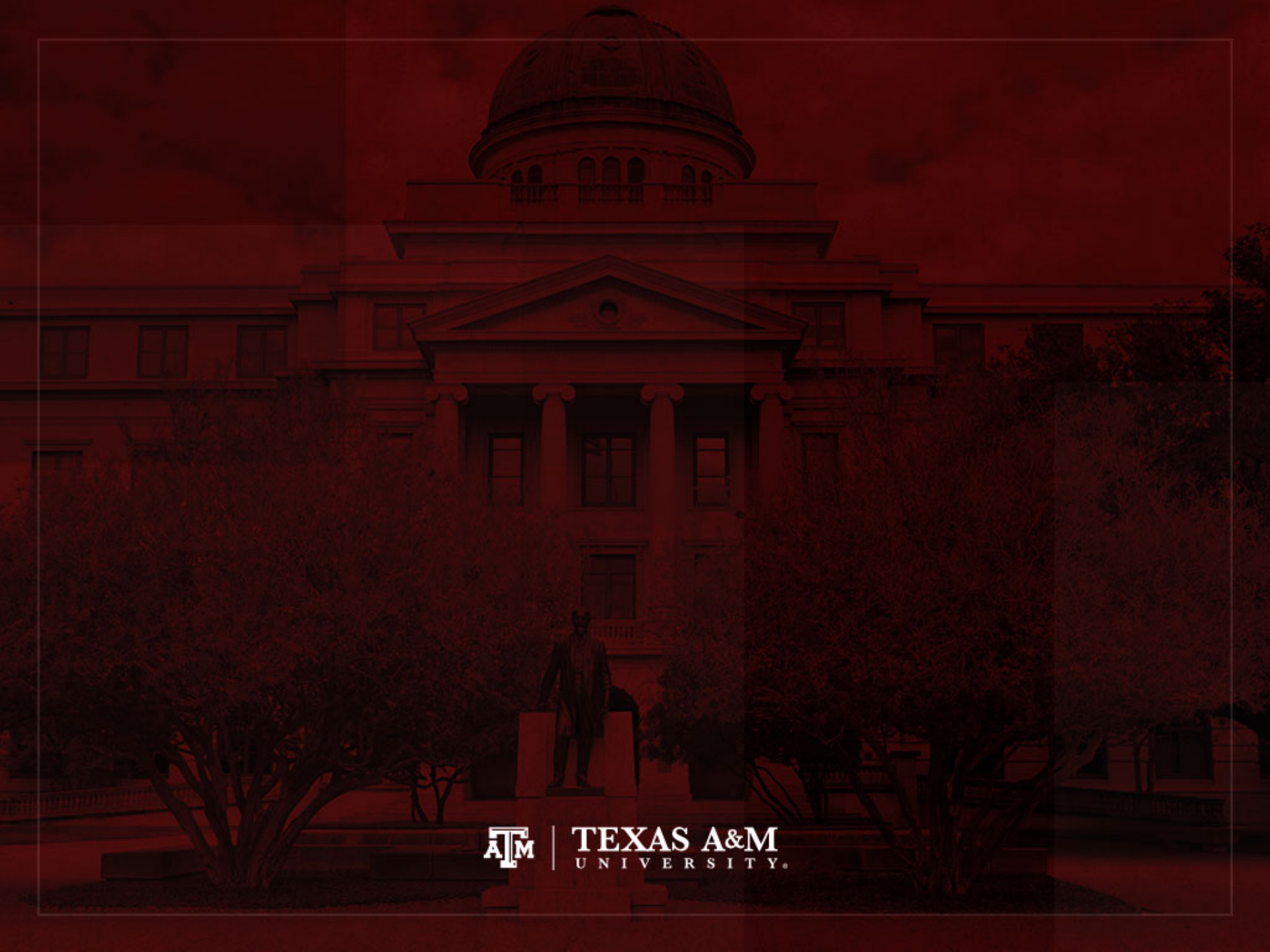(https://gssdataexplorer.norc.org/pages/show?page=gss%2Fstandard_error)

- VSTRAT and VPSU were created with a minimum of three respondents within a cell
  - If all cases are missing on a variable, you get an error message in Stata
  - "Missing standard error because of stratum with single sampling unit"
- It is recommended to utilize the "subpop" option for any subdomain analyses (e.g., for males)

```
svy, subpop(if sex==1): tab x
```

- You can also specify that strata with one sampling unit are "centered" at grand mean instead of stratum mean

```
svyset [weight=wtssall], strata(vstrat) psu(vpsu) singleunit(centered)
```