

Sampling Topic Linkages

Here I show the linkages between all the Sampling Theory Topics in the Text that we cover (Chs 1-14).

First focus is primarily on Issues of
Precision of Estimates

Probability Sampling (1)
We know properties
of samples



General Theory (6)
Hansen-Hurwitz (wr)
Horvitz-Thompson (any design)



Simple Random Sampling
Without Replacement (2-5)
(simple sampling units)



**Improving Sampling
Design with Auxiliary
Information**



Regression Methods
Ratio Estimator (7)
Regression Estimator (8)

**Stratified Random
Sampling (11)**



Double Sampling (14)
Practical Advantages



Nested Sampling Units
Cluster Sampling (12)
Multi-Stage Sampling (13)

Improving Sampling Designs with Auxiliary Information

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graph TD; A[Improving Sampling Designs with Auxiliary Information] --> B[Regression Methods]; A --> C[Stratified Random Sampling]; B --> D[Double or Two-Phase Sampling]; C --> D;
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Regression Methods

Use relationship between y and x in **linear regression models**.

Stratified Random Sampling

Use auxiliary variable (s) to set up roughly **homogeneous groups** or **strata**

Double or Two-Phase Sampling

Practical Advantages as sometimes not enough information on Frame to use either directly without Two-phase sampling

**Regression Methods
Improve Precision if Auxiliary
Variable x is available**

Linear Regression thru Origin

Ratio Estimator (7)
Estimators in Text
Model

$$y_i = \beta x_i + \varepsilon_i$$

$$\hat{\mu}_r = r\mu_x = \left[\frac{\bar{y}}{\bar{x}}\right]\mu_x$$

Regression thru origin with errors increasing
with x. Discussed in class and text.

$$\hat{\tau}_r = N\hat{\mu}_r$$

Standard Linear Regression

Regression Estimator (8)
Estimators in Text
Model

$$y_i = \alpha + \beta x_i + \varepsilon_i$$

$$\hat{\mu}_L = a + b\mu_x$$

$$\hat{\mu}_L = \bar{y} + b(\mu_x - \bar{x})$$

a and b standard least squares estimators
of intercept and slope

$$\hat{\tau}_L = N\hat{\mu}_L$$

$$\hat{\mu} = \bar{y}$$

$$\hat{\tau} = N\bar{y}$$

If we ignore the x's then we lose precision!!.

Simple Random Sampling

Without Replacement (2-5)

(Simple Sampling Units)



Nested Sampling Units

Primary and Secondary Units

Examples-Family then

Individual in family

Cluster Sampling (12)

All Secondary Units
sampled

Multi-Stage Sampling (13)

Not all Secondary Units
Sampled

Survey Topic Linkages

Later we considered the Survey
Sampling Topics

Here focus is primarily on issues
of **Bias of Estimates**

General Survey Design Issues

Computation Issues

Weighting (Notes)
Calculation of Variances (Notes)

Bias

Frame Errors
Non Response Errors
Response Errors

Frame Errors

Incompleteness
Dual Frame Surveys (Notes)

Non Response Errors

Unit Non Response (Examples and Notes)

Item Non Response (Imputation Notes)

Response Errors

Recall Bias

Prestige Bias

Rounding (Digit) Bias

Lies (Intentional Deception)

Question Misinterpretation

Incorrect Measurements

Group Projects

Questionnaire Design*

Contact Methods

Mail Surveys*
Email and Web Surveys*
Telephone Surveys*
Face to Face Surveys
Combination Methods

Sensitive Topic Surveys*