

Sampling Topic Linkages

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

Here focus is primarily on Issues of
Precision of Estimates

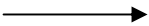
Probability Sampling (1)
We know properties
of samples



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



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



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



**Improving Sampling
Design with Auxiliary
Information**



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



**Stratified Random
Sampling (11)**



Double Sampling (14)
Practical Advantages



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 will consider the Survey
Sampling Topics

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

Survey Design Issues (Bias)

Frame Errors

Duplications

Incompleteness

Non Response Errors

Unit Non Response

Item Non Response (Imputation)

Response Errors

Questionnaire Design*

Contact Methods

Mail Surveys*

Email and Web Surveys*

Telephone Surveys*

Face to Face Surveys

Combination Methods

Sensitive Topic Surveys*