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***Social Science
Research Methods***

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Overview

- Properties of Estimators
- Moderation, Mediation and Suppression
- Financial Accounting Research
- Readings for next week

Properties of Estimators

- Many probability models are indexed by *parameters*
- E.g.
 - ★ Binomial – p
 - ★ Poisson – λ
 - ★ Normal – m and s
- Generally, we will use q to represent some (unknown) parameter

Properties of Estimators

- We estimate unknown parameters from sample data using statistics – i.e., functions of the random variables
- Suppose, $f_X(x; \mathbf{q})$ is the probability model
- Suppose X_1, X_2, \dots, X_n are a random sample
- Let $W = h(X_1, X_2, \dots, X_n)$ be a statistic used to estimate \mathbf{q}

Properties of Estimators

- W is *unbiased* if, on average, it is equal to the parameter estimated; i.e., $E(W) = \mathbf{q}$
- Thus $E(\bar{X}) = \mathbf{m}$ where $\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i$
- $E(S^2) = \mathbf{s}^2$ where $S^2 = \frac{1}{n} \sum_{i=1}^n (X_i - \mathbf{m})^2$
- $E(s^2) = \mathbf{s}^2$ where $s^2 = \frac{1}{(n-1)} \sum_{i=1}^n (X_i - \bar{X})^2$

Properties of Estimators

- The *relative efficiency* of two estimators W_1 and W_2 is given by $\text{Var}(W_1) / \text{Var}(W_2)$
- Recall that:
 - ★ The Cramer-Rao Inequality sets a lower bound for the variance of an estimator
 - ★ An estimator is *best* if it has the minimum variance of all unbiased estimators
 - ★ An estimator is *efficient* if it achieves the Cramer-Rao lower bound

Properties of Estimators

- Sometimes we can find efficient estimators; e.g., \bar{X} is efficient
- On other occasions, there is no efficient estimator, and we must settle for a best estimator
- OLS estimators are *BLUE*
Best Linear Unbiased Estimators

Properties of Estimators

- W is *consistent* (for q) if it converges in probability to q ;
i.e., $P(|W_n - q| < \epsilon) > 1 - \delta$ for $n > n(\epsilon, \delta)$
- A consistent estimator is *asymptotically unbiased*, and its variance converges to 0

Moderation, Mediation and Suppression

■ Moderator variables

- ★ Qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable
- ★ Essentially, representable as an interaction
 - ◆ Moderator hypothesis is supported if the interaction term is significant
- ★ Moderator variables always function as independent variables, whereas mediators shift roles from effects to causes . . .

Moderation, Mediation and Suppression

■ Moderator variables

- ★ Most commonly we suppose, and investigate dichotomous or linear moderation effects
- ★ If we have explicit (theoretical?) non-linear moderation hypotheses (e.g. quadratic) we can investigate them explicitly
- ★ Otherwise (e.g., step functions), we can “dichotomize” at points of non-linearity
- ★ Generally, however, we will use significance of interaction term in regression models to test for moderation (generalizing all four of Baron & Kenny’s cases . . .)
- ★ $Y = \alpha + \beta_1 X + \beta_2 Z + \beta_3 X \cdot Z$

Moderation, Mediation and Suppression

■ Mediator variables

- ★ A variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the criterion
- ★ Because the independent variable is assumed to cause the mediator, they should be correlated
- ★ Using multiple regression to test mediator hypotheses assumes
 - ◆ No measurement error in the mediator
 - ◆ The dependent variable does *NOT* cause the mediator

Moderation, Mediation and Suppression

■ Mediator variables

★ The variable M (fully) mediates the effect of variable X on variable Y iff

◆ $X \rightarrow Y$

◆ $X \rightarrow M$

◆ $M \rightarrow Y$

◆ $X, M \rightarrow Y$ but X is not significant

Moderation, Mediation and Suppression

- Moderator variables are typically introduced when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion
- Mediation is best done in the case of a strong relation between the predictor and the criterion
- In Baron & Kenny's discussion of investigations ranging from moderation to mediation, note the role played by weak or absent theory!
- Do not allow their discussion of *mediated moderation* and/or *moderated mediation* to obfuscate the distinction for you!

Moderation, Mediation and Suppression

- This paper's clear and most valuable contribution for us is the clarity of the distinction and the simplicity of testing for either moderation or mediation – however, do not neglect the importance of proper incorporation of moderators or mediators into your theoretical models – they should be an integral part of the story you have to tell . . .

Moderation, Mediation and Suppression

■ Suppressor variables

- ★ A variable acts as a suppressor when it has zero (or close to zero) correlation with the criterion but is correlated with one or more of the predictors
- ★ Suppressor variables measure invalid variance in the predictor measures and serve to suppress this invalid variance
- ★ Accounting for suppressor variables increases the partial correlations between predictors and criterion because it *suppresses* (or controls for) irrelevant variance
- ★ Thus examining zero order correlations with the criterion is not necessarily a good way to choose explanatory variables
- ★ When included in the analysis, suppressor variables often have a negative *b* coefficient

Financial Accounting Research

- Professor Elizabeth Gordon

Readings for next week

1. “Moral Hazard and Observability”
Robert Holmstrom
The Bell Journal of Economics, 1979
2. “Initial Public Offerings, Financial Reporting System Choice, and Disclosure Management”
Phillip C. Stocken & Robert E. Verrecchia
3. “Possibility Theory: A Fuzzy Logic Approach to Audit Evidence and Audit Planning Models”
Peter R. Gillett
4. “What affects the efficiency of a market? Some answers from a laboratory”
Russ Lundholm
The Accounting Review, July 1991

Readings for next week

5. “CFO Intentions to Report Fraudulently on Financial Statements”
Nancy Uddin & Peter R. Gillett
6. “Accountability, the dilution effect, and conservatism in auditors' fraud judgments”
Vicky B. Hoffman & James M. Patton
Journal of Accounting Research Vol. 25 No. 2, 1997
7. “Fraudulent financial reporting: consideration of industry traits and corporate governance mechanisms”
Mark S. Beasley, Joseph V. Carcello, Dana R. Hermanson & Paul D. Lapedes
Accounting Horizons Vol. 14 No. 4, 2000