

# Empirical Methods in Business: Modeling and Estimation

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Lecture 1: Research Classification

## Introduction to Experiments

### Field Experiment

- Field Experiment and Natural Experiment
- Control Variables: Price, Sales

## Identifying Causal Effects

### Necessary Conditions for Experiments

- Golden Rule: Randomization of Treatment Status
  - Everyone has the same probability to be treated or controlled
- No endogenous attrition or selection issue
- No spillover effects across groups

## Statistical Methods for Inferring Causality

### Data Considerations

- Data cannot be randomized
- Econometric Methods: Fixed Effects, Instrumental Variables
- Importance of identifying assumptions and verifying their reasonableness

### Research Questions and Data

1. Research Questions: Why is it important?
2. Data: Can the data help address the research questions?
3. Model: Data generating process (relationship between Y and X)
4. Estimation: Methods for identification

## Empirical Analysis

### Linear Regression Model

### Complementarity and Substitutability

- Complementarity: Implementation of one practice increases the marginal return to other practices
- Substitutability: Implementation of one practice decreases the marginal return to other practices

## Example: Olympic Games Analysis

### Research Question

- How do population and GDP per capita affect the number of medals won by a country?

### Model Specification

### Mixed Effects Model

- Captures the total effect of competition
- Example:  $(T_i = \alpha + \beta_1 \text{Population}_i + \beta_2 \text{GDP per capita}_i + \epsilon_i)$

## Prediction and Model Validation

### Predictions

- Example: Predict medals based on the model
- Use known values for Population and GDP per capita to estimate future medals

### Equation Solving

- Solving the equation systems to get predictions

## Conclusion

- Summary of key points
- Importance of considering assumptions in econometric models
- Future research directions
- test text

## Appendices