Combining Case Studies and Regression I

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Case Study Roles

- Test Measurement

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- Test Measurement
- Test Causal Pathway Hypotheses

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- Account for Outliers

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- Test for Confounders

Case Study Roles

- Test Measurement
- Test Causal Pathway Hypotheses
- Account for Outliers
- Test for Confounders
- Test for Complexity

Measurement

Bowman, Lehoucq, and Mahoney

Measurement

Chong

Measurement

1. Use in-depth exploration of one or a few cases for qualitative correspondence test.
2. Process trace the quantitative measurement process to form a theory for the causes of any errors.
3. Qualitatively examine a few other cases that would be likely to suffer from the same kinds of errors to test the theory.
4. Revise the coding for all relevant cases.

Mechanisms?

1. Causal pathway

Mechanisms?

1. Causal pathway
2. Unobservable cause

Mechanisms?

1. Causal pathway
2. Unobservable cause
3. Easily observable cause

Mechanisms?

1. Causal pathway
2. Unobservable cause
3. Easily observable cause
4. Bounded explanation

Mechanisms?

1. Causal pathway
2. Unobservable cause
3. Easily observable cause
4. Bounded explanation
5. Universal explanation

Mechanisms?

6. Highly contingent explanation

Mechanisms?

6. Highly contingent explanation
7. Explanation built on lawlike regularities

Mechanisms?

6. Highly contingent explanation
7. Explanation built on lawlike regularities
8. An analytic technique

Mechanisms?

6. Highly contingent explanation
7. Explanation built on lawlike regularities
8. An analytic technique
9. A micro-level explanation of a macro-level phenomenon

Process Tracing

Causal Pathways and Overall Causal Effects

- Is the causal pathway "isolated" from other causal factors?

Causal Pathways and Overall Causal Effects

- Is the causal pathway "isolated" from other causal factors?
- Is the causal pathway "exhaustive"?

Causal Pathways and Overall Causal Effects

- Is the causal pathway "isolated" from other causal factors?
- Is the causal pathway "exhaustive"?
- Could the causal pathway plausibly account for the whole estimated effect?

Front-door Versus Back-door Adjustment with Unmeasured Confounding: Bias Formulas for Front-door and Hybrid Adjustments with Application to a Job Training Program

Adam N. Glynn & Konstantin Kashin

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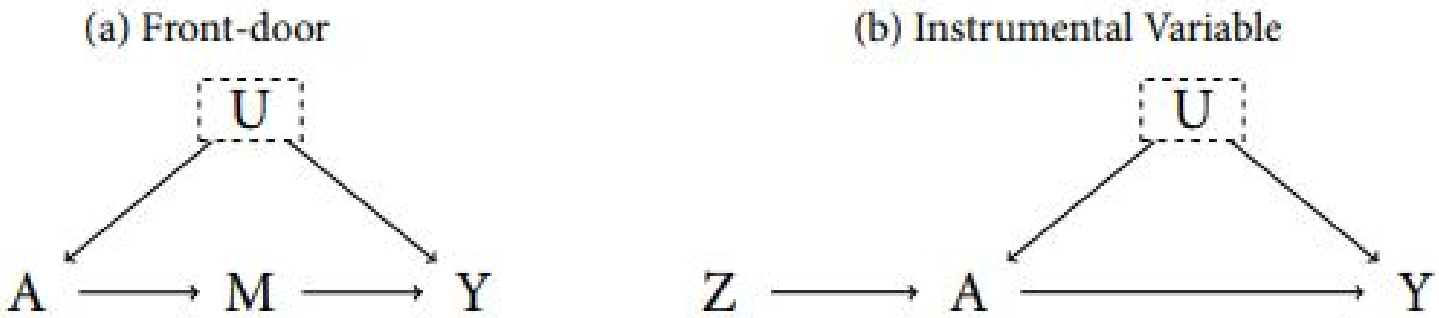
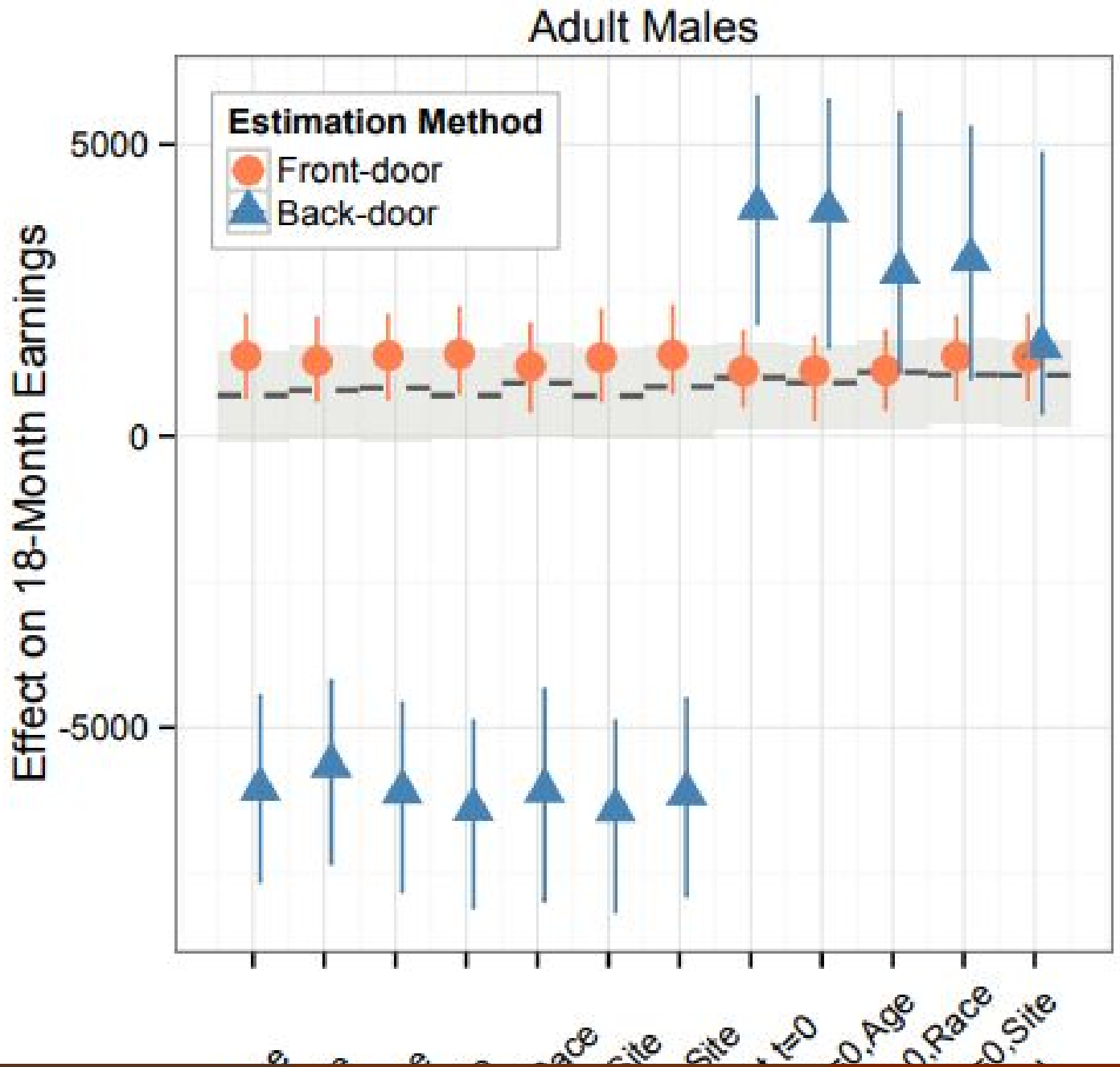
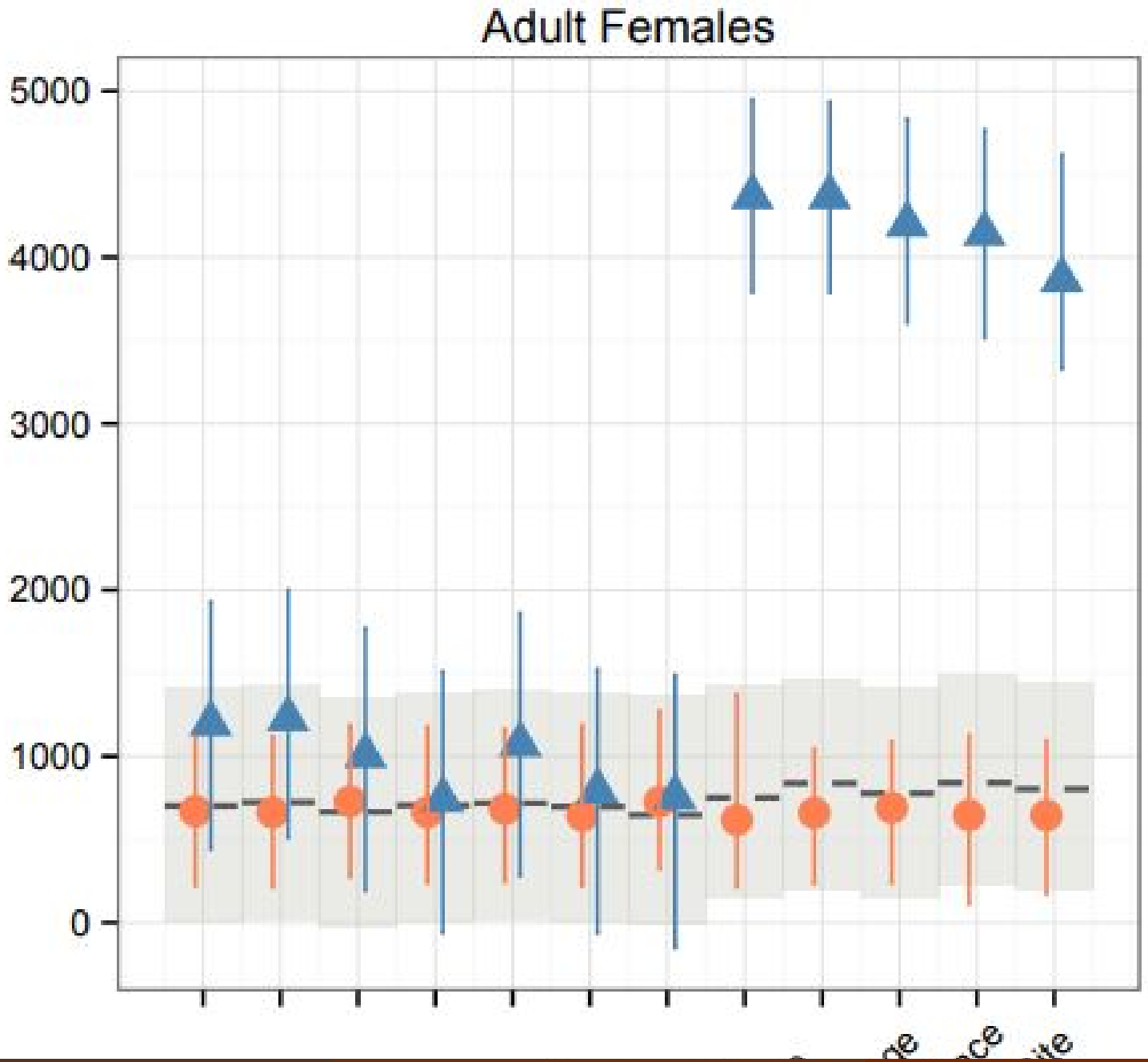
Figure 1: DAGs



months following random assignment (Bloom et al., 1993; Orr et al., 1994). The key feature of this study for our analysis is that there was sizable noncompliance among the treated units. In our sample, roughly 57% of adult men and 55% of adult women who were allowed to receive JTPA services actually utilized JTPA services (see Table 1).


Adult Males
Estimation Method
Front-door
Back-door
5000
0
-5000
Effect on 18-Month Earnings


Adult Females
5000
4000
3000
2000
1000
0

Exploring Outliers

Exploring Outliers

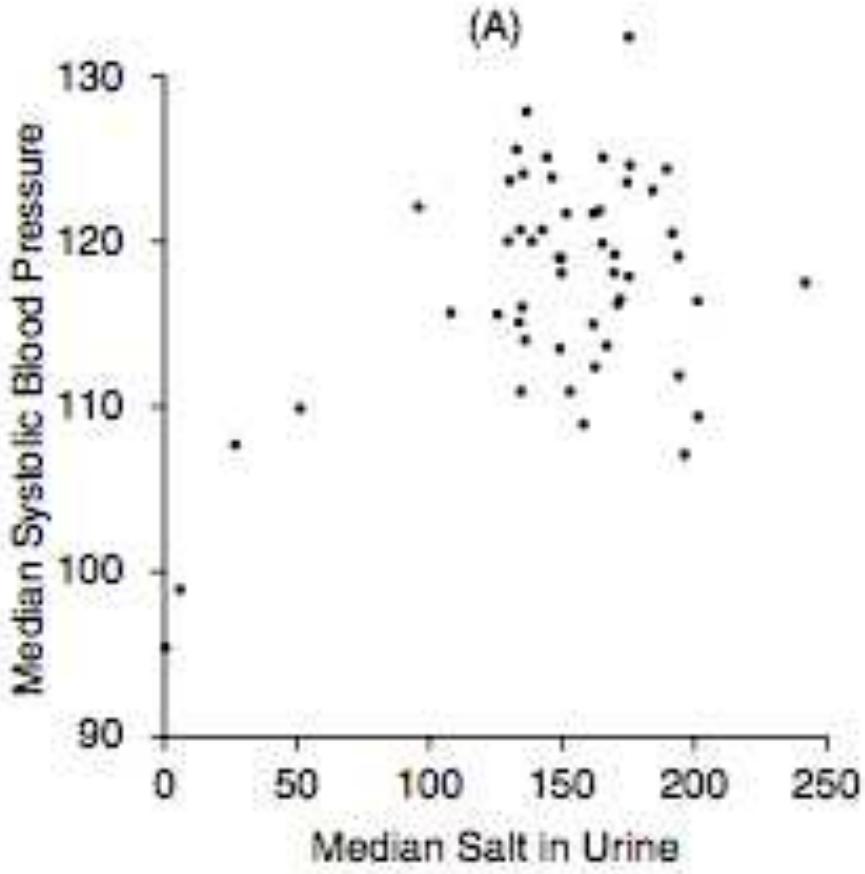


Figure: Salt and Blood Pressure, Intersalt Data

Omitted Variables

Omitted Variables and Confounders

Omitted Variables

1. Trace the causes of the cause, then forward to Y: triangular process-tracing design.

Omitted Variables

1. Trace the causes of the cause, then forward to Y: triangular process-tracing design.
2. Examine the X to Y causal pathway for any influence by potential causes of the cause.

Causal Complexity

Causal Complexity

- Interaction terms

Causal Complexity

- Interaction terms
- Substitutability

Causal Complexity

Causal Complexity

- Interaction terms: process tracing

Causal Complexity

- Interaction terms: process tracing
- Substitutability
  - Process tracing

Causal Complexity

- Interaction terms: process tracing
- Substitutability
  - Process tracing
  - Targeted comparison

Diffusion

Diffusion

Statistical models

Diffusion

Can process tracing help?

Diffusion

Elkins and the Brazilian constitutional assembly.

Regression Roles

Regression Roles

- Testing generalizability

Regression Roles

- Testing generalizability
- Causal pathways and models

Regression Roles

- Testing generalizability
- Causal pathways and models
- Addressing measurement problems

Regression Roles

- Testing generalizability
- Causal pathways and models
- Addressing measurement problems
- Testing the "importance" of omitted variables

Generalizability

Data Quality

Generalizability

Data Quality

Does the model capture the qualitative hypothesis?

Generalizability

Data Quality for Historical Data Sets:

Generalizability

Data Quality for Historical Data Sets:

- Proximity of Observations

Generalizability

Data Quality for Historical Data Sets:

- Proximity of Observations
- Transparency of Citations

Generalizability

Data Quality for Historical Data Sets:

- Proximity of Observations
- Transparency of Citations
- Certainty of the Historical Record

Generalizability

Data Quality for Historical Data Sets:

- Proximity of Observations
- Transparency of Citations
- Certainty of the Historical Record
- Attention to Valid Comparison

Generalizability

Data Quality for Surveys:

Generalizability

Data Quality for Surveys:

- Simple Questions

Generalizability

Data Quality for Surveys:

- Simple Questions
- Framing Effects

Generalizability

Data Quality for Surveys:

- Simple Questions
- Framing Effects
- Pre-Test Evidence

Generalizability

"Thick" Concepts:

Generalizability

"Thick" Concepts:

- Cannot be reduced to a single indicator without losing some important part of their meaning.

Generalizability

"Thick" Concepts:

- Cannot be reduced to a single indicator without losing some important part of their meaning.
- Multidimensional: no aspect of the concept is reducible to any of the others.

Mediation

T_i is 1 or 0

Mediation

T_i is 1 or 0

$Y_i(t)$

Mediation

$M_i(t)$

Mediation

$M_i(t)$

$Y_i(t, m)$

Mediation

$$\tau_i = Y_i(1, M_i(1)) - Y_i(0, M_i(0))$$

Mediation

$$\tau_i = Y_i(1, M_i(1)) - Y_i(0, M_i(0))$$
$$\delta_i(t) = Y_i(t, M_i(1)) - Y_i(t, M_i(0))$$

Mediation

$$\tau_i = Y_i(1, M_i(1)) - Y_i(0, M_i(0))$$
$$\delta_i(t) = Y_i(t, M_i(1)) - Y_i(t, M_i(0))$$
$$\zeta_i(t) = Y_i(1, M_i(t)) - Y_i(0, M_i(t))$$

Mediation

Assumption of Sequential Ignorability:

Mediation

Assumption of Sequential Ignorability:

$$\{Y_i(t, m), M_i(t')\} \perp T_i | X_i = x$$

and

$$Y_i(t, m) \perp M_i | T_i = t', X_i = x$$

Mediation

1. Fit model for mediator, conditional on treatment, etc.

Mediation

1. Fit model for mediator, conditional on treatment, etc.
2. Fit model for observed outcome, conditional on treatment, mediator, etc.

Mediation

1. Fit model for mediator, conditional on treatment, etc.
2. Fit model for observed outcome, conditional on treatment, mediator, etc.
3. Using the first model, simulate $M_i(0)$ and $M_i(1)$ for each case.

Mediation

4. Using the second model, simulate $Y_i(0, M_i(0))$, $Y_i(0, M_i(1))$, $Y_i(1, M_i(0))$, and $Y_i(1, M_i(1))$ for each case.

Mediation

4. Using the second model, simulate $Y_i(0, M_i(0))$, $Y_i(0, M_i(1))$, $Y_i(1, M_i(0))$, and $Y_i(1, M_i(1))$ for each case.
5. Use simulated values to compute τ_i, $\delta_i(t)$, and $\zeta_i(t)$ for each case.

Mediation

4. Using the second model, simulate $Y_i(0, M_i(0))$, $Y_i(0, M_i(1))$, $Y_i(1, M_i(0))$, and $Y_i(1, M_i(1))$ for each case.
5. Use simulated values to compute τ_i, $\delta_i(t)$, and $\zeta_i(t)$ for each case.
6. Repeat steps 3, 4, and 5 many times, saving the calculated values for each repetition.

Multi-Method Tests of Mediation Models

- Case Selection
- Qualitative Design Considerations