Social Science and Statistics

UseR Conference
Iowa State University
August 9, 2007
(Applied) Causal Inference

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<table>
<thead>
<tr>
<th>Unit Selection</th>
<th>Treatment Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomized</td>
<td>Randomized Experiment (gold standard)</td>
</tr>
<tr>
<td>Not Randomized</td>
<td>Survey Sampling (allows population inference)</td>
</tr>
<tr>
<td>Randomized</td>
<td>Controlled Experiment (allows causal inference)</td>
</tr>
<tr>
<td>Not Randomized</td>
<td>Observational Study (large potential for bias)</td>
</tr>
</tbody>
</table>
What to do with observational data?

- Ignore it → biased results
What to do with observational data?

- Ignore it → biased results
- Use modeling assumptions
What to do with observational data?

- Ignore it $\rightarrow$ biased results
- Use modeling assumptions
- “Fix” the data
Fixing the data ≡ Matching!
Fixing the data ≡ Matching!
  ▶ Exact matching
Fixing the data ≡ Matching!

- Exact matching
- Propensity scores
Fixing the data ≡ Matching!

- Exact matching
- Propensity scores
- Optimization-based matching (the way forward)
Choices for optimization-based matching

- Loss-function
Choices for optimization-based matching

- Loss-function
- Optimization algorithm