What is Your Estimand?

A workshop on specifying quantitative research goals

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NOTE: These slides are for a pedagogical workshop.
The main slides for this paper are here.

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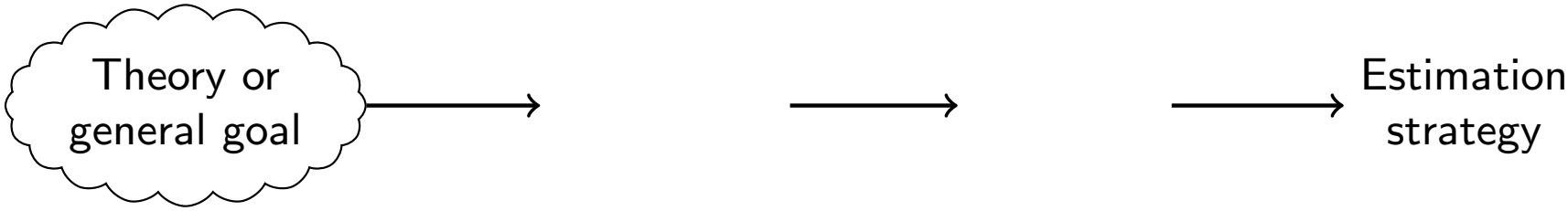
Plan for today

- Brief recap of paper: "What is Your Estimand?"
- In groups, we will discuss
  - Defining the intervention in a causal estimand
  - Defining the target population in a descriptive estimand
  - Policy implications of descriptive and causal estimands
- Professional development: Open for questions

Research framework: Estimands connect theory to evidence



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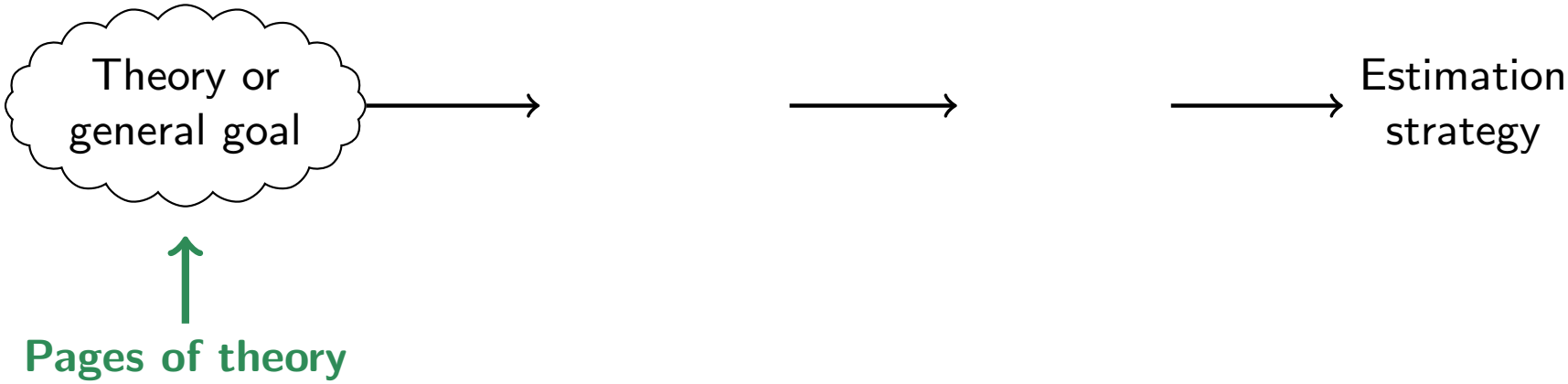

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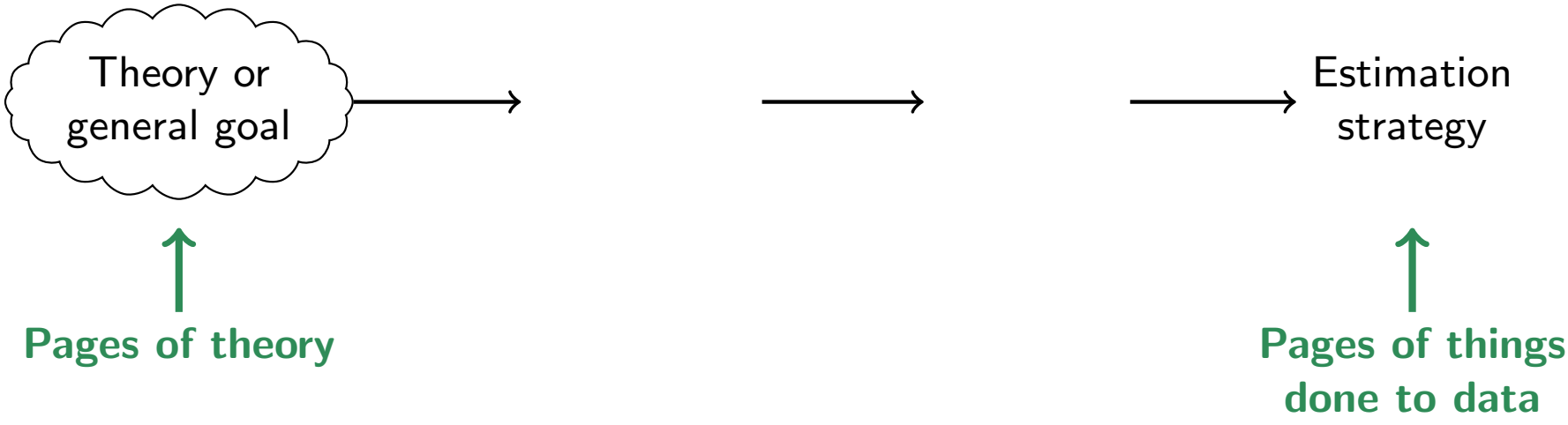

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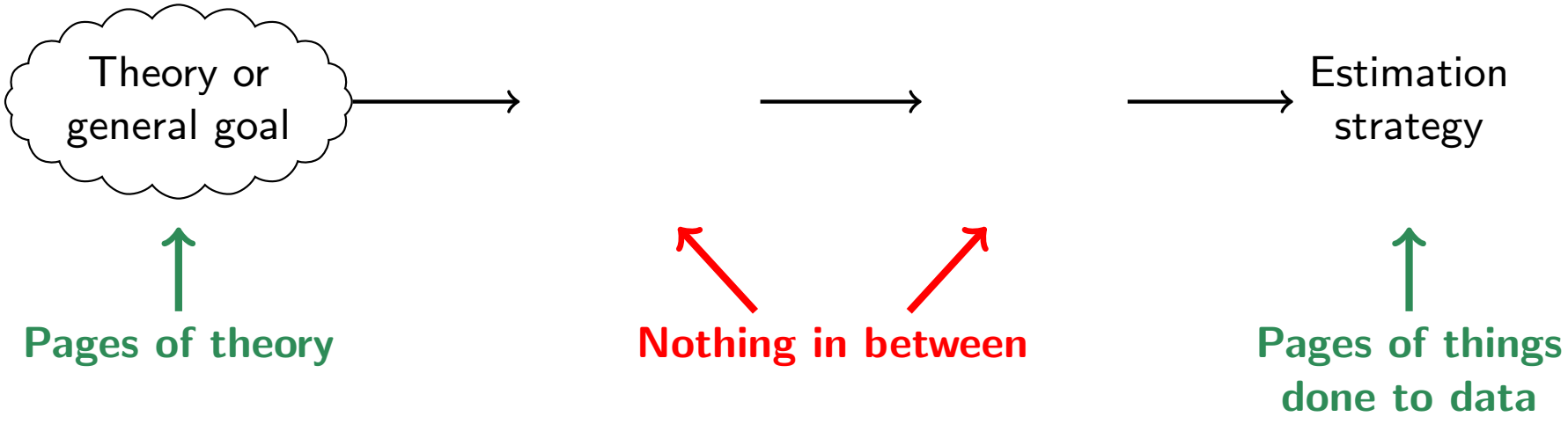

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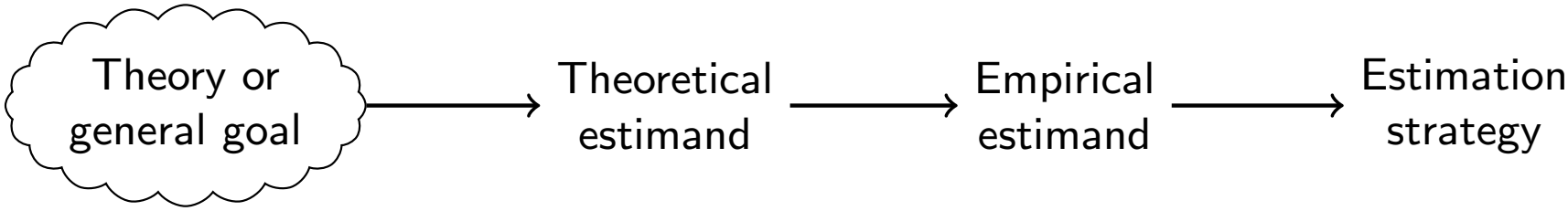

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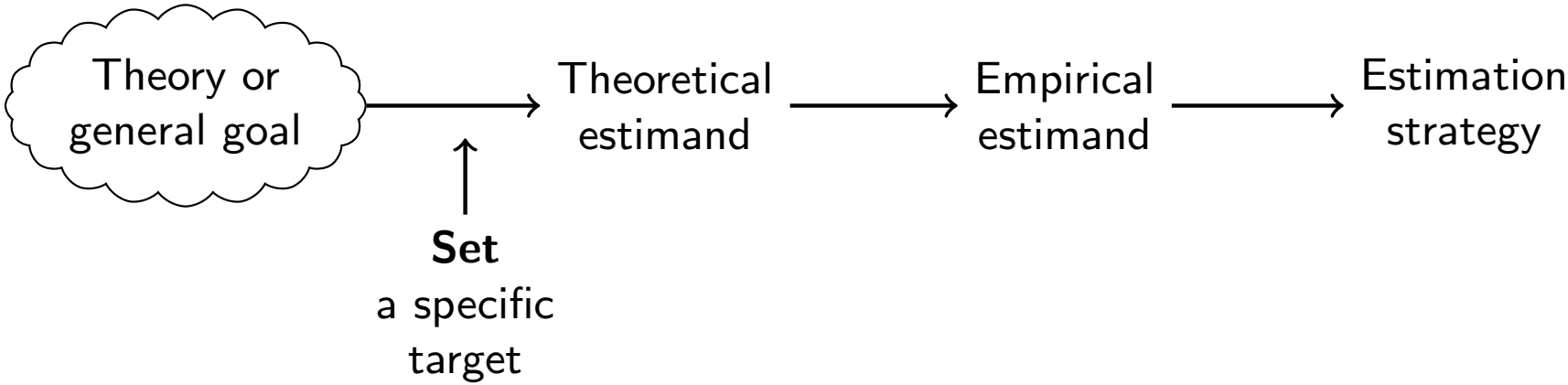

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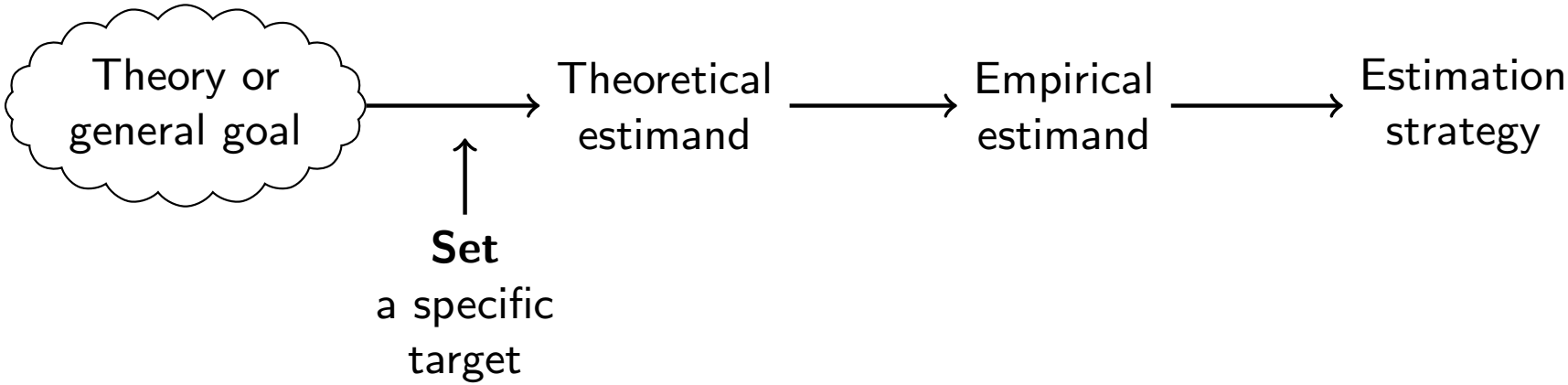
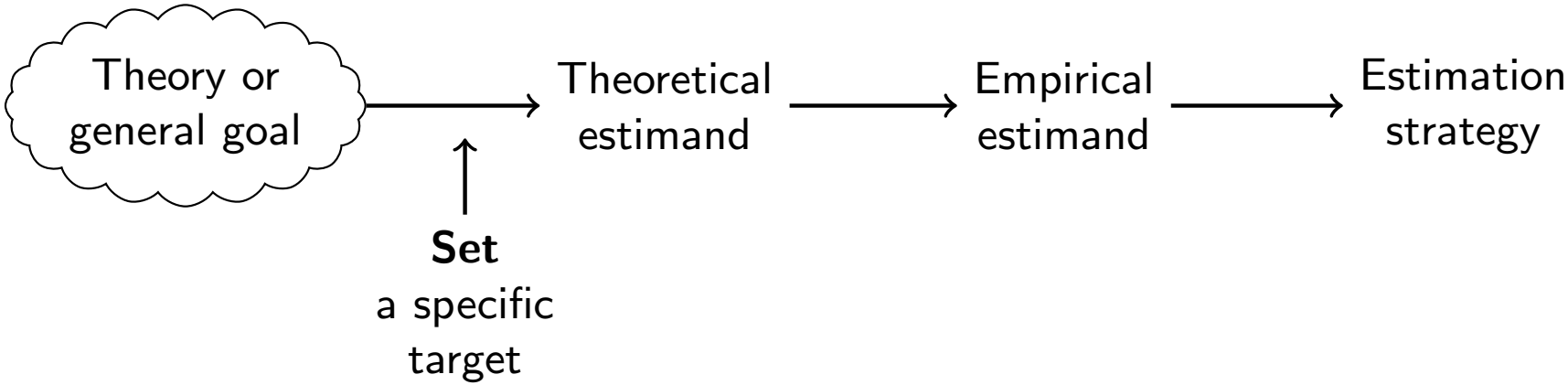


Definition

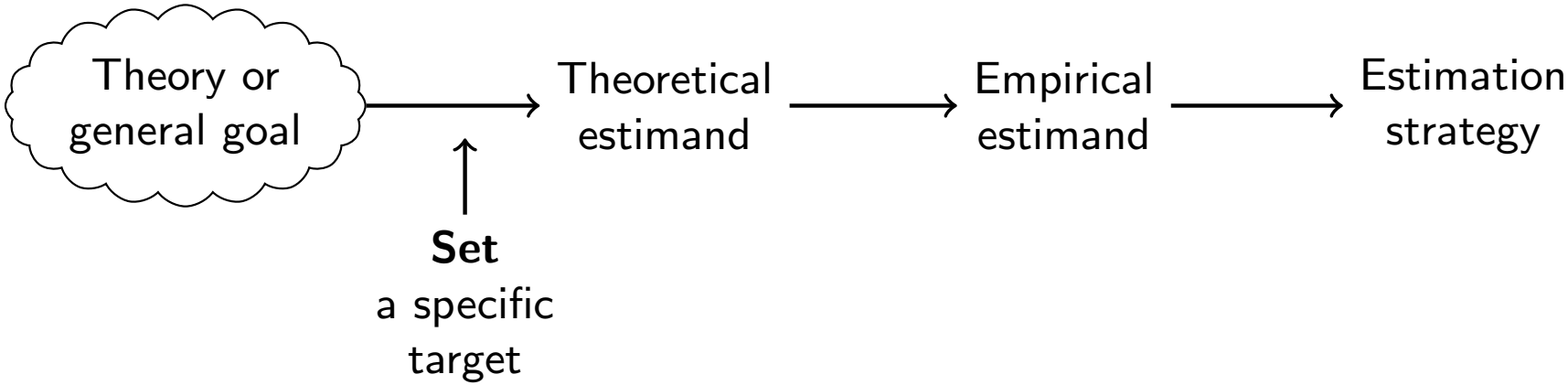
A **unit-specific quantity** aggregated over a **target population**

Research framework: Estimands connect theory to evidence



Definition	Example
A **unit-specific quantity** aggregated over a **target population**	$\frac{1}{\text{Size of U.S. adult population}} \sum_{i \text{ in U.S. adult population}} \left(\text{Employed}_i \right)$

Research framework: Estimands connect theory to evidence



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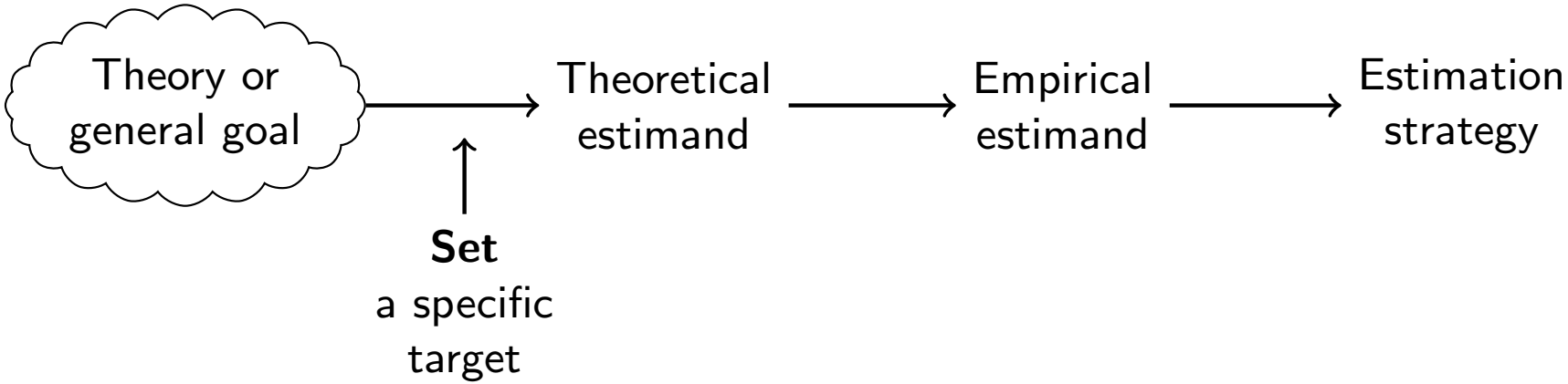

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Lieberson 1987, Abbott 1988, Freedman 1991, Xie 2013, Hernán 2018

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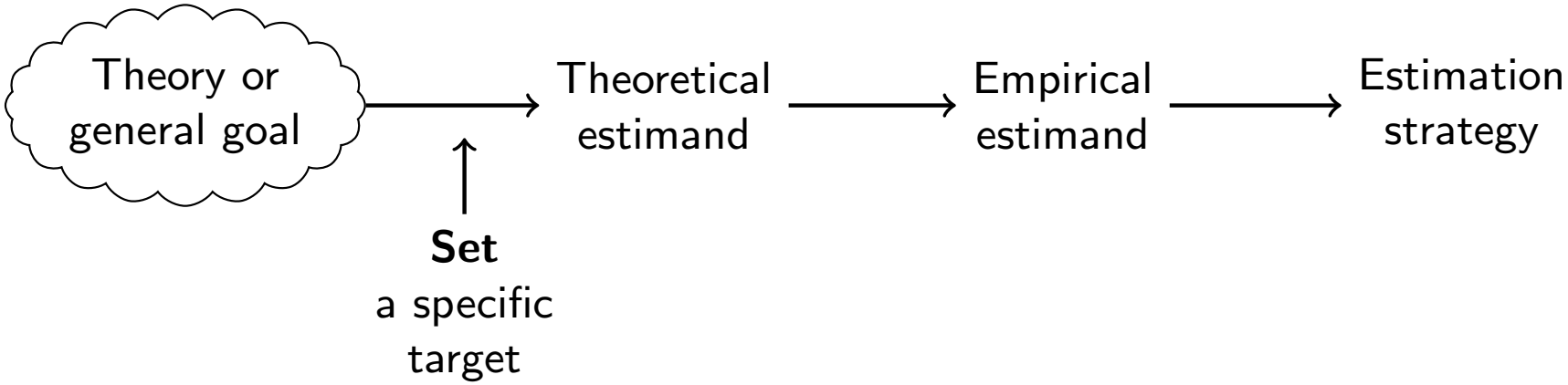

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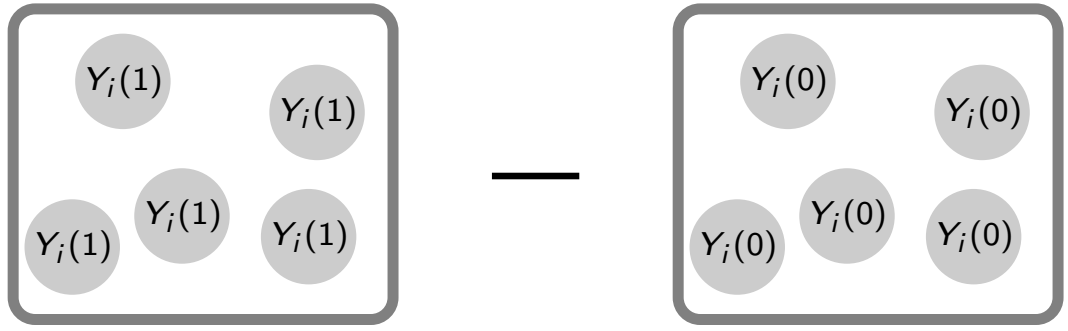

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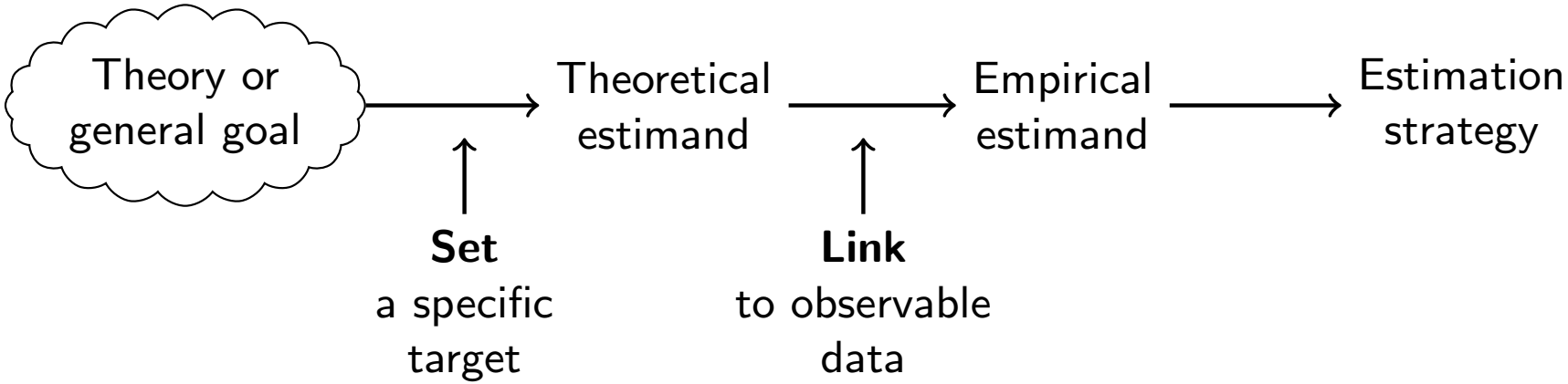

Definition	Example
A quantity involving **observable data**	$Y_i(1)$ $Y_i(1)$ $Y_i(1)$ $Y_i(1)$ $Y_i(1)$ − $Y_i(0)$ $Y_i(0)$ $Y_i(0)$ $Y_i(0)$ $Y_i(0)$

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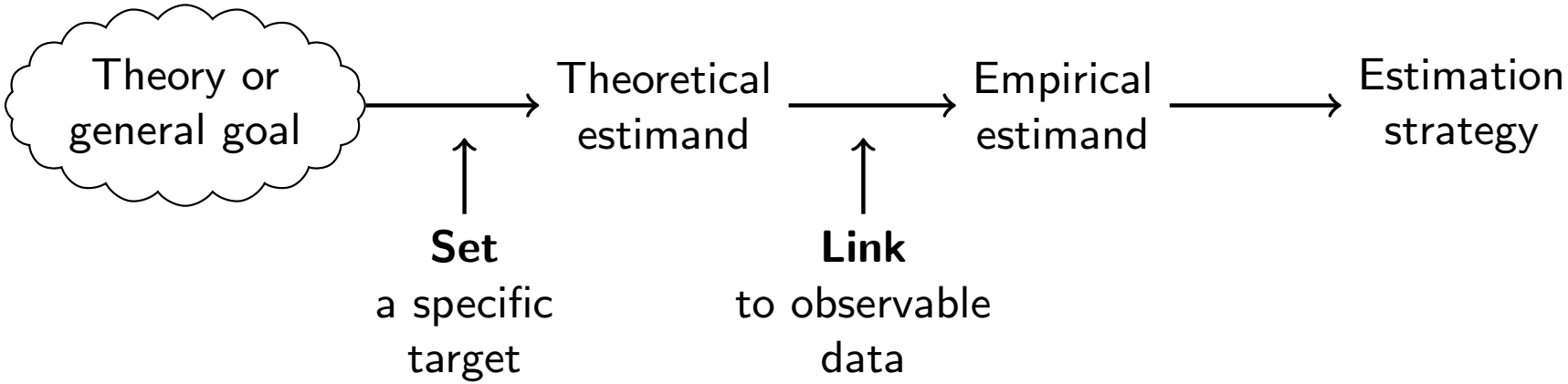

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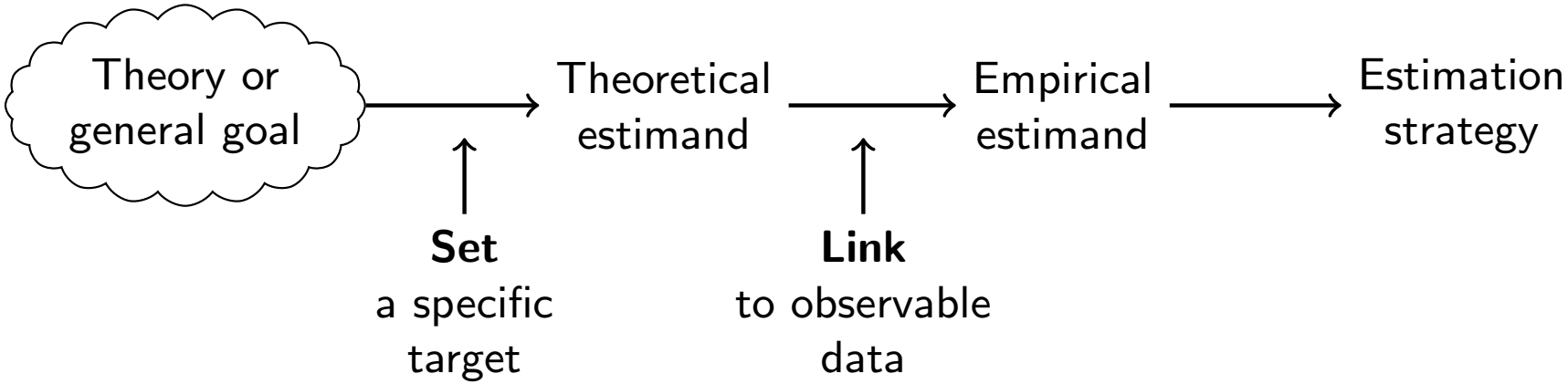

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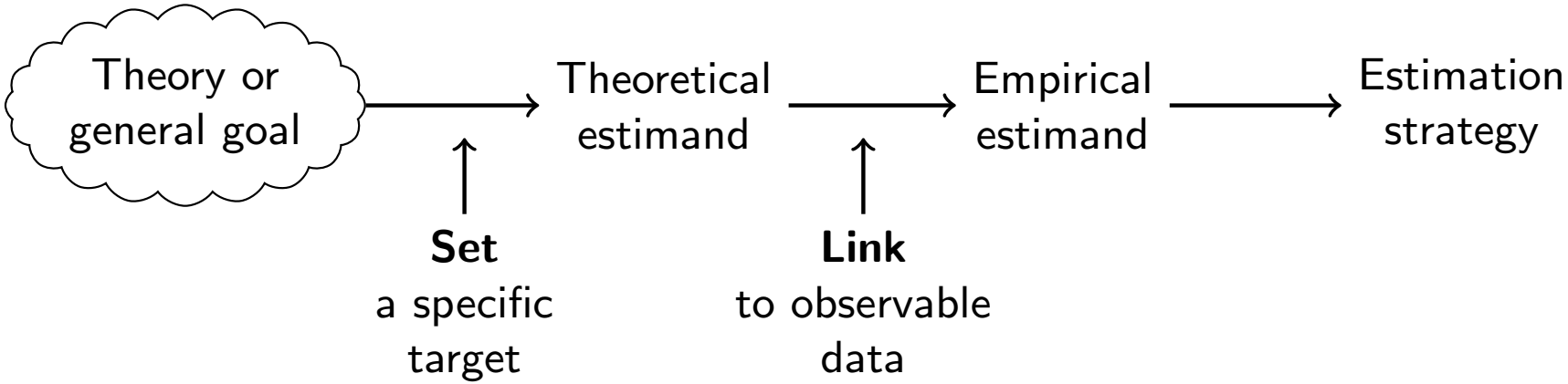

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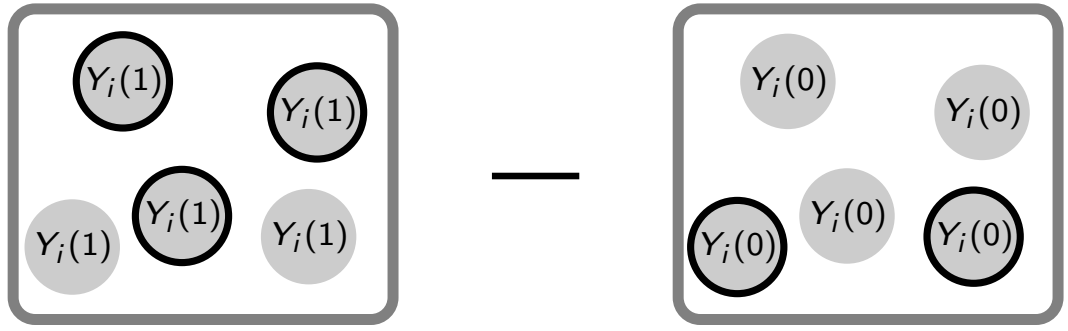

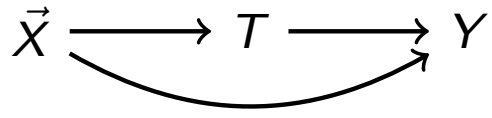

Pearl 2009, Imbens and Rubin 2015,
Morgan and Winship 2015, Elwert and Winship 2014

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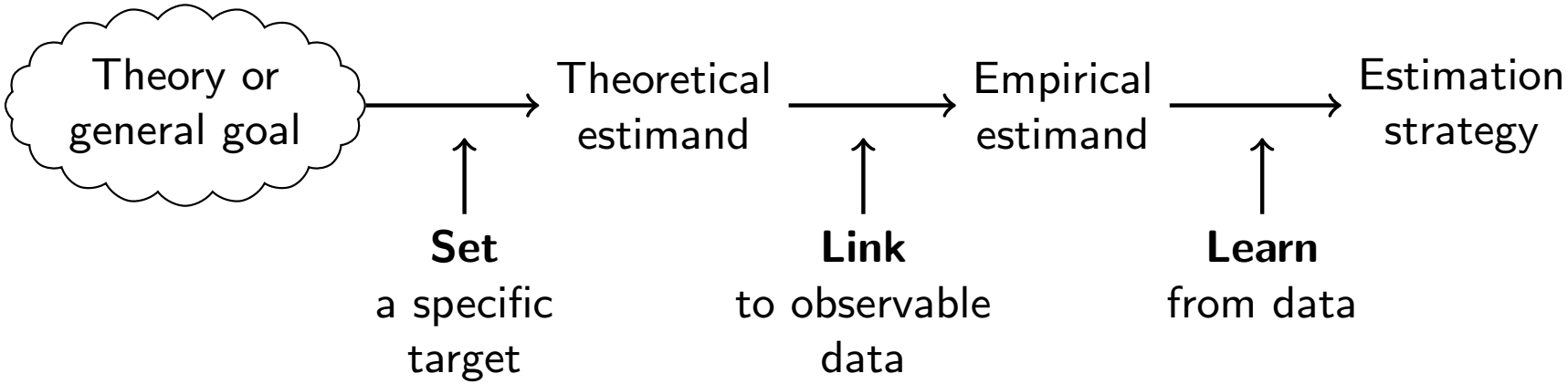

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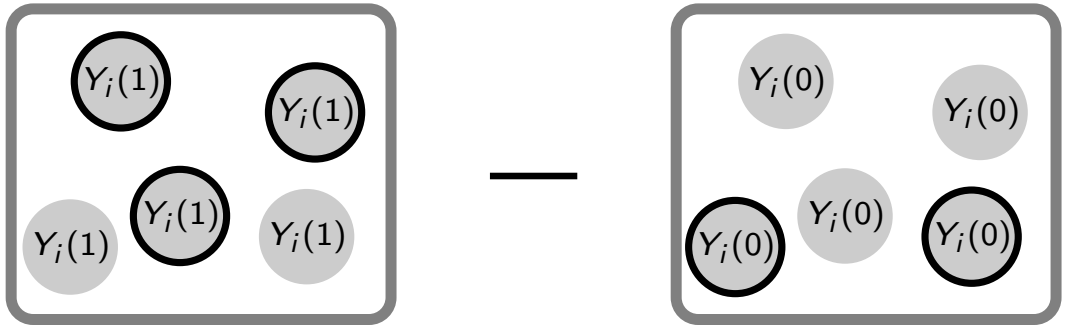
An algorithm applied to data	

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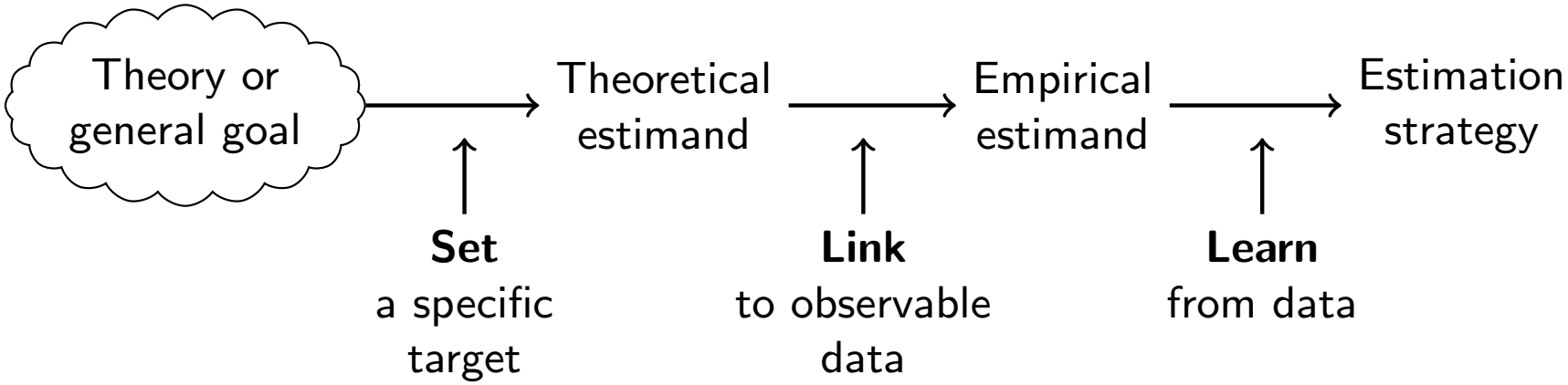

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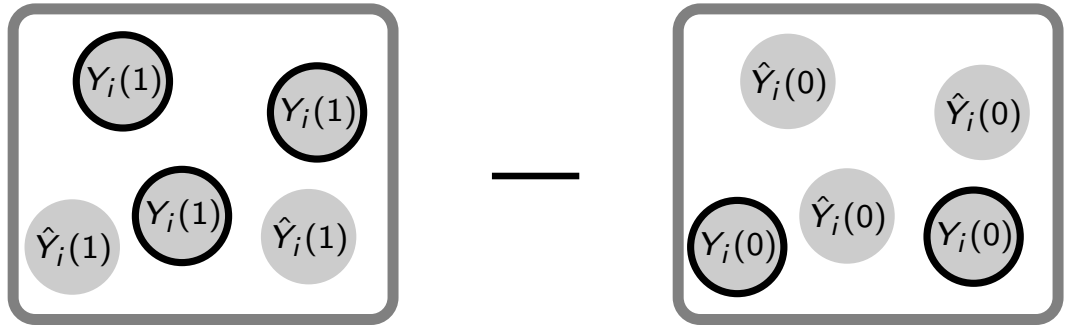
An algorithm applied to data	

Young 2009, Watts 2014, Berk et al. 2019, Molina and Garip 2019

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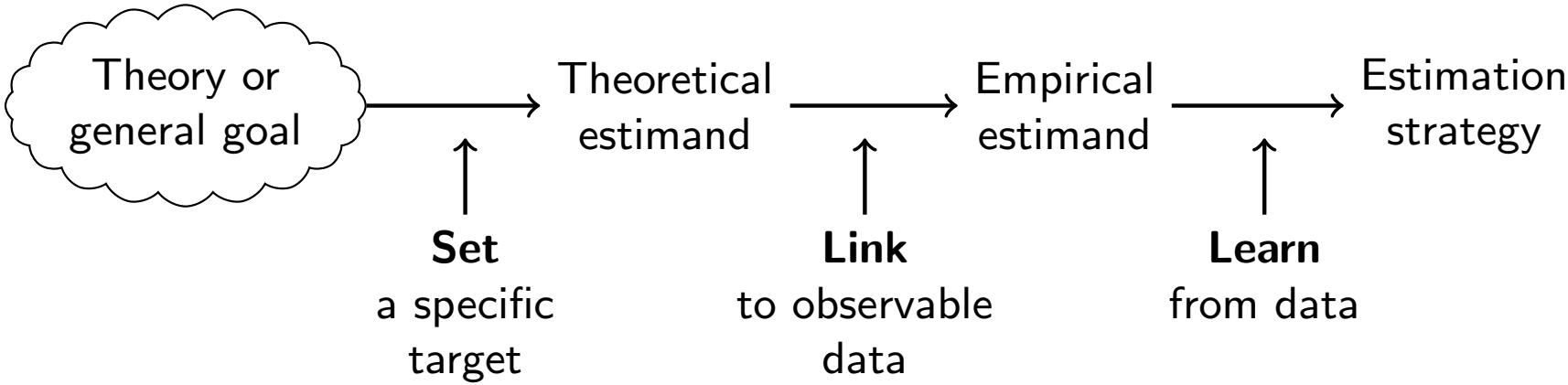

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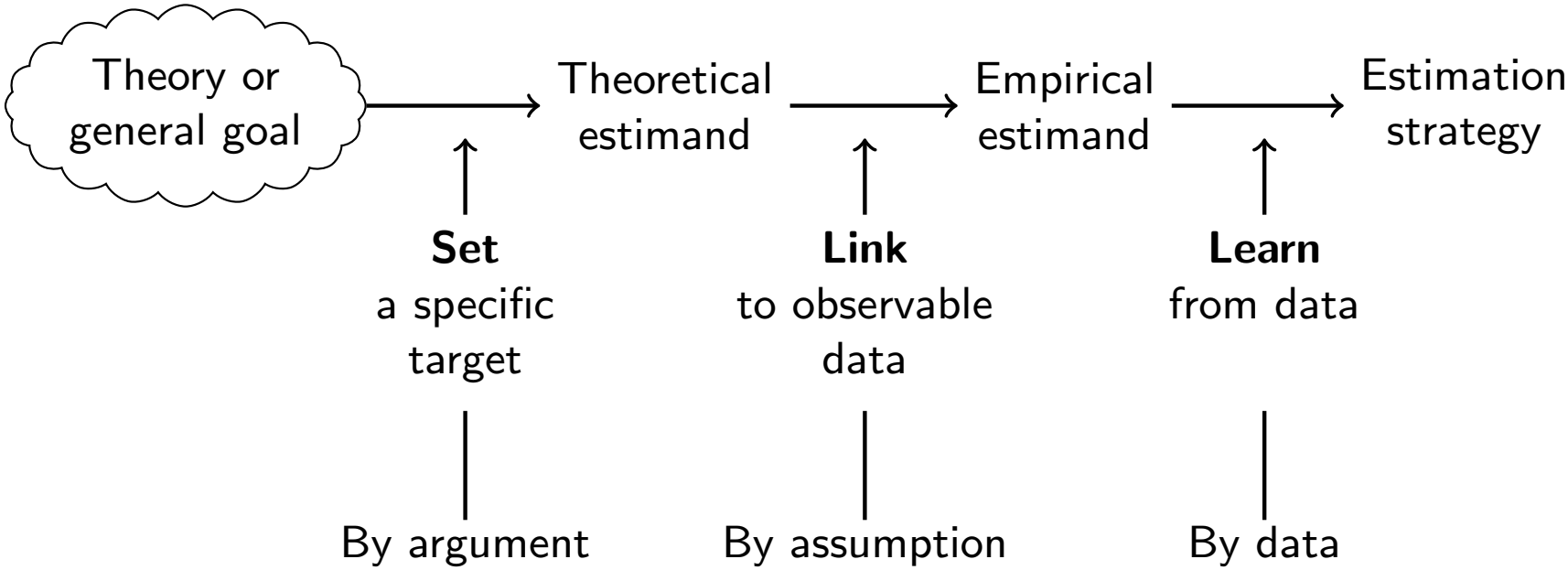

1. Set the target quantity.

Describe a population

What is the proportion employed
among U.S. resident women ages 21–35?

Describe a population

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Woman 1
Woman 2
Woman 3
Woman 4

Describe a population

What is the proportion employed
among U.S. resident women ages 21–35?

	Employed?
Woman 1	1
Woman 2	0
Woman 3	1
Woman 4	1

Describe population subgroups

What is the proportion employed
among U.S. resident women ages 21–35,
comparing mothers to non-mothers?

Describe population subgroups

What is the proportion employed among U.S. resident women ages 21–35, comparing mothers to non-mothers?

	Employed?
Mother 1	0
Mother 2	0
Mother 3	0
Mother 4	1

	Employed?
Non-Mother 1	1
Non-Mother 2	0
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Non-Mother 4	1

Causal effect in a population

What is the causal effect of motherhood on employment among U.S. resident women ages 21–35?

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Woman 1
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	Would be employed if a mother? $Y(1)$
Woman 1	0
Woman 2	0
Woman 3	0
Woman 4	1

Causal effect in a population

What is the causal effect of motherhood on employment among U.S. resident women ages 21–35?

	Would be employed if a mother? $Y(1)$	Would be employed if a non-mother? $Y(0)$
Woman 1	0	1
Woman 2	0	0
Woman 3	0	1
Woman 4	1	1

Causal effect in a population

What is the causal effect of motherhood on employment among U.S. resident women ages 21–35?

	Would be employed if a mother? $Y(1)$	Would be employed if a non-mother? $Y(0)$	Causal effect $Y(1) - Y(0)$
Woman 1	0	1	-1
Woman 2	0	0	0
Woman 3	0	1	-1
Woman 4	1	1	0

Describe population subgroups

What is the proportion employed among U.S. resident women ages 21–35, comparing mothers to non-mothers?

	Employed?
Mother 1	0
Mother 2	0
Mother 3	0
Mother 4	1

	Employed?
Non-Mother 1	1
Non-Mother 2	0
Non-Mother 3	1
Non-Mother 4	1

Very **different** research goals

Causal effect in a population

What is the causal effect of motherhood on employment among U.S. resident women ages 21–35?

	Would be employed if a mother? $Y(1)$	Would be employed if a non-mother? $Y(0)$	Causal effect $Y(1) - Y(0)$
Woman 1	0	1	-1
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Woman 3	0	1	-1
Woman 4	1	1	0

If the estimand is causal, you have to tell the reader:

what is the intervention?

(Hernán 2016)

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Example: Effect of motherhood on employment

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— How many kids?

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Example: Effect of motherhood on employment

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Example: Effect of motherhood on employment

— How many kids?

— Adopted? Biological?

— Sex mix of the kids?

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Example: Effect of motherhood on employment

— How many kids?

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— Born this year? 5 years ago?

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Example: Effect of motherhood on employment

— How many kids?

— Adopted? Biological?

— Sex mix of the kids?

— Born this year? 5 years ago?

One resolution: Effect **among mothers** with their factual configuration of kids, compared with a counterfactual of having no kids

(Hernán 2016)

Group Exercise

If the estimand is causal, you have to tell the reader:

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Group Exercise

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> — A policymaker

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$$\frac{1}{n}\sum_{i=1}^{n}\Big(\text{Poverty}_i(\text{Married}) - \text{Poverty}_i(\text{Unmarried})\Big)$$

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Is this policymaker being sufficiently precise about the intervention?

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$$\frac{1}{n}\sum_{i=1}^{n}\Big(\text{Poverty}_i(\text{Married}) - \text{Poverty}_i(\text{Unmarried})\Big)$$

Is this policymaker being sufficiently precise about the intervention?

Suggestion: For a given woman i, are there versions of "married" and "unmarried" that might lead to distinct outcomes? Does it matter who you marry?

Regardless of descriptive or causal,
you have to tell the reader the **target population**

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Example: The unemployment rate

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Example: The unemployment rate

U.S. non-institutionalized civilians age 16+

actively looking for work in past 4 weeks

Group Exercise

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> "My online sample is nationally representative"
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What might the target population be if the question is:

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What might the target population be if the question is:

1) Do you plan to vote for Biden?

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> — An academic

What might the target population be if the question is:

1) Do you plan to vote for Biden?

2) What is your hourly wage?

Group Exercise

Regardless of descriptive or causal,
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> "My online sample is nationally representative"
>
> — An academic

What might the target population be if the question is:

1) Do you plan to vote for Biden?
2) What is your hourly wage?
3) Would you recommend this hypothetical resume for an interview?

Policy implications depend on the type of claim.

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Descriptive Claim

"People who go to Disneyland twice are more likely to buy an annual pass"

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"A second trip to Disneyland causes people to decide they need an annual pass"

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"People who go to Disneyland twice are more likely to buy an annual pass"

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Policy implications for Disney

Policy implications depend on the type of claim.

Descriptive Claim

"People who go to Disneyland twice are more likely to buy an annual pass"

Causal Claim

"A second trip to Disneyland causes people to decide they need an annual pass"

Target annual pass ads at the return visitors

Policy implications for Disney

Policy implications depend on the type of claim.

Descriptive Claim

"People who go to Disneyland twice are more likely to buy an annual pass"

Target annual pass ads at the return visitors

Causal Claim

"A second trip to Disneyland causes people to decide they need an annual pass"

Offer discounts to induce a second visit

Policy implications for Disney

Group Exercise

Policy implications depend on the type of claim.

Descriptive Claim

Causal Claim

Group Exercise

Policy implications depend on the type of claim.

Descriptive Claim

"College graduates are more financially stable than non-graduates"

Causal Claim

Group Exercise

Policy implications depend on the type of claim.

Descriptive Claim

"College graduates are more financially stable than non-graduates"

Causal Claim

"College completion causes greater financial stability"

Group Exercise

Policy implications depend on the type of claim.

Descriptive Claim

"College graduates are more financially stable than non-graduates"

Causal Claim

"College completion causes greater financial stability"

What kinds of policies would these claims suggest?

Professional development

- Social media
- Professional networking
- Anything else you want to discuss!