Introduction to Advanced Research Methods

Philip Leifeld

GV903: Advanced Research Methods, Week 2

1. Practical Introduction

About the Instructor

- MA in Politics and Public Administration, Konstanz, 2007
- PhD, Max Planck Society and University of Konstanz, 2011
- Postdoc at Eawag (ETH Domain, Zurich), University of Bern, and Konstanz, 2012–2016
- Senior Lecturer, University of Glasgow, 2016–2018
- Professor of Research Methods, Glasgow, 2018–2019
- Professor of Comparative Politics, Essex, since 2019

Publications in political science, public administration, statistics, computer science, physics, psychology, climate science, and public health.

Interested in political networks, the policy process, and computational social science.

Should You Take GV903 or GV900?

GV900:

- Leads to an MA.
- Similar topics, but easier, less rigorous, less advanced.
- Take this module if you have average stats skills.
- Statistical Literacy: Consuming academic papers with statistical results in political science.

GV903:

- Leads to an MSc.
- More mathematical and rigorous; more advanced.
- Take this module if you have good mathematical knowledge.
- Only take this module if you have intrinsic motivation.
- Conducting your own empirical polisci research.
- Academic career and publishing.

How to Make the Right Decision

- Self-assessment test: checks for prior maths skills.
- Brief maths refresher in weeks 3–4.
- Read some chapters from Wooldridge and perhaps Chapter 2 of Long (1997).
- Look at the topics on the module handbook and think about whether you might need these skills.
- Most importantly: Are you motivated to play with the data, equations, and code until you understand the methods?
- GV903 is *hard*. You don't want to realise in the middle of the semester that you might fail. Better figure it out early.
- Last time, 5 out of 19 failed, one of whom passed the resit assignment and four of whom did not resubmit.

Intended Learning Outcomes

- Understanding different regression models and their assumptions thoroughly (i. e., mathematically).
- Being able to decide in a competent way which model to apply in which situation.
- Using R to manage data, calculate regression results, and interpret them.
- Applying these models to empirical data "manually" (i. e., on paper, without R) to make sure you understand them.
- Rewriting the regression models and measures from scratch as computer code.

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4. Exercises
   - Built into the videos or in separate documents.
   - Answers will be provided with a delay.

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8. Module handbook (syllabus)
   - Summarises everything.
   - Authoritative resource.
   - Familiarise yourself with it early on.

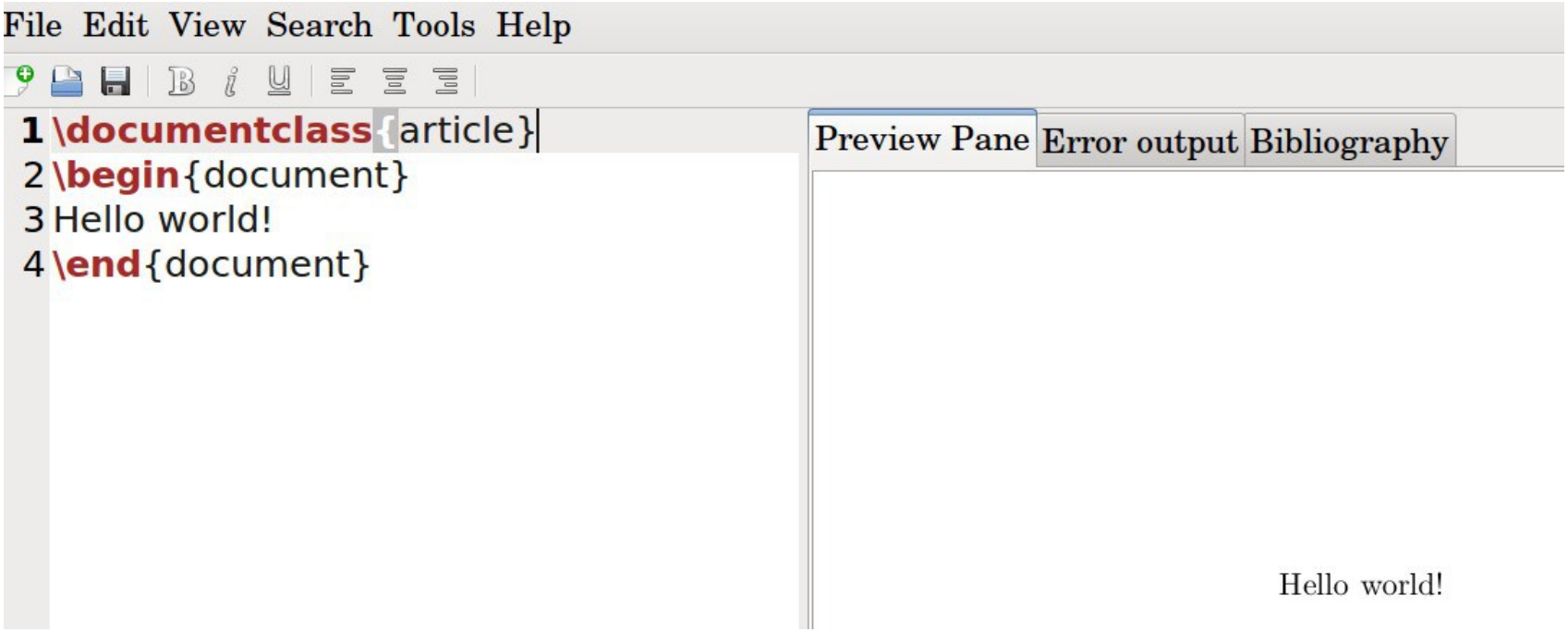
Job Market Relevance

- Interesting substantive research based on faulty methods is useless.
- Academic hiring at research-intensive universities is mainly a function of four things:
  1. Publications in good journals.
  2. Institutional pedigree.
  3. Recommendation letters from reputable supervisors.
  4. A mainstream research topic.
- For publications in good journals, you need methods knowledge.
- Also in research-related non-academic jobs, pay and opportunities are correlated with how technical one's studies are.
- Trend: both stats and programming (i. e., data science).

Typesetting using LaTeX

- LaTeX is a document preparation system.
- You are required to use it for your assignments.
- Like MS Word, but more sophisticated.
- It separates the contents from the layout.
- You can write the text in a plain text file.
- You use commands like `\section{My heading}` or `\emph{emphasised text}` to structure your document.
- You also select a class (e. g., `\documentclass{thesis}`) to get proper formatting of your contents.
- You use an editor to facilitate the writing of your documents.
- The editor can compile your document into a PDF file.

Editor with a Simple LaTeX Document and PDF Preview



Source: `http://www.highschoolmathandchess.com/latex/create-a-simple-latex-document/`

Generated PDF File of LaTeX Article

https://tex.stackexchange.com/questions/150841/

An important paper

R. Campbell M. Dane J. Jones

December 21, 2013

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References

[1] A. Uthor, A paper, J. of Interesting Results, 2015

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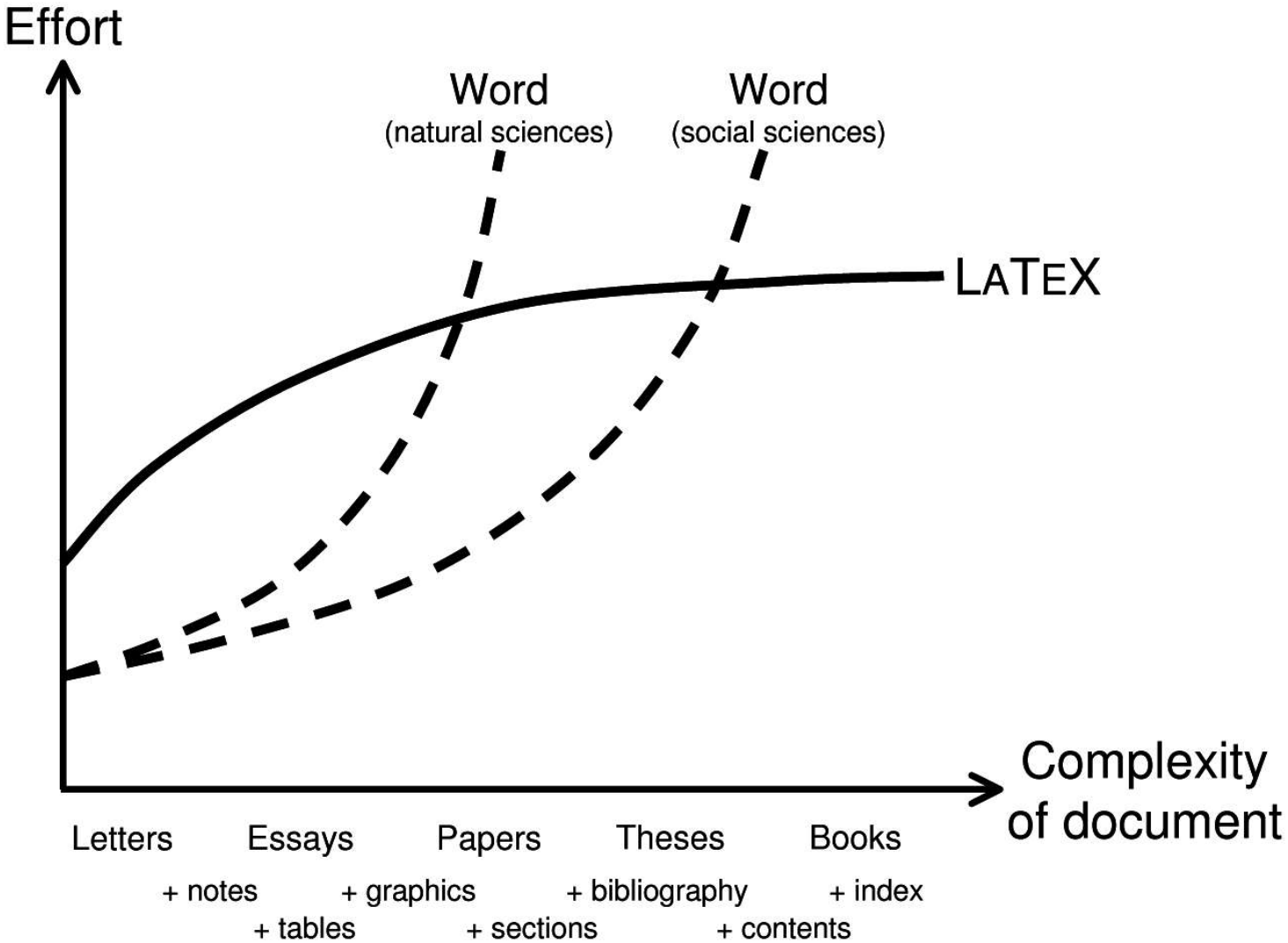
Word and LaTeX

https://softwareengineering.stackexchange.com/questions/47402/



Some Advantages of LaTeX

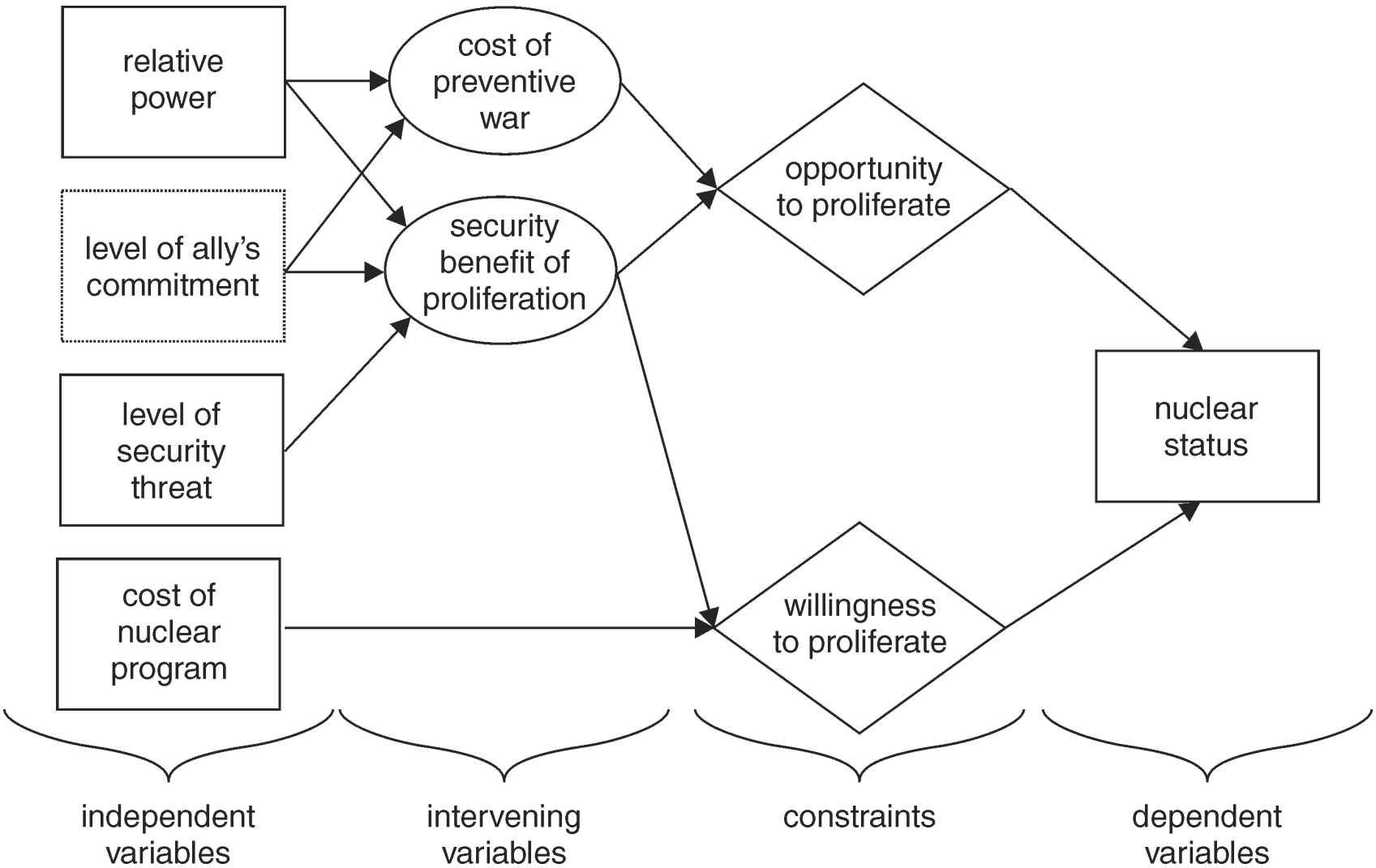
- Equations and other special elements are easier to typeset.
- Integration with R.
- Formatting is automatically taken care of.
- No more moving back and forth of diagrams.
- Automatic reference formatting with a built-in citation manager (BibTeX).
- Templates for many purposes, including articles, theses, books, CVs, posters, slides...

2. Substantive Introduction: Research Design

Dependent and Independent Variables

- A *variable* takes multiple values across units, a *constant* is always the same.
- When assessing causality:
  - Dependent variable (DV) = outcome variable = explanandum.
  - Independent variable (IV) = explanatory variable = explanans.
  - IVs: composed of treatment variables and control variables.

What is a Theory?



Example from: Monteiro and Debs (2014): The Strategic Logic of Nuclear Proliferation. *International Security* 39(2): 7–51.

Causality and Counterfactuals

- Causality can be assessed by looking at counterfactual thought experiments.
- Switching the value of exactly one treatment and thinking about changes in the outcome, holding other variables constant.
- That is, if you could observe the IVs and changed the value of only one of them, how would this change the outcome?
- Difference between outcome variable in these two hypothetical states of the IV is the causal effect!
- The "fundamental problem of causal inference": you cannot observe both conditions, so there is always uncertainty.

(Mean) Causal Effect

. . . or the way out of the fundamental problem of causal inference

- DV: Final mark in this course.
- Treatment: Attendance of lectures.
- Control_1: Reading materials carefully.
- Control_2: Intelligence.
- Control_3: Number of courses taken in this semester.
- Causal effect: difference between attendance and non-attendance *at constant levels of the controls*.
- Mean causal effect: average difference in this thought experiment *over many units* (= students).

Omitted Variable Bias

Example: explaining final marks in a course

- Y: final marks
- X_1: attendance
- X_2: intelligence/skills
- X_3: study

If X_3 is omitted, marks are wrongly attributed to attendance.

If an omitted variable X_3 is correlated both with Y and X_1, too much variance in Y is explained by X_1, leading to a biased estimate for X_1 (type I error).

Take-home message: include all relevant control variables.

Exception: do not include intervening variables as controls.

Do Not Use Mediating Variables as Control Variables!

Depression and Heart Failure Example

- Depression $\rightarrow$ heart failure: causal relationship?

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- Typical example where we *should not* control for other consequences of the treatment than the DV.
- If we did, we could no longer assess the causal effect of depression.
- But: As good social scientists, we incorporate this intervening variable in our theory as a theoretical underpinning of the causal effect of depression.

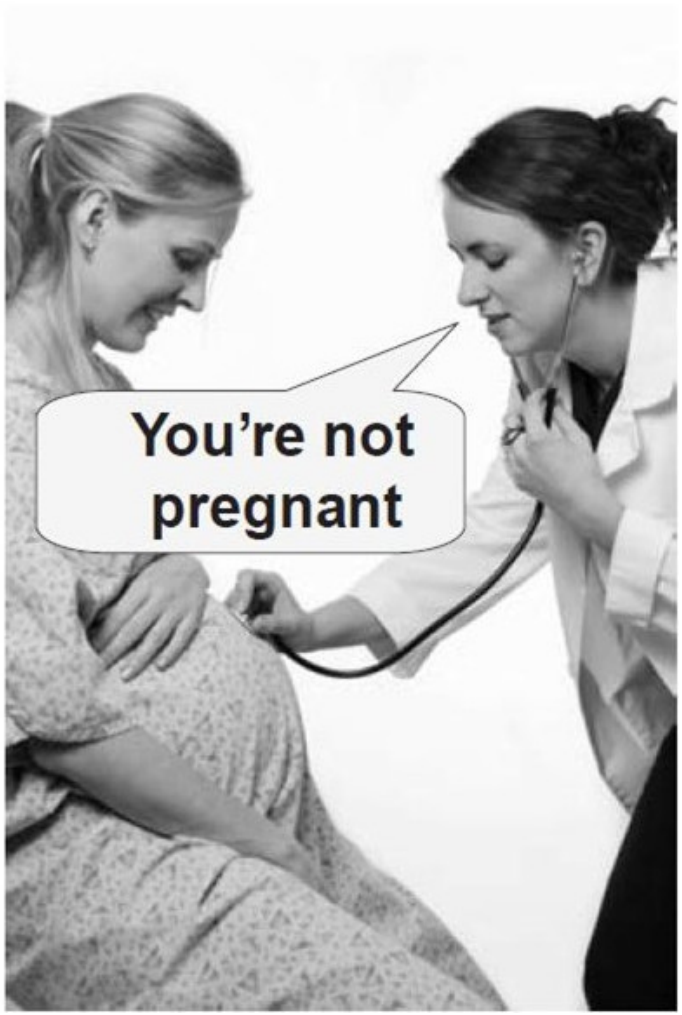
Choosing among Competing Theories

Bueno de Mesquita: the "first principle of wing-walking"

"The more things a theory can explain and the fewer the errors it makes compared with alternative theories, the better it is. [. . .] It is not enough to get more things right; the theory must also not get things wrong that were previously accounted for. There must be a net improvement in prediction."

Type I error
(false positive)

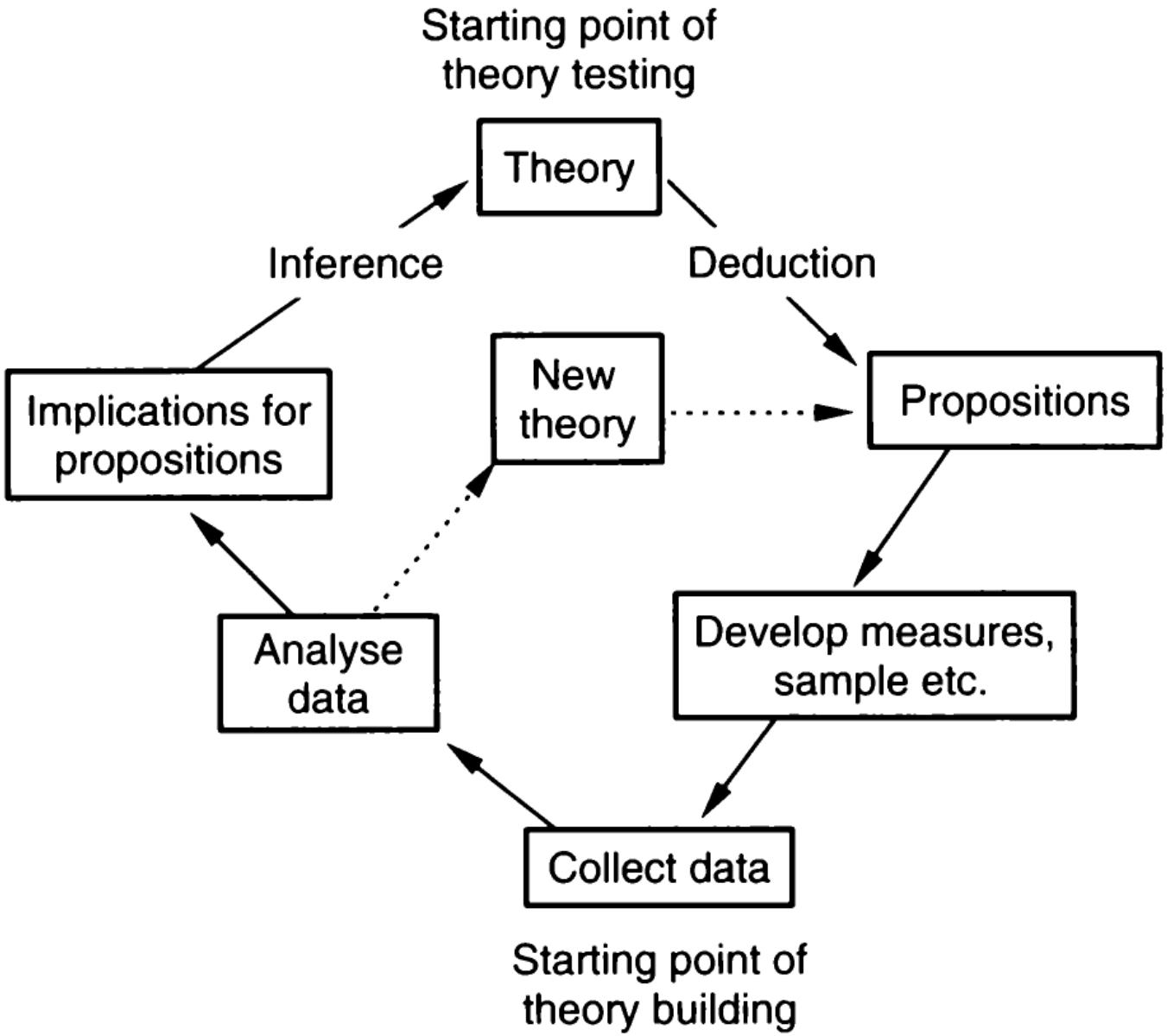
Type II error
(false negative)



Source: Ellis, Paul D. (2010): *The Essential Guide to Effect Sizes.* Cambridge University Press.

A Sketch of the Research Process

De Vaus, David (2001): *Research Design in Social Research*. Sage.



What Do We Need Regression Models For?

- Estimate relative importance of each IV.
- Hold other IVs constant.
- Assess uncertainty of a relationship between variables.
- Test parts of theories using empirical data.
- Explain variables using other variables, but also predict.