PS 2010: Introduction

Qing Chang

Department of Political Science
University of Pittsburgh

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Today's Agenda

- Welcome
- Motivation
- Go through the syllabus and course overview

A little bit about myself...

- Name: Qing Chang
- Fields: comparative politics and political methodology
- Research:
  - political economy of development in developing countries
  - causal inference + machine learning
- Fun things about me.

What this course about

- Political science: study of government, public policies, political process, and political behavior
- Topics such as political economy, war and conflict, voting, and institutions
- Political Methodology: **both** qualitative and quantitative tools to examine the political sphere

Why Study Quantitative Methods?

- Systematically collect and analyze data to test theories and hypotheses
- Brings precision, objectivity, and rigor to political science research (replicable)
- Multi-mode research: complement qualitative approaches like interviews and comparative case study

Why You Need to Learn?

- It is a standard now
- Allows you to read and critically evaluate academic literature
- Signal of your capability
- Quantitative chops can give you an edge, e.g applying for grants https://www.nsf.gov/funding/programs.jsp?org=SBE
- More opportunities

This Course

- Foundations of Quantitative Methods
- An introductory level course covers mathematical and key statistical concepts
  - If $A \Rightarrow B$
  - How to test? Quantify uncertainty and generalize to others
- Helps build foundations for advanced study

Structure of the class

Our class has three modules:

- Mathematics:
  - calculus, linear algebra
- Probability theory:
  - probability, random variable
- Statistical inference:
  - hypothesis testing, OLS

In additional to theory, I also introduce you:

- R and Rstudio
- Data cleaning, transformation, visualization, and analysis

Example 1: Pierskalla, Schultz, Wibbels, et al. 2017

Table: Historical Capitals and Development

	(1) log(Lights)	(2) log(Lights)
LHCE δ=5%	2.062***	1.956***
	(0.570)	(0.346)
Current Capital Distance	0.0420	-0.146
	(0.138)	(0.102)
log(Population)	0.279***	0.268***
	(0.0765)	(0.0213)
Absolute Latitude	0.0144	-
	(0.0111)	-
Avg Precipitation	0.0475	-0.0238
	(0.371)	(0.206)
Constant	-3.134***	-2.177***
	(0.850)	(0.263)
Observations	6591	6591
Adjusted R^2	0.472	0.433
F	120.9	87.55

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table is part of the Table 2 in Pierskalla, Schultz, Wibbels, et al. 2017 paper.

To know how you get those numbers and stars, you need to know:

1. Derivatives
2. System equations, matrix Algebra
3. Probability theory
4. Random variables
5. Hypothesis testing

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To know how you calculate standard errors in parentheses, you need to know:

1. Derivatives
2. Matrix Algebra
3. Probability theory
4. Statistical inference

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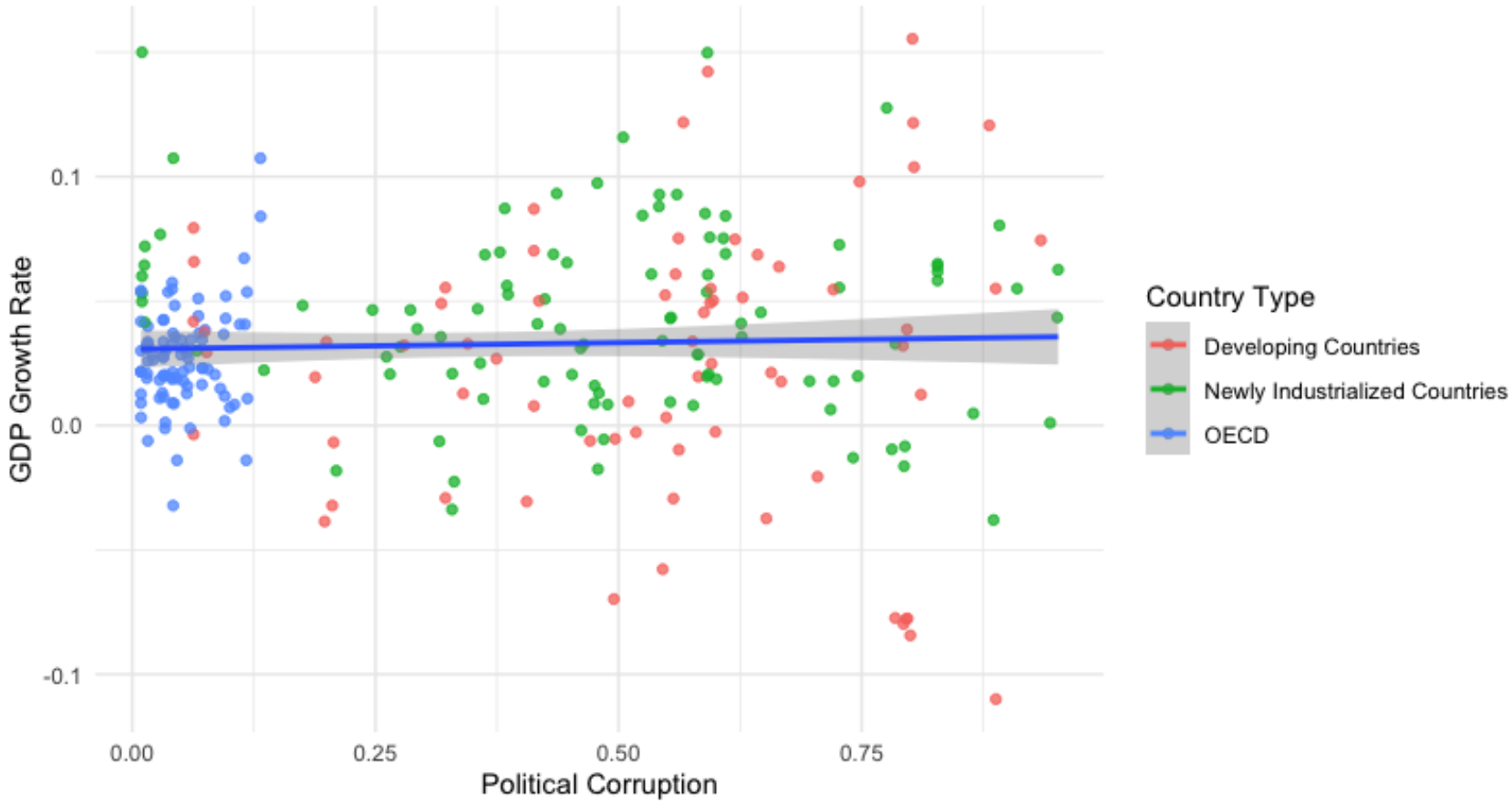
To know why they need to add other variables, you need to know:

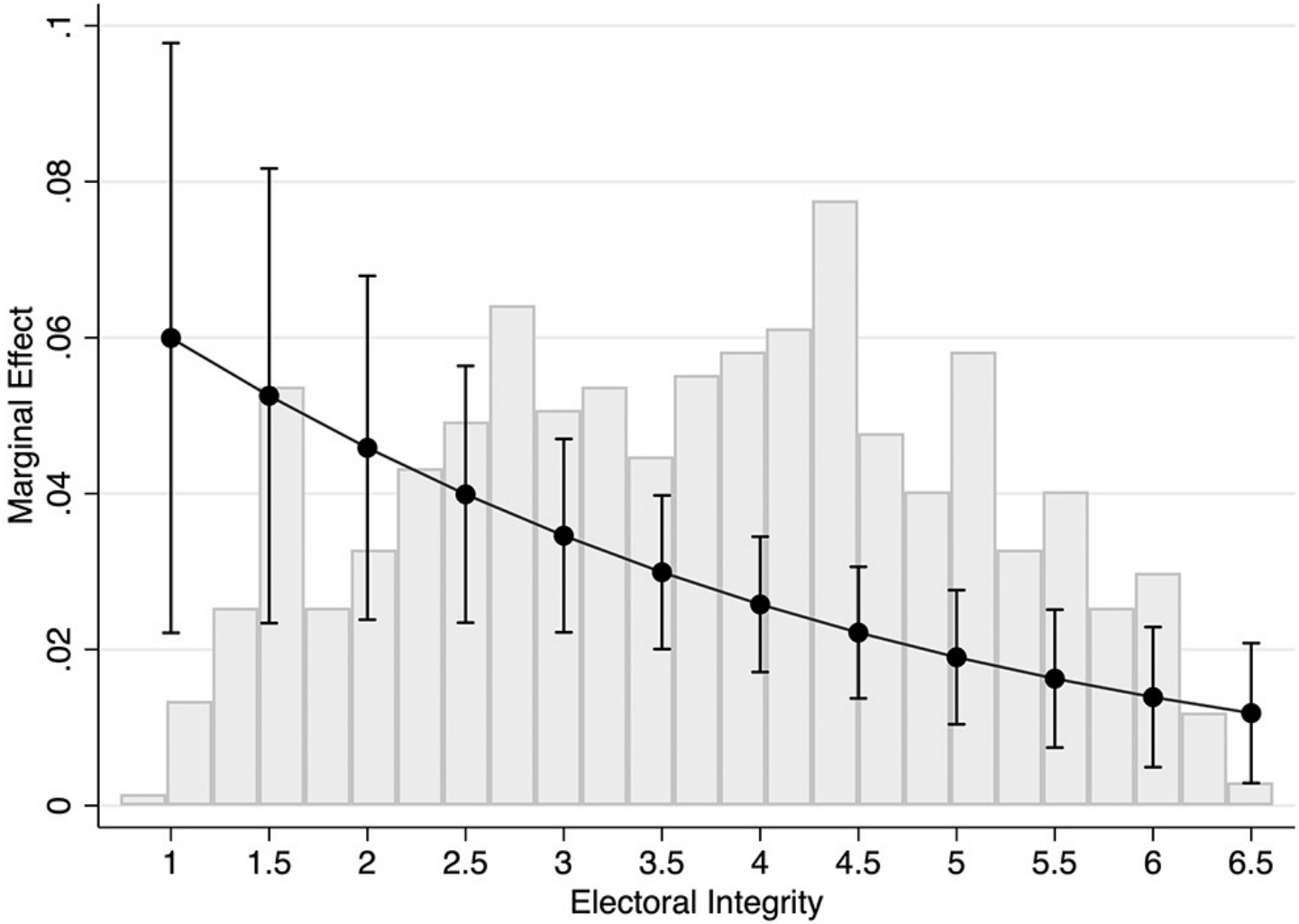
1. Idea of causal inference
2. Confounding variables

Example2: Political Economy

Figure: Corruption and GDP growth



Example3: Conflict



Source: Daniela Donno, et al. Not All Elections Are Created Equal: Election Quality and Civil Conflict. The Journal of Politics 2022 84:134-147. DOI: 10.1086/714778

Example4: Method

$$\hat{\boldsymbol{\alpha}}_\lambda = \underset{\boldsymbol{\alpha}}{\text{argmax}} \; -\frac{1}{2\sigma^2}\left[\sum_{i=1}^{N}(y_i - \boldsymbol{k}_i^T\boldsymbol{\alpha})^2 + \lambda\boldsymbol{\alpha}^T\boldsymbol{K}\boldsymbol{\alpha}\right]; \quad \hat{\boldsymbol{\alpha}}_\lambda = (\boldsymbol{K} + \lambda\boldsymbol{I})^{-1}$$

Source: Qing Chang and Max Goplerud, Generalized Kernel Regularized Least Squares, forthcoming Political Analysis.

Assignments and Exams

- Assignment:
  - Weekly assignment starts from week 2
  - Math exercises.
  - **Homework due before class**
  - Answers will be provided
  - Better written in Latex or Word, but scanned PDF also acceptable
- Exams:
  - Middle term exam, 10/03 (then enjoy the spring break!)
  - Final, 12/05
- Office Hour/Recitation: every Friday after noon, Time: TBD

Grades

- 10 assignments with 5% each (50%)
- 2 exams with 20% each (40%)
- 10% participation.
- Letter grade: (93-100: A, 90-92: A-, 87-89: B+, 83-86: B, 80-82: B-, etc.)

However, don't care too much on the numerical grades. This course isn't about grades (it's about learning)

Requirements

- All slides will be online.
- Textbook:
  - Moore, Will H. and David A. Siegel. 2013. A Mathematics Course for Political & Social Research. Princeton University Press. (short as MS)
- Software:
  - R
  - Rstudio

Course Website

- `https://canvas.pitt.edu/` for uploading your assignments.
- `https://qingcchang.com/courses/ps2010/` for course materials and assignments.

Questions

Any questions?

Recitation

Let's take a vote!