

國立中央大學數學系

專題演講

主 講 人：Dr. Daniel Guth (University of Rochester Medical Center)

演講題目：Causal Inference with Instrumental Variables:
Air Pollution and School Absences in New York City

演講茶會：2024年12月05日(星期四) 3:00 p.m. ~ 3:30 p.m.

茶會地點：中央大學鴻經館M306

演講時間：2024年12月05日(星期四) 2:00 p.m. ~ 3:00 p.m.

演講地點：中央大學鴻經館M107

Abstract：

Modern economics research tries to obtain causal effects, not just correlations or associations with an outcome, and instrumental variables (IV) are one method of doing so. In this seminar, I will use linear algebra to show the proof of the Gauss-Markov theorem and its derivation of ordinary least squares (OLS) regression as the best linear unbiased estimator. That result holds when errors are uncorrelated between observations, but that is often not the case in real data. Next, I will show the extension to IV estimators and describe when they can be used to obtain unbiased results. The paper I will present uses the effects of wind direction on daily air pollution in New York City (NYC) to show that PM2.5 and Ozone pollution both cause children to get sick and be absent from school. The direction that the wind is blowing on any given day is quasi-random, satisfying the condition that errors are uncorrelated between observations, and pollution gets carried hundreds of miles by wind such that the wind direction in NYC can nearly double PM2.5 pollution that day. Using daily attendance data on all NYC public schools from 2006 to 2019, I show that both Ozone and PM2.5 pollution cause children to be sick and miss school. I show that improvements in air quality have prevented approximately 380,000 absences per year which increased NYC school budgets by at least \$19 million per year.

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