Replication of "Educational Expansion and Its Heterogeneous Returns for Wage Workers" by Michael Gebel and Friedhelm Pfeiffer

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TODO: include outline of present.

Theoretical Part

Introduction

Summary

- Educational Expansion and Its Heterogeneous Returns for Wage Workers
- by Michael Gebel and Friedhelm Pfeiffer, published on Schmollers Jahrbuch in 2010
- basic idea: examine evolution of returns to education in West German labour market. Focus on change in returns to education over time covering education expansion in Germany.
- methodology:
  - Wooldrigdge's (2004) **conditional mean independence**
  - Garen's (1984) **control function** approach, that requires an *exclusion restriction*
  - as well as OLS
- data: SOEP 1984 2006

Data and Variables

- Log of hourly wage
- Years of education (constructed from categorical variable)
- Age and age squared
- Gender
- Father's education
- Mother's ecucation
- Father's occupation
- Rural or urban household
- Number of Siblings

TODO: more detailed table?

Background Information

- **increase in educational attainment** in the 1960s. From 1984 to 2006, avg years of schooling:
  - woman: 11.3 -> 12.8
  - men: 11.9 -> 12.9 (but with a shrinking gap over time.)
- unobserved characteristics leading to **selection bias**:
  - higher ability and motivation to stay longer in education
  - select jobs with expected higher returns.

A few a priori hypotheses

Factors affecting RtE	$\Uparrow$ RTE	$\Downarrow$ RTE
Increase in female labour participation		✓
Birth cohort sizes (Baby boom)		✓
Wage determination processes (entrants)		✓
Skill-biased technological change	✓	

Econometric Approach

Empirical Framework (Derivation) I

The study is based on the **correlated random coefficient model** (Blundell / Dearden / Sianesi, 2005; Heckman / Vytlacil, 1998; Wooldridge, 2004).

$$\ln Y_i = a_i + b_i S_i$$

with $a_i = a' X_i + \varepsilon_{ai}$, and $b_i = b' X_i + \varepsilon_{bi}$

where $\ln Y_i$: log of wages and S_i years of schooling of individual i

- The model has, therefore, an **individual-specific intercept** a_i and **slope** b_i dependent on **observables** X_i and **unobservables** ε_{ai} and ε_{bi}.
- Do not assume b_i and S_i are independent –> Individuals with higher expected benefits from education are more likely to remain longer in education –> b_i may be correlated with S_i meaning positive self-selection.

Empirical Framework (Derivation) II

- focus: estimate average partial effect (APE), which is the return per aditional year of education for a randomly chosen individual (or averaged across the population)

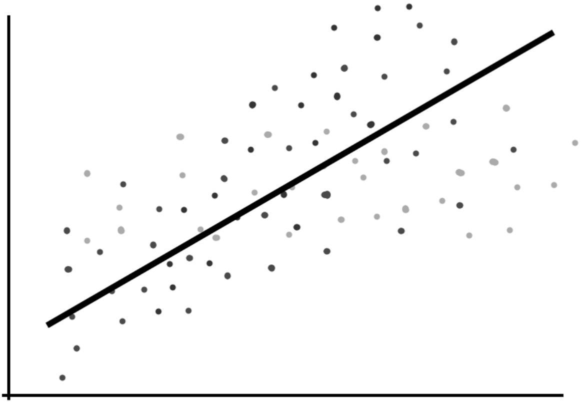
$$E(\partial \ln Y/\partial S) = E(b_i) = \beta$$

Would one assume homogenous returns to education:

$$\ln Y_i = a' X_i + \bar{b} S_i + \varepsilon_{ai}$$

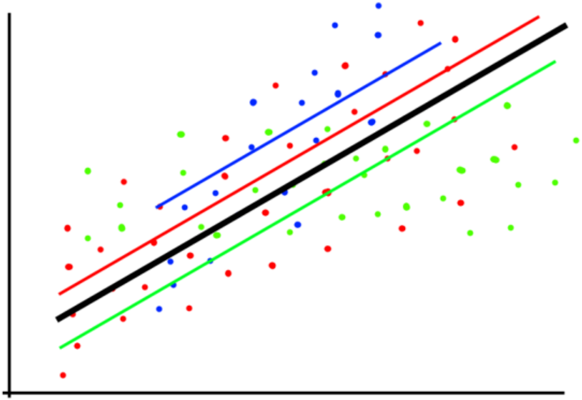
- Unobserved heterogeneity may only affect the **intercept** of the wage equation.
- still potential Endogeneity if ε_{ai} correlates with S_i

Empirical Framework (Intuition) I



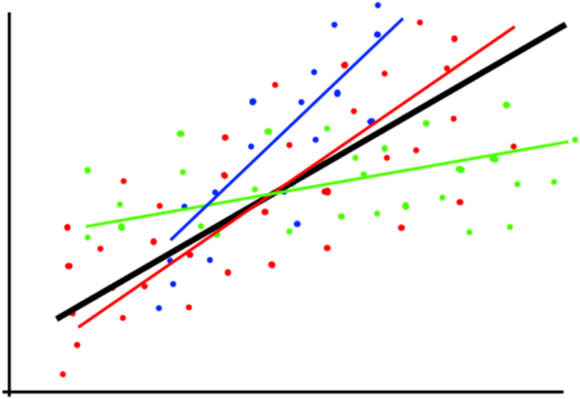
- Simple OLS

Empirical Framework (Intuition) II



- Multiple OLS with homogenous return to Educ

Empirical Framework (Intuition) III



- Correlated Random Coefficient Model

Distinction to conventional methods

- OLS
  - ability and “background” bias
- IV Methods
  - if education correlates with **unobserved individual heterogeneity**, IV methods may fail to identiy APE.
    - alternative: **L**ocal **A**verage **T**reatment **E**ffect.

Conditional Mean Independence

According to Wooldridge (2004, pg. 7), **APE** is identified by:

$$E \ln Y_i \mid a_i, b_i, S_i, X_i,) = E \ln Y_i \mid a_i, b_i, S_i) = a_i + b_i S_i \qquad (A.1)$$

$$E(S_i \mid a_i, b_i, X_i) = E(S_i \mid X_i) \text{ and } \mathrm{Var}(S_i \mid a_i, b_i, X_i) = \mathrm{Var}(S_i \mid X_i) \qquad (A.2)$$

TODO: add interpretation of assumptions

Estimator for β and GLM

$$\hat{\beta} = \frac{1}{N} \sum_{i=1}^{N} \left(\left(S_i - \hat{E}(S_i \mid X_i) \ln Y_i \right) \Big/ \hat{Var}(S_i \mid X_i) \right)$$

$$E(S_i \mid X_i) = e^{\gamma X_i} \quad \text{and} \quad Var(S_i \mid) = \sigma^2 e^{\gamma X_i}$$

Where σ^2 can be consistently estimated by the mean of squared Pearson residuals and standard errors are bootstrapped.

Control Function Approach I

- Based on proposition by Garen (1984).
- Similar to Heckman two-step estimator.
- CF approach can identify APE in heterogeneus returns while standard IV approach may not.

$$S_i = c'X_i + dZ_i + v_i \quad \text{with} \quad E(v_i \mid Z_i, X_i) = 0$$

where:

- X_i and Z_i influence the educational decision.
- v_i: Error term incorporating unobserved determinants of education choice.
- Z_i: Exclusion restriction.
- V_i, ε_{ai} and ε_{bi} are normally distributed with zero means and positive variances.

Control Function Approach II

- possible correlation between error terms

Augmented Wage equation:

$$\ln Y_i = a_i + \beta S_i + \gamma_1 v_i + \gamma_2 V_i S_i + w_i$$

where:

- $\gamma_1 v_i$ and γ_2 are the **control functions**
  - $\gamma_1 = cov(\varepsilon_{ai}, v_i)/var(v_i)$
  - $\gamma_2 = cov(\varepsilon_{bi}, v_i)/var(v_i)$
- $E(w_i \mid X_i, S_i, v_i) = 0$ (as shown in Heckman / Robb, 1985)

TODO: intuition for CF approach

Replication results

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