Ability bias in the returns to schooling:

How large it is and why it matters

Petr Čala

Institute of Economic Studies
Charles University, Prague

Introduction

Motivation

- Does ability bias affect the estimation of returns to education?
- Two extensive meta-analyses on the topic (1754 and 293 observations)

Findings

- Average effect of returns to education of around 7%
- Drops by around one percentage point after correcting for publication bias
- Ability matters, and controlling for it in a regression decreases the expected returns to education
- The returns drop even further for twin studies with identical inherent ability (4% to 6%)

Introduction

Motivation

- Does ability bias affect the estimation of returns to education?
- Two extensive meta-analyses on the topic (1754 and 293 observations)

Findings

- Average effect of returns to education of around 7%
- Drops by around one percentage point after correcting for publication bias
- Ability matters, and controlling for it in a regression decreases the expected returns to education
- The returns drop even further for twin studies with identical inherent ability (4% to 6%)

Introduction

Motivation

- Does ability bias affect the estimation of returns to education?
- Two extensive meta-analyses on the topic (1754 and 293 observations)

Findings

- Average effect of returns to education of around 7%
- Drops by around one percentage point after correcting for publication bias
- Ability matters, and controlling for it in a regression decreases the expected returns to education
- The returns drop even further for twin studies with identical inherent ability (4% to 6%)

Introduction

Motivation

- Does ability bias affect the estimation of returns to education?
- Two extensive meta-analyses on the topic (1754 and 293 observations)

Findings

- Average effect of returns to education of around 7%
- Drops by around one percentage point after correcting for publication bias
- Ability matters, and controlling for it in a regression decreases the expected returns to education
- The returns drop even further for twin studies with identical inherent ability (4% to 6%)

What Is Ability Bbias

Mincer Equation (Mincer, 1974)

$$\text{Wage} \sim \text{Schooling} + \text{Experience} + \text{Experience}^2$$

- Ability bias: Distorted estimation of returns to education due to omission of ability (Blackburn & Neumark, 1993)
- Ability correlates with both education and earnings
- Sorting bias: Correlation between education and ability
- How to separate the effect of education from the effect of ability?

What Is Ability Bbias

Mincer Equation (Mincer, 1974)

$$\text{Wage} \sim \text{Schooling} + \text{Experience} + \text{Experience}^2$$

- Ability bias: Distorted estimation of returns to education due to omission of ability (Blackburn & Neumark, 1993)
- Ability correlates with both education and earnings
- Sorting bias: Correlation between education and ability
- How to separate the effect of education from the effect of ability?

What Is Ability Bbias

Mincer Equation (Mincer, 1974)

$$\text{Wage} \sim \text{Schooling} + \text{Experience} + \text{Experience}^2$$

- Ability bias: Distorted estimation of returns to education due to omission of ability (Blackburn & Neumark, 1993)
- Ability correlates with both education and earnings
- Sorting bias: Correlation between education and ability
- How to separate the effect of education from the effect of ability?

What Is Ability Bbias

Mincer Equation (Mincer, 1974)

$$\text{Wage} \sim \text{Schooling} + \text{Experience} + \text{Experience}^2$$

- Ability bias: Distorted estimation of returns to education due to omission of ability (Blackburn & Neumark, 1993)
- Ability correlates with both education and earnings
- Sorting bias: Correlation between education and ability
- How to separate the effect of education from the effect of ability?

What Is Ability Bbias

Mincer Equation (Mincer, 1974)

$$\text{Wage} \sim \text{Schooling} + \text{Experience} + \text{Experience}^2$$

- Ability bias: Distorted estimation of returns to education due to omission of ability (Blackburn & Neumark, 1993)
- Ability correlates with both education and earnings
- Sorting bias: Correlation between education and ability
- How to separate the effect of education from the effect of ability?

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

Ways To Deal With Ability Bias

- Inclusion of Ability Measures
  - Use cognitive test scores as control variables
  - Separates effect of education from ability
- Instrumental Variables (IV)
  - Find variable correlated with education, not with error term
  - Isolates exogenous variation in education
- Fixed Effects Models
  - Use within-individual variation over time
  - Controls for time-invariant unobserved heterogeneity
- Sibling and Twin Studies
  - Compare siblings/twins with different education levels
  - Controls for family and genetic factors

My approach

- A large meta-analysis of 1754 estimates of returns to education over 115 studies
- Correct for publication bias, observe heterogeneity
- Observe the isolated effect of ability
- Conduct a whole another meta-analysis comprised of twin studies (293 observations)
- Fully automate the whole analysis process

My approach

- A large meta-analysis of 1754 estimates of returns to education over 115 studies
- Correct for publication bias, observe heterogeneity
- Observe the isolated effect of ability
- Conduct a whole another meta-analysis comprised of twin studies (293 observations)
- Fully automate the whole analysis process

My approach

- A large meta-analysis of 1754 estimates of returns to education over 115 studies
- Correct for publication bias, observe heterogeneity
- Observe the isolated effect of ability
- Conduct a whole another meta-analysis comprised of twin studies (293 observations)
- Fully automate the whole analysis process

My approach

- A large meta-analysis of 1754 estimates of returns to education over 115 studies
- Correct for publication bias, observe heterogeneity
- Observe the isolated effect of ability
- Conduct a whole another meta-analysis comprised of twin studies (293 observations)
- Fully automate the whole analysis process

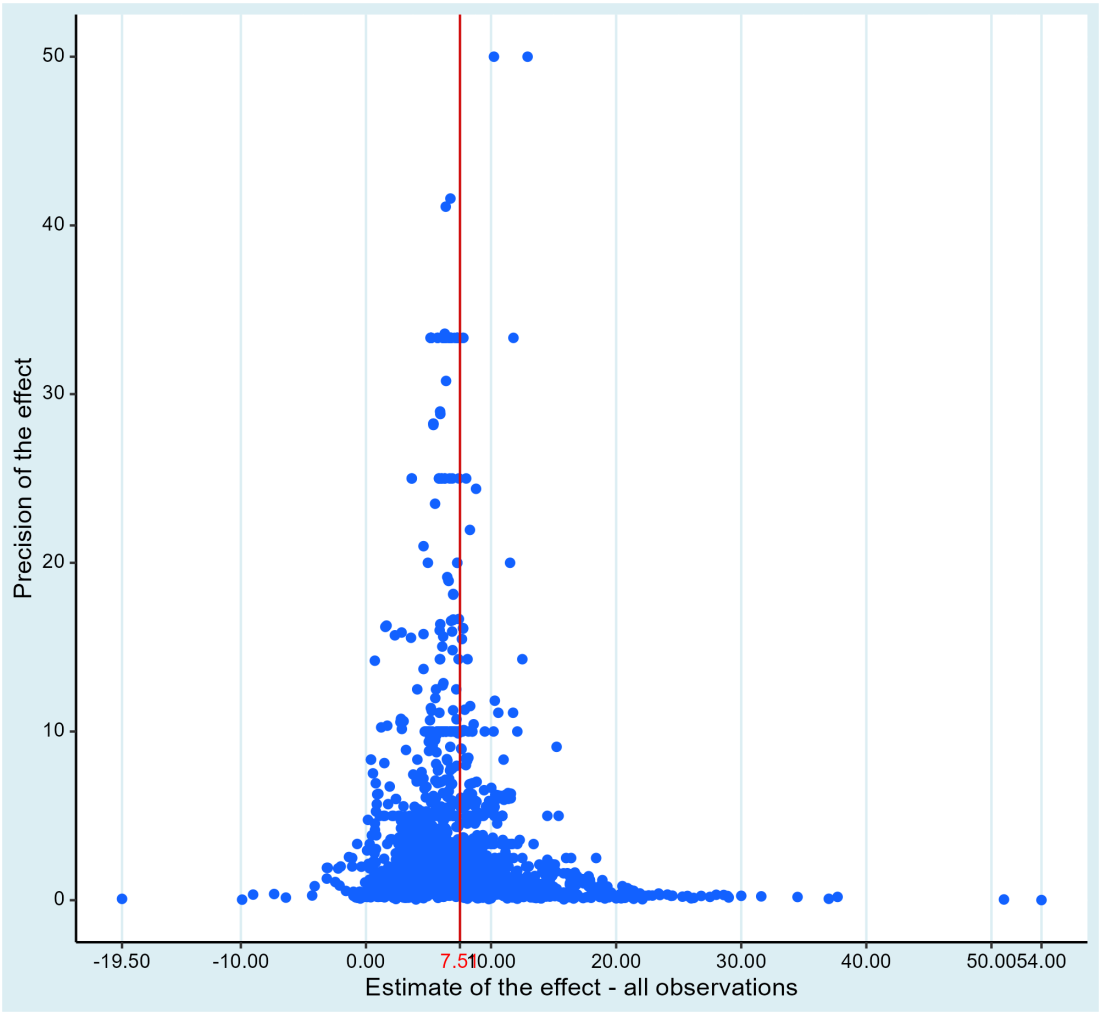
My approach

- A large meta-analysis of 1754 estimates of returns to education over 115 studies
- Correct for publication bias, observe heterogeneity
- Observe the isolated effect of ability
- Conduct a whole another meta-analysis comprised of twin studies (293 observations)
- Fully automate the whole analysis process

What do we already know?

Study name	AB	AB*	PB	PB*	Method
Psacharopoulos (1994)	.	.	.	.	.
Fleisher et al. (2005)	.	.	.	.	✓
Churchill & Mishra (2018)	.	.	✓	✓	✓
Psacharopoulos & Patrinos (2018)	.	.	.	.	.
Patrinos & Psacharopoulos (2020)	.	.	.	.	.
Cui & Martins (2021)	.	.	✓	✓	✓
Iwasaki & Ma (2021)	.	.	✓	.	✓
Ma & Iwasaki (2021)	.	.	✓	✓	✓
Wincenciak et al. (2022)	✓	✓	.	.	✓
Horie & Iwasaki (2023)	.	.	✓	.	.
Number of studies:	1	1	5	3	6
Percentage of studies:	10%	10%	50%	30%	60%

Graphical Test Using a Funnel Plot



Statistical Tests and Publication Bias

	OLS	FE	BE	RE	Study	Precision
Publication bias	0.832	0.746	0.752	0.747	1.169	0.262
(Standard error)	(0.097)	(0.060)	(0.244)	(0.058)	(0.121)	(0.425)
Effect beyond bias	6.408	6.517	6.741	6.708	6.294	6.540
(Constant)	(0.118)	(0.107)	(0.418)	(0.294)	(0.153)	(0.168)
	WAAP	**Top10**	**Stem**	**Hier**	**AK**	**Kink**
Publication bias				0.503	P = 2.764	0.262
				(0.168)	(0.107)	(0.39)
Effect beyond bias	6.9	6.439	7.2	6.801	6.548	6.54
	(0.092)	(0.548)	(1.186)	(0.266)	(0.091)	(0.054)
Observations	1,754	1,754	1,754	1,754	1,754	1,754

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Individual Variables in Returns to Education

Over 30 variables split into six categories:

- Estimates and their descriptive statistics
- Estimate characteristics
- Data characteristics
- Spatial/structural variation
- Estimation method
- Publication characteristics

Different Approach to Ability

Four ways to address ability:

- Directly - using cognitive test scores
- Indirectly - using instrumental variables
- Verbally - acknowledging the issue
- Not at all - ignoring the problem

Different Approach to Ability

Four ways to address ability:

- Directly - using cognitive test scores
- Indirectly - using instrumental variables
- Verbally - acknowledging the issue
- Not at all - ignoring the problem

Different Approach to Ability

Four ways to address ability:

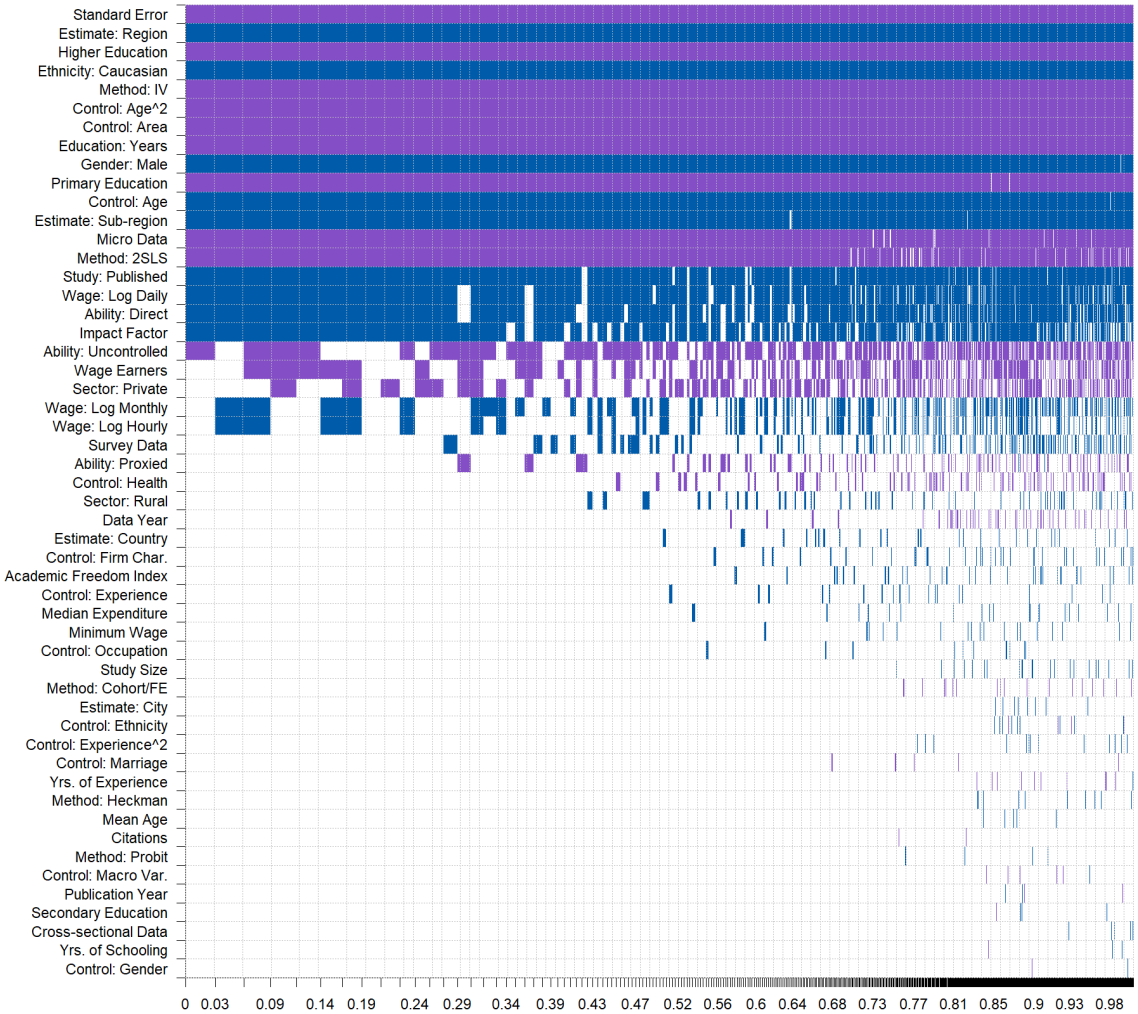
- Directly - using cognitive test scores
- Indirectly - using instrumental variables
- Verbally - acknowledging the issue
- Not at all - ignoring the problem

Different Approach to Ability

Four ways to address ability:

- Directly - using cognitive test scores
- Indirectly - using instrumental variables
- Verbally - acknowledging the issue
- Not at all - ignoring the problem

Model Inclusion in Bayesian Model Averaging



Conclusion

- An overall effect of returns to schooling drops roughly one percentage point (7% to 6%) after corrected for publication bias
- Ability matters, and controlling for it in the regression decreases the expected returns to schooling
- Nine variables have a significant positive influence on returns to schooling, while ten have a negative one
- The returns to schooling drop even further for twin studies with identical inherent ability (4% to 6%)

Conclusion

- An overall effect of returns to schooling drops roughly one percentage point (7% to 6%) after corrected for publication bias
- Ability matters, and controlling for it in the regression decreases the expected returns to schooling
- Nine variables have a significant positive influence on returns to schooling, while ten have a negative one
- The returns to schooling drop even further for twin studies with identical inherent ability (4% to 6%)

Conclusion

- An overall effect of returns to schooling drops roughly one percentage point (7% to 6%) after corrected for publication bias
- Ability matters, and controlling for it in the regression decreases the expected returns to schooling
- Nine variables have a significant positive influence on returns to schooling, while ten have a negative one
- The returns to schooling drop even further for twin studies with identical inherent ability (4% to 6%)

Conclusion

- An overall effect of returns to schooling drops roughly one percentage point (7% to 6%) after corrected for publication bias
- Ability matters, and controlling for it in the regression decreases the expected returns to schooling
- Nine variables have a significant positive influence on returns to schooling, while ten have a negative one
- The returns to schooling drop even further for twin studies with identical inherent ability (4% to 6%)

Thank you!

References

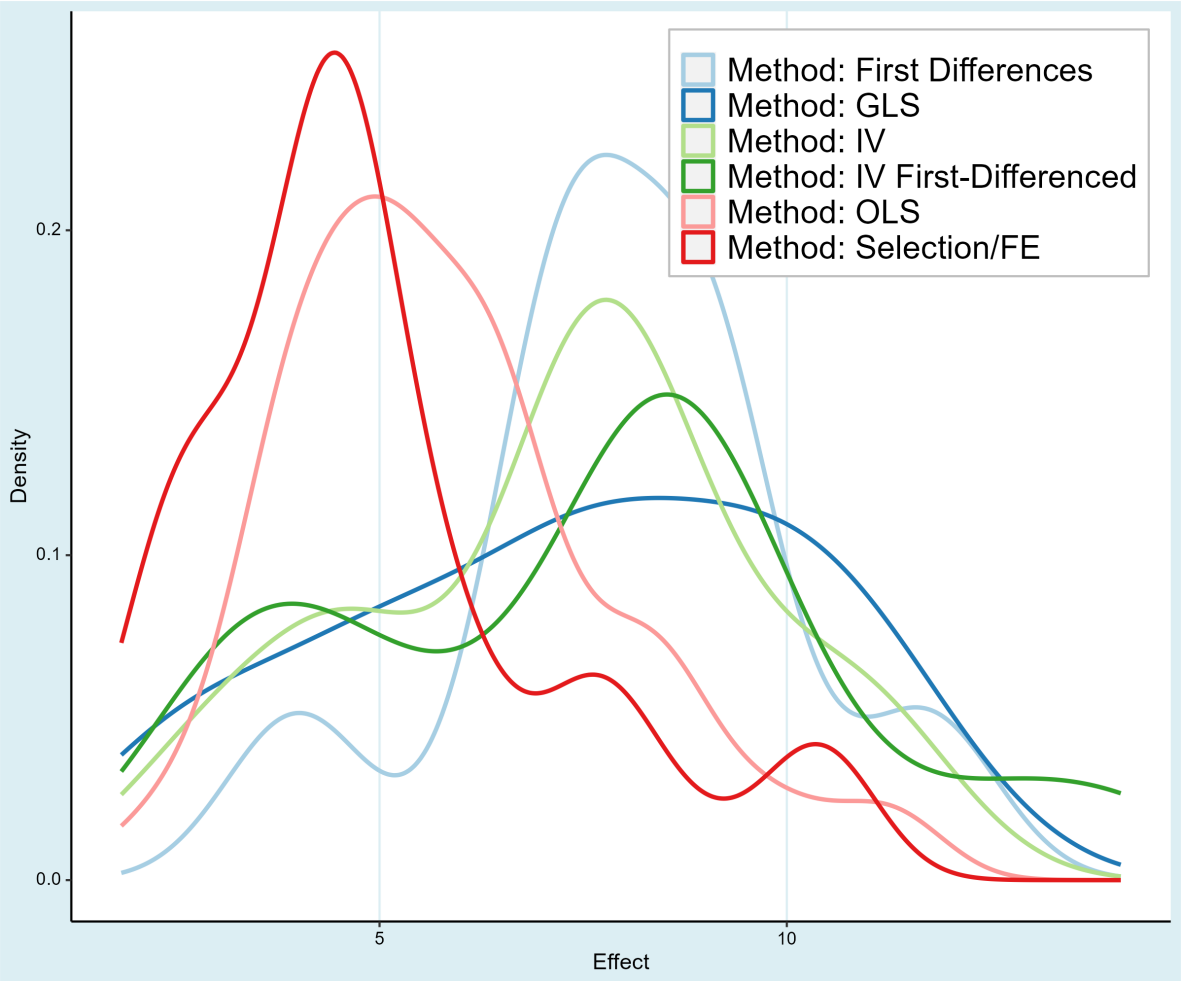
Mincer, Jacob A. "The human capital earnings function." *Schooling, experience, and earnings, pp. 83-96. NBER, 1974.*

Blackburn, McKinley L., and David Neumark. "Omitted-ability bias and the increase in the return to schooling." *Journal of labor economics 11, no. 3 (1993): 521-544*.

Making a twin dataset

- Only subjects with identical inherent ability - twins
- 16 twin studies with 293 observations
- Assumption: Differences in returns to education are due to differences in education

Graphing out the individual method differences



Publication bias for twins

	OLS	FE	BE	RE	Study	Precision
Publication bias	1.347	0.602	2.133	0.840	0.947	2.897
(Standard error)	(0.138)	(0.162)	(0.505)	(0.154)	(0.177)	(0.442)
Effect beyond bias	4.735	5.574	4.106	5.55	4.754	3.907
(Constant)	(0.175)	(0.219)	(0.711)	(0.342)	(0.185)	(0.232)
	WAAP	**Top10**	**Stem**	**Hier**	**AK**	**Kink**
Publication bias				0.601	2.257	2.895
				(0.365)	(0.126)	(0.435)
Effect beyond bias	5.77	4.314	3.403	5.857	5.616	3.908
	(0.159)	(0.265)	(0.95)	(0.544)	(0.157)	(0.093)
Observations	293	293	293	293	293	293

Schooling in Years vs. Levels

$$S_i = \left(1 + \beta_{i,higher} - \beta_{i,lower}\right)^{\frac{1}{Y_{i,higher} - Y_{i,lower}}} - 1$$