
Discussion of “Measuring Heterogeneity in the Returns to Education in Norway Using Educational Reforms”

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Contribution of the Paper

- ▼ Examine 1960's expansion of compulsory high school in Norway
- ▼ Estimate plausibly exogenous returns to education, taking selection seriously
- ▼ Look for heterogeneity in returns to education
 - Estimating a range of treatment parameters

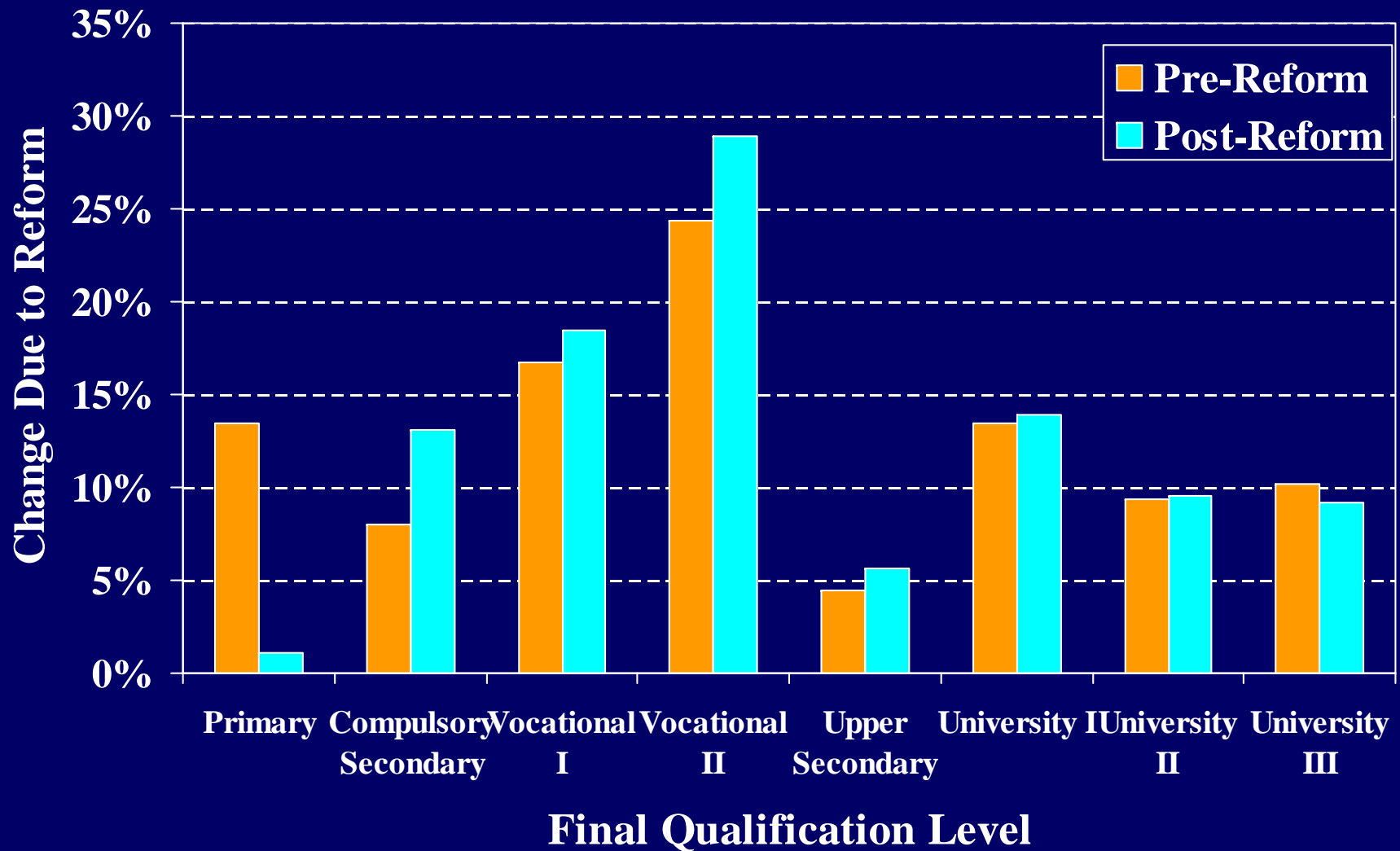
The Norwegian School System

- ▼ Initially 7 years of required (primary) education (“Level 1”)
- ▼ Choose to pursue 2 years of further education (“Level 2”)
- ▼ Can then choose Vocational OR Academic
 - Vocational track
 - » Finish first year (“Level 3”)
 - » Continue to 2nd and 3rd year (“Level 4”)
 - Academic track
 - » Upper secondary for 2-3 years (“Level 5”)
 - » Choose College OR University
 - ▼ Regional colleges (“Level 6”)
 - ▼ University track
 - Continue to University II (undergraduate) (“Level 7”)
 - Continue to University III (Grad school) (“Level 8”)

Policy Intervention: Level 2 became compulsory between 1960 and 1970, with 750 different municipalities changing laws at different times.

Experiment #1: The Reform

Distribution of Qualifications



Experiment #1: Results (Table 13)

Dependent Variable: Log(Wage)			
	OLS	“IV” ^(b)	“IV with Het.” ^(b)
Education ^(a)	.075 (.0005)	.1026 (.0024)	.0634
Inverse Mills Ratio ^(c)		.0522 (.0043)	.0320 - .0138*Ed (.0044) (.0005)
Controls	Experience, Experience ² , Tenure, Tenure ² , Parent’s college, Family income quartiles, Cohort and Municipality Fixed Effects		

a) “Education” is *not* years of education
(Coefficient on years is closer to 0.04)

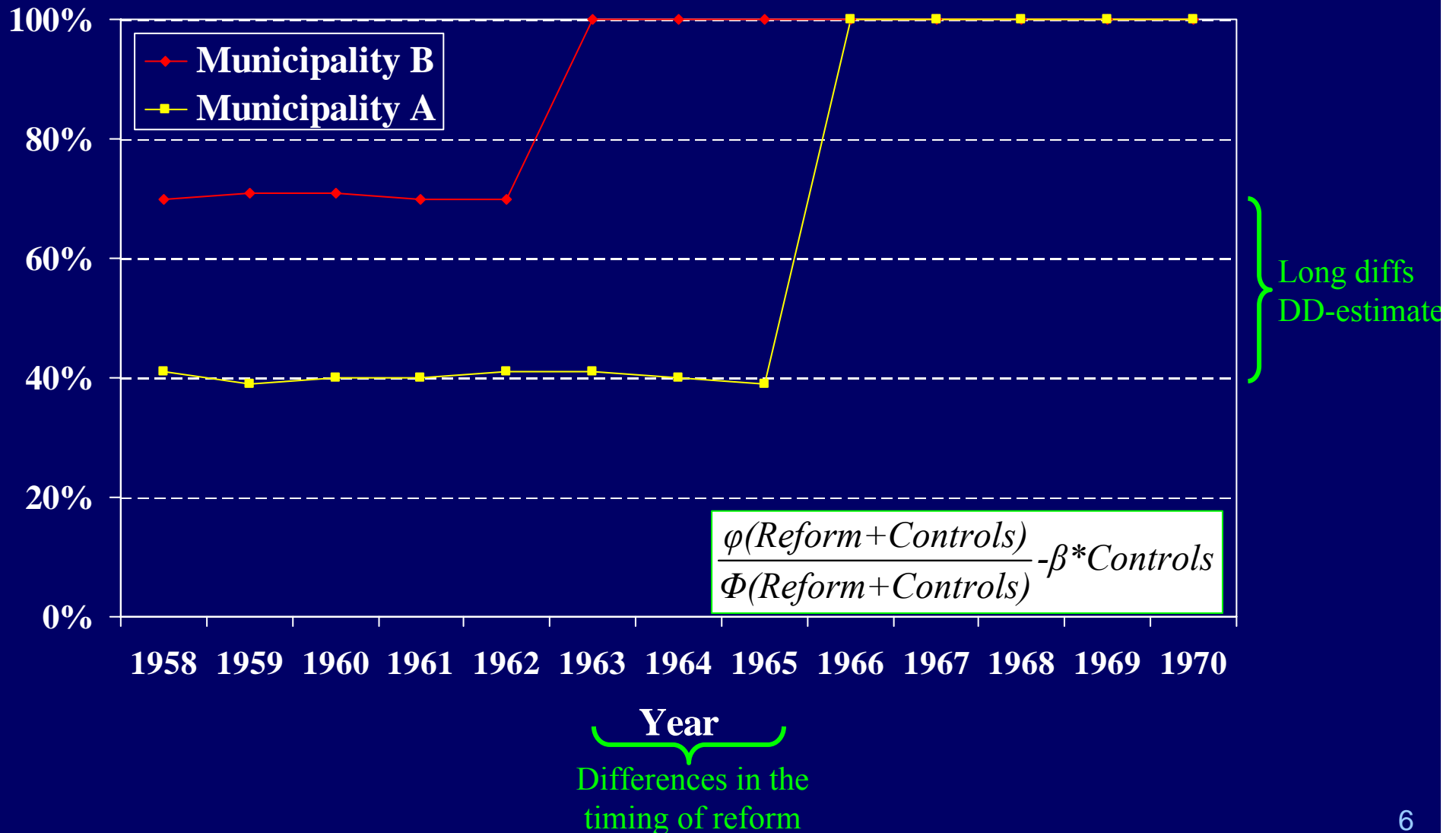
b) “IV” models are sample correction models (not IV)

c) Inverse Mills Ratio from first stage ordered probit

$$Schooling = Reform_{Cohort, Municipality} + Cohort + Municipality + Controls$$

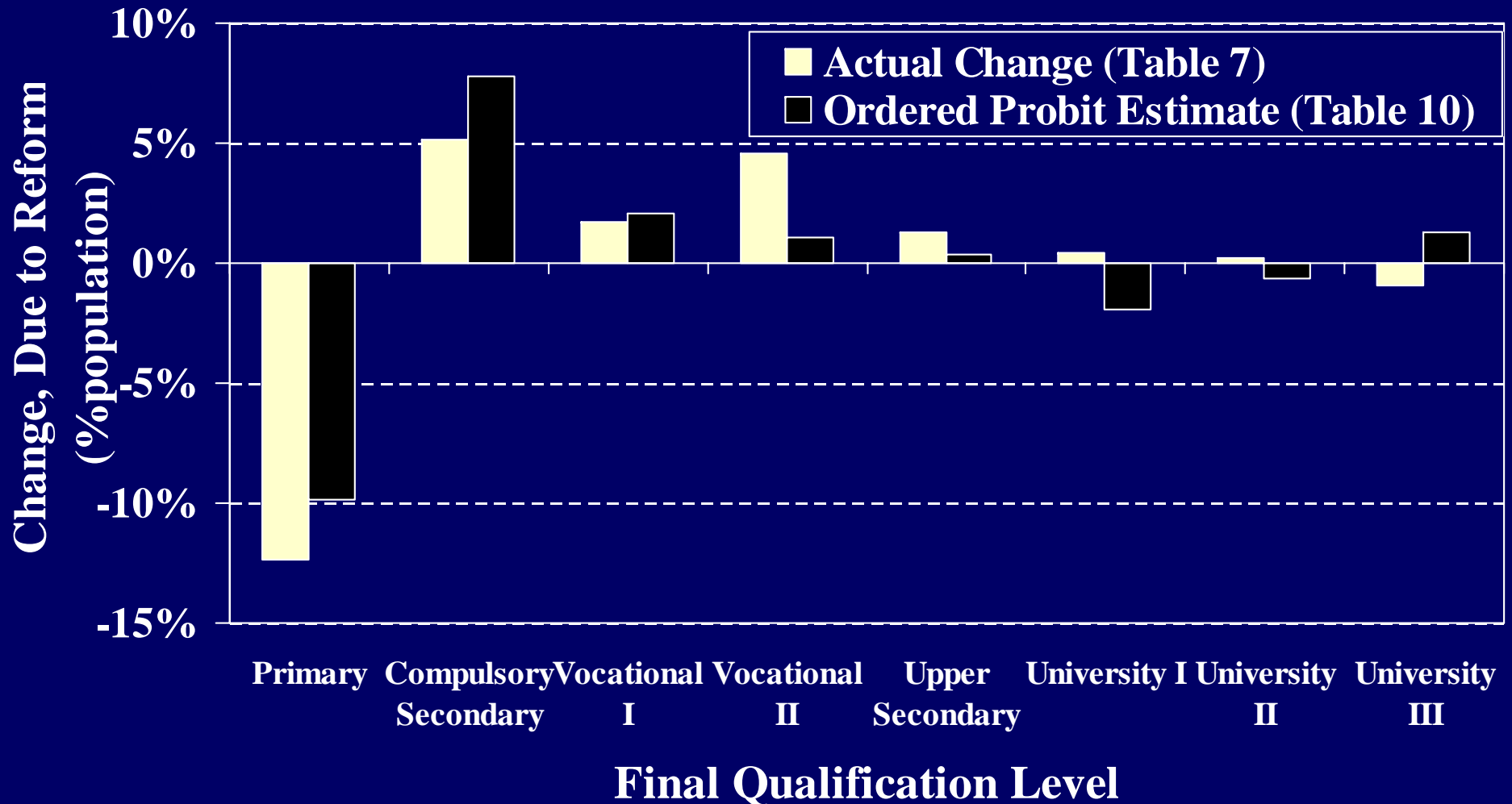
Three Sources of Variation

Share of Population with at least 9 Years of Schooling



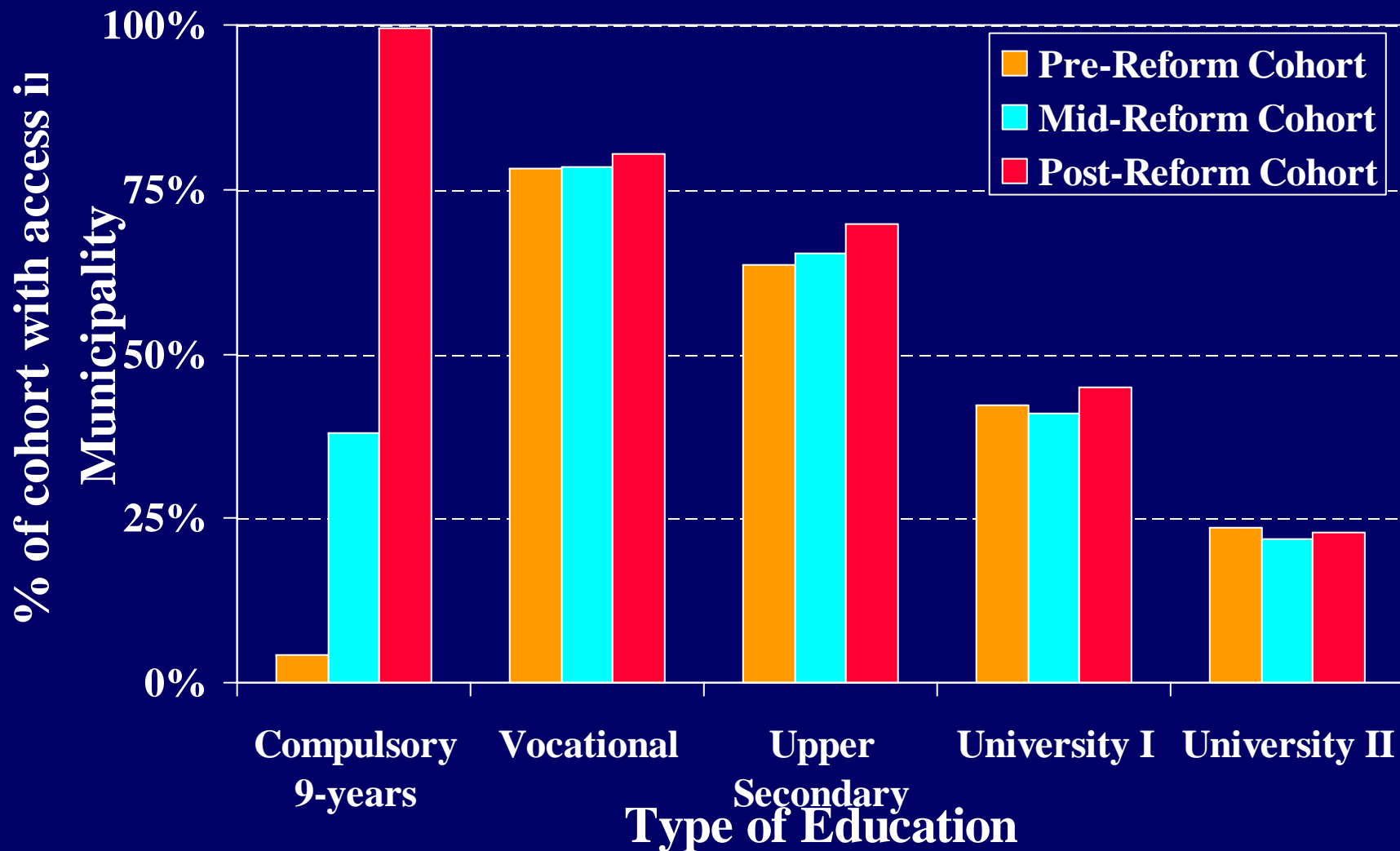
Does Selection or Mis-Specification Vary?

Changes in Qualifications



Experiment #2: Access to Education

Access to Types of Education



Wage Equations

- ▼ For *each* level of terminal education, regress wages on:
 - Tenure and experience
 - Family background
 - Municipal characteristics
 - County and Cohort fixed effects
 - » Cohort
 - » County
 - Inverse Mills Ratio from Selection equation
- ▼ Allows one to construct counterfactual wage distributions for individuals who differ on both observables and unobservables
 - Identifying a family of treatment effects

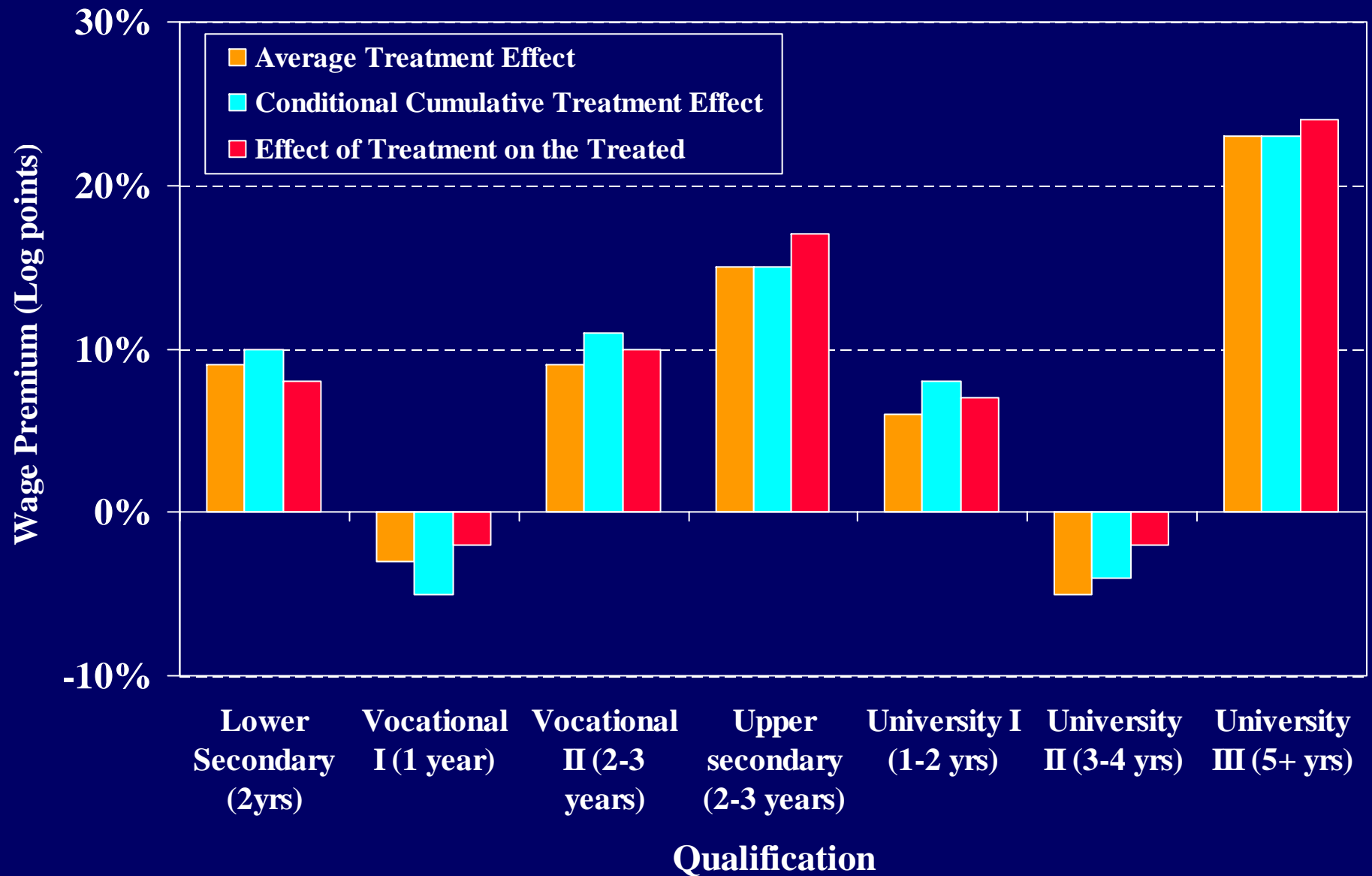
Sequential Probit Selection Equation

- ▼ Choose whether to do Lower Secondary (level 1):
 - $\Pr(D_1=1)=\Phi(\beta_1Q+\theta_1Z)$
- ▼ Then choose grade level 2 (vocational training), given choice of lower secondary:
 - $\Pr(D_2=1|Q,Z)=\Phi(\beta_2Q+\theta_2Z) \Phi(\beta_1Q+\theta_1Z)$
 - ...and so on...

Observations

- ▼ You can't do graduate work without an undergraduate degree (and you can't do either without a university)
 - Independence of error terms across selection equations?
- ▼ Choose between vocational *track* and academic *track*
 - A series of sequential choices?
- ▼ There are 4½ million Norwegians in 750 municipalities (Ave. size =6,000 people, and 40 boys per municipality-cohort)
 - These seem small: Is the municipality the right level to think about distance from college?
 - County fixed effects exacerbate this problem
- ▼ Solves a problem in most binary choice models
 - Intensity of treatment no longer varies with selection into treatment

Marginal Effects of Higher Qualifications (Table 15)



Conclusions

- ▼ Pre-1960 variation in schooling levels ensures that compulsory schooling laws have very different effects
 - Arguably “cleanest” source of variation
 - Moving from selection control to IV methods will aid
 - » Transparency
 - » Robustness
 - With 750 municipalities, effectively 750 instruments, which can provide evidence on the heterogeneity of treatment effects
- ▼ Heterogeneity of treatment effects