The Long-Run Impact of Increasing School Funding on Labor Market Outcomes

Formerly 'Was that much (education) spending worth it at all? The Long-Run Impact of a School Funding Reform on Later-Life Outcomes in Norway'

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Motivation

- Education is often the second largest area in social spending, and it is not decreasing (4.1% of OECD GDP in 2000-19).
- Why? Increasing funding overused to address concerns about enrollment, school quality, and student achievement inequality.
- Has it been working though? We don't know much.

Norway has an unique setting to explore impacts of higher education funding:

1. It is among the top education spending countries.
2. Decentralized but heavily regulated educational system.
3. Also heavily unionized labor market [Balsvik et al., 2015].

This Paper I

- Follows the money to fund primary and lower-secondary education, from Central Government to local administrations, reaching schools and, ultimately, students.
- Matches detailed municipal and individual data, allowing to explore the education funding immediate and long-run effects.
- Finds that higher funding leads to (1) hiring teachers, but no effect to class size and (2) students' labor market, education and migration outcomes about 20 years later.
- Finds higher effects on students exposed earlier in their lives, with equality-enhancing impacts.
- Finds that municipalities with lower dependency of grants crowd-out school funding, with no impact on students.

This paper II

- Exploits a large funding reform, which shifted education funding from the Central Administration at the municipal level.
- The reform, that took place in 1986, lifted the differentiation between educational level in the grant size formula $\rightarrow$ relative increase of transfers level in municipalities with a higher share of younger children.
- Employs an event-study design, with a wide range of controls and fixed-effects.
- Interacts the school funding shock at the municipal level with different cohorts, finding consistent patterns of individual outcomes' effects by exposure to higher education spending and school inputs.

Contribution

- The literature on the effects of education spending rely heavily on school state funding reforms. Many studies have found sizable effects on outcomes.
  Card & Payne (2002), Pirim et al. (2014), Jackson et al. (2015), Hyman (2017), Lafortune et al. (2018) & Biasi (2019)

- Literature expects that higher central administration funds might be crowded-out, but evidence is mixed.
  Gordon [2004], Reiling et al. [2021], Hanushek & Cascio et al. [2013]

- There is also a strong literature on school inputs and their role on learning and outcomes later on.
  Angrist (1999), Hanushek & Luque (2003), Hanushek & Rivkin (2012), Fredriksson et al. (2013), Leuven & Løkken (2017) & Borgen et al. (2022)

Gap to be filled: how do the funding-spending-input-outcome links actually work? Do administrations respond differently to those education revenue shocks?

1. Motivation and Lit. Review
2. **Institutional Background**
3. Data
4. Empirical Framework
5. Results
6. Conclusions

Education system in Norway

- Municipalities are responsible for primary - 1st-6th grades (7 to 12 years old children) - and lower-secondary education - 7th-9th grades (13 to 15 years old children).
- Education accounts for 40% of all municipal social spending.
- Day-to-day responsibilities of purchases, staffing and student admissions are devolved at the school level.
- Municipalities are primarily responsible for defining the level and distribution of resources among schools.
- The Ministry of Education and Research sets national policy by national education laws and curriculum.

Grants for municipal schools until 1985

- Central Administration grants account for 30% of all municipal revenues.
- Those had to cover 25-85% of local education expenditures, according to teaching hours, which were valued by a certain amount (*Cost Factor*).
- In 1985, Primary Education teaching hours were valued at **NOK 130.05** (2011 PPP $29.4), whereas Lower-Secondary Education were valued at **NOK 146.80** (2011 PPP $33.2).
- Other minor criteria: (tax revenues & others)

New grant distribution scheme

- In the 1986 reform, Norway introduced a block grant, which replaced about 50 earmarked grants, including in education.
- The block grant was distributed according to three sector Cost Matrices, which calculated points based on some 'neutral' characteristics and associated weights.
- Under this new criteria, there was no differentiation between primary and lower-secondary education.
- Thus, municipalities with primary school students had a relative increase in the grant transfers amount.

Cost Matrix for Education

How it used to be:

$$Grant_{m,t} = \sum_{l}(CF_{l,t} \times Hours_{l,m,t}) + \epsilon_{l,m,t}$$

How it has changed to:

Criteria	Weight
Teaching hours in 1985	0.47
Number of inhabitants 7-15 years	0.41
Others	0.12

Source: langorgen2013kommunenes

No differentiation between primary and lower-secondary levels!
Only the total sum of students was taken into account.

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Data

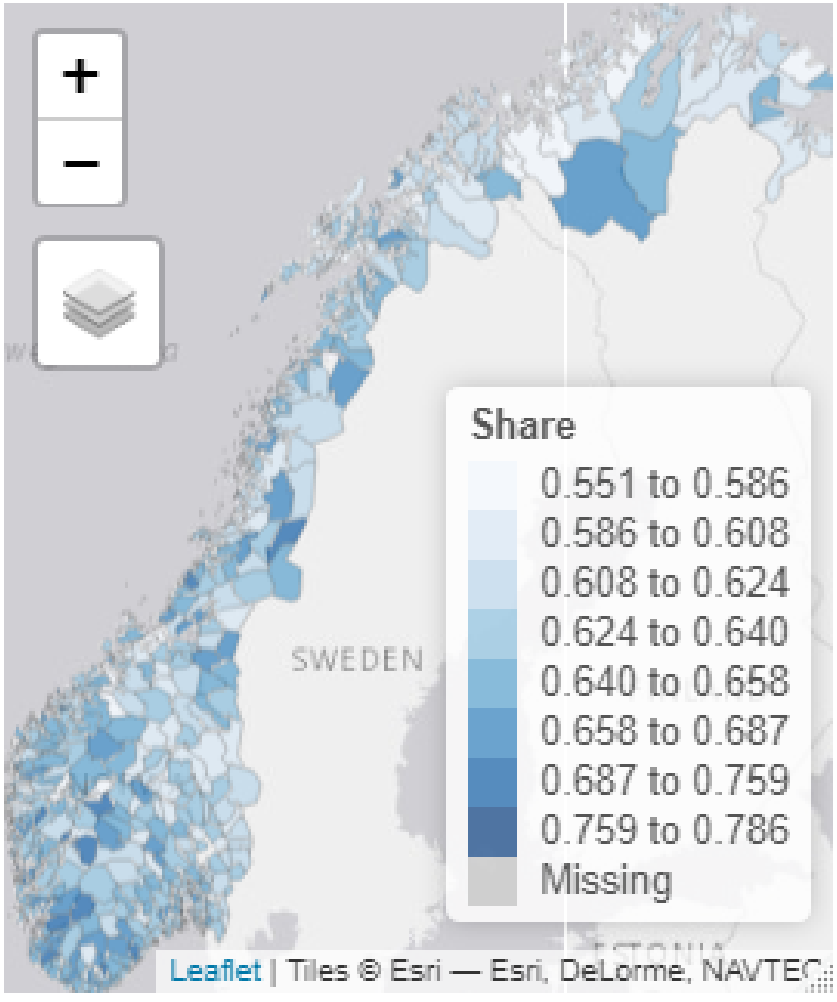
For fiscal data, I will use the 'Strukturtall for kommunenes økonomi' documents, available on Statisk Sentralbyrå (SSB).

For treatment and control variables, I will either use Norwegian register data or municipal data available at *Kommunedatabasen*.

For individual outcomes, I will use Norwegian register data.

I will link all Norwegian individuals to municipalities they were living by the time of the reform, analyzing their outcomes later in life, around their 30s (Haider and Solon, 2006 and Böhlmark & Lindquist, 2006).

Treatment Variable distribution



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Estimating the Grant Size in the Data

- It is possible to observe the education grant size until 1985.
- I use that to estimate its relationship to the share of primary school students.
- Similar fashion as presented in Frean et al. (2017) for a "simulated" measure of health care eligibility.
- Formula 1 describes the model to assess the determinants of the education transfer amount to municipalities.

$$y_{i,t} = X'_{i,k}\alpha_k + \gamma_m + \delta_t + \epsilon_{m,t} \quad (1)$$

where $X_{i,k}$ is a matrix of variables that may influence the distribution of resources for education.

Municipal Level Effects

Estimated shock ($Shock_{m,85} = \hat{\alpha} \times \frac{\text{7 to 12 years old population in 1985}}{\text{7 to 15 years old population in 1985}}$) in \$ 1000 per pupil.

$$Y_{m,t} = \sum_{t=1979}^{1991} [\pi_t Shock_{m,85}] + \sum_{t=1979}^{1991} [\phi_{k,t} X_{k,m,\bar{t}}] + \alpha_1 \Delta Pop_{m,t} + \alpha_2 Sh.715_{m,t} + \gamma_m + \delta_t + \vartheta_{ct,t} + \epsilon_{m,t} \quad (2)$$

- π_t represents the elasticity of the outcome with respect to the treatment each year t. The baseline is 1985.

Discussing the controls and fixed effects

- **County-by-year**: controls for any change in the region (ex: oil shock)
- **1982-85 Share of Tax Revenue-by-Year**: part of the criteria for pre-reform grants distribution
- **1980-85 Share of Educ. Exp.-by-Year**: part of the criteria for pre-reform grants distribution
- **1983 Health Sector Matrix Points-by-Year**: part of the criteria for post-reform grants distribution
- **Share of 7-15 children over Pop.**: controls for education demand differential changes.
- **Pre-Reform Annual Percentage Demographic Changes**: controls for public services demand differential changes.

Individual Level Effects

Similar framework to the previous one, but replacing year by year of birth (cohort c).

Treatment variable will use cohort groups (g) on the interaction.

$$Y_i = \sum_{g=-1}^{3} [\pi_g Share_{m,85}] + \sum_{c=1964}^{1983} [\phi_{k,c} X_{k,i}] + \gamma_m + \delta_c + \vartheta_{ct,c} + \epsilon_i \quad (3)$$

Individual controls: **(i)** Man/Foreigner dummies ; **(ii)** Mother and Father Level of Education ; **(iii)** Within siblings birth order

Cohort	Group	1986	1987	1988	1989	1990	1991
1964	Never Exposed	22	23	24	25	26	27
1965		21	22	23	24	25	26
1966		20	21	22	23	24	23
1967		19	20	21	22	23	24
1968	Not exposed	18	19	20	21	22	23
1969		17	18	19	20	21	22
1970	[Baseline in Regressions]	16	17	18	19	20	21
1971	Marginally exposed	**15**	16	17	18	19	20
1972		**14**	**15**	16	17	18	19
1973		**13**	**14**	**15**	16	17	18
1974		**12**	**13**	**14**	**15**	16	17
1975		**11**	**12**	**13**	**14**	**15**	16
1976	Exposed at Lower Secondary School	**10**	**11**	**12**	**13**	**14**	**15**
1977		**9**	**10**	**11**	**12**	**13**	**14**
1978		**8**	**9**	**10**	**11**	**12**	**13**
1979		**7**	**8**	**9**	**10**	**11**	**12**
1980	Exposed at Primary School	6	**7**	**8**	**9**	**10**	**11**
1981		5	6	**7**	**8**	**9**	**10**
1982		4	5	6	**7**	**8**	**9**
1983		3	4	5	6	**7**	**8**

Alternative specification

- Robustness check: imposing an alternative structure, by interacting the school funding shock with continuous variables.
- This allows to examine how the effects of the shock vary depending on the length of time the cohort was exposed and their age at the time of exposure.

$$Y_i = \pi_1 Shock_m \times Exposure_i + \pi_2 Shock_m \times Exposure_i \times \text{Age in 1985}_i + \sum_{c \neq 1970} [X_i' \phi_c] + \gamma_m + \delta_c + \vartheta_{ct,c} + \epsilon_i \quad (4)$$

- This model does not test for pre-trends, but it enlightens whether there are any age- or length-specific.

Data and Treatment Assignment

Sample: children born between 1964 and 1983, who lived in a municipality m by the year of 1985 (last one before the reform).

Problem: Attrition. Grant shock is not fully experienced by the whole sample due to migration.

	Whole Data	Movers in 1986/91
Sample Size	1,177,056	269,246 (22.9%)
Mothers' Years of Study	11.60	11.54
Fathers' Years of Study	12.14	12.17
Men	.512	.452
Scad. Foreigners	.005	.010
Other. Foreigners	.019	.026

So all estimates should be seen as Intention to Treat.

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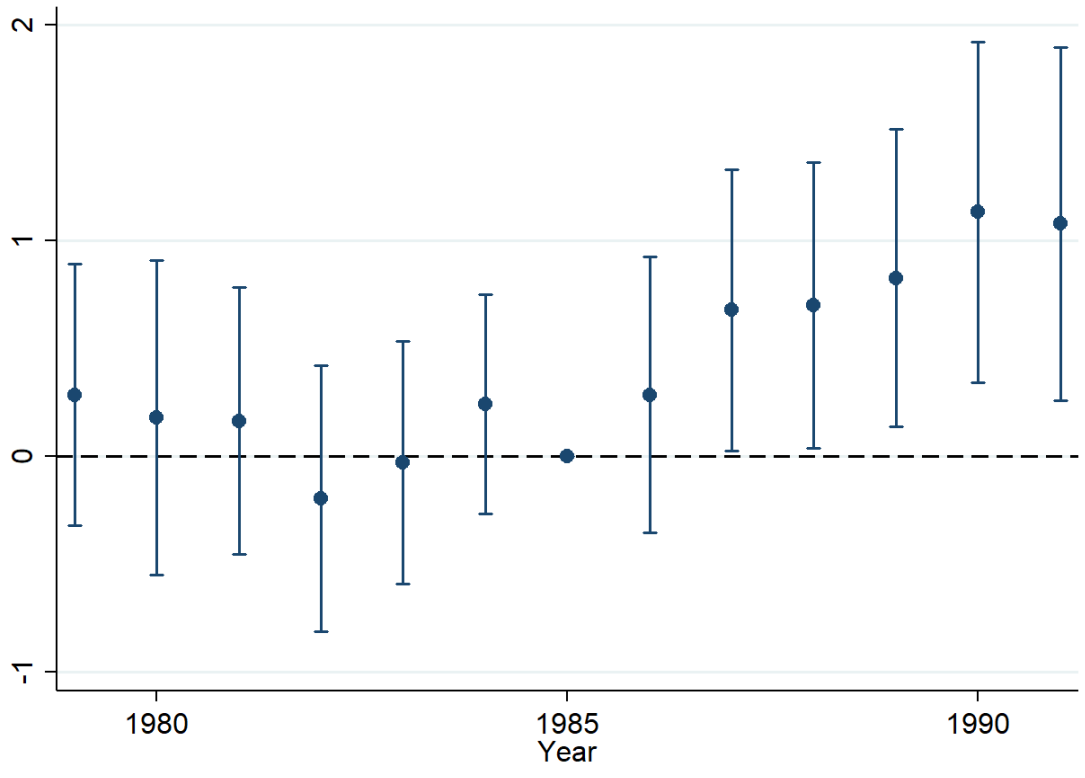
Grant per pupil determinants

VARIABLES	Education Grant ($)
Teachers per Pupil	4,531***
	(1,426)
Share of 7-12 years old children (over 7-15)	-858.1**
	(428.4)
Share of Education Expenditure	234.1
	(259.0)
Municipal Per Capita Tax Revenues (ln)	-1,621***
	(334.8)
Share of 7-15 years old children	-16,448***
	(2,166)
Observations	1,590
R-squared	0.962

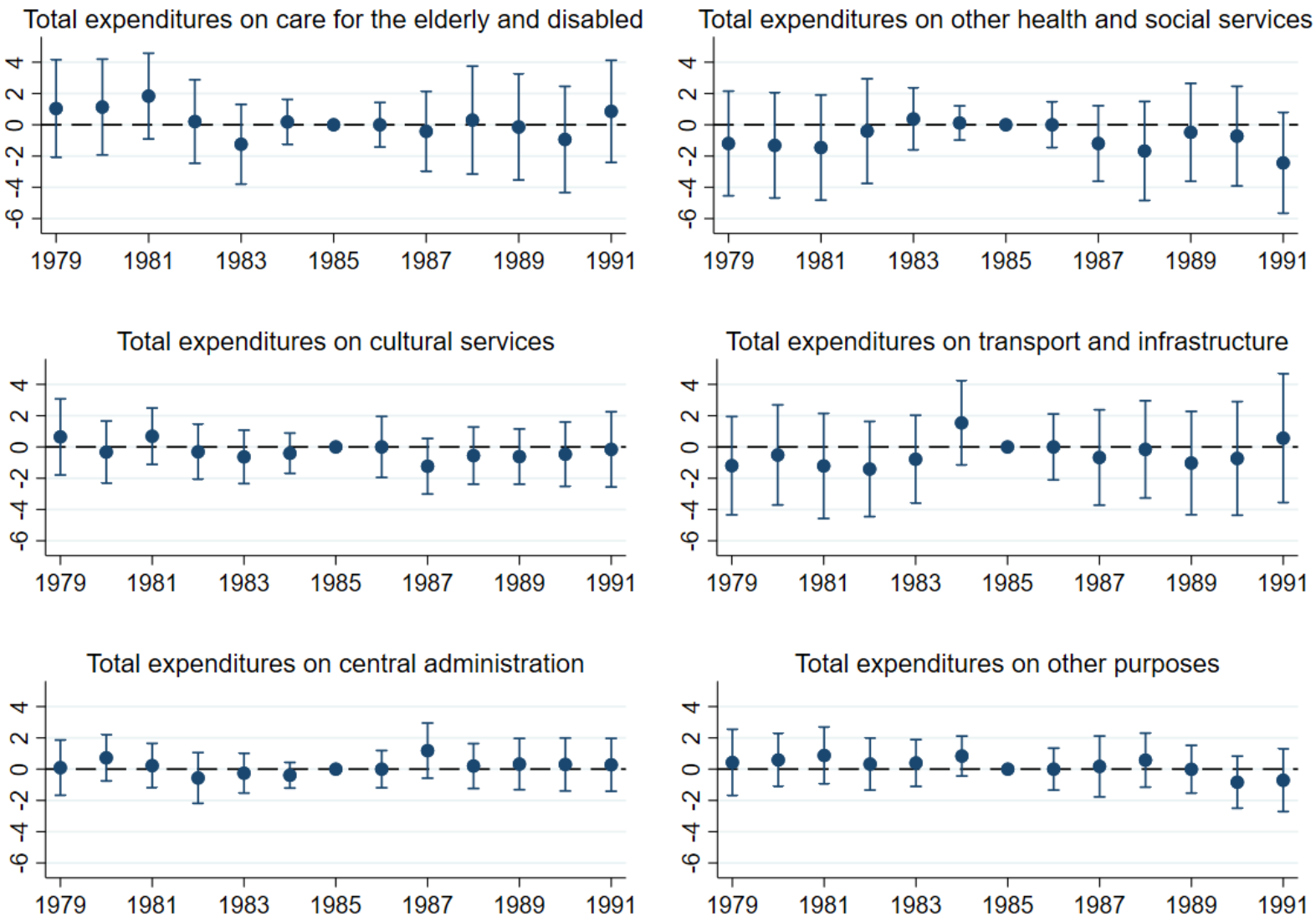
*** p<0.01, ** p<0.05, * p<0.1

First Stage: Estimated Grant Shock on Spending



FEs: Municipality; Year; County-By-Year; 1982-5 Avg. % Tax Revenue-by-Year; 1980-5 Avg. % Educ. Exp.-by-Year; 1983 Health Matrix Points-by-Year.
Controls: Population Annual Increase Pre-Reform Trend (0-4; 5-9; 10-14; 15-19; 20-29; 30-49; 50-64; 65-79; 80+); Share of the Pop. aged 7-15 over Total

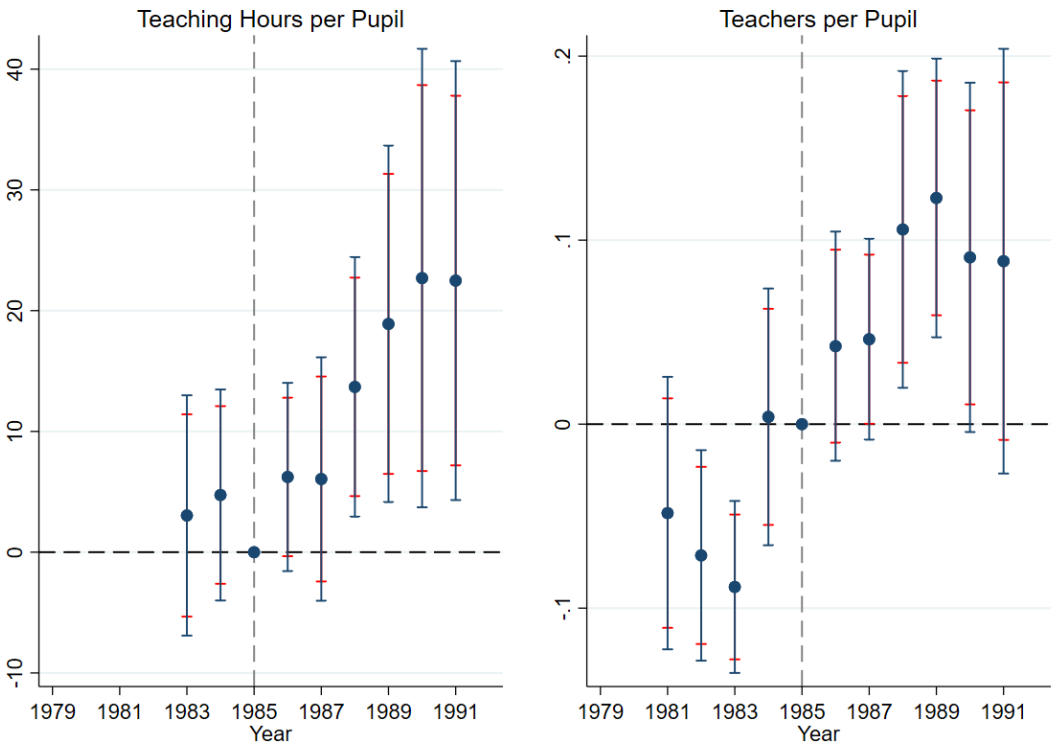
By the way: no effect on any other sector



Discussing the First stage

- Transition to a new grants scheme in 1986 did not lead to major changes in a short time.
- 1986 and 1987: previous rule level in the distribution was weighted by 90%.
- 1988: the previous year level was weighted 80%.
- Variation in the underlying criteria does not lead to immediate treatment impact.

Municipal Outcomes regressions I



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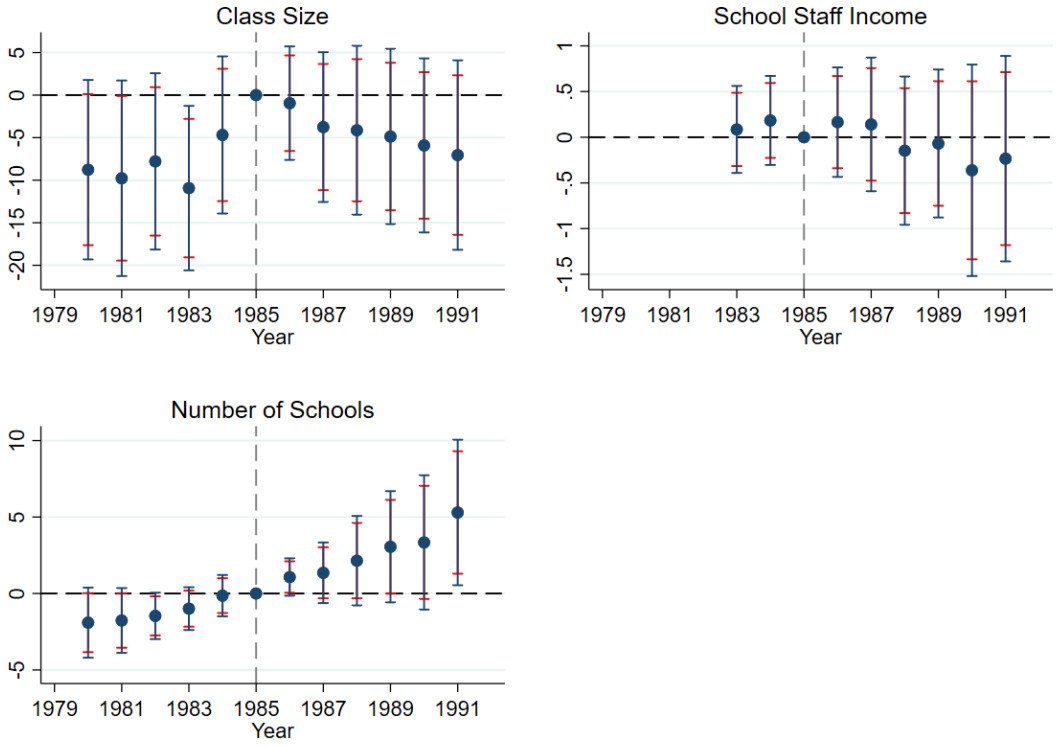
Municipal Outcomes regressions II



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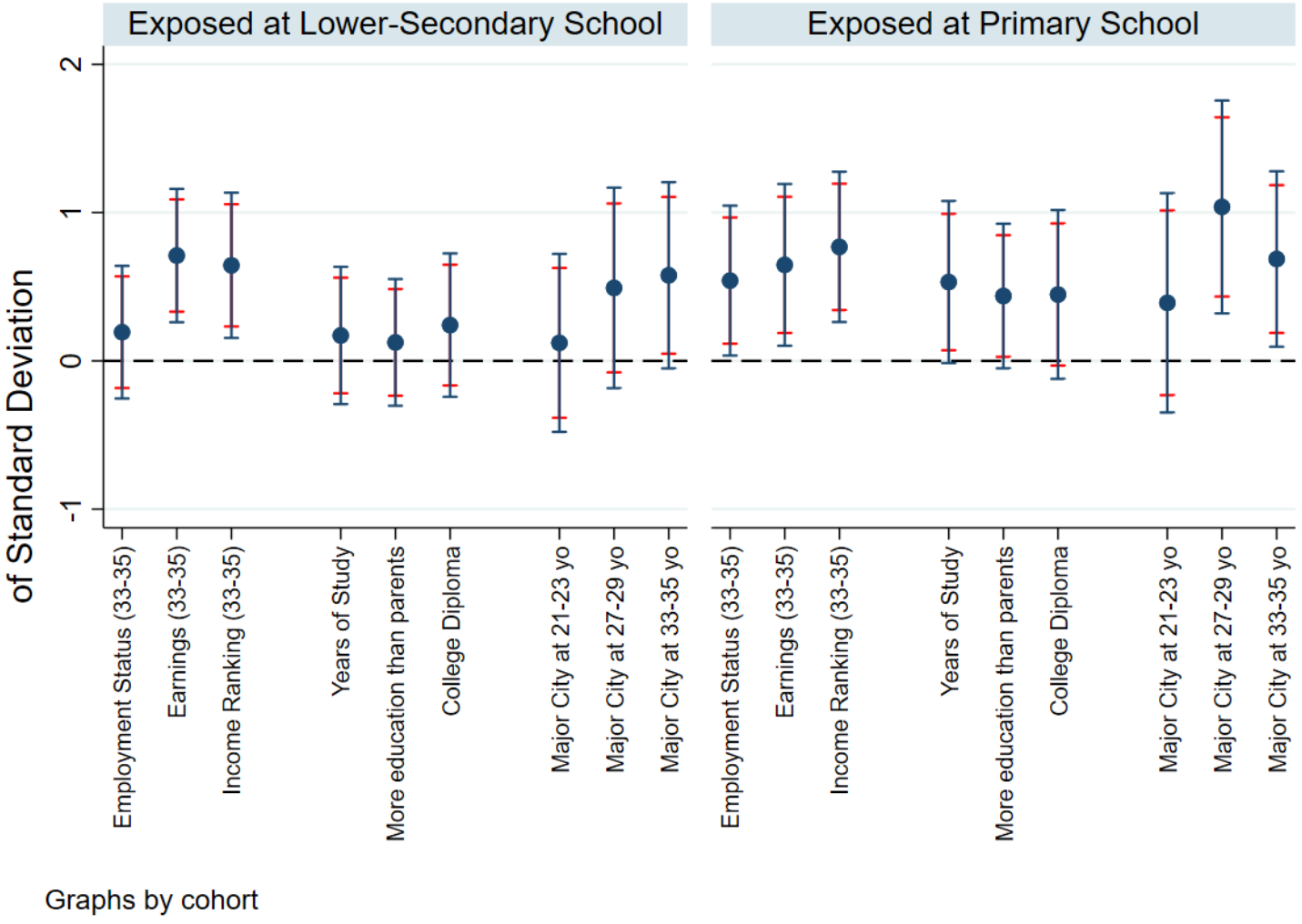
Individual level regressions (effect of +$1000 on grants)



Individual level effects by time of exposure and age

VARIABLES	(1) Labor Income	(2) Years of Study
Shock ×Years of Exposure	4,341***	0.641***
	(1,590)	(0.199)
Shock ×Years of Exposure × Age	-319.9*	-0.063***
	(170.1)	(0.021)
Observations	981,270	1,023,285
R-squared	0.262	0.229

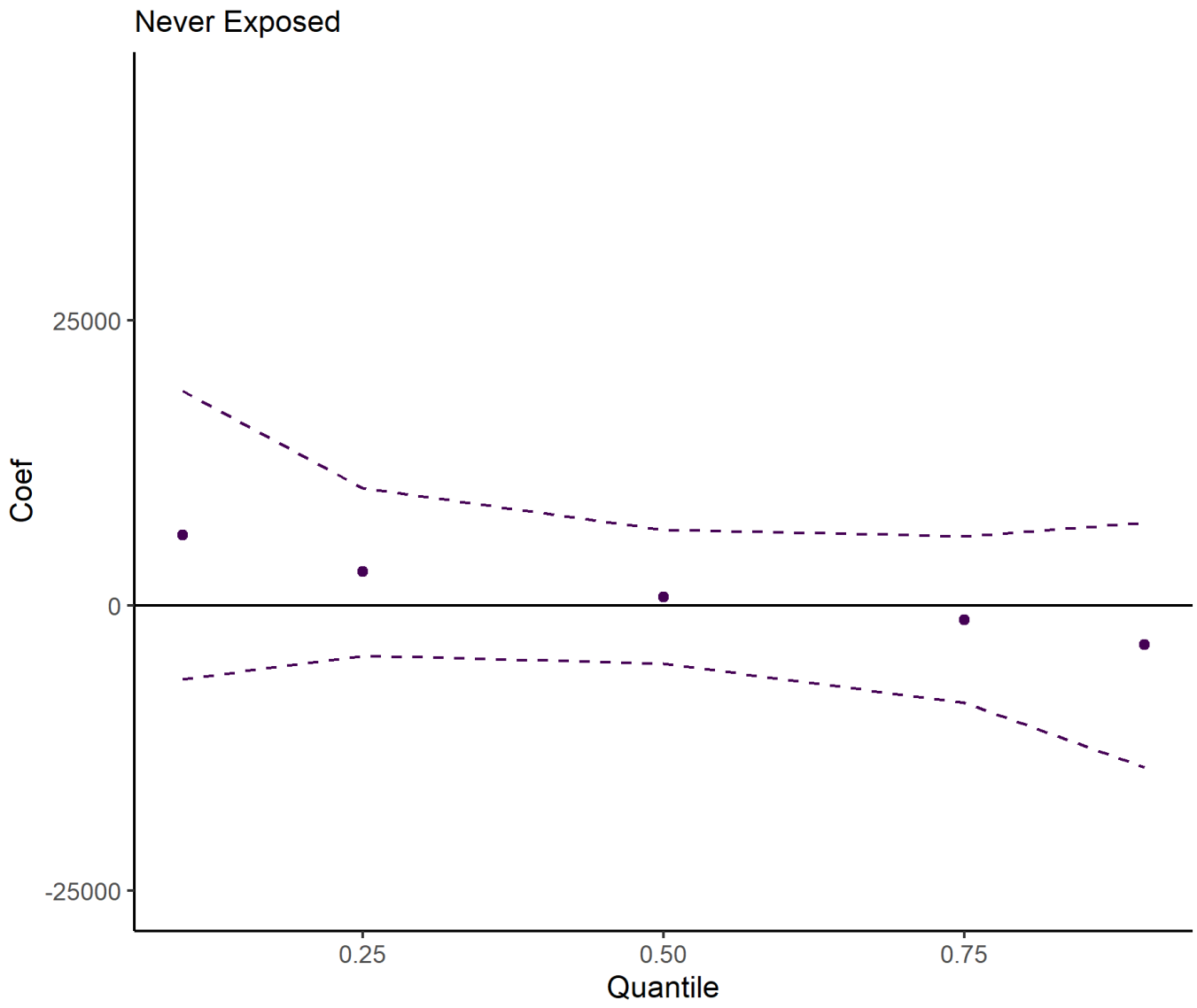
Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Effect by Parental Education

VARIABLES	Years of Study		Labor Income	
	(1)	(2)	(3)	(4)
Never Exposed	-0.442	-1.537	2,355	-2,567
	(0.646)	(1.097)	(3,536)	(6,222)
Marginally Exposed	-0.251	-0.045	2,700	7,053
	(0.640)	(0.905)	(3,570)	(6,238)
Exposed in Lower-	0.418	0.342	10,087*	15,624**
Secondary School	(0.802)	(1.044)	(5,374)	(6,290)
Exposed in Primary	**1.806***	0.975	**22,373*****	4,508
School	(0.951)	(1.127)	(6,749)	(7,798)
Observations	524,678	498,607	508,233	473,037
R-squared	0.095	0.169	0.256	0.217
Parental Education	Low	High	Low	High

Quantile Regressions



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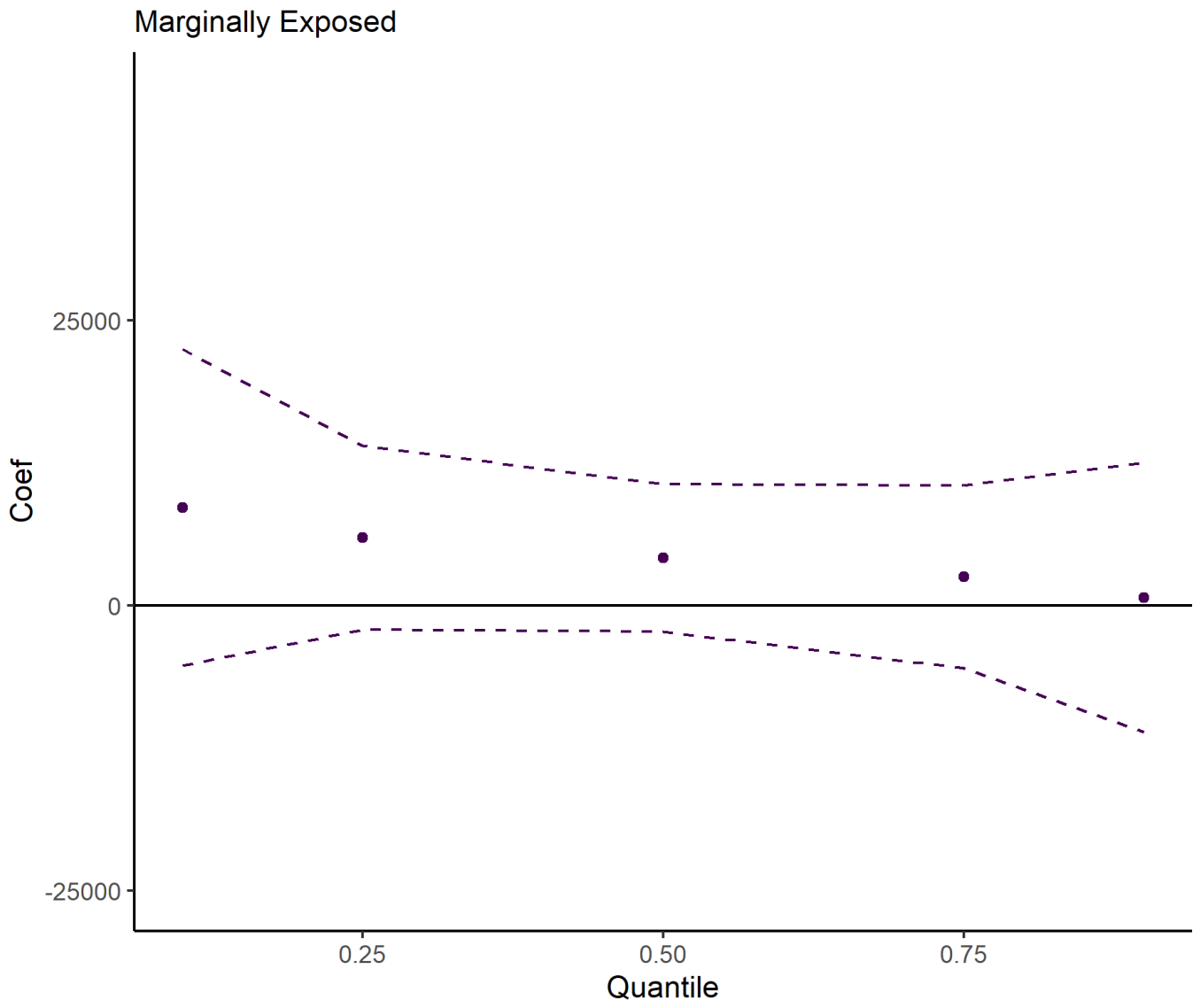

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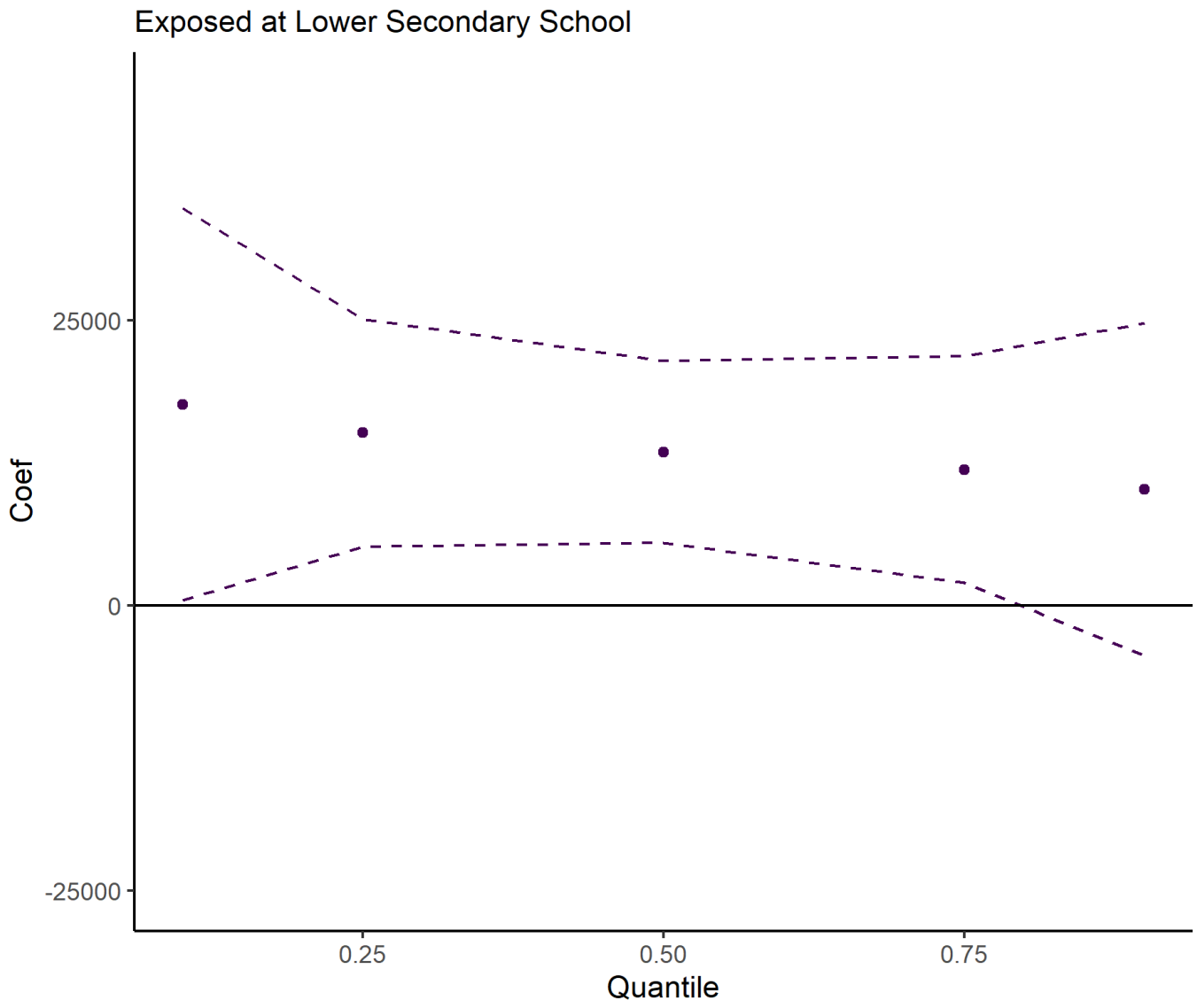

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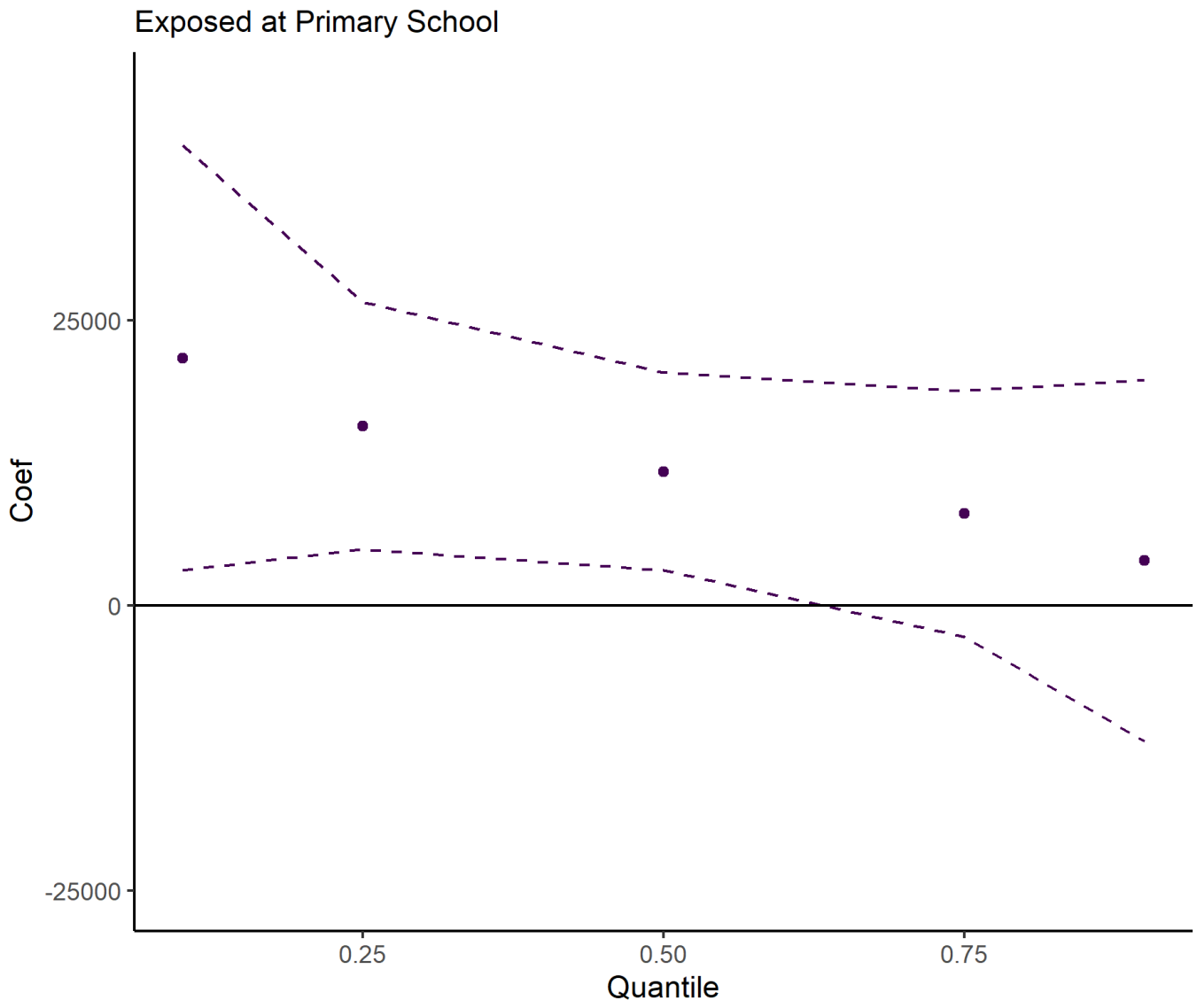


Heterogeneity Analysis

- There might be differences among certain types of municipalities.
- Certain types of municipalities might also crowd-out Central Administration grants (Wu, 2019).
- Cascio et al. (2013): municipalities that are more able to crowd-out to higher external education funding, lowering their own investments, show lower or no actual increases on school spending.

Municipalities by centrality

- 7 levels of geographical location in relation to towns of different sizes.
- Measured by the Norwegian Statistics Bureau in 1980.
- 3 groups: from rural (levels 1 and 2) to central (level 7).

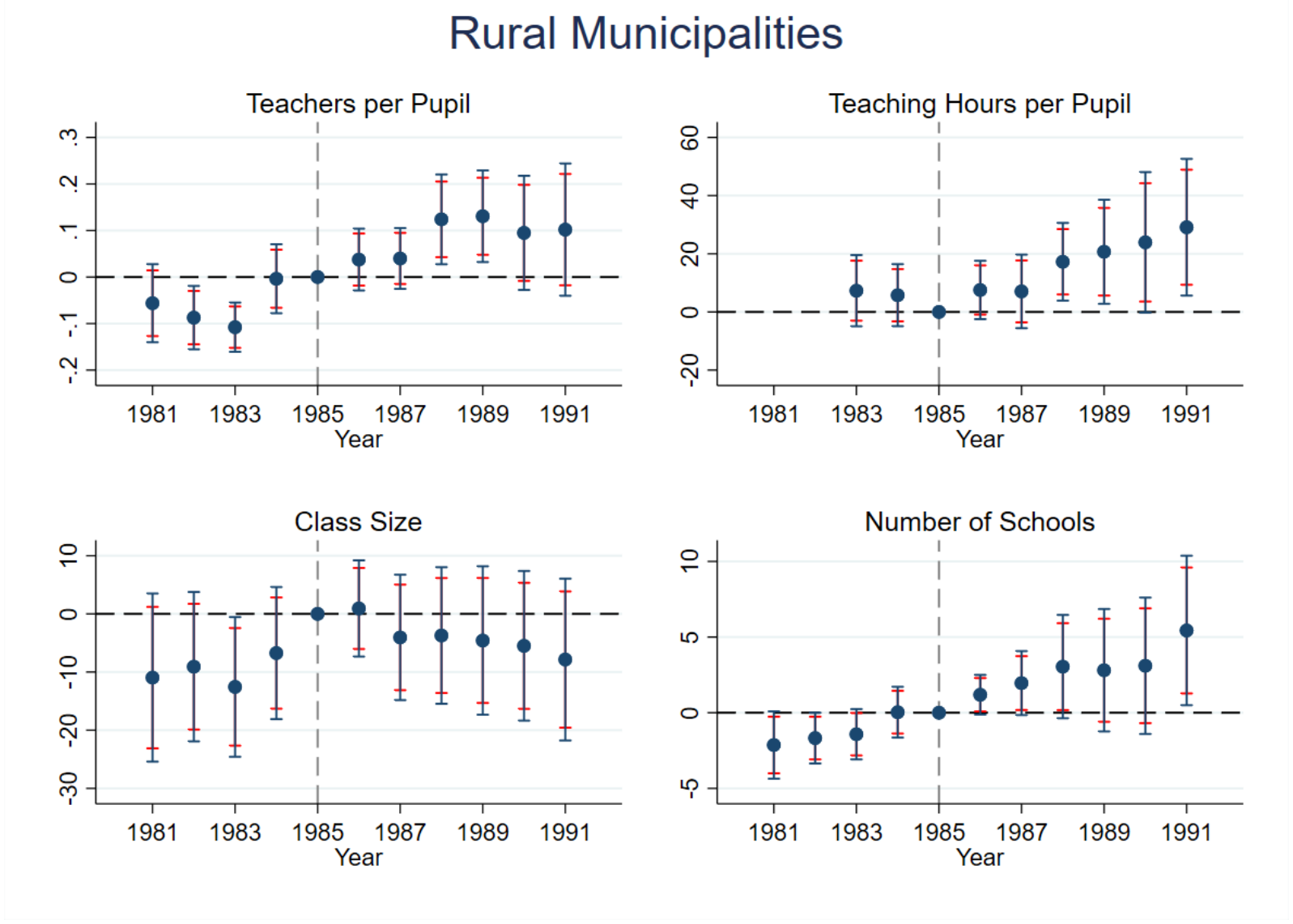
Why centrality? Lower per capita tax revenues + Higher dependency on central administration grants

→ **Less ability to crowd-out education funding.**

	Per Pupil Educ. Spending	Share of Tax Revenues	Share of Educ. Federal Funding
Rural	6890.9	.414	0.525
Neither	5452.2	.538	0.426
Central	6031.0	.584	0.321

Obs: Expenditure in 2011 PPP dollars

Municipal Results by Centrality



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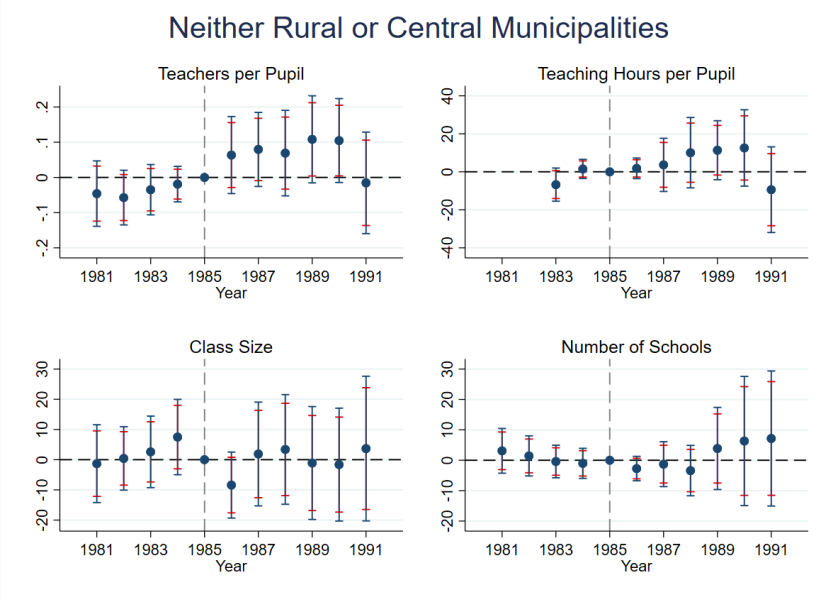

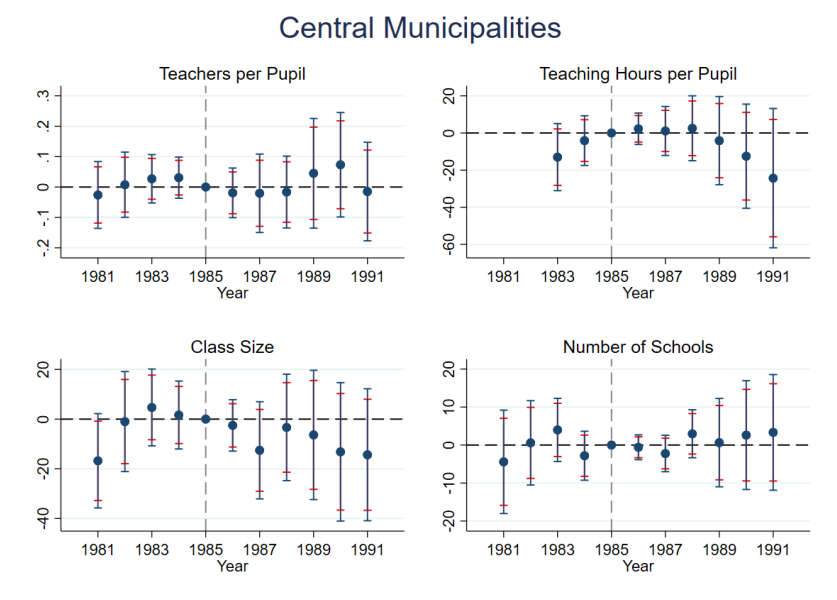

Municipal Results by Centrality

VARIABLES	Years of Study			Labor Income		
	(1)	(2)	(3)	(4)	(5)	(6)
Never Exposed	-1.134	0.918	0.573	2,429	418.4	7,077
	(0.772)	(1.365)	(1.300)	(3,764)	(7,317)	(8,473)
Marginally Exposed	-0.549	0.989	-0.789	5,881	4,279	-1,520
	(0.726)	(1.083)	(1.268)	(4,461)	(6,740)	(7,413)
Exposed at Lower-	-0.228	2.098	-1.510	12,472**	14,443*	12,021
Secondary School	(0.944)	(1.362)	(1.339)	(6,244)	(7,449)	(10,595)
Exposed at Primary	0.741	2.317	0.175	12,118*	11,273	9,896
School	(1.038)	(1.866)	(1.644)	(6,772)	(10,378)	(14,491)
Observations	227,265	315,740	480,280	219,650	303,681	457,939
R-squared	0.204	0.216	0.253	0.295	0.267	0.247
Group	Rural	Neither	Central	Rural	Neither	Central

Groups defined by centrality measure from Statistics Norway, which varies from 1 to 7 (1-2: rural; 3-6: neither; 7: central)

*** p<0.01, ** p<0.05, * p<0.1

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Conclusions and topics for further investigation

- Municipalities increased expenditure and school inputs (teachers, teaching hours, public schools)
- Small effects on educational attainment, but more sizeable impacts on labor market income and migration, especially for those exposed at Primary School.
- Results are stronger for children from under-educated parents and at lower ends at the distribution.
- Results driven by rural municipalities, that have lower per capita revenue and higher dependency on central administration grants.

Thank you!

*Correlations