The impact of teacher input on achievement at age 16 using a hydro-powered instrument

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1. Introduction

The motivation for this study is the controversy on the effects of school resources, like class size and teacher intensity, on student achievement. Identification of causal effects of school resources on pupil performance is challenging due to possible sorting of pupils across school districts when parents choose neighbourhoods based on the performance of schools, compensating resource allocation by school authorities directing extra resources to low-performing students, and teacher sorting into schools with a favourable student composition and school performance.

In the present paper we exploit a particular institutional setting in Norway for property tax revenues from hydro power plants for host municipalities. There are 434 municipalities in Norway. They are also the school authorities for primary and lower secondary schools. Revenues from local income tax, fees and transfers from the central government are used for expenditures on education, child care, health care, administration etc. Allocation of resources to the different areas are based on local priorities, but also *minimum* standards exists for school resources to education in terms of maximum class size and minimum teaching hours plus limits on traveling time from home to school for students. A tax rate cap exists for local income taxation for all municipalities. Given this, host municipalities of hydro power plants have a large advantage since they receive extra revenues from taxing the hydro-power plants. Hydro power plants are located where the waterfalls are, hence making this an exogenous variation in local revenues and therefore resources spent on education. Municipalities hosting hydro power plants are relatively rich, and spend significantly more on education than other comparable municipalities. About 40 % of the municipalities receive revenues from property tax on hydro-power plants.

We use a very rich matched register data set for two complete cohorts for the last year of compulsory schooling (10^{th} grade) for schools, pupils' performance and family background. The student performance measure is pupil level information on final exam results in all fields. Conditioning on a very rich set of family background variables, we are able to control for the schools' student composition and thus family sorting into neighbourhoods. Since we have information on the complete population in each municipality, we can also control for age and education composition to

condition out differences across municipalities. Measures of traveling distance within municipalities are also used in order to control for differences in school resource use due to geographic differences.

We find that when using hydro power revenues as the instrument, school resources do have a positive impact on student performance. The OLS results support no effect of school resources on student performance.