Introduction

There is a rich literature investigating whether resource expenditure in education is connected to the performance of students; despite the wealth of research, there is far from a consensus to this question (see Baker, 2017; Hanushek, 1989; Greenwald et al., 1996). Many research approaches have explored the extent to which student performance can be explained in terms of education resource availability. As schools evolve to meet modern day needs, so too do their funding structures and financial needs which are often tied to district resources. As such, this field of research continually needs to be refreshed and reassessed to respond to the changing education finance landscape.

This research explores the results and viability of linking national assessment data to district-level finance data and then controlling for necessary school environment factors.

The Education Production Function Model

In economics, a production function generally constructs a relation of inputs to a desired quantitatively measured outcome. An education production function substitutes these aspects for education-related inputs and outputs. In this study, this function takes the form of:

\[ A = f([X_{a,b}], [X_{c,a}]) \]

Where:

- \( A \) = measure of school output
- \( X_{a,b} \) = direct input variables measuring a district’s resources
- \( X_{c,a} \) = control variables representing environmental influences inside districts

Analysis

The models in this analysis are based on two different measures of school funding, utilizing the same set of controls:

**Model 1:** Total current district expenditure on elementary and secondary schools, in thousands of dollars per-pupil

**Model 2:** The percentage of district’s total elementary and secondary expenditure spent on instruction

## Data

### National Assessment of Educational Progress (NAEP) Grade 8 Mathematics

The NAEP dataset is fitting for a national analysis perspective because it is the largest nationally representative assessment of public and private schools in the U.S. Instead of assessing individual student level data for achievement, NAEP is designed to provide a common measure of student achievement across the nation drawing on a student sample drawn from schools from every state. These NAEP data allow for an analysis of the effects of spending on performance in schools through the linking of outside datasets such as the F-33.

### School District Finance Survey (F-33)

This universe survey is a component of the Common Core of Data, the primary National Center for Education Statistics database for public elementary and secondary education in the U.S. The F-33 consists of district-level finance data that is submitted annually to NCES, containing detailed breakdowns of a district’s revenues and expenditures.

### Control Variables

Necessary controls for district variances in socioeconomic status, district size (accounting for economies of scale), and geographic wage variations were added to isolate the effects of funding-related aspects on NAEP scores.

### Results

Comparing the results of the two models reveals that the total current per-pupil expenditure on elementary and secondary schools has a small and not significant (\( p > .05 \)) effect on grade 8 NAEP performance (Model 1).

However, when viewed through the lens of Model 2, a district’s total expenditures that are put towards instruction (as opposed to administration, facilities, etc.), this proportion does have a significant (\( p < .05 \)) positive effect on grade 8 NAEP performance (Model 2).

## Limitations - Further Research

Though NAEP is a rich nationally representative dataset, it is not explicitly designed for district-level estimates. To adequately estimate scores, as a minimum the methodology requires a certain student sample size to be met in each district; due to this, many small districts with insufficient sample size were removed from the dataset. Thus, the results are only generalizable on medium- to large-sized districts.

### Multi-Level Models

NAEP samples individual schools, and then samples students within those schools. Because schools are grouped within in districts, this nested data structure would best be studied through multi-level modeling, which will a next step to be explored in our research.

### School-Level Finance Data

Data at the school level would isolate the effects of different school types and structures in districts, as well as allowing for more precise estimates for large districts. A recent NCES report concluded from a pilot School-Level Finance Survey that high-quality school-level finance data could be collected in the future.

### References