PHASE I - STUDENT SPENDING AND ACADEMIC OUTCOMES

Prepared for Delaware Department of Education

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In the following report, Hanover Research uses data provided by the Delaware Department of Education to find potential relationships between per student spending and four academic outcomes: graduation rate, dropout rate, mathematics proficiency on the Delaware Comprehensive Assessment System (DCAS), and reading proficiency on the DCAS. Phase I of this study examines district-level finances and expenditures, while Phase II will examine school-level data.

HR HANOVER RESEARCH

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INTRODUCTION

In this report, Hanover Research presents a snapshot of district academic outcomes and district-level student funding for Delaware schools. The report describes the means for each variable and presents scatterplots which depict the bivariate relationship between per pupil expenditure (PPE) and academic outcomes for each district. An accompanying data supplement presents all academic outcomes at the school-level, depending on data availability. Note that Phase I of this study examines district-level finances and expenditures, while Phase II will examine school-level data.

This report consists of two sections:

- **Section I: Data and Methodology** outlines the data provided by the Delaware Department of Education (DDOE), the data processing conducted by Hanover Research, and the methodology employed in the analysis.
- **Section II: Analysis** presents district-level expenditures, outcomes, and scatterplots depicting the bivariate relationship between district PPE and each outcome.

KEY FINDINGS

- We analyzed four outcome variables and their relationship to PPE. In three of the four variables, namely, **student dropout rate, math proficiency, and reading proficiency, we found no relationship between PPE and these variables.** In the fourth variable, graduation rate, we do find a positive relationship between PPE and graduation rate. Thus, districts with greater PPE tend to also have higher graduation rates. However, this relationship is not statistically significant and therefore we cannot say with any level of assurance that this relationship is not due to chance.

- **Cost-of-living adjusted PPE varies substantially across the 19 districts**, with Appoquinimink (New Castle County) spending the least ($11,296 per student) and Polytech (Kent County) spending the most ($33,056 per student).

SECTION I: DATA AND METHODOLOGY

In this section, Hanover Research discusses the data analyzed in this report and presents our methodological approach to the analysis.

DATA

The Delaware DOE presented Hanover Research with three data sources, including a file with financial expenditures for each district in the state, an Excel spreadsheet with graduation rate and DCAS outcome data, and an Excel spreadsheet with data on high school students who have dropped out. Hanover evaluates the most recent year of data, the 2013-2014 school year.

In all, the files include assessment outcome data on 19 school districts (including the vocational school districts) and 212 elementary, middle, and high schools, student dropout data for 40 high schools, and graduation rate data for each district.

INPUT VARIABLES

The variable of interest in the report is adjusted per pupil expenditure (PPE). We construct this variable by modifying the total expenditures from each district to account for cost-of-living differences, then dividing by the district's enrollment. To adjust for the cost-of-living differences across the state, we divide each district's expenditures by a region-specific figure derived by the National Center for Education Statistics, then multiply the resulting figure by the national mean.[1]

OUTCOME VARIABLES

In this report, we examine four outcomes: graduation rate, dropout rate, DCAS math proficiency, and DCAS reading proficiency. All of these outcomes are measured as a percent of the total students to whom the variable applies. For graduation rate, we use the averaged freshman graduation rate (AFGR), which sometimes produces numbers greater than 100 percent.[2] For the dropout rate, Hanover computes district averages by weighting and summing the averages of the high schools in each district.[3]

Figure 1.1 describes the average inputs and outcomes for the 19 school districts we evaluate.

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[1] Taylor et al., *Documentation for the NCES Comparable Wage Index Data Files*, p. 6, http://nces.ed.gov/edfin/pdf/2007397.pdf.

[2] This is possible if more students moved into a certain school district compared to those who started as freshmen. We assume that AFGR is calculated consistently across the district and therefore we use these numbers as reported by DDOE.

[3] Dropout rate is only provided for Delaware high schools.

Figure 1.1: Summaries Statistics of District-level Variables

Variable	Minimum	Mean	Maximum	Std.Dv.	N
Inputs					
Enrollment	1,206	6,317	16,015	4,432	19
Adjusted PPE	11,296	18,693	33,056	6,996	19
Outcomes					
Graduation Rate	57.0%	87.4%	134.3%	21.3%	19
Drop Out Rate	0.1%	2.1%	5.6%	1.7%	19
Math Proficient	50.3%	70.7%	91.9%	10.7%	19
Reading Proficient	55.0%	72.5%	89.5%	9.1%	19

METHODOLOGY

In this report, we examine the outcomes for each district and present scatterplots depicting the bivariate relationship between PPE and each outcome for the districts. Districts are labeled in the scatterplots to simplify identifying any outliers. The scatterplots also include confidence intervals in order to clarify any statistically significant relationships between outcome variables and PPE.

The bivariate relationships depicted in the scatterplots do not represent any causal link between expenditure and the outcome variables. Districts with greater student expenditures may have student populations that are systematically different than those with less PPE. If, for example, the student populations of better funded districts are more socioeconomically advantaged in other ways than school funding, the effect of this advantage cannot be disentangled from the effect of school funding. The same statistical problem exhibits itself if, for example, students with greater disadvantages receive more funding. Hanover cautions against interpreting a correlation between expenditure and outcome as "return on investment" since differences in outcomes are not necessarily a result of different levels of PPE.

SECTION II: ANALYSIS

This section presents the results of Hanover's analysis of PPE and district outcomes. First, we describe the enrollment, PPE, and outcomes for each district. Then, we present scatterplots depicting the statistical relationship between PPE and each outcome for the 19 public school districts we analyze.

DISTRICT INPUTS AND OUTCOMES

Figure 2.1 presents the enrollment and adjusted PPE for each district. PPE ranges from $11,296 (Appoquinimink) to $33,056 (Polytech).

Figure 2.1: District Inputs

DISTRICT	DISTRICT NUMBER	ENROLLMENT	ADJUSTED PPE
New Castle County			
Appoquinimink	29	9,750	$11,295.75
Brandywine	31	10,802	$14,629.09
Christina	33	16,015	$14,018.78
Colonial	34	9,880	$12,548.65
NCC Votech	38	4,548	$19,379.90
Red Clay	32	15,934	$14,437.66
Kent County			
Caesar Rodney	10	7,031	$11,944.29
Capital	13	6,527	$22,063.13
Polytech	39	1,206	$33,056.35
Lake Forest	15	3,770	$13,546.08
Milford	18	4,203	$12,471.70
Smyrna	24	5,235	$12,441.84
Sussex County			
Cape Henlopen	17	5,034	$24,046.38
Delmar	37	1,347	$13,356.96
Indian River	36	9,320	$16,098.38
Laurel	16	2,135	$31,883.37
Seaford	23	3,486	$23,351.86
Sussex Technical	40	1,491	$25,641.57
Woodbridge	35	2,309	$28,949.78

Figure 2.2 presents academic outcomes for each district.

Figure 2.2: District Outcomes

DISTRICT	DISTRICT NUMBER	GRADUATION RATE	MATH PROFICIENT	READING PROFICIENT	DROP OUT RATE
New Castle County					
Appoquinimink	29	76.5%	82.4%	83.7%	0.9%
Brandywine	31	84.0%	67.0%	73.1%	5.0%
Christina	33	69.5%	60.0%	62.0%	3.5%
Colonial	34	78.0%	60.5%	64.5%	3.6%
NCC Votech	38	120.9%	80.6%	76.1%	0.7%
Red Clay	32	87.5%	65.2%	69.8%	0.2%
Kent County					
Caesar Rodney	10	73.9%	76.4%	79.0%	1.4%
Capital	13	87.0%	62.1%	65.6%	1.5%
Polytech	39	134.3%	82.2%	82.6%	0.1%
Lake Forest	15	68.1%	79.1%	78.1%	2.1%
Milford	18	113.0%	70.4%	72.9%	2.5%
Smyrna	24	73.1%	70.5%	75.4%	1.9%
Sussex County					
Cape Henlopen	17	87.6%	81.7%	80.7%	0.8%
Delmar	37	83.8%	70.5%	72.1%	0.8%
Indian River	36	100.4%	77.6%	77.7%	1.6%
Laurel	16	67.8%	58.0%	63.7%	5.0%
Seaford	23	57.0%	50.3%	56.1%	5.6%
Sussex Technical	40	126.9%	91.9%	89.5%	0.1%
Woodbridge	35	70.9%	57.8%	55.0%	2.1%

Additional analysis is presented on the following pages.

SCATTERPLOTS

As described in the methodology section, the scatterplots depict the bivariate relationship between PPE and the outcome variable of interest. Hanover has added a trend line with a confidence interval so that any statistical relationship between the variables is visualized.

GRADUATION RATE

As mentioned above, the average freshman graduation rates range from 57.0 percent (Seaford) to 134.3 percent (Polytech). Figure 2.3 shows a slight upward trend, indicating a positive correlation between PPE and graduation rate. However, this result is not statistically significant.

Figure 2.3: PPE and Graduation Rate
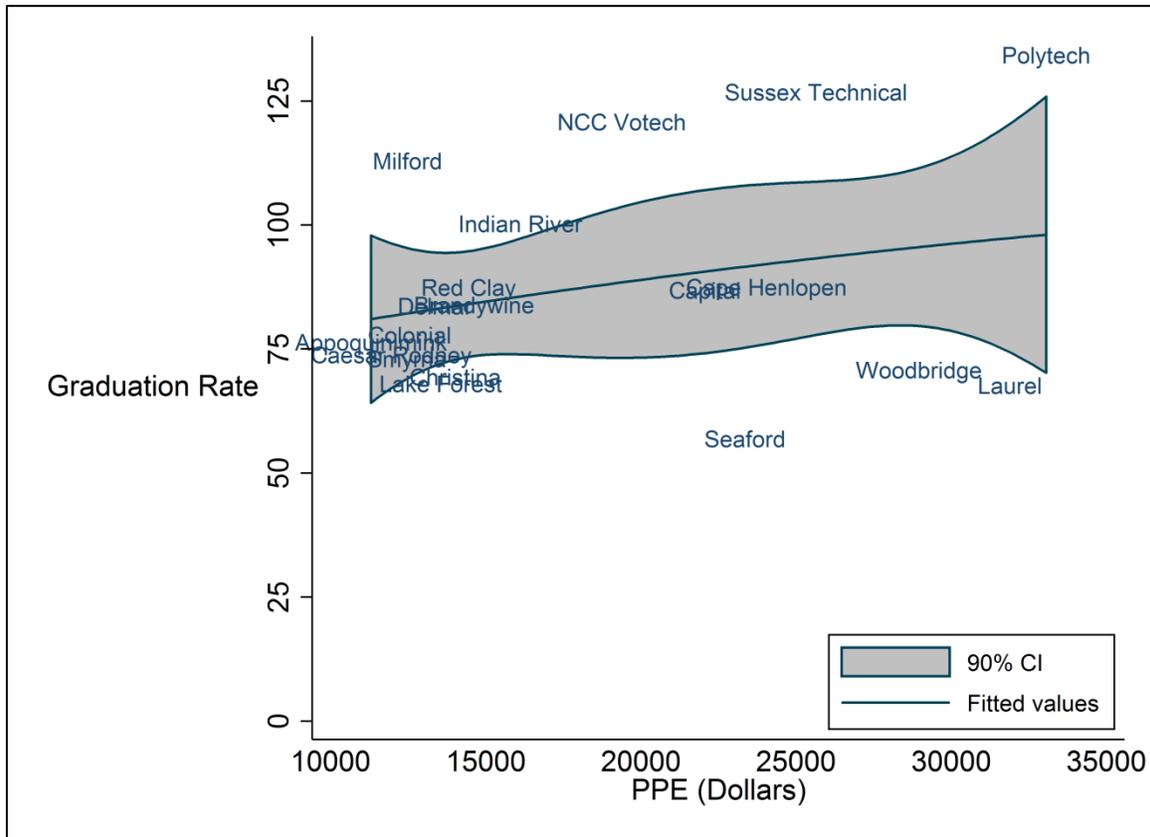
DROPOUT RATE

Figure 2.4 depicts the bivariate relationship between PPE and the district dropout rate. The horizontal trend line indicates that there is no statistical relationship between these two variables.

Figure 2.4: PPE and Dropout Rate
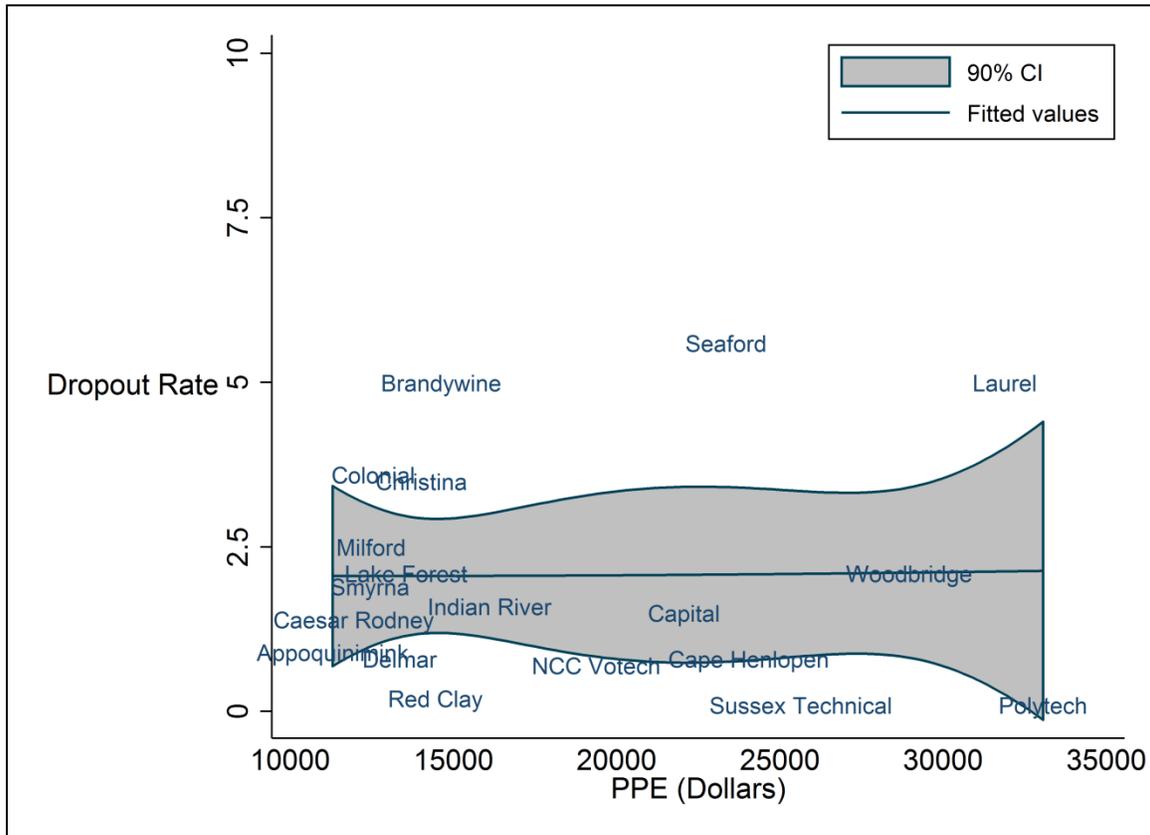
MATH PROFICIENCY

Figure 2.5 depicts the bivariate relationship between PPE and the percent of students in the district who are proficient at math on the DCAS. As with the relationship between PPE and the dropout rate, the horizontal trend line in Figure 2.6 indicates that there is no statistical relationship between these two variables.

Figure 2.5: PPE and Math Proficiency
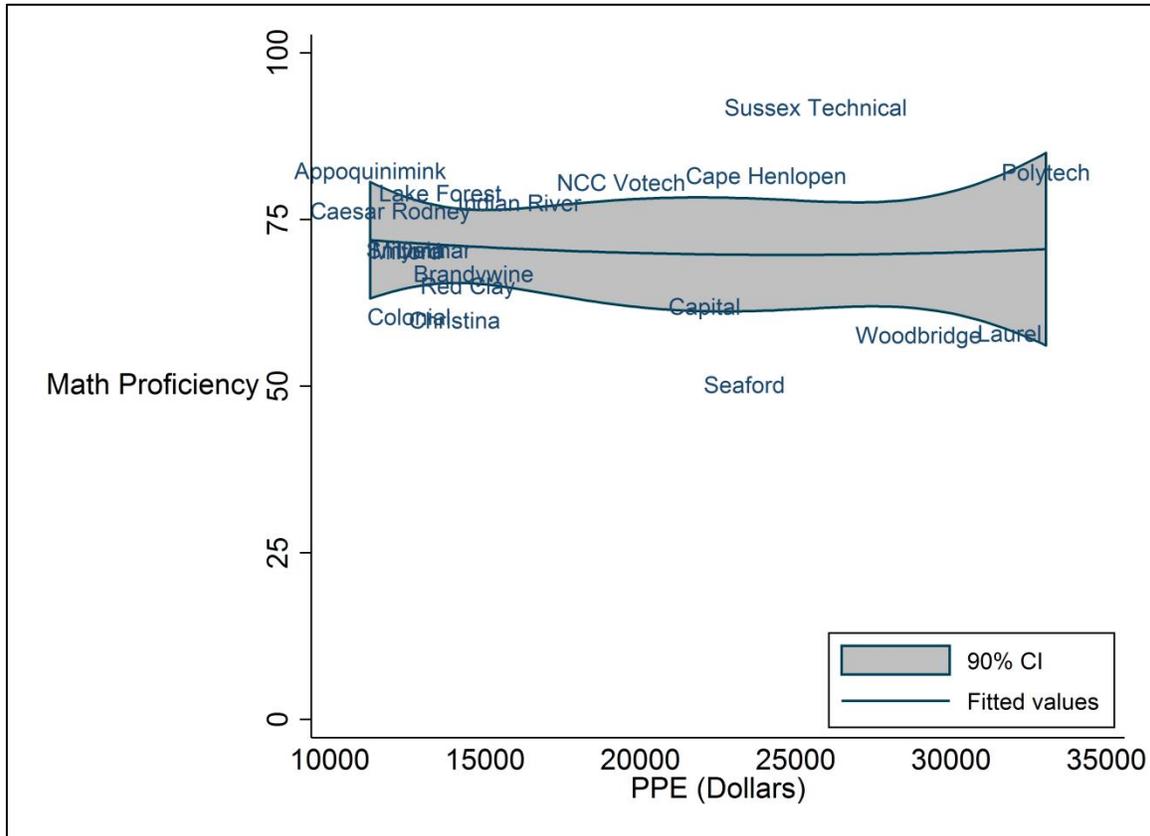
READING PROFICIENCY

Figure 2.6 depicts the bivariate relationship between PPE and the percent of students in the district who are proficient at reading on the DCAS. Although the trend line is not perfectly horizontal, the line is nearly so. This indicates that there is no statistically significant relationship between these two variables.

Figure 2.6: PPE and Reading Proficiency
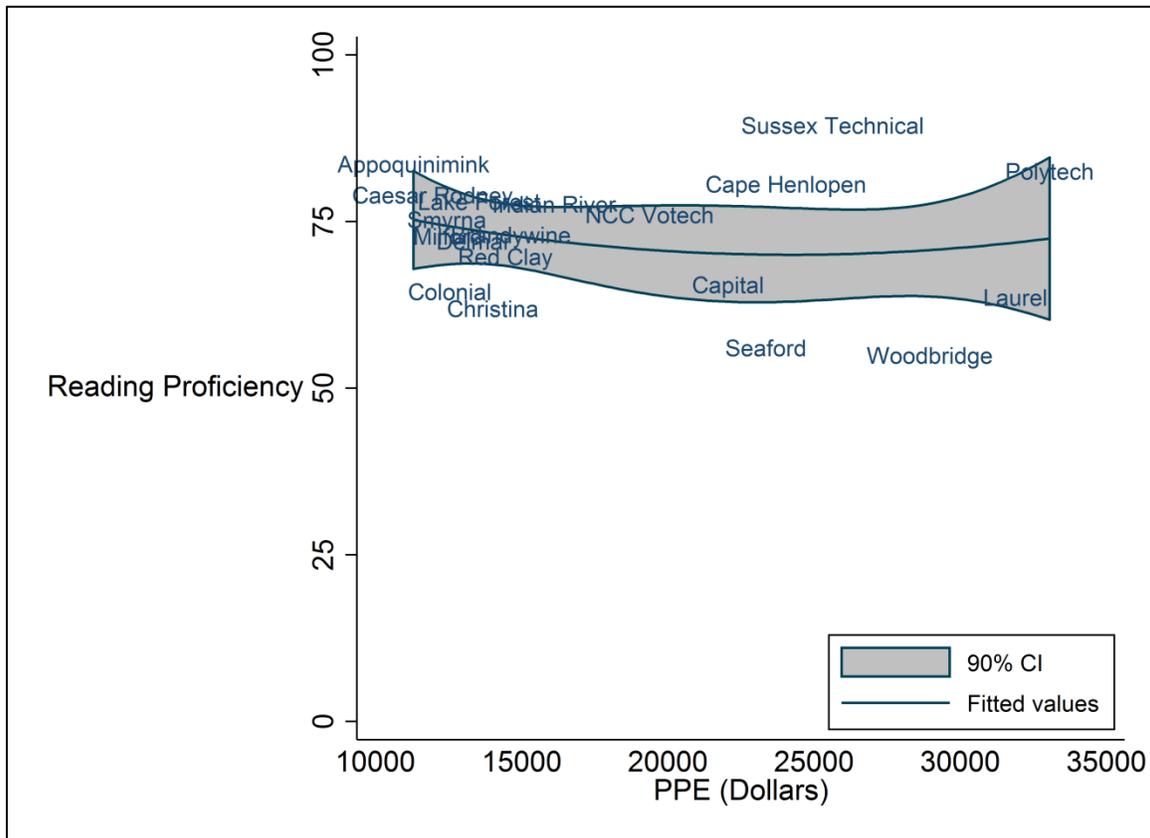
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CAVEAT