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The Relative Impact of Family Income Vs Per Student Expenditures on Education Outcomes in Washington

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ABSTRACT

Since education is often attributed to reducing wealth inequality, the growing wealth inequality in the United States has led to concerns on how wealth might affect education outcomes. Research regarding socioeconomic and per student expenditures on education outcomes, suggest a correlation between student outcomes and wealth inequality. However, prior research has only been conducted on how these factors influence education outcomes individually, no research has been done comparing the relative impact of family income and per student expenditures on student outcomes. I used multiple linear regression to determine the relationship between wealth and student outcomes to compare the effects of median household income versus per student expenditures. I found that median household income overall had a more significant influence on education outcomes than per student expenditures in Washington public high schools. These outcomes were measured by graduation rates of high school, enrollment into four-year education, and percent not enrolled in post-secondary education. While median household income was found to have a significant relationship with all education outcomes, per student expenditures only had a statistically relationship with percent not enrolled in post-secondary education. Thus, inequality in per student expenditures had a significantly less influence on college enrollment compared to what previous research suggested. This suggests targeting differences in education originating from differences in socioeconomic status would be more effective than focusing on programs targeted at per student expenditures. Therefore, this research holds implications for policy makers and school administrators looking to improve student outcomes in high school.

Introduction

According to the Distributional Financial Accounts (DFA) released by the Federal Reserve System, the wealth share held by the top 1 percent in the third quarter of 2021 was 32.1%, and the top 90 to 99 percent held 37.5%. Combined, the top 10 percent of individuals own 69.6% of the wealth in the USA. In contrast, the bottom 50% only own 2.5% of the wealth. While the percentages of wealth owned by the wealthy vary depending on how wealth is measured, the trend generally shows increasing wealth inequality (Bricker et al., 2020; Zucman & Saez, 2016). At the same time, there is a perception that education is a great equalizer, allowing individuals to succeed independent of economic circumstances (Bradbury et al., 2015; Breen & Chung, 2015; Goldhaber et al., 2018; Hippel, Workman, Downey, 2018). However, the current education system contains many inequalities that limit social mobility. There exists an achievement gap between students who come from affluent families and those with disadvantaged backgrounds (Bradbury et al., 2015).

Two main trends of research emerged in my examination of how wealth inequality translates into unequal educational outcomes: socioeconomic status and educational funding. Prior research on the socioeconomic status (SES) of families mainly revolves around test scores and college graduation rates as measurements of education outcomes. This trend of research found median household income, a measurement of SES, plays a significant role in education outcomes. Additional research found that per student expenditures strongly influences college graduation rates and wages. While these two trends have been researched individually, no research has been done explicitly comparing the effects of median household income versus per student expenditures on education outcomes.

Furthermore, prior research mainly focuses on education outcomes occurring before primary education or upon completion of post-secondary education. Research has not focused on the effects of wealth on education outcomes in secondary education, such as outcomes in public school districts in Washington.

This leads to my research question: What is the relative importance of family income versus per student expenditures when assessing educational outcomes in Washington public school districts, as measured by graduation rates from high schools, enrollment into four-year institutions, and percent not enrolled into post-secondary education? Research that assesses the relative importance of family income versus per student expenditures would have implications for policy makers and school administrators looking to improve education outcomes in public school districts. It could inform potential reforms aimed at mitigating education disparities caused by wealth inequality, and thereby help public school districts better live up to their reputation as "great equalizers".

Literature Review

Socioeconomic Status and Education Outcomes

In the past 50 years, educational achievement gaps between high income and low-income families have been increasing (Pfeffer, 2018). In the United States, family income is strongly related to educational attainment. Researchers suggest that the socioeconomic status of families is especially important in developing the cognitive skills during early childhood, prior to schooling, while they are susceptible to the environment (Von Hippel, Workman, & Downey, 2018; Bradbury et al., 2015). Research conducted by Von Hippel, Workman, and Downey, measured the reading and writing scores of individuals of high and low socioeconomic status at different ages and found that most of the inequalities are present at the age of 5 (2018). Another article by Bradbury et al. tracked the test scores among gaps between low and high SES in the United States and compared it to that of three other socially and economically similar countries, namely the United Kingdom, Australia, and Canada found similar results. They found that not only was there a gap between individuals from low SES households and median SES households, but there was also a substantial gap between the skills of median SES households and high SES households. This inequality also remained virtually unchanged as students progressed through elementary school. 60 to 70 percent of socioeconomic achievement gap at the age of fourteen is caused by inequalities present prior to school entry while 30 to 40 percent emerges in the school year (Bradbury et al., 2015).

Both these research articles suggest that differences in education outcomes are based on the SES of the families. However, this does not mean schooling has no impact on education inequality. Perhaps the growth of inequality grows faster than school can ameliorate it, meaning that schools are preventing further growth of inequality (Bradbury et al., 2015; Von Hippel et al., 2018). This branch of research focuses on SES and education outcomes in terms of test scores. It suggests that the education inequality is due to difference in the SES of the household. However, this is only based on math and reading skills measured through tests. According to Jackson, Johnson, and Persico, "test scores are imperfect measures of learning" and do not accurately measure long term inequalities (2016). Therefore, more research is needed to better understand whether there are long term effects of socioeconomic status.

Another branch of research looks at socioeconomic disparities and college graduation rates. Trends in research have shown an increase in education inequality as a result of income inequality in higher education. College graduation rates of children from high SES families have increased to the point where the top 20% have 48.9 percentage point higher chance of graduating than individuals in bottom 20% of wealth (Pfeffer, 2018). According to Pfeffer (2018), these changes are caused by "the heightened private investment in children, the increased economic segregation of neighborhoods and schools, the rising costs of college attendance, and increasing insecurities facing children and young adults as they embark on their educational and labor market careers".

One of the main causes of inequality cited by Pfeffer was increased economic segregation of schools. Property taxes finance schools and link education to wealth, allowing wealthier districts to have more money than less

wealthy neighborhoods (Pfeffer, 2018). In theory, households choose jurisdictions based on which public service and goods they prefer; therefore, they are willing to pay taxes to support such services. Individuals who prefer good schools will reside in communities with high quality schools and their taxes will go into supporting schools and such. However, many households cannot afford to live in neighborhoods with good quality schools, therefore supporting a socioeconomic gap in school funding (Baker, 2018). Families with high social backgrounds can invest in their children's early education by buying houses with good residential schools therefore gaining an advantage, further ingraining wealth as a factor in education attainment (Baker, 2018).

Per Student Expenditures and Education Outcomes

The cost of attending college increased relative to before the great recession by 17 percent in public schools, and 11 percent in private nonprofit institutions after accounting for inflation (Webber, 2021). The increased cost of college follows a trend of decreasing state support for education, which was exasperated by the great recession. Support for higher education is often one of the first types of spending to be cut (Webber, 2021). Since it is an investment in the future, the results of decreased spending on education are not felt until later. This negatively impacts low-income students the most. They are the most likely to enroll but not complete college, taking on student debt but not gaining the college premium, the increased wages one would get for attending college (Pfeffer, 2018; Webber, 2021). The reasoning behind this decision is, "America has spent more and achieved less", and "systems must learn to do more with less" (Baker, 2018). These claims are mainly false and exaggerated, trends show that spending, staffing, and wage competitiveness have declined, implying that the education system of the United States is not becoming more inefficient, but more efficient (Baker, 2018). While the United States education system is different with each state, on average there is significant improvement in national assessments when average spending increases, and a decline when spending decreases (Baker, 2018).

A research article comparing student spending in educational attainment found that results vary based on SES. Increasing per pupil spending for individuals of low SES had significant increases improvements in educational attainment. On the other hand, children from medium to high SES had small or moderate effects of increased per student spending (Jackson et al., 2016). Similarly, other research looking at educational spending in Michigan found increasing spending by one thousand dollars increased college enrollment by 7 percent and increased degree recipients by 11 percent (Hyman, 2017).

This branch of research finds funding of schools has stagnated, and only eleven states have increased education spending since the great recession (Baker, 2018). This damages the ability of schools to offset inequalities in attainment, since evidence regarding per student expenditures shows increased spending improves outcomes in college graduation and wages. This especially improves education outcomes of low-income students, potentially having a great equalizing effect. However, since funding of schools is primarily funded by neighborhoods, low-income students do not get the funding needed for schools to have an equalizing effect.

Both branches of research regarding education outcomes involving per student expenditures and median household income demonstrate that their measurement of wealth is significant in student outcomes. However, research has not been done with both median household income and per student expenditures to determine their relative importance on outcomes in public school districts. This research will result in increased understanding of which factor of wealth is more significant in improving education outcomes.

Methods

The purpose of my research project is to determine whether family income or per student expenditures has a more significant impact on education outcomes in Washington public school districts. The data collected is from counties shown in **Figure 1**. I chose this data based on counties with publicly available median household incomes. After

excluding districts with less than three schools as well as districts without sufficient data for all variables, there were a total of 139 school districts. The complete list of all the school districts for which I collected data is detailed in Appendix A.

Benton County, WA	Franklin County, WA	Kitsap County, WA
Chelan County, WA	Grant County, WA	Lewis County, WA
Clallam County, WA	Grays Harbor County, WA	Mason County, WA
Clark County, WA	Island County, WA	Pierce County, WA
Cowlitz County, WA	King County, WA	Skagit County, WA
Snohomish County, WA	Spokane County, WA	Thurston County, WA
Whatcom County, WA	Yakima County, WA	

Figure 1: List of Counties in Washington

Educational spending was measured using per student expenditures since the funding of schools varies with the size of the districts. Both Jackson et al. (2016) and Hyman (2017) also used per student expenditures in measuring education inequalities. Family income was measured using median household income in school districts. I used median household income since it is a determinant of SES and there has been a great amount of research done involving median household income and education inequality (Von Hippel, Workman, & Downey, 2018; Pfeffer, 2018). This data was collected under the assumption that per student expenditures and median household incomes of families in the school districts for each school year does not vary significantly. **Table 1** below illustrates the data collected and where it was collected from.

Table 1. Independent variables collected and their sources.

Data collected	Source
Per student expenditures (2017-2018)	National Center for Educational Statistics (U.S. Department of Education, **n.d.**)
Median household income in five-year cohorts (2015-2019)	American Community Survey on the National Center of Educational Statistics (U.S. Department of Education, **n.d.**)

Student outcomes were measured using graduation rates, enrollment into four-year institutions, and percent not enrolled into post-secondary education. I chose these variables because they would be better predictors of long-term inequality in education attainment compared to measuring test scores (Jackson et al., 2016). I collected the graduation rates of all students in four-year cohorts in the designated school districts. The enrollment into post-secondary education publicly available is categorized into percent enrolled into four-year, two-year/CTE (College for technical education), and not enrolled. I collected data on enrollment into four-year colleges and data on individuals not enrolled in post-secondary education in the graduating class of 2018. I expected an inverse relationship between four-year college enrollment rates and percent not enrolled in post-secondary education. I did not collect on enrollment into two-year or CTE schools. I assumed that having four-year institutions and percent not enrollment will imply the remainder goes into CTE and two-year schools. **Table 2** below illustrates the data collected at the source of the data.

Table 2. Dependent variables collected and their sources

Data collected	Source
Graduation Rates in four-year cohorts (2017-2018)	Data.WA.gov provided by the Washington Office of Superintendent of Public Instruction (OSPI, 2020)
Four-year college enrollment rates (2017-2018)	Education Research and Data Center (Education Research & Data Center, 2020)
Percent not enrolled in post-secondary education (2017-2018)	Education Research and Data Center (Education Research & Data Center, 2020)

The independent variables in my study will be per student expenditures and median household income, and the dependent variable will be the varying measures of student outcomes. The data of the relevant categories were compiled onto an Excel document. Then I used Excel to conduct a regression analysis of the data.

Multiple Linear Regression

I conducted a multiple linear regression since there are two independent variables: median household income and per student expenditures. Using a multiple linear regression gives us the correlation between the multiple independent and dependent variables so we can determine which independent variable has a more significant relationship. I followed the precedent set by prior research measuring the relationship between wealth inequality and education outcomes, which also used some type of regression analysis (Hyman, 2017; Jackson et al., 2016; Pfeffer, 2018).

I conducted a regression analysis for each dependent variable, once for graduation rates, enrollment into four-year institutions, and percent not enrolled in post-secondary education. This is because a multiple linear regression can only test for one dependent variable at a time. Based on the outcomes of these regression analyses, I determined whether median household income or per student expenditures had a more significant effect on education outcomes in public school districts in Washington. To check if multiple linear regression can be conducted, I first plotted each independent variable in relation to the dependent variable. After confirming a linear relationship, I conducted the multiple linear regression using the data analysis tool in Excel.

The relationship between the independent variable and the dependent variable can be determined by accessing the null hypothesis. The null hypothesis assumes that there is no relationship (Albers, 2017). The rejection of the null hypothesis would imply a relationship, while the failure to reject the null hypothesis would imply no relationship between the variables. Since multiple linear regression tests for a statistically significant relationship between the independent variables and the dependent variable, the null hypotheses would be:

H_1 = There is no relationship between median household income and the dependent variable

H_2 = There is no relationship between per student expenditures and the dependent variable

The p-value was used to test the null hypothesis. A p-value shows the probability that the observed results would be seen if the null hypothesis were true (Albers, 2017). Taken this, the p-value can be used to make "a claim of statistical significance" (Albers, 2017). In essence, the p-values allows us to determine if differences between the independent variables and the dependent variable are statistically significant, the lower the p-value, the stronger the ability to reject the null hypothesis. The criteria for determining the relationship of the p-value is shown below in **Table 3.**

Table 3. Interpreting the P-value.

P-value	Significance
$P > 0.05$	Failed to reject the null hypothesis. There is no relationship between the independent and dependent variable (Albers, 2017).
$P < 0.05$	Null hypothesis is rejected. There is a statistically significant relationship between the independent and dependent variable (Albers, 2017).

In the instance where one of two independent variables had no significant impact on the dependent variable, I reconducted the linear regression with only the independent variable that had significant influence on the dependent variable. By using the outputs of the multiple linear regression analysis, I created a model to predict the student outcomes based on the measurements of wealth in the following equation:

$$\gamma = \beta_o + \beta_1 X_1 + \beta_2 X_2$$

β is the coefficient of the independent variable, and repersents how one unit of change in the independent variable affects the dependent variable (Albers, 2017). The coefficient for median household income was repersented by β_1, and was be multiplied by X_1, the observed median household income. The coefficient for per student expenditures was repersented by β_2, and was multiplied by X_2, the observed value for per student expenditures. $\beta_o$was the coefficient given by the intercept coefficient in the output of the regression analysis. Since the equation predicts the education output, the y repersents the predicted value of education outcome.

The accuracy of the model can be determined using the R^2. The R^2 measures the percent variation in dependent variable explained by independent variables. Essentially, what percent of student outcomes is determined by per student expenditures and/or household income versus what percent is explained by other factors not accounted by this model, such as teacher experience or counselor to student ratio. It shows how accurately we can predict the outcomes based on these measurements of wealth. The higher the percentage, the greater percentage of outcomes is based on these wealth factors.

Since a linear regression assumes a homoscedastic distribution and no multicollinearity, I tested for homoscedasticity and multicollinearity to confirm the viability of my results, A homoscedastic distribution is defined as when the residuals, the difference between the observed value and the predicted values, are evenly distributed. Multicollinearity is when the independent variables are not dependent on eachother. The failure to comply with these assumptions will mean the results are untrustworthy (Zach, 2021).

Homoscedasticity was tested using the Breusch-Pagan test (Zach, 2020). The Breusch-Pagan test checks for homoscedasticity by looking for a heteroskedastic data set, where the residuals are unevenly distributed. Since it is testing for a heteroskedastic data, the null hypothesis is:

$N_1 =$ The data set is homoscedastic

Rejecting the null hypothesis would mean that the data is heteroscedastic and would cause the results to be untrustworthy. To conduct a Breusch-Pagan test, it first involves conducting a regression analysis using the residuals squared as the responding variable (Zach, 2020). The residuals squared can be calculated by using the following equation:

$$Residual\ Squared = (Predicted\ Value - Observed\ Value)^2$$

The predicted value can be found by plugging in the numbers into the regression equation for the relevant dependent variable. Then using the results of the new linear regression, conduct the Chi-squared test using the following equation:

$$X^2 = n * R^2$$

R^2 is the residual squared outputted in the new linear regression analysis and n is the number of observations (Zach, 2020). Then I found the p-value using the CHISQ.DIST.RT(test statistic, degrees of freedom) function in Excel. I inputted the X^2 for test statistic and the used the df value as my degrees of freedom (Zach, 2020). Then I tested the null hypothesis, rejecting the hypothesis if the p-value was less than 0.05.

Multicollinearity only needs to be tested when two independent variables have a significant relationship with the dependent variable. Multicollinearity was tested by finding the VIF (variance inflation factor) for each of the

independent variables. The VIF indicates the strength of correlation between the independent variables. I found the VIF of an independent variable by conducting another linear regression with one of the independent variables as the explanatory variable, and the other as the responding variable (Zach, 2020). Since there only was a maximum of two independent variables effecting the dependent variable, the VIF value for median household income on per student expenditures will be the same as the VIF value for per student expenditures on median household income. After, I calculated the VIF value using the following equation:

$$VIF = 1 / (1 - R\ Square)$$

The VIF value and its significance is demonstrated in Table **4** below.

Table 4. Interpreting VIF values (Zach 2020).

VIF Value	Correlation
1	No correlation between the independent variables
1-5	Some correlation between the independent variables, but not enough to warrant attention.
5 and above	Severe correlation

Results

The main findings of my research suggest that median household income plays a more significant role in determining education outcomes than per student expenditures. In fact, per student expenditures does not impact four-year enrollment or graduation of high school at all. Although it was somewhat correlated with percent not enrolled in post-secondary education, its effects on education outcomes were meager compared to prior research. Overall, this implies that spending effort on increasing per student expenditures to improve education outcomes will not be effective in reducing inequality. However, there was some homoscedastic in that data, so further follow up is necessary.

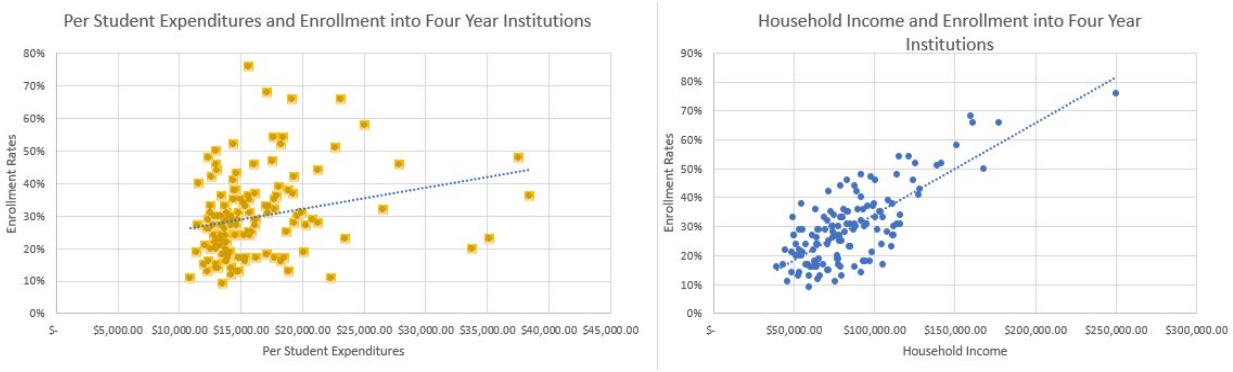

Figure 2: Shows an increasing linear relationship between four-year college enrollment rates and the independent variables

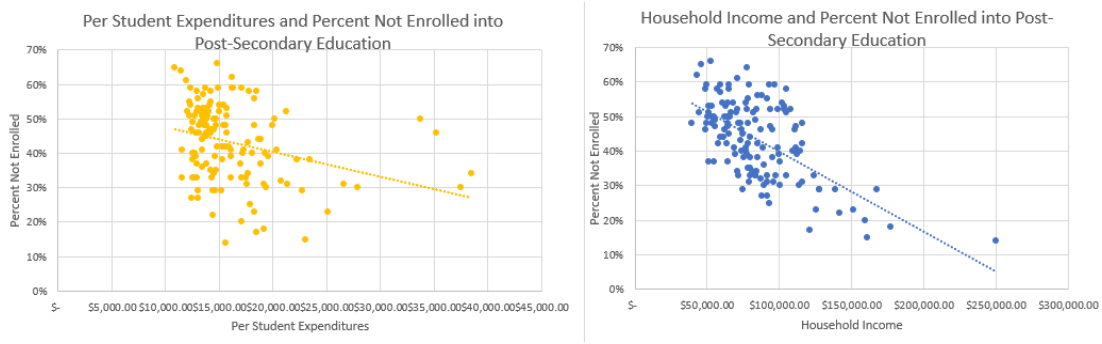

Figure 3: Shows a decreasing linear relationship between percent not enrolled in post-secondary education and the independent variables

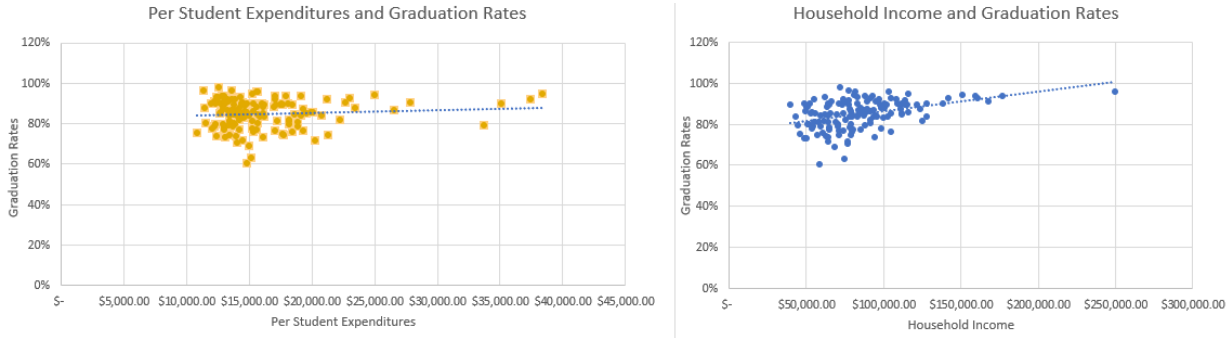

Figure 4: Shows the increasing linear relationship between graduation rate and independent variables

All the data was collected in an Excel chart and is displayed in **Appendix A**. A preliminary analysis of the independent variables effects on each dependent variable, as shown in **Figure 2** through **Figure 4**, indicates the relationships between the independent and dependent variables to be linear. This allows us to conduct a multiple linear regression, which requires a linear relationship. The yellow graphs depict the relationship between per student expenditures and the dependent variables. The blue graphs depict the relationship between median household income and the dependent variable.

Graduation Rates

A multiple regression analysis was conducted to test the hypothesis that the per student expenditures and median household incomes would affect the graduation rates of students. The explanatory variables were the per student expenditures and median house incomes measured in US dollars, and the responding variable were the graduation rates measured in percentages. The p-value for per student expenditures was 0.90 and the p-value for household incomes was $9.3*10^{-07}$. The failure to reject the null hypothesis for per student expenditures, due to the p-value being greater than 0.05, indicates per student expenditures does not have a significant impact on graduation rates. Since the p-value for household income of $9.3 * 10^{-7}$ is less than 0.05, the null hypothesis is rejected, and median household income was determined to have a significant effect on graduation rates.

Since per student expenditures had no statistically significant relationship with graduation rates, a linear regression was conducted excluding per student expenditures. The outputs of this regression can be found in **Appendix B**. The fitted regression model was:

$$Graduation\ Rate = 0.77 + 9.6 * 10^{-7} * Medium\ Household\ Income.$$

It was found that household income significantly predicted graduation rates, $\beta = 9.6*10^{-07}$, and the updated p-value was $4.6*10^{-07}$. The percentage of variation as measured by the R^2 in the graduation rates caused by median household income was 17%. A the Breusch-Pagan Test found that the set of data, household income and graduation rates, were heteroskedastic (P = 0.02). The null hypothesis was rejected as the p-value was less than 0.05, meaning the data is heteroskedastic.

Enrollment Into Four-Year Institutions

A multiple regression analysis was conducted to test the hypothesis that the per student expenditures and median household incomes would affect enrollment into four-year institutions. The explanatory variables were the per student expenditures and median household incomes measured in US dollars, and the responding variable was the percentage enrolled into four-year institutions. The p-value for median household income was $3.3*10^{-25}$ and the p-value for per student expenditures was 0.098. The failure to reject the null hypothesis for per student expenditures indicates it has no significant effect on enrollment into four-year institutions.

A linear regression was conducted excluding per student expenditures. The complete output of the regression can be found on **Appendix C**. The fitted regression model for the new regression analysis was:

$$College\ Enrollment\ Rates\ (4\text{-}Year) = 0.026 + 3.2 * 10^{-6} * \ Medium\ Household\ Income.$$

Household income significantly predicted enrollment into four-year intuitions after high school, $\beta = 3.16*10^{-06}$, the new p-value was $1.34*10^{-26}$. The percent variation in the enrollment of four-year post-secondary education explained by median household income was 57%. A the Breusch-Pagan Test found that the set of data, household income and percent enrolled into four-year institutions, was homoscedastic (P = 0.19). The failure to reject the null hypothesis, p-value was greater than 0.05, meant there was not sufficient evidence to prove that the data was heteroskedastic.

Percent Not Enrolled into Post-Secondary Education

A multiple regression analysis was conducted to test the hypothesis that the per student expenditures and median household incomes would affect percent not enrolled in post-secondary education. The explanatory variables were the per student expenditures and median household incomes measured in US dollars, and the responding variable was the percentage not enrolled in post-secondary education.

The p-value for median household income was $9.26*10^{-15}$ and the p-value for per student expenditures was 0.007. Since both p-values were less than 0.05, the null hypothesis for both independent variables were rejected; both median household income and per student expenditures affect percent not enrolled in post-secondary education. The complete output of the multiple linear regression can be found on **Appendix D**. The fitted regression model for the regression analysis was:

$$Percent\ Not\ Enrolled\ into\ Post\text{-}Secondary\ Education = 0.69\ - (2.17 * 10^{-6}\ * \ Medium\ Household\ Income) - (4.38 * 10^{-6} * \ \ Per\ Student\ Expenditures).$$

The percentage of variation in the percent not enrolled in post-secondary education explained by median household income and per-student expenditures was 41%. A the Breusch-Pagan Test found that the set of data, household income, per student expenditures and percent not enrolled in post-secondary education, was homoscedastic (P = 0.75).

Since per student expenditures impacted percent not enrolled in post-secondary education, I tested for multicollinearity. The VIF values for median household income and per student expenditures were both 1.04. Since the VIF was extremely close to 1, the independent variables were slightly correlated, but not enough to be significant.

Discussion

Contrary to my expectations, only median household income was correlated with graduation rates and four-year college enrollment rates, per student expenditures had no significant correlation. Both per student expenditures and median household income affected percent not enrolled in post-secondary education. According to my analysis, a ten thousand dollar increase in median household income correlates to a 0.96 percentage point increase in graduation rates, a 3.16 percentage point increase in four-year college enrollment, and a decrease of 2.17 percentage points in percent not enrolled in post-secondary education. An increase of one thousand dollars in per student expenditures would decrease percent not enrolled in post-secondary education by 0.43 percentage points.

In **Figure 5**, I break down how much influence the wealth factors have on the student outcomes by using the R^2. Overall, wealth factors influence percent enrolled into four-year institutions the most, followed by percent not enrolled into post-secondary education, and lastly graduation rates. I further break down the data to the influence of only median household income in orange, per student expenditures in blue, and the influence of both independent variables in grey. Only per median household income impacts graduation rates and enrollment into four-year colleges and both factors impact percent not enrolled into post-secondary education

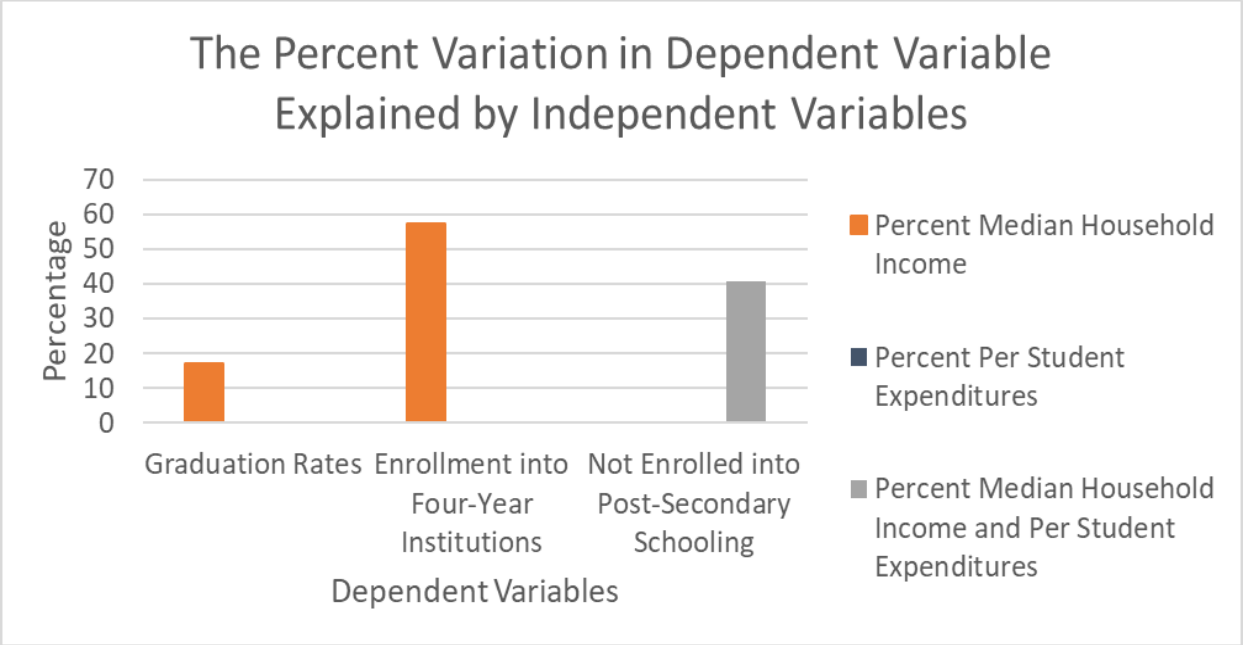

Figure 5: Comparing the R^2 of Each Dependent Variable

The R^2 for graduation rates was only 17%, meaning 17% of variation in the graduation rates was explained by median household income. This suggests that graduation rates are largely influenced by some other factors not accounted by our model. 57% of the variation in enrollment rates was explained by median household income. This implies that enrollment into four-year institutes is strongly correlated with median household income. The R^2 for percent not enrolled in post-secondary education was 41%. This means 41% of variation in the graph can be explained by median household income and per student spendings combines. While per student expenditures and median household income strongly impacts percent not enrolled in post-secondary education, the R^2 suggests that there are other significant factors influencing percent not enrolled in secondary education.

In the **Table 5**, I compiled the p-values in order compare the strength of correlation between median household incomes and per student expenditures on education outcomes. Since only median household income influences

graduation rates and enrollment into four-year education, median household income is more correlated by default. Since the p-value for median household income is lower than the p-value for per student expenditures, median household income is more closely correlated to percent not enrolled in post-secondary education than per student expenditures. This means increasing median household income is more reliable than increasing funding.

Table 5. Comparing the P-values of the Dependent Variables

P-Values		
	Median Household Income	**Per Student Expenditures**
Graduation Rates	$4.62*10^{-07}$	N/A
Enrollment into Four-Year Institutions	$1.34*10^{-26}$	N/A
Not Enrolled into Post-Secondary Schooling	$9.26*10^{-15}$	0.0073

I found median household income affects education outcomes in Washington public high schools. This aligns previous research done on education outcomes in primary and higher education and the socioeconomic status of families (Pfeffer, 2018; Von Hippel, Workman, & Downey, 2018; Bradbury et al., 2015). However, it is more difficult to explain my findings on per student expenditures with past research. Prior research suggested that increasing per student expenditures yields great improvements in college attainment and wages, however I found no correlation between enrollment into four-year colleges and per student expenditures (Hyman, 2017; Jackson et al., 2016). Although, I find a correlation between percent not enrolled in post-secondary education. However, Hyman (2017) found college enrollment increased by 3.0 percentage points when increasing per student expenditures by one thousand dollars, while my research showed only a 0.43 percentage point decrease in percentage enrolled in post-secondary education. Although, if increases in college attainment and wages found by Hyman (2017) and Jackson et al. (2016), were linked to CTE and two-year colleges, it could somewhat explain the difference in results.

Overall, the results from the multiple linear regression suggest that medium household income has a more significant relationship with education outcomes in Washington high schools compared to per student expenditures. Therefore, to overall improve education attainment in terms of these factors, addressing inequalities stemming from inequality in family income would be the most effective. For example, prior research suggest that expectations differ between individuals with different socioeconomic backgrounds, even after accounting for academic ability (Parker et al., 2016). Reforms could be targeted at expanding the expectations of students from SES families. However, more research should be done on how different social welfare programs affect education outcomes. On the other hand, reform efforts focused on increasing per student expenditures would result in little increase in student outcomes.

Limitations

The most blatant limitation in my research was the data between median household and graduation were heteroskedastic. Recall that the Breusch-Pagan found a p-value of 0.02. Since the value was less than 0.05, there was sufficient evidence to suspect heteroscedasticity. Since the multiple linear regression assumes homoscedasticity, the conclusion that median household spending influences graduation rates may be unreliable. It is more likely for our model to declare a statistically significant relationship between graduation rates and per student expenditures, when if fact there may not be (Zach, 2021). To fix heteroskedasticity in the data, I would need to conduct a weighted linear regression or transform the dependent variable (Albers, 2017). This uncertainty only applies to graduation rates, since the other data sets were homoscedastic.

Another possible limitation was the difference in the measurement of independent variables and dependent variables. I took data on per student expenditures, median household incomes and education outcomes from public school districts in Washington, however I primarily measured outcomes pertaining to high schools. It would improve the accuracy of the results if I took my data from public high schools rather than school districts. This way, per student expenditures of primary schools and family incomes of primary school students will be excluded, therefore resulting in more accurate data of high school students. These limitations were discovered late in the research process; therefore, I did not have time to collect a whole new set of data.

Another limitation of my research was that I did not collect data on enrollment into two-year and CTE schools. I assumed that having four-year institutions and percent not enrollment will imply the remainder goes into CTE and two-year schools. It would take longer to collect and conduct analysis on enrollment into CTE and two-year schools. Additionally, I originally did not expect that per student expenditures would have no effect on enrollment into four-year colleges but would affect percent not enrolled. If I had collected data on CTE and two-year schools, I would have been able to gain a better understanding of how per student expenditures affect education outcomes.

Taken the limitations of my research, my conclusion that median household income has a more significant impact on education outcomes than per student expenditures is weakened. Further research should be conducted on comparing median household income and per student expenditures, addressing all the limitations in my research, to affirm my results.

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