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From American Dream to American Reality: The Effect of Educational Expenditures on Intergenerational Mobility and the Great Gatsby Curve

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Abstract

Income inequality and intergenerational mobility are two common measures of economic fairness in society. While they measure distinct ideas, they are significantly related in an inverse way across countries as well as across regions in the United States. This relationship is illustrated on the Great Gatsby Curve. Unequal access to education is one factor that has been found to drive the negative relationship between these two measures and therefore create the negatively sloping Great Gatsby Curve. Therefore, creating more equal access to education, such as through government spending, could lessen the connection between these two factors. The primary purpose of this research is to explore the effect of public educational expenditure on intergenerational mobility as well as on the slope of the Great Gatsby Curve. At the primary/secondary education level, this study finds that places with higher public spending on education tend to have higher levels of intergenerational mobility. However, no significant relationship is found between spending on tertiary education and intergenerational mobility. In addition, while higher primary/secondary educational spending is associated with a flatter Great Gatsby Curve at the school district level, these results were not consistent at the commuting zone level, so no strong conclusions can be made about the effect of public educational expenditures as a mediating factor of the Great Gatsby Curve.

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Introduction

As a nation of immigrants, The United States has always valued upward mobility and the ability for anyone to achieve anything with hard work. This idea is best exemplified through The American Dream which has been defined as "that dream of a land in which life should be better and richer and fuller for everyone, with opportunity for each according to ability or achievement" (Adams, 1931). While the ideas of success and how to achieve success change with generations, two commonly thought ways of achieving this goal have been education and homeownership. I will focus on the former: the effect of public education spending on the likelihood of The American Dream becoming a reality.

While The American Dream is a broadly defined concept, it is heavily related to intergenerational mobility: a measure of the dependence (or independence) of one's socioeconomic status on the socioeconomic status of one's parents. While the desired amount of economic inequality in a society is highly debated, high intergenerational mobility is more agreed upon as desirable. High intergenerational mobility indicates that a society places emphasis on talent and ability rather than the circumstances in which one happens to be born. Thus, higher intergenerational mobility likely indicates a more meritocratic society as value is placed on merit over wealth or connections.

Higher intergenerational mobility is important not only out of the principle of fairness and equal opportunity for all, but it is also economically desirable. It likely indicates that people are employed based on qualifications rather than how well-off their parents were, so people's skillsets are being used more efficiently. Thus, people work where they benefit society the most, increasing overall productivity and efficiency in society.

The primary purpose of this research is to assess the impact of public educational expenditures on intergenerational mobility and the relationship between intergenerational mobility and income inequality. The relationship between intergenerational mobility and income inequality was initially discovered across various countries. Higher income inequality is associated with lower intergenerational mobility (Corak, 2013). This negative correlation is famously illustrated in a scatter plot of intergenerational mobility on the y-axis and income inequality on the x-axis that is known as the Great Gatsby Curve. In addition to being a cross-country relationship, this correlation has also been found to be true within the United States as Figure 1.1 illustrates below.

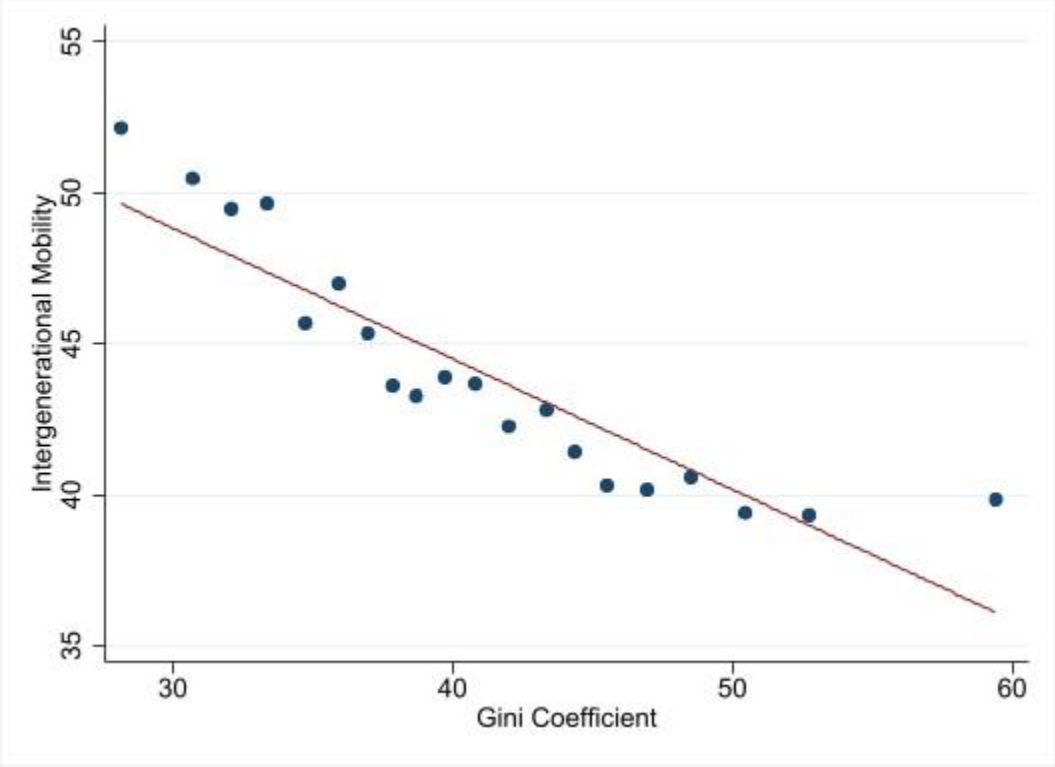


Figure 1.1. The Great Gatsby Curve within the United States. The measure of mobility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile), and the Gini Coefficient is multiplied by 100. A binned scatter plot was used to make the plot more visible. The bins were created from the 692 commuting zones that are used in the following analysis. The data was taken from Chetty et al. (2014).

I examine both the effects of public primary/secondary spending and public higher education funding. Chetty, et al. suggest that there may be a positive correlation between proxies for the quality of K-12 schools and intergenerational mobility indicating that the better the school system, the higher the intergenerational mobility (2014). While similar, this research focuses on spending at the K-12 and higher education levels. The primary research question considers how the amount of public spending on each of these types of education influences intergenerational mobility and more broadly, The American Dream. I use data from different regions to estimate the relative value of a dollar spent at multiple points in the education trajectory on the level of mobility in that region.

While it is helpful to consider the effects of school quality on intergenerational mobility, the more relevant and important question is the effect of public educational expenditures on intergenerational mobility. It is challenging to quantify school quality and to know how to improve it. This study could provide guidance on the importance of spending in schools. As money is scarce and places look to cut funding from schools, these findings could act as a reminder of the importance of funding. In addition, if spending is found to be most important at a certain level (i.e. K-12), then the money can be more properly allocated to the respective levels of school, so the highest level of intergenerational mobility is achieved.

Some of the expected results were confirmed with the data, and others were not. The OLS regression results confirmed that an increase in public K-12 expenditures is associated with an increase in intergenerational mobility across regions of the United States. However, the slope of the Great Gatsby curve did not change while controlling for these expenditures. Thus, this data suggests that public primary/secondary school expenditures are not a mediating factor between the relationship between income inequality and intergenerational mobility. However,

there is a significant interaction between income inequality and K-12 educational expenditures at the school district level. I found that in places with higher income inequality, an increase in school spending has a positive effect on mobility, but in places with low income inequality, the opposite is true: an increase in school spending is associated with lower intergenerational mobility. In addition, at the commuting zone level, these same models produce an interaction term between inequality and K-12 spending of the opposite sign. This finding suggests that smaller school districts may be driving the relationship seen at the school district level, and when the school districts are aggregated, the larger districts overshadow the smaller ones. Finally, higher education spending was not found to be significantly correlated with mobility. These findings suggest missing variables or potential reverse causality.

Section 2: Literature Review

There is ample research on both income inequality and intergenerational mobility and the relationship between the two. While these two ideas both measure levels of fairness in society, they are very different concepts with different surrounding research. Although they are two distinct concepts, they have a unique relationship such that places with higher income inequality often have lower intergenerational mobility. A fundamental question in this field of study is: what drives this inverse relationship between inequality and mobility?

Income Inequality

Over the last few decades, income inequality has increased substantially (Heathcote, Perri, & Violante, 2010). There is considerable research on economic and income inequality, showing both potential causations and potential effects of this recent rise. These effects have been the focus of a lot of research, as there are both advantages and disadvantages to higher inequality. Income inequality has been shown to promote GDP growth and likely works to

motivate hard work and encourage entrepreneurship (Naguib, 2015). In contrast, high inequality has been linked to diminishing marginal utility of income and a rise in social problems or unrest (Peterson, 2017). Overall, economists have not agreed upon a desirable level of inequality. Thus, intergenerational mobility may likely be a better indicator of fairness and efficiency in society than economic or income inequality. There are many different ways to quantify income inequality, but one of the most common measures of income inequality is the Gini coefficient. For ease of reference, I will refer to income inequality, measured by the Gini coefficient, as simply inequality and all other inequality measures by their full name.

Intergenerational Mobility

While income inequality has long been studied, intergenerational mobility is a relatively less researched topic. However, Raj Chetty has contributed an extensive amount of research to this topic. He has written countless papers and has made almost all his data from his findings publicly available. One interesting and important discovery he found is that not all geographic regions in the United States have the same level of mobility. In fact, there is a considerable variation in mobility levels across the country with the lowest relative mobility levels in the Southeast and the highest in the Mountain West and the rural Midwest (Chetty, et al., 2014). This extensive variation in mobility levels allows for further exploration into potential causes of higher or lower intergenerational mobility. Many factors are thought to be correlated with intergenerational mobility, including inequality, education, racial segregation, social capital, and family structures, but most previous literature has looked only at correlations and not attempted to identify any causal relationships (Chetty, et al., 2014).

There are two main measures of intergenerational mobility: relative and absolute. Relative mobility is the slope of the linear relationship between a parent and child's income

ranks or percentiles. In contrast, absolute upward mobility measures the expected rank (or income percentile) of a child whose parents have a rank of 25 (25^{th} income percentile). This measure is helpful because it focuses mainly on upward mobility. In contrast, changes in relative mobility could be caused by either people moving up or down in the income percentiles. These two measures of inequality are often highly correlated with each other (Chetty, et al., 2014). Chetty et al. writes, "areas with high levels of relative mobility (low rank-rank slopes) tend to have better outcomes for children from low-income families" (2014). Thus, for this paper, I will be focusing on absolute upward intergenerational mobility, but the results are likely highly comparable if this same research were to be performed with relative mobility. For ease of reference, I will refer to absolute upward intergenerational mobility as simply mobility and all other measures by their full name.

Income Inequality and Intergenerational Mobility

The Great Gatsby Curve illustrates the relationship between intergenerational mobility and income inequality. Originally, it was used to illustrate this inverse relationship across different countries. Countries with higher intergenerational mobility tend to have lower inequality, and countries with lower intergenerational mobility tend to have higher inequality (Corak, 2013). While the curve itself does not suggest any causal relationship, there are a few theories behind the mechanism causing this. One of the leading theories and most relevant to this research is that education is a strong causal mechanism. In places with higher inequality, those at the top end of the income distribution will likely receive a higher quality education or at least devote more time to their education than those on the lower end of the income distribution (Jerrim & Macmillan, 2015). Sakamoto et al. expands on this idea by writing, "The implication of their results is that the stress induced by poverty lowers the chances for low-income youth to

be competitive in educational attainment thereby increasing their chances of inheriting their low-income status." (2014).

Since education is one of the main ways people can move up the socioeconomic ladder, this unequal access and quality of education could lead to less mobility as the wealthy stay wealthy and the poor stay poor. Jerrim and Macmillan found that countries with high levels of inequality have more private investment in education and less public investment (2015). Thus, in places with greater inequality, having more money plays a larger role in the transmission of advantage and therefore wealth to future generations.

Further studies have confirmed a relationship between education and The Great Gatsby Curve. Brandén explored some potential mechanisms of The Great Gatsby Curve in Sweden. He found that the lead driving factors in the relationship between inequality and mobility are educational attainment and cognitive and non-cognitive skills in Sweden and also found that one's educational attainment accounts for a significant amount of the mobility or immobility a person faces (2019). Along with education being a driving factor of the Great Gatsby Curve, government spending has been found to increase mobility since more government spending increases the likelihood that less well-off children receive more investments both to their education and overall social welfare or human capital (Mayer & Lopoo 2008).

While education is thought to be a driving factor in the relationship illustrated in the Great Gatsby Curve, previous research on public educational expenditures has found mixed effects. Boudreaux found that government spending on education was not significant in his research on institutional measures' effects on mobility while controlling for inequality (2014). In this study, educational expenditures were taken from the World Bank and measured as a percent of GDP. There are two potential reasons that my results could vary from the ones found in this

study. First, educational spending is measured as a percent of GDP rather than spending per student. Second, this was a cross-country study whereas this research focuses on different regions in the United States. However, other studies have found that there is a strong positive correlation between mobility and educational expenditures across countries, but this study failed to control for inequality (Blanden, 2013).

While education seems to play some role in the Great Gatsby Curve, its effect in the United States as well as the type of educational spending that best works to raise mobility is less researched. Chetty et al. finds that the quality of primary/secondary education is one of the strongest factors correlated with mobility (2014), while Jeon and Lee find that public tertiary, or higher education spending (directed at individuals) has a stronger effect on mobility than K-12 spending on education (2018).

Thus, there is ample research that education is extremely important to the relationship between mobility and inequality. In addition, there is evidence that both public K-12 educational spending and public higher educational spending directed at individuals could influence this relationship. Therefore, this paper will work to address the gaps in previous literature while also trying to confirm previous findings.

Data

Data from a few sources were used to study how public educational expenditure affects the relationship between income inequality and intergenerational mobility. For the data on intergenerational mobility, income inequality, and other various control variables, I used data from Chetty et al.'s "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States" (2014). This data set focused on intergenerational mobility by commuting zone for children born between 1980-1982. Commuting zones are geographical areas

or groups of counties that cover the entire United States. There are about 740 commuting zones in the United States, and these commuting zones include both rural and metropolitan areas. To calculate mobility, total family incomes were measured in 2011 or 2012 when the children were approximately 30 years old. Their parents' incomes were measured between 1996 and 2000 when their children were between 15 and 20 years old. This data set also includes many other variables measured at the commuting zone level such as the Gini coefficient, Census population from 2000, household income per capita, the level of racial segregation, the fraction of adults married, a social capital index, and more.

In addition to this data, I collected information on average spending per student in each commuting zone. This data was taken from the Annual Survey of School System Finances which is performed yearly by the US Census Bureau starting in 1992. I collected one survey result dataset from 1992 and another from 1998 (when the children in Chetty's study were approximately 10-12 and 16-18 respectively). This data provides information about each school district's finances including the amount of total revenue as well as revenue broken down by federal, state, and local contributions. In addition, there is data on the level of expenditures in each school district. I also used the CPI to adjust the 1992 and 1998 data to 2015 dollars for consistency, since that is the year in which all Chetty's dollars are reported.

Out of the roughly 15,000-15,500 school districts, about 800 school districts were missing data on the number of enrolled students. Originally, I speculated that they were missing randomly, so I assigned them enrollments of the mean school district size in the state. However, I soon noticed that there were a significant number of outliers that had low spending per student yet very high mobility. This led me to believe that the enrollment data was not missing at random

and was instead mostly missing from small districts with low spending. Thus, I chose to remove these observations completely from the dataset.

To perform a regression with intergenerational mobility, the Gini coefficient, and levels of school spending, the school district level spending data would have to be combined with the commuting zone level Chetty et al. data. To do this, I used the FIPS code of each of the roughly 15,000 school districts to create county identifiers. Then, I used these county FIPS codes to match the counties to a commuting zone using a spreadsheet from Chetty et al. that had both of these pieces of information. For the regressions run at the school district level, I merged the Chetty data with the school district level Census data on the commuting zone identification number. I also calculated spending per student as public educational expenditures divided by the number of students enrolled in the district. I replaced the bottom 1% and top 99% of these values with the bottom 1% value and top 99% value, respectively to reduce the effect of extreme outliers. While sometimes outliers can provide valuable information, in this case, many were examples where spending was increased or decreased for a brief period for a temporary reason, like the construction of a new school. An additional very small number of observations were dropped that were missing other important variables like mobility data.

The summary statistics tables at the school district level (Tables 1.1 and 1.2) can be found below. The main variables that I will be focusing on appear along with the number of observations in the dataset, the mean, the standard deviation, and the extrema. One of the key observations from these tables is that average K-12 public school spending per enrolled student was $9,929.80 in 1992 and $11,140 in 1998 (adjusted to 2015 dollars). In addition, these tables also illustrate that the average school district in both years was running a budget deficit by spending more money than they were receiving through public funds. This deficit was likely

compensated for by issuing bonds or other forms of borrowing. Also, the Gini coefficient, which usually ranges from zero to one, is multiplied by 100 for ease of interpretation.

Table 1.1: 1992 School District Level Summary Statistics

	Observations	Mean	Std. dev.	Min	Max
Intergenerational Mobility	14,785	43.7325	4.6669	26.6718	64.0193
Gini	14,785	42.2370	7.6021	25.1470	84.7330
Racial Segregation	14,785	0.1838	0.1181	0.0000	0.5537
Social Capital Index	14,785	0.1781	1.0382	-3.1990	5.2660
Fraction of Adults Married	14,785	0.5625	0.0385	0.3729	0.6947
Household Income per Capita	14,785	36.1710	6.8057	17.3786	58.6284
Log Population 2000	14,785	12.8652	1.7549	8.5421	16.6124
Enrollment	14,785	2787.85	12371.25	1.00	962269.00
Total Revenue	14,785	21437.79	38222.30	54.08	248654.80
Total Federal Revenue	14,785	1217.86	2636.51	0.00	18889.13
Total State Revenue	14,785	9738.50	19340.51	0.00	130763.80
Total Local Revenue	14,785	10358.78	19257.43	28.73	120706.60
Total Expenditures	14,785	21708.32	38760.45	54.08	247693.20
Budget Surplus	14,785	-270.53	3382.44	-60302.58	51200.23
Expenditure per Enrollment	14,785	9.9298	4.0707	3.2264	27.1695

Notes. The table reports summary statistics for school districts from 1992 in the United States. The data here was combined from the Annual Survey of School Sytstem Finances (Census) and from Raj Chetty's data from "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States." All money amounts are in thousands of 2015 adjusted dollars.

Table 1.2: 1998 School District Level Summary Statistics

	Observations	Mean	Std. dev.	Min	Max
Intergenerational Mobility	14,148	43.5944	4.5365	26.6718	64.0193
Gini	14,148	42.4789	7.5594	25.1470	84.7330
Racial Segregation	14,148	0.1856	0.1182	0.0000	0.5537
Social Capital Index	14,148	0.1388	1.0239	-3.1990	5.2660
Fraction of Adults Married	14,148	0.5619	0.0383	0.3729	0.6947
Household Income per Capita	14,148	36.2552	6.8876	17.3786	58.6284
Log Population 2000	14,148	12.9135	1.749697	8.542081	16.61239
Enrollment	14,148	3176.47	13949.93	1.00	1071853.00
Total Revenue	14,148	27606.29	48573.49	60.90	317739.90
Total Federal Revenue	14,148	1587.72	3420.25	0.00	23565.40
Total State Revenue	14,148	13366.23	25086.57	2.90	165217.30
Total Local Revenue	14,148	12394.49	22443.76	21.75	138190.80
Total Expenditures	14,148	27974.76	49092.13	53.65	319609.00
Budget Surplus	14,148	-368.47	4581.51	-86074.91	45167.50
Expenditure per Enrollment	14,148	11.1400	4.3286	3.4800	32.3730

Notes. The table reports summary statistics for school districts from 1998 in the United States. The data here was combined from the Annual Survey of School Sytstem Finances (Census) and from Raj Chetty's data from "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States." All money amounts are in thousands of 2015 adjusted dollars.

To view the same data but at the commuting zone level instead of the school district level, I collapsed all the school spending variables by commuting zone and merged the data with the original Chetty data by commuting zone number. Aggregating the data greatly reduced the number of observations (from around 14,500 to around 690). In collapsing this data, the spending and enrollment values were summed to obtain the total spending in each commuting zone. The expenditures per enrolled student were recalculated at the commuting zone level to place more weight on larger school districts and less on smaller school districts. If the expenditures per student had just been averaged in the collapsing process, all the school districts would have been weighted the same, regardless of size.

Once the data was collapsed at the commuting zone level, there were roughly 50 commuting zones that were missing data on expenditures per student. These commuting zones were missing important spending variables due to the approximately 800 observations that were dropped due to missing enrollment data. Almost all of these commuting zones that were missing data were among the smallest commuting zones. The median population of the zones that were missing data was 4,354 while the overall median commuting zone population was 103,842. Thus, the observations missing the expenditure per student data were dropped, but it should be noted that these results may not be applicable to the districts or commuting zones with very small populations.

In addition, data was obtained from the State Higher Education Finance Report compiled by the State Higher Education Executive Officers Association on higher education expenditures. Unlike public K-12 spending which can easily be broken down into spending by school district, it is very difficult to divide higher education funding in a similar way. Many states only have a few universities. In addition, it is extremely common for people to move to different parts of the

Table 1.3: 1998 Commuting Zone Level Summary Statistics

	Observations	Mean	Std. dev.	Min	Max
Intergenerational Mobility	692	44.0268	5.6645	26.6718	64.0193
Gini	692	41.0976	7.9177	25.1470	84.7330
Racial Segregation	692	0.1351498	0.0994369	0	0.5537449
Social Capital Index	692	0.1087768	1.23348	-3.198993	5.266008
Fraction of Adults Married	692	0.5739602	0.0447694	0.3729193	0.6947249
Houshold Income per Capita	692	32.768	5.64228	17.3786	58.62839
Log Population 2000	692	11.71195	1.469955	8.542081	16.61239
Enrollment 92	692	58689.26	148997	1064	2462907
Enrollment 98	692	63949	167610	1011	2817426
Total Revenue 92	692	454091.6	1126086	8265.79	14300000
Total Revenue 98	692	559392.1	1370585	9024.8	19100000
Total Federal Revenue 92	692	25809.79	48383.03	373.49	820630.2
Total Federal Revenue 98	692	32216.24	67101.63	207.35	1259021
Total State Revenue 92	692	206683.2	489889	380.25	8906014
Total State Revenue 98	692	271486.1	638077.9	2146	11300000
Total Local Revenue 92	692	219196.4	648129.7	1813.37	7287324
Total Local Revenue 98	692	250955.2	726653.9	1851.65	8118566
Total Expenditures 92	692	459887.8	1139590	8504.08	14800000
Total Expenditures 98	692	566907.5	1380743	7455.9	18700000
Budget Surplus 92	692	-5796.165	43405.5	-626570.9	318385.8
Budget Surplus 98	692	-7515.411	42721.14	-365916.3	373437.1
Expenditure per Enrollment 92	692	8.138551	1.84716	1.847692	17.24053
Expenditure per Enrollment 98	692	9.413148	1.849023	1.850631	16.58961
Total State and Local Higher Education F	692	2464033	2679007	89481.44	14200000
Total State Financial Aid Funding 01	692	145167	184112.6	119.394	791843.5
FTE Enrollment Higher Education 01	692	236.3835	248.2857	15.914	1322.308
State Financial Aid per FTE 01	692	0.5701394	0.4532143	0.0054113	1.616199
Higher Education Funding per FTE 01	692	10.03473	1.656375	5.439674	18.89132

Notes. The table reports summary statistics for commuting zones in the United States. The data here was combined from the Annual Survey of School Sytstem Finances (Census), Raj Chetty's data from "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States", and the State Higher Education Finance Report (State Higher Education Executive Officers Association). All money amounts are in thousands of 2015 adjusted dollars.

state for higher education, so commuting zone level data would not be helpful for tracking intergenerational mobility. Thus, all the higher education data is state and local funding at the state level. While a state-level measurement still isn't completely unbiased as people may move out of the state for higher education, it is the broadest possible breakdown while still including some variation.

The two variables of most interest were total state and local spending on public higher education and total state financial aid. These values were taken and divided by the full-time

equivalent (FTE) students enrolled in that state to give values of spending per student and financial aid per student. In this dataset, the value of a FTE student is calculated by the number of total enrolled credit hours divided by the number of credit hours taken by a full-time student. Summer credits and vocational/technical programs are included in this calculation, but it does not include most non-credit or non-degree programs. Once again, the dollar amounts were adjusted to 2015 dollars. Instead of collapsing the mobility and inequality data to the state level, the higher education data was expanded to the commuting zone level for consistency with the K-12 spending data. The summary statistics at the commuting zone level are given in Table 1.3. As seen in this table, the mean spending per student for 1992 K-12, 1998 K-12, and 2001 higher education are approximately $8,138, $9,413, and $10,034. The mean financial aid per student is approximately $570.

Econometric Methodology

The primary econometric technique employed in this research is a multiple linear regression model that regresses a measure of absolute intergenerational mobility on educational spending per student and various other controls mentioned above. First, I regress intergenerational mobility (M) on the income inequality, or specifically the Gini coefficient (G), along with control variables (X_n). These control variables include other factors that have been found to be correlated with intergenerational mobility, such as population, household income per capita, racial segregation, social capital index, and the fraction of adults that are married.

$$M = \alpha_0 + \alpha_1 G + \sum_n \gamma_n X_n + \varepsilon \quad (1)$$

In equation (1), according to previous research and economic theory, I expect α_1 to be less than zero as this would illustrate the inverse relationship between intergenerational mobility and income inequality. This is the slope of the Great Gatsby Curve.

Then, I add educational expenditure (E) as another independent variable and estimate the regression again. This model is run with 1992 primary/secondary educational expenditures, 1998 primary/secondary educational expenditures, and 2001 higher educational expenditures as E.

$$M = \beta_0 + \beta_1 G + \beta_2 E + \sum_n \gamma_n X_n + \varepsilon \quad (2)$$

In equation (2), according to previous research and economic theory, I expect β_2 to be greater than zero for each type of educational expenditure. This finding would illustrate that an increase in educational expenditures would be associated with higher intergenerational mobility. Comparing the two higher education expenditure measures, I would expect the coefficient for financial aid to be larger than the coefficient for state and local support for higher education as previous literature has found that individually directed higher educational funding is more strongly correlated with mobility. This also would make sense intuitively as financial aid should directly and disproportionately help low-income people obtain a higher education and therefore move up in society. In addition, I would expect $\alpha_1 < \beta_1$ as this would illustrate the slope of the Great Gatsby Curve flattening when controlling for educational expenditures compared to not controlling for educational expenditures.

In addition, I add an interaction term to the model. Districts or commuting zones with different levels of inequality may have different responses to a change in educational spending.

$$M = \delta_0 + \delta_1 G + \delta_2 E + \delta_3 G * E + \sum_n \gamma_n X_n + \varepsilon \quad (3)$$

In equation (3), I would expect δ_3 to be positive. This result would support the idea that places with high levels of inequality experience a larger increase in intergenerational mobility compared to places with low levels of inequality when educational expenditures increase. In places with high levels of inequality, the variation in incomes is higher, so many people may be unable to provide their children with the support they need for a quality education. Thus, higher educational expenditures would increase resources for everyone and thus help those children that may not have originally had the support they need to succeed.

These models are run at the school district and commuting zone level. I expect results for each to be similar once the standard errors are clustered at the proper level.

Results

In the following section, I first address all regressions and results at the school district (only K-12 spending). Then, I move to the regressions and results at the commuting zone level (K-12 spending as well as higher education).

School District Level

Table 2.1 illustrates regressions run at the school district level for districts surveyed in 1992. Absolute intergenerational mobility was regressed on the Gini coefficient, 1992 K-12 spending, and other controls. The standard errors were clustered at the commuting zone level as many of the variables were measured at the commuting zone. In column 1, the value of -0.322 illustrates the slope of the Great Gatsby Curve. As hypothesized, the relationship between income inequality and intergenerational mobility is negative. Column 2 suggests that there is a significant relationship between educational spending from when the children sampled are

between ten to twelve years old and intergenerational mobility, controlling for inequality. At a constant level of inequality, an increase in $1000 per student in school spending is associated with an increase of 0.186 in intergenerational mobility. While this is a relatively small amount (mobility values range from around 26 to 64), it is statistically significant at the one percent level. Column 3 suggests that there may be an interaction between K-12 spending and inequality levels. There exists some relationship such that if the baseline level of inequality is high, an increase in school spending is correlated with a greater increase in intergenerational mobility than in places where the baseline level of inequality is low (which are correlated with a smaller increase in mobility with the same increase in school spending). Another result that can be concluded from this interaction is that an inverse relationship between income inequality and intergenerational mobility is stronger in places with lower school spending and weaker in places with more school spending.

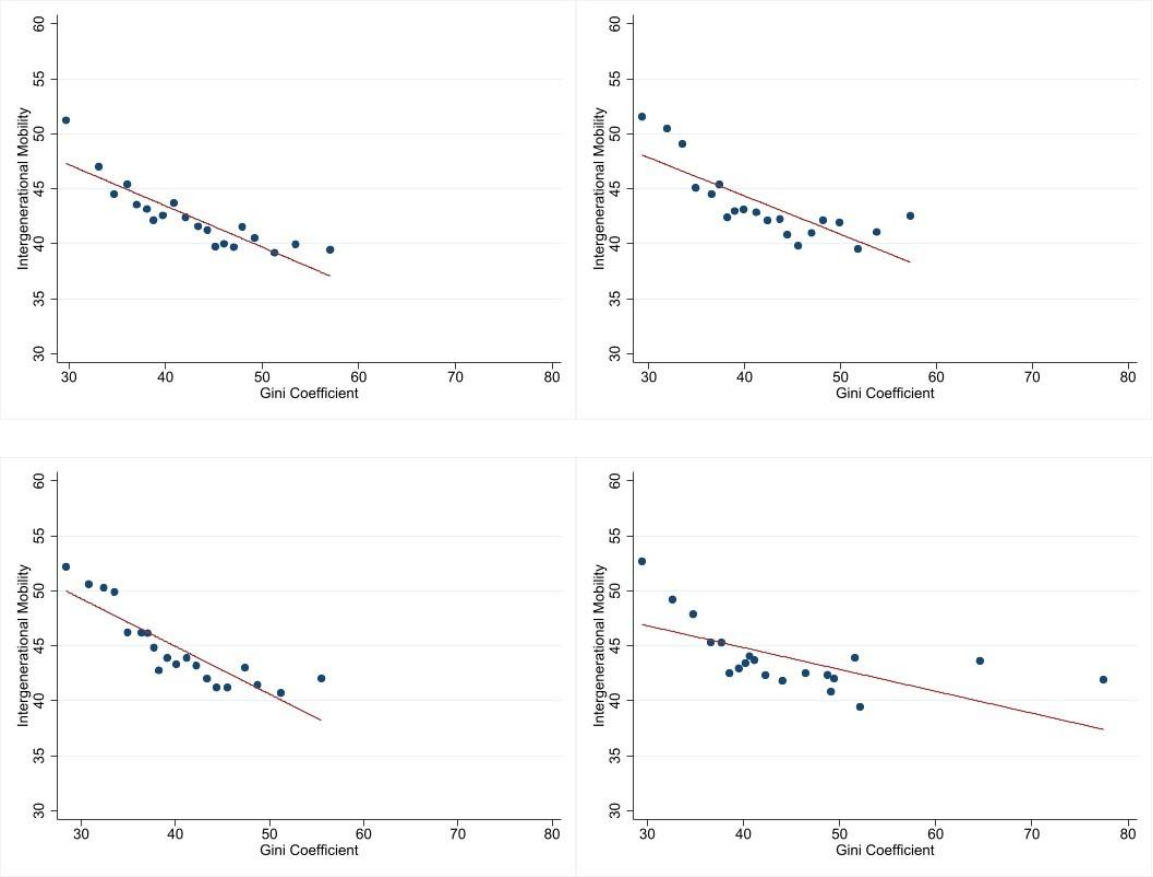
To make more sense of the interaction term results, a case study of two school districts will be examined: one with a Gini coefficient of around 37 (the 25^{th} percentile of all districts) and one with a Gini coefficient of around 47.7 (the 75^{th} percentile of all districts). Consider Gary Community School Corporation that serves most of Gary, Indiana (Gary CZ) with a Gini coefficient of about 37. At this level of inequality, the marginal effect of an additional thousand dollars of school spending per student on mobility is an increase of 0.0163*(37) - 0.548 = 0.0551. Now, consider Medford Public Schools in Medford, Massachusetts (Boston CZ) with a Gini coefficient of about 47.7. At this level of inequality, the marginal effect of an additional thousand dollars of school spending per student on mobility is an increase of 0.0163*(47.7) - 0.548 = 0.2295. While this number is still relatively small, it is over four times the amount that

mobility would increase in a school district at the 25th percentile for inequality, like Gary, Indiana.

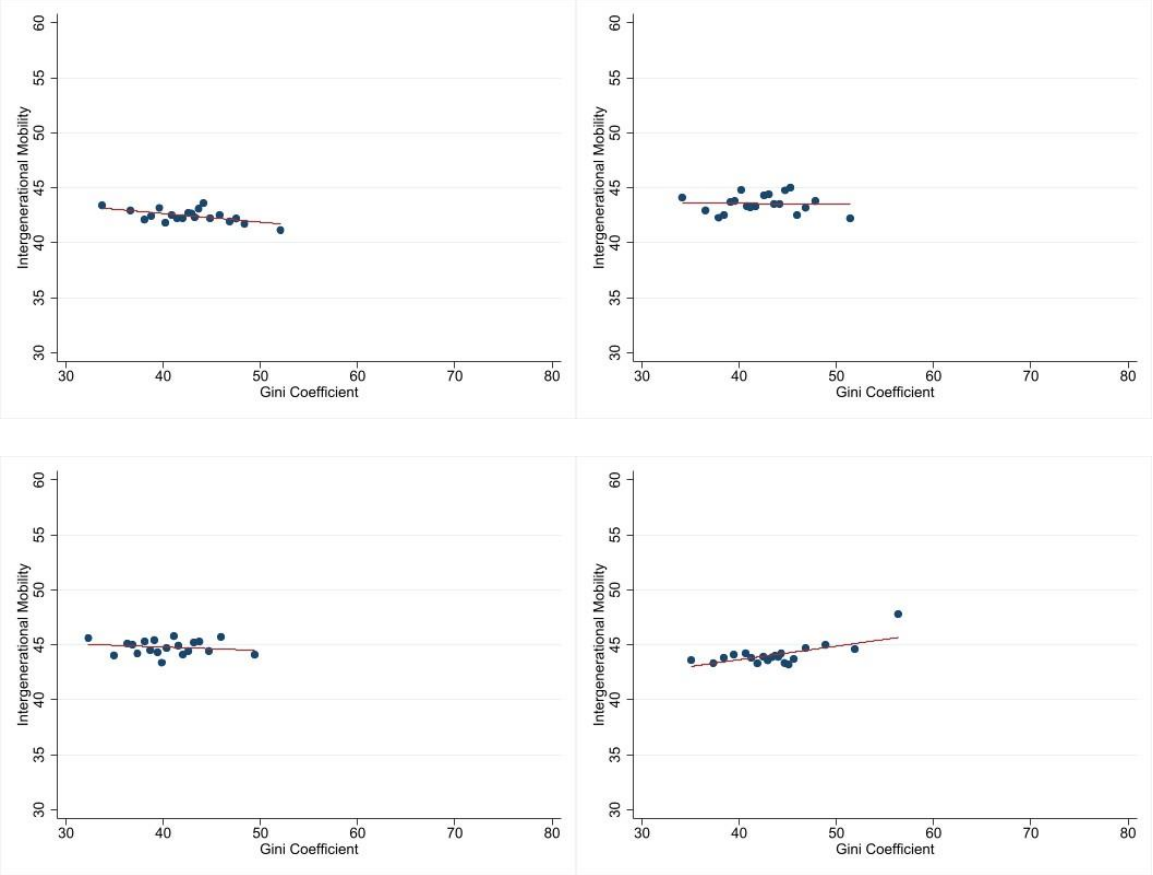
Figures 2.1-2.4 also help illustrate this relationship. Each figure shows the relationship between mobility and inequality at each quartile of 1992 K-12 school expenditures. The first and most notable trend in the graphs is that there is a strong negative slope in each graph. This is the Great Gatsby Curve broken down by school spending. Regardless of school spending, mobility and inequality have a strong negative relationship. However, as school expenditures increase (going from Figure 2.1 to 2.4), the slopes of each curve slightly change. The slopes change slightly between the first, second, and third quartile but appear to be relatively similar. However, when school spending is at its highest, the slope of the graph becomes flatter, indicating that an increase in inequality is correlated with a smaller decline in mobility compared to places with lower school spending. This slope change in the fourth quartile appears to be caused by a greater number of school districts with high inequality yet average mobility. These two data points (which represent two bins of inequality) to the right of the rest of the points indicate that places with high inequality are more concentrated in areas with higher educational spending. Thus, these figures raise the question of whether this interaction term can be broadly applied to places of all levels of inequality, or if this result is caused by these extreme outliers.

Figures 3.1-3.4 represent the same four scenarios as Figures 2.1-2.4, except controls have been added (as in column 4-6). Once other factors are controlled for, the Great Gatsby Curve has less variation to it and becomes much flatter. At the first (lowest) quartile of educational spending, the Great Gatsby curve is negatively sloped, consistent with the relationship without any controls. However, as spending increases in the second and third quartiles, the relationship between inequality and mobility becomes almost constant. Due to controlling for other variables

like racial segregation, social capital, and more, an increase in inequality has little to no correlation with a decline in mobility. At the highest quartile of spending, an increase in inequality is associated with an increase in mobility. These figures suggest that the controlling factors, along with public educational expenditures, play a large role in mediating the relationship between inequality and mobility.



Figures 2.1-2.4 in order of top left, top right, bottom left, bottom right. A binned scatter plot was used to make the plot more visible. The bins were created from the 14,785 school districts. In order from Figure 2.1 to 2.4, the levels of expenditure per student (1992 K-12) are broken down by quartile, with Figure 2.1 being the lowest quartile. The expenditure per student cutoffs are 7.197, 8.749, and 11.369.



Figures 3.1-3.4 in order of top left, top right, bottom left, bottom right. A binned scatter plot was used to make the plot more visible. The bins were created from the 14,785 school districts. In order from Figure 3.1 to 3.4, the levels of expenditure per student (1992 K-12) are broken down by quartile, with Figure 3.1 being the lowest quartile. The expenditure per student cutoffs are 7.197, 8.749, and 11.369. The following variables are controlled for in each of these figures: 1992 K-12 expenditure per student, Log 2000 population, Household Income per Capita, Social Capital Index, Fraction of Adults Married, and Racial Segregation

Columns 4-6 illustrate very similar relationships to columns 1-3 with the addition of control variables. Chetty found that segregation, social capital, and parents' relationships all have an impact on intergenerational mobility in the region. I also controlled for population and household income. Thus, even while controlling for all these factors that influence mobility, 1992 K-12 educational spending and the interaction between this spending and the Gini coefficient was still significant.

Table 2.1: 1992 K-12 Educational Expenditures per Student (School District Level)

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the school district level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

Dependent Variable:	*Absolute Intergenerational Mobility*					
	(1)	(2)	(3)	(4)	(5)	(6)
Gini Coefficient (x100)	-0.322***	-0.335***	-0.516***	0.00577	0.00134	-0.151***
	(0.0553)	(0.0453)	(0.0621)	(0.0624)	(0.0518)	(0.0560)
1992 K-12 Spending per Student		0.186***	-0.548***		0.178***	-0.409**
		(0.0516)	(0.201)		(0.0427)	(0.171)
Gini Coefficient x 1992 K-12 Spending per Student			0.0163***			0.0132***
			(0.00478)			(0.00409)
Log Census Population 2000				-0.517*	-0.410	-0.397
				(0.286)	(0.282)	(0.295)
Household Income per Capita				0.118**	0.0706	0.0646
				(0.0573)	(0.0575)	(0.0585)
Racial Segregation				-6.635***	-6.879***	-7.174***
				(1.830)	(1.790)	(1.773)
Social Capital Index				1.653***	1.646***	1.573***
				(0.268)	(0.245)	(0.224)
Fraction Adults Married				34.56***	37.28***	36.96***
				(4.921)	(4.803)	(4.874)
Constant	57.35***	56.01***	64.05***	27.35***	24.62***	31.61***
	(2.247)	(2.191)	(2.605)	(4.465)	(4.466)	(5.293)
Observations	14,785	14,785	14,785	14,785	14,785	14,785
R-squared	0.276	0.302	0.321	0.512	0.533	0.545

Robust standard errors clustered by commuting zone in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.2 illustrates very similar results to Table 2.1, except K-12 educational spending was taken from 1998 instead of 1992. Thus, this measures the effect of public primary/secondary educational spending when the children are 16-18 years old rather than 10-12 years old. The other variables have slightly different values as the number of school districts surveyed in each is slightly different. While it appears that the educational spending from 1998 doesn't have as strong of an impact on intergenerational mobility as educational spending from 1992, the standard errors illustrate that the difference is likely statistically insignificant. Since there is no significant difference between Table 2.1 and Table 2.2, these results suggest that there is not major difference in when the spending is most important in a child's K-12 schooling. The two years of spending are also likely highly correlated with each other, so any difference would be hard to differentiate from this data.

Table 2.2: 1998 K-12 Educational Expenditures per Student (School District Level)

This table shows OLS regressions of intergenerational mobility on inequality and 1998 K-12 public educational expenditures at the school district level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

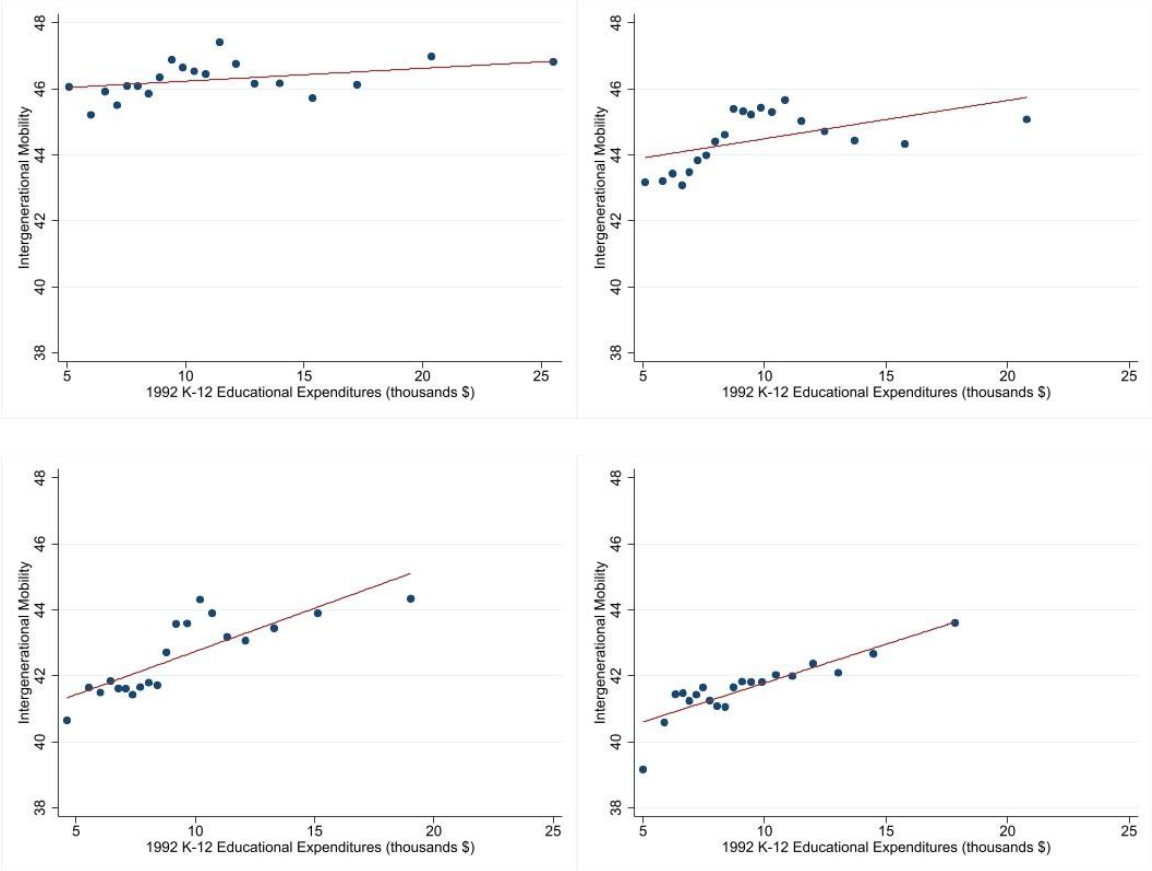
Dependent Variable:	*Absolute Intergenerational Mobility*					
	(1)	(2)	(3)	(4)	(5)	(6)
Gini Coefficient (x100)	-0.307***	-0.316***	-0.513***	0.00358	0.00126	-0.157***
	(0.0533)	(0.0468)	(0.0638)	(0.0603)	(0.0537)	(0.0589)
1998 K-12 Spending per Student		0.138***	-0.586***		0.133***	-0.422**
		(0.0412)	(0.192)		(0.0328)	(0.174)
Gini Coefficient x 1998 K-12 Spending per Student			0.0163***			0.0126***
			(0.00463)			(0.00423)
Log Census Population 2000				-0.447	-0.374	-0.358
				(0.287)	(0.284)	(0.294)
Household Income per Capita				0.111*	0.0794	0.0731
				(0.0568)	(0.0555)	(0.0558)
Racial Segregation				-7.015***	-7.113***	-7.387***
				(1.857)	(1.839)	(1.812)
Social Capital Index				1.595***	1.602***	1.532***
				(0.263)	(0.249)	(0.227)
Fraction Adults Married				33.68***	35.68***	35.33***
				(4.809)	(4.673)	(4.697)
Constant	56.64***	55.47***	64.17***	27.36***	25.07***	32.28***
	(2.171)	(2.210)	(2.627)	(4.440)	(4.433)	(5.458)
Observations	14,148	14,148	14,148	14,148	14,148	14,148
R-squared	0.262	0.279	0.299	0.493	0.507	0.519

Robust standard errors clustered by commuting zone in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Commuting Zone Level

These regression results were re-estimated at the commuting zone level. Total school district spending was aggregated (summed) to the county level which was then aggregated (summed) to the commuting zone level. Then, the total expenditures were divided by the number of enrolled students in the commuting zone to calculate the weighted average (by enrollment) spending per student in each commuting zone. Thus, larger school districts have a higher impact on the spending per student in the commuting zones than smaller districts. In the commuting zones, the results are similar to the results at the school district level; however, there are some key differences. In column 2 of Table 3.1 and 3.2, the coefficient for school expenditures is larger in both years compared to the school district level. This indicates that an increase in school expenditures across commuting zones is associated with higher mobility compared to an increase in school expenditures across school districts. This effect is likely due to the greater emphasis placed on large school districts in the aggregating process.

Consider Figures 4.1-4.4. These figures illustrate the relationship between mobility and 1992 K-12 school expenditures at four different quartiles of enrollments. As enrollment in school districts increase, the slope becomes steeper on average. This slope increase indicates that school districts with higher enrollments have a stronger positive relationship between school expenditures and mobility compared to smaller school districts. Thus, when districts are aggregated to the commuting zone level and large districts are weighted more than small districts, the coefficient of educational expenditures increases (which can be seen comparing column 2 in Table 2.1 to Table 3.1).



Figures 4.1-4.4 in order of top left, top right, bottom left, bottom right. A binned scatter plot was used to make the plot more visible. The bins were created from the 14,785 school districts. In order from Figure 4.1 to 4.4, the cutoff levels of enrollments 350, 940, and 2450. Inequality is controlled for.

Column 3 indicates another difference between the school district and commuting zone level. The educational expenditure coefficient and interaction term coefficient are no longer significant at the commuting zone level. Referring to Figures 2.1-2.4, this interaction term was thought to have mostly existed due to the presence of the few districts with high inequality but medium mobility levels in districts with high school spending. Now that the districts have been aggregated, these districts with high spending could have been combined with districts with low spending, cancelling out this effect. Columns 4-5 exhibit similar relationships to columns 4-5 in Table 2.1. As the control variables are added, the slope of the Great Gatsby Curve flattens out.

The surprising result is the interaction term in column 6. While controlling for other factors, there exists some relationship such that if the baseline level of inequality is high, an increase in school spending is correlated with a smaller increase in intergenerational mobility than in places where the baseline level of inequality is low (which are correlated with a larger increase in mobility with the same increase in school spending). This interaction term has the opposite sign from what was found at the school district level. This difference is likely due to the way in which the school districts are combined to aggregate to the commuting zone level. The large districts contribute more to the amount of school spending per student, and any outliers at the school district level are combined with other districts, so they blend into the data.

To further explore this sign change with the addition of control variables, regressions were run adding one control variable each time in an attempt to isolate the control variable(s) causing this effect. These results can be found in the Appendix Table 7.1. Each time a control was added, the coefficient on the interaction term was found to become slightly more negative, suggesting that it is the combination of all of these controls that lead to the negative significant

control seen when all of the controls are used. Thus, there is not a clear singular variable responsible for this sign change.

Table 3.1: 1992 K-12 Educational Expenditures per Student (Commuting Zone Level)

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the commuting zone level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

Dependent Variable:	*Absolute Intergenerational Mobility*					
	(1)	(2)	(3)	(4)	(5)	(6)
Gini Coefficient (x100)	-0.433***	-0.400***	-0.434***	-0.123***	-0.111***	0.0844
	(0.0324)	(0.0343)	(0.114)	(0.0292)	(0.0309)	(0.0899)
1992 K-12 Spending per Student		0.420***	0.243		0.198**	1.184***
		(0.113)	(0.597)		(0.0958)	(0.438)
Gini Coefficient x 1992 K-12 Spending per Student			0.00415			-0.0233**
			(0.0144)			(0.0102)
Log Census Population 2000				-0.430***	-0.347**	-0.363**
				(0.165)	(0.164)	(0.159)
Household Income per Capita				-0.00734	-0.0324	-0.0290
				(0.0400)	(0.0408)	(0.0397)
Racial Segregation				-4.542***	-4.688***	-5.088***
				(1.502)	(1.522)	(1.530)
Social Capital Index				1.851***	1.825***	1.843***
				(0.192)	(0.189)	(0.187)
Fraction Adults Married				36.78***	38.31***	39.02***
				(4.620)	(4.619)	(4.689)
Constant	61.81***	57.03***	58.50***	33.68***	30.56***	21.89***
	(1.336)	(2.052)	(4.952)	(3.681)	(3.800)	(5.484)
Observations	692	692	692	692	692	692
R-squared	0.366	0.382	0.383	0.608	0.611	0.616

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.2: 1998 K-12 Educational Expenditures per Student (Commuting Zone Level)

This table shows OLS regressions of intergenerational mobility on inequality and 1998 K-12 public educational expenditures at the commuting zone level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

Dependent Variable:	*Absolute Intergenerational Mobility*					
	(1)	(2)	(3)	(4)	(5)	(6)
Gini Coefficient (x100)	-0.433***	-0.414***	-0.619***	-0.123***	-0.122***	0.0517
	(0.0324)	(0.0347)	(0.131)	(0.0292)	(0.0300)	(0.104)
1998 K-12 Spending per Student		0.284**	-0.656		0.0351	0.787*
		(0.111)	(0.573)		(0.0893)	(0.430)
Gini Coefficient x 1998 K-12 Spending per Student			0.0214			-0.0173*
			(0.0138)			(0.00992)
Log Census Population 2000				-0.430***	-0.418**	-0.454***
				(0.165)	(0.164)	(0.160)
Household Income per Capita				-0.00734	-0.0105	-0.00814
				(0.0400)	(0.0399)	(0.0392)
Racial Segregation				-4.542***	-4.542***	-4.823***
				(1.502)	(1.505)	(1.518)
Social Capital Index				1.851***	1.846***	1.876***
				(0.192)	(0.193)	(0.192)
Fraction Adults Married				36.78***	36.96***	37.85***
				(4.620)	(4.620)	(4.677)
Constant	61.81***	58.39***	67.43***	33.68***	33.15***	25.44***
	(1.336)	(2.219)	(5.629)	(3.681)	(3.882)	(6.010)
Observations	692	692	692	692	692	692
R-squared	0.366	0.374	0.379	0.608	0.608	0.611

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In addition to K-12 spending, regressions on higher education spending were also run at the commuting zone level. The results are illustrated in Tables 4.1 and 4.2. For these regressions, any model with a higher education funding term has standard errors clustered at the state level as higher education data was only available at the state level. Table 4.1 shows the results of the relationship between intergenerational mobility and total state and local funding toward higher education, while Table 4.2 shows the results of the relationship between intergenerational mobility and state financial aid for higher education. In column 2 of Table 4.1, state and local funding for higher education is not significantly correlated with intergenerational mobility. In Table 4.1, no educational expenditure coefficients are significantly different than zero.

Table 4.1: 2001 State and Local Higher Educational Funding per FTE (Commuting Zone Level)

This table shows OLS regressions of intergenerational mobility on inequality and 2001 public higher educational funding at the commuting zone level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

Dependent Variable	Absolute Intergenerational Mobility						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gini Coefficient (x100)	-0.433***	-0.424***	-0.543	-0.123**	-0.120**	-0.278	-0.274
	(0.0324)	(0.0629)	(0.373)	(0.0473)	(0.0467)	(0.272)	(0.282)
State and Local Funding Higher Education per FTE 2001		-0.275	-0.752		-0.236	-0.875	-0.927
		(0.272)	(1.556)		(0.195)	(1.099)	(1.122)
Gini Coefficient x Higher Education Funding per FTE 2001			0.0115			0.0154	0.0163
			(0.0352)			(0.0252)	(0.0258)
1992 K-12 Spending per Student							0.220
							(0.180)
Log Census Population 2000				-0.430	-0.422	-0.392	-0.297
				(0.280)	(0.279)	(0.284)	(0.271)
Household Income per Capita				-0.00734	0.00180	-0.000435	-0.0278
				(0.0715)	(0.0719)	(0.0716)	(0.0733)
Racial Segregation				-4.542***	-4.811***	-4.943***	-5.129***
				(1.642)	(1.627)	(1.640)	(1.733)
Social Capital Index				1.851***	1.805***	1.820***	1.789***
				(0.288)	(0.268)	(0.276)	(0.277)
Fraction Adults Married				36.78***	37.02***	37.32***	39.05***
				(8.087)	(8.155)	(8.301)	(8.248)
Constant	61.81***	64.23***	69.11***	33.68***	35.43***	41.51***	38.51***
	(1.336)	(3.947)	(16.45)	(6.394)	(6.579)	(12.36)	(13.68)
Observations	692	692	692	692	692	692	692
R-squared	0.366	0.372	0.373	0.608	0.613	0.614	0.618

Robust standard errors (clustered by state in columns 2-7) in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A significant effect is seen in with financial aid spending toward higher education in Table 4.2; however, it is a negative coefficient and only exists in the regression without any controls (column 2). Thus, higher education public financial aid is associated with lower

intergenerational mobility, but it does not appear to be a significant causal relationship since once the control variables are added, the significance level drops. Potential reverse causality or missing variables could contribute to explaining the opposite expected sign on the coefficients in Table 4.2, specifically in column 2.

Table 4.2: 2001 Higher Educational Financial Aid Funding per FTE (Commuting Zone Level)

This table shows OLS regressions of intergenerational mobility on inequality and 2001 public higher educational financial aid funding at the commuting zone level. The measure of mbility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gini Coefficient (x100)	-0.433***	-0.413***	-0.463***	-0.123**	-0.132***	-0.169*	-0.165*
	(0.0324)	(0.0582)	(0.111)	(0.0473)	(0.0437)	(0.0904)	(0.0893)
Financial Aid Higher Education per FTE 2001		-2.473**	-6.026		-1.059	-3.716	-4.956
		(1.017)	(5.593)		(0.782)	(4.126)	(3.950)
Gini Coefficient x Higher Education Fin Aid per FTE 2001			0.0863			0.0646	0.0876
			(0.135)			(0.101)	(0.0964)
1992 K-12 Spending per Student							0.315*
							(0.185)
Log Census Population 2000				-0.430	-0.390	-0.322	-0.154
				(0.280)	(0.287)	(0.286)	(0.265)
Household Income per Capita				-0.00734	0.0138	-0.000665	-0.0398
				(0.0715)	(0.0655)	(0.0605)	(0.0595)
Racial Segregation				-4.542***	-4.832***	-5.031***	-5.414***
				(1.642)	(1.642)	(1.623)	(1.735)
Social Capital Index				1.851***	1.775***	1.815***	1.766***
				(0.288)	(0.275)	(0.294)	(0.297)
Fraction Adults Married				36.78***	33.95***	34.58***	36.45***
				(8.087)	(7.375)	(7.257)	(7.348)
Constant	61.81***	62.40***	64.43***	33.68***	35.16***	35.97***	31.72***
	(1.336)	(2.443)	(4.419)	(6.394)	(6.167)	(6.929)	(7.549)
Observations	692	692	692	692	692	692	692
R-squared	0.366	0.404	0.407	0.608	0.614	0.616	0.623

Robust standard errors (clustered by state in columns 2-7) in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Discussion

Overall, some of the hypothesized results were observed while other were not. Most notably, these results indicate that there is a positive association between K-12 public school expenditures and mobility, even while controlling for inequality and other key variables that are correlated with mobility. While causality is almost always impossible to conclude, these results provide strongly suggestive evidence that local governments should work to increase funding to primary and secondary school systems to increase mobility. Higher K-12 educational expenditures are associated with a greater chance of children's income rank to be less dependent on their parent's income rank, increasing the likelihood for children to achieve the American

Dream. However, the same results were not seen for higher education. Contrary to what Jeon and Lee (2018) found, higher education funding and higher education financial aid spending are not significantly related to mobility when controlling for other key variables that are correlated to mobility.

There are a few possible reasons for the insignificant relationship between tertiary educational expenditures and mobility. The first possibility is that there is reverse causality that is combining with causality in the direction I hypothesized that is cancelling out the effects. For example, places with higher financial aid could have higher mobility as people from lower income households have more access to higher education than in places with lower financial aid, allowing them to graduate college and move up in society. However, in the other direction, places with lower mobility could try and raise financial aid to increase mobility and access to education for all. Because there is possibility for causation in both directions, the effects could be cancelling out each other. In addition, tertiary education spending data is only available at the state level. While this reduces the variance in the data, any further subdivisions would make identifying correlation between mobility and tertiary education difficult as many children may leave the commuting zone in which they were born for college. Another potential cause for concern with higher education in this research is that many people leave the state in which they were born for college, especially those from higher income backgrounds as their parents have the means to help fund more prestigious or out-of-state college. Thus, the link between a state's level of mobility and the funds going toward the children born in the state may be weak, especially in places of lower inequality. Due to this combination of factors, finding tertiary education spending results that are not statistically significant is not surprising and does not signify that previous literature is incorrect in any way. In some ways, finding no significant relationship is

likely expected as higher education spending could be focused on those already in college (the more advantaged) and thus further increase inequality and decrease mobility.

Another result that was hypothesized was that controlling for public educational expenditures would flatten the slope of the Great Gatsby Curve. This hypothesis originated from previous literature that found that education is a driving factor in the relationship between mobility and inequality (Brandén, 2019). Therefore, an increase in public expenditures on education would make education more accessible to all and therefore create a weaker relationship between mobility and inequality. However, these results suggest that the slope of the Great Gatsby curve does not change when controlling for educational expenditures. At the school district level, the results indicate a positive interaction term between inequality and K-12 school expenditures; however, Figures 2.1-2.4 suggest that this interaction may be partially or completely explained by the presence of outliers at the highest level of spending. In addition, at the commuting zone level this effect becomes insignificant with no controls and significant in the negative direction when controls are added. Thus, the null hypothesis that public educational expenditures have no effect on the slope of the Great Gatsby Curve cannot be rejected.

One remaining question is why exactly the interaction term changes when the school district results are collapsed to the commuting zone level. To try and answer this question, I explored the breakdown of commuting zones by district sizes. First, a majority (554 of 692) of the commuting zones contain a school district of the 75th percentile of enrollment or higher, and a smaller amount but still a majority (416 of 692) contain a school district of the 25th percentile of enrollment or lower. Just under half of the commuting zones (299 of 692) contain at least one school district of the 75th percentile of enrollment or higher as well as at least one of the 25th percentile of enrollment or lower. This indicates that all of the large school districts are not

combined into a few commuting zones, but instead, each commuting zone contains multiple school districts of varying sizes. The large districts which carry the most weight after the districts are collapsed are spread out amongst different commuting zones. Therefore, as identified previously, these commuting zone results are likely dominated by the results of the large school districts because expenditure per student is weighted heavier for students from larger districts.

To further try and identify the reasoning behind the interaction sign change at the commuting zone level, a few more regressions were run. I performed the same regression in Table 3.1 column 6 for commuting zones with total student enrollments greater than the median and those with total student enrollments less than the median. The result was that those with smaller student populations exhibited an insignificant interaction term, but those with larger student populations exhibited the negative interaction term (the overall result). This confirms the idea that large districts and therefore commuting zones are contributing to this sign change at the commuting zone level. See Table 5.1 in the Appendix for these detailed results.

As with any OLS regression, there is potential for endogeneity problems with these results. Therefore, the use of an instrumental variable would be helpful for identifying endogeneity and ensuring the results are appearing for reasons we had hypothesized and not through other channels or reverse causality. To identify an instrumental variable for educational expenditure, I wanted something strongly correlated with K-12 educational expenditures but not correlated at all with mobility. Public funding to fire departments seemed to satisfy both of these requirements. Logically, both fire department funding and school spending are likely correlated as they are both types of government spending. Places with higher educational expenditures likely invest more in all their public services, including the fire department. However, there are no obvious channels through which fire department funding and mobility would be related. An

increase in fire department funding would likely mean that response times to fires are faster and fires are put out quicker but neither of these would obviously affect mobility between generations.

Thus, a few of the regressions in Tables 2.1 and 3.1 were run again with fire department funding (by state) as an instrumental variable for K-12 educational expenditure. However, since the fire department funding is only available at the state level, the standard errors were clustered by state. The results are illustrated in the appendix in Table 6.1 and 6.2. While the coefficient for school spending in the instrumental variable regression is much larger than the coefficient in column 2 of Table 2.1, the result is not significant. This indicates that there is likely some degree of endogeneity in the results as there are other factors that affect both educational expenditures and mobility that weren't included in the initial regressions of Table 2.1. Some of these factors could include political leanings of areas or amount of local taxes. Some reverse causality could also be identified if places of lower mobility choose to increase spending in hopes of increasing future mobility.

While this instrumental variable is not extremely strong, it does indicate that there are likely potential endogeneity problems with the OLS regressions used in this research. Future research could potentially work to identify other possibly stronger instrumental variables to identify and control for this endogeneity. In addition to finding a better instrumental variable, future research could also explore a finer breakdown of difference spending levels. For example, it would be interesting to explore these same models and regressions with data on preschool spending. In addition, using time series data could also help provide a new way of looking at these results. In this research, data was taken from a single moment in time and compared across different geographical regions. Using time series data could help account for some of the

endogeneity problems as it could control for factors such as political leaning and public opinion in certain areas that weren't able to be controlled for in this research.

Conclusion

While the American Dream is just a dream, this research explored one way of helping make that dream a reality for more people. Education is one of the foundational ways that wealth is transferred between generations. Thus, in theory, more public spending on education should increase access and quality of education for everyone, not just those from wealthy families. While this research was unable to conclude causality, an increase in public educational expenditures were found to be significantly correlated with higher mobility, even while controlling for inequality. Specifically, higher primary/secondary educational expenditures were found to be significantly correlated with higher mobility at both the school district and commuting zone level. In comparison, public spending on higher education and financial aid for higher education was not found to be significantly correlated with higher mobility in the same way that public primary/secondary spending is.

In addition, the hypothesis that public educational expenditures could help flatten the Great Gatsby Curve was unable to be confirmed due to conflicting results at the school district and commuting zone level as well an insignificant change in the coefficient on inequality when educational spending was added to the model. Thus, further research is needed to explore whether public spending on education mediates the relationship between mobility and inequality.

While I was unable to reject the null hypothesis that the slope of the Great Gatsby Curve is unaffected by educational expenditures, it is clear from my other results as well as prior research that education is extremely important to mobility and the relationship between mobility and inequality. Increasing spending on education and using that spending in meaningful ways

works to provide more children with higher quality education. Providing everyone with equal, or more equal, access to education is one key way of making the American Dream less of a dream and more of a reality.

Appendix

Table 5.1: 1992 K-12 Educational Expenditures per Student (Commuting Zone Level) by enrollment level

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the commuting zone level. The measure of mobility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars. Column 1 illustrates the results from the commuting zones with enrollments above the median (20,062), and column 2 illusrates the results from the commuting zones with enrollments below the median.

Dependent Variable:	*Absolute Intergenerational Mobility*	
	(1)	(2)
Gini Coefficient (x100)	0.201*	-0.256*
	(0.113)	(0.140)
1992 K-12 Spending per Student	1.752***	-0.253
	(0.623)	(0.661)
Gini Coefficient x 1992 K-12 Spending per Student	-0.0333**	0.0104
	(0.0140)	(0.0166)
Log Census Population 2000	1.004***	-0.751***
	(0.259)	(0.278)
Household Income per Capita	-0.119***	-0.118
	(0.0396)	(0.0799)
Racial Segregation	-11.86***	-5.975**
	(1.967)	(2.310)
Social Capital Index	1.535***	2.017***
	(0.244)	(0.276)
Fraction Adults Married	28.19***	43.29***
	(5.127)	(6.662)
Constant	8.140	40.88***
	(6.538)	(8.333)
Observations	346	346
R-squared	0.453	0.632

Robust standard errors clustered by state in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6.1: 1992 K-12 Educational Expenditures per Student (School District Level) with Fire Department Funding as IV

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the school district level. The measure of mobility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars. Fire department funding was used as an instrumental variable for K-12 Spending per Student.

Dependent Variable:	*Absolute Intergenerational Mobility*	
	(1)	(2)
Gini Coefficient (x100)	-0.113	-0.669
	(0.934)	(2.847)
1992 K-12 Spending per Student	4.768	-1.296
	(39.33)	(19.50)
Gini Coefficient x 1992 K-12 Spending per Student		0.0559
		(0.268)
Log Census Population 2000	2.350	0.256
	(23.73)	(4.360)
Household Income per Capita	-0.00115	-0.000226
	(0.0105)	(0.00192)
Racial Segregation	-13.15	-9.526
	(54.27)	(6.308)
Social Capital Index	1.475	1.300
	(1.809)	(1.159)
Fraction Adults Married	107.3	51.49
	(585.4)	(126.8)
Constant	-45.69	38.64
	(594.8)	(258.1)
Observations	14,785	14,785
R-squared	0	0

Robust standard errors clustered by state in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6.2: 1992 K-12 Educational Expenditures per Student (Commuting Zone Level) with Fire Department Funding as IV

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the commuting zone level. The measure of mobility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars. Fire department funding was used as an instrumental variable for K-12 Spending per Student.

Dependent Variable:	*Absolute Intergenerational Mobility*	
	(1)	(2)
Gini Coefficient (x100)	-0.0862	-12.15
	(0.0962)	(33.46)
1992 K-12 Spending per Student	0.641	-65.47
	(1.447)	(189.5)
Gini Coefficient x 1992 K-12 Spending per Student		1.375
		(3.777)
Log Census Population 2000	-0.184	-2.291
	(0.617)	(11.90)
Household Income per Capita	-7.45e-05	0.000646
	(0.000174)	(0.00357)
Racial Segregation	-4.963***	22.80
	(1.838)	(82.28)
Social Capital Index	1.733***	1.759
	(0.305)	(3.614)
Fraction Adults Married	41.12***	-59.33
	(11.66)	(340.8)
Constant	23.85	659.7
	(22.45)	(1,868)
Observations	691	691
R-squared	0.594	

Robust standard errors clustered by state in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7.1: 1992 K-12 Educational Expenditures per Student (Commuting Zone Level)

This table shows OLS regressions of intergenerational mobility on inequality and 1992 K-12 public educational expenditures at the commuting zone level. The measure of mobility is a child's expected income percentile rank given their parents' rank of 25 (25th percentile). All money measurements are thousands of 2015 adjusted dollars.

Dependent Variable:	*Absolute Intergenerational Mobility*					
	(1)	(2)	(3)	(4)	(5)	(6)
Gini Coefficient (x100)	-0.434***	-0.289***	-0.215**	-0.177**	-0.049	0.084
	(0.114)	(0.105)	(0.089)	(0.090)	(0.095)	(0.090)
1992 K-12 Spending per Student	0.243	0.521	0.563	0.760*	0.787*	1.184***
	(0.597)	(0.532)	(0.440)	(0.445)	(0.450)	(0.438)
Gini Coefficient x 1992 K-12 Spending per Student	0.004	-0.004	-0.011	-0.015	-0.0175*	-0.0233**
	(0.014)	(0.013)	(0.010)	(0.010)	(0.010)	(0.010)
Log Census Population 2000		-1.021***	-1.642***	-1.381***	-0.809***	-0.363**
		(0.143)	(0.158)	(0.166)	(0.161)	(0.159)
Household Income per Capita			0.282***	0.267***	0.0876**	-0.029
			(0.045)	(0.043)	(0.044)	(0.040)
Racial Segregation				-7.345***	-8.603***	-5.088***
				(1.726)	(1.656)	(1.530)
Social Capital Index					1.613***	1.843***
					(0.203)	(0.187)
Fraction Adults Married						39.02***
						(4.689)
Constant	58.50***	64.84***	61.99***	58.52***	53.01***	21.89***
	(4.952)	(4.739)	(4.044)	(4.209)	(4.379)	(5.484)
Observations	692	692	692	692	692	692
R-squared	0.383	0.438	0.490	0.502	0.555	0.616

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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