Threatening the American Dream: How State-Funded Merit Scholarships Impact Intergenerational Economic Mobility

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I. Abstract

Much debate exists about the benefits of state-funded merit scholarships in bridging the opportunity gap between those who can and cannot afford quality post-secondary education. This paper employs a difference in difference methodology to analyze the relationship between state-funded, merit scholarships and economic mobility in thirteen states. It also investigates other short-term outcomes such as college completion and college enrollment, long-term outcomes such as income, and government spending at the state level. This study finds that state-funded merit aid has small and statistically insignificant impacts on overall economic mobility within states. However, statistically significant evidence suggests that these scholarships lead to a small reduction in college enrollment for African-Americans. Moreover, lottery-funded merit scholarships are estimated to have an adverse effect on employment benefits for state residents in the short term. This finding suggests that the use of lottery revenues for scholarships detracts from other forms of government spending that might otherwise benefit the poor and unemployed. Finally, there is suggestive evidence that merit aid has the greatest adverse effect on income for the bottom 25th percentile of earners, but benefits the top quartile of earners. Overall, the findings imply that merit scholarships may exacerbate wealth inequality by crowding out minorities and low-income students from in-state campuses, and in some cases, diverting resources away from government assistance programs.

II. Acknowledgements

I sincerely appreciate the incredible mentorship, support, and helpful comments of Amanda Pallais who thoughtfully and patiently advised me throughout this research process. I am truly in awe of her work and dedication not only to the academic study of
education, but also to my personal educational journey and intellectual growth while writing this paper. I am also thankful for the advice of Judd Cramer, who continuously challenged me to produce my best work. I recognize the insight of Donald E. Heller and Patricia Marin, whose research first inspired my interest in the unintended consequences of merit scholarships. The entire department of Economics at Harvard College is gratefully acknowledged for providing the ample resources and encouragement necessary to better understand a topic I care so deeply about.

III. Introduction

Bridging the gap between what American families can afford and what they are expected to pay for higher education is not a new issue in policy discussion. In fact, as early as 1643, Lady Anne Radcliffe Mowlson established the first need-based, endowed scholarship at Harvard University. Since then, hundreds of private universities across the country have developed their own scholarship programs, awarding these by need, merit, or sometimes both. Private institutions, attempting to attract academically strong students into their classrooms, were usually the benefactors of merit-based aid. However, in 1955, the National Merit Scholarship Corporation was established to build greater public encouragement of high academic achievers and has since grown to provide millions of students with merit-based scholarships.

This growth is indicative of a broader trend that began in the twentieth century of increasing public sector involvement in providing merit-based aid. The founding of the Georgia HOPE scholarship program in 1993 exemplifies this trend. In the 2010 to 2011 academic year alone, the Georgia HOPE program awarded US$500 million to hundreds of students.
of thousands of students. After 1993, more than a dozen other scholarship programs, similar in spirit and scope, emerged in Florida, Kentucky, Louisiana, Nevada, New Mexico, South Carolina, Tennessee, West Virginia, and other states. Unlike previous merit aid, these scholarships were state-funded, and eligibility thresholds for standardized test scores and Grade Point Averages (GPAs) were much more lenient, for example.

There is some debate around whether these new scholarships benefit all high school students fairly. On the one hand, political advocates of the programs suggest that merit-based scholarships encourage high school students to achieve more academically, enroll in in-state colleges, and consequently contribute productively to the local labor force. Bolstering this argument are multiple studies that have shown sensitivity among students to the scholarship eligibility requirements, with more students enrolling in college, choosing to attend college in-state, and graduating with higher GPAs and test scores (Dynarski, 2000; Hickman, 2009; Henry, Rubenstein, & Bugler, 2004).

On the other hand, merit-based scholarships introduced throughout the 1990s in Florida, Kentucky, Alaska, and other states, were disproportionately awarded to middle- or upper-class white students (Heller & Marin 2004). The exclusion of lower-income students is in part the result of programs such as Georgia HOPE, which exclude students who qualify for the maximum Pell Grant from eligibility, and offer awards in the form of tax credits. For such programs, students who may meet the academic requirements, but whose families are too poor to pay taxes, do not qualify for the merit scholarship (Dynarski, 2000). The underrepresentation of low-income students and minorities is also

2 “A Comparison of States’ Lottery Scholarship Programs.” theec.ppr.tn.gov/THECSIS/Lottery/pdfs/SpecialReports/A%20Comparison%20of%20States%20Lottery%20Scholarship%20Programs%201207117.pdf
driven by the wide achievement gap that exists along wealth and racial lines. For example, African Americans have consistently underperformed relative to their white counterparts. As of 1998, black SAT test-takers reported average scores of 434 and 426 on math and verbal respectively, relative to white test-takers who reported average scores of 526 and 528 for the same subjects. This achievement gap resulted in an almost systematic exclusion of African Americans from such scholarships. If these programs successfully incentivize high-achieving white students to remain in-state for college, they may crowd out ethnic minorities from those same college campuses. This reality could prevent minorities and low-income students from reaping the labor market returns of a college degree, and consequently stifle their upward mobility.

Some states have turned to lottery revenues as a creative funding alternative to raising taxes for statewide merit scholarships. Although revenue from state lotteries can be pooled into the state’s general fund for the benefit of all taxpayers, revenue can also be specifically repurposed to causes such as environmental protection, education, or crime control. Research has shown that such efforts rarely lead to any tangible, long-term benefits, but rather tend to result in lower government budget allocations to public programs after the first year of the lottery. Furthermore, unlike raising taxes, which adds to existing state funds, lottery funding of merit scholarships may impede economic mobility by diverting finite government resources away from other state programs, many of which cater to the poor. Because merit scholarships are typically awarded to middle- and upper-class white students, this repurposing of lottery revenues may act as a

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6 Libaw, Oliver, and Mailto Href. “Where Does Lottery Revenue Go?” ABC News, 25 August
regressive tax on the poor.\textsuperscript{7} Unless existing educational expenditure is reallocated among other government programs, lottery funded merit scholarships may divert resources away from the poor more than non-lottery-funded merit scholarships, which tend to be funded through increased taxes. Ultimately, lottery-funded scholarships could exacerbate the inequality between the low and middle/upper income classes, making it harder for the poor to escape poverty.

In addition to potentially diverting resources away from existing government assistance programs, evidence in this paper suggests that on average, lottery-funded merit scholarships were associated with lower overall education expenditures as of 2000, by which time all but two of the treated states in this analysis had implemented a statewide merit scholarship (See Table 7 in Section VI). This finding is consistent with other research suggesting that citizens in these states are more likely to vote against ballot initiatives that intend to increase educational expenditure due to the false sense of investment that lottery-funded programs create (Heberling, 2000). The relatively reduced overall investment in education could have important implications for income and other long-term outcomes investigated in this paper.

This paper offers one of the first direct analyses of how merit scholarships impact long-term intergenerational economic mobility. This is made possible through recently published data by the Equality of Opportunity Project, which has gathered the first comprehensive framework for tracking intergenerational mobility. Using publicly available data from the American Community Survey (ACS) and the Current Population Survey (CPS), this study also examines the long-term effects of state-funded merit aid on

\textsuperscript{7} Kolodner, Meredith. “States Moving College Scholarship Money Away from the Poor, to the Wealthy and Middle Class.” The Hechinger Report, Teachers College at Columbia University, 22 June 2015. hechingerreport.org/states-moving-college-scholarship-money-away-from-the-poor-to-the-wealthy-and-middle-class/.
income, government spending, and employment, as well as short-term educational effects on college enrollment and college completion.

I employ a difference in difference analysis, taking the introduction of state-funded merit scholarships during the 1990s as natural experiments. The analysis treats birth cohorts that were exposed to state merit scholarships before entering college as the treatment group, and cohorts not exposed to any state-funded merit scholarships as the control group. Individuals’ exposure is determined by age and state of birth.

The most important findings from this paper include small, statistically significant results to suggest that these policies result in a 1.35% fall in college enrollment among African Americans in states with strong merit scholarship programs.

Moreover, the evidence in this paper suggests that these programs are most harmful to low-income earners. Relative to those not exposed to such policies, the bottom 25th percentile of total personal income in scholarship states falls by an estimated US$1,736.00 per year. Although this coefficient is not significant, there is sufficient precision in these estimates to reject the possibility of a positive impact on the bottom income quartile resulting from merit scholarships. There is further directional evidence that the top quartile of earners may experience an income boost due to these programs, which is consistent with the idea that merit scholarships disproportionately benefit middle- and upper-income students. This is consistent with research by Stranahan and Borg (2004), who use the Florida Bright Futures Scholarship as a case study and find adverse long-term impacts of the scholarship on the poor, but positive impacts for the wealthy.
While exploring mechanisms through which the poor may be negatively impacted by merit-based scholarship programs, statistically significant results emerge to suggest that these programs, when lottery-funded, lead to a short-term reduction in unemployment benefits for state residents, but have no meaningful, persistent adverse impacts on government programs such as social security or welfare (See Appendix Exhibit E).

Moreover, an analysis of employment provides statistically significant evidence that when treated cohorts enter the workforce at the age of 22, state residents experience a boost in employment by approximately 2.30%. This finding bolsters policymakers’ claims that by inducing talented students to attend college in-state, more college graduates are likely to contribute to the local economy productively. This is also consistent with a broadly developed literature pointing to the positive impacts of the scholarships on short-term educational outcomes such as college enrollment. Moreover, some limited research into long-term impacts of merit scholarships suggests that the programs tend to marginally improve the financial well-being of students as they reach adulthood (Scott-Clayton and Zafar, 2016).

Finally, when relying on synthetic controls, the study estimates that merit scholarships may cause state mobility to fall by 0.0675. Interpreting this value per the rank-rank specification of the underlying mobility data, suggests that for every one percentile increase in parent income, child income changes by 0.0675 of a percentile less when he or she is exposed to the policy compared to when he or she is not exposed to the policy. In other words, if the parent were to move from the 25th to the 50th percentile, or the 50th to 75th percentile of income, child income would move by approximately 1.7 percentiles less when exposed to the policy versus when not exposed to the policy.
This study therefore presents a range of results suggesting that state merit scholarships crowd out minorities and impose an adverse economic burden on low-income earners by shifting government assistance resources away from the poor to benefit those whose college attendance is usually indifferent to financial aid.

The structure of this paper is as follows. Section IV describes the history and nature of the merit scholarship programs in detail. Section V provides a close review of the literature and its implications for intergenerational mobility outcomes. Section VI summarizes the data and describes the sources that have been used to compile the main regression results. Section VII explains in greater detail the empirical methodology, a difference in difference analysis. Section VIII presents estimates for the impact of state-funded, merit scholarships on intergenerational economic mobility and other outcomes. Finally, Section IX discusses the implications of the findings and concludes.

IV. Background

The imperative for understanding the impact of merit-based scholarship programs on educational outcomes and economic mobility is increasingly urgent due to the rising labor market returns of a college degree as shown in Figure 1. If it is the case that such programs crowd out minorities applying to college, the programs must have important implications for later outcomes in life for non-recipients, including lower income and reduced economic mobility.

Data from the U.S. Bureau of Labor Statistics, demonstrates that those with only a college degree have median weekly earnings of US$1,156, almost seventy percent more than earnings for high school graduates, who have median weekly earnings of only

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Evidently, the financial hurdles that American families face in securing a college education pose sometimes insurmountable obstacles, yet can have defining impacts on a student’s future.

Figure 1: The Increasing College Premium

![Graph showing Total Personal Income by Educational Attainment from 1995 to 2017.](image)


Scholarship Characteristics

Merit scholarships established in the 1990s departed from past merit scholarships in their target demographic. While merit scholarships were historically targeted towards extremely high performing students, during the 1990s, such programs were targeted towards more modest academic achievers, and were restricted to in-state residents who agreed to attend college in-state. The eligibility requirements for these new programs typically included at least a 2.5-3.0 GPA cutoff, strong standardized test score results, core course requirements, or some combination thereof. Although each state sets its own

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parameters and eligibility requirements for the awards, most also require a certain level of academic achievement in college for students to renew the award each year. Data is presented in the table below to demonstrate eligibility requirements for thirteen states with strong merit-based scholarship programs (Dynarski, 2004). The choice of these states as treatment states is discussed in greater detail below.

*Table 1: Eligibility Requirements of State-Funded Merit Aid as of 2004*

<table>
<thead>
<tr>
<th>State</th>
<th>Eligibility</th>
<th>Award (in-state attendance only, exceptions noted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>Initial: 2.5 GPA in HS core and 19 ACT&lt;br&gt;Renew: 2.75 college GPA</td>
<td>Public: $2,500&lt;br&gt;Private: Same</td>
</tr>
<tr>
<td>Florida</td>
<td>Initial: 3.0–3.5 HS GPA and 970–1270 SAT/20–28 ACT&lt;br&gt;Renew: 2.75–3.0 college GPA</td>
<td>Public: 75–100% tuition/fees*&lt;br&gt;Private: 75–100% average public tuition/fees*</td>
</tr>
<tr>
<td>Georgia</td>
<td>Initial: 3.0 HS GPA&lt;br&gt;Renew: 3.0 college GPA</td>
<td>Public: Tuition/fees&lt;br&gt;Private: $3,000</td>
</tr>
<tr>
<td>Kentucky</td>
<td>Initial: 2.5 HS GPA&lt;br&gt;Renew: 2.5–3.0 college GPA</td>
<td>Public: $500–3,000&lt;br&gt;Private: same</td>
</tr>
<tr>
<td>Louisiana</td>
<td>Initial: level 2.5-3.5 HS GPA and ACT &gt; state mean&lt;br&gt;Renew: 2.3 college GPA</td>
<td>Public: Tuition/fees + $400–800*&lt;br&gt;Private: Average public tuition/fees*</td>
</tr>
<tr>
<td>Maryland</td>
<td>Initial: 3.0 HS GPA in core&lt;br&gt;Renew: 3.0 college GPA</td>
<td>2-Year School: $1,000&lt;br&gt;4-Year School: $3,000</td>
</tr>
<tr>
<td>Michigan</td>
<td>Initial: level 2 of MEAP or 75th percentile of SAT/ACT&lt;br&gt;Renew: NA</td>
<td>In-State: $2,500 once&lt;br&gt;Out-of-State: $1,000 once</td>
</tr>
<tr>
<td>Mississippi</td>
<td>Initial: 2.5 GPA and 15 ACT&lt;br&gt;Renew: 2.5 college GPA</td>
<td>Public Freshman/Sophomore: $500&lt;br&gt;Public Junior/Senior: $1,000&lt;br&gt;Private: Same</td>
</tr>
<tr>
<td>Nevada</td>
<td>Initial: 3.0 GPA and pass Nevada HS exam&lt;br&gt;Renew: 2.0 college GPA</td>
<td>Public 4-year: tuition/fees (max $2,500)&lt;br&gt;Public 2-year: tuition/fees (max $1,900)&lt;br&gt;Private: none</td>
</tr>
<tr>
<td>New Mexico</td>
<td>Initial: 2.5 GPA 1st semester of college&lt;br&gt;Renew: 2.5 college GPA</td>
<td>Public: Tuition/fees&lt;br&gt;Private: None</td>
</tr>
<tr>
<td>South Carolina</td>
<td>Initial: 3.0 GPA and 1100 SAT/24 ACT&lt;br&gt;Renew: 3.0 college GPA</td>
<td>2-Year School: $1,000&lt;br&gt;4-Year School: $2,000</td>
</tr>
<tr>
<td>Tennessee</td>
<td>Initial: 3.0–3.75 GPA and 890–1280 SAT/19–29 ACT&lt;br&gt;Renew: 3.0 college GPA</td>
<td>2-Year School: tuition/fees ($1,500–2,500) *&lt;br&gt;4-Year School: tuition/fees ($3,000–4,000) *</td>
</tr>
<tr>
<td>West Virginia</td>
<td>Initial: 3.0 HS GPA in core and 1000 SAT/21 ACT&lt;br&gt;Renew: 2.75–3.0 college GPA</td>
<td>Public: Tuition/fees&lt;br&gt;Private: Average public tuition/fees</td>
</tr>
</tbody>
</table>

Note: (*) Amount of award rises with GPA and/or test score. | HS = High School
Source: Data from Dynarski 2004
Looking at the 2010 to 2011 academic year as an indicator, these scholarships offer awards between US$2,500 and US$5,500 and often cover around 50-100% of the average public 4-year tuition and fee costs. The key point for these programs is that they are far more accessible in terms of their eligibility requirements than merit-based scholarship programs in the past, and continue to offer substantial rewards that could make an important difference for students around the country who otherwise may not attend college at all.

Following previous literature, this analysis distinguishes between strong and weak scholarship programs, restricting the main regression to only those programs that are deemed strong, although the main findings regarding economic mobility are robust to including all scholarship states as treatment observations (See Appendix Exhibit A). This distinction is important since states across the country have implemented multiple variants of such scholarship programs, some of which are much stronger than others. To meet the definition of a “strong” scholarship program, the aid must be broad-based, and have relatively large award sizes (Sjoquist & Winters, 2012). In all thirteen states under this analysis, at least thirty percent of high school students are qualified based on grades and test scores (Dynarksi, 2004). Table 2 demonstrates the thirteen states to which the treatment birth cohorts belong, as well as the name of the broad-based scholarship program being considered. The table also identifies twelve states that will be excluded from both the treatment and control groups. The rationale for this methodology will be discussed in more detail in the Methodology section.

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States have elected to introduce these scholarships for several reasons. The driving incentives are to encourage the state’s highest academic performers to stay in-state, to increase the accessibility to and choice of higher-education institutions for students, and finally to promote academic achievement among high schoolers and college-going students. Together, these components of merit-based aid are arguably key

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11 This differs from Dynarski’s identification of the starting year, given as 2002. This data is based instead on a 1999 Maryland Senate Bill which describes the program being established for the class of 2000
to building the local economy and opening the doors of opportunity to more high school students.

**State Lottery Funding**

Particular attention should be paid to state merit scholarships that draw funding from state lottery revenues. A well-developed literature, outlining the deeply adverse impacts of the lottery on the poor, has been produced. However, the advent of merit-based scholarships has the potential to exacerbate these negative effects, and further reinforce the cycle of poverty that faces the poorest families in America.

**Negative Impacts of the Lottery on the Poor**

Typically, merit-based scholarship programs have a broad funding base in which the burden of funding these programs falls on all taxpayers. In some states, lottery revenue has been repurposed towards a specific public good such as education or park preservation.

The number of states that rely on lottery revenues to fund government programs has grown steadily since the 1980s, at which time only fourteen states had legalized gambling. Since then, forty-three states have legalized the lottery, and national lottery revenues have soared to $70.1 billion.\(^\text{12}\) The table below shows how lottery revenues are spent for states in which the proceeds fund merit-based scholarship programs.

**Table 3: Lottery Revenue and Spending (Treatment States)**

<table>
<thead>
<tr>
<th>STATE</th>
<th>REVENUES ($MM)</th>
<th>PROGRAMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>$ 85.27</td>
<td>Educational Trust Fund</td>
</tr>
<tr>
<td>Florida</td>
<td>$ 1,700.00</td>
<td>Education Enhancement Trust Fund</td>
</tr>
<tr>
<td>Georgia</td>
<td>$ 1,100.00</td>
<td>Lottery for Education Account</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>Amount</th>
<th>Program Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky</td>
<td>$253.04</td>
<td>Post-Secondary &amp; College Scholarships; Literacy Programs &amp; Early Childhood Reading</td>
</tr>
<tr>
<td>New Mexico</td>
<td>$46.30</td>
<td>Lottery Tuition Fund</td>
</tr>
<tr>
<td>South Carolina</td>
<td>$398.91</td>
<td>Education Lottery Fund</td>
</tr>
<tr>
<td>Tennessee</td>
<td>$394.05</td>
<td>Lottery for Education Account; After School Program</td>
</tr>
<tr>
<td>West Virginia</td>
<td>$588.19</td>
<td>Direct aid to Public Education K-12</td>
</tr>
</tbody>
</table>


The lottery proceeds are funded by those who buy lottery tickets, a population comprised largely of the poorest families in the country. In fact, surveys have indicated that the poorest third of American households are responsible for purchasing approximately fifty percent of lottery tickets (McAuliffe, 2006). Because the lottery is funded largely by the poor, and used in part to fund government programs that serve all state residents, it acts as a deeply regressive tax and reinforces the cycle of poverty in the United States.

Additional Burden of Introducing Lottery-Funded Scholarships

When lottery-funded merit scholarships are introduced, in addition to the already regressive tax that the lottery imposes on poor families, there may be additional burdens.

When used to fund merit scholarships, the lottery, unlike taxes, becomes more regressive over time because revenues plummet after the novelty of the games wears off. Many states find themselves unable to service the same number of students with the same generous coverage and are forced to either cap the award sizes at a value less than full tuition, or make the eligibility requirements more stringent (Heberling, 2002). In some cases, states may dip into existing funds, which could directly reduce resources available to other government programs, some of which might usually curb poverty by funding
unemployment benefits or healthcare, for example. Instead, this finite source of funds could be shifting from the poorest families in America to wealthier families who usually played no part in contributing to the lottery revenue, and whose college attendance is likely indifferent to scholarships. The natural volatility in lottery revenues due to various factors such as interstate lottery competition, makes the lottery incapable of funding all scholarships over a sustainable period. However the state chooses to adjust to meet scholarship demand, whether dipping into existing funds, capping the award size, or making eligibility requirements more stringent, the effect over time is to divert resources from the poor to the wealthy, or squeeze out low-income students who need full tuition coverage and are unable to meet more stringent academic standards.

Moreover, funding merit scholarships through lottery revenues makes citizens more likely to vote strongly against ballot proposals to increase educational expenditures (Heberling, 2002). As discussed more in the results section, this cultural opposition to educational investments stems from the inflated sense of investment that residents receive from the lottery-funded scholarships. A relatively reduced investment in state education overall may have important implications for the income of all earners and ultimately economic mobility for these affected birth cohorts.

To investigate whether lottery funding acts as an addition to or replacement of other state-level funding sources, this study also looks at the impact that lottery-funded merit scholarships have on state-level income taxes. A range of literature has suggested that over time, lottery revenues tend to supplant rather than supplement existing
investments in state education. It may be the case that states use lottery revenue as a mechanism by which to lower income taxes and reduce other forms of spending on education. Alternatively, because the lottery revenue is being repurposed towards education, state taxes may increase to maintain equal levels of investment in the government programs previously funded through lottery revenues.

Regarding economic mobility, state-funded merit scholarships have the potential to expand the wealth gap between the rich and poor by diverting resources away from the poor in favor of those who would likely be able to afford college without the financial aid. Lottery revenues that might otherwise be used to fund government assistance programs that benefit the poor are being used to educate the wealthy, thereby stifling upward mobility. This paper intends to quantify the impact of these scholarships on economic mobility and other outcomes to better assess the advantages and disadvantages of lottery-funded scholarship programs relative to those funded through other means.

**Possible Implications for Economic Mobility**

Though the literature provides evidence of benefits that arise from state-funded scholarship programs, the scholarships have also been shown to have unintended negative consequences. For example, state-funded merit scholarships rarely have income restrictions, meaning that students from the very top to the very bottom of the income distribution are judged equally when competing for a limited amount of state-funded financial aid. The funds may be unevenly skewed towards those who can afford resources that prepare them to meet the academic demands of merit aid both prior to and when

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enrolled in college. This disadvantage is especially prevalent in preparation for standardized tests, which is why many state scholarship programs were broadened to consider GPA requirements. Indeed, studies have shown that in the late 1990s, when these programs were first introduced at scale to American high school students, a strong correlation existed between socioeconomic characteristics and scholarship qualification rates. In Florida, Whites comprised 61% of total high school graduates, but represented a weighty 77% of total merit scholarship recipients. This statistic can be contrasted against the experience of some ethnic minorities. Although Blacks and Hispanics represented 21.7% and 14.2% of total graduates respectively, they received only 7.5% and 10% of total scholarships. One might infer that such discrimination in the distribution of merit scholarships would reduce intergenerational economic mobility by exacerbating the disadvantages of ethnic minorities relative to their white peers.

These issues are key motivations for the analysis presented in this paper. While much of the existing literature has analyzed this topic as it relates to students in a variety of states, few have considered whether the positive and negative impacts of merit-based scholarships are restricted to certain races or what the long-term implications are for economic mobility.

Based on this brief background of merit-based scholarship awards, one can envision an intuitive scenario for multiple results of this analysis. On the one hand, it is possible that the presence of merit-based aid increases the state’s intergenerational economic mobility. The programs are broad-based, with modest eligibility requirements and therefore may offer affordable secondary education to students who might otherwise

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never attend college or reap the labor-market returns of a college degree. Providing these students with such an educational opportunity may offer the necessary catalyst for upward economic mobility.

On the other hand, one can also envision a scenario in which state-funded merit aid reduces economic mobility within states. Although the scholarships seem to post modest eligibility requirements, these may not be accommodative enough to allow low-income students an equal opportunity to attend college. Additionally, such scholarships may crowd out ethnic minorities and low-income students from state campuses by filling them with higher-income, higher-performing students. In this case, merit aid potentially exacerbates the economic inequalities along both income and racial lines by making it easier for high- and middle-income families to afford college, and making it harder for low-income families and minorities to do the same.\(^\text{15}\)

Finally, it is possible that merit scholarships have no significant effects on long-term economic mobility. For example, there may be sufficient demand at colleges that these scholarship programs do not crowd out minorities. Moreover, states that invest in merit scholarships may also invest sufficiently in need-based financial aid to meet the economic demand of relatively high achieving, low-income students.

In any of the three scenarios, these developments in the American education system fundamentally threaten the concept of the “American Dream”, and the expectation that all Americans have an equal opportunity to succeed regardless of economic status at birth.

V. Literature Review

A wide body of literature, spanning decades of research, addresses the impact of merit-based scholarships on high school graduates and college students. For the most part, the literature has attempted to validate and disprove the driving incentives for states to invest heavily in merit scholarships.

As mentioned above, one key argument in favor of these scholarships is that the programs reward academic achievement, and provide an effective financial incentive for students to maintain strong academic performance. Perhaps unsurprisingly, one subset of the literature looks closely at the educational outcomes related to merit scholarships such as college completion rates (Dynarski, 2005; Sjoquist & Winters, 2014; Welch, 2014). Unfortunately, the literature on this topic has been relatively limited and has yet to reach a clear consensus on how merit scholarships impact college graduation rates. Dynarski, for example, finds that scholarships have a positive and statistically significant effect on college graduation rates, but Sjoquist and Winters, and Welch find a small and statistically insignificant effect. Moreover, some research concludes that merit-based scholarships in fact lead to a slight reduction in bachelor’s degree attainment (Fitzpatrick & Jones, 2012). The studies by Fitzpatrick and Jones (2012) and Sjoquist & Winters (2014), are unique because while a large portion of the literature attempts to address merit scholarships using one or two specific scholarship programs as case studies, these studies conduct a broader analysis of state merit scholarship programs throughout the United States, as will the analysis in this paper.

Given that the labor market returns to a college degree are shown to be increasingly meaningful for long-term wealth, the effect of merit-based scholarships on
College completion may have important implications for economic mobility. If, for instance, these scholarships were shown to substantially increase college completion rates, one might also expect the programs to have positive effects on economic mobility. Such evidence might confirm that the programs successfully incentivize students who may have otherwise dropped out of college due to poor performance, lack of motivation, or lack of familial encouragement, to persevere and obtain a Bachelor’s degree, making them far more competitive in the labor force. Increasing college attainment among those more prone to dropping out, such as first-generation college students and other minorities, could propel them into more rewarding job markets and spur upward mobility. However, if these college completion rates only increase due to the crowding out of lower-income, less academically prepared students, the effect on intergenerational economic mobility could also be negative.

College completion is not the only educational outcome of interest to researchers. A now extensive literature has also developed regarding the impact of merit-aid on students’ college enrollment decisions. For the most part, consensus in the existing literature has shown that merit scholarships increase college enrollment, particularly at in-state post-secondary institutions (Dynarski, 2004; Dynarski, 2008; Scott-Clayton, 2011). This positive effect could imply an increased representation of lower-income students who were previously unable to afford college. This evidence may also debunk the theory that merit-based scholarships crowd out various minorities, suggesting instead that colleges simply absorb a larger student body overall, and therefore the programs could have no meaningful effect on economic mobility.
Cornwell et al (2005) also study the impact of these programs on course enrollment and withdrawal once students enter in college. Their findings suggest that merit-based scholarships increase course withdrawal among freshman, and reduce full-load enrollment. This evidence marks another important, unintended consequence of merit-based financial aid. Once students secure the aid, they are beholden to high academic standards that encourage more manageable course loads and less rigorous majors. This pressure might be a driver for falling completion rates if students reduce their course load to maintain strong grades and then cannot graduate with sufficient requirements within the years that they are eligible for the scholarship. For example, the West Virginia PROMISE scholarship has a limit of six years,\(^\text{16}\) while the Tennessee HOPE scholarship has a five-year limit from the initial enrollment date.\(^\text{17}\)

Existing research suggests that state-funded merit scholarships positively impact educational achievement among high school students. For instance, Kramer (2016) takes advantage of the change in some merit scholarships to include GPA requirements, to show that Advanced Placement participation increases after the policy change. This finding suggests that high schoolers are sensitive to the scholarship eligibility requirements. This is also consistent with research by Pallais (2009), which studies the response of ACT scores to the introduction of the Tennessee Education Lottery Scholarships, and finds that although students may not be sensitive to the in-state scholarship requirements, they are sensitive to the academic achievement thresholds. This

\(^{16}\) XAP, “College Foundation of West Virginia (CFWV),” CFWV.com - PROMISE FAQ, secure.cfwv.com/Financial_Aid_Planning/Scholarships/Promise/FAQ.aspx.

consensus suggests that the programs could have positive impacts on intergenerational economic mobility by motivating greater academic achievement among high schoolers.

Another strand of the literature investigates whether merit scholarships lead to a higher retention of academic achievers in the state, which policymakers point to as a leading benefit of these scholarship programs. Using evidence from the Georgia HOPE program, Cornwell et al (2006) find that overall enrollment at private, four-year institutions, increases by approximately 14.1% per year due to the program. Their further analysis suggests that the HOPE scholarship reduces the number of students leaving Georgia to attend college by 560 per year, which is consistent with much of the existing literature (Hickman 2009; Zhang & Ness, 2010). These findings could affirm the belief that colleges are simply absorbing the additional supply of high academic achievers rather than crowding out minorities. The findings could also suggest an intuitive scenario in which higher-income students suffer negative long-term outcomes if their decision to stay in-state causes them to forgo substantial improvements in college quality.

Fortunately, research has been done to address the potential for state merit scholarships to encourage students to greatly forgo college quality for the sake of securing financial aid. For example, Cohodes and Goodman (2014) use the Massachusetts merit aid program as a case study and find that students are heavily swayed by modest scholarship awards, often choosing to sacrifice substantial improvements in college quality to apply the aid in state. The long-run benefit of this seems obscure since the earnings differentiator of a competitive school dwarfs the short-term benefits of the scholarship money. Concurrent with the argument above, this could suggest that these merit scholarships have negative impacts on intergenerational
economic mobility by essentially restricting the top academic achievers to lower-quality schools in state.

The Cohodes and Goodman paper also deduces that lower college quality has further adverse effects on college completion rates, which is consistent with findings by Angrist et al (2016). As Angrist et al point out, this relationship may be due to the lower abilities of incoming students to low-quality schools, or due to lack of funding, resources, or investment in teacher instruction. In any case, merit scholarships may have a doubly adverse effect on college completion rates, the first resulting from the high academic standards that they impose on college students as discussed above, and a second adverse effect resulting from the unintended incentive for students to potentially forgo college quality to take advantage of merit aid.

In addition to promoting academic achievement, and increasing the state retention of academic achievers, policy makers also hope that these programs increase the accessibility to and choice of higher education institutions for low-income students. Although relatively little research into this topic has been conducted, Singell et al (2006) analyze whether the Georgia Hope Scholarship had positive impacts on college access among lower income students relative to other Southern states. Their results suggest that students who ordinarily would apply for the Pell Grant as a source of need-based aid are not crowded out of in-state institutions because of more merit-award recipients choosing to stay in state. They also find evidence of positive impacts on college access for low-income students. This finding would imply that the merit-based scholarship programs increase intergenerational mobility by increasing the sources of financial aid available to
low-income students. This would allow them to attend college more easily, and reap the subsequent labor market rewards.

There has also been little research done on how merit-based scholarships impact long-term outcomes such as income, occupation or economic mobility. Using the West Virginia PROMISE scholarship as a case study, Scott-Clayton and Zafar (2016) attempt to investigate long-term outcomes such as homeownership, neighborhood characteristics, and financial management among scholarship recipients. The study finds no significant impact on employment rates, but finds increased likelihood of homeownership, strong financial health and residence in higher-income neighborhoods, relative to peers who were not exposed to the PROMISE scholarship (Scott-Clayton and Zafar, 2016). These indicators suggest that merit-based scholarships have positive long-term outcomes that could increase upward economic mobility among scholarship recipients.

Because there is limited research on the topic of lottery-funded merit scholarships, little consensus seems to have emerged on how these programs impact recipients relative to other state-funded scholarships. Nonetheless, Stranahan and Borg (2004) use the Florida Bright Futures Scholarship as a case study to find that, due to the lottery-based funding mechanism, high socioeconomic households receive almost $2,200 in net benefit from the program, while low socioeconomic households suffer a loss of almost $700. This implies that at the lower end of the income distribution, these scholarship programs do more harm than good, thus reducing economic mobility by widening the gap between the rich and poor.

This paper hopes to contribute meaningfully to the existing literature in multiple ways. First, it offers a close empirical analysis of long-term consequences, focusing on
how state-funded merit scholarships impact intergenerational economic mobility. This analysis is arguably a meaningful improvement over much of the existing literature in two key ways. Unlike many previous studies, this paper attempts to answer the question using a broad base of merit scholarship programs rather than one or two case studies. This sample is expected to provide more robust, broadly applicable results for estimating the long-term impact of such scholarships. The results of this analysis may also be more meaningful to policy decisions since state-specific studies may not be easily replicated elsewhere. Most importantly, this analysis makes use of long-term measures for intergenerational mobility provided through the Equality of Opportunity Project, data that has never been available to researchers. Employing this data gives unique insight into perhaps one of the most meaningful long-term outcomes of state-funded, merit-based scholarships.

VI. Data and Descriptive Statistics

While the primary goal of this paper is to quantify the impact of broad-based merit scholarships on intergenerational economic mobility within states, additional analysis addresses the impact of these scholarships on outcomes such as college enrollment, college completion, income, and government spending.

Any empirical analysis of how merit-based scholarships impact economic mobility will inevitably encounter some data limitations. An ideal dataset for this analysis would provide longitudinal income data at the individual level as well as parental income at the time of the child’s birth. An ideal dataset might also provide data at the high school level to compare the economic mobility of high school students who were exposed to the policy with those who were not exposed to the policy. Using such individual level data,
the sample would be large enough to allow for the most informative analysis, and the control group would likely be more comparable to the treatment group. Unfortunately, no such public database exists, so multiple sources of data are combined for the primary analysis in this paper.

**Intergenerational Mobility**

First, I use data from the Equality of Opportunity Project to measure intergenerational mobility throughout the United States. This data provides intergenerational mobility statistics for each commuting zone in the United States between 1980 and 1986, where commuting zones are defined by 1990 boundaries. The mobility metric provided for these years is a rank-rank specification of intergenerational mobility, and is based on dependent claims in tax filings. The rank-rank specification means that the family income of children aged 29-30 is ranked relative to all other children in their birth cohort. Similarly, parents’ income during the child’s birth year is ranked relative to all other parents of children in the same birth cohort. The metric provided is an ordinary least squares (OLS) regression of parent rank on child rank (Chetty et al, 2014). Therefore, as the rank-rank specification increases, child income is more dependent on parents’ income. As the value falls, child income is less dependent on parents’ income. The slope of the regression indicates the difference in the ranks of children from the richest families compared to the ranks of children from the poorest families. For these reasons, throughout the analysis, the metric is referred to as ‘immobility’.

The metrics for immobility, by commuting zone, have been aggregated to state level measures by computing a weighted average of each commuting zone based on total
population in 1990. Figure 2 illustrates the intergenerational economic immobility metrics for seven birth cohorts across thirteen treatment states, after the weighted average is computed.

*Figure 2: Measure of Immobility for Treatment States*

This weighting method assumes that the population in each state born from 1980 to 1986 is proportional to the overall population relative to other states. This weighting should be approximately accurate, and the study proceeds with that assumption.

The economic mobility data has some important limitations in practice. Because only seven observations (birth cohorts) are available for each state, this analysis relies on only ninety-one total treatment observations. This moderately small sample size may result in larger standard errors and hinder the economic precision that would allow for

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conclusive claims regarding the impact of merit scholarships on the outcomes studied in this paper.

**Control Variables**

This analysis controls for some aspects of the demographic profile of each state at the time when each birth cohort reaches eighteen years old. This data is based on the Integrated Public Use Microdata Series (IPUMS) Current Population Survey (CPS). The IPUMS-CPS provides individual level data spanning more than fifty years from 1962 onward. The survey is a U.S. household survey administered by the U.S. Census Bureau and the Bureau of Labor Statistics every October, which gathers detailed information regarding educational attainment, race, economic status, and more.

The CPS differs from the American Community Survey and decennial census in that it provides individual state of residence, but not state of birth, making it a useful tool for control variables based on the current population of each state, but difficult to use in studying additional outcomes, as discussed later. The CPS is also immensely useful because it allows cross-time comparisons for each year, unlike the decennial U.S. census, for which annual data is only provided by the American Community Survey starting in 2001. The annual nature of the CPS is critical to allow comparisons of demographic conditions for each birth cohort at age eighteen, starting in 1998 for the 1980 birth cohort and ending in 2004 for the 1986 cohort.

**Additional Outcomes**

In addition to studying the main outcome of interest, intergenerational mobility, this paper also studies state spending to investigate whether these scholarships add to
existing investment in government assistance programs or detract from them. Annual data from the CPS survey is used to compute the average welfare income, social security income, state income tax, and unemployment benefits for states that have and have not implemented this policy. Fortunately, this dataset allows for the comparison of these rates not only for a single year after the policy was implemented, but also during every subsequent year for each birth cohort and state. This method allows the analysis to consider any delayed impacts on various aspects of government spending, as discussed more in the methodology section.

Much of the analysis in this paper comes from the IPUMS American Community Survey (ACS). Like the CPS, the ACS provides individual-level data for a wide variety of variables including educational attainment, race, total income, and state of birth. The state of birth is critical to compare treatment and control groups for each of the additional outcomes since state of birth is used as a proxy for determining treatment assignment.

While the ACS is the world’s largest collection of publicly available individual-level census data, it still presents important limitations for this analysis. Namely, the data lacks information regarding parental economic status, educational attainment, or other indicators of wealth. This omission necessitates state-level analysis and the integration of this data with that provided by the Equality of Opportunity Project.

Additionally, the ACS provides no information about the state of residence or high school and college attendance for individuals. Therefore, the treatment assignment relies on state of birth rather than state of high school graduation or academic performance, which are the true determinants of whether a child is exposed to and eligible for a state-funded merit scholarship program. This approximation makes it
possible that the mobility estimates incorrectly capture students who were born in a
treatment state, but attended high school in a control state, for instance.

Moreover, the survey lacks information regarding academic performance
measures such as GPA, standardized test scores or class rank. Consequently, the study
cannot restrict itself only to those students who were initially eligible for the aid. Instead
the study captures all eighteen year olds born in a treatment state, regardless of eligibility.

**Summary Statistics**

*Table 4: Demographic Profile Statistics by Merit Strength*

<table>
<thead>
<tr>
<th>(Mean)</th>
<th>Strong Merit-Aid (Treatment Group)</th>
<th>Weak Merit-Aid (Excluded)</th>
<th>No Merit-Aid (Control Group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Immobility</td>
<td>0.255</td>
<td>0.231</td>
<td>0.293</td>
</tr>
<tr>
<td>Total Personal Income</td>
<td>$28,408.00</td>
<td>$27,563.00</td>
<td>$24,901.00</td>
</tr>
<tr>
<td>Wage and Salary Income</td>
<td>$23,188.50</td>
<td>$22,327.14</td>
<td>$19,804.75</td>
</tr>
<tr>
<td>Percent White</td>
<td>85.87%</td>
<td>86.34%</td>
<td>78.54%</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>9.64%</td>
<td>13.25%</td>
<td>11.23%</td>
</tr>
<tr>
<td>Percent Black</td>
<td>7.42%</td>
<td>6.92%</td>
<td>18.20%</td>
</tr>
<tr>
<td>Percent Female</td>
<td>51.26%</td>
<td>51.44%</td>
<td>52.12%</td>
</tr>
</tbody>
</table>

Sources: IPUMS-CPS; IPUMS-USA; Equality of Opportunity Project

A preliminary analysis of the data yields interesting summary statistics. Table 4
considers all seven birth cohorts across all fifty states. Here, the treatment group
includes the thirteen states with strong programs as listed in Table 2, and the control
group contains all states that implemented no statewide merit scholarship before 2004.
For example, the second column of the second row shows total personal income for all
those who were born in a treatment state regardless of whether their birth cohort was
exposed to the treatment.

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19 This excludes the District of Colombia, Puerto Rico, and Hawaii
This preliminary summary suggests that intergenerational economic immobility is highest among states with no merit-based scholarship programs implemented before 2004, which seems to contradict the hypothesis that economic mobility is stifled by strong merit-based aid programs due to the crowd out of minorities and low-income students.

Other interesting summary statistics also emerge. For example, I find that states with no merit scholarships have a higher proportion of non-Whites, and a significantly higher percent of Blacks, as shown in Table 4. The treatment states also have an underrepresentation of Hispanic students relative to states with weak or no scholarship programs. This difference in racial demographics could be indicative of the fact that these scholarship programs have been implemented largely throughout the Southern United States, where minorities are often underrepresented. In fact, with the exceptions of Nevada, Michigan and New Mexico, all scholarship programs that have been identified as ‘strong’ belong to states in the Southern Regional Education Board (SREB). This geographic concentration within the treatment group is important to consider as a potential threat to validity for this difference in difference analysis, as discussed in the Methodology section. Figure 3 illustrates how treatment assignment is closely linked to geography.
Figure 3: United States Map by Treatment Assignment

Table 5 demonstrates average educational attainment levels among 26-year-olds living in both treatment and control states at the time that the birth cohort reaches age 26. The rationale for choosing this age is to avoid excluding those who may have finished college slightly later than average. Descriptive statistics in Table 5 suggest that states with strong merit-based scholarship programs are associated with lower overall levels of educational attainment. College enrollment in treatment states is approximately 7 percentage points less than in control states. Likewise, associate and bachelor degree attainment in treatment states fall by approximately 8.5 and 7 percentage points respectively relative to control states.

Table 5: Educational Attainment by Treatment Assignment (Age 26)

<table>
<thead>
<tr>
<th>(Mean)</th>
<th>Strong Merit-Aid (Treatment Group)</th>
<th>No Merit-Aid (Control Group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s Degree (4 Years)</td>
<td>26.90%</td>
<td>33.85%</td>
</tr>
<tr>
<td>Associate’s Degree (2 Years)</td>
<td>35.29%</td>
<td>43.76%</td>
</tr>
<tr>
<td>College Enrollment</td>
<td>53.54%</td>
<td>60.85%</td>
</tr>
</tbody>
</table>

Source: IPUMS-USA
Table 6 summarizes the average levels of educational attainment in each state as of 1990, prior to any merit scholarship programs being introduced. This data is important to parse out the inherent differences in educational achievement between states rather than differences that may result from the merit scholarship programs. With this data, the educational attainment in the treatment states still consistently underperforms relative to control states, although the difference is smaller by approximately two to three percentage points. This suggests that the introduction of the programs causes strong merit scholarship states to experience an overall reduction in college enrollment that persists through college completion.

Table 6: Educational Attainment by Treatment Assignment (1990)

<table>
<thead>
<tr>
<th>(Mean)</th>
<th>Strong Merit-Aid (Treatment Group)</th>
<th>Weak Merit-Aid (Excluded)</th>
<th>No Merit-Aid (Control Group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s Degree (4 Years)</td>
<td>16.71%</td>
<td>23.93%</td>
<td>20.31%</td>
</tr>
<tr>
<td>Associate’s Degree (2 Years)</td>
<td>23.76%</td>
<td>32.96%</td>
<td>28.74%</td>
</tr>
<tr>
<td>College Enrollment</td>
<td>46.16%</td>
<td>57.44%</td>
<td>49.61%</td>
</tr>
</tbody>
</table>

Source: IPUMS-USA

This study also considers spending on welfare, social security income and education. Descriptive statistics regarding federal programs such as welfare and social security are provided in Appendix Exhibit E. Exhibit E provides additional summary statistics regarding government spending for each level of treatment in 1990, prior to any implementation of these policies, and in 2004, after all the treatment states have implemented the respective policies. The statistics illustrate that both before and after the years of policy implementation, those living in treatment states received a higher average level of social security income relative to those in weak or control states. Moreover, although average welfare income is larger in treatment states prior to the policy implementation, this trend reverses after the policies are implemented, and control states in fact provide a higher average level of welfare income to residents.
As discussed, one of the key motivations for studying lottery-funded scholarship programs is evidence in existing research to suggest that these programs cause states to spend less on education in the long-term due to an inflated sense of investment arising from lottery-funded merit scholarships. Table 7 shows the average difference in overall expenditure and collected revenue for various educational programs separated by policy exposure.

Table 7: Education Expenditure for Lottery-Funded States

<table>
<thead>
<tr>
<th>Treatment Status</th>
<th>Control</th>
<th>Weak</th>
<th>Strong (Non-LF)</th>
<th>Strong (LF)</th>
<th>Strong (Non-LF – LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Expenditure</td>
<td>$6,222,348</td>
<td>$11,577,111</td>
<td>$6,835,447</td>
<td>$6,304,375</td>
<td>7.769%</td>
</tr>
<tr>
<td>Total Elementary-Secondary Revenue</td>
<td>$6,084,945</td>
<td>$11,414,782</td>
<td>$6,627,911</td>
<td>$6,299,412</td>
<td>4.956%</td>
</tr>
<tr>
<td>Total Revenue from Federal Sources</td>
<td>$384,609</td>
<td>$823,918</td>
<td>$494,908</td>
<td>$515,760</td>
<td>-4.213%</td>
</tr>
<tr>
<td>Total Revenue from State Sources</td>
<td>$2,866,652</td>
<td>$5,577,568</td>
<td>$3,598,220</td>
<td>$3,342,051</td>
<td>7.119%</td>
</tr>
<tr>
<td>Spending for Instruction</td>
<td>$3,168,070</td>
<td>$6,106,570</td>
<td>$3,364,965</td>
<td>$3,155,261</td>
<td>6.232%</td>
</tr>
<tr>
<td>Spending for Support Services</td>
<td>$1,750,061</td>
<td>$3,200,691</td>
<td>$2,037,995</td>
<td>$1,802,854</td>
<td>11.538%</td>
</tr>
<tr>
<td>Spending for Other Elementary-Secondary Programs</td>
<td>$872,769</td>
<td>$1,684,887</td>
<td>$1,016,235</td>
<td>$855,647</td>
<td>15.802%</td>
</tr>
</tbody>
</table>

Note: LF = Lottery-Funded
Source: 2000 Public Elementary-Secondary Education Finance Data

The table demonstrates that on average, states with lottery-funded merit scholarships consistently spend less on education than states that fund merit scholarships through other means. This evidence reinforces the idea that citizens in these states are less likely to vote for increases in educational investments and due to the scholarships have an inflated sense of existing investment. Consequently, the state spends less on education overall, a trend that could conceivably impact state economic mobility, and income for all residents.
Some of the analysis in this paper will attempt to determine whether a causal relationship exists between state spending on such government assistance programs and lottery-funded merit scholarships.

VII. Methodology

The following analysis employs a quasi-experimental difference in difference approach, using the establishment of merit-based scholarship programs as natural experiments. This study uses longitudinal data from the Equality of Opportunity Project, the Current Population Survey and the American Community Survey to compare intergenerational economic mobility outcomes for treatment and control states before and after a statewide merit scholarship was established.

The treatment group contains all the states that adopted a ‘strong’ merit-based scholarship program before 2004 as defined in the background and per Dynarski (2004). It is important to define the treatment group in this way because including weak programs in the treatment or control groups could cause the effect of the policy to be underestimated. Therefore, the preferred specification limits analysis to states that have ‘strong’ programs or no programs at all, similar to the approach employed by Sjoquist & Winters (2012). Results for the impact of state-funded merit scholarships on economic mobility are shown to be robust to the inclusion of weak scholarship states in the treatment group (see Appendix Exhibit A). As anticipated, the coefficient attenuates toward zero since it is now also capturing the effect within states whose merit scholarships were too niche to impact most high school students or their college choices.

Notably, the preferred regression includes, in the treatment group, states that introduced strong merit scholarship programs before the 1980 birth cohort is expected to
have graduated high school. Seven of the thirteen treatment states implemented the program before 1998, therefore excluding these states would substantially reduce the sample size. However, the main findings are robust to excluding the single treatment states (See Appendix Exhibit D). Exhibit D excludes states for which all birth cohorts are assigned to either treatment or control. As expected, the coefficient of interest in Exhibit D has a significantly higher standard error due to the lower number of observations available in the regression. Excluding these states can help to determine whether the single treatment states are significantly different from the states that changed their policies around the time that the 1980-1986 cohorts graduated high school. The single treatment states are included in the preferred regression specification because these additional observations increase the economic power of the analysis.

The treatment group excludes all states in which programs were implemented after 2004 since by this time, the birth cohorts under analysis would have entered college or are assumed to have surpassed the age of eligibility for these programs. This exclusion is necessary because to identify a causal effect, the difference in difference approach requires that the policy be implemented within the years for which the outcome variable is measurable.

**Parallel Trends Assumption**

By nature of this observational setting, no control group is perfectly exchangeable with the treatment states. Instead, a key assumption of the difference in difference approach is that in the absence of the policy intervention, the treatment and control groups would evolve the same way on average. This concept is referred to as the parallel trends assumption. The difference between the observed outcome and the expected
outcome based on the parallel trends assumption is the estimated causal effect of the policy.

The validity of the parallel trends assumption is investigated below:

*Figure 4: Testing the Parallel Trends Assumption and Estimated Causal Effects of Policy Intervention*

The states represented in Figure 4 are separated based on the year in which they experienced the policy intervention. This allows for a direct visual comparison of the economic mobility in treatment states with the average mobility metric for the control group before and after the intervention. Figure 4 excludes any states for which there is not at least one pretreatment year available since this would not allow one to observe the change between the treatment and control group due to the policy intervention. As
shown, the parallel trends assumption does not hold strongly. That this assumption is violated implies that there may be some unobserved variable responsible for differences between the treatment and control groups.

**Preferred Regression Specification**

This study relies on a linear regression model that controls for time and state fixed effects, state and year trends, and some demographic covariates shown in Equation 1 below:

(Equation 1)

\[
Y = \beta_0 + \beta_1(policy) + \sum_{s=1}^{s=38} \beta_s(state_s) \\
+ \sum_{t=1980}^{t=1986} \beta_t(year_t) + \sum_{s=1}^{s=38} \beta_{st}(state_s \ast year trend) + \beta_2(covariates) + \epsilon_{st}
\]

In this equation, \(\beta_0\) is the baseline average of intergenerational economic immobility for all control states. The coefficient of interest, \(\beta_1\), is the difference between the expected outcome for economic mobility in the treatment group based on parallel trends, and the observed outcome after the policy change. *Policy* is an indicator variable that takes the value 1 if the birth cohort in that state was exposed to a statewide merit-based scholarship program at the age of eighteen and zero otherwise. The results for intergenerational mobility are robust to manipulations of this age as a determinant of the treatment assignment (see Appendix Exhibit B). This regression assigns treatment to all students to who were seventeen or younger when the policy intervention was in place.
This may be more accurate since those at age eighteen may have already applied to college by the time the policy was instituted. The results are consistent with this manipulation of the treatment assignment, suggesting that the findings are robust to changes in the treatment assignment age threshold.

The inclusion of fixed effects is to eliminate omitted variable bias from this analysis and to control for unobserved heterogeneity between states that is likely fixed over this period. $\beta_s$ represents state fixed effects, capturing time-invariant characteristics inherent to each state that may influence intergenerational mobility. Such characteristics could include low levels of agricultural resources, for example, which could limit the growth of the economy and consequently limit economic mobility. Notably, the preferred regression specification excludes all twelve weakly treated states, leaving only 38 state observations for each birth cohort. $\beta_t$ captures year fixed effects. These are state-invariant characteristics such as national unemployment rates, which could change over time and impact the intergenerational economic mobility.

$\beta_{st}$ represents the year trend for each state. This coefficient controls for the changes that are expected to have occurred within a state in the absence of the policy, assuming the intergenerational mobility had evolved linearly.

Finally, $\varepsilon_{st}$ captures the residual variation in the outcome that is not explained by these controls.

Other covariates are also included to ensure that the coefficient of interest does not capture the impact of characteristics that may differ between the treatment and the control group such as demographic makeup. This study controls for the percent of Whites and those of Hispanic origin in the state when the birth cohort reaches eighteen years old.
This age is chosen as a representative year for the demographic makeup of the state between when the child may have been exposed to the policy and when the child reaches age twenty-six, when their income rank is used to determine economic mobility.

These demographic conditions are controlled for because differences in racial composition in each state could foreseeably impact the outcome variable. At the extreme, for example, if a state were comprised entirely of one ethnicity that experiences consistent discrimination, opportunities for upward economic mobility may be nonexistent within the state.

The study does not control for any additional covariates because many potential controls such as personal income or employment rates may themselves be the mechanisms through which the merit scholarships affect economic mobility. Including these as controls could confound the estimated causal effect of the policy.

**Other Outcomes**

**Income and Education**

Beyond intergenerational economic mobility, the study also considers other outcomes including educational attainment and income.

Using IPUMS-ACS data, this analysis employs the main regression specification defined above, setting educational attainment outcomes and income as dependent variables. Exploring these additional outcomes may help to shed light on the mechanisms through which merit scholarships impact economic mobility.

This analysis is restricted to the income and college completion outcomes for each of the seven birth cohorts once they reach age 26. This age is chosen because it is the most salient time at which individuals are of income-earning age, and are also expected
to have completed college. Because the analysis is not concerned with the timing of college completion, choosing 26 instead of 23, for example, ensures that late graduates are not excluded from the results. Maintaining consistency with the state-level of other analysis in this paper, the percent of individuals in each birth cohort and each state that attained a given level of education by the age of 26 is computed. This percent is the value taken to be the dependent variable in the regression.

Throughout the analysis, raw income percentiles rather than log income are investigated due to the approximately normal distribution of average incomes at the state level (see Appendix Exhibit C). This satisfies the assumption of OLS, that the error for the response variable is approximately normally distributed. Additionally, percentiles rather than only average income for each state and cohort are computed to avoid the estimated causal effect of the policy intervention being inflated or underestimated due to the right-skewed nature of income at the individual level.

Due to the disparate racial profiles of award recipients and non-recipients, this study also considers educational outcomes by race, unlike much of the existing literature. This analysis of race makes use of the same main regression equation and sample data.

**State Spending**

Using IPUMS-CPS, this analysis also employs the main regression specification to investigate the impact of lottery-funded merit scholarships on various forms of government assistance programs such as welfare, social security income, unemployment benefits, and state income taxes for the median and 75th percentiles of earners. CPS data is used because in this analysis, state of residence is most important, with the expectation
being that state residents are most impacted by potential changes to the state budget that may arise from funding these scholarship programs.

To investigate this hypothesis, I determine the average of these rates for each birth cohort when they reach ages eighteen, nineteen, twenty and so on until they reach age twenty-eight. Rather than looking at one arbitrary year after the treatment, such as at age eighteen when the policy is first implemented, I look at many different ages because government services may not adjust immediately to the lottery scholarships. Because it is not clear how long the government services could take to respond to the policy, this method ensures that any delayed effects are captured.

**Synthetic Controls**

The control group for this analysis must satisfy three key assumptions of a standard difference in difference model for the results to be accurately interpreted. First, the model assumes that the implementation of merit-based scholarships is independent of intergenerational economic mobility. One might argue that in states where there are low levels of economic, the public is more sensitive to controversial policies such as state-funded merit scholarships. This public pressure might induce policy makers in these states to deliberately avoid or adopt merit scholarships. While this scenario is intuitively possible, to my knowledge, such lobbying pressure has not influenced the presence or absence of merit scholarships in these states, making the independence assumption seem reasonable for this study.

Second, the model assumes that there are no spillover effects. For example, one would have to assume that if the policy is implemented in Georgia, control group states are not affected. This is not a perfect assumption because if Georgia’s scholarship
program successfully encourages the most talented high schoolers to remain in state, neighboring control states may see a reduction in the top talent enrolling in their colleges each year. This could mean that students who would otherwise have been crowded out of colleges by out-of-state competition now have greater college choice and more opportunities for upward mobility. In this scenario, the spillover effect seems plausible, particularly considering a subset of research, described above, which finds evidence that merit-based scholarship programs impact cross-state migration for college.

Finally, the difference in difference approach assumes that the control states satisfy the parallel trends assumption. Because this assumption is shown to be weak, synthetic controls are created to investigate the causal effect without limiting the control group to the naturally observed average for intergenerational mobility. The synthetic controls are constructed by computing a weighted average of the control states that results in the most parallel pre-treatment trend for intergenerational mobility relative to treatment states. The analysis that includes synthetic controls necessarily excludes states in which all birth cohorts are assigned to either treatment or control. This is because the synthetic control requires at least one pre-treatment and post-treatment year to estimate a causal effect.

VIII. Results

Intergenerational Mobility

The results of the main specification are presented in the last column of Table 8. This specification includes only control and treatment states, while states with weak policies are excluded from the analysis. Treatment assignment is defined by whether the individual is exposed to the policy at age eighteen based on the year of the policy
implementation, and the individual’s birth state. The coefficient of interest is estimated to be approximately zero. For one percentile increase in parent income rank, child income changes by 0.0034 of a percentile less when he or she is exposed to the policy compared to when he or she is not exposed to the policy. Therefore, even if the parents were to move from the 25th to the 50th percentile, or the 50th to 75th percentile of income, child income would only move by less than one tenth of a percentile more when not exposed to the policy.

We might have expected to see a much larger coefficient because, as discussed in the background section of this paper, merit scholarships are awarded to hundreds of thousands of students within the state. The scale of state-funded merit scholarships makes it conceivable that the implementation of such a policy could have implications for mobility not only for individuals, but also for the state. This very small coefficient rules out the possibility that state-funded merit-based scholarships have a meaningful impact on intergenerational economic mobility across the entire state.

This finding is robust to multiple manipulations of the regression specification such as including all weak states in the treatment group, adjusting the treatment assignment to those cohorts exposed to merit-based scholarship programs at age seventeen instead of eighteen, and excluding strong treatment states for which all birth cohorts are assigned to only treatment or control (see Appendix Exhibits A, B and D).

Table 8: Impact of Merit scholarships on Intergenerational Economic Mobility

<table>
<thead>
<tr>
<th>Policy Intervention</th>
<th>0.00817</th>
<th>0.00141</th>
<th>0.00261</th>
<th>0.00410</th>
<th>0.00340</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.0146)</td>
<td>(0.0192)</td>
<td>(0.0192)</td>
<td>(0.0196)</td>
<td>(0.0196)</td>
</tr>
</tbody>
</table>
Educational Outcomes by Race

In addition to analysis for the main variable of interest, economic mobility, results from additional analysis are presented in Table 9, which presents the estimated effect of the policy on educational outcomes for Whites, Asians, Hispanics, Blacks, and the population overall in strong treatment states. The results imply that merit-based scholarship programs have essentially no impact on overall educational attainment levels. However, when decomposed by race, the analysis estimates a small, statistically significant adverse impact of merit scholarships on college enrollment for Blacks. The study suggests that due to the implementation of state-funded merit scholarships, college enrollment for Blacks falls by 1.35%. This persists directionally through college completion, and is directionally consistent with the estimated impact on other ethnic minorities.

That overall enrollment remains approximately unchanged, while enrollment of African Americans falls. This finding is consistent with the idea that ethnic minorities are being crowded out of in-state colleges to cater to the increased incentives for high achieving white students to matriculate into in-state, post-secondary institutions.
Table 9: Impact of Merit scholarships on Educational Attainment (by Race)

<table>
<thead>
<tr>
<th>Policy Intervention</th>
<th>College Enrollment</th>
<th>Associate’s Degree (At Least 2 Yrs.)</th>
<th>College Completion (Bachelor’s Degree)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(All)</td>
<td>-0.00660</td>
<td>0.0135</td>
<td>-0.000695</td>
</tr>
<tr>
<td></td>
<td>(0.0175)</td>
<td>(0.0190)</td>
<td>(0.0157)</td>
</tr>
<tr>
<td>(White)</td>
<td>0.00548</td>
<td>0.00809</td>
<td>0.00162</td>
</tr>
<tr>
<td></td>
<td>(0.0164)</td>
<td>(0.0179)</td>
<td>(0.0152)</td>
</tr>
<tr>
<td>(Asian)</td>
<td>-0.00472</td>
<td>-0.00165</td>
<td>-0.00217</td>
</tr>
<tr>
<td></td>
<td>(0.00515)</td>
<td>(0.00547)</td>
<td>(0.00420)</td>
</tr>
<tr>
<td>(Hispanic)</td>
<td>-0.00388</td>
<td>0.00376</td>
<td>-0.00135</td>
</tr>
<tr>
<td></td>
<td>(0.00590)</td>
<td>(0.00445)</td>
<td>(0.00369)</td>
</tr>
<tr>
<td>(Black)</td>
<td>-0.0135*</td>
<td>-0.000533</td>
<td>-0.00504</td>
</tr>
<tr>
<td></td>
<td>(0.00531)</td>
<td>(0.00470)</td>
<td>(0.00398)</td>
</tr>
</tbody>
</table>

Control Variables
- State and Year Fixed Effects: x x x
- State Year Trends: x x x

No. of Observations: 266 266 266

Note: * (p < 0.05), ** (p < 0.01), *** (p < 0.001)

Table presents the impact of merit scholarships on educational outcomes for each race and for the aggregate population in treatment and control states only. Weak policy states are excluded.

Impact on Income

All Treatment States:

The impact of merit scholarships on total personal annual income for all treatment states is estimated to be negative for those belonging to the bottom 25th percentile of earners. Specifically, merit scholarships are estimated to reduce total personal income for the bottom 25th percentile by US$1,736.5 relative to those in this income quartile who are not exposed to the policy. Although the result is not statistically significant, the relatively small standard error means that one can reject the possibility of a positive impact on
income resulting from this policy intervention. Similarly, overall average income is estimated to fall by approximately US$1,338.9 due to exposure to merit scholarships.

The impact of these policies on the median and 75th percentile of earners is inconclusive. However, the results are directionally consistent with the hypothesis presented in some of the existing literature that merit scholarships benefit higher-income earners while burdening low-income students.

Table 10: Impact of all Strong Merit-Based Scholarships on Income

<table>
<thead>
<tr>
<th>Policy Intervention</th>
<th>25th Percentile</th>
<th>50th Percentile</th>
<th>75th Percentile</th>
<th>Average Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1736.5</td>
<td>-509.5</td>
<td>165.6</td>
<td>-1338.9</td>
</tr>
<tr>
<td></td>
<td>(1167.8)</td>
<td>(979.1)</td>
<td>(1075.6)</td>
<td>(892.0)</td>
</tr>
</tbody>
</table>

State and Year Fixed Effects: x x x x

State Year Trends: x x x x

No. of Observations: 266 266 266 266

R-squared: 0.754 0.8583 0.828 0.8347

Adj. R-squared: 0.6457 0.7959 0.7522 0.7619

Root MSE: 2028.8 1700.9 1868.4 1549.7

Note: Table shows the impact of merit scholarships on 3 quartiles of income (USD). These have been aggregated from the individual level, using IPUMS-ACS data, to the state level. Results are shown to be insignificant, but directionally consistent with hypothesis. Only weak policy states excluded.

Lottery-Funded States:

As discussed previously, lottery-funded programs are analyzed for their impact on government spending, income, and educational outcomes. This analysis excludes states without lottery-funded scholarship programs. Under this specification, Table 11 shows that the estimated impacts are directionally consistent with those found when non-lottery funded states are included. As before, the merit scholarships are estimated to have the
most adverse impact on the bottom 25th percentile of earners, and essentially no impact on state economic mobility or overall college enrollment and completion. Unlike in the non-lottery-funded cases, the evidence also suggests that merit scholarships have a negative effect on all earners.

This negative impact on income across the spectrum might be anticipated. Research has shown that residents in states with lottery-funded scholarships tend to vote more strongly against proposals to increase educational investments due to the false sense of investment that arises specifically from lottery-funded merit scholarships. This false sense of investment arises because unlike taxes, which require only 1 cent of each dollar to collect, it is little known that 66 cents of every dollar paid to the lottery is used to cover overhead costs. Based on voting behavior, the assumed perception among state residents is that hundreds of millions in lottery revenue is invested directly into education. It is conceivable that if states experience public pressure to invest less in education relative to states that fund merit scholarships through taxpayer money, then income across all earners might suffer, as observed.

It is important to note that the small sample size, which includes only eight treatment states rather than thirteen, inflates the standard errors, making conclusive claims about the impact of lottery-funded merit scholarships on income and education outcomes somewhat elusive.

Table 11: Impact of Lottery-Funded Scholarship Programs on Economic Mobility, Income and Education

<table>
<thead>
<tr>
<th>Effects of Lottery-Funded Merit-Aid</th>
<th>Difference-in-Difference Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: State Immobility (Rank-rank Specification)</td>
<td></td>
</tr>
</tbody>
</table>

Impact of Lottery Funding on Government Spending and Revenue

Table 12 demonstrates how lottery-funded scholarship programs may impact state spending and taxes. As an example, the final row in column 2 of Table 12 suggests that by the time these birth cohorts reach age twenty-eight, residents in lottery-funded scholarship states pay approximately US$206.00 less in state income taxes on average than in states not exposed to any such policy.

Overall, merit-based scholarships do not appear to have meaningful or persistent adverse impacts on government assistance programs such as social security, welfare (see Appendix Exhibit F), or state taxes. However, in the short-term, when these cohorts graduate from high school and are first exposed to the scholarships, state residents experience a statistically significant drop in unemployment benefits by an estimated US$42.00 relative to residents in treatment states. This is a relatively small annual impact given that unemployment benefits can range from US$260 to approximately US$1,000 per week.21 It is important to note that this reduction in unemployment benefits could have two drivers. First, the benefits may rise or fall proportional to unemployment. When

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there are high levels of unemployment, these benefits are expected to rise, and when
unemployment rates are low, these benefits are expected to fall according to need.
However, the benefits may also be driven by state-level decisions to reduce funds spent
on unemployment due to changes in other government programs.

To investigate this further, employment rates are also studied. The evidence
indicates that only when treated students first enter the labor force at the age of twenty-
two, do residents in treatment states experience a statistically significant, 2.30% increase
in employment relative to those living in control states. This may be consistent with the
idea that these scholarship programs induce academically talented students to remain in
state and contribute meaningfully to the economy once they graduate from college.

Given that in the short term, there is little impact of the scholarships on
employment (except possibly a negative impact), the evidence implies that the short-term
reduction in unemployment benefits is driven more by state-level decisions rather than
reduced need. The finding that unemployment benefits fall slightly in the short term even
though the boost to employment is not observed until the treated cohorts graduate at age
twenty-two, is consistent with the idea that other state level government assistance
programs may be reduced when lottery revenue is repurposed towards education.

*Table 12: Estimated Impact of Merit scholarships on Government Spending*

<table>
<thead>
<tr>
<th>Age</th>
<th>State Income Tax (Avg.)</th>
<th>IT for 50th Percentile</th>
<th>IT for 75th Percentile</th>
<th>Unemployment Benefits</th>
<th>Employment Rates (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>66.69</td>
<td>13.63</td>
<td>33.98</td>
<td>-42.15*</td>
<td>-0.761</td>
</tr>
<tr>
<td>19</td>
<td>49.42</td>
<td>10.40</td>
<td>102.5</td>
<td>-16.52</td>
<td>-1.491</td>
</tr>
<tr>
<td>20</td>
<td>40.59</td>
<td>6.154</td>
<td>104.2</td>
<td>-3.387</td>
<td>-0.918</td>
</tr>
<tr>
<td>21</td>
<td>-63.9</td>
<td>-17.43</td>
<td>-66.27</td>
<td>23.20</td>
<td>1.905*</td>
</tr>
<tr>
<td>22</td>
<td>-96.89</td>
<td>-12.44</td>
<td>-127.6</td>
<td>13.54</td>
<td>2.292**</td>
</tr>
<tr>
<td>23</td>
<td>38.01</td>
<td>2.106</td>
<td>-35.10</td>
<td>-29.37</td>
<td>-0.252</td>
</tr>
<tr>
<td>24</td>
<td>-20.87</td>
<td>6.381</td>
<td>-25.72</td>
<td>-12.54</td>
<td>-0.683</td>
</tr>
<tr>
<td>25</td>
<td>33.34</td>
<td>2.568</td>
<td>100.8</td>
<td>-13.54</td>
<td>-0.757</td>
</tr>
</tbody>
</table>
### Synthetic Controls

As discussed, synthetic controls are generated to estimate the effect of merit scholarships on economic mobility, with additional flexibility in defining the control group so that it is more comparable to the treatment group and may satisfy the parallel trends assumption more closely. Figure 5 presents the effect of the merit scholarships on intergenerational mobility in all states for which there is at least one pre-treatment year and one post-treatment year.

<table>
<thead>
<tr>
<th></th>
<th>19.78</th>
<th>-1.833</th>
<th>36.04</th>
<th>28.58</th>
<th>-0.704</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>205.9**</td>
<td>-1.328</td>
<td>38.54</td>
<td>28.80</td>
<td>-0.994</td>
</tr>
<tr>
<td>28</td>
<td>-206.4*</td>
<td>-6.709</td>
<td>-243.6*</td>
<td>20.91</td>
<td>0.443</td>
</tr>
</tbody>
</table>

Notes: * (p < 0.05), ** (p < 0.01), *** (p < 0.001); IT = State Income Tax; Table demonstrates the impact of merit scholarships on state income taxes and government assistance programs only for states in which the scholarship is funded by state lottery revenues (231 observations across 33 control and treatment states).
Figure 5 suggests that, with the exceptions of Michigan and Kentucky, there is no sufficient weighting of the control states such that the parallel trends assumption holds strongly prior to the policy intervention. Nonetheless, the average causal effect of the policy is computed. Using synthetic controls, the estimated positive impact of merit scholarships on intergenerational economic immobility is greater relative to the previous analysis. The results in Table 13 suggest that when parents move from the 50th to 75th percentiles of income, for example, children exposed a state merit scholarship would move approximately 1.7 percentiles less in income relative to their peers who were not exposed to the scholarship at age eighteen (when excluding Kentucky).
<table>
<thead>
<tr>
<th></th>
<th>All 6 States</th>
<th>5 States*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>0.0129</td>
<td>0.0675</td>
</tr>
<tr>
<td><strong>Standard Error</strong></td>
<td>0.0072</td>
<td>0.0037</td>
</tr>
</tbody>
</table>

Note: Table shows average estimated treatment effect when all six states are included, and when (*) excluding Kentucky, which has only 1 pre-treatment year.

IX. Discussion and Conclusion

The programs analyzed in this paper are motivated largely by ambitious policymakers attempting to spur academic achievement among high schoolers, increase talent retention in their states, and possibly improve college access and choice for low-income students. The fact that the literature has yet to reach a strong consensus regarding the impact of these scholarships on key outcomes such as income, college graduation rates, or long-term economic mobility, makes this study highly relevant to policy discussion.

While this analysis benefits greatly from recently published data by the Equality of Opportunity Project, much of the data available remains imperfect. Specifically, the data provides a smaller sample size than desired, and restricts the ability to define an ideal control group that satisfies all the key assumptions of a difference in difference analysis. These natural limitations on the observational data result in a lack of desired economic precision for many of the outcomes studied in this paper, and make conclusive claims regarding the impact of these merit scholarships difficult to attain.

Fortunately, the data provided is certainly not devoid of insight, and may offer some suggestions for policymakers going forward. Although the direct impact of scholarships on economic mobility is inconclusive, there is statistically significant evidence to suggest that the college enrollment of African Americans is adversely impacted by the implementation of state-funded merit scholarships. Moreover, the
analysis presents multiple pieces of suggestive evidence that the bottom 25th percentile of earners both in lottery-funded and non-lottery-funded states bear the greatest income loss because of the programs. Finally, preliminary descriptive statistics imply that lottery-funded programs do in fact lead to a reduced investment in overall education for the state.

Because these scholarship programs were enacted in the 1990s, many may be inclined to overlook these policies even though they impact thousands of students who become eligible for these scholarships every year. The lack of experimental data is a major obstacle to determining whether these scholarships have accomplished what they set out to do almost three decades ago. Based on the suggestive evidence presented in this paper, and the existing literature, policymakers and the public may benefit greatly from implementing pilot scholarship programs at the local high-school level before implementing them statewide. This additional data would provide a much larger sample size, with more comparable control groups and consequently a more robust analysis of how these programs impact long-term outcomes for students.

Other avenues for further research should also be pursued, particularly into how lottery-funded programs affect government spending on other educational programs. Because the lottery-funded programs tend to be the most prestigious, and most well-known, evidence to suggest that the proceeds are in fact not a free source of revenue, but rather a human capital tax on the entire state could be extremely meaningful for voters. As tuitions rise, college attendance becomes more common, and lottery proceeds more unpredictable, these scholarship programs may no longer be the best way to service all students fairly.
Certainly, some aspects of state merit scholarships seem to stand in the argument for maintaining the merit scholarships. The incentive design is extremely successful in encouraging high academic achievement among high school students, which is a valuable contribution to ensuring students make the most of the resources available to them.

The importance of studying these policies cannot be overstated, particularly in states where billions of dollars in lottery revenue could be spent on funding more salient programs such as need-based financial aid, children’s healthcare or greater investment in K-12 education, for instance. Although the data limitations in this study prevent firmly conclusive claims regarding the magnitude of some seemingly unintended consequences of merit scholarships, I believe there is sufficient doubt cast on the merit of state-funded scholarships for politicians and the public to take a closer look at how they are affecting the American Dream for high school students across the country.
X. Appendix

Exhibit A: Robustness Check - Including Weak States in the Treatment Group

Table 14: Estimated Effect of Scholarships on Economic Mobility when Including Weak States in the Treatment Group

<table>
<thead>
<tr>
<th>Policy Intervention</th>
<th>0.00875</th>
<th>-0.00103</th>
<th>-0.00103</th>
<th>-0.000357</th>
<th>-0.000568</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.00969)</td>
<td>(0.0120)</td>
<td>(0.0120)</td>
<td>(0.0121)</td>
<td>(0.0121)</td>
</tr>
<tr>
<td>State and Year Fixed Effects</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>State Year Trends</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent White</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent Black</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.7408</td>
<td>0.8489</td>
<td>0.8489</td>
<td>0.8497</td>
<td>0.8506</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.6913</td>
<td>0.7839</td>
<td>0.7839</td>
<td>0.7832</td>
<td>0.7837</td>
</tr>
<tr>
<td>Root MSE</td>
<td>0.03486</td>
<td>0.02916</td>
<td>0.02916</td>
<td>0.02921</td>
<td>0.02918</td>
</tr>
</tbody>
</table>

Exhibit B: Robustness Check - Assigning Treatment to 17 Year Olds

Table 15: Estimated Effect of Scholarships when Assigning Treatment to 17 Year Olds

<table>
<thead>
<tr>
<th>Policy Intervention</th>
<th>0.00490</th>
<th>0.00440</th>
<th>0.00456</th>
<th>0.00452</th>
<th>0.00420</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.0131)</td>
<td>(0.0169)</td>
<td>(0.0169)</td>
<td>(0.0169)</td>
<td>(0.0169)</td>
</tr>
<tr>
<td>State and Year Fixed Effects</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>State Year Trends</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent White</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Percent Black</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>266</td>
<td>266</td>
<td>266</td>
<td>266</td>
<td>266</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.6627</td>
<td>0.8025</td>
<td>0.804</td>
<td>0.8042</td>
<td>0.805</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.5955</td>
<td>0.7156</td>
<td>0.7162</td>
<td>0.7149</td>
<td>0.7145</td>
</tr>
<tr>
<td>Root MSE</td>
<td>0.03975</td>
<td>0.03333</td>
<td>0.03329</td>
<td>0.03337</td>
<td>0.03339</td>
</tr>
</tbody>
</table>
Exhibit C: Testing for Normal Distribution of Income

Figure 6: Testing for normal distribution of income across states and birth cohorts

Exhibit D: Robustness Check - Excluding States Without Treatment Variation

Table 16: Robustness Check - Excluding States Without Treatment Variation
**Exhibit E – Descriptive Statistics: Federal Spending**

Table 17: Summary of Federal Spending by Treatment Type

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Weak</td>
</tr>
<tr>
<td>Social Security</td>
<td>1107.406</td>
<td>960.1608</td>
</tr>
<tr>
<td>Welfare</td>
<td>59.87427</td>
<td>109.4951</td>
</tr>
</tbody>
</table>

Source: IPUMS-CPS

**Exhibit F – Federal Spending (Main Regression)**

Table 18: Impact of Merit-Scholarships on Social Security and Welfare Spending

<table>
<thead>
<tr>
<th>Age</th>
<th>Social Security</th>
<th>Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>92.64</td>
<td>-2.145</td>
</tr>
<tr>
<td>19</td>
<td>77.85</td>
<td>-1.481</td>
</tr>
<tr>
<td>20</td>
<td>204.7*</td>
<td>-11.39</td>
</tr>
<tr>
<td>21</td>
<td>-48.88</td>
<td>-11.25</td>
</tr>
<tr>
<td>22</td>
<td>-157.4</td>
<td>0.920</td>
</tr>
<tr>
<td>23</td>
<td>-135.8</td>
<td>11.58</td>
</tr>
<tr>
<td>24</td>
<td>35.10</td>
<td>10.29</td>
</tr>
<tr>
<td>25</td>
<td>119.6</td>
<td>-3.083</td>
</tr>
<tr>
<td>26</td>
<td>22.32</td>
<td>-7.848</td>
</tr>
<tr>
<td>27</td>
<td>54.95</td>
<td>-1.452</td>
</tr>
<tr>
<td>28</td>
<td>-77.82</td>
<td>-0.369</td>
</tr>
</tbody>
</table>

Notes: * (p < 0.05), ** (p < 0.01), *** (p < 0.001); Table demonstrates the impact of merit scholarships on state government assistance programs only for states in which the scholarship is funded by state lottery revenues (231 observations across 33 control and treatment states).
XI. References


