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Institutional Resources or Changing Compositions? Unpacking Neighborhood Effects on Education

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Children in neighborhoods marked by concentrated poverty and racial isolation face persistent educational barriers, yet the mechanisms underlying neighborhood effects remain poorly understood. This study employs a multi-method analysis of the Near North Side Choice Neighborhoods Initiative (CNI) in St. Louis, Missouri—the nation's largest mixed-income redevelopment program—to unpack two core mechanisms: institutional resources and compositional changes. Using nine years of student-level administrative data, we apply a Callaway and Sant'Anna Difference-in-Differences model to estimate academic effects, Synthetic Control Models to assess displacement and demographic change, and Exploratory Spatial Data Analysis to trace mobility patterns. Results reveal large, significant gains in ELA and Math for students residing in and attending CNI schools, operating on distinct timescales. Critically, these gains occurred without racial compositional changes, directly challenging the assumption that demographic diversification is a necessary precondition for mixed-income redevelopments to improve educational outcomes for Black children.

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INSTITUTIONAL RESOURCES OR CHANGING COMPOSITIONS? UNPACKING NEIGHBORHOOD EFFECTS ON EDUCATION

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ABSTRACT. Children in neighborhoods marked by concentrated poverty and racial isolation face persistent educational barriers, yet the mechanisms underlying neighborhood effects remain poorly understood. This study employs a multi-method analysis of the Near North Side Choice Neighborhoods Initiative (CNI) in St. Louis, Missouri—the nation's largest mixed-income redevelopment program—to unpack two core mechanisms: institutional resources and compositional changes. Using nine years of student-level administrative data, we apply a Callaway and Sant'Anna Difference-in-Differences model to estimate academic effects, Synthetic Control Models to assess displacement and demographic change, and Exploratory Spatial Data Analysis to trace mobility patterns. Results reveal large, significant gains in ELA and Math for students residing in and attending CNI schools, operating on distinct timescales. Critically, these gains occurred without racial compositional changes, directly challenging the assumption that demographic diversification is a necessary precondition for mixed-income redevelopments to improve educational outcomes for Black children.

KEYWORDS: Neighborhood Effects; Choice Neighborhood Initiative; Institutional Resources; Racial Composition.

INTRODUCTION

Children who grow up in neighborhoods marked by concentrated poverty and racial isolation face persistent structural barriers that shape their educational opportunities and, ultimately, their educational outcomes (Wilson, 2012; Johnson Jr., 2012). This is especially true in neighborhoods with distressed public housing (Chyn, 2018). Moreover, these neighborhood effects can endure throughout the life course. Indeed, research has consistently demonstrated that when children leave high-poverty neighborhoods and distressed public housing, they experience better educational, economic, and health outcomes into adulthood (Chetty, Hendren, & Katz, 2016; Chyn, 2018).

However, while early policy responses to concentrated poverty and racial isolation focused on individual people and choices (e.g., through the provision of housing vouchers), these responses only addressed the needs of a select group of people—the individuals who were able to obtain housing vouchers and use them to secure better housing and schooling opportunities for their children. Embodied by neoliberal logics of individualism, choice, and market responses to social problems, these poverty-dispersal policies not only failed to improve educational opportunities in origination neighborhoods but may have actually worsened educational opportunities in these neighborhoods—as select individuals left, taking their social, human, and financial capital with them.

In response to the shortcomings of people-focused poverty dispersal policies, policymakers have increasingly turned to mixed-income initiatives, which combine people-based strategies with place-based housing and neighborhood redevelopment to minimize some of the root causes of poverty, while providing an array of neighborhood opportunities related to parents' employment, along with children's education, health, and safety. Mixed-income initiatives allow for a unique understanding of neighborhood effects, as they include exogenous changes in the neighborhoods themselves, as opposed to the effects of people changing neighborhoods, as seen in mobility experiments. Furthermore, given the multi-pronged nature of these initiatives, there is an opportunity to understand the central mechanisms driving the intervention effects, helping to resolve one of the central challenges in the neighborhood effects literature—that the effects often remain a “Black Box” (Sampson, 2012).

This paper addresses these gaps in the knowledge base through a multi-method analysis of the Choice Neighborhood Initiative (CNI) in St. Louis, Missouri, focusing on its educational, compositional, and mobility-related effects. The CNI represents a mixed-income redevelopment initiative (e.g., redeveloping distressed public housing units for a mix of market-rate and subsidized tenants, while improving neighborhood amenities to attract more economically and racially diverse families), yet it is unknown whether changes in student performance reflect family, school, and neighborhood resources, or effects stemming from compositional changes resulting from selective out- and in-migration and gentrification (Pearman, 2019).

Using longitudinal administrative records from the Missouri Department of Elementary and Secondary Education (DESE), we first estimate the effects of the CNI on the academic performance of students living in the CNI neighborhood *and* attending the CNI partnering schools through an advanced difference-in-difference method developed by Callaway & Sant’Anna (2021), which leverages matching to construct a more plausible counterfactual, while also providing dynamic effects to understand differences among original residents and newcomers. Estimating both neighborhood and school effects is exceedingly important in school choice environments, like St. Louis, as more advantaged families in these contexts may forgo neighborhood schools (Keels et al., 2013). Next, we leverage Synthetic Control Models (SCM) to assess both displacement and potential compositional mechanisms at play through comparisons of racial/ethnic changes in the CNI neighborhood and partnering schools to a synthetic combination of surrounding neighborhoods and schools. Finally, we employ exploratory spatial data analysis (ESDA) to trace neighborhood and school mobility patterns within and beyond the CNI neighborhood and partnering schools to understand broader effects on neighborhood and school diversity.

In the next section, we provide a review of the neighborhood effects literature, with a particular focus on people-based, place-based, and mixed-income initiatives. This section is followed by an overview of related theoretical frameworks and our study contexts.

PREVIOUS LITERATURE

Neighborhood effects on children are often understood through (1) people-based mobility initiatives—in which families move to new neighborhoods and (2) place-based redevelopment initiatives—in which the neighborhoods themselves are redeveloped, and new families move in, and (3) mixed-income initiatives – in which people-based and place-based strategies are pursued in tandem to provide a comprehensive solution to issues of concentrated poverty. We describe these initiatives below, highlighting the outcomes of children.

Mobility Initiatives

Gautreaux I and II

The *Gautreaux Assisted Housing Program* originated in Chicago following a 1966 lawsuit (*Gautreaux v. Chicago Housing Authority*), which found that the Chicago Housing Authority and the U.S. Department of Housing and Urban Development (HUD) had intentionally segregated public housing by race. As part of the court-ordered remedy, HUD was required to provide

Section 8 housing vouchers enabling eligible low-income Black families to relocate from segregated public housing developments into racially integrated suburban neighborhoods (Rosenbaum, 1995). The program, implemented in the 1970s and 1980s, became the first large-scale housing desegregation initiative in the United States and a prototype for later mobility programs.

As summarized by Johnson Jr. in his review of mobility initiatives and education outcomes (2012), children who relocated to the suburbs were more likely to stay in school, take college-track courses, and attend 4-year colleges. Here, institutional resources could potentially explain these outcomes, as suburban movers attended schools with higher test scores (Briggs et al., 2008), higher standards, and more educational supports (Rosenbaum et al., 1988). Decreased poverty from movers could also explain these outcomes, as suburban movers also worked more and spent less time on government assistance programs (Mendenhall, DeLuca, and Duncan, 2006). Nevertheless, the nature of Gautreaux and its focus on suburban moves made it difficult to isolate institutional resources. Indeed, increased peer pressure to go to college was also observed (Kaufman & Rosenbaum, 1992).

MTO

While *Gautreaux* represented a quasi-experimental study in its design, the *Moving to Opportunity* (MTO) demonstration, launched by HUD between 1994 and 1998 in five U.S. cities (Baltimore, Boston, Chicago, Los Angeles, and New York), marked the federal government's first experimental study of residential mobility. Eligible families living in public housing were randomly assigned to one of three groups: (1) an "experimental" group receiving vouchers restricted to low-poverty neighborhoods (below 10% poverty) plus relocation counseling; (2) a "Section 8" group receiving unrestricted vouchers; and (3) a control group receiving no additional assistance beyond their existing housing support (Goering & Feins, 2003). However, as summarized by Clampet-Lundquist & Massey (2008), high levels of racial/ethnic segregation were a persistent challenge in MTO: the majority of MTO families relocated to more segregated areas. Moreover, while there were some improvements in destination schools (Ladd and Ludwig 2003), many MTO families chose to keep their children in their original schools (Briggs et al. 2008). Unsurprisingly, most MTO children remained in schools that were highly segregated by race and income (Sanbonmatsu et al., 2006).

Consequently, early evaluations of MTO found limited and mixed results on children. Sanbonmatsu and her colleagues (2006) found no significant gains in test scores or school engagement. Potentially explaining these null results, Ludwig et al. (2013) found positive effects for girls but negative effects for boys. Notably, Chetty and his colleagues (2016) found positive effects on college attendance, earnings, and family stability, but only for children who moved before the age of 13, representing a dosage effect. Nevertheless, similar to Gautreux, it is difficult to fully unpack neighborhood effects into institutional resources and compositional effects.

Place-Based Initiatives

Harlem Children's Zone

Place-based intervention strategies target limited resources toward specific geographic areas with the goals of concentrating investments over time in order to address complex community issues. Targeted investments toward comprehensive educational, school, and community development is a unique approach embedded in programs such as the Harlem Children's Zone (HCZ), Promise Neighborhoods, and Promise Zones.

The HCZ was formed in 1997 to address problems facing impoverished children such as poor schooling, housing issues, crime, and asthma (Dobbie, & Fryer Jr, 2011). The initiative envisioned providing services for students from birth until graduation (Dobbie, & Fryer Jr, 2011). The goal of HCZ was to enhance the quality of life of 13,000 residents, living across 24-blocks in Harlem, through health and well-being (Nicholas et al., 2005). By 2004 the HCZ was a 64-block initiative and by 2007 it was a 97-block initiative (Dobbie, & Fryer Jr, 2011). HCZ offers an array of programs for youth and their families. Some of these programs include: tax preparation, college consultation office, public, middle, and high school programming, and health care programs (Dobbie, & Fryer Jr, 2011). In their study of the Harlem Children's Zone (HCZ), Dobbie and Fryer (2009) found that student academic achievement was largely driven by school efforts, specifically the development of a charter school within the zone, and that community supports alone were not significant predictors of education gains in math and English language arts. However, the authors were unable to "disentangle whether communities coupled with high-quality schools drive our results, or whether the high-quality schools alone are enough" (Dobbie & Fryer Jr, 2009, p. 4).

Promise Neighborhoods/Zones

Based on the success of the Harlem Children's Zone, two place-based education programs emerged: the federal Promise Neighborhoods Initiative and the Promise Zones Program. Promise Zones and Promise Neighborhoods were both federal initiatives designed to help improve the quality of education, health and well-being, and economic opportunities within disadvantaged neighborhoods and local schools. Core principles of the programs included selecting a specific geographic area to work comprehensively and at scale, creating a pipeline of support for children and families, building community among residents, evaluating outcomes to assess program effects and improve decision making, and cultivating a culture of success through collaboration (Harlem Children's Zone, 2009). Each program was designed to make substantial changes to the social, physical, and cultural environment within the target area by providing uninterrupted support at the individual, family, and community levels (Harlem Children's Zone, 2009).

The federal Promise Neighborhoods initiative was initiated in 2010. This federal program leveraged community support to improve educational and developmental outcomes for children (Center for the Study of Social Policy, 2018), and empowered communities to transform neighborhoods into places of opportunity. Specifically, the Promise Neighborhoods goal was to ensure that children have equitable opportunity for schooling, including this cradle-to-career approach that focuses on providing early learning, college and career preparation services to children and youth (Hulsey, Esposito, Boller, Osborn, 2015). The Promise Neighborhoods program is administered through the Department of Education, which has allocated 98 planning and implementation grants since 2010.

The Promise Zones initiative was developed in 2014 with a focus on education, economic activity, employment, crime, and private investment in target areas (Center for the Study of Social Policy, 2013). The program was administered through the U.S. Department of Housing and Urban Development (HUD). Through three rounds of funding, 22 Promise Zone communities across the U.S. have worked to address the needs of students attending schools in disinvested communities. While research on educational outcomes have yet to be produced, Kitchens and Wallace (2022) found significant increases in property values resulting from the Promise Zone in Los Angeles, CA.

Mixed-Income Initiatives

HOPE VI

The Housing Opportunities for People Everywhere (HOPE VI) program was established by the U.S. Department of Housing and Urban Development (HUD) in 1993 to transform distressed public housing. The HOPE VI program focused on mixed-income housing redevelopment, while providing supportive services to residents during the demolition and redevelopment phases. Despite HOPE VI's goals of providing housing opportunities to people *everywhere*, original residents faced obstacles in finding suitable housing during the redevelopment phase, as well as difficulties eventually returning to the redeveloped site, which limited educational opportunities and outcomes for children.

Even though families living at the housing sites targeted for redevelopment were offered housing vouchers to assist with relocation, only about one-third of HOPE VI families utilized housing vouchers; rather, many families moved to other public housing sites or moved without assistance, which limited families' ability to move to neighborhoods with low levels of poverty (Buron et al., 2002; Popkin et al., 2004). Moreover, many families who used vouchers also faced difficulties in relocating to neighborhoods with low levels of poverty—particularly families that were deemed "hard to house" (e.g., large families, etc.) (Popkin et al., 2009). Furthermore, even when voucher recipients moved to lower-poverty neighborhoods, these neighborhoods often remained racially segregated (Goetz, 2010; Popkin et al., 2009). In addition to relocation difficulties, return difficulties were also documented: reports from the *HOPE VI Panel Study* found that although 70% of families preferred to return to the redeveloped housing, only half of these families (36%) actually moved back (Popkin et al., 2004, 2009). Concerning family support services, there is evidence of variability in the type, amount, quality, and availability of family support services within HOPE VI, which has led some research to suggest that these services were largely ineffective (Gress et al., 2019).

Thus, it is unsurprising that positive education outcomes were not widely observed for HOPE VI children. While Popkin et al. (2004) found some improvements in school quality among HOPE VI voucher recipients, not all families used vouchers, which can be seen as limiting educational opportunities for HOPE VI children. Nevertheless, as noted by Jabbari et al. (2024), some HOPE VI sites made intentional efforts to partner with nearby schools in an effort to improve the education outcomes of HOPE VI children. Most notably, Turbov and Piper (2005) found that HOPE VI sites that made educational investments in instruction, while positioning schools as community anchors, experienced more positive educational outcomes. Similarly, Comrie (2018) found positive education outcomes through intentional school partnerships. Additionally, Varady and colleagues (2005) found that effective school partnerships could also be successful in attracting middle-income families.

Choice Neighborhoods Initiative (CNI)

The Choice Neighborhoods Initiative (CNI) replaced HOPE VI in 2009 and included an expanded focus on neighborhoods (as implied by its name), providing substantial funding ($25-50 million) for critical community improvement projects and requiring local housing authorities to collaborate with community stakeholders to permanently increase neighborhood services. Moreover, unlike HOPE VI, intentional efforts for educating children and youth became an explicit goal of the CNI (Pendall & Hendey, 2013; Pendall et al., 2016). As noted by Jabbari et al. (2024), the CNI also includes several policy mechanisms that attempt to increase resident return rates (e.g., *right-to-return* policy for original residents, *one-for-one* affordable housing unit replacement policy, etc.), which can increase their opportunities to reap the rewards of the mixed-income redevelopment. At the same time, the CNI helps address the difficulties of finding suitable housing during the redevelopment process by pairing housing choice vouchers with more robust individualized case management services that occur six months prior to redevelopment and extend throughout the duration of the project, regardless of relocation. Additionally, CNI services expanded the focus on economic self-sufficiency to include a focus on education as well.

Despite decades of implementation, there is little empirical evidence on the impacts of the CNI. Most of the research, to date, comes from the Memphis CNI. Concerning mobility, research by Chun et al. (2025), found that higher level of involvement with case management services was positively associated with moving to a higher-income neighborhood during the redevelopment process, as well as returning to the revitalized neighborhood afterwards. Additionally, Foell et al. (2025) found that families who moved out of the CNI zip code improved their neighborhood quality compared to families who stayed. Finally, Jabbari et al. (2025) found that attending a CNI school significantly decreased punishment, while receiving case management services significantly increased reading performance. However, dynamic modeling revealed that the effects on academics were short-lived, while the effects on punishment were more durable. While the latter findings provide some evidence of institutional resources, the authors could not rule out neighborhood and school compositional changes.

THEORETICAL FRAMEWORKS

Intended Consequences

The enduring effects of neighborhoods on children's educational outcomes have long been demonstrated in the literature (Johnson, Jr., 2012; Chyn, 2018; Chetty, Hendren, & Katz, 2016). However, given the strong link between social class, race/ethnicity, and school and neighborhood resources (Raudenbush et al., 1998; Darling-Hammond, 2004), it is often difficult to fully unpack the effects of neighborhoods on children. Indeed, research from MTO found few differences in school quality among the treatment group (i.e., voucher recipients) (Sanbonmatsu, 2006), despite long-term positive effects on students. While there are multiple potential mechanisms at play in the effects of neighborhoods on children, three theoretical explanations are particularly salient in mixed-income neighborhood redevelopment initiatives: Institutional Resources, Compositional Effects, and Residential and School Attainment.

Institutional Resource Theory

Neighborhood investments can be understood from an institutional resource perspective (Arum, 2000), in which resources provided to institutions can in turn provide opportunities to individuals who interact with these institutions within neighborhood contexts. In the case of mixed-income redevelopment initiatives, like the CNI, neighborhood investments are achieved through transformation projects (e.g., new public parks, small business development, early childhood education centers, and job-training programs, etc.), housing redevelopment (e.g., tearing down dilapidated public housing units and building single-family units), and school programming (e.g., new curriculums, tutoring and mentoring services, college preparation programs, and extracurricular activities, etc.). These resources, which can lead to improved neighborhood, home, and school conditions, increase opportunities to learn across multiple interrelated contexts, and can ultimately lead to increased academic performance. As institutional resources may be more or less effective in particular contexts (Dobbie & Fryer, 2011), demonstrating the effectiveness of both neighborhood and school resources is an important aspect of testing institutional resource theory.

Compositional Effects

Research has consistently demonstrated that racially segregated schools lower achievement for Black students (Hanushek et al., 2009). Indeed, a meta-analysis of racial composition studies supports this finding (Mickelson et al., 2013). In the case of mixed-income neighborhood redevelopment initiatives, housing redevelopment involves replacing distressed public housing units with a mix of “market rate” and subsidized single-family housing that can—in theory—meet the preferences for a variety of income levels. Here, it is theorized that mixed-income housing will lead to mixed-income, racially diverse neighborhoods, as well as mixed-income, racially diverse schools. Through increased social class and racial/ethnic diversity, lower-income students and families may be able to develop new relationships with higher-income students and families, representing social capital formation, which can ultimately increase academic achievement (van Ewijk & Sleegers, 2010) and social mobility (Chetty, 2022). Thus, changing compositional effects—increased socio-economic and racial diversity—may increase academic achievement for CNI students.

Residential and School Attainment

As housing redevelopment inevitably involves displacement, mixed-income redevelopment initiatives provide housing choice vouchers (HCVs) to families who live in homes slated for redevelopment, along with individualized case management services that help families locate housing, school, and employment opportunities during the redevelopment process. Notably, customized case management services occur six months prior to the redevelopment, which may limit the “crunched for time” scenarios where residents rely on short-term survival strategies—“anywhere but here”—as opposed to long-term strategies for thriving, such as finding a neighborhood with a good school (DeLuca & Jang-Trettien, 2020, p. 453). Indeed, the use of case management—when coupled with housing vouchers—has been found to increase moves to higher opportunity neighborhoods in similar contexts (Bergman, Chetty, DeLuca, Hendren, Katz, & Palmer, 2024). In essence, case managers can act as a connector to valuable resources and information, as well as a connector to broader communities, both of which can help individuals solve problems and seize opportunities (de Souza Briggs, 1998). Thus, HCVs and case management services can lead to both residential and school attainment in areas with greater socioeconomic and racial/ethnic diversity, which can increase social capital, as well as opportunities to learn (e.g., through schools with greater levels or resources). As a result, relocators in the CNI can be expected to experience increased school performance, as well as decreased disparities in school performance.

Unintended Consequences

Beyond the intended effects of institutional resources, as well as social class and racial/ethnic diversity, on students living in CNI neighborhoods or attending partnering schools, the CNI can also have unintended consequences. First, mixed-income housing may not attract more socioeconomically and racially diverse tenants. Second, displacement from housing redevelopment may cause large root shocks on CNI neighborhoods. Third, relocating families may not able to achieve residential and school attainment during the redevelopment process, leading to increased racial stratification.

Anti-Blackness

Conversely, mixed-income neighborhood redevelopment initiatives may not increase the socio-economic and racial diversity of their neighborhood or schools. Rather, racial biases may limit diversity in these contexts. For example, while some research has suggested that many parents have a desire for integration (Frankenberg & Jacobsen, 2011; Torres & Weissbourd, 2020) and adhere to an "diversity ideology" that prioritizes their children's exposure to diversity in order to facilitate positive social change (Underhill, 2019), other parents may harbor anti-Black sentiments—that Black students are "spatially illegitimate" in mixed-income spaces (Jenkins, 2021)—and other racial resentments. Previous research suggests that these underpinnings may be especially prevalent in mixed-income neighborhood developments. For example, Hwang and Sampson (2014) found that racialized neighborhood stigma was associated with barriers to increased diversity in minoritized communities. Similarly, Wells (2015) demonstrated that parents make implicit assumptions about school quality based on racial composition. These findings are further supported by Billingham and Hunt's (2016) study, which found that the proportion of Black students in a hypothetical school was inversely related to white parents enrolling their children in that school.

Transition Stress and Root Shock

Additionally, during the redevelopment phase some relocating students may experience increased stress during their move and might not be able to bridge the learning from old schools to their new ones (Keels, 2013, p. 1012). Indeed, research by Goldstein et al. (2015) demonstrated that transition stress can lead to lower academic performance and reduced ability to bond with peers. Transition stress may be particularly salient when students move to schools with similar—or worse—academic environments (Jabbari et al., 2025). More generally, as redevelopment often involves displacement and disruption, high rates of student mobility may signal larger "root shocks" in CNI neighborhoods due to losses in social organization and capital, as well as collective efficacy and action (Fullilove, 2002).

Racial Stratification

Finally, while mixed-income redevelopment initiatives assume that housing vouchers and case management will help families locate and "bundle" neighborhood, home, and school opportunities, racial biases may steer racially minoritized and poor families away from more affluent and diverse neighborhoods and schools (Wells & Crain, 1997). Indeed, previous mobility studies found that families tend to move to neighborhoods and schools that resemble the ones they left and that better neighborhoods did not always lead to better schools (Popkin et al,, 2004; Jacob, 2004; Clampet-Lundquist, 2004; Goetz, 2010), For instance, due to a variety of residential constraints, such as limited housing options, lease-up difficulties, and discrimination in rental markets (DeLuca, Garboden, & Rosenblatt, 2013), many residents in similar neighborhood redevelopment initiatives moved to poor, racially segregated neighborhoods during the redevelopment process (Goetz, 2010), and—despite their desire—very few of them moved back to their redeveloped neighborhoods afterward (Popkin et al., 2010).

CURRENT STUDY

Research Questions

Informed by the gaps in the previous literature and drawing on the theoretical frameworks discussed, we ask the following questions:

1) What are the effects of living in a CNI neighborhood and attending a CNI school on students' academic performance?
2) Do we observe greater levels of mobility in the CNI neighborhood or in partnering schools?
3) Are there observable racial/ethnic compositional changes in the CNI neighborhood or in partnering schools?
4) Do spatial patterns of mobility into and out of the CNI neighborhood and partnering schools signal broader processes of socioeconomic diversity and integration in neighborhoods and schools?

By answering these research questions, we not only demonstrate the effects of the CNI on child outcomes through neighborhoods and schools, but we also unpack two core mechanisms of neighborhood effects—institutional resources and compositional changes. In doing so, this study contributes new evidence to debates on whether mixed-income redevelopment initiatives can improve child outcomes without socioeconomic and racial/ethnic diversity, offering novel insights into how neighborhood policies can advance educational equity. Additionally, our analyses allow us to examine an important but often overlooked byproduct of redevelopment, relocation, and displacement—residential and school attainment. Indeed, by tracing the neighborhood and school originations and destinations of residents in the CNI, we are able to speak to some of the unintended consequences of mixed-income redevelopment initiatives—a lack of residential and school attainment. In examining both the intended and unintended consequences of mixed-income redevelopment initiatives, we not only unpack neighborhood effects into core component parts (i.e., institutional resources and compositional changes), but we also speak to critical social phenomena, such as anti-Blackness, transition stress and root shock, and racial stratification.

The Near North Side of St. Louis

The Near North Side (NNS) of St. Louis—centered on neighborhoods within the 63106 zip code, including the Carr Square and Columbus Square neighborhoods, has long faced disinvestment, concentrated poverty, and declining population despite its proximity to downtown. Much of the area's housing stock consisted of aging subsidized units such as O'Fallon Place and Blumeyer Apartments, alongside schools serving predominantly low-income and Black students.

In 2016, the City of St. Louis, in partnership with McCormack Baron Salazar, and Urban Strategies Inc., received a $29.5 million Choice Neighborhoods Implementation (CNI) grant from the U.S. Department of Housing and Urban Development. The project—known as Preservation Square—aimed to redevelop distressed housing units and to improve educational and neighborhood outcomes through the initiative's "People," "Housing," and "Neighborhood" components. Education strategies targeted a cluster of CNI partner schools that primarily serve 63106 students: Carr Lane VPA Middle School, Gateway Elementary, Jefferson Elementary, Dunbar Elementary, and St. Louis College Prep. These schools became focal sites for coordinated attendance, behavioral strategies, and family-engagement supports implemented by Urban Strategies in collaboration with St. Louis Public Schools.

Although planning began soon after the award, the implementation phase inevitably involved substantial demolition and reconstruction of aging public housing units, requiring temporary or permanent relocation of many original residents. This process, while necessary to address severe physical deterioration and safety issues, also reproduced a longstanding tension in federal housing redevelopment policy: balancing physical revitalization with the right-to-return for displaced residents. Critics have noted that earlier programs such as HOPE VI often led to low return rates among original tenants and contributed to neighborhood gentrification and social displacement (Schwartz, 2021). The NNS CNI faced similar scrutiny—whether it could achieve meaningful neighborhood improvement without replicating patterns of exclusion, loss of community cohesion, or demographic turnover that have historically accompanied large-scale mixed-income redevelopment.

Given this timeline, this analysis defines 2019 as the baseline year for educational outcomes, capturing the beginning of active CNI interventions, and 2017 as the baseline for residential mobility, encompassing pre-implementation relocation trends. ZIP 63106 represents the focal CNI area, while all other ZIPs in St. Louis City serve as comparisons without major redevelopment investments. This contextual framing enables investigation of whether the CNI launch altered student residential mobility or racial composition and whether residence in or attendance at CNI-affiliated schools corresponded with improvements in academic achievement.

METHODS

Data and Sample

This study draws on administrative data from the Missouri Department of Elementary and Secondary Education (DESE), which provided longitudinal, student-level records for all public and charter school students in St. Louis City. The DESE dataset includes each student's demographic information (race and ethnicity, gender, and eligibility for free or reduced-price lunch), annual school enrollment and district identifiers, residential ZIP code, and standardized test results on the Missouri Assessment Program (MAP) for English Language Arts (ELA) and Mathematics in Grades 3 through 8. These administrative records allow the construction of a yearly panel that links individual students to both their school of enrollment and their residential neighborhood across time. A key strength of this data source is its annual, individual-level structure, which enables detection of short-term changes in neighborhood residence and school enrollment. Unlike the American Community Survey (ACS), which reports five-year moving averages of population characteristics at the ZIP or tract level, DESE data permit near-real-time observations of student residential mobility and school and neighborhood composition. This precision is particularly critical for evaluating the NNS CNI, where relocation and school transitions may occur abruptly following the start of redevelopment.

The analytic sample includes all students enrolled in St. Louis City public and charter schools from 2014-15 school year (SY2015) through 2022-23 school year (SY2023), encompassing both the pre-implementation period (SY2015–SY2018) and the early implementation years following the onset of the CNI in SY2019. The unit of analysis is the *student-year*. For analyses of residential mobility, the sample includes all students with valid residential ZIP codes (Grades K–12). For the analyses of academic outcomes, we restricted the initial sample to students in Grades 3–8 within St. Louis public and charter schools who were eligible for the MAP evaluation. The initial pool consisted of 814,832 student-year observations representing 360,439 unique students. We excluded observations with missing ZIP codes, invalid school codes, or missing test scores in either ELA or Math. Following this listwise deletion, the sample comprises 644,413 student-year observations of 210,009 students. To isolate effects during periods of active residence or enrollment, the sample is truncated after a student moves or transfers out of the CNI neighborhood or a CNI school. The final analytic sample includes 564,200 student-year observations of 194,231 students.

Measures

Residential mobility is measured using an indicator of whether a student resides in ZIP 63106, the designated CNI neighborhood. The categorical variable distinguishes students who *never* lived in 63106, *moved in*, *moved out*, or *stayed* within the area in a given year. *School mobility* is defined analogously, identifying whether a student attended one of the five CNI partner schools—including Carr Lane VPA Middle, Gateway Elementary, Jefferson Elementary, Dunbar Elementary, and St. Louis College Prep.

Academic outcomes are measured using students' MAP scale scores, which are annual test scores that measure mastery of Missouri Learning Standards (MLS). They are typically used to measure student progress and for school accountability purposes.

Neighborhood composition focuses on the percentage of students attending public schools that are Black in each zip code. School composition is measured analogously.

Student socioeconomic and demographic characteristics. Models include *controls* for sex (male/female), race/ethnicity (Black/white/Hispanic/other), lunch status (none/free-price/reduced-price), homeless (yes/no) grade, and school-year fixed effects. The baseline year for mobility analyses is 2017, capturing early relocation dynamics, while the baseline for academic outcomes is 2019, marking the beginning of active CNI implementation. ZIP 63106 serves as the treatment area, and all other ZIP codes in St. Louis function as comparison neighborhoods.

Empirical Model Design

The analysis proceeds in two stages. First, we estimate the causal impact of CNI exposure on student academic outcomes using the Callaway and Sant'Anna (2021) Difference-in-Differences (CSDID) framework. Second, to examine whether these educational gains coincided with changes in neighborhood composition, we conduct supplementary Synthetic Control Model (SCM) and Exploratory Spatial Data Analysis (ESDA) at both ZIP-code and school levels.

In addition to their distinct focal points, these methods also differ in scope and analytic design. The CSDID analysis operates at the student level, leveraging longitudinal individual records to estimate causal effects of CNI exposure on academic achievement. In contrast, the SCM and ESDA are conducted at the ZIP code and school levels, capturing neighborhood-wide or institutional shifts in population and composition. Also, the two approaches differ in their temporal baselines. The CSDID model uses 2019 as the baseline year, marking the start of active CNI interventions through neighborhood revitalization and school reform. By contrast, the SCM/ESDA analyses adopt 2017 as the baseline, corresponding to the onset of resident relocation and early redevelopment activities preceding formal implementation.

Data Analysis

CNI Student Academic Achievement

To answer the first research question (RQ1), we utilize the Callaway and Sant'Anna (2021) Difference-in-Differences analytic approach. Because CNI exposure occurred at different times and durations across student cohorts, the analysis employs the Callaway and Sant'Anna (2021) Difference-in-Differences (CSDID) framework as the primary identification strategy. This approach estimates the Average Treatment Effect on the Treated (ATT) while accounting for staggered treatment timing and heterogeneity in exposure. Compared with conventional two-way fixed effects (TWFE) models, which may yield biased estimates under staggered adoption, the CSDID estimator provides a more reliable approach to identifying cohort-specific and dynamic treatment effects.

The CSDID model estimates not only the overall Average Treatment Effect on the Treated (ATT) but also cohort-specific and dynamic (event-time) effects, allowing for analysis of how academic impacts emerge and accumulate across different entry cohorts and post-treatment years. Formally, we implement a three-way fixed effects specification within the CSDID framework:

$$Y_{it} = \alpha_i + \lambda_t + \kappa_g + \sum_c \tau_{ct} D_{it}(c) + \epsilon_{it}$$

where Y_{it} denotes the MAP score (ELA or Math) for student i in year t; α_i, λ_t, and κ_g represent student, year and grade[1] fixed effects; $D_{it}(c)$ is an indicator equal to 1 if student i belongs to

[1] We include grade fixed effects to account for grade-specific developmental trajectories and the cumulative nature of the MAP assessment. This ensures that estimated treatment effects are adjusted for the systematic differences in academic growth and test difficulty inherent as students' progress. Furthermore, this specification addresses potential standardization issues across different test forms; by absorbing grade-level intercepts, we ensure that the results are not confounded by variations in the scaling or difficulty of the MAP assessment as students progress through the 3–8 grade continuum

cohort c and is observed in period $t \geq c$; and τ_{ct} represents the treatment effect for cohort c at time t.

Consistent with the CSDID focus on the timing of first exposure rather than prolonged treatment, the analytic sample is truncated at exit: once a student who entered 63106 (or a CNI school) subsequently moves or transfers out, all post-exit observations are excluded. This restriction isolates effects tied to the initial entry event, and prevents contamination by post-treatment non-exposure periods that CSDID is not designed to capture. As a robustness check, all models were re-estimated without truncation, retaining post-exit observations. The resulting ATTs were consistent in sign and magnitude with the truncated specification, indicating that findings are not driven by sample restriction.

The CSDID estimator aggregates these effects into (1) overall ATTs, (2) cohort-specific averages, and (3) dynamic event-time effects relative to the first-treatment year. The model assumes conditional parallel trends in untreated potential outcomes across cohorts. CSDID estimates were obtained using the inverse propensity weighting (IPW) estimator with not-yet-treated students as the control group. We employ Inverse Propensity Weighting (IPW) to correct for significant baseline imbalances in demographics and academic achievement (see Table 1), ensuring the parallel trends assumption is satisfied.[2] Models included year fixed effects and student-level time-fixed (race/ethnicity and gender) and time-varying covariates (FRL status and homelessness). This framework allows estimation of both immediate and cumulative academic effects associated with CNI exposure and reveals how program impacts unfolded across successive cohorts of students.

[2] We intentionally avoid a Doubly Robust (DR) approach because the CNI intervention explicitly targets shifts in neighborhood and school compositions (e.g., racial/economic balance); including these potentially endogenous post-treatment covariates in an outcome model risks introducing bias.

Residential Mobility and Neighborhood Composition

This component of the analysis addresses three related questions: (RQ2) whether students were more likely to move into or out of 63106 following the CNI implementation; (RQ3) where students moved to or from; and (RQ4) whether these mobility patterns were accompanied by observable changes in the racial composition of students residing in the area. The second and fourth questions are addressed through a series of Synthetic Control Model (SCM) analyses, and the third through Exploratory Spatial Data Analysis (ESDA) of origin–destination (OD) flows.

The SCM and ESDA analyses test the hypothesis that CNI implementation may have triggered residential displacement or compositional changes in 63106.

<u>Synthetic Control Model (SCM).</u> To identify whether CNI implementation corresponded with meaningful changes in residential mobility or racial composition, ZIP 63106 was treated as the "intervention unit," and all other St. Louis City ZIP codes served as potential controls. For each outcome, a synthetic comparison area was constructed as a weighted combination of "donor" ZIPs whose pre-2017 trends most closely matched that of 63106. The pre-implementation period spans 2015–2018, and the post-period covers 2019–2023, corresponding to the onset of active redevelopment and relocation.

Three outcomes were modeled separately:

(1) the rate of student outflow from 63106 (the share of students residing in 63106 in year t-1 who relocated elsewhere in year t, RQ2a);

(2) the rate of student inflow (the share of students living outside 63106 in year t-1 who relocated into it in year t, RQ2b) and

(3) the percentage of Black students residing in 63106 each year (RQ4).

Each SCM was fit using lagged pre-period outcomes as predictors. Formally, let Y_{1t} denote the outcome for ZIP 63106 at time t and Y_{ji} for donor ZIP j. The synthetic comparison, $\hat{Y}_{1t}^{syn}$, is constructed as

$$\hat{Y}_{1t}^{syn} = \sum j \in \mathcal{D} w_j Y_{ji}$$

where weights $w_j \geq 0$ and $\sum w_j = 1$ are chosen to minimize the pre-2017 prediction error between 63106 and the weighted donor pool. The treatment effect at each time point is expressed as the post-intervention gap.

$$\Delta_t = Y_{1t} - \hat{Y}_{1t}^{syn}$$

To avoid potential positive spillover effects from geographically adjacent areas, ZIP codes 63107 and 63108—immediately north and west of the CNI target zone—were excluded from the donor pool. Both areas are likely to have benefited directly and indirectly from redevelopment activities, improved amenities, or school-choice spillovers associated with the CNI intervention. Model fit and inference were evaluated using placebo-in-space tests, in which the "treatment" was reassigned to each donor ZIP and synthetic weights were recalculated. The resulting post/pre RMSPE ratios (R_j) for all placebos formed the empirical reference distribution. The pseudo-p value for 63106 was calculated as

$$\hat{p} = \frac{1 + \sum_{j \in \mathcal{D}} 1(R_j \geq R_{63106})}{1 + |\mathcal{D}|},$$

representing the share of donor ZIPs that exhibited post-2017 deviations as large or larger than that of 63106. Large $\hat{p}$ values imply no significant departure of 63106 from the synthetic counterfactual. RMSPE ratios, donor-weight diagnostics, and sensitivity checks excluding high-weight donors were further examined to confirm robustness.

Explanatory Spatial Data Analysis (RQ3). To visualize the spatial distribution of student mobility, Exploratory Spatial Data Analysis (ESDA) was conducted using both annual and cumulative origin–destination (OD) maps. These maps display outflows—students originally residing in 63106 who moved to other ZIP codes—and inflows—students relocating into 63106 from elsewhere—between School Years (SY) 2015 and 2023. Arrows indicate the direction of movement, with line thickness proportional to the number of student moves, and the most frequent origins and destinations labeled each year. In addition to directional arrows, each ZIP code area is shaded according to the cumulative number of students moved since SY2017, providing a continuous surface representation of spatial intensity. For each ZIP area, darker shades indicate higher cumulative counts of students who moved from 63106 (outflows) or moved into 63106 (inflows). These layers capture both the direction and magnitude of residential shifts over time.

This spatial visualization supplements the SCM analysis by illustrating the geography of student mobility and identifying whether any outflows clustered toward specific suburban or higher-income ZIPs. The cumulative maps confirm that student movements were broadly distributed across St. Louis City and County, rather than concentrated in any single direction, further supporting the conclusion that the early phase of CNI implementation did not trigger significant displacement or concentrated relocation patterns.

RESULTS

This section presents findings from two complementary analyses. We begin with the Callaway and Sant'Anna Difference-in-Differences (CSDID) results, which estimate the causal effects of the Choice Neighborhoods Initiative (CNI) on student academic achievement. We then report results from the Synthetic Control Model (SCM) and Exploratory Spatial Data Analysis (ESDA), which assess whether the CNI intervention coincided with residential or demographic changes in the target area.

Descriptive Statistics at the Baseline

Table 1 presents the baseline characteristics for students in SY2019, partitioned into neighborhood (Panel A) and school (Panel B) treatment groups. At this baseline period, significant disparities are evident between the CNI-treated cohorts and the never-treated comparison group across nearly all dimensions. Students residing in the CNI neighborhood (ZIP 63106) and those enrolled in the five targeted CNI schools exhibited substantially lower average MAP scores in both ELA and Math compared to their never-treated peers. Demographically, the treated samples are characterized by a higher concentration of Black students and significantly greater economic disadvantage, as indicated by the high proportion of students eligible for Free or Reduced Price Lunch (FRPL) and higher rates of reported homelessness. While the gender distribution remains relatively similar across groups, the pronounced imbalances in baseline academic achievement and socio-economic status highlight the distinct environment of the CNI-targeted areas and underscore the necessity of the reweighting strategy employed in the causal analysis.

**** Table 1 is about here****

CSDID Results: CNI Student Academic Achievement

Having established that the NNS CNI sought to revitalize neighborhoods and strengthen educational environments, we first examine whether CNI exposure corresponded with measurable improvements in student academic performance. Using the Callaway and Sant'Anna Difference-in-Differences (CSDID) framework, we estimate Average Treatment Effects on the Treated (ATTs) for English Language Arts (ELA) and Mathematics among students residing in or attending schools within the CNI target area.

Overall, the CSDID estimates reveal large and statistically significant improvements in academic outcomes following CNI implementation. For students residing in the CNI neighborhood, the estimated ATT is 25.97 points in ELA and 23.46 points in Math. Similarly, for students attending CNI schools, the ATT is 23.90 points in ELA and 18.24 points in Math. All estimated effects are significant at $p < 0.001$, indicating substantial academic gains associated with CNI exposure.

Cohort-Specific Treatment Effects.

To assess whether CNI's academic impacts differed across exposure cohorts, Figure 1 presents cohort-specific ATTs estimated from the CSDID models. The cohort-based results indicate that CNI's academic benefits were front-loaded, concentrated among original residents and early enrollees directly exposed to the program's launch. Later cohorts—joining after major physical and programmatic transformations had stabilized—experienced weaker or null academic gains, implying that the early phase of CNI generated the most substantial learning returns.

Across both neighborhood and school contexts, early cohorts exhibited the strongest and most consistent gains, while effects for later entrants attenuated toward zero or became negative. For neighborhood exposure, the 2019 and 2021 cohorts showed large positive effects on both ELA (+23–28 points) and Math (+22–26 points), suggesting that students who experienced CNI from its early implementation benefited substantially in academic achievement. By contrast, the 2022 and 2023 cohorts—students who entered after the main redevelopment and resident relocation phases—displayed smaller and statistically insignificant effects, with some estimates turning slightly negative.

A similar pattern appears in the school-level models: early CNI school cohorts achieved notable ELA and Math improvements (≈ +16–31 points), while later cohorts' estimates declined and widened in uncertainty. These patterns suggest diminishing marginal impacts for students newly entering CNI schools or neighborhoods, possibly reflecting that the largest academic benefits occurred during the initial implementation stage, when neighborhood redevelopment and school reforms were most intensive.

The concentration of effects among early cohorts is consistent with program design and contextual dynamics. The 2019 cohorts primarily consisted of original public housing residents—families directly affected by demolition and relocation—who also received comprehensive case management and wraparound supports through a local nonprofit partner under the CNI framework. These households were thus more deeply engaged with both the housing and supportive service components of the initiative. Meanwhile, new entrants to the redeveloped area may have experienced an initial period of "root shock"—the social and psychological dislocation that often accompanies neighborhood turnover and resettlement (Jabbari et al., 2024)—limiting their short-term academic adjustment. Moreover, longer and more continuous exposure to the CNI environment likely magnified cumulative gains in learning outcomes, reinforcing the importance of sustained stability and service continuity for student achievement. These cohort differences motivate further examination of how CNI's academic impacts evolved over time, which is addressed next through dynamic treatment effect estimates tracing the temporal progression of student outcomes relative to initial exposure.

**** Figure 1 is about here****

Dynamic Treatment Effects

Figure 2 displays the dynamic event-time effects from the CSDID models, tracing how students' academic performance evolved relative to their first year of exposure to the Choice Neighborhoods Initiative (CNI). Estimates are centered around the first-treatment year (t = 0), with negative values representing pre-treatment periods and positive values indicating years since exposure.

For both ELA and Math, the neighborhood-level effects exhibit a gradual and sustained pattern of improvement. Pre-treatment coefficients are negative or statistically indistinguishable. Following the initial year of exposure, treatment effects increase steadily, with significant gains emerging in the second year and continuing to grow through subsequent years. By four years post-exposure, ELA and Math scores rise by approximately 39–45 points relative to pre-treatment baselines. This trajectory suggests that students residing in the redeveloped neighborhood benefited progressively from improvements in housing stability, environmental quality, and neighborhood resources that accompanied the CNI transformation.

In contrast, school-level effects show an immediate and pronounced response in the first post-treatment year. Both ELA and Math scores increased sharply one year after attending a CNI school and remained elevated thereafter. The effect sizes stabilize around +28 to +31 points at t+1, indicating that academic benefits materialized quickly once students were exposed to restructured school environments. This immediate impact aligns with the timing of CNI-funded educational interventions—such as curriculum redesign, student support services, and leadership reforms—that were implemented concurrently with physical redevelopment.

These dynamic patterns underscore a key distinction between neighborhood-mediated and school-mediated effects. Neighborhood improvements produced cumulative, long-horizon gains, likely reflecting the gradual influence of stability and environmental change, whereas school reforms generated immediate, short-horizon benefits, consistent with targeted investments in classroom-level instruction and student supports. The combination of these mechanisms suggests that CNI's dual investments in housing and education operated on distinct but complementary timescales, together contributing to the broader academic uplift observed among children in the target area.

****Figure 2 is about here****

Robustness Check

Additionally, while our main model considers all of St. Louis (City and County) as sites for comparison, employing IPW to ensure similarities between treatment and control groups, we recognize that unobservable characteristics could still introduce bias. As a result, we conduct a similar set of analyses, leveraging only students in St. Louis City (Appendix D). Results are similar, demonstrating robustness.

SCM and ESDA Results: Residential Mobility and Neighborhood Composition

To assess whether the academic improvements identified in the CSDID analysis coincided with changes in residential mobility or demographic composition, we applied the Synthetic Control Model (SCM) and Exploratory Spatial Data Analysis (ESDA) at the ZIP-code level, using 63106 as the focal area. These analyses evaluate whether the Choice Neighborhoods Initiative (CNI) produced unintended displacement or neighborhood compositional changes during its early implementation period.

Residential Mobility in 63106: Did Students Move More After CNI Implementation?

Figure 3 presents the observed and synthetic trends in the annual rate of students moving into 63106 (Panel A) and corresponding trends in moving out of 63106 (Panel B), both using 2017 as the baseline year. Overall, the results indicate no statistically significant changes in either inflow or outflow rates following the onset of CNI implementation. As shown in *Panel A,* the share of students relocating into 63106 remained relatively stable from 2015 to 2023, with an estimated ATT of −0.008 ($p = 0.966$), suggesting no meaningful deviation from the synthetic control trajectory. Similarly, *Panel B* shows a slight post-2019 increase in the outflow rate, which could be associated with temporal displacement of original CNI residents due to old housing unit demolition and reconstruction. However, the estimated ATT of 0.022 ($p = 0.542$) is statistically indistinguishable from zero. Placebo-in-space tests confirm that the observed post-treatment deviations for 63106 are within the range of random fluctuations observed across other St. Louis City ZIP codes.

In both the inflow and outflow models, 63106 does not stand out from the distribution of placebo estimates, indicating no evidence of elevated mobility or displacement following CNI implementation. In other words, these null findings imply that the early phase of CNI implementation (2019–2023) did not trigger notable displacement or racial compositional changes among school-aged residents.

**** Figure 3 is about here ****

Spatial Patterns of Student Mobility: Where Did Moves Occur?

To visualize the spatial distribution of student flows into and out of the CNI target area, exploratory spatial data analysis (ESDA) was conducted using annual origin–destination (OD) maps (Figure 4). *Panel A* displays ZIP-level origins of students who relocated into 63106 between SY2018 and SY2023. Arrow thickness represents the relative volume of student movement, and the shading of each ZIP code indicates the cumulative number of students who moved from that area into 63106 since 2017. Across all years, both the volume and spatial pattern of inflows remained relatively stable. The majority of new CNI students originated from ZIP codes within the St. Louis City boundary (red dashed line)—particularly from neighborhoods adjacent to 63106. These nearby areas share similar demographic and socioeconomic profiles, being predominantly low- to moderate-income and majority Black. This pattern suggests that residential mobility primarily occurred within comparable neighborhood contexts, rather than reflecting large-scale in-migration from more advantaged or suburban areas. No consistent cross-boundary inflow was observed, reinforcing that the early phase of CNI implementation did not attract demographically distinct households into the neighborhood.

Panel B (Figure 4) illustrates the annual destinations of students who moved out of 63106 between 2018 and 2023. Each map visualizes cumulative outflow volumes to surrounding ZIP codes, with arrow thickness proportional to the number of movers and color intensity indicating the magnitude of out-migration. Two key patterns emerge. First, student out-migration peaked during the early implementation phase (SY2018–SY2019), coinciding with the demolition and reconstruction of public housing units under the CNI redevelopment plan. This temporary surge aligns with short-term displacement of original residents during construction rather than sustained, long-term outflow. Second, while most movers relocated to other neighborhoods within St. Louis City, a substantial share resettled in North County St. Louis—areas such as Ferguson, Jennings, and Normandy. Despite being outside the city boundary, these communities exhibit racial and socioeconomic conditions comparable to 63106, characterized by similar poverty rates, housing costs, and racial composition.

These patterns indicate that the CNI redevelopment produced localized and lateral mobility—resettlement largely within demographically similar neighborhoods—rather than outward migration toward higher-income or suburban contexts. This spatial evidence is consistent with the null SCM findings for overall inflow and outflow rates, suggesting that CNI's early phase did not generate significant neighborhood compositional changes or large-scale neighborhood sorting among school-aged residents.

*** *Figure 4 is about here* ***

Changes in Racial Composition in 63106: Did the CNI Alter the Area's Demographic Makeup?

To assess whether the Choice Neighborhoods Initiative (CNI) corresponded with measurable shifts in the racial composition of student residents within the target neighborhood (ZIP 63106), we again applied a Synthetic Control Model (SCM) using the annual percentage of Black students as the outcome variable. Figure 5 presents the observed and synthetic trajectories of the share of Black students residing in 63106 between 2015 and 2023 (top panel), along with the corresponding placebo-in-space test (bottom panel). Prior to CNI implementation, the observed racial composition in 63106 closely mirrored that of its synthetic counterpart, with both maintaining near-total Black representation—approximately 98% of all students residing in the ZIP code. Following 2019, the observed share in 63106 remained largely stable, while the synthetic control showed a gradual decline. The estimated Average Treatment Effect on the

Treated (ATT) was 0.009 ($p = 0.477$), indicating that the minor post-2019 divergence was statistically indistinguishable from zero. The placebo test further confirms that the post-implementation deviation for 63106 lies well within the range of variation observed across other St. Louis ZIP codes, suggesting that CNI implementation did not produce a detectable change in racial composition.

These results indicate that the early phase of CNI implementation did not meaningfully alter the racial composition of student residents in 63106. The neighborhood continued to serve a predominantly Black student population, consistent with its historical demographic profile. In conjunction with the null findings on inflow and outflow rates (RQ2) and the spatially diffuse mobility patterns primarily within similarly segregated neighborhoods (RQ3), these results provide no evidence of neighborhood composition-related demographic change or racial displacement during the initial years of redevelopment.

**** Figure 5 is about here****

While these findings indicate the absence of residential displacement, one potential concern is that student turnover could still have occurred at the school level even without major residential change. Families might remain in the same neighborhood but shift enrollment patterns in response to school reforms, programmatic changes, or perceived quality differences among CNI and non-CNI schools.

To address this possibility, we conducted parallel SCM and ESDA analyses at the school level. The results confirmed a similar pattern to the neighborhood-level analysis: no evidence of massive displacement or enrollment restructuring following the CNI interventions. Student mobility remained stable, with inflows and outflows primarily occurring within demographically similar city schools. These null findings reinforce that the CNI implementation neither displaced students from their original schools nor induced widespread neighborhood compositional changes through selective enrollment shifts. Detailed results from the school-level SCM and ESDA analyses are presented in Appendices A–C.

DISCUSSION

Decades of research have established that neighborhoods can affect children's educational outcomes, yet neighborhood effects still remain largely a "Black Box" (Sampson, 2012) in the research literature. The "Black Box" phenomenon can be especially true in mobility studies—where children move to different neighborhoods, which contain a variety of components (e.g., new schools, new neighbors, new housing, etc.) that could all theoretically be linked to children's educational outcomes. Moreover, from a policy perspective, mobility studies face inherent limitations in scale and equity. Concerning scale, policy-makers can't move everyone; indeed, housing vouchers have limits. Concerning equity, mobility projects do little to improve the outcomes for children who are not lucky enough to receive a voucher—those who are left behind.

However, place-based and mixed-income initiatives—where the neighborhood itself undergoes change—can offer unique opportunities to open the Black Box and begin to unpack these neighborhood effects. While neighborhoods can change on their own, these changes are often fraught with inherent sources of selection and issues of endogeneity. Rather, what is needed to understand neighborhood effects is an exogenous "shock" to neighborhoods. In this regard, the Choice Neighborhoods Initiative (CNI)—the largest and most expansive federally funded mixed-income initiative—offers a unique window into neighborhood effects. While our previous work on the Choice Neighborhoods Initiative in Memphis demonstrated significant school and case management effects, data limitations in Memphis did not allow us to understand the effects of participants living in the CNI neighborhood—the primary intended policy beneficiary.

This study addresses these gaps through a multi-method analysis of the Near North Side Choice Neighborhoods Initiative in St. Louis, Missouri, using nine years of student-level administrative data and three complementary strategies: a Dynamic Difference-in-Difference model developed by Callaway and Sant'Anna (CSDID) to estimate academic outcomes, a Synthetic Control Model (SCM) to assess compositional change and displacement, and Exploratory Spatial Data Analysis (ESDA) to trace the geography of mobility. Together, these analyses allow us to go beyond asking whether the CNI worked and instead ask *how it worked, for whom,* and *through which pathways*. The paper makes three distinct contributions: it provides the first causal estimates of academic effects based on CNI's neighborhood component; it demonstrates both in- and out-migration patterns of original and new residents; and it offers rigorous null evidence on compositional mechanisms and displacement effects. Each contribution informs specific sociological theories, while informing the broader field of neighborhood effects.

Summary of Findings

The CSDID analysis yields large and statistically significant improvements in academic performance for students both residing in the CNI neighborhood and attending CNI partner schools. Students living in ZIP 63106 gained approximately 26 points in ELA and 23 points in Math on the Missouri Assessment Program (MAP) scale relative to their comparison counterparts. Students attending CNI schools gained approximately 24 points in ELA and 18 points in Math. These are substantively meaningful effect sizes—representing roughly 1/3 standard deviation unit changes—in the context of a population that has historically faced among the most severe concentrations of poverty and racial isolation in Missouri.

Yet the cohort-specific and dynamic models reveal important nuance. Academic benefits were concentrated among the earliest cohorts—those who lived in or entered the CNI neighborhood or its partner schools at or near the beginning of the program and attenuated substantially for students who joined after the major phases of redevelopment when programmatic restructuring had stabilized. This finding aligns with prior findings from Memphis (Jabbari et al., 2025), where dynamic modeling similarly revealed that academic effects were short-lived while behavioral effects were more durable. Several theoretical interpretations of this pattern deserve consideration. First, early cohorts were the primary intended beneficiaries of the initiative and may have received additional services in the beginning; for example, wraparound case management services were offered six months prior to redevelopment. It is also possible that families who received intensive case management in the earliest phase of redevelopment were more deeply embedded in the initiative, accumulating informational resources that later arrivals did not receive to the same degree. It is also possible that the CNI neighborhood and partnering schools "spent" an outsized portion of tangible resources at the beginning of the initiative.

Second, the attenuating effects for later cohorts are consistent with what Fullilove (2002) has described as "root shock"—the acute social and psychological disruption accompanying neighborhood turnover and resettlement that could be especially prevalent for newcomers. Here, newly arriving students in a redeveloped neighborhood may lack the relational anchors and community trust that confer academic stability, naturally dampening cohort-specific estimates for later entrants. This interpretation is consistent with Goldstein and colleagues' (2015) research on transition stress, as well as Keels' (2013) work on the difficulty of bridging learning from old to new schools.

Two Pathways, Two Timescales: Unpacking the Institutional Resource Mechanism

Among the most theoretically generative findings of this study is the divergence in temporal dynamics between neighborhood-mediated and school-mediated pathways. Dynamic CSDID estimates reveal that effects through neighborhood residence were gradual and cumulative: negligible in the first year of exposure, emerging significantly by the second year, and continuing to build through four or more years post-entry. Effects through school enrollment were immediate and stabilizing: large positive gains appeared in the first post-treatment year and remained elevated without further accumulation.

This distinction advances Arum's (2000) institutional resource theory by demonstrating that institutional proximity does not operate uniformly across contexts. Schools deliver resource benefits rapidly through structured daily contact: curriculum redesign, student support services, and leadership reforms that act on students in real time. Neighborhoods, by contrast, materialize benefits through more diffuse and cumulative processes, such as housing stability that can reduce stress and cognitive loads over time, public park and safety investments that can alter long-term social interactions, and early childhood centers providing early learning opportunities that can compound over time. Thus, the temporal profile of academic gains reflects the underlying logic of each context: schools are instructional environments calibrated for short-cycle learning, while neighborhoods are social ecologies whose effects unfold across developmental time horizons.

This finding also adds nuance to prior neighborhood effects research. MTO studies found null effects in the short term (Sanbonmatsu et al., 2006), while Chetty and colleagues (2016) found significant long-term effects of the MTO on college attendance and earnings—particularly for children who moved at earlier ages. Our dynamic estimates provide a nuanced analogue: the school pathway provides the largest gains for the earliest cohort, which may resemble a dosage effect, while the neighborhood pathway produces cumulative effects in later years, which could resemble more meaningful neighborhood change. In essence, the neighborhood "dose" becomes more powerful over time. Researchers who examine place-based and mixed-income initiatives on short horizons may systematically underestimate neighborhood-mediated benefits while more readily detecting school-mediated ones.

Gains Without Racial Diversity: A Challenge to Mixed-Income Ideology

Perhaps the most consequential finding is the absence of compositional changes in the presence of positive school and neighborhood effects. While ideologies of mixed-income initiatives tend to focus on social class, as evidenced in the name, the placement of these initiatives—in areas of extreme racial segregation and isolation—imply that new mixed-income residents will be racially diverse. Indeed, it is difficult to consider the redevelopment of housing projects without considering race. The SCM analyses reveal no statistically significant shifts in residential inflow, outflow, or racial composition in ZIP 63106 following CNI implementation. The neighborhood remained approximately 98% Black throughout the study period, and student mobility rates showed no meaningful deviation from synthetic control trajectories. While our compositional analyses mainly focused on race, ESDA confirmed that both inflows and outflows were spatially concentrated within demographically similar neighborhoods: predominantly low-income, majority-Black ZIP codes within St. Louis City and adjacent North County communities. There appears to be no evidence of neighborhood composition-driven demographic turnover in terms of race, nor of the upward residential sorting that the mixed-income redevelopment model assumes as a pathway to improved outcomes.

This null finding, taken together with the positive academic achievement results, constitutes a direct empirical challenge to theories of compositional changes and effects when considered as a byproduct of mixed-income redevelopment initiatives. The CNI in St. Louis was designed, in part, around the logic that attracting market-rate tenants would diversify the neighborhood in terms of economic characteristics and *potentially* racial/ethnic characteristics, allowing compositional benefits (e.g., social capital) to flow to original residents (Jabbari et al., 2024). However, in St. Louis, that compositional transformation did not occur; yet academic gains did. This pattern is consistent with theories of Anti-Blackness and Racial Stratification. For example, Hwang and Sampson (2014) documented that racialized neighborhood stigma functions as a structural barrier to integration, while Billingham and Hunt (2016) showed that the proportion of Black students in a school is inversely associated with white parents' willingness to enroll their children there. Although we cannot ascertain racial preferences from our analyses, the absence of cross-boundary inflows from more affluent ZIP codes suggests that racial residential preferences are not easily moved by neighborhood redevelopment initiatives.

Importantly, this finding does not undermine the value of the CNI. Rather, it reorients our understanding of the mechanisms of impact. Direct investments in schools, housing quality, and neighborhood infrastructure appear sufficient to generate meaningful academic gains even without demographic diversification. Black children in deeply segregated urban neighborhoods can experience substantial educational gains through well-designed institutional investments in their existing communities *without* the presence of more affluent or racially diverse neighbors as an intermediary condition.

Limitations

Despite this study's novel contributions, several limitations remain. Starting with internal validity, the CSDID estimator rests on a conditional parallel trends assumption. Through the combination of DID and inverse propensity score weighting (IPW), this assumption mostly holds. However, the potential for unobserved confounders cannot be ruled out: net of selection into the CNI treatments, families who remained in the CNI neighborhood or enrolled children in CNI schools may have unobserved characteristics that independently predisposed their children to the outcomes under study. Future research should exploit sources of discontinuity (e.g., in CNI award scores or neighborhood boundaries) to arrive at true causal claims. Furthermore, even though we consider racial compositional changes in both the CNI neighborhood and school, our design cannot cleanly separate the contributions of housing redevelopment, school investments, case management, and neighborhood amenity improvements in this study. Future research should leverage additional sources of data (e.g., case management service connections) to further unpack these effects. Relatedly, the null compositional findings also carry an important temporal caveat: compositional changes in the neighborhood may not occur until after the CNI project is complete. Additionally, while racial composition is a key metric of neighborhood diversity and opportunity, it does not rule out the possibility of additional socioeconomic compositional changes. Although community eligibility provisions (CEP) do not allow for changes in free- and reduced-price lunch (FRPL) to be comprehensively observed in this context, future research should leverage additional sources of data (e.g., tax records) to further unpack economic changes. Finally, ZIP codes aggregate considerable internal heterogeneity and may mask finer-grained displacement at the block or parcel level; given that the CNI boundary comprises most, but not all of the 63106 zip code, our findings can be considered conservative treatment estimates in this regard. Nevertheless, parcel-level residential data would provide a more precise portrait of mobility dynamics and should be explored in the future.

Regarding external validity, these findings are bounded by St. Louis's particular characteristics: extreme racial residential segregation, a pronounced school choice ecosystem, and decades of neighborhood disinvestment on the Near North Side. Cities with different demographic profiles, housing markets, or school governance arrangements may yield different results. That said, the convergence of positive academic findings—albeit on different CNI dimensions—across Memphis (Jabbari et al., 2025) and St. Louis suggests these patterns may reflect features of the CNI design that extend beyond any single site.

Implications

Focus on Institutional Resources, rather than Compositional Changes

The most urgent policy implication is that federal and local stakeholders should not treat compositional diversification as a necessary precondition for mixed-income investments to improve educational outcomes. The NNS CNI generated substantial academic gains in a neighborhood that remained overwhelmingly Black throughout the study period. The institutional resource components of the initiative, such as school investments, wraparound services, housing quality improvements, and neighborhood infrastructure appear to be driving most of the educational improvements, and they can be effective even when mixed-income demographic transformation does not materialize on the anticipated timeline. Policymakers who evaluate CNI-style initiatives primarily through the lens of diversification risk undervaluing the mechanisms that appear most effective, while simultaneously holding communities of color to a standard of integration that structural racism may render unreachable in many urban markets—particularly in a condensed time period.

Invest in Early Cohorts and Sustain Intensive Services

The concentration of academic benefits among early cohorts underscores the importance of sustaining intensive, individualized support throughout the redevelopment process, rather than front-loading investment in physical infrastructure and scaling back human services as the initiative matures. In this regard, our findings suggest that the CNI's benefits concentrate among those most deeply engaged at the moment of greatest disruption, which may signal the effectiveness of CNI's case management model. As demonstrated in previous research (e.g., Chun et al., 2025), case management represents a meaningful policy innovation in place-based initiatives. Thus, federal program design should prioritize both depth and continuity of case management over the full arc of redevelopment, while also considering how to extend comparable services to students who enter CNI schools and neighborhoods in later phases of redevelopment when the initial programmatic energy may have dissipated.

Match Evaluation Horizons to Mechanism Timescales

The divergence in temporal dynamics has direct implications for federal program evaluation. School-mediated effects appear rapidly and can be detected within standard evaluation windows of two to three years. Neighborhood-mediated effects accumulate gradually over four or more years. Evaluations capturing only short-term academic performance may correctly detect school-level gains while systematically underestimating longer-horizon benefits flowing from neighborhood stabilization and environmental change. HUD and its evaluation partners should design longitudinal monitoring systems capable of tracking academic trajectories over the full duration of redevelopment and into the post-redevelopment period, ensuring that neighborhood-mediated effects are not rendered invisible by truncated evaluation designs.

Address the Right-to-Return Gap and Lateral Displacement

The ESDA findings reveal that students displaced during early CNI redevelopment relocated primarily within demographically similar neighborhoods—particularly low-income, majority-Black communities in North County St. Louis such as Ferguson, Jennings, and Normandy. This pattern of lateral mobility is consistent with the broader literature on place-based redevelopment (Goetz, 2010; Popkin et al., 2004), reflecting housing market constraints, racial steering, and the limited navigational capacity that even well-designed case management may provide when structural barriers to higher-opportunity neighborhoods remain entrenched. Federal policymakers should treat residential and school attainment among displaced residents as a co-equal goal alongside neighborhood revitalization. This may require pairing housing choice vouchers with more aggressive anti-discrimination enforcement in rental markets, mobility counseling focused both on school quality and neighborhood opportunity, and sustained follow-up with displaced families well beyond the immediate redevelopment phase.

CONCLUSION

This study begins to open the “Black Box” of neighborhood effects in ways that prior research could not. Mobility studies, like MTO and Gautreaux, moved families across neighborhoods but left the original neighborhood unchanged, making it difficult to attribute effects to specific features of new environments. HOPE VI changed housing conditions in various neighborhoods, but did not make intensive, comprehensive investments in the neighborhood itself or its institutions or people. As such, even new HOPE VI research (Chetty et al., 2026) may not be able to pick up institutional resource effects. The CNI, by contrast, intervenes simultaneously in housing, neighborhood, school, and family contexts with uniquely coordinated resource deployments that can improve children’s educational outcomes, but also that require mechanism-sensitive, multi-method analyses conducted here. By showing that neighborhood and school pathways operate positively on distinct temporal timescales—in the absence of racial compositional changes, this study offers a theoretical reorientation for how sociologists of education should conceptualize institutional resource theory and how evaluators should design studies capable of detecting the full range of place-based effects.

Furthermore, the finding that a predominantly Black, economically distressed neighborhood generated substantial academic gains without compositional diversification challenges the embedded assumption that Black children require proximity to racially diverse neighbors to benefit from place-based investment. That assumption, left unexamined, risks subtly reinforcing the racial hierarchies that concentrated poverty and residential segregation reflect. Our evidence reorients the conversation: the institutional resources from the CNI work, and they work in communities that remain deeply Black and likely poor. The policy question is not whether to wait for diversity, but rather how to design and sustain the investments that generate gains regardless of whether demographic transformation follows.

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TABLES AND FIGURES

Table 1. Descriptive Statistics of Student Characteristics (as of 2019, the CNI baseline year)

Panel A. By Neighborhood Treatment

Variable	**Full** (N=84,125)	**Untreated** (n=82,236)	**Treated** (n=1,889)	**t-test** (p-value)
MAP ELA, mean (SD)	396.22 (49.71)	396.88 (49.63)	367.34 (44.44)	<0.001
MAP Math, mean (SD)	391.85 (56.35)	392.54 (56.26)	361.79 (51.86)	<0.001
Gender				
Female, %	48.7	48.7	50.3	0.176
Race/Ethnicity				
Black, %	41.9	40.6	98.5	<0.001
White, %	44.7	45.7	0.4	<0.001
Hispanic, %	5.1	5.2	0.6	<0.001
Other race, %	8.4	8.6	0.5	<0.001
Free/Reduced Lunch, %				
Free Lunch, %	53.5	52.5	97.1	<0.001
Reduced Lunch, %	3.0	3.1	1.0	<0.001
Homeless, %	5.0	4.7	16.9	<0.001

Panel B. By School Treatment

Variable	**Full** (N=84,125)	**Untreated** (n=81,361)	**Treated** (n=2,746)	**t-test** (p-value)
MAP ELA, mean (SD)	396.22 (49.71)	397.19 (49.58)	367.60 (44.75)	<0.001
MAP Math, mean (SD)	391.85 (56.35)	392.80 (56.26)	363.77 (51.48)	<0.001
Gender				
Female, %	48.7	48.6	51.2	0.008
Race/Ethnicity				
Black, %	41.9	40.0	96.1	<0.001
White, %	44.7	46.1	2.0	<0.001
Hispanic, %	5.1	5.2	1.5	<0.001
Other race, %	8.4	8.7	0.5	<0.001
Free/Reduced Lunch, %				
Free Lunch, %	53.5	52.0	98.8	<0.001
Reduced Lunch, %	3.0	3.1	0.3	<0.001
Homeless, %	5.0	4.6	17.7	<0.001

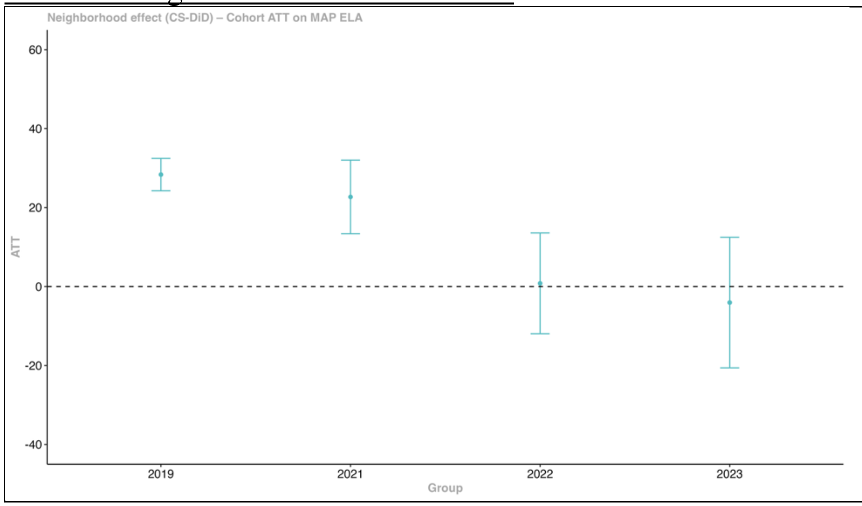
Table 2. CSDID results

		Neighborhood Effects (N=559,937)				School Effects (N=559,762)			
		ELA		**Math**		**ELA**		**Math**	
		(1)		**(2)**		**(1)**		**(2)**	
Simple	ATT	25.966	***	23.463	***	23.905	***	18.241	***
		(1.489)		(1.701)		(1.309)		(1.446)	
Cohort	2019	28.359	***	25.758	***	23.318	***	15.867	***
		(1.766)		(2.137)		(1.709)		(1.970)	
	2021	22.698	***	22.227	***	31.409	***	29.414	***
		(4.008)		(4.311)		(1.850)		(2.058)	
	2022	0.807		-5.638		14.964	***	13.221	***
		(5.487)		(5.653)		(2.598)		(3.341)	
	2023	-4.058		-8.148		1.395		-0.091	
		(7.114)		(9.369)		(4.350)		(5.217)	
Dynamic	t-4	-12.905	***	-21.719	***	-31.754	***	-33.702	***
		(3.418)		(3.988)		(1.847)		(1.943)	
	t-3	-3.050		-5.815	**	-11.289	***	-14.261	***
		(2.269)		(2.374)		(1.506)		(1.574)	
	t-2	0.019		-0.903		-4.589	***	-7.876	***
		(1.617)		(1.838)		(1.145)		(1.156)	
	t-1								
	t0	3.959	**	1.137		8.522	***	3.806	***
		(1.642)		(2.010)		(1.174)		(1.444)	
	t+1	22.124	***	19.446	***	30.977	***	27.564	***
		(3.201)		(3.578)		(1.585)		(1.818)	
	t+2	29.105	***	31.939	***	30.599	***	26.745	***
		(1.781)		(1.937)		(1.550)		(1.569)	
	t+3	34.993	***	30.395	***	31.506	***	24.016	***
		(1.896)		(2.374)		(2.005)		(2.517)	
	t+4	45.047	***	38.641	***	29.895	***	20.275	***
		(2.267)		(2.796)		(3.760)		(4.671)	

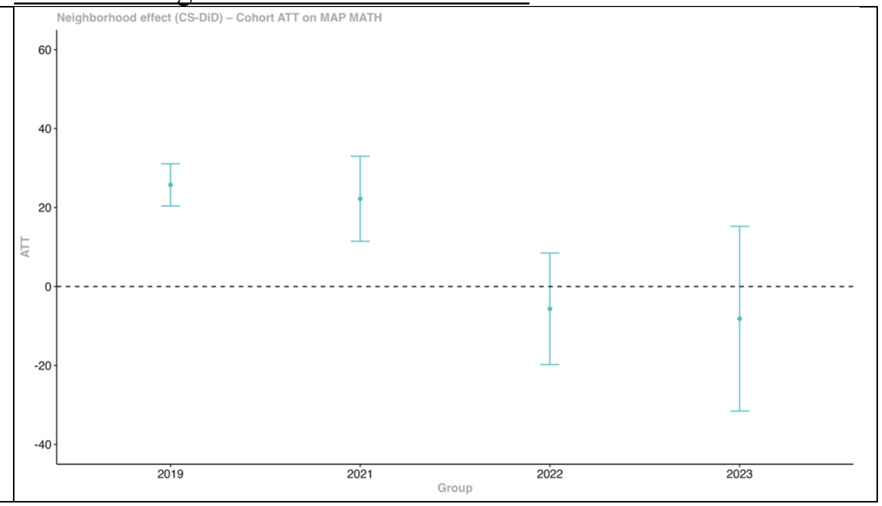
Notes: Callaway and Sant'Anna uses an Inverse Probability Weighting (IPW) / Doubly Robust estimator based on influence functions, rather than a traditional Maximum Likelihood or Ordinary Least Squares estimation. Because it is not estimating a variance-decomposition model or a likelihood function, standard goodness-of-fit measures like R-Square, AIC, or BIC are not applicable or generated by this estimator.

Figure 1. Callaway-Sant'Anna DID Results (Cohort Model)—CNI Neighborhood and School Effects on Academic Achievement

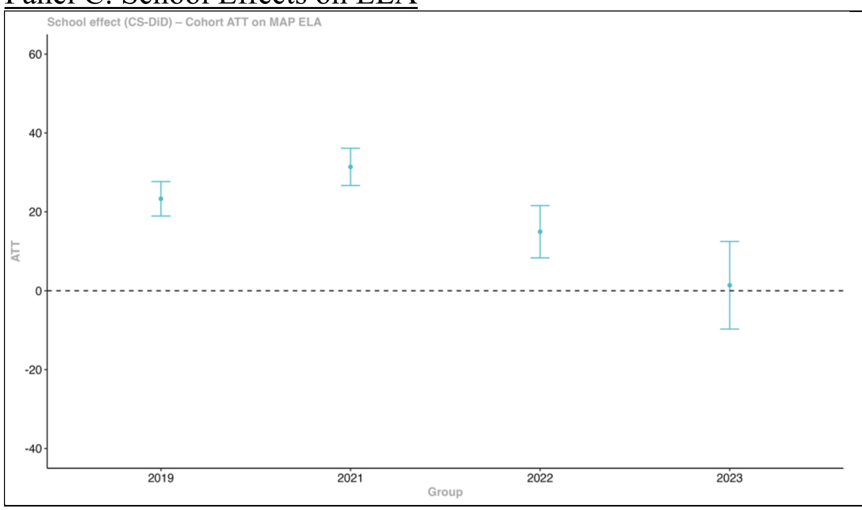
Panel A. Neighborhood Effects on ELA



Panel B. Neighborhood Effects on Math



Panel C. School Effects on ELA



Panel D. School Effects on Math

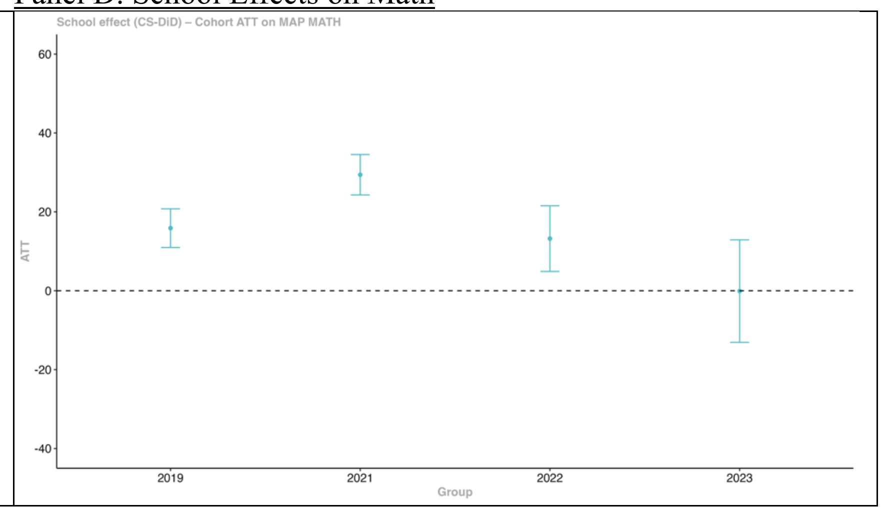
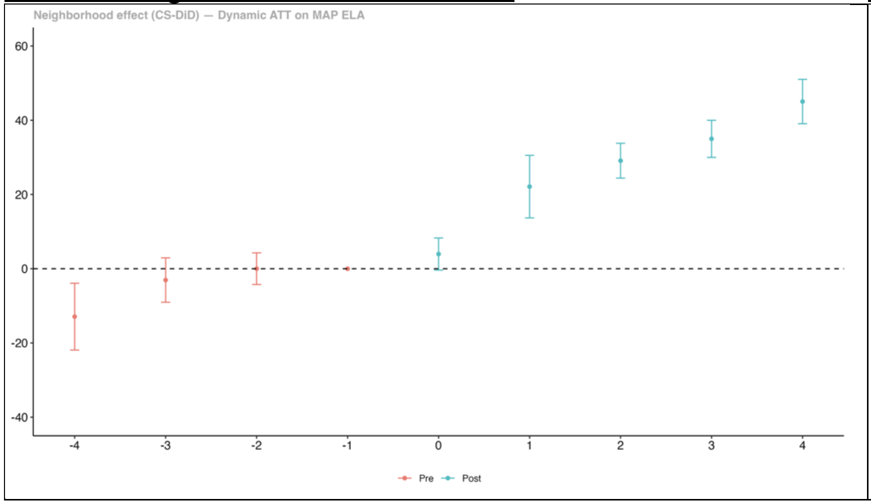
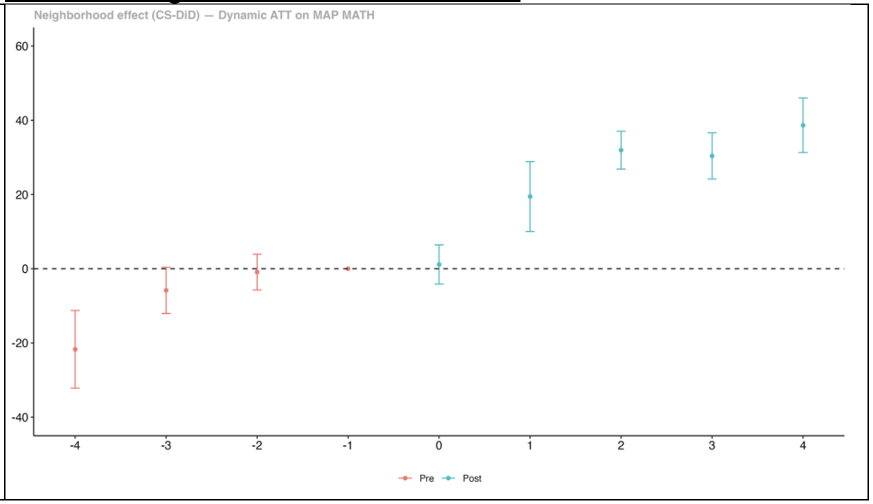


Figure 2. Callaway-Sant'Anna DID Results (Dynamic Model)—CNI Neighborhood and School Effects on Academic Achievement

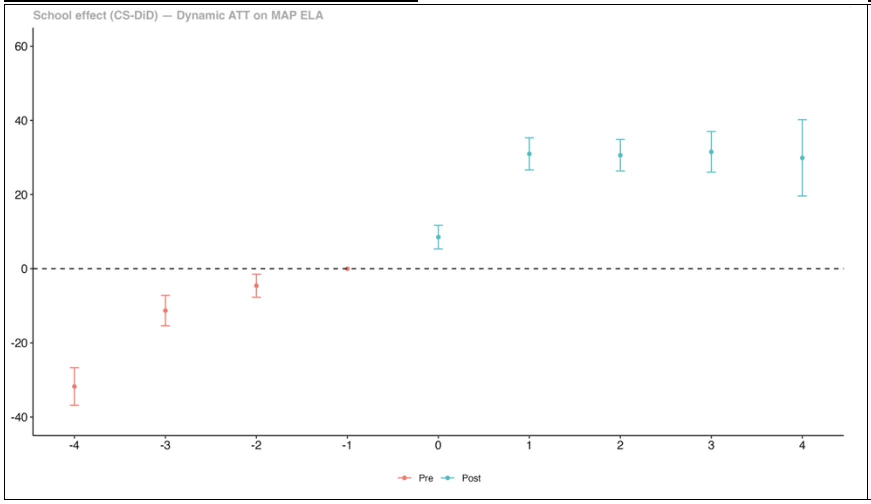
Panel A. Neighborhood Effects on ELA



Panel B. Neighborhood Effects on Math



Panel C. School Effects on ELA



Panel D. School Effects on Math

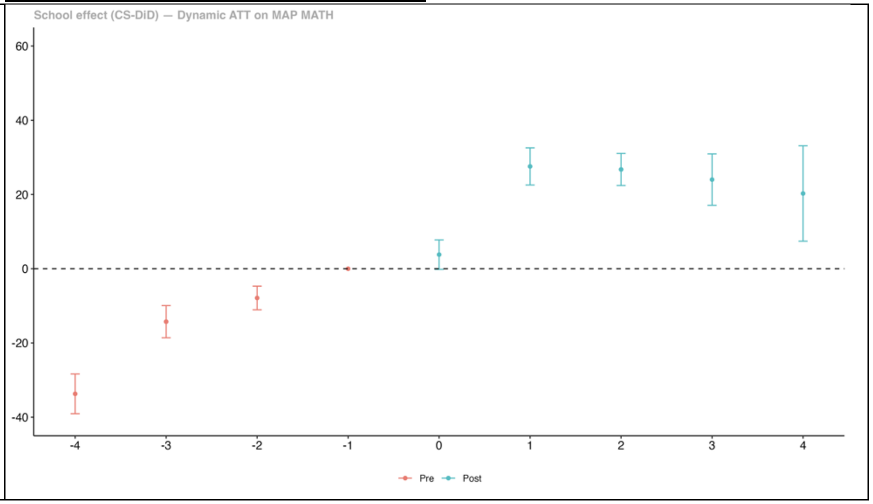
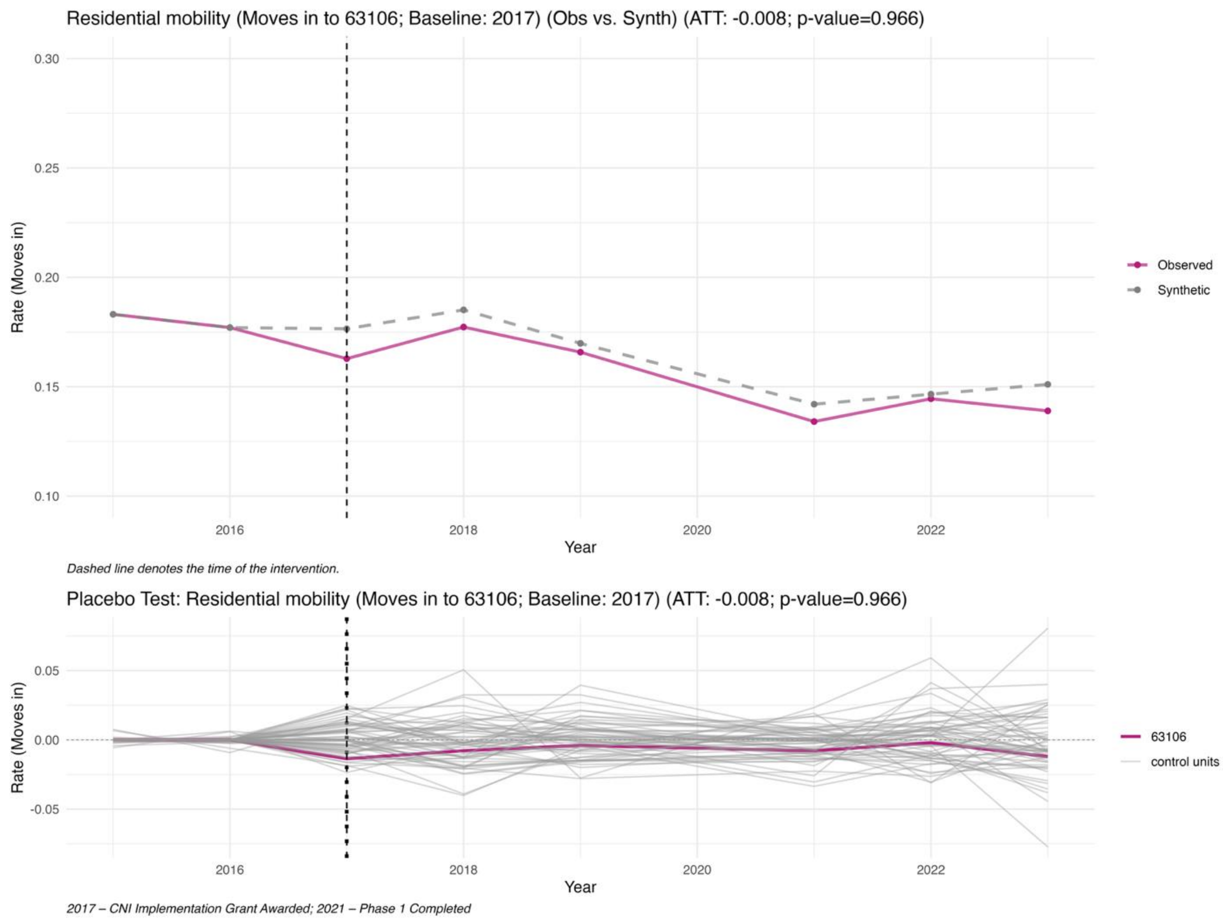
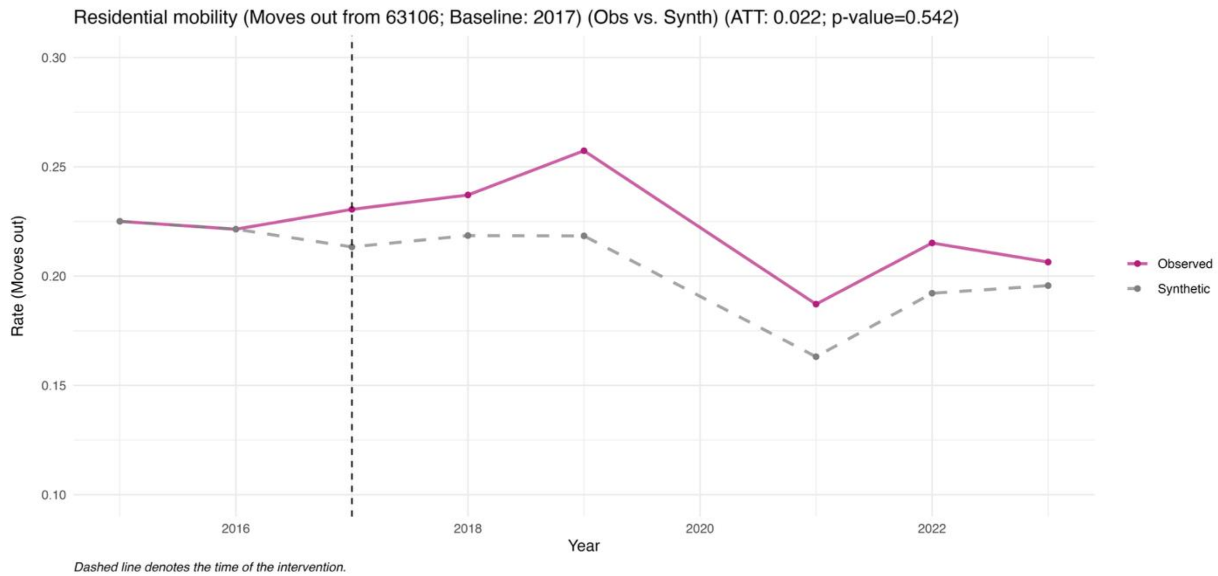


Figure 3. Synthetic Control Model Results—Residential Mobility in 63106

Panel A. Moving into 63106



Panel B. Moving out from 63106



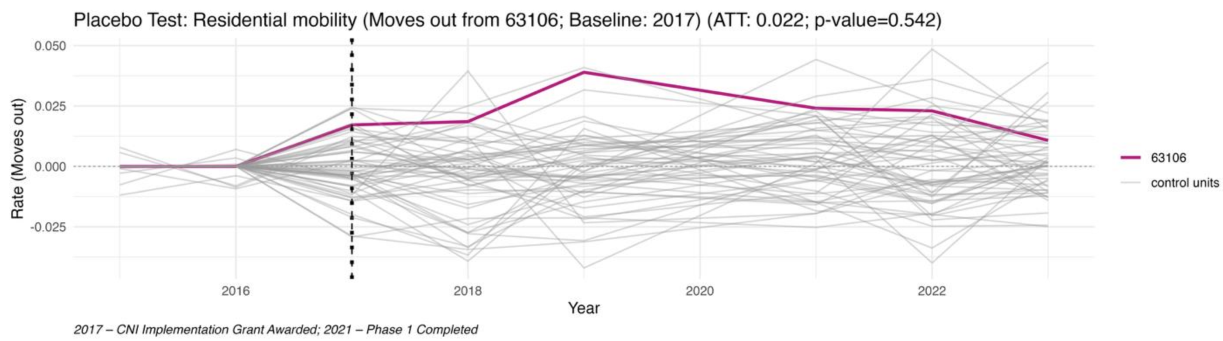
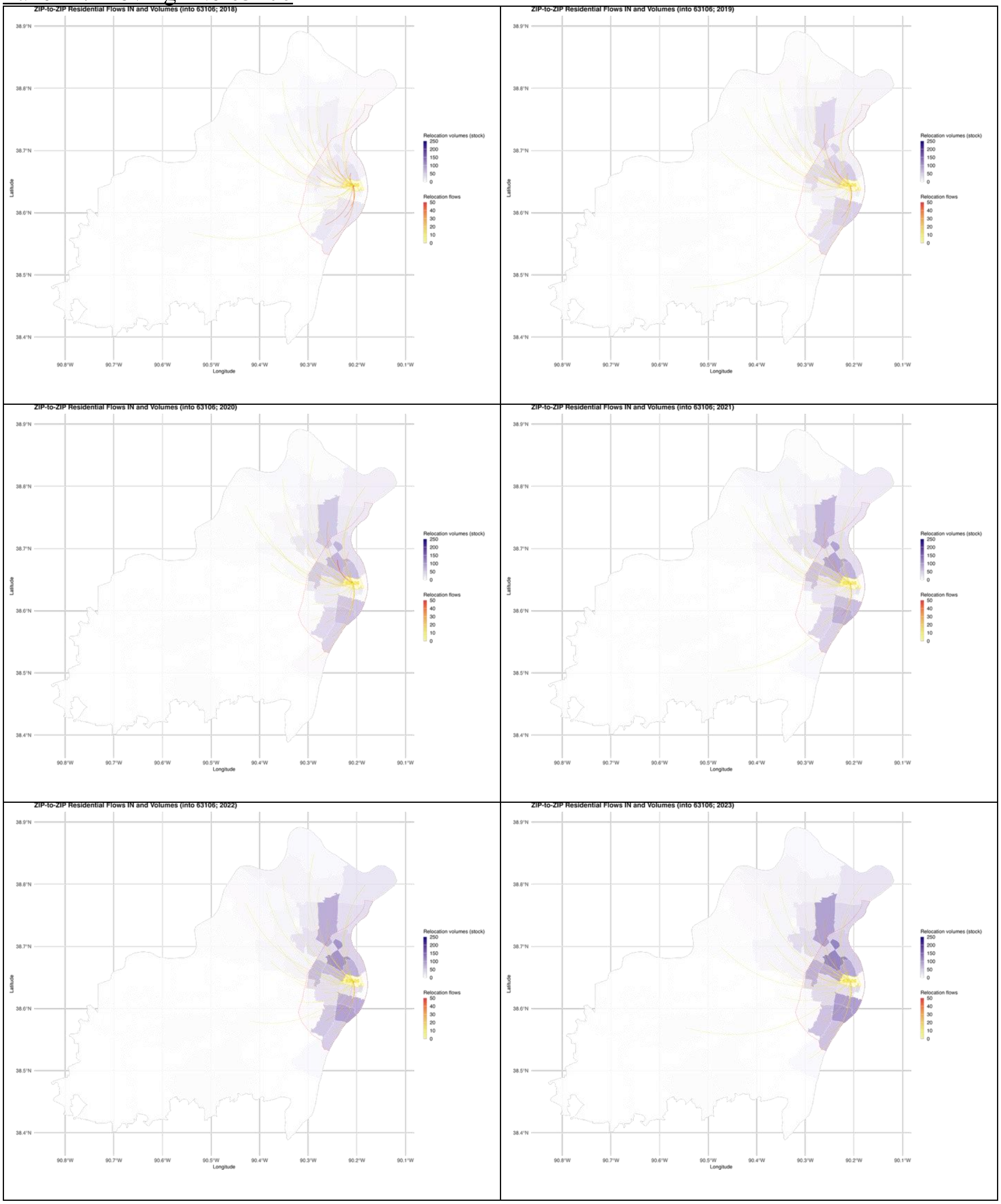
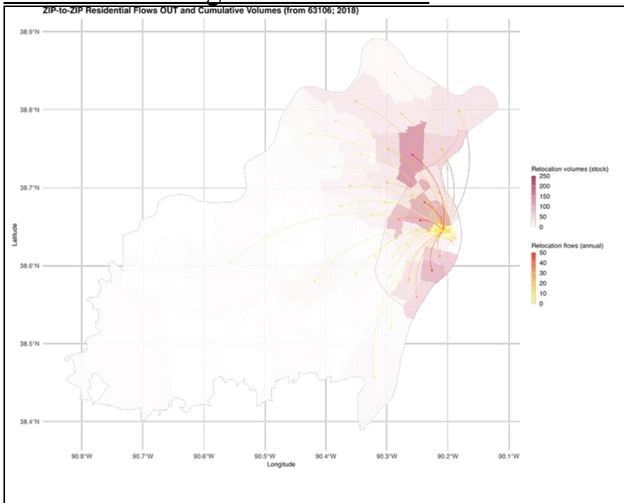


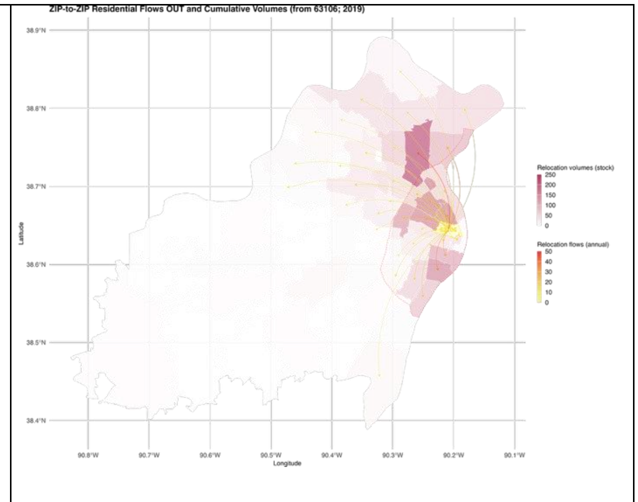
Figure 4. Explanatory Spatial Data Analysis Results—Spatial Patterns of Student Mobility

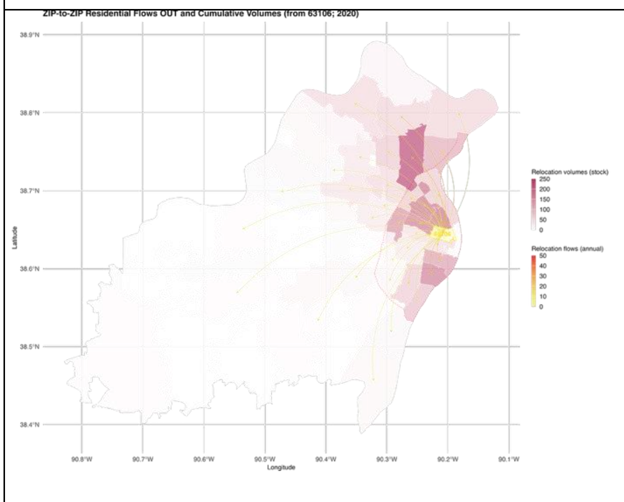
<u>Panel A. Moving into 63106</u>

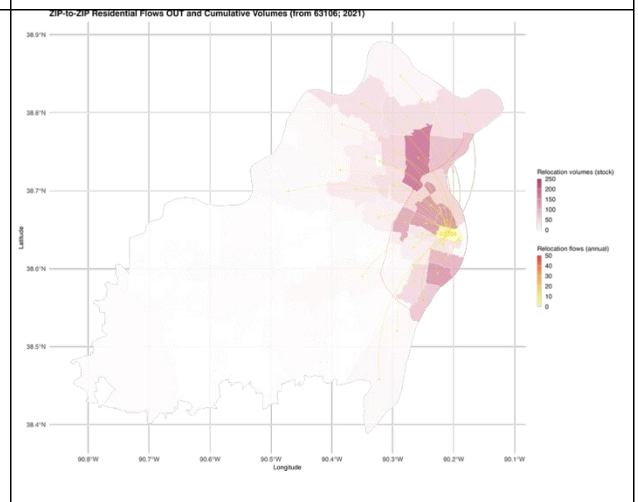


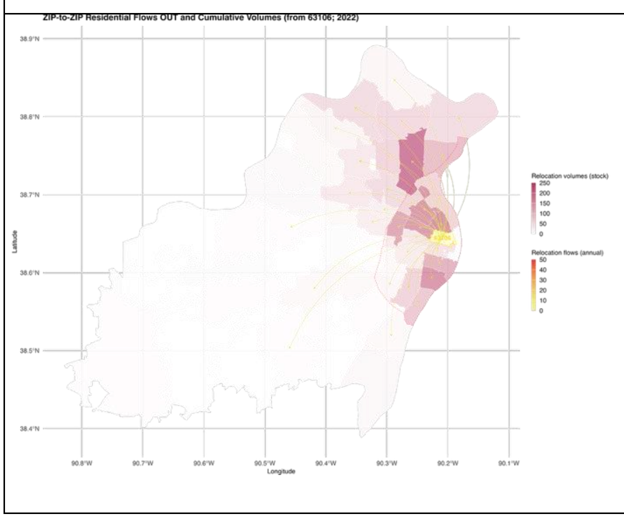
<u>Panel B. Moving out from 63106</u>











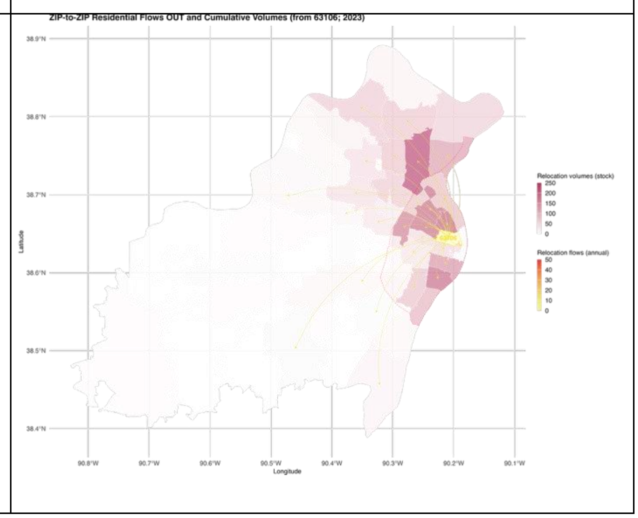
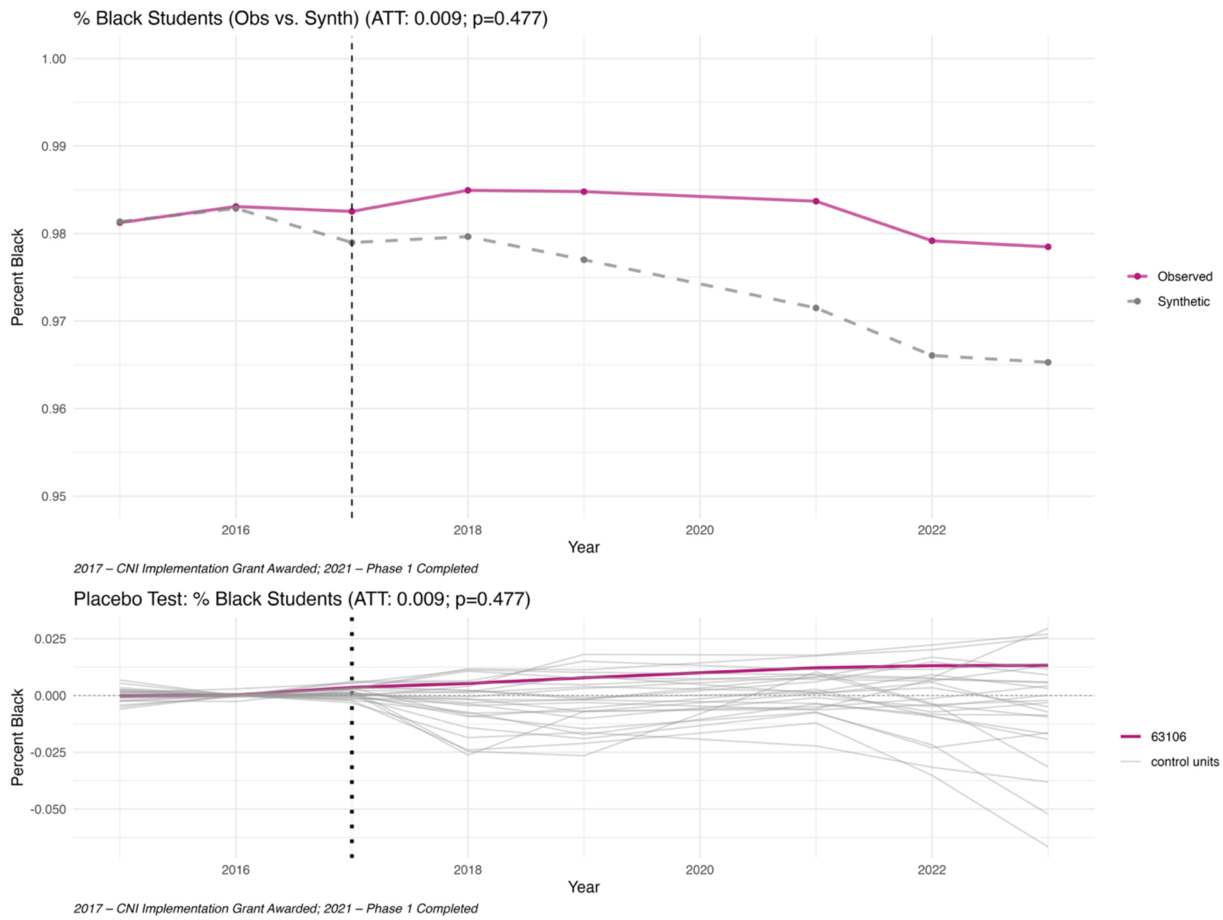
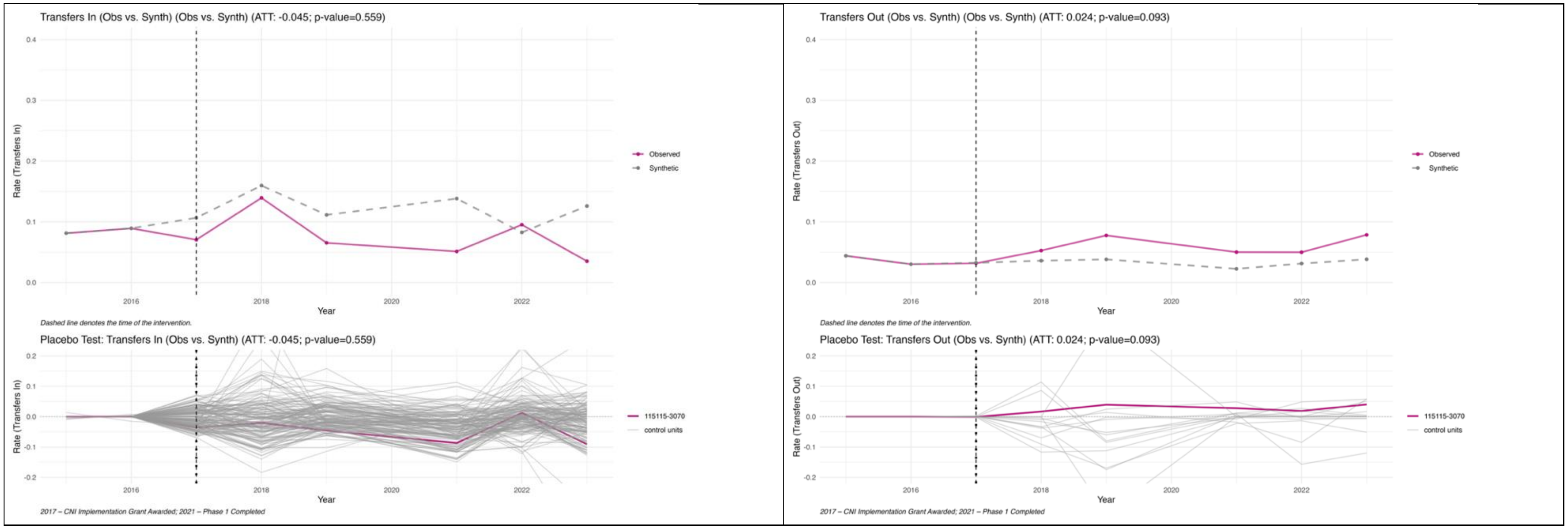


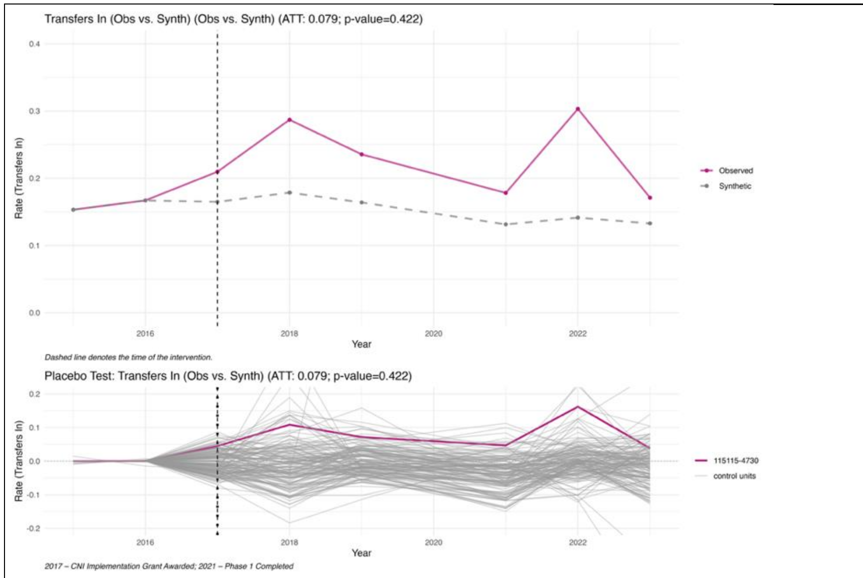
Figure 5. Synthetic Control Model Results—Racial Compositions in 63106

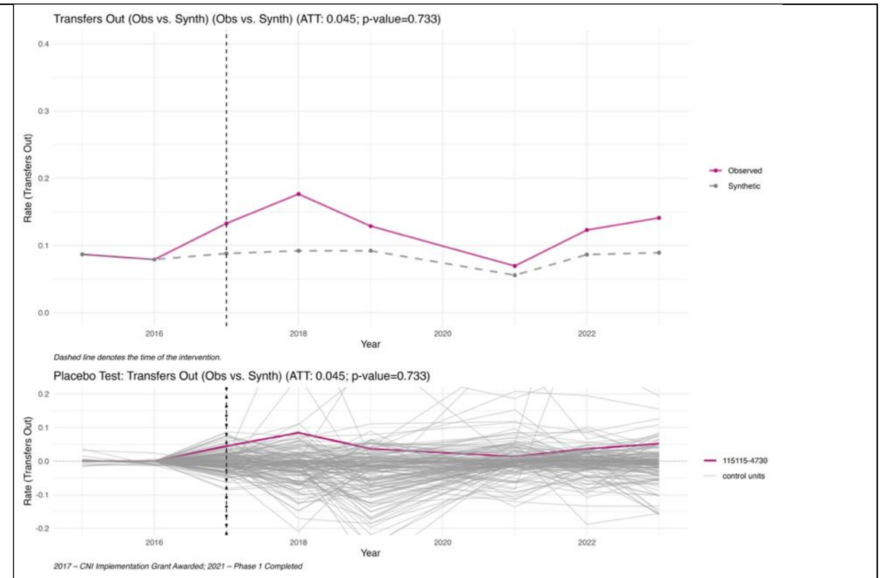


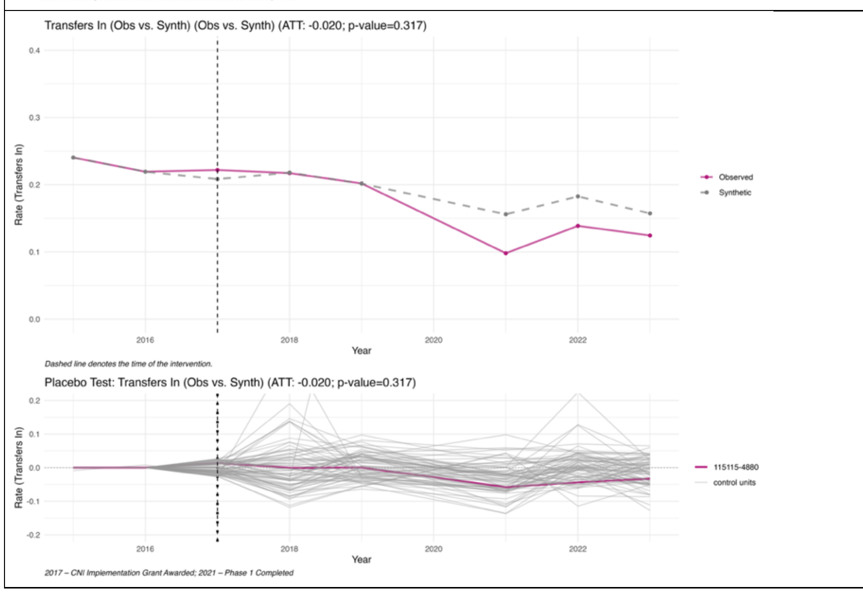
APPENDICES

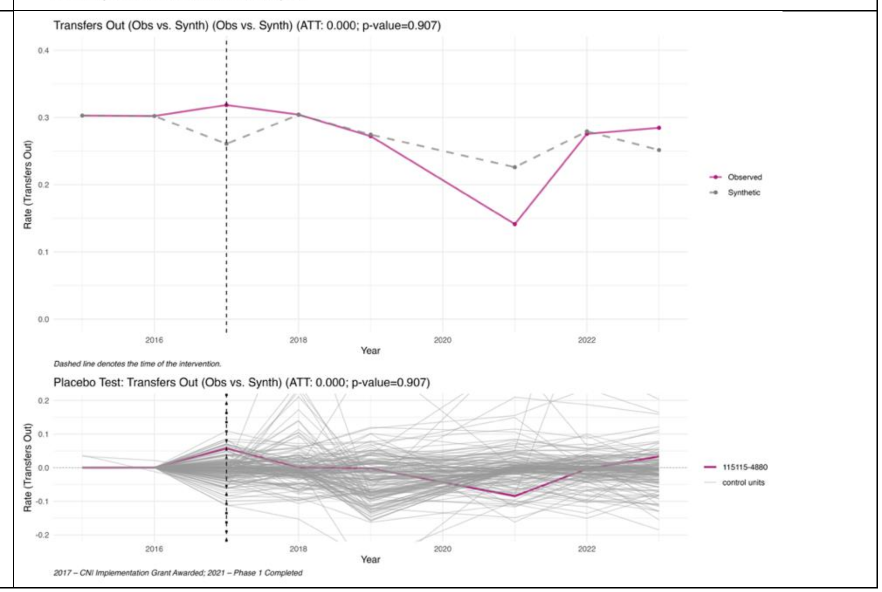
Appendix A. Synthetic Control Model Results—School Transfers of Five CNI Schools

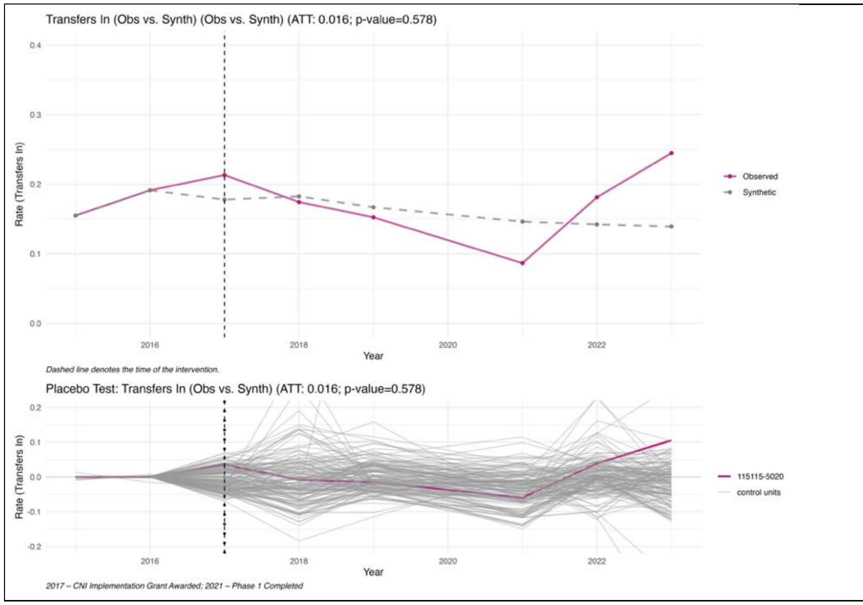


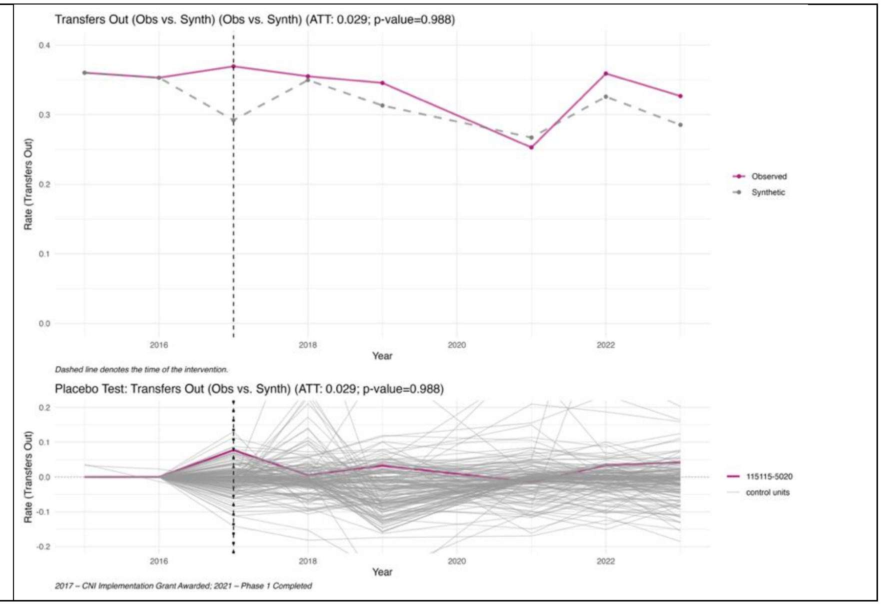

Transfers In (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.079; p-value=0.422)
Rate (Transfers In)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers In (Obs vs. Synth) (ATT: 0.079; p-value=0.422)
Rate (Transfers In)
Year
115115-4730
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

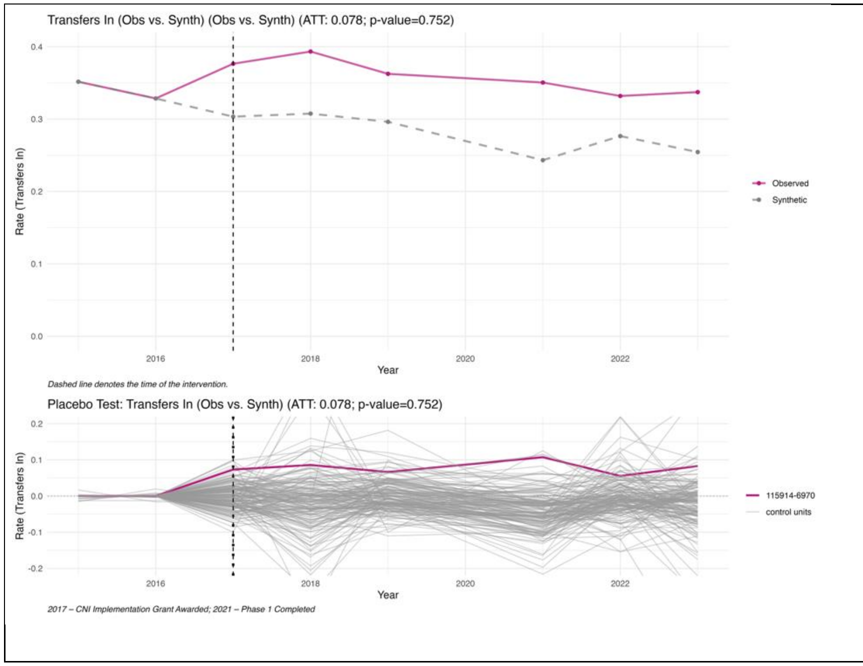

Transfers Out (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.045; p-value=0.733)
Rate (Transfers Out)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers Out (Obs vs. Synth) (ATT: 0.045; p-value=0.733)
Rate (Transfers Out)
Year
115115-4730
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

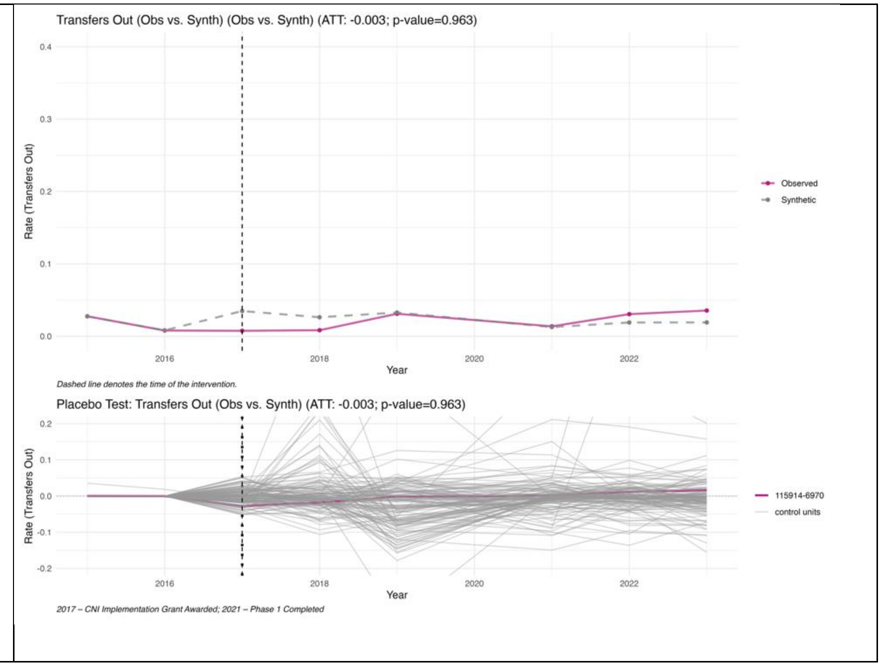

Transfers In (Obs vs. Synth) (Obs vs. Synth) (ATT: -0.020; p-value=0.317)
Rate (Transfers In)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers In (Obs vs. Synth) (ATT: -0.020; p-value=0.317)
Rate (Transfers In)
Year
115115-4880
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed


Transfers Out (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.000; p-value=0.907)
Rate (Transfers Out)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers Out (Obs vs. Synth) (ATT: 0.000; p-value=0.907)
Rate (Transfers Out)
Year
115115-4880
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed


Transfers In (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.016; p-value=0.578)
Rate (Transfers In)
0.4
0.3
0.2
0.1
0.0
2016
2018
2020
2022
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers In (Obs vs. Synth) (ATT: 0.016; p-value=0.578)
Rate (Transfers In)
0.2
0.1
0.0
-0.1
-0.2
2016
2018
2020
2022
Year
115115-5020
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

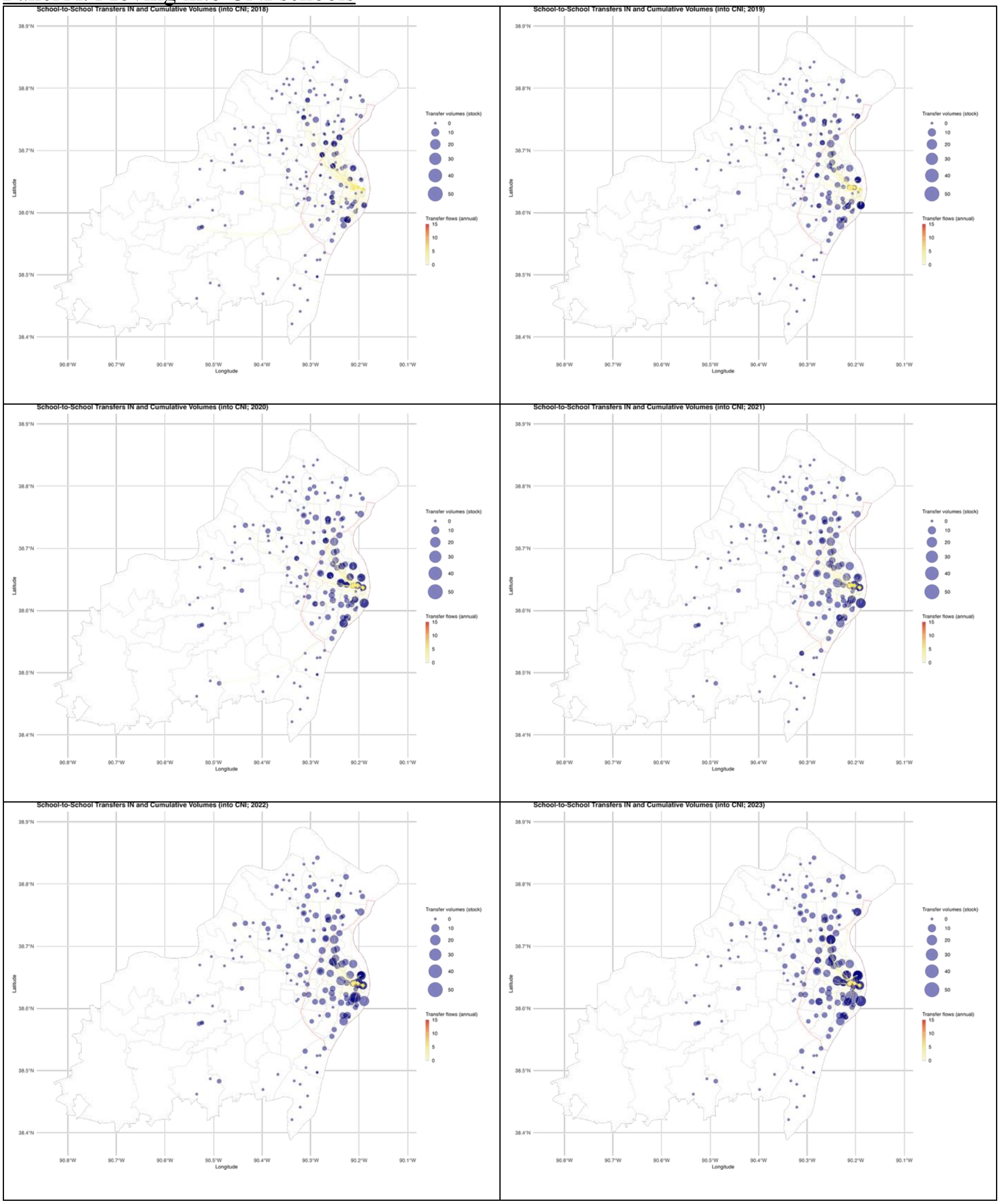

Transfers Out (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.029; p-value=0.988)
Rate (Transfers Out)
0.4
0.3
0.2
0.1
0.0
2016
2018
2020
2022
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers Out (Obs vs. Synth) (ATT: 0.029; p-value=0.988)
Rate (Transfers Out)
0.2
0.1
0.0
-0.1
-0.2
2016
2018
2020
2022
Year
115115-5020
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed


Transfers In (Obs vs. Synth) (Obs vs. Synth) (ATT: 0.078; p-value=0.752)
Rate (Transfers In)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers In (Obs vs. Synth) (ATT: 0.078; p-value=0.752)
Rate (Transfers In)
Year
115914-6970
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

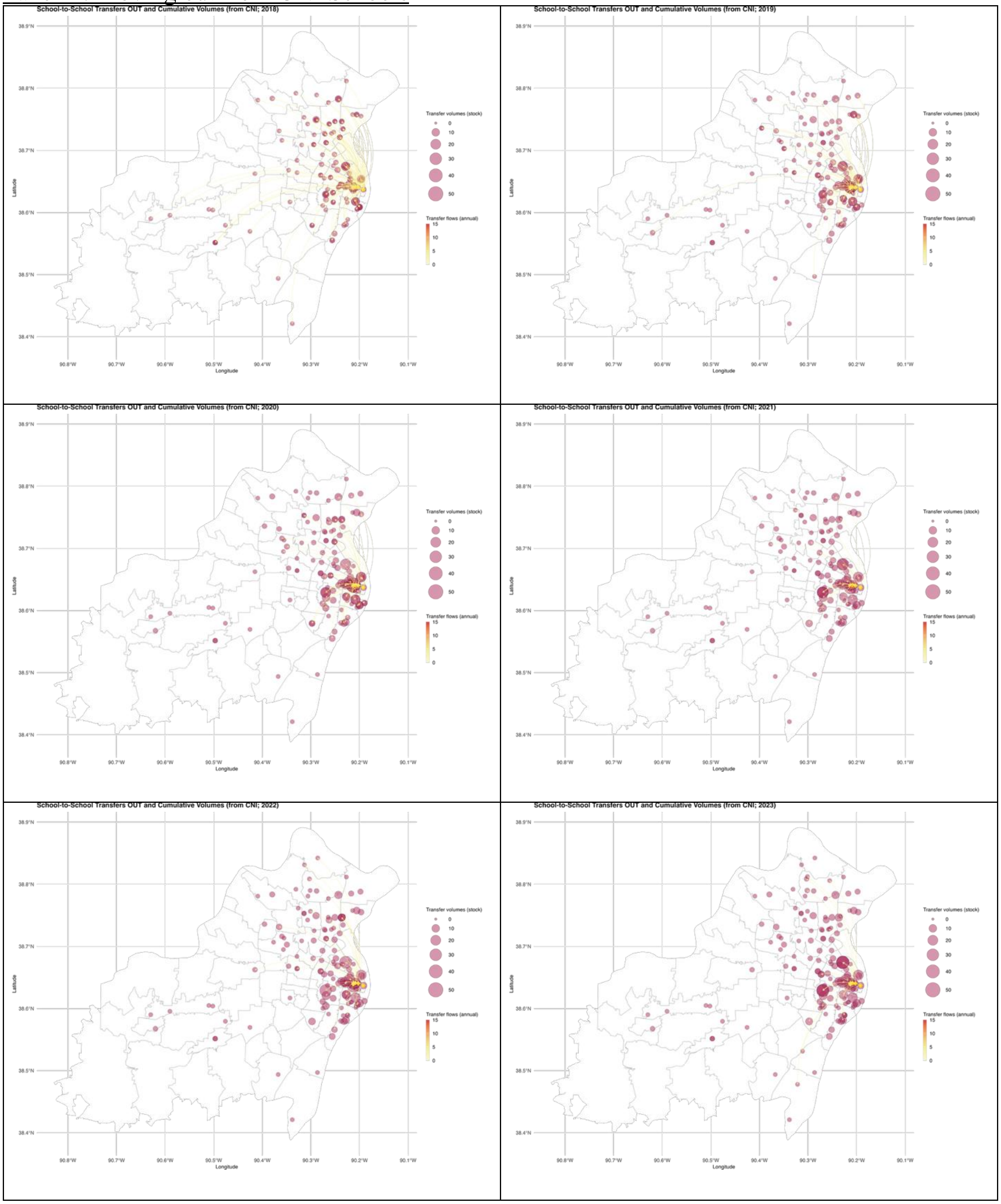

Transfers Out (Obs vs. Synth) (Obs vs. Synth) (ATT: -0.003; p-value=0.963)
Rate (Transfers Out)
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: Transfers Out (Obs vs. Synth) (ATT: -0.003; p-value=0.963)
Rate (Transfers Out)
Year
115914-6970
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

Appendix B. Explanatory Spatial Data Analysis Results—Spatial Patterns of Student Transfer

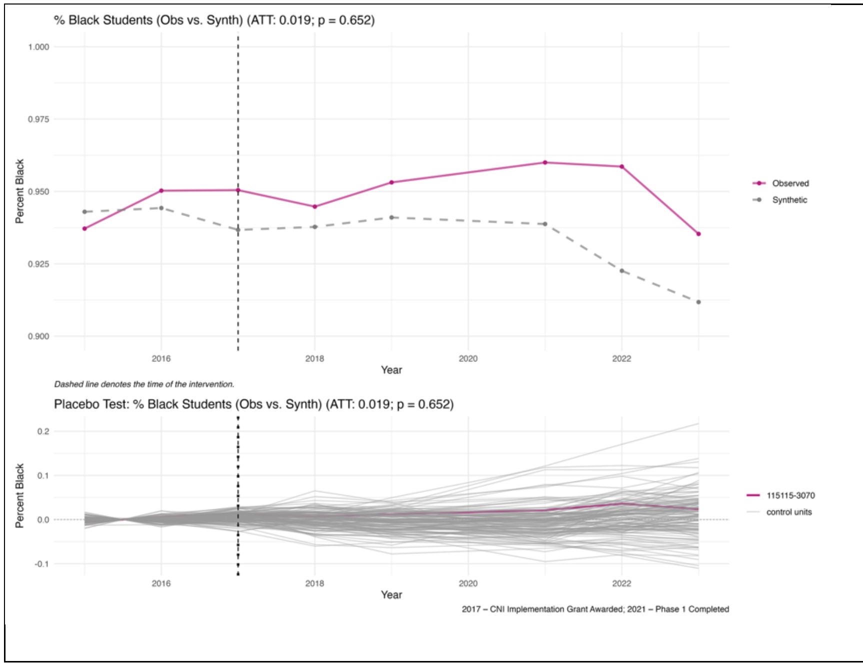
<u>Panel A. Moving into CNI schools</u>

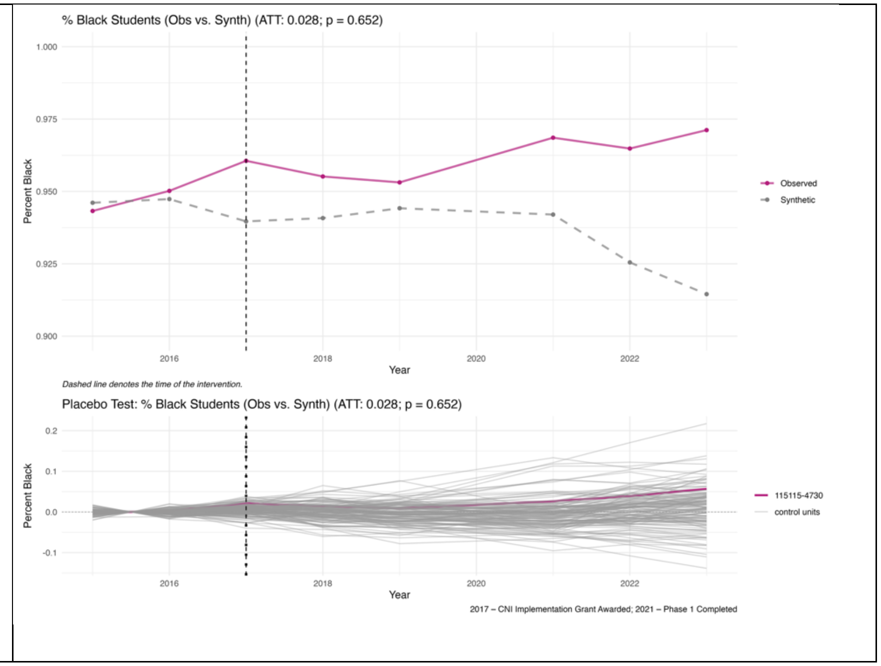


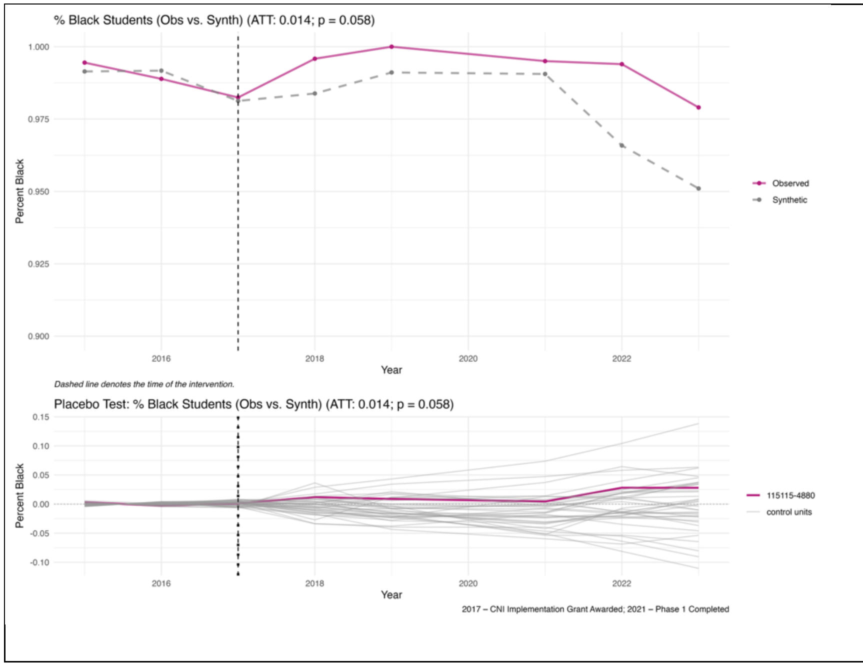
Panel B. Moving out from CNI Schools

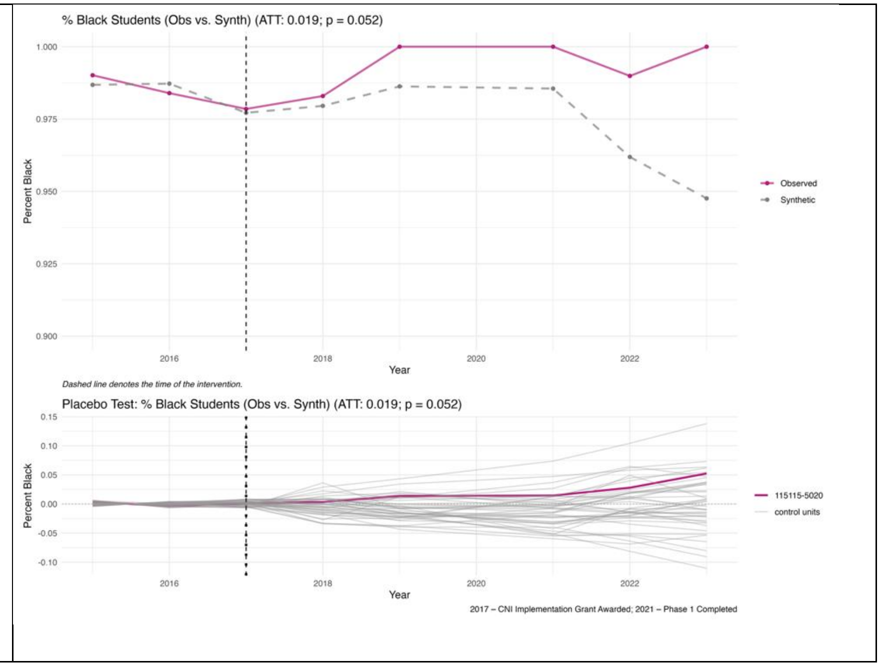


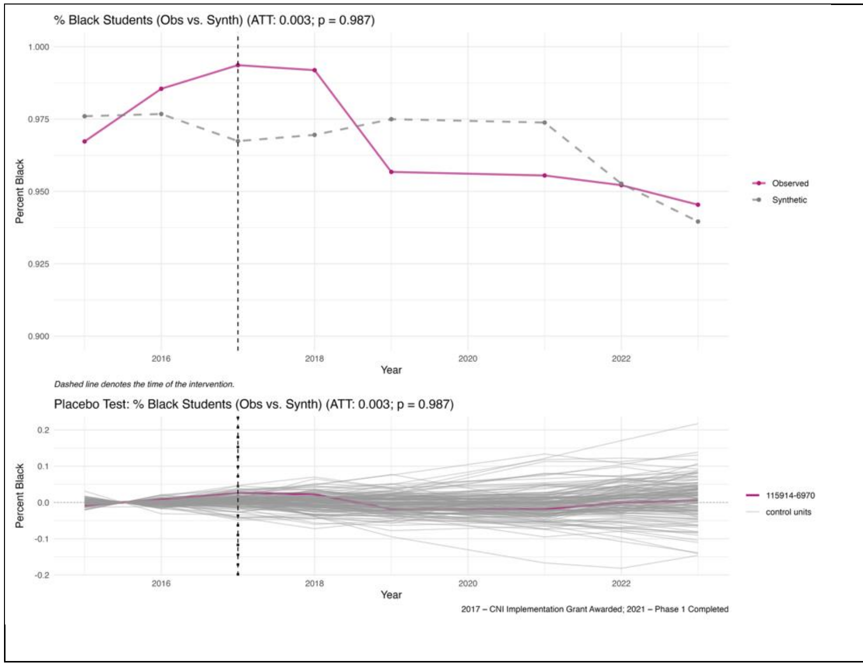
Appendix C. Synthetic Control Model Results— Racial Compositions of Five CNI Schools






% Black Students (Obs vs. Synth) (ATT: 0.014; p = 0.058)
Percent Black
1.000
0.975
0.950
0.925
0.900
2016
2018
2020
2022
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: % Black Students (Obs vs. Synth) (ATT: 0.014; p = 0.058)
0.15
0.10
0.05
0.00
-0.05
-0.10
115115-4880
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed


% Black Students (Obs vs. Synth) (ATT: 0.019; p = 0.052)
Percent Black
1.000
0.975
0.950
0.925
0.900
2016
2018
2020
2022
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: % Black Students (Obs vs. Synth) (ATT: 0.019; p = 0.052)
0.15
0.10
0.05
0.00
-0.05
-0.10
115115-5020
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed


% Black Students (Obs vs. Synth) (ATT: 0.003; p = 0.987)
1.000
0.975
0.950
0.925
0.900
Percent Black
2016
2018
2020
2022
Year
Observed
Synthetic
Dashed line denotes the time of the intervention.
Placebo Test: % Black Students (Obs vs. Synth) (ATT: 0.003; p = 0.987)
0.2
0.1
0.0
-0.1
-0.2
Percent Black
2016
2018
2020
2022
Year
115914-6970
control units
2017 – CNI Implementation Grant Awarded; 2021 – Phase 1 Completed

Appendix D. Robustness Check--St. Louis City only

D1. Descriptive Statistics of Student Characteristics (as of 2019, City only)

Panel A. By Neighborhood Treatment

Variable	Full (n=17,227)	Untreated (n=15,615)	Treated (n=1,612)	t-test
MAP ELA, mean (SD)	374.70 (49.42)	375.52 (49.77)	366.69 (45.18)	<0.001
MAP Math, mean (SD)	368.77 (55.60)	369.53 (55.87)	361.48 (52.36)	<0.001
Gender				
Female, %	49.1	49.0	50.1	0.387
Race/Ethnicity				
Black, %	77.7	75.5	98.6	<0.001
White, %	13.4	14.8	0.5	<0.001
Hispanic, %	5.0	5.5	0.5	<0.001
Other race, %	3.8	4.2	0.4	<0.001
Free/Reduced Lunch, %				
Free Lunch, %	90.1	89.3	97.5	<0.001
Reduced Lunch, %	1.9	2	1	0.005
Homeless, %	12.1	11.6	16.9	<0.001

Panel B. By School Treatment

Variable	Full (n=17,227)	Untreated (n=14,856)	Treated (n=2,371)	t-test
MAP ELA, mean (SD)	374.70 (49.42)	375.88 (50.00)	367.27 (44.93)	<0.001
MAP Math, mean (SD)	368.77 (55.60)	369.56 (56.25)	363.86 (51.11)	<0.001
Gender				
Female, %	49.1	48.8	50.9	0.057
Race/Ethnicity				
Black, %	77.7	74.8	96.0	<0.001
White, %	13.4	15.3	2.2	<0.001
Hispanic, %	5.0	5.6	1.6	<0.001
Other race, %	3.8	4.4	0.3	<0.001
Free/Reduced Lunch, %				
Free Lunch, %	90.1	88.6	99.5	<0.001
Reduced Lunch, %	1.9	2.2	0.2	<0.001
Homeless, %	12.1	11.3	17.3	<0.001

D2. CSDID results (City Only)

		Neighborhood Effects (N=559,937)				School Effects (N=559,762)			
		ELA		**Math**		**ELA**		**Math**	
		(1)		**(2)**		**(1)**		**(2)**	
Simple	ATT	24.821	***	24.131	***	23.133	***	19.844	***
		(1.482)		(1.651)		(1.370)		(1.487)	
Cohort	2019	26.997	***	26.432	***	22.335	***	17.730	***
		(1.587)		(1.922)		(1.796)		(1.982)	
	2021	21.856	***	21.616	***	30.865	***	29.992	***
		(4.418)		(4.329)		(1.909)		(1.891)	
	2022	1.520		-3.201		15.466	***	16.511	***
		(5.126)		(5.826)		(2.636)		(3.065)	
	2023	-7.187		-7.464		0.843		-0.559	
		(7.810)		(8.645)		(4.374)		(5.144)	
Dynamic	t-4	-11.704	***	-24.370	***	-31.575	***	-33.141	***
		(3.548)		(4.066)		(2.026)		(1.885)	
	t-3	-2.524		-6.661	***	-11.280	***	-14.775	***
		(2.275)		(2.492)		(1.546)		(1.676)	
	t-2	0.691		-0.101		-4.309	***	-7.980	***
		(1.633)		(1.708)		(1.168)		(1.168)	
	t-1								
	t0	3.540	**	1.179		8.225	***	3.790	***
		(1.730)		(2.053)		(1.201)		(1.430)	
	t+1	21.764	***	20.219	***	30.440	***	28.811	***
		(3.632)		(3.673)		(1.581)		(1.896)	
	t+2	27.623	***	31.934	***	28.829	***	26.857	***
		(1.707)		(2.004)		(1.492)		(1.560)	
	t+3	33.737	***	32.229	***	30.303	***	26.598	***
		(2.017)		(2.401)		(1.953)		(2.977)	
	t+4	42.824	***	39.461	***	29.873	***	26.108	***
		(2.156)		(2.429)		(4.053)		(4.512)	

Notes: Callaway and Sant'Anna uses an Inverse Probability Weighting (IPW) / Doubly Robust estimator based on influence functions, rather than a traditional Maximum Likelihood or Ordinary Least Squares estimation. Because it is not estimating a variance-decomposition model or a likelihood function, standard goodness-of-fit measures like R-Square, AIC, or BIC are not applicable or generated by this estimator.

Use of AI: During the preparation of this work the authors used ChatGPT and Claude to assist with identifying additional related work, revising short sections of text, finding grammatical errors, and correcting citations. After using these tools, the authors reviewed and edited the material. The authors take full responsibility for the content of the published article and the overall analysis, which remain human generated.