



School Vouchers and Student Neighborhoods: Evidence from the Milwaukee Parental Choice Program

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Citation: Carlson, D. E., & Cowen, J. M. (2015). School choice and student neighborhoods: Evidence from the Milwaukee parental choice program. *Education Policy Analysis Archives*, 23(60). <http://dx.doi.org/10.14507/epaa.v23.1930>

Abstract: In this paper we explore the relationship between students' residential location and participation in Milwaukee's large, widely available private school voucher program. We are interested in one overarching question: do voucher schools disproportionately draw students from better public schools and city neighborhoods, or do they draw students most in need of alternative options? We consider whether the public schools attended by students in neighborhoods contributing large numbers of students to the voucher program are more or less effective than those attended by students in neighborhoods with fewer voucher students. We also consider whether voucher students are located in city neighborhoods that directly contribute more or less to student outcomes. We find consistent evidence that neighborhoods whose students attend less effective public schools and neighborhoods with lower academic outcomes contribute disproportionately to the voucher program. This evidence is quite consistent with patterns apparent on Census-based observational measures of neighborhood socioeconomic characteristics: higher rates of voucher use are found in the least advantaged

neighborhoods. We also find, however, that disadvantaged students in general are those most likely to leave the voucher program after enrolling.

Keywords: school choice; neighborhood effects; student mobility; vouchers

Elección de Escuelas y Barrios Estudiantiles: Evidencia de el Programa de Elección de Padres Milwaukee

Resumen: En este trabajo se explora la relación entre el lugar de residencia y la participación en el programa de vales educativos (*vouchers*) de la gran Milwaukee, ampliamente disponibles para usar en escuelas privadas. Estamos interesados en la pregunta: funcionan los vales educativos (*vouchers*) para atraer desproporcionadamente a estudiantes de las mejores escuelas públicas y barrios de la ciudad, o atraen a estudiantes con mayores necesidad de opciones alternativas? Consideramos si las escuelas públicas en los barrios que contribuyen un gran número de estudiantes para el programa de vales educativos (*vouchers*) son más o menos eficaces que las que asistieron estudiantes de barrios con menor número de estudiantes de vales educativos (*vouchers*). También consideramos si los estudiantes de vales educativos (*vouchers*) están situados en los barrios de la ciudad que contribuyen directamente a mejores o peores resultados de los estudiantes. Encontramos evidencia consistente de que los barrios cuyos estudiantes asisten a escuelas públicas menos eficaces, y los barrios con los resultados académicos más bajos contribuyen de manera desproporcionada al programa de vales educativos (*vouchers*). Esta evidencia es bastante consistente con los patrones aparentes sobre las medidas de observación basados en los Censos de las características socioeconómicas de la vecindad: las tasas más altas de uso de vales educativos (*vouchers*) se encuentran en los barrios menos favorecidos. Sin embargo también encontramos que los estudiantes desfavorecidos en general, son los más propensos a abandonar el programa de vales educativos (*vouchers*) después de inscribirse.

Palabras clave: elección de la escuela; efectos de vecindad; movilidad de los estudiantes

A Escolha da Escola e Bairros dos Estudantes: Evidências de Escolha Pelos Pais Desde o Programa Milwaukee

Resumo: Neste trabalho exploramos a relação entre o local de residência e participação no programa de vales (*vouchers*) de ensino de Milwaukee, um programa enorme e amplamente disponibilizado para uso em escolas privadas.. Estamos interessados em uma abrangente questão: os vales (*vouchers*) escolares atraem desproporcionalmente os estudantes das melhores escolas públicas e bairros da cidade ou atraem alunos com maior necessidade de opções alternativas? Nós consideramos em que medida escolas públicas de bairros que contribuem com um grande número de alunos para o programa de vales (*vouchers*) educativos são mais ou menos eficazes do que aquelas frequentadas por alunos em bairros com menor número de vales (*vouchers*) educativos. Consideramos, também, se os alunos que utilizam vales (*vouchers*) educacionais estão localizados nos bairros da cidade que contribuem diretamente para melhores ou piores resultados para os alunos. Encontramos evidências consistentes que os distritos cujos alunos frequentam escolas públicas menos eficazes e que os bairros com o desempenho acadêmico menor contribuem desproporcionalmente para o programa de vales (*vouchers*) de ensino.. Esta evidência é bastante consistente com os padrões aparentes sobre medidas observacionais baseados em censo de características socioeconômicas do bairro: as maiores taxas de utilização dos vales (*vouchers*) de ensino estão em bairros desfavorecidos. Mas também descobrimos que os alunos desfavorecidos em geral, são mais propensos a deixar o programa de vales (*vouchers*) educativos, após a matrícula.

Palavras-chave: a escolha da escola; efeitos de vizinhança; mobilidade dos estudantes

Introduction

School choice policies remain among the most controversial educational reforms in the United States. Although this debate is informed by a substantial body of empirical evidence, much of the literature remains focused on two central questions: whether school choice programs cause positive changes in student outcomes (typically measured by standardized test scores) and whether choice programs disproportionately enroll students with higher levels of previous academic success.

These questions are particularly present in the development of school vouchers or tax credits, both of which essentially subsidize student attendance in private school with public resources. Such plans are available subject to means tests in states like Florida, Indiana, Louisiana, Ohio, and Wisconsin (Workman, 2011), with several additional states providing other tax-based private tuition plans or direct voucher subsidies for students with special needs. Although most voucher or voucher-like programs are quite new, pilot versions have existed for years and have drawn significant numbers of students away from traditional public schools in Florida, Ohio, and Wisconsin (e.g., Figlio, 2011; Metcalf, West, Legan, Paul, & Boone, 2003; Plucker, Muller, Hansen, Ravert, & Makel, 2006; Witte, 2000; Witte, Wolf, Cowen, Fleming, & Lucas-McLean, 2008).

In the context of such expansion, our objective is to move beyond the debate over whether voucher programs “work” in terms of their average impact on student outcomes, and to consider instead the contexts in which students who do use vouchers make those decisions. We argue that the appropriate case for such an inquiry is an environment in which a voucher program is large enough, and well-enough established, to represent a genuine educational option for most students. Our research examines students’ voucher use in Milwaukee, Wisconsin, a state that operates the oldest and largest urban voucher program in the country.

We are interested in one overarching question: do voucher schools disproportionately draw students from better public schools and city neighborhoods, or do they draw students most in need of alternative options? Using student-level panel data, we consider whether the public schools attended by students in neighborhoods contributing large numbers of students to the voucher program are more or less effective than those attended by students in neighborhoods with fewer voucher students. We also consider whether voucher students are located in city neighborhoods that directly contribute more or less to student outcomes. Finally, we exploit a particular feature of Milwaukee’s voucher program – its high rate of attrition back to public schools (Carlson, Cowen & Fleming, 2013; Cowen, Fleming, Witte, & Wolf, 2012) – to consider the school and neighborhood contexts of those returning to the public sector. We argue that this evidence allows us to consider the academic tradeoffs that students make within a school system that comes as close to providing a competitive market for schooling options as any empirical context in the United States. As such, this paper provides guidance to both the scholarly and policymaking communities considering school choice policies in general and voucher programs in particular.

Background

Much of the work on vouchers has focused directly on the average impact on student achievement associated with participation in voucher programs. In Milwaukee, early evidence was mixed (e.g., Greene, Peterson & Du, 1998; Rouse, 1998; Witte, 2000), generally indicative of small positive effects. More recent full-scale evaluations of voucher or voucher-like programs have occurred in Cleveland (e.g., Metcalf et al., 2003; Plucker et al., 2006), Florida (e.g., Figlio, 2011), and Washington, D.C. (Wolf et al., 2013). Evaluations of private voucher programs have also been conducted in the latter location, as well as Dayton, Ohio and New York City (Howell et al., 2006). These studies have collectively provided evidence for both positive and null voucher impacts on

achievement, a finding mirrored by secondary analysis of data such as those from New York City (Barnard et al., 2003; Krueger & Zhu, 2004). Additional nuance was added in the most recent evaluation of Milwaukee's program, where after five years analysts found few differences in public-private test scores until the last year of study, when a new public-style accountability system directed at the city's voucher schools appeared to have stimulated test score growth in that sector considerably (Witte et al., 2014). The literature is also considering non-test measures of school productivity, most notably student attainment, which new studies have shown to respond positively to voucher usage even where test score impacts are marginal or non-existent (Cowen et al., 2013; Wolf et al., 2013).

The studies above generally maintain a program-wide focus, addressing the policy question of whether vouchers have large enough positive effects (or even positive effects in the first place) necessary for decision-makers to weigh those benefits against program costs. But as vouchers have expanded from small, targeted interventions to large city-wide or even state-wide initiatives, other features may be critical to understanding how such programs function in highly local contexts. In urban environments, the neighborhoods in which students live are a particularly open avenue for inquiry, as these communities may include a dynamic combination of family, peer, and school influences that contribute to, and are affected by, the educational choices of individuals. One of the primary – if not the dominant – motivations for school choice policy in general is to provide students with schooling opportunities apart from those offered by traditional neighborhood-based attendance boundaries. The extent to which neighborhoods play a lingering role in determining choice when vouchers are readily available is a natural question within this framework.

Moreover, scholars have recognized that neighborhoods in their own right may play a role in determining student success. A large body of work suggests that the quality of the neighborhood in which a student resides is associated with his or her educational outcomes (e.g., Aaronson, 1998; Brooks-Gunn et al., 1993; Crane, 1991; Duncan, Brooks-Gunn, & Klebanov 1994; Mendenhall, DeLuca, & Duncan 2006), and neighborhood-based interventions – most notably the Moving to Opportunity (MTO) experiment – have been undertaken with improving student achievement and attainment specified as a primary goal (see Sanbonmatsu et al., 2011). The general pattern emerging from earlier work is one where the quality of a student's neighborhood – as measured by socioeconomic characteristics – is positively associated with his or her cognitive test scores, although there is heterogeneity in the substantive magnitude of the detected relationships. Sharkey and Elwert (2011) note that these studies often control for factors that may be endogenous to neighborhood quality – they specify family income and health as examples – and thus potentially underestimate the influence of neighborhoods on relevant outcomes. Relying on observational data from the Panel Study of Income Dynamics and employing methods designed to mitigate the methodological issue noted above, the authors find statistically significant and substantively strong relationships between neighborhood and student achievement outcomes. Substantively similar results are found in Sampson, Sharkey, and Raudenbush (2008), who use comparable methods and observational data from Chicago, Illinois.

In addition to these studies of direct neighborhood effects on outcomes, scholars have also examined the link between housing policies (e.g., housing vouchers) and school quality. The earliest evidence in this vein dates back to the Gautreaux study, which was made possible by a 1976 court order requiring the provision of housing vouchers to thousands of Chicago public housing residents. These voucher recipients were to be randomly assigned to move to the suburbs or remain in the city. Analyses of the children of voucher recipients found that those who moved to the suburbs had access to higher quality schools, and that the mothers of children in the suburban group were pleased with the educational opportunities (Kaufman & Rosenbaum, 1992; Rubinowitz &

Rosenbaum, 2000). More recent evidence, however, suggests that such policies do not translate into access to better schools for at-risk students (e.g., Horn, Ellen, & Schwartz, 2014).

The development of school choice policy as at least partly an effort to break the relationship between residential location and schooling, as well as the shared emphasis between such policies and those in the neighborhood-based studies on student outcomes, suggests an important line of inquiry at the nexus of neighborhoods and school choice. Until recently, however, this context has remained “largely been unaddressed” (Lauen, 2007, p. 181). Citing the role of social and economic disadvantages and peer effects as possible elements of a relationship between school choice and neighborhood context, Lauen (2007) finds that students in neighborhoods with higher numbers of African Americans, higher rates of poverty, and lower levels of affluence are less likely to select into surrounding private schools. Lauen also finds that students assigned to higher quality high schools via their neighborhood location were less likely to choose. Such patterns are generally consistent with earlier evidence suggesting that private school choices are generally made by students in more affluent families (Betts & Fairlie, 2001; Figlio & Stone, 2001; Lankford & Wyckoff, 2001; Long & Toma, 1988), even among those offered a voucher (Campbell, West, & Peterson, 2005; Cowen, 2010).

This paper joins these various strands of literature to suggest a dynamic relationship between student participation in a fully-scaled voucher program, student success in these programs (as measured by test scores and sustained participation) and the neighborhood conditions to which students are exposed or – in some cases – move into. Although the earlier evidence suggests that students in more affluent neighborhoods are more likely to avail themselves of different school choice options, such a pattern may not hold within a carefully targeted governmental choice program like means-tested vouchers (e.g., Figlio, Hart, & Metzger, 2010; Fleming et al., 2014; Hart, 2013), and different studies of charter school selection have yielded more nuanced results, as charters often locate in areas with direct access to target populations.

In this context, our work directly informs the critical question of the determinants of school voucher usage, where evidence is scarce relative to the body of studies on voucher impacts overall. One explanation is that such determinants, both observable and unobserved, are typically those that evaluations of voucher programs must control away to identify average treatment effects. In addition, because only a handful of true voucher programs have existed to any sort of scale until recently (and are still under development), evidence for who chooses vouchers may have been limited with respect to generalizability.

This paper directly confronts two competing possibilities: first, that voucher schools draw from better public schools and city neighborhoods in the first place, and, conversely, that students attend voucher schools to escape poor academic surroundings. We focus not only on how the patterns of voucher use within urban neighborhoods can inform such questions, but also on the extent to which student background and neighborhood characteristics may affect long-term participation in a voucher program. The latter focus is important, but understudied, save a small body of earlier work (Carlson et al., 2013; Cowen et al., 2012; Howell, 2004) that has suggested that particularly at-risk students tend to be less likely to remain in a voucher program even within a generally disadvantaged population. These issues are central to any understanding of school choice policy. As scholars, advocates and policymakers alike debate the potential for alternative educational options to improve the outcomes of both students who choose and those who remain in public schools, a greater understanding of the context in which these choices occur is warranted. Critics of school choice programs have long employed the language of “creaming” away the best students or “cropping” off the worst performers to describe the process by which alternative educational options may exacerbate rather than improve educational inequality. Our paper suggests that the questions of who chooses, and why, are more complex than a simple comparison of individual

characteristics. Our paper suggests that in a large and fully mature school choice system – one we observe empirically in areas like Milwaukee, Wisconsin – the choice process may be a function as much of where students live and of their educational options.

Data and Program Background

The state of Wisconsin operates the nation's oldest and largest urban school voucher system for low-income students. Since its inception in 1990, the Milwaukee Parental Choice Program (MPCP) has been funded by state and local taxpayers and administered by the Wisconsin Department of Public Instruction (DPI), the state's central educational agency. When the first official evaluation of the MPCP began in 1990, there were 341 voucher students enrolled (MPS) in seven secular private schools (Witte, 2000). After that evaluation ended in 1995, the state of Wisconsin expanded the voucher program to include religious schools, and the student enrollment grew dramatically over the next ten years as a result.

In 2005, the legislature passed Wisconsin Act 125, which re-authorized and expanded the MPCP again, but also made several important changes to the program. Before the re-authorization, the total number of students who could participate in the voucher program was limited to 15 percent of the number of students enrolled in the Milwaukee Public School District (MPS), which translated to about 15,000 students. Act 125 raised the cap to a nominal figure of 22,500 students. Subject to this cap, any student residing in Milwaukee whose family income was below 175 percent of the federal poverty level was eligible for a voucher, the value of which had been capped near \$6,500 for the past decade (Witte et al., 2008).¹ The law also required a new evaluation, conducted by independent researchers, to report on program outcomes. The data for this paper are drawn from that official evaluation of the MPCP, which occurred between 2006 and 2011 (Witte et al., 2008, 2014).

This evaluation provided detailed information on a representative panel of more than 2,500 MPCP (i.e., voucher-using) students drawn from the nearly 20,000 students participating in the program citywide during the evaluation years. In addition, and critically for our purposes, the evaluation also provided data on the full population of MPS students, making it possible to observe a rich set of data on students, schools and neighborhoods within the city itself. Several specific attributes of these data are particularly important for our purposes here.

The first is that the MPCP operates in a school-based application framework. Students apply to the MPCP after selecting a particular private school, and – subject to the general guidelines noted above – each school receives voucher funds directly from the DPI. This school-based approach contrasts with most other private school choice programs where students receive vouchers or scholarships first and only then select a school to attend. The evaluation from which we draw data, while authorized by the state of Wisconsin, did not provide access to this application process.²

Instead, Witte et al. (2008) were provided an audited file of the population of approximately 18,000 students confirmed to be enrolled in the MPCP as of September 30, 2006. This audited file identified the school attended by each student, and it was from this file that the initial evaluation drew the representative sample required by 2005 Wisconsin Act 125. Specifically, the evaluators drew a grade-stratified random sample of nearly 1,926 MPCP participants for students in grades 3 through 8 in 2006, as well as the entire population of 801 9th graders for purposes of tracking student attainment over time. In 2007 and 2008, the evaluators used a similar process to refresh the

¹ Schools participating in the MPCP were required to accept the voucher as full payment – they were prohibited from charging voucher-holding students any supplementary charges.

² See 2005 Wisconsin Act 125 and Witte et al. (2008) for more details on the authorizing legislation.

sample with an additional 500 incoming 3rd graders that were evenly distributed across the two sectors. Table 1 provides summary statistics on available administrative measures for this panel, which comprises the baseline analytic sample of voucher students for the present paper.

Table 1
Representative MPCP Panel Descriptive Statistics 2006-2010

Characteristics	% (s.d.)
African American	66.630 (47.160)
Hispanic	22.219 (41.578)
Asian	2.754 (16.365)
Female	53.975 (49.849)
Confirmed Ex.Ed.	2.464 (15.506)
Confirmed ELL	6.900 (25.349)
Confirmed F/RL	50.466 (50.000)
Unique N	3,652

Source: Witte et al. (2008). “Confirmed” status for English Language Learners (ELL), Free/Reduced Lunch (FRL) and Special Needs (ExEd) may understate MPCP levels because some MPCP schools do not record these distinctions. See Witte et al. (2008) and Cowen et al. (2012) for additional information

The Witte et al. (2008) evaluation was based on a matched comparison between the MPCP panel and a sample of Milwaukee Public Schools (MPS) students drawn from the universe of students enrolled in MPS who took the Wisconsin Knowledge and Concepts Exam (WKCE), which was the test the state used to meet federal accountability requirements. It is this universe of data that provide the basis for generating the MPS student and neighborhood statistics with which we compare the representative MPCP panelists between the 2006-07 and 2010-11 academic years. It is important to note that the program has since broadened to other parts of the state, and caps on participant income have been raised, so the students in this sample no longer reflect the expanded population of current participants.

Along with student results on the WKCE, which are standardized using the district-wide mean and standard deviation for the proper grade, subject, and year, the dataset contains a unique but confidential student identifier and standard student demographics such as sex, race, grade, free- and reduced-price lunch status, English language learner status, and special education status. School-level characteristics of all test-takers such as mean math and reading scores by grade and student demographics are available by aggregating the characteristics of the test-taking population. Finally, the data include an annual record of students’ residential neighborhood, operationalized as the U.S. Census tract.

Nested within county boundaries, Census tracts are small geographic units that generally contain between 1,500 and 8,000 individuals, with a targeted population of 4,000. Tracts are purposefully drawn to reflect the true character of a neighborhood – efforts are made to make them homogenous along dimensions such as socioeconomic status, demographic characteristics, and quality of the housing stock (Iceland & Steinmetz, 2003). Furthermore, tracts are drawn to follow relevant physical boundaries, such as highways, waterways, and railroad tracks, among others. In short, Census tracts are the product of a comprehensive and systematic attempt to identify true neighborhood boundaries. Within the MPS dataset, students reside in approximately 220 different Census tracts and attend about 160 unique elementary and middle schools across the City of Milwaukee.³ To the Census tract of record, we merged a number of observable tract-level

³ Throughout this paper we use the term “neighborhood” interchangeably with “Census tract.”

characteristics from the American Community Survey (ACS). Following Lauen (2007), we focus here on measures of residential mobility, the percentage of families below poverty, residents on public assistance, residents unemployed, and residents who are African American. To these we also add the percentage of high school dropouts, those possessing bachelor's degrees and those identified as Hispanic. We also include median home value and use the percentage of households headed by a single parent in lieu of Lauen's inclusion of female-headed homes.

Methodological Approaches

Neighborhood Differences Associated with Voucher Usage

Our first research question simply concerns the neighborhood characteristics of students who participate in the Milwaukee voucher program. As far as we are aware, even these basic statistics – those providing summary information on neighborhoods from which such students are drawn – are heretofore unreported in the literature. The most basic way to operationalize such statistics is to simply compare neighborhoods without any of the MPCP panelists to those where MPCP students actually resided. In Milwaukee, however, where the program is large, available citywide and is generally available (at least by income) to the vast majority of children, there are relatively few Census tracts that contain no MPCP panelists – only about 12 percent of the tracts contained no member of the voucher panel. To test whether such neighborhoods are generally outliers we simply compare descriptive statistics for neighborhoods with no MPCP students against neighborhoods in one of four quartiles of MPCP participation rates. Although we base these estimated quartiles on a sample rather than the full population of MPCP students (for reasons detailed above), because the sample was grade-stratified and randomly drawn from all MPCP students using a voucher in September 2006, the relative frequency of panelists in each neighborhood should approximate the underlying contribution of students each neighborhood makes to the MPCP.

Estimation of Public School Effectiveness and Neighborhood Quality

Carlson and Cowen (2015) outline the procedural, conceptual and identification details necessary for estimating school and neighborhood effects on student outcomes simultaneously, and consider whether such estimates can plausibly represent causal impacts. Here, we are less concerned with the causal nature of the estimates *per se*, and rather with our preference for such estimates over other indicators of neighborhood or school outcomes – particularly those operationalized by aggregated test score levels.

We are interested in calculating the separate neighborhood and school contributions to outcomes for students in the surrounding Milwaukee public school system – the default system for Milwaukee children, including those participating in the voucher program. Valid estimation of neighborhood and school contributions to student test score gains is only possible if students are sufficiently cross classified in these two contextual settings. That is, estimation of the two sets of parameters requires neighborhoods to be linked through the schools that students attend and schools to be linked through the neighborhoods in which students reside. It is important to note that the linkages of neighborhoods through schools and schools through neighborhoods do not need to be direct – they can be linked indirectly.

In our data, there is substantial cross-classification between schools and neighborhoods – a pattern that may be explained in part by the fact that MPS provides families with substantial latitude

in selecting the specific school that their child will attend.⁴ Recalling that students in our dataset reside in over 200 unique Census tracts and attend about 160 different MPS elementary and middle schools,⁵ we note that most schools draw students from multiple neighborhoods, most often in excess of 50, and that in most tracts, students attended more than 50 different elementary or middle schools across the five years we observe (Carlson & Cowen 2015).

Given the requisite cross-classification of students in neighborhoods and schools, we isolate the relationships between neighborhoods, schools, and student test score growth using the following model:

$$Y_{ijkt} = \beta Y_{ijkt-1} + \rho G_{it} + \tau H_{ijkt} + \gamma S_j + \theta N_k + \varepsilon_{ijkt} \quad (1)$$

In this model, Y represents a measure of student achievement on the WKCE – the state test used for federal accountability purposes – standardized by the district mean and standard deviation for the proper year, grade, and subject for student i attending school j and living in neighborhood k at time t . This achievement measure is modeled as a function of a vector of lagged achievement measures, a vector of grade dummies, G , a vector of student characteristics, H , a Census tract (i.e., neighborhood) fixed effect, N , a school fixed effect, S , and an error term, ε .⁶ We estimate the model separately for reading and math. The coefficients associated with the neighborhood and school fixed effects – respectively denoted by θ and γ in Equation (3) – represent the estimated neighborhood and school contributions to student test score gains that, along with their standard errors, we recover after estimation of Equation 1. The recovered neighborhood and school fixed effects were each parameterized using sum-to-zero constraints, implying that neighborhood and school contributions to test score gains are estimated relative to the average neighborhood and school contribution, respectively.⁷ We are ultimately interested in some average value of γ , $\bar{\gamma}_k = \sum \gamma_j / n_k$ across all schools attended by students in neighborhood k , as well as any unique and direct effect θ of the neighborhood itself. The difference between θ and $\bar{\gamma}_k$ is subtle yet quite important. For our purposes, $\bar{\gamma}_k$ is perhaps more policy-relevant and conceptually straightforward to understand: it simply represents the average estimated effectiveness of all public schools (including district-run charter schools) attended by students in k . In the Carlson and Cowen (2015) framework, what makes $\bar{\gamma}_k$ an appealing quantity here is that we are able to estimate it after controlling for any direct neighborhood effects θ that students may realize from their residential peers. It is important to stress that the cross-classification of students in neighborhoods and schools (via Milwaukee’s open

⁴ See <http://mpsportal.milwaukee.k12.wi.us/portal/server.pt/doc/74435/Directions+Booklet+-+2011> for a description of MPS enrollment policy.

⁵ We restrict our analysis to elementary and middle schools because students are only tested once in high school (10th grade), a reality that renders us unable – because of the inclusion of lagged achievement in Equation 1 – to estimate a reliable school contribution to student test score gains at the high school level.

⁶ The vector of lagged reading scores contains a 1-year lag of the student’s standardized score as well as squared and cubed terms of that lag. The vector of lagged math scores contains an identical set of terms. The vector of student characteristics includes indicators for gender, race, English language learner status, free or reduced-price lunch status, and special-needs status.

⁷ To recover neighborhood and school contributions that were each parameterized using sum-to-zero constraints we estimated Equation (1) twice using Stata’s user-written “felsdsvregdm” command (Mihaly et al. 2010). In the first estimation, the neighborhood fixed effects were estimated and subsequently recovered using sum-to-zero parameterization while the school fixed effects were eliminated through the subtraction of group means. The reverse occurred in the second estimation – the neighborhood fixed effects were eliminated using the within transformation while the school fixed effects were estimated under a sum-to-zero parameterization and subsequently recovered.

enrollment system) described above implies that \bar{V} is not necessarily a measure of the average quality of public schools that voucher students necessarily would have attended (or been assigned to) had they remained in the public sector. However, we argue that because \bar{V} is by definition calculated using all public schools attended by public students in the same neighborhood k as each voucher student i , \bar{V} is our best approximation of the effectiveness of public schools in the choice set of a typical student in neighborhood k , regardless of whether such a student in k attends a public school out of neighborhood assignment or through open enrollment.

We estimate Equation 1 across the population of MPS students observed between 2007 and 2010, and cross-link the recovered school and neighborhood estimates to the MPCP panel by Census tract for analysis. As such, and because the estimated neighborhood and school contributions to student test score gains includes both the “true” contribution and measurement error, we use an Empirical Bayes approach to shrink the estimated contributions of both neighborhoods and schools (e.g., Hanushek et al., 2007; Jacob & Lefgren, 2005).

Neighborhood Transfer and Voucher Exits

The approach described above provides a direct way to assess the relationship between the average effectiveness of public schools attended by students in a given neighborhood and rates of MPCP participation, as well as any differences in average direct contributions of neighborhoods themselves to student learning. The next step in an analysis of neighborhood-based differences in voucher participation might be the formulation and estimation of a student-level model of the decision to transfer to the voucher sector. Such a model would conceptually identify the observable characteristics of students, their public schools and their surrounding neighborhoods that were related to transfer. However, while the original Witte et al. (2008) study indicated that more than 70 percent of MPCP students had at some point been in the public sector (see also Cowen et al., 2012), such transfers occurred prior to the beginning of data collection in 2006-07, and we observe in this paper only the panelists who were already in the voucher sector. Fleming et al. (2014) consider regression-adjusted differences between voucher students and the panel of public school students, but these were based on otherwise “similarly situated” students on the basis of 2006 test scores, racial demographics and, critically for our purposes here, between public/private school students within the same neighborhoods (this study found that religious behavior was among the key predictors of voucher take-up within the same neighborhoods).

On the other hand, there is an indirect way to check whether any differences in neighborhood-level characteristics associated with different rates of MPCP participation among residents are helping to explain whether the individual decision to use an MPCP voucher includes an appraisal of neighborhood conditions. Although the data prevent us from directly modeling the impact of neighborhoods (or, for that matter, public schools) on individual students’ initial decision to make use of the voucher, we are able to explicitly consider the extent to which such characteristics influence the decision to *stay* in the voucher sector. If poor neighborhood school quality is an explanation for voucher use, we might expect to see an improvement in neighborhood school quality associated with the decision to give up the voucher later on.

Using the same data employed in this study, Cowen et al. (2012) showed that students with low levels of achievement as well as minority students are less likely to remain in MPCP after any given year, suggesting that for these students the voucher program is a temporary alternative to public schooling. Moreover, Carlson et al. (2013) showed that for such students a return to MPS might actually be beneficial, as those who left the voucher sector realized achievement gains in their first year back in MPS. Although the latter study also found that former voucher students were more likely to enter lower performing public schools, neither study explicitly considered the influence of

students' surrounding neighborhood or public school quality in the decision to remain in or leave the voucher sector. To put the point differently, earlier work on the voucher program did not fully consider the role of students' residential context in determining whether the voucher sector represented a *long-term* schooling option. To that end we estimate

$$P(MPS_{ikt+1} = 1) = \beta_0 + \beta_1 X_{it} + \beta_2 N_{ik} + \beta_3 \hat{\theta}_{ik} + \beta_4 \hat{\gamma}_{jk} + G_{it}\rho + T_t\delta + \varepsilon_{ikt} \quad (2)$$

where the probability P that a student transfers out of the voucher program and returns to MPS after time t (i.e., $t+1$) is a function not only of the characteristics of her initially observed neighborhood k but also of her own student-level characteristics X that include achievement at t , as well as the neighborhood and public school quality estimates denoted as follows: N is a vector of observed neighborhood characteristics summarized in Table 1 for each tract k ; $\hat{\theta}$ is an estimate of each neighborhood's direct academic effects and $\hat{\gamma}$ is the mean estimate of the academic effectiveness of each Milwaukee public school attended by students in k , per Equation 1 above.⁸ Equation 2, which we estimate as a logit model, thus allows us to predict the extent to which students in neighborhood k continue to participate in the Milwaukee voucher program, as a function not only of observable measures like income and demographics, but also as a function of the contributions to student learning associated with neighborhood k and the public schools attended by students in k .

Finally, for any student i who does transfer back to MPS, we are able to directly compare $\hat{\theta}$ and $\hat{\gamma}$ corresponding to the student during their time in MPCP and after transferring to MPS. In addition to simply determining the extent to which student transfers away from the voucher sector are accompanied by (and, plausibly, precipitated by) a change in residential neighborhood, we are able for such students to consider whether the resulting change in residence was associated with improvements in either direct neighborhood contributions to achievement, or in average effectiveness of public schools attended by each neighborhood's children.

Results

To provide our basic depiction of neighborhoods from which the voucher program draws, Table 2 compares the 28 Census tracts with no voucher students to those from each of the four quartiles of MPCP participation rates (with quartile 1 estimated as the lowest non-zero MPCP participation rate, and quartile 4 estimated as the highest). All comparisons yield fairly consistent and substantively important results. Moving left to right on the table from the lowest to the highest MPCP participation rates, clear social and economic disadvantages become more apparent: neighborhoods with more MPCP students have higher rates of high school drop-outs and fewer bachelor's degrees among their residents; unemployment is higher, as are the percentages of single parent homes and residents on public assistance. In these high MPCP neighborhoods, home prices are far lower and the number of minority residents is higher. The only ambiguous finding relates to residential mobility: it would appear that neighborhoods with more MPCP students have lower year-to-year mobility, as measured by the percentage remaining in the same home as the year prior.

⁸ G and T represent vectors of grade and school year fixed effects, respectively.

Table 2
Characteristics of Neighborhoods by Estimated MPCP Participation Rate

	No MPCP Students Participating	Quartile 1 of MPCP Participation	Quartile 2 of MPCP Participation	Quartile 3 of MPCP Participation	Quartile 4 of MPCP Participation
Pct H.S. Dropouts	6.70	7.91	16.82***	25.75***	23.13***
Pct. Bach Deg.	46.77	36.66**	22.76***	10.98***	11.86***
Pct. Unemp. Parent	6.32	7.53	10.15**	16.67***	17.63***
Pct. Single on Public Asst.	10.57	13.32*	26.51***	39.99***	32.448**
Pct. Very Poor	1.52	1.72	3.29**	5.65***	5.43***
Pct. Same House	8.95	7.95	9.50	13.72***	13.65**
Med. Home Value	72.81	78.44	79.65**	80.79**	78.27**
Total Pop.	221,073	180,688***	145,710***	108,272***	106,137***
Pct. Hispanic	5.79	8.97**	15.84***	19.49**	17.69**
Pct. Black	7.88	8.96	32.31***	58.67***	62.20***
Total Pop.	2,899	2,893	2,424	2,665	3,669***

Note: Stars indicate difference with No MPCP neighborhoods at ***p<0.01; **p<0.05; *p<0.10
 Source: Carlson and Cowen (2015) and American Community Survey

Table 3 reports the same neighborhood comparisons on estimated public school quality and neighborhood contributions to student learning. Neighborhoods without MPCP participation tend to be those whose children attend higher average quality public schools ($\hat{\gamma}$), and those with higher direct neighborhood effects $\hat{\theta}$ suggesting that the voucher program draws more heavily from neighborhoods where academic resources in the public sector are scarcer. This basic result would fit with a scenario in which the voucher sector meets a genuine academic need for neighborhoods in Milwaukee. Such a scenario fits qualitatively with the more readily observed differences reported in Table 2: namely, that MPCP participation rates are higher in neighborhoods with greater socioeconomic disadvantages. This qualitative agreement between Tables 2 and 3 provide a sort of cross-validation for the neighborhood and school quality estimates described here.

Table 3
Characteristics of Neighborhoods by Estimated MPCP Participation Rate

	No MPCP Students Participating	Quartile 1 of MPCP Participation	Quartile 2 of MPCP Participation	Quartile 3 of MPCP Participation	Quartile 4 of MPCP Participation
Nhood Reading $\hat{\theta}$	0.018	0.011	-0.012***	-0.027***	-0.029***
Nhood Math $\hat{\theta}$	0.003	0.016*	-0.001	-0.008*	-0.010**
Nhood Sch Read $\hat{\gamma}$	0.081	0.081	0.065**	0.044***	0.040***
Nhood Sch Math $\hat{\gamma}$	0.064	0.069	0.052	0.028***	0.018***

Note: Stars indicate difference with No MPCP neighborhoods at *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$
 Source: Carlson and Cowen (2015) and American Community Survey

We now turn to our estimates of Equation 2, the student-level prediction of transfer out of the MPCP and back to public school. Recall that this equation represents a model of how the neighborhoods in which students resided when we first observed them in the voucher program may determine the extent to which the MPCP represents a long-term alternative to the public sector. We begin by estimating a simple prediction of student transfer back to MPS using student-level administrative data, notably the test scores of student at t (where transfer would occur at $t+1$). Column 1 of Table 4 provides estimates of this specification, which substantively replicate the findings in Cowen et al. (2012) using updated data: lower performing students and African Americans are more likely to leave the voucher program after any given t .

Table 4
Prediction of Transfer from the MPCP Back to MPS

Student Characteristics	(1)	(2)	(3)	(4)
Reading (t)	-0.228*** (0.056)	-0.219*** (0.055)	-0.225*** (0.057)	-0.223*** (0.055)
Math (t)	-0.026 (0.059)	-0.014 (0.060)	-0.021 (0.059)	-0.015 (0.060)
Af. Amer.	1.011*** (0.285)	0.803*** (0.276)	0.831*** (0.261)	0.804*** (0.275)
Hisp.	0.401 (0.302)	0.303 (0.297)	0.328 (0.280)	0.306 (0.295)
Asian	1.561*** (0.357)	1.421*** (0.335)	1.408*** (0.335)	1.393*** (0.336)
Female	-0.127 (0.094)	-0.144 (0.096)	-0.142 (0.095)	-0.149 (0.096)
Confirmed Ex Ed.	0.182 (0.177)	0.186 (0.175)	0.185 (0.174)	0.188 (0.175)
Confirmed ELL	-0.196 (0.218)	-0.184 (0.218)	-0.198 (0.216)	-0.197 (0.216)
Confirmed FRL	-0.180 (0.159)	-0.187 (0.158)	-0.184 (0.158)	-0.194 (0.158)

Table 4
Prediction of Transfer from the MPCP Back to MPS

Student Characteristics	(1)	(2)	(3)	(4)
<i>Neighborhood Characteristics</i>				
Pct H.S. Dropouts		0.005 (0.007)		-2.800 (2.681)
Pct. Bach Deg.		0.008 (0.009)		1.405 (2.229)
Pct. Unemp.		-0.009 (0.007)		-0.595 (6.870)
Pct. Single Parent		0.008 (0.006)		-2.751 (3.852)
Pct. on Public Asst.		0.015 (0.015)		0.004 (0.007)
Pct. Very Poor		0.006 (0.009)		0.013 (0.010)
Pct. Same House		0.002 (0.006)		-0.009 (0.007)
Med. Home Value		-0.000 (0.000)		0.007 (0.007)
Pct. Hispanic		0.001 (0.006)		0.016 (0.014)
Pct. Black		0.002 (0.004)		0.007 (0.009)
Total Pop.		-0.000 (0.000)		0.004 (0.006)
Nhood Reading $\hat{\theta}$			-3.070 (2.227)	-0.000 (0.000)
Nhood Math $\hat{\theta}$			1.809 (2.043)	0.001 (0.006)
Nhood Sch Read $\hat{\gamma}$			-7.099 (5.086)	0.001 (0.005)
Nhood Sch Math $\hat{\gamma}$			1.538 (3.588)	-0.000 (0.000)
Intercept	-0.494 (1.217)	-0.691 (1.411)	-0.158 (1.152)	-0.769 (1.327)
N	4,762	4,714	4,745	4,704

Notes: ***p<0.01; **p<0.05; *p<0.10; Robust standard errors in parentheses, clustered by MPCP school at *t*. Models include grade and year fixed effects; estimates are logit coefficients.

In Column 2 we add the observable neighborhood characteristics, in Column 3 the neighborhood and school academic quality measures, and in Column 4 the full model. We see few apparent relationships between our estimates of $\hat{\theta}$ and $\hat{\gamma}$ and the probability that a student transfers from the voucher sector. It is difficult to discern a distinct pattern in these results, save that initial neighborhood characteristics in general appear to play little role in student-level decisions to make continued use of the voucher, and student-level determinants are far clearer. If at the aggregate level the socioeconomic and academic features of a neighborhood partly determine the extent to which it

contributes families to the city's voucher program, student characteristics are more critical in determining which individuals actually stay there. This hints at a resolution to the apparent contradiction between Tables 2, 3, and 4: our general finding that neighborhoods whose children attended lower quality public schools send more students to the voucher program, while the lowest performing individual students leave it. As we discuss further below, although the voucher program appears to serve a relatively disadvantaged population with respect to the public school students in the city as a whole, the students who are able to make the MPCP in to a viable alternative to public schools may be comparably better off with *respect to other voucher participants* themselves.

Before summarizing and concluding this analysis, we make one more empirical contribution. Neither Cowen et al. (2012) nor Carlson et al. (2013) were able to determine the extent to which exits from the voucher program were driven by residential mobility itself, or a genuine decision to exit the program while remaining in the same relative location. While we did not have individual addresses, we were able to determine whether a transfer from the MPCP was accompanied by a move away from the neighborhood in which we first observed the voucher student. This is an important step because although it is still relevant to policy formation that low performing and African Americans leave the program, the conclusions one draws may be entirely different if students left because of those characteristics instead of the possibility that such students were simply more mobile in the first place.

Table 5 indicates that just over half of the students who moved to MPS between 2007 and 2010 were also found in a new residential neighborhood in the first public school year, relative to the neighborhood in which they lived when they were selected into the MPCP sample in 2006. Our data do not allow us to confirm that the neighborhood move occurred at the same time as the move back to MPS, only that the MPS Census tract was different than that recorded in MPCP when the data collection began in 2006. Although the 53% figure thus only approximates the extent to which transfers out of the MPCP were accompanied by neighborhood change, it suggests that such residential location is indeed a component of MPCP-to-MPS mobility in the city. The remaining cells in Table 5 cross-tabulate these figure by race and quartile of student achievement scores (mean math and reading) on their final pre-MPS exams. There is some evidence that residential mobility is disproportionate to different pre-transfer achievement, with the lowest quartiles more likely to be moving residence as well. Moreover, African American students are considerably more likely to be in a new neighborhood in their first year back in public school than are non-African Americans.

Table 5
Transfers Back to MPS By Neighborhood Mobility Pattern

	All	Non Af Amer.	Af. Amer.	Q1 (lowest)	Q2	Q3	Q4 (highest)
No Neighborhood Move	46.96	60.74	42.50	43.39	33.96	48.25	47.79
Neighborhood Move	53.04	39.26	57.50	56.61	66.04	51.75	52.21
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Notes: Cells represent percentage of students in each cross-category. Q1-4 represent achievement quartile in final pre-MPS year.

These statistics compel the additional question of whether, for students who did leave the voucher program and move to a new neighborhood, the new neighborhood was better or worse than the initial location with respect to the academic quality indicators we examine above. If such indicators are at all a component of aggregate transfers into the voucher program, as we have suggested they are, we might expect exits from the voucher program to be accompanied by

discernible changes in neighborhood academic outcomes. Table 6 provides at least suggestive evidence that this is indeed the case. Overall, we see that the average effectiveness of public schools attended by children in the new neighborhood is higher than in the old, and that average direct neighborhood effects in reading (i.e., peers) are slightly but significantly higher in the new neighborhood post-transfer. These patterns do not differ meaningfully between pre-MPS achievement quartile or for African Americans, except that the quality of schools attended by the new neighborhood students appears more salient than neighborhood academic effects themselves. Taken as a whole, and although not confirming a causal link, this is exactly the pattern we would expect if some students initially transferred to MPCP in part to make up for lower neighborhood or school quality, but left when a residential change provided access to better locations. This would be particularly the case if, as we and Cowen et al. (2012) show, those exiting the MPCP were performing relatively poorly there anyway. With a change in location, the public options available may have become more appealing.

Table 6
Difference in Neighborhood and Public School Quality for MPCP Exits who Moved Residence

	All		Non Af Amer.		Af. Amer.		Q1 (lowest)		Q2		Q3		Q4 (highest)	
	New	Diff From Old	New	Diff From Old	New	Diff From Old	New	Diff From Old	New	Diff From Old	New	Diff From Old	New	Diff From Old
Nhood Reading $\hat{\theta}$	-0.026	0.004*	-0.024	0.004	-0.027	0.004*	-0.031	0.002	-0.027	0.005	-0.026	0.005	-0.024	0.003
Nhood Math $\hat{\theta}$	-0.011	0.002	0.004	0.002	-0.014	0.002	-0.015	0.001	-0.012	0.001	-0.015	0.004	0.010	0.001
Nhood Sch Read $\hat{\gamma}$	0.043	0.004*	0.065	0.007*	0.038	0.003*	0.038	0.002	0.041	0.002	0.043	0.005*	0.049	0.006*
Nhood Sch Math $\hat{\gamma}$	0.028	0.004*	0.043	0.009*	0.024	0.002*	0.026	0.002	0.024	0.000	0.030	0.008*	0.032	0.006

“New” columns represent estimates of neighborhood or public school quality; difference columns represent change from estimates associated with initial neighborhood location at * $p < 0.05$

Discussion

In this paper we take a step toward examining the role that neighborhood residence may play within a large, urban voucher program. The traditional link between where students live and which public schools they are assigned to attend suggests that neighborhoods may be an important consideration in the design of a voucher program. Indeed, one underlying motivation for voucher programs, as for charter schools, magnets and public school open enrollment policies, is to provide a variety of schooling options regardless of where students actually live. More formally, scholarship on school choice compels further examination of vouchers and student neighborhoods, not only because these relationships are yet understudied in this literature (Lauen, 2007) but also because neighborhood location is itself intertwined with a variety of student and family characteristics – notably race, socioeconomic status, family education and family structure – identified as salient predictors of the decision to leave traditional public schools (e.g., Betts & Fairlie, 2001; Campbell, West, & Peterson, 2005; Cowen, 2010; Figlio, Hart, & Metzger, 2011; Figlio & Stone 2001; Hart, 2013; Lankford & Wyckoff, 2001; Long & Toma, 1988).

The voucher program we examine here, the Milwaukee Parental Choice Program, has existed for more than twenty years, and over the past decade has grown into a large- scale program that, with enrollment at one-fifth the size of the surrounding public school system, exists as a meaningful alternative many students in the city. At the time our data were collected, the MPCP drew from students across Milwaukee, with only a handful of the city's neighborhoods contributing few or no students to the program. A primary contribution of this paper is to demonstrate that neighborhoods with the highest rates of voucher participation are generally those with particularly disadvantaged residential populations. On a variety of measures – race, income and family structure among them – the program draws from precisely those neighborhoods one would expect in a scenario in which the MPCP was serving residents most in need. This is almost certainly what decision-makers intended, and establishing this simple evidence of the program's basic operation broadens the policy perspective on major choice programs.

Our evidence also provides insight on the role that the academic quality of students' surroundings may play in voucher participation. We estimate two quantities: one is a measure of the average effectiveness of schools attended by students in each neighborhood, the other a measure of each neighborhood's direct impact on student outcomes in public schools. Conceptually, the first serves as an indicator of the quality of schools available to students within that neighborhood (whether they are assigned to those schools because they are in that neighborhood or whether they are using open enrollment to attend elsewhere), while the latter may function like an average neighborhood peer effect. From the standpoint of face validity, our estimates not only track with observed neighborhood attributes in expected ways – e.g., neighborhoods with higher academic impacts are wealthier – but also with the relationship to voucher choice suggested by these observables. Neighborhoods with higher academic quality contribute fewer students to the MPCP; neighborhoods with students attending higher quality public schools contribute fewer as well. This is the relationship one would expect if at the individual level students choose vouchers at least in part to improve their academic conditions.

If these results are encouraging to supporters of school choice, there are some more sobering indicators as well. Due to data limitations, we are unable to observe new transfers into the MPCP, but consistent with Cowen et al. (2012) we note that the lowest performing individual students tend to leave the MPCP and return to public schools. African American students are also

more likely to exit the program. We see very little evidence that the conditions of students' initial neighborhoods plays a role in determining such exits, underscoring that – in as much as neighborhood patterns appear relevant to determining MPCP participation in the aggregate – the decision to use and, here, to keep using a voucher is ultimately made at the student and family level. As Carlson et al., (2013) have shown, those low-students who exit the voucher program tend to perform better upon their initial return to MPS. Adding a new dimension to this finding, we show here that such exits may be at least partly related to student mobility between neighborhoods themselves – especially for African Americans. And, consistent with our supposition that the MPCP may serve students whose families are looking to improve upon their public school options, we see that the average quality of public schools attended by students in the new neighborhoods marginally improves for those who moved to MPS.

Taken alongside our neighborhood evidence, we suggest these patterns are not conflicting but instead highlight an important nuance about selection concerns in a voucher program. The MPCP appears to have served a relatively disadvantaged population with respect to the city as a whole, particularly in terms of the academic options available to such students. However, those students who are best able to make the MPCP a longer term alternative to lower quality neighborhoods and commonly attended public schools may be better off with respect to other voucher participants. This suggests that in considering who makes use of a school choice program, policymakers should pay at least as much attention to who *continues* to participate as well.

There are several limitations to this work. Perhaps most directly is our inability to fully observe individual selection into the MPCP at the time of the initial decision to use the voucher. Without those data we are not able to confirm at the student-level the importance of neighborhood conditions we observe in the aggregate. There is also the question of external validity with respect to other voucher programs. Milwaukee is almost uniquely a choice-rich environment. Not only does the MPCP offer a meaningful private school option for most students (at least by scope and income eligibility), but the city has two large charter programs: one administered by Milwaukee Public Schools and the other by independent providers. The city's open enrollment policy also provides wide access to a variety of public schools, as well as to schools in the surrounding suburbs. Whether and to what extent our conclusion that the MPCP itself draws more heavily from disadvantaged neighborhoods is an artifact of the city's choice environment is unknown at present. At minimum, future work might attempt to place the neighborhood conditions we examine here in the context of each competing choice option. As noted above, too, the means-test associated with the MPCP continues to be relaxed, and Wisconsin has recently expanded vouchers to areas across the state. In other contexts, especially those where vouchers are not precisely targeted toward at-need populations, it may well be that such programs serve students who are better off in the first place.

These limitations aside, we argue that the results here provide an important if preliminary insight into the way a large-scale voucher program may operate. Even if the empirical evidence on voucher outcomes remains mixed, it is inarguable that these programs are expanding in size and number. In Arizona, the District of Columbia, Indiana, Louisiana, Ohio, and Wisconsin, voucher or voucher-like programs exist, while Florida, Georgia, Utah, and Oklahoma provide vouchers for students with special academic needs. Moreover, at least ten states – Arizona, Florida, Georgia, Indiana, Iowa, New Hampshire, Oklahoma, Pennsylvania, Rhode Island, and Virginia – support private school attendance by offering refunds or credits for tuition via their state-specific tax systems (National Conference of State Legislatures, 2012; Workman, 2012). As policymakers develop similar programs in new cities and states, the determinants of participation will remain critical not only to the operation of these programs but to their ultimate success as well. We have argued here that neighborhood location represents one such determinant.

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education policy analysis archives

Volume 23 Number 60

June 29th, 2015

ISSN 1068-2341



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