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Are Inclusionary Housing Programs Color-blind?

The Case of Montgomery County MPDU Program*

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Abstract

Relying on exhaustive administrative data spanned over four decades, this paper studies the treatment of African American applicants by the Moderately Priced Dwelling Unit (MPDU) program in Montgomery County, MD. We show that this program was equally accessible to African-American applicants, except between 1995 and 2000, when African Americans' conditional probability of purchasing a home through the program was lowered by 10% compared to that of other applicants, maybe as a temporary response to the sudden surge in African American applicants that occurred at that time. Turning to the outcome of the allocation process, we show that even if the spatial allocation of beneficiaries does reflect preference-based sorting patterns observed on the private housing market at the neighborhood level, the program seems to induce some scattering of different ethnic groups at the most local level. When comparing beneficiaries living in the same housing development, but at different addresses, we find that African American beneficiaries have 15% fewer African-American neighbors.

JEL codes: R31, R38, J15.

Keywords: Housing Market Discrimination; Housing Policy; Spatial Sorting; Propensity Score Matching.

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1 Introduction

African Americans have historically faced many barriers that limit housing access and choice. Aside continued discrimination in the private market documented through the use of fair housing audits (Yinger 1986, Turner, Ross, Galster, and Yinger 2002, Turner, Aranda, Levy, Pitingolo, Santos, and Wissoker 2012), rising metropolitan housing prices have only made things worse. In the past couple of decades, many regions and cities -especially on the East and West Coasts (Glaeser and Gyourko 2002)- have suffered from a perennial shortage in affordable housing due to acute economic conditions, rising rent prices, difficulties in obtaining mortgages (Urban Institute 2012) and in several cases, strict zoning regulations (Rosen and Katz 1981, Ihlanfeldt 2004).

To address affordability issues, many localities have engaged in inclusionary practices and relied on mandatory or voluntary measures. Those range from price or rent control mandates to cities and counties offering bonus densities or additional lots or units normally allowed under specific zoning regulation, as well as fee waivers to streamlined review processes or other incentives to developers. Inclusionary zoning (IZ) programs are one of the most common and often require developers to set aside a percentage of units in housing developments for low and moderate-income residents (Schuetz, Meltzer, and Been 2009, Meltzer and Schuetz 2010). They allow for the creation of mixed-income communities in low-poverty neighborhoods (Schwartz, Ecola, Leuschner, and Kofner 2012). Density bonuses or other cost-reducing incentives are provided to compensate developers for providing affordable units in order to offset the potential reduction in profit margins.

IZ housing policy was initiated in the Washington, D.C. metropolitan area in the early 1970s. Among the first localities to experiment with this type of program was Montgomery County (MC), Maryland (Schwartz 2010). Since then, over 500 local jurisdictions in 25 states have adopted similar programs with communities regionally divided across the United States from Davis County, FL to Orange County, CA (Stromberg and Sturtevant 2016). As demand for affordable housing continues to be on the rise, so does the price of housing, prompting many areas to consider IZ programs as a premier method. IZ's strategy is particularly attractive to local municipalities due to its reliance on the private market to supply housing units rather than using public sector subsidies or funds. Besides its primary aim to increase the housing stock, one of the main goals of the program is to promote income integration at the project level through the dispersion of housing units, unlike the ethnic and income clustering often caused by other subsidized housing programs (Calavita and Grimes 1998). It is also thought to help mitigate the segregating effects of restrictive land use practices.

This paper investigates the experience of African Americans in purchasing owner-occupied housing through the MC IZ program. Specifically, we study the outcome of the Moderately Priced Dwelling Unit (MPDU) program in terms of affordability and integration by race and income. Our analysis is based on data describing over 22,000 original participants or applicants to the program, from 1980 to 2015.

First, purchasers are supposed to be chosen through a race-neutral random selection process and we use a propensity score matching methodology to investigate whether this is actually the

case, that is, if African American applicants are equally likely to access home-ownership through the program. We provide estimates of African Americans' relative likelihood to purchase an MPDU housing property conditional on the only individual characteristics that are supposed to be available to MPDU agents through the selection process and condition applicants' eligibility.

Then, we study the final result of the allocation process, after successful applicants have accepted to purchase a unit. First, we investigate whether there exists a racial price premium in the context of this policy. Then, and more importantly, we construct spatial sorting indices to examine the success of the MPDU program at integrating participants at several geographical levels: municipality, zip code, census tract, block group and development project. We show that while the program has not always successfully ensured African American applicants' equal access to affordable owner-occupied homes, it does seem to have a positive impact on integration at the development project level for African American beneficiaries.

To our knowledge, this is the first paper to study the allocation process of an inclusionary zoning program and to use the universe of applicants and beneficiaries while doing so. This is also one of the first studies of a housing policy to empirically model racial integration at a geographical level smaller than block groups. Studying potential ethnic biases in the selection process of this type of programs not only adds to the literature on housing market discrimination and segregation but also provides guidance on the implementation for a fair housing policy such as the MPDU program.

The remainder of the paper is organized as follows. Section 2 surveys literature on housing market discrimination, sorting and segregation patterns of African Americans, and available evidence on outcomes of IZ policy on neighborhood integration. Section 3 presents the study area, features and mechanisms of the MPDU program, data, and variables. Our analysis of selection into the program is presented in Section 4, while section 5 focuses on program outcomes, especially the level of racial clustering within localities. We then conclude by discussing results and policy recommendations.

2 Related Literature

2.1 Discrimination in access to housing

Discrimination in housing markets and increasing prices of housing have long been an impediment to affordable housing. Housing market discrimination can occur at several stages in the purchase or rental of a home such as through direct contact with leasing or sales agents, during mortgage lending, or indirectly through house prices (Ross 2010). Previous work documenting the experiences of minorities in housing access has relied heavily on experimental studies using matched-pair techniques or audits such as that of Yinger's (1986) real estate agent experiment in Boston and those conducted by the Department of Housing and Urban Development (HUD) in 1977, 1989, 2000, and 2012 (Turner, Ross, Galster, and Yinger 2002, Turner, Aranda, Levy, Pitinolo, Santos, and Wissoker 2012). Significant level of discrimination was found in all studies. However, the last two HUD studies show that the gap in access between Whites and African Americans shrunk.

Although seen as a more reliable method in detecting discriminatory practices in the housing market, audits have become increasingly criticized due to likelihood of bias in results if actors are dissimilar along other dimensions except race (Heckman and Siegelman 1993, Heckman 1998). Such actor bias may be reduced if actors are carefully chosen and given proper training. However, Hanson and Hawley (2011) also suggest that actors may either not report their experiences accurately or unknowingly cause a discriminatory response. To avoid actor bias, this study and many others began to utilize alternative audit methods using the Internet. Hanson, Hawley, Martin, and Liu (2016)'s study using electronic correspondence with mortgage loan originators (MLOs) is one of the most recent and the only looking specifically into home buying and mortgage market discrimination through online audits. Their results point out that African Americans receive 1.8 percent less response than Whites when they seek housing.

Another limitation of the paired testing studies, described by the previous paper, comes from their focus on the initial encounter between the home-seeker and a rental or sales agent, whereby they may only detect discrimination at the early stages of home purchase. Discrimination may occur later in the housing transaction when a home-buyer makes an offer on a particular unit or applies for financing. Our research differs from the pair testing studies such that it is non-experimental, which makes causal inference more difficult. On the other hand, its goal is specifically to assess whether random selection of participants, conditional on a narrow set of administratively-defined characteristics, which are both observable to the econometrician and to the program agents, is actually taking place.¹ Using the observable characteristics of the participants, in particular, income and household size, which define MPDU eligibility requirements, we are able to identify and test whether race has an effect on the likelihood of purchasing a home through the program. In addition, dealing with a universe of applicants to the program, with a long time span, allows us to try and assess the long run effects of the program, contrary to the "one-shot" dimension of audit studies.

2.2 Racial price differentials, sorting, and segregation

Empirical measures of racial differentials in housing prices have yielded mixed results due to data limitations. Rather than using address level data, most studies have relied on the immediate block surrounding a household as a proxy for neighborhood characteristics (Myers 2004). King and Mieszkowski (1973) offered the first study to look into price differential at the smallest possible geography by using survey data of 220 rental units in New Haven, Connecticut. They controlled for renter's race, the racial composition of the neighborhood and whether the neighborhood was considered "black ghetto", "white interior", or "boundary areas", and found that Blacks paid about 7 percent more than whites in the boundary areas, where Blacks were the minority.

Follain and Malpezzi (1981) implemented a similar methodology but used a larger dataset from the Annual Housing Survey (AHS) on 39 SMSAs. Contrary to King and Mieszkowski

¹From now on, a "purchaser" will refer to an individual who met the program eligibility requirements, was successful in the random selection drawing and purchased a home, while a "participant" will refer to someone who applied and met the program eligibility requirements but was not successfully selected in the drawing to purchase a house.

(1973), they found that, compared to Whites, black owners paid 15 percent less while black renters paid 6 percent less. However, an important shortcoming of the study is that, rather than using race as a direct measure of neighborhood racial composition, it uses central city as a proxy to capture neighborhood racial differential impact. Later studies such as Chambers (1992) and Kiel and Zabel (1996) using census tracts as the lowest geography also found contradictory results. Through investigation of a longer time period, Cutler, Glaeser, and Vigdor (1999) found that the housing price differential between African Americans and whites significantly narrowed from the late 1800s to 1990. However, after controlling for neighborhood fixed effects, a more recent study Myers (2004) still found that black homeowners were paying 10 percent more for housing.

Although research results on price premia are quite mixed, African Americans remain highly segregated compared to other minority groups. After reviewing the vast literature on this topic, (Ross 2010) concludes that the level of segregation occurring among African Americans cannot be attributed to economic and demographic factors as it might be in the case of other race groups. Although much of the segregation in 20th century is shown to be a result of historical discriminatory barriers in housing markets, Cutler, Glaeser, and Vigdor (1999) pointed that higher housing prices in predominantly white neighborhoods are generated by whites' preference to live in segregated neighborhoods.

In our paper, we attempt to test the racial premium hypothesis in the context of the MPDU program because we are able to control for area fixed effects at the block group and building level, smallest geographies ever used to study price discrimination. Our distinctive unit level data hence allows us to investigate whether or not African Americans pay a premium after controlling for housing quality variables.

2.3 IZ policy outcomes and neighborhood integration

While some of the previous studies have described on the locational impact of IZ policy, specifically on program structure and geographical distribution of units produced (Calavita, Grimes, and Mallach 1997, Schuetz, Meltzer, and Been 2009, Meltzer and Schuetz 2010), others have focused on its effects on housing supply and prices as well as its impacts on the production capacity of affordable housing (Clapp 1981, Porter et al. 2004, Knapp, Bento, and Lowe 2008, Mukhija, Regus, Slovin, and Das 2010, Schuetz, Meltzer, and Been 2011). Although diverse in methods and outcomes, previous IZ policy studies have shown that inclusionary zoning programs can serve as an effective policy tool to counter the negative outcomes of various zoning regulations that limit the supply of affordable housing. While there is hardly any research on the allocation of units produced through IZ policy, a few studies such as Kontokosta (2014) and (Schwartz 2010) have attempted to look how IZ policy can impact neighborhood integration by income and race.

Research on IZ in particular as a tool to integrate neighborhoods economically and racially have looked into whether places with IZ units are more integrated than those without. Kontokosta (2014) investigates this question using administrative data from MC and Suffolk County, NY. His results show that even though units are scattered throughout the neighborhoods in MC,

certain race groups purchased more than others which in turn might limit the level of integration. Using propensity score matching method, he asserts that in MC, neighborhoods receiving IZ units were mostly integrated from the outset and that there is not enough evidence to conclude that the program led to increased integration. He suggests that this could be due to the inequitable allocation of the housing units among purchasers from different racial groups.

Schwartz (2010) and Schwartz (2011) also study the MC IZ program but focus specifically on a sample of MPDU rental units sold to the public housing administrator in the county, the Housing Opportunity Commission (HOC). These units are mostly allocated to households earning less than 30% of the area median income and selected households are randomly assigned to housing units throughout the county. Results show that this program was successful in placing public housing residents to better neighborhoods. As a result, children of these occupants experienced higher educational outcomes because they were able to attend higher performing schools in low-poverty neighborhoods.

Unlike the previous studies, who focus on school-based income integration of public housing in mixed-income neighborhoods, our study investigates how the allocation of MPDU owner-occupied housing properties to participants impacts integration by income and race. The address level MPDU data allow us to test for integration by race at different geographical levels by looking at whether African American beneficiaries of the program are more likely than other beneficiaries to have other African American beneficiaries as neighbors.

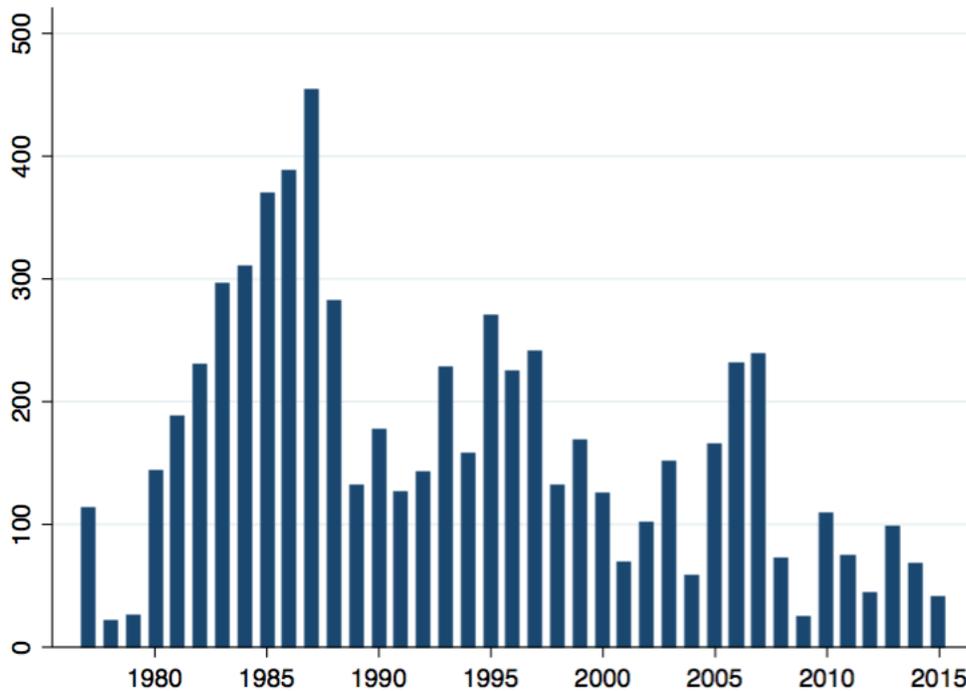
3 Study Area and Data

3.1 History and context

The MPDU program was designed to address three housing policy concerns: land use and density, fair housing and desegregation, and "workforce" housing and economic development (personal communication 2016). In exchange, developers were permitted to build more units than zoning codes typically allow or offered tax abatements and other incentives. Affordability became a major issue in the county due to rapid appreciation of housing prices as a result of slow residential and commercial building caused by a sewer moratorium in the county for most part of the 1970s (Reeves 1974). Once resolved, building arose and the program benefited from a surge in construction and thus affordable units built in the 1980s as shown in Figure 1. These units now represent roughly 4 to 5 percent of the total housing stock in the county. This figure is significantly lower than the mandated 12.5 percent requirement due to the durability of the housing stock.²

²According to the 2015 American Community Survey (5-year estimates), the median housing unit in Montgomery County was built in 1977, implying that roughly half of the housing units in the county were built before the MPDU law was enacted. Another explanation for the gap is that many smaller subdivisions did not participate in the program because they did not meet the mandated unit minimum.

Figure 1: Number of MPDU Housing Properties Built



Note: The totals on this chart only include owner-occupied housing units produced through the MPDU program for which we were able to determine the year the property was built. Rental units produced are not included.

Source: DHCA.

By 2013, the program had created over 14,000 units including rental and owner-occupied housing (DHCA 2016). A third of the units produced through the program were to be sold to the Housing Opportunity Commission (HOC) for use as lower-income rental housing, thereby reaching households with income as low as 30 percent of the median area income (Schwartz 2010). Currently, the MPDU law stipulates that 12.5 to 15% of all units constructed in subdivisions of 20 units or more must be set below market price, up to a 30 percent discount. In return, developments are allowed a density bonus for up to 22 percent. Ever since its adoption, the program has been through several changes, often centered on ways to expand the affordable housing stock. Most of these changes were extensions to unit control periods, participating developers' project size limits, and percentage of housing to be allocated. Table 1 provides a summary of those changes. For example, the 1974 MPDU mandate included projects of size 50 or more but in 2005, the cutoff was lowered to 20 units. The control period was also expanded through the years because the county was losing many of the MPDU housing units through resale by owner as a result of shorter control periods.

In order to increase resident participation, the MPDU program went through several changes over the years. In the late 1970s for example, high mortgage rates were disqualifying many families from purchasing; as a result the County Council modified the ordinance to include the

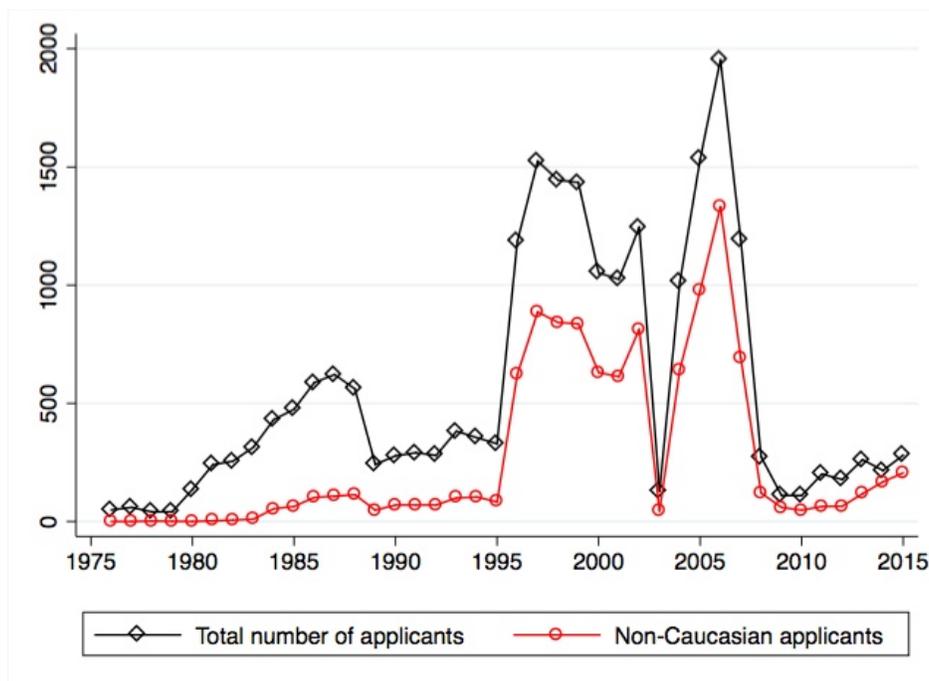
Table 1: MPDU Ordinance Timeline

	1974	1981	1988	2002	2005-Present
Project Size	50	50	50	35	20
Affordable Units Required	15%	12.5%	12.5-15%	12.5-15%	12.5-15%
Density Bonus Allowed	20%	20%	up to 22%	up to 22%	up to 22%
Control period - rental units (years)	5	10	20	20	99
Control period - Ownership units (years)	5	10	10	10	30

Notes: A sliding scale requirement is enacted in 1988, with the minimum set 12.5%, whether the developer uses the density bonus or not. The bonus increases up to 22% by providing more affordable units up to a maximum of 15%. Source: Levy, Franks, Bertumen, Abravanel, Knaap, Sartori, and Garcia-Colberg (2012).

cost of financing when calculating the income limit (Levy, Franks, Bertumen, Abravanel, Knaap, Sartori, and Garcia-Colberg 2012). Although not a formal ordinance change, in 1995, as a result of an increase in the number of housing units built, the county’s Department of Housing and Community Affairs (DHCA) engaged in outreach activities by sending information about the program to county regional service centers and libraries ³ (MC Confidential Interview 2016). This advertising effort led to a major evolution in the number of applicants, and especially those of minorities as shown in Figure 2.

Figure 2: Evolution of the Number of Applicants



Note: Caucasian is used in the MPDU applicant dataset as an equivalent to Census race category Non-Hispanic White. In the above graph, Non-Caucasian refers to those who do not fall into this group.

Source: DHCA.

³These centers serve as liaisons to the county in their respective catchment areas by providing information to residents and businesses as well as opportunities for their involvement in community decision-making.

In addition, the county’s demographic profile dramatically changed since the 1980s, becoming more diverse by race, income, and immigration status. Part of this change is attributed to the aging of existing population and a surge in foreign-born immigration (see Table 2). Total non-Hispanic white population declined by 18% between 1987 and 1997. Today, an estimated 55% of the county’s residents are minorities.

Table 2: Evolution of Montgomery County Population

	1980	1990	2000	2015
Population	579,053	757,027	873,341	1,040,116
% African American	8.8	12.2	15.1	19.1
% Hispanic	3.9	7.4	11.5	19.0
% Asian	3.9	8.1	11.3	15.4
% Non-Hispanic White	82.5	72.4	59.5	45.2

Notes: Historical statistics are available on the MC Government’s website, while estimates for 2015 were obtained from U.S. Census Bureau County Quickfacts. Source: *US Census Bureau*.

3.2 Program design and mechanism

The county restricts participation to households earning 70% or less than the HUD Washington, D.C. MSA’s median income, adjusted for family size, tenure, and unit size.⁴ Income limits for both purchase and rental units are set by the County Executive and updated on a yearly basis. In 2016, they ranged from \$53,500 for a single-person household to \$82,500 for a family of five for purchasing households. We restrict our sample to individuals who participated in the ownership program between 1980 and 2015, who make up for more than half of total participants. Applicants seeking rental units were excluded from our study because the county does not directly collect data on rental participants.

To be eligible for purchase, applicants are also restricted to a minimum income level to serve as a guarantee that they could afford costs associated with the purchase. In 2015, purchasers’ minimum annual household income requirement was \$35,000. The applicant must not already own a house or have owned a house anywhere in the past five years. The participants are required to be able to make a 5 percent down payment, as well as absorb settlement fees and other closing costs. In terms of financing, applicants must provide a pre-qualification letter from a Maryland Housing Opportunities Commission (HOC) approved lender in an amount of at least \$120,000 in 2015 (DHCA 2016). Income requirements have not changed much in real terms since the program’s inception but, if anything, they were lowered to increase the pool of eligible applicants. This requirement might not have always been binding because if the HOC lender deemed the applicant able to afford their mortgage payments based on income and credit history, the lender could pre-approve the application of a participant whose income was lower than allowed. On the other hand, since pre-approval letter is one of the eligibility conditions, a

⁴In 2015, the limit was \$75,000 for a family of four, about 17 percent higher than the national median family income.

participant with impaired credit history can be denied even if she meets the minimum income requirement (MC Confidential Interview 2016).

Finally, in order to be able to participate, interested MPDU ownership applicants are also required to attend three classes mandated by the program: one class for orientation, another devoted to homeownership counseling, and a third for the application submission. Figure 3 describes the MPDU application and purchase process.

Once applicants complete the orientation class, home-buying class, submit their application, and provide a pre-approval letter, they are assigned "priority points". Priority points are used to give higher preference in the random selection drawing to the eligible applicants who live in the county, work in the county, and have stayed in the pool of eligible applicants longer. These points are given based on the following scale; one point for living in the county, one point for working in the county, and up to three points for applicants who have frequently applied and been approved MPDU purchase program participants on yearly basis. The maximum total number of points a participant can earn is five.⁵ Applications are to be renewed on yearly basis and participants are ranked using these priority scores.

A developer notifies the county of unit availability and in turn the county notifies residents.⁶ All available units are posted on the MPDU website. Interested applicants enter the lottery drawing for a housing unit in a particular development. The MPDU program determines whether these applicants are eligible to enter the lottery based on affordability and household size. All applicants are required to have pre-approval letters which show the mortgage amount the participant can afford. The county can deem applicants with insufficient mortgage amounts ineligible, and therefore exclude them from the drawing. Similarly, a household can be excluded from the drawing if their household size does not match the size of the available unit.⁷

Applicants are grouped based on their total priority scores. At maximum, there can be up to six groups ranging from 0 to 5 in total priority points. Starting with the group with the highest total priority scores, the county conducts a random selection drawing to determine the winners. Figure A1 shows a copy of an actual random selection drawing for a particular development in 2015. It shows the list of winners and their rankings as well as the list of participants who were not eligible to participate in the drawing because they might have been pre-approved for an amount that is less than the sale price of the available property. The first randomly picked participant, picked from the highest total priority point group, would be ranked as 1 and the second randomly picked participant would be assigned a rank of 2 and so on. Once all of the eligible participants who entered the lottery in the highest total priority point group are randomly drawn and given a rank, the program then moves to the next group with the second highest total priority points.⁸

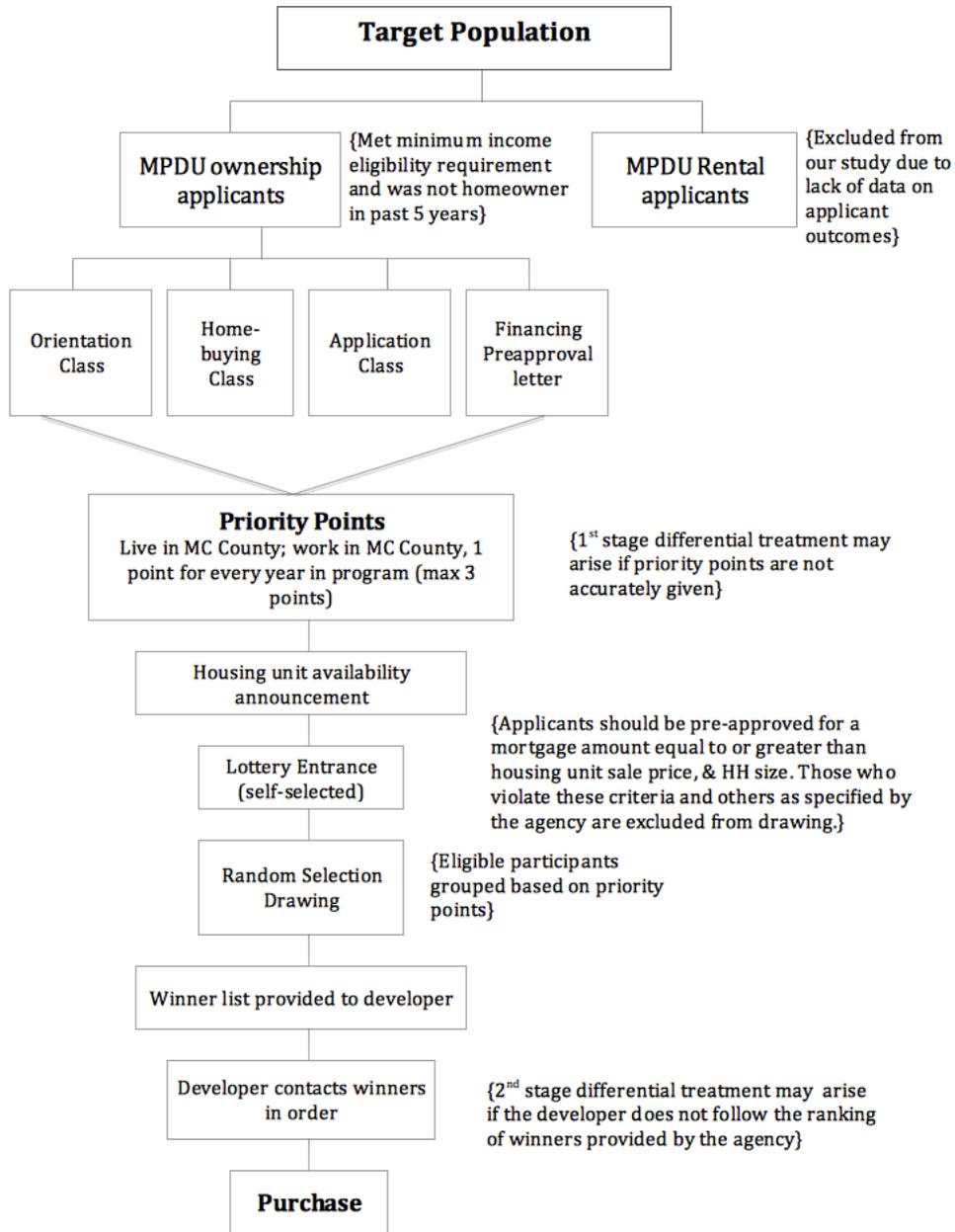
⁵For example, an applicant who resides and works in the county and applied in the last three years would be assigned five priority points in total. A comparable applicant who only applied twice would only obtain four priority points.

⁶The same applies for units owned by an MPDU participant sold within the control period.

⁷According to the program's housing size mandate, households with two or less individuals are eligible to apply for an MPDU property with 1 or 2 bedrooms and households with household size of three or four people can apply for the units with 2 or 3 bedrooms, and lastly those with household size of five can apply for the units with 3 bedrooms (DHCA).

⁸For example, if there are 40 applicants and they are equally divided into 4 total priority point groups (i.e., 5,4,3,2),

Figure 3: MPDU Application Process



Notes: This figure describes the steps of the MPDU program design, and various stages of the application process towards purchase. Applicants who are successfully drawn but decide not to purchase remain in the program as long as they meet the requirements. They can also earn higher priority points by renewing their applications a on yearly basis. In terms of criteria other than household size and mortgage, most are specific to development in terms of resident age restriction or if the participant already has a purchase contract pending with another development.

Source: DHCA.

The household ranked first has the first opportunity to purchase a home. If she declines, the household ranked second has a chance to purchase, followed by the household ranked third and so on. Declining to purchase a home does not in any way penalize a household in future drawings. In other words, since households are free to self-select into the lottery drawing for a particular location, this would not affect their standing for future drawings for other development projects as long as they still meet all program requirements.⁹ The builder's sales agent contacts the highest ranked participants, beginning with the first one on the list. The number of participants that will be contacted depends on the number of homes available in that selection process. For example, if five units are available, the five highest ranked participants will be contacted first.

3.3 Data

Our primary dataset of 22,351 participants, which was provided by the DCHA, includes both ownership and rental applicants. Given that the county does not collect data on rental outcomes, we restrict our analysis to individuals who participated in the ownership program between 1980 and 2015. Of the total, about half are ownership applicants (11,938) as shown in Table 3. Besides characteristics on applicants (e.g. race, income, household size, and whether applicant works and/or lives in the county) the MPDU participant dataset also contains unit level features such as address of unit, number of bedrooms and baths, and unit type (e.g. townhome, condo, and single-family). To complement the housing unit characteristics from the MPDU data, we use 2016 tax assessment and deeds records file from the Maryland State Department of Assessment and Taxation (SDAT), also provided by the DCHA. This tax assessment file contains detailed information on type of units (e.g. residential, commercial, single-family or condo) and structural characteristics of the dwellings, including the year built, square footage, and number of stories). This file is particularly important because it allows for the addition of unit square footage to our main dataset. We use the tax-id number to match the two datasets. Of the roughly 8,000 MPDU units purchased, we are able to successfully match about 7,500 of them with the property tax records.

We also have lottery drawing results of about 198 developments from 2007 to 2015. This important dataset provide detailed information on roughly 4,500 lottery registrants and whether they were either qualified to partake in a specific lottery or were deemed unqualified based on household size, insufficient mortgage preapproval among or other criteria listed in the notes on Figure 3. In addition, we are also able to obtain the ranks of individuals by lottery as well as the reason why certain lottery applicants were not allowed to participate in a lottery. Although these data are not fully able to provide a complete picture of the program design (i.e., lottery drawings) for all years in our study, we can still examine how the lottery was designed and implemented

the random selection drawing would assign the rank of 1 to the first winner randomly picked from the group with 5 priority scores and then sequentially assign ranks as the drawing proceeds until they draw from all 10 applicants in this group. Since there are ten participants in this group, the last person drawn from this group would be assigned a rank of 10. Then, the first person from the 4 total priority point group would be assigned a ranking of 11 until all eligible applicants are assigned a rank.

⁹For more information on lottery process see DHCA at <http://montgomerycountymd.gov/DHCA/housing/singlefamily/mpdu/programsales.html>.

for the years available. Also, through private conversation with MPDU agents, we were also told that these lottery drawings mirror the program design of the years prior to 2007 and that the only difference is the agency’s adoption of a computerized system which allows participants to register for lotteries via the MPDU website instead of by mail or in person. Hence, the lottery design the program used since its inception has remained intact but much improved due to use of a computerized system. The move to a computerized system also provided a means for record keeping which is a key issue for program implementation.

When we merge this dataset to our main data of program applicants and purchasers, we observe 406 participants who purchased homes through the program between 2007 and 2015. As we indicate in the paper, in order to participate in a lottery the individual’s household size has to match with the household size as well as have a preapproval mortgage amount that is equal to or greater than the price of the housing units in the lottery. These lottery drawings are later used in Section 4 to further shed light on program lottery design in order to fully capture its effect on possibly purchasing a home through the MPDU program.

Tables 3 and 4 report the average characteristics of ownership applicants and purchasers used in Sections 4 and 5. We consider two binary partitions for our data, where we either isolate Caucasians or African Americans, which are the two extreme groups in terms of potential exposure to housing market discrimination. However, since this paper focuses on how the MPDU program performs in terms of integration by income and race, we will focus on the subsequent empirical analysis on the latter partition because African Americans’ segregation patterns are documented to be more persistent compared to other race groups (Ross 2010).

Table 3: The population of applicants

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	43,586	43,647	43,289	43,410	43,592	45,048
Household size	2.46	2.73	1.87	2.63	2.37	2.48
Disable	0.005	0.006	0.002	0.007	0.004	0.009
Number of applications	1.20	1.23	1.12	1.18	1.21	1.41
Only lives in MC	0.26	0.27	0.23	0.28	0.25	0.24
Only works in MC	0.09	0.08	0.11	0.11	0.08	0.06
Both lives and works in MC	0.65	0.65	0.66	0.61	0.67	0.69
Number of observations	11,938	7,794	3,713	3,834	7,673	431

Notes: (i) This dataset is restricted to ownership applicants that have applied less than 9 times to the program, between 1982 (no minority applicants before) and 2015; (ii) Income is in \$2015; (iii) For applicants with multiple applications, income and household size are averaged over all observations.

Source: DHCA.

As shown in Table 3, African American and Caucasian applicants form two groups of very comparable size (respectively, 3,834 and 3,713 observations) while Table 4 shows that there are more than twice as many Caucasian purchasers (1,994 versus 925). This striking contrast justifies to conduct an analysis of the selection into the program, in order to check whether it is mostly driven by structural effects such as demographic trends combined with variability in unit supply. Table 3 also shows that applicants’ observable characteristics are similar across

ethnic groups, except for disability rates, although this variable is too small to matter in our empirical analysis. Caucasian households are also somewhat smaller. This overall view remains valid if we breakdown these descriptive statistics by the periods that will be isolated in subsequent analysis. In addition, Tables C1 to C13 in Appendix C show that the average number of applications increased between 1982 to 2015, which indicate that the program’s attractiveness increased over the years.

Table 4: The population of purchasers: individual and dwelling characteristics

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	48,266	47,193	47,243	48,894	46,771	56,330
Household size	2.45	2.92	1.90	2.74	2.38	2.37
Disable	.004	.006	.002	.011	.002	.007
Number of applications	1.24	.1.37	1.10	1.35	1.22	1.19
Only lives in MC	0.20	0.24	.20	0.27	0.21	0.07
Only works in MC	0.10	0.08	0.14	0.08	0.11	0.02
Both lives and works in MC	0.50	0.59	0.50	0.51	0.56	0.17
Purchase price	145,525	159,477	130,306	163,229	141,765	140,087
Townhouse	0.60	0.66	0.53	0.65	0.59	0.55
Unit square footage	1,216	1,342	1,111	1,152	1,262	1,042
Number of observations	4,989	2,420	1,994	925	3,489	575

Notes: (i) The sample is restricted to purchasers of the MPDUs who have applied less than 9 times to the program, between 1982 (no minority applicants before) and 2015; (ii) Income and price are in 2015 \$; (iii) For applicants with multiple applications, income and household size are averaged over all observations; (iv) Shares variables are the share of African American neighbors within the population of neighbors also registered in the program at the city, zipcode, census tract, census block, and development levels.

Source: *DHCA*.

This even distribution of covariates across ethnic groups is confirmed in Table 4; this already indicates that controlling for observable characteristics will be unlikely to dramatically affect ethnic gaps in program outcomes. Note, however, that the income difference between African American purchasers and African American applicants is more pronounced than within other ethnic groups, which may show that African Americans are more likely to end up benefiting from the program if they have better individual characteristics in the first place. Table 4 also shows that real purchase price is larger for African Americans, which may indicate the presence of a racial premium: as will be shown in the next section, it turns out that this difference is entirely driven by the fact that real prices have increased over the period and African Americans are more massively present at later stages. Units are of comparable square footage, but they are more likely to be townhouses for African Americans (65%), than for Caucasians (53%). This feature hints toward the possible existence of racial sorting patterns generated by the program. We come back in more detail to this question in the next section.¹⁰

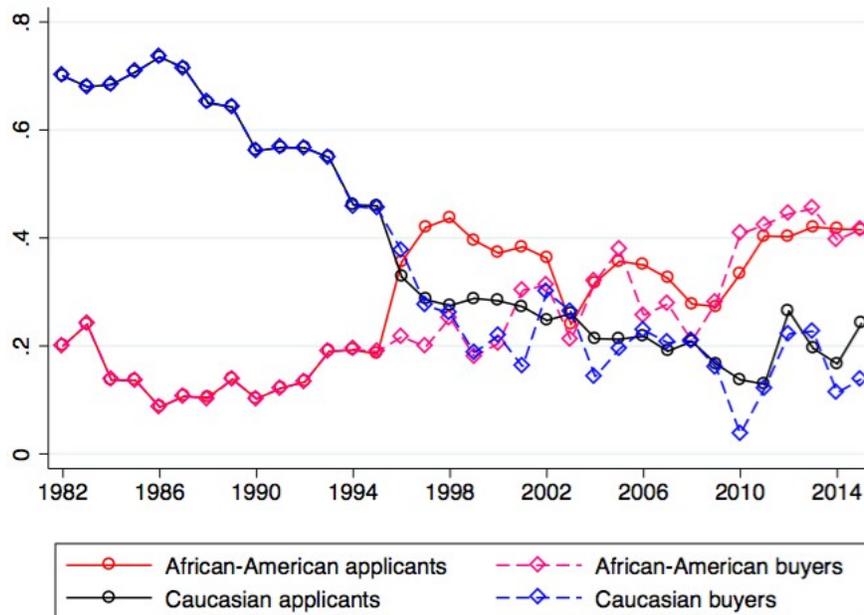
¹⁰Note that the dataset also includes some information about the number of bedrooms and bathrooms in the unit. However, for most observations, this information is missing, so we do not report it here, but we will include a set of dummy variables in the analysis presented in section 4 to ensure that we make use of all the information at our disposal. We believe this to be of little concern, because the units are recent and follow very standardized construction patterns, so that most of the information regarding the number of rooms is already comprised in square footage.

4 Access: from Application to Purchase

4.1 Raw statistics

For initial measures of access to housing units by ethnic group, we focus on visual differences in odds-ratios determined by differences between the racial composition of the pool of applicants and that of the population of purchasers. Figure 4 shows the shares of Caucasian applicants and purchasers versus African American applicants and purchasers.

Figure 4: Share of African Americans Applicants and Purchasers vs. Caucasian Applicants and Purchasers



Notes: Share of African Americans and Caucasians among applicants and among purchasers by year of application or purchase.
Source: *DHCA*.

Until 1995, the share of the applicants and the share of purchasers were moving together but we observe that between 1996 and 2002, there is a divergent pattern between the share of African American applicants and the share of African American purchasers: while the latter still make up for about 20% of purchasers, the share of African American applicants has doubled, up to about 40%. This difference suggests that, unconditionally, African Americans become twice less likely to purchase a home, than Caucasians, over this period. Interestingly, this gap arises as soon as African-American applicants outnumber Caucasian applicants, which reminds of tipping mechanisms à-la Schelling. After 2002, a new regime starts. It is less stable than prior to 1995, but the odds-ratios converge back to similar figures between ethnic groups.

Note that the pattern would be very similar if, instead of using Caucasian applicants as a control group, we used all non-African American households, which is what we do in the next section. In the next section, we investigate whether these divergent patterns were the results of differential treatment of African Americans in the housing market. We use a propensity score

matching methodology to empirically test for whether African Americans were treated differently in the program during those particular years, conditional on the individual characteristics that were supposed to be relevant to program administrators.

4.2 Examining differential treatment using propensity score matching

Random draws should only be determined by the program eligibility requirements (income, household size and whether an applicant has owned a home in the past five years), and the three factors (live in the county, work in the county, and tenure) used to determine priority points. We seek to test for randomness in the allocation of the owner-occupied housing part of the MPDU program. To that end, we use a propensity score matching (PSM) method to estimate the average treatment effect of being African American on the probability of purchasing a home, conditional on applicants' characteristics related to eligibility requirements. We choose this method for three reasons: first, it is more flexible than a parametric regression; second, and more importantly, it takes into account the issue of common support of covariates, which is of primary concern here since we need to make sure that the households that are compared to each other were actually competing over the same segment of the lottery; finally, it provides us with an estimate of the average impact of being African American on the probability of purchase that is more straightforward to interpret than a regression result.

Table 5 presents the results of our first stage regressions where the treatment status (being African American) is regressed on these characteristics. The analysis is performed every year when there are enough observations in the dataset, or over a group of years. In the second stage, we match non-African American participants to their African American counterparts thanks to a nonparametric kernel estimator using weighted averages of all participants in the control group to construct the counterfactual outcome.

Table 5: Propensity Score Matching: First-stage regression results

	1982/8	1989/95	1996	1997	1998	1999	2000	2001	2002	2003/4	2005	2006	2007/15
Applic.	0.985 (0.816)	-0.607 (1.001)	-1.753* (1.014)	-0.931** (0.370)	-0.522 (0.341)	-1.096** (0.464)	-0.891* (0.514)	-0.662 (0.415)	-0.802** (0.338)	0.219 (0.248)	0.244 (0.223)	-0.0503 (0.102)	-0.0725* (0.0424)
HH inc.	2.64e-05*** (1.01e-05)	1.71e-05 (1.07e-05)	1.91e-06 (8.29e-06)	-5.84e-06 (7.04e-06)	-1.20e-05* (6.49e-06)	-7.43e-06 (6.57e-06)	-4.49e-06 (8.53e-06)	-3.65e-06 (5.85e-06)	-1.46e-06 (2.93e-06)	1.77e-05 (1.13e-05)	3.74e-05*** (9.99e-06)	-2.31e-06 (6.47e-06)	1.62e-05*** (4.26e-06)
HH size	0.0764 (0.0873)	0.0847 (0.0735)	0.0151 (0.0629)	0.133*** (0.0515)	0.0577 (0.0513)	0.263*** (0.0530)	0.187*** (0.0622)	0.0874 (0.0589)	0.0643 (0.0523)	0.0737 (0.0806)	0.0144 (0.0807)	0.180*** (0.0616)	0.180*** (0.0431)
Live MC	0.428* (0.228)	0.709*** (0.194)	0.177 (0.172)	0.186 (0.143)	0.330** (0.145)	0.303** (0.151)	0.217 (0.179)	0.113 (0.174)	-0.0341 (0.159)	0.190 (0.242)	0.715*** (0.233)	0.153 (0.191)	0.276** (0.131)
Work MC	0.205 (0.248)	0.349 (0.248)	1.304*** (0.265)	1.087*** (0.233)	1.098*** (0.233)	0.820*** (0.211)	0.910*** (0.285)	0.594** (0.287)	1.104*** (0.243)	1.042* (0.565)	0.772 (0.492)	0.679* (0.397)	-0.174 (0.429)
Disabl.				0.391 (1.420)							-0.373 (1.206)	0.639 (1.015)	0.538* (0.325)
Observations	1,034	1,023	790	1,073	1,007	1,037	763	747	965	409	455	677	1,522

Notes: (i) Estimation of a logit model of the probability of being African American for all applicants; (ii) Applic. is the number of applications completed by the household, HH inc. is household income, HH size is the number of members in the household, Live MC and Work MC are dummy variables for whether the household lives or work in MC at the time of application and Disabl. is a dummy variable for whether one of the household members suffers from a disability; (iii) Income is in \$2015; (iv) For applicants with multiple applications, income and household size are averaged over all observations

Source: DHCA.

Table 6: Effect of matching on mean value of three main covariates

	1982-1988				1989-1995				1996			
	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap
N applic.	1.02	1.01	1.01	0	1.02	1.02	1.02	0	1.02	1.03	1.03	90%
Income	55,776	52,032	53,456	38%	46,086	44,066	45,139	53%	39,053	38,875	39,074	88%
HH Size	2.37	2.09	2.19	34%	2.47	2.20	2.33	49%	2.40	2.37	2.33	-122%
Observations	120	914			163	866			285	512		

	1997				1998				1999			
	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap
N applic.	1.02	1.04	1.02	94%	1.02	1.05	1.02	97%	1.01	1.06	1.01	100%
Income	37,842	38,139	38,157	-6%	39,991	40,911	40,547	39%	41,021	40,321	40,647	56%
HH Size	2.46	2.30	2.32	12%	2.49	2.43	2.46	55%	2.69	2.31	2.57	76%
Observations	446	620			438	568			411	630		

	2000				2001				2002			
	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap
N applic.	1.03	1.03	1.03	79%	1.03	1.05	1.03	57%	1.02	1.05	1.02	98%
Income	41,210	40,774	41,003	52%	42,150	42,316	42,356	-24%	42,937	43,812	42,974	96%
HH Size	2.70	2.43	2.64	79%	2.52	2.42	2.44	15%	2.50	2.44	2.38	-92%
Observations	286	475			291	459			343	608		

	2003-2004				2005				2006			
	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap	Treated	Control	Matched	Δ gap
N applic.	1.22	1.21	1.22	34%	1.25	1.20	1.26	75%	1.51	1.55	1.52	84%
Income	42,652	41,290	42,394	81%	47,108	42,275	46,465	87%	44,476	43,578	43,890	35%
HH Size	2.65	2.55	2.64	87%	2.67	2.40	2.62	82%	2.51	2.32	2.41	46%
Observations	130	283			159	311			237	450		

	2007-2013			
	Treated	Control	Matched	Δ gap
N applic.	1.85	2.04	1.88	85%
Income	52,802	47,938	51,867	81%
HH Size	3.19	2.71	3.11	84%
Observations	534	970		

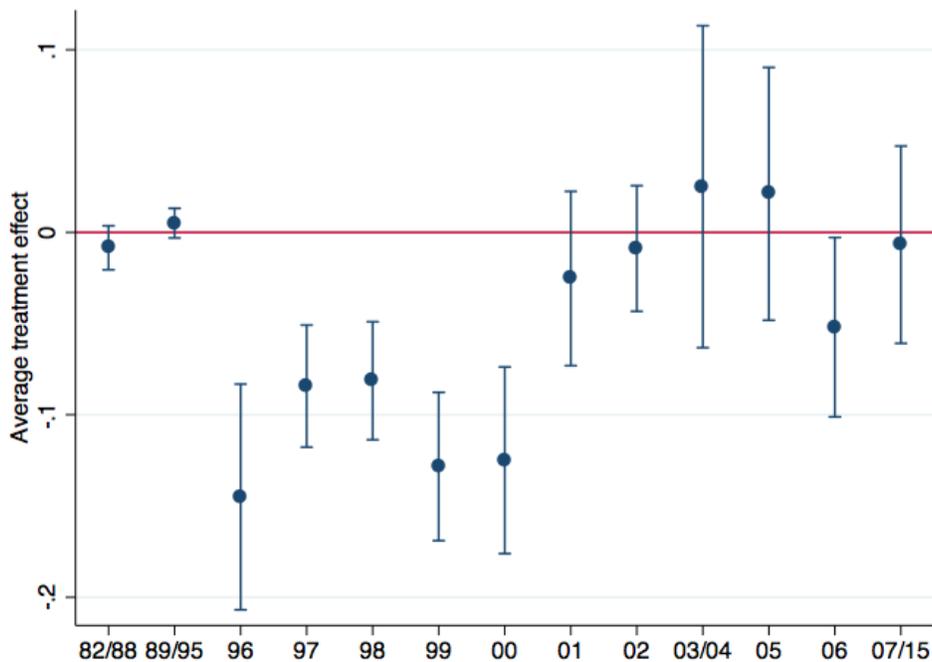
Notes: (i) Mean values of the number of applications, household income and household size for African Americans, non-African Americans and matched non-African Americans; (ii) Δ gap stands for the percentage change in the gap due to matching; a positive value of Δ gap of x% implies that the gap falls by x% for the given variable after matching; (iii) Income is in \$2015; (iv) For applicants with multiple applications, income and household size are averaged over all observations

Source: DHCA.

Table 6 provides an eye-ball test for the impact of matching for the specified year or group of years. In most cases, and in particular when gaps between characteristics are sizable and are associated in large coefficients in the first stage regressions, matching does reduce the gaps in the means of the covariates.¹¹

Average treatment effects are summarized in Figure 5, where the segments display the 95% confidence intervals obtained by bootstrap. Results confirm the raw diagnosis displayed in Figure 4, in that there is a strong indication of differential treatment in the years 1996 to 2000, when African American applications also increased substantially. Depending on the year, African Americans' relative probability of purchasing a home through the program went down between 7 and 15 percentage points.¹²

Figure 5: The impact of being African-American on the probability of purchasing a home through the program



Notes: (i) Average treatment effect of being African-American on the probability of being selected into the program (ii) Estimations are performed year by year or over the period specified on the x-axis (iii) Kernel propensity score matching with a 10% bandwidth, using a logit estimation in the first stage (iv) 95% confidence intervals obtained with bootstrapped standard using 100 replications

Source: DHCA.

¹¹This table does not provide parametric equality tests, which are controversial in this context.

¹²Note that since we are only able to observe those who purchased an MPDU housing property through the random selection drawing, our treatment group consists of purchasers but not necessarily all randomly drawn winners. It is possible that some participants won the lottery but did not make a purchase. Therefore, some of the lottery winners can be in our control group because either they did not want the housing unit or the program did not work as designed. As described in Figure 3, those who won the random selection drawing are to be contacted based on their rank on the list of winners but the list of winners might not mirror that of the purchasers if somehow a winner did not like the offered unit or if the developer's sales agent did not contact the winner. However, this event is unlikely, because applicants pick the developments to which they will apply.

4.3 Discussion

The analysis using the 2007 to 2015 lottery drawings of the 198 developments shows participants enter about 4 (3.9) lotteries on average, this number is also the average for African Americans. Asians appear to enter more lotteries (4.3) while Caucasians and Hispanics enter fewer lotteries (3.1) as shown in Table D2 in Appendix D. Lottery participants did not differ much in terms of rejection rate due to both household size and preapproval amount. For example, about 8% African Americans were unqualified to participate in a lottery as a result of insufficient mortgage amount compared to 10% across all races. Since the program design has remained the same, it is less likely that preapproval or wealth related variables could explain the gap between African American program applicants and purchasers. It could be that though they applied into the program annually, they may not have had sufficient information about lottery drawings but due to data limitations, we cannot say for sure. The results presented in Table D1 and Table D3 Appendix D assist us in showing that when African Americans enter many lotteries, it seems to have a positive effect by increasing their purchase rates. In other words, their purchase rates mirror their application rates also as shown previously in Figure 4 for years 2007 to 2015 where we compare raw statistics of applicants versus purchasers.

However, since our PSM, does not capture such lottery outcomes, our results might be biased in stating differential treatment since our control group might be composed of individuals who did not apply to lotteries, as stated before. It also seems like participants do not tend to crowd into certain lotteries. For example when we compute the standard deviation and the average share of participants across developments in which they enter lotteries for, the share of racial groups across all developments did not vary much which means that they had similar crowding out patterns except Hispanics which tend to concentrate in certain lotteries a little more than other races. Tables D5 show the lottery application rates by race and development to further confirm that African Americans are not concentrated in certain lotteries.

5 Outcomes: Price Differentials and Spatial Integration

5.1 African-American beneficiaries purchase homes located in cheaper neighborhoods

An additional check of the relevance of the quantity approach followed in section 4 is to examine how various factors affect prices using a hedonic price model. In doing so we also employ finer locational fixed effects to control for broader locations of the dwelling unit. Since demand and supply are not separately identified, the hedonic price model is the only economic theory technique that leads to conclusions about the different types of differentials (Myers 2004). Our model specification includes occupant characteristics (ethnic group, income and household size) and unit characteristics (square footage, number of bedrooms and bathrooms) as well as location controls.

Our regression findings in Table 7 below lead us to the conclusion that contrary to what was suggested by the raw statistics in Table 4, African Americans never pay more than their

Table 7: Hedonic regressions on purchase price

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Afr.-Am.	-2,408* (1,251)	-3,651*** (1,244)	-3,049** (1,361)	-1,806 (1,362)	-1,672 (1,355)	-1,977 (1,373)	-509.1 (1,308)	-904.7 (1,315)
HH income		0.280*** (0.0480)	0.304*** (0.0517)	0.298*** (0.0570)	0.287*** (0.0567)	0.243*** (0.0598)	0.117** (0.0572)	0.114** (0.0575)
HH size		3,933*** (418.8)	2,792*** (477.3)	2,721*** (476.5)	2,317*** (480.0)	1,459*** (502.8)	775.6 (495.6)	630.8 (499.0)
Unit sqf			5.295*** (1.568)	4.951*** (1.566)	4.073*** (1.577)	8.335*** (2.855)	-1.328 (3.668)	-5.497 (4.324)
Unit type			X	X	X	X	X	X
Location				City	Zipcode	Tract	B.G.	B.G.& D.
Time dummies	X	X	X	X	X	X	X	X
Observations	4,320	4,252	3,640	3,640	3,640	3,451	3,451	3,451
R-squared	0.225	0.258	0.261	0.289	0.302	0.351	0.518	0.527

Notes: (i) Ordinary-least-square regressions of purchase price as a function of individual and dwelling characteristics, with *, ** and *** respectively denoting 10%, 5% and 1% significance levels; (ii) Unit type is a set of dummy variables indicating the number of bedrooms and bathrooms, when it is specified; (iii) B.G. stands for block group and D. stands for Project Development.

Source: *DCHA*.

counterparts to access the program, as soon as purchase time is controlled for: they may even seem to pay less, to the extent of between \$2,400 (column 1) and \$3,600 (column 3), but this difference is purely driven by differences in the location of the units: the units themselves are very standardized, as is shown by the very similar R-squared in column 3, where we control for dwelling characteristics, and in column 2, where we do not.

We show in the last five columns that as soon as unobservable characteristics at the municipality level are controlled for, any ethnic-based difference in purchase price disappears. Note that these parsimonious models, featuring very few characteristics of the dwelling, are still able to recover up to over 50% of the heterogeneity in unit prices, mostly thanks to time effects and location characteristics. Going from municipality to block group fixed effects boosts the regression R-squared from 29% (column 4) to 52% (column 7)%, and the main gap takes place when we control for block group rather than for census tract. Finally we also seek to account for unobserved dwelling differentials by including fixed effects at the development level: however, despite the large number of additional fixed effects carried by this last specification, both coefficient estimates and R-squared remain almost unchanged between column 7 and column 8, which shows that differentials in unit attractiveness are not development-specific, but mostly depend on location.

5.2 Spatial correlations suggest demand-driven sorting of MPDU Purchasers

Besides differential access and prices, the other important feature of the program is its impact on the spatial distribution of its beneficiaries. Generally, Montgomery County encourages developers to scatter MPDUs in the same development in an effort to integrate MPDU owners with those in the market-rate homes. This might not always be possible because on average MPDUs

are generally smaller than market-rate units and since design standards can change with the size of the units, this can lead to clustering in large subdivisions. As a result, MPDUs are often placed alongside each other. However, due to planning regulations and developers' private incentives, the exterior design of MPDUs are similar to nearby market-rate units (DeFusco 2016). A question that emerges from the possible clustering caused by design standards then becomes, are MPDU owners themselves integrated within areas, especially developments?

Controlling for prices, we seek to investigate whether there are residual differences in the places people end up living. Our choice of model provides us with the possibility to detect residential location choices of households that makes explicit the way individual locational decisions aggregate to form a housing market. Like in our previous model, we incorporate location-specific unobservables and use these as indicators of household preference over choice of characteristics, including those that depend on household sorting such as the ethnic composition of program beneficiaries at the city, neighborhood, and even development project levels.

For each purchaser, we construct a set of sorting indices which measure the share of African American "neighbors" among program beneficiaries, at different levels: municipality, zip code, Census tract, block group and street address.¹³ Under random distribution across space, these different indices should not vary with the ethnic group of the household. However, Table 8 shows that this is not the case: the share of African American MPDU neighbors is 2% larger for African American MPDU households at the municipality level, and up to 7% larger at the block group level.

Table 8: Sorting indices: the share of African-Americans among neighboring beneficiaries

	African American	Non-African American	Difference
City	0.16 (0.002)	0.14 (0.002)	0.02*** (0.002)
Zipcode	0.16 (0.002)	0.14 (0.001)	0.02*** (0.003)
Census tract	0.19 (0.003)	0.14 (0.001)	0.05*** (0.004)
Block group	0.21 (0.004)	0.14 (0.002)	0.07*** (0.005)

Notes: (i) Shares of African American neighbors within the population of neighbors also registered in the program at the city, zipcode, census tract and census block; (ii) Reading: on average, African American MPDU households have 0.19 African-American MPDU neighbors within their census tract, whereas non-African American MPDU households only have 0.14 African American MPDU neighbors within their census tract; (iii) Standard deviations are in parentheses; (iv) *** indicates that differences can be considered statistically significant at the 99% confidence level. Source: DHCA.

Table 9 confirms this initial finding using a regression framework which allows to control for other individual and unit characteristics. Interestingly, the magnitude of the estimates are

¹³For example, if a household, regardless of their ethnic group, lives in a block group with four other MPDU beneficiaries, among whom one is African American, her block group index will be equal to 0.25.

Table 9: Raw sorting: the share of African American neighbors at various spatial levels

	Municipality		Zip code		Census tract		Block group	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Afr.-Am.	0.026*** (0.0028)	0.024*** (0.0031)	0.029*** (0.0031)	0.027*** (0.0034)	0.025*** (0.0036)	0.023*** (0.0041)	0.038*** (0.0056)	0.036*** (0.0064)
Income		-5.4e-08 (1.3e-07)		-8.2e-09 (1.5e-07)		-1.2e-07 (1.8e-07)		2.7e-07 (2.8e-07)
HH size		-0.0019* (0.0011)		-0.00064 (0.0012)		0.0042*** (0.0015)		0.00012 (0.0023)
Price		-4.9e-09* (2.7e-09)		3.0e-09 (3.0e-09)		1.1e-09 (3.6e-09)		-7.8e-10 (5.7e-09)
Unit square footage		-1.3e-06 (3.5e-06)		1.1e-06 (3.9e-06)		7.2e-06 (4.6e-06)		7.9e-06 (7.3e-06)
Obs.	4,617	3,744	4,618	3,745	4,612	3,743	4,579	3,715
R-sq.	0.139	0.143	0.131	0.144	0.237	0.201	0.216	0.189

Notes: (i) Ordinary-least-square regressions of the share of African-American MPDU neighbors at the city (columns 1 & 2), zip code (columns 3 & 4), census tract (columns 5 & 6) and block group (columns 7 & 8) levels, as a function of individual and dwelling characteristics, with *, ** and *** respectively denoting 10%, 5% and 1% significance levels; (ii) Columns 2, 4, 6 and 8 include a set of dummy variables coding for the number of bathrooms and bedrooms and all specifications include time dummies.

Source: *DCHA*.

not very far from the unconditional differences, even if controlling for other factors reduces the dissimilarity observed between different geographical levels. These results are also consistent with MPDU housing property dispersion across neighborhoods (census tracts). As depicted by the maps in Appendix B where we show units built by decade and race and income demographics, we observe that units are mostly built in neighborhoods with more African Americans and middle income households. The location of these units mirrors the ethnic diversity of the county in the later years.¹⁴

It is important to stress that these results do not demonstrate the existence of explicit sorting behavior by MPDU agents because they do not allow us to distinguish between the supply and demand effects that would achieve this sorting equilibrium. Since applicants are allowed to choose to which development they want to apply, they are for instance likely to choose developments in locations with more households similar to them, either through a preference channel, or through informational network effects. In particular, applicants are likely to target specific municipalities or even specific community neighborhoods, which can be proxied as an intermediate level between zipcode and Census Tract. Table 10 shows that if we model this choice by allowing for fixed effects in the previous regressions, new features emerge.

In Table 10, we augment the last specification in Table 9 by including city (column 2), zipcode (column 3), and census tract (column 4) fixed effects. The sorting coefficient disappears or even slightly reverts when controlling for precise enough location. Results suggest that overall sorting at the block group level is lower than at the tract level and roughly the same as at the zip code or at the city levels. This confirms the importance of demand effects on the observed equilibrium,

¹⁴Data for these maps are from the Minnesota Population Center (2016) using corresponding censuses (i.e. 1980, 1990, 2000, and 2010).

Table 10: Sorting conditional on greater location: the share of African American neighbors at the block group level

	(1)	(2)	(3)	(4)
African American	0.036*** (0.0064)	0.0071 (0.0059)	0.0021 (0.0059)	-0.018*** (0.0058)
Income	2.7e-07 (2.8e-07)	3.3e-07 (2.6e-07)	3.5e-07 (2.5e-07)	4.3e-07* (2.5e-07)
Household size	0.00012 (0.0023)	0.00019 (0.0021)	-0.00094 (0.0021)	-0.0027 (0.0021)
Price	-7.8e-10 (5.7e-09)	5.5e-09 (5.2e-09)	3.2e-09 (5.6e-09)	-1.4e-07** (7.3e-08)
Unit square footage	7.9e-06 (7.3e-06)	2.7e-06 (6.7e-06)	-3.0e-06 (6.7e-06)	-6.6e-06 (0.000011)
Location		City	Zipcode	Census Tract
Observations	3,715	3,715	3,715	3,441
R-squared	0.189	0.336	0.361	0.475

Notes: (i) Ordinary-least-square regressions of the share of African American MPDU neighbors at the block group level, as a function of individual and dwelling characteristics, with *, ** and *** respectively denoting 10%, 5% and 1% significance levels; (ii) All columns include a set of dummy variables coding for the number of bathrooms and bedrooms as well as time dummies
Source: *DHCA*.

so that we cannot conclude on the impact of the program in terms of integration.

5.3 At the most local level: spatial integration of MPDU beneficiaries

The main caveat of the previous exercise comes from applicants' choosing which development or building's lottery drawing to participate in. Therefore, the only plausible test of the sorting impact of the program has to take place within the development. This analysis can be performed over a subsample of MPDU beneficiaries, who live in development projects that feature several street addresses, and for which each address hosts at least two MPDU households, so that computing shares among neighbors remains meaningful. The identifying assumption is that while applicants do choose which developments to apply to (i.e., partake in the lottery for), they do not choose which part of the development (unit address, for example).

The results of this quasi-natural experiment are reported in Table 11 where column 1 shows strong positive sorting at the address level on this subsample of dwellings, which is even stronger than for the larger geographies displayed in Table 9 and is not driven by differences in income or household size (column 2), even though sorting fades away if we control for dwelling characteristics (column 3). In columns 4 to 6 we do the same but add development fixed effects in order to control for choice. As a result, we observe a situation of reverse sorting, with very stable coefficients across specifications that tend to show that the program induces scattering of African Americans at the most local level: African American beneficiaries have 15% fewer African American MPDU neighbors sharing the same address, than other non-African Ameri-

can beneficiaries living in the same development at another address.

Table 11: Sorting conditional on applicants' choice: the share of African American neighbors at the address level

	(1)	(2)	(3)	(4)	(5)	(6)
African American	0.0907*** (0.0311)	0.0865*** (0.0313)	0.0431 (0.0327)	-0.139*** (0.0299)	-0.135*** (0.0303)	-0.154*** (0.0314)
Income		1.60e-06 (1.43e-06)	1.12e-06 (1.45e-06)		7.55e-09 (1.32e-06)	-1.84e-07 (1.36e-06)
Household size		0.0157 (0.0134)	0.0147 (0.0155)		0.0233 (0.0152)	0.0287* (0.0162)
Price			-4.63e-07* (2.65e-07)			-3.78e-07 (2.91e-07)
Unit square footage			0.000103 (6.79e-05)			0.000121 (0.000109)
Dwelling characteristics			X			X
Development fixed effects				X	X	X
Observations	647	637	520	644	634	520
R-squared	0.116	0.125	0.180	0.436	0.438	0.480

Notes: (i) Ordinary-least-square regressions of the share of African American MPDU neighbors at the address level, as a function of individual and dwelling characteristics, with *, ** and *** respectively denoting 10%, 5% and 1% significance levels; (ii) Dwelling characteristics are a set of dummy variables coding for the number of bathrooms and bedrooms; all specifications include time dummies
Source: DHCA.

6 Conclusion

Recognized as a preferred tool in local affordable housing provision, inclusionary zoning policy has served low and moderate income households in various ways, including the increase of the housing stock in below market price tiers and expansion of housing options. As a form of mixed-housing policy, it also emerged to counter discrimination and segregation often caused by traditional subsidized housing programs (Calavita and Grimes 1998).

Using participant and unit level data from the leading inclusionary zoning policy in the U.S., the Montgomery County, Maryland's Moderately Priced Dwelling Unit (MPDU), this paper studies the treatment of African American applicants by the Moderately Priced Dwelling Unit (MPDU) program in Montgomery County, MD. We show that the program was equally accessible to African-American applicants, except between 1995 and 2000, when African Americans' conditional probability of purchasing a home through the program was lowered by 15% compared to that of non-African American applicants. Potential causes of this gap can be attributed to various features of the program design that may have reduced the number of African American participants to enter random drawings or purchase. Similarly lack of credit can also disqualify participants to participate in random drawings. However, based on a subsample of lottery results from 2007 to 2015 period we show that the rejection rate due to household size and pre-approval amount was not different among lottery participants. For example, compared

to 10% among all race and ethnic groups, 8% of African Americans were unqualified to participate in a lottery because of insufficient mortgage pre-approval amounts. On average African American participants entered the same number of lotteries as other races in that period as well suggesting that there were no systematic differences in the likelihood to enter a lottery among participants by race during that period.¹⁵

Furthermore, results imply that applicant preference of certain neighborhoods may partly overcome program efforts. In other words, participants are shown to sort into neighborhoods of similar racial composition, African American beneficiaries are seen to reside in cities and neighborhoods with 2% more other African Americans receivers, with a twice as large effect at the building level made up of mostly townhomes and condos.

However, if we fully control for applicant preferences, by comparing households sharing the same development building, there is suggestive evidence that the program acts, voluntarily or not, as an integration device at the most local (the postal address) level. Although this finding calls for further research to be confirmed, it certainly suggests that the integration goal of this example of an inclusionary zoning program does not only help mitigate income segregation, but ethnic-based segregation as well.

¹⁵Thanks to its current use of a computerized system, the MPDU program is now able provide a more reliable and accurate information on the priority scores and total priority scores used in the random drawings for recent years, unfortunately information on the earlier years is lost.

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A Random Selection Drawing

Montgomery County, MD					
MPDU Random Selection Drawing Results					
Offering ID: 800		Project Name: Poplar Run			
RSD Date: 06/23/2015		Pre-qualified Loan Amount: \$158,710			
Number of Units: 14		Number of Bedrooms: 3			
Eligible Participants					
Rank	Certificate Number	Rank	Certificate Number	Rank	Certificate Number
1	29918	17	47944	33	47727
2	47908	18	48171	34	48029
3	48169	19	48114	35	48170
4	47755	20	48227	36	48166
5	48197	21	48222	37	47964
6	48209	22	48228	38	48203
7	47812	23	48130	39	48176
8	48137	24	48204	40	48126
9	48208	25	48145	41	48233
10	48225	26	48106	42	47930
11	48139	27	48213	43	48149
12	48207	28	48128	44	47912
13	48202	29	48183		
14	48117	30	48007		
15	48052	31	25109		
16	48185	32	27248		
Wednesday, June 24, 2015			Page 1 of 2		
Ineligible Participants					
Certificate Number	Ineligibility Reason				
36515	Household size of 2 limited to 1 or 2 bedrooms				
47186	Pre-qualified Loan Amt is less than Price				
47744	Household size of 2 limited to 1 or 2 bedrooms				
47819	Pre-qualified Loan Amt is less than Price				
47842	Household Size of 1 not eligible for TH				
47931	Household size of 2 limited to 1 or 2 bedrooms				
48049	Pre-qualified Loan Amt is less than Price				
48079	Pre-qualified Loan Amt is less than Price				
48080	Household size of 6 or more limited to 4 or more bedrooms				
48094	Household size of 6 or more limited to 4 or more bedrooms				
48168	Household size of 2 limited to 1 or 2 bedrooms				
48184	Pre-qualified Loan Amt is less than Price				
48205	Household size of 2 limited to 1 or 2 bedrooms				
48206	Pre-qualified Loan Amt is less than Price				
48231	Household size of 2 limited to 1 or 2 bedrooms				
48236	Household Size of 1 not eligible for TH				
48238	Pre-qualified Loan Amt is less than Price				
Wednesday, June 24, 2015			Page 2 of 2		

Figure A1: Sample Random Selection Drawing MPDU Development Results for a Project in 2015

B Geographic Distribution of MPDU Owner-Occupied Properties by Selected Neighborhood Demographics and Year

Figure B1: 1980s MPDU properties by neighborhood share of African American population

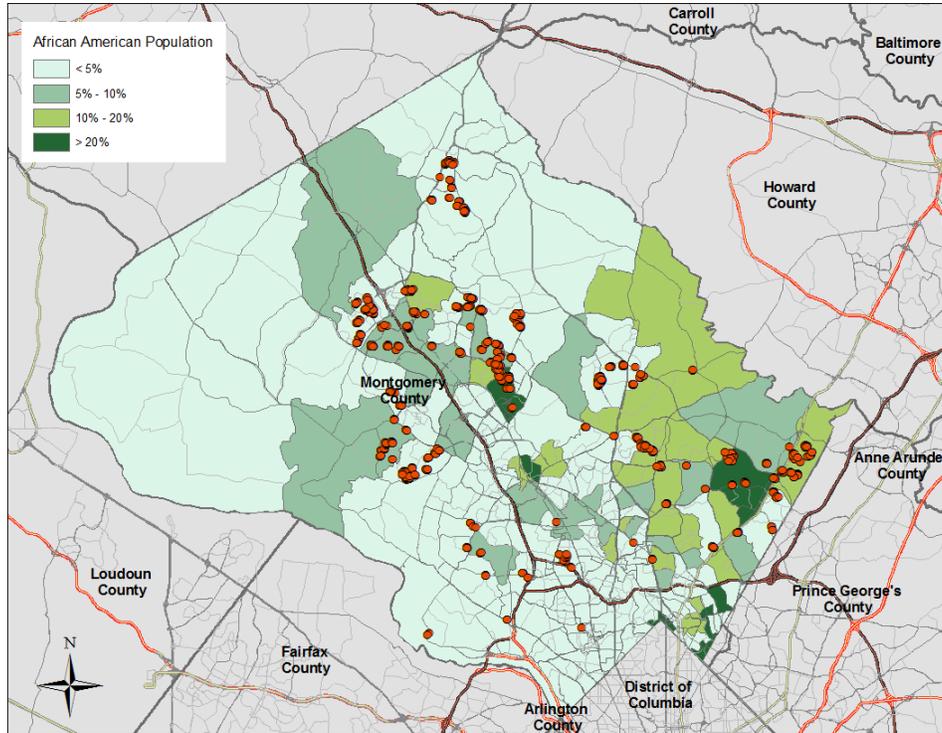


Figure B2: 1990s MPDU properties by neighborhood share of African American population

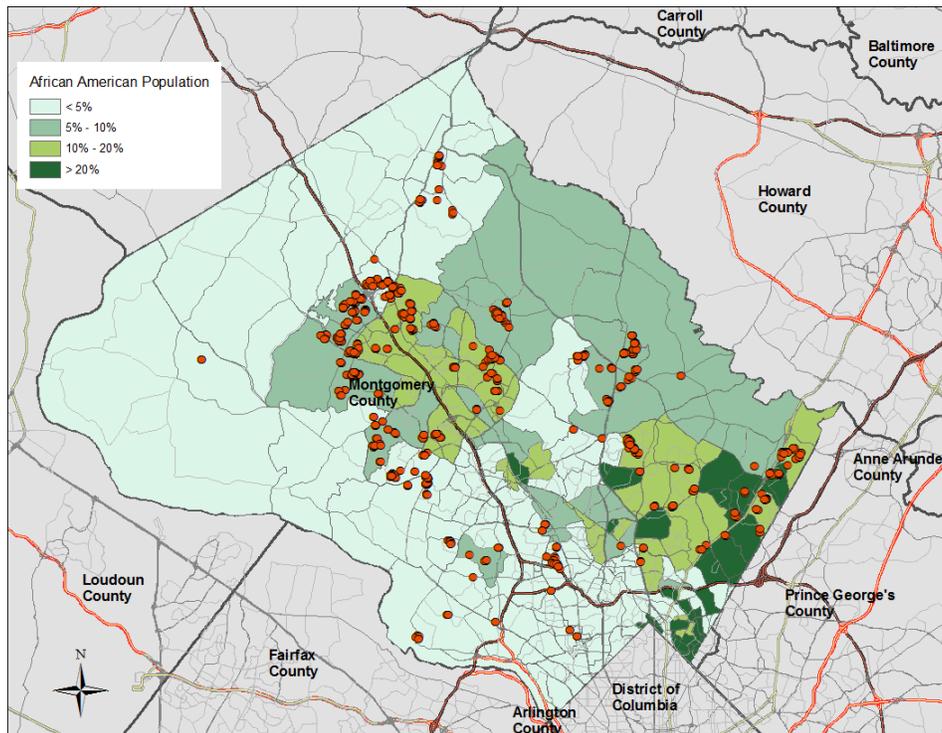


Figure B3: 2000s MPDU properties by neighborhood share of African American population

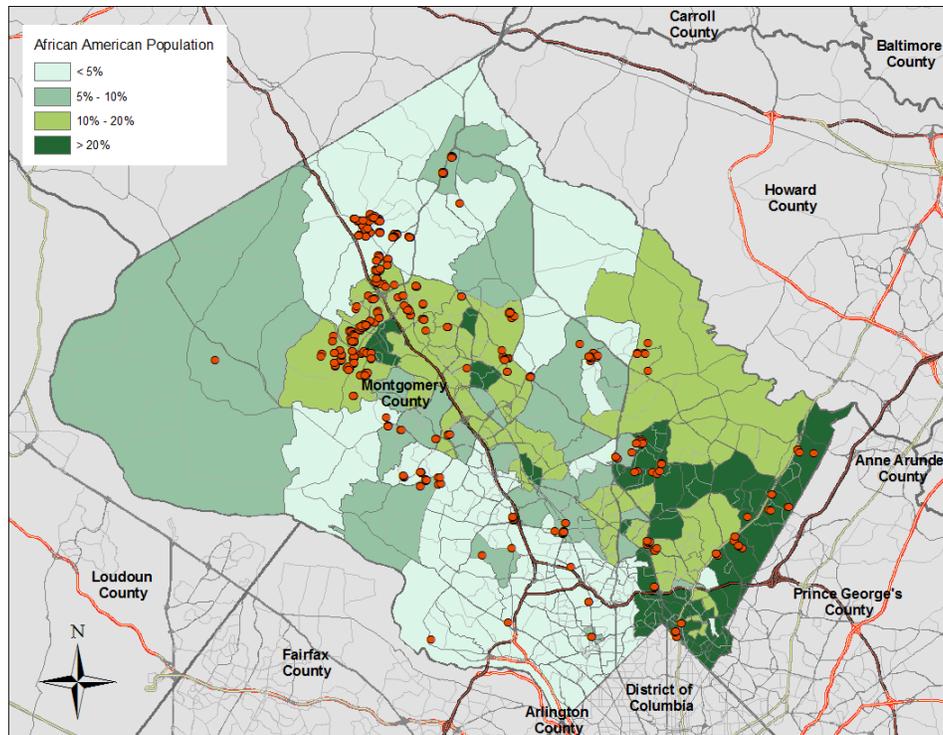


Figure B4: 2010s MPDU properties by neighborhood share of African American population

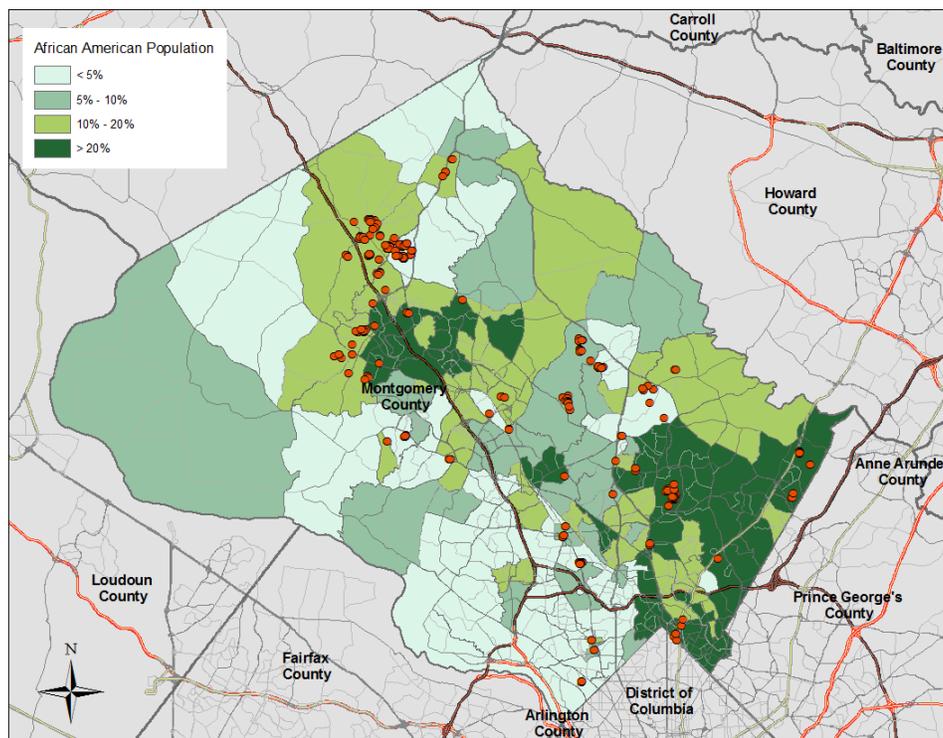


Figure B5: 1980s MPDU properties by neighborhood median household income

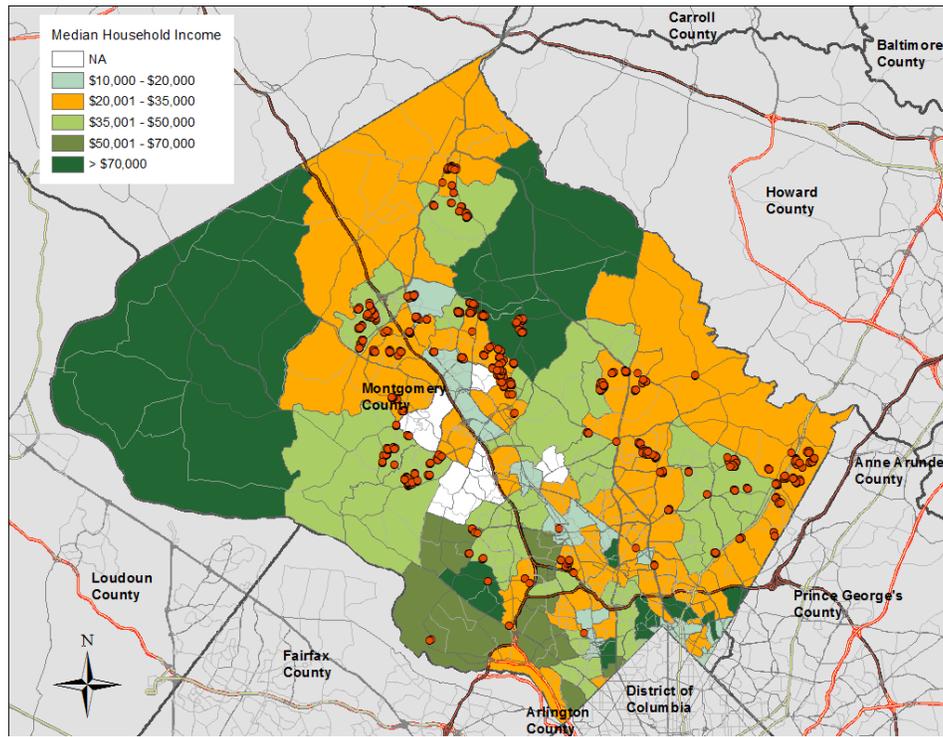


Figure B6: 1990s MPDU properties by neighborhood median household income

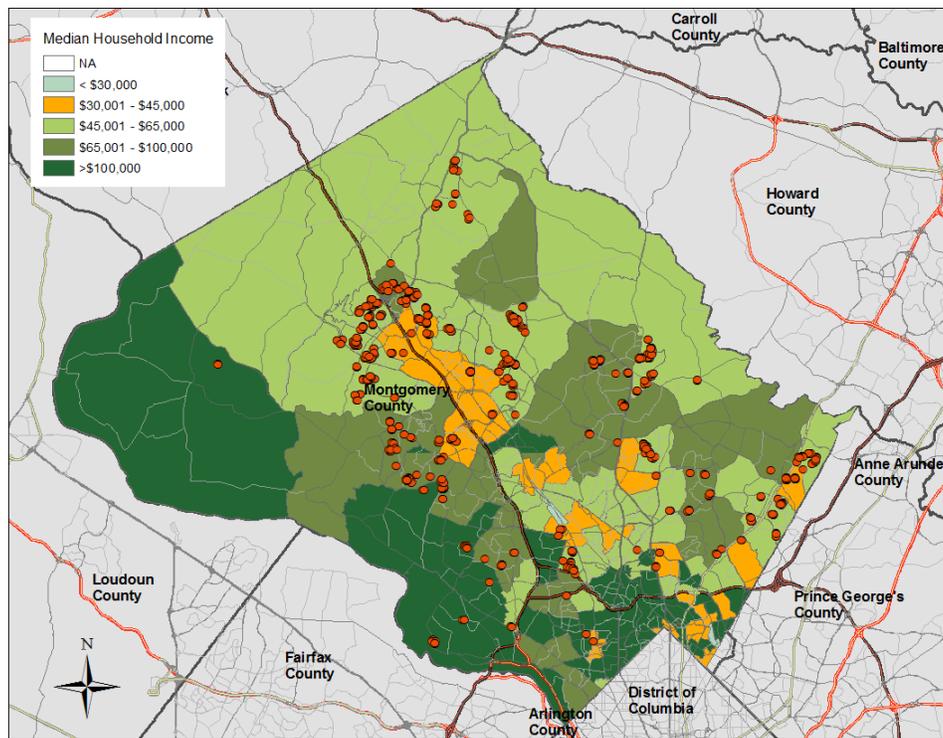


Figure B7: 2000s MPDU properties by neighborhood median household income

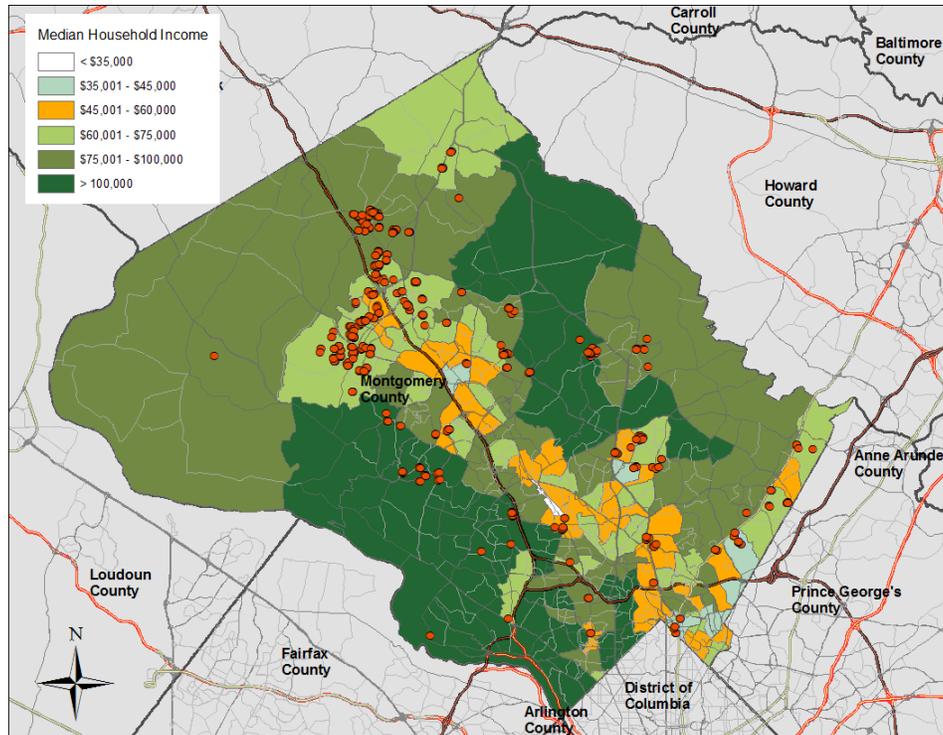
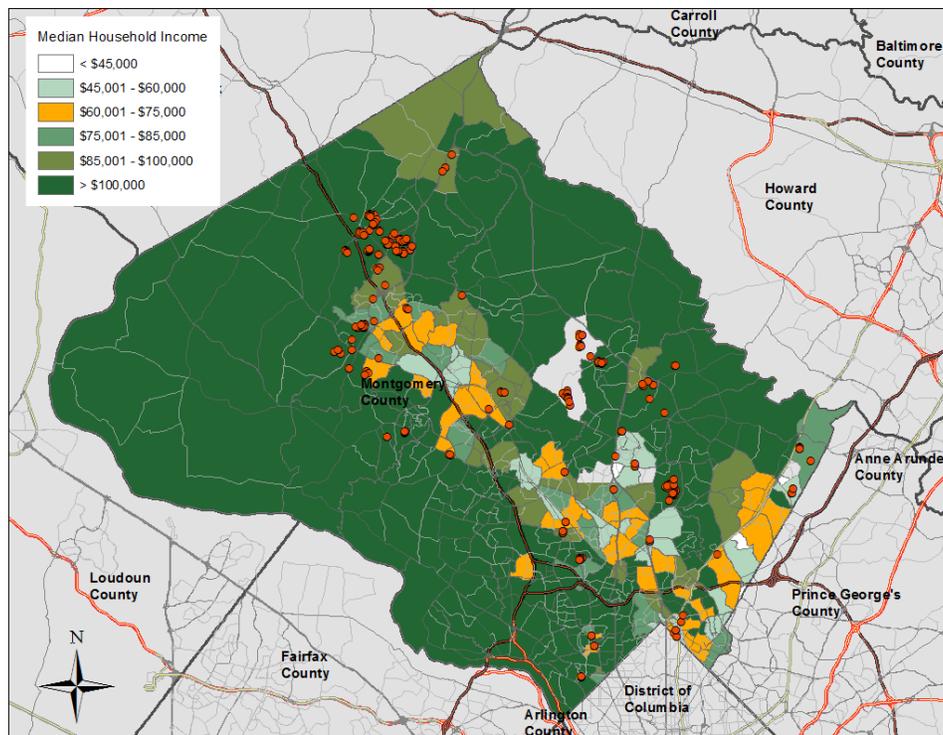


Figure B8: 2010s MPDU properties by neighborhood median household income



Notes: (i) The above figures (A1-A8) show the location of MPDUs by purchase decade except for 2010's which end in 2015 (ii) Census tracts are shaded based on the percentage of African American residents or the median household income (see legends) as reported by the corresponding Census (1980, 1990, 2000, 2010).
 Source: DHCA and U.S. Census Bureau

C Additional statistics: applicants and purchasers

Table C1: The population of applicants: individual and eligibility characteristics, 1982-1988

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.
Income	52,501	55,035	51,399	55,911	52,061
Household size	2.12	2.72	1.87	2.38	2.09
Disable	0	0	0	0	0
Number of applications	1.01	1.00	1.01	1.00	1.01
Only lives in MC	0.27	0.28	0.27	0.33	0.26
Only works in MC	0.25	0.23	0.26	0.25	0.25
Both lives and works in MC	0.48	0.49	0.41	0.42	0.49
Number of observations	1,033	313	720	118	915

Notes: See Table 3

Table C2: The population of applicants: individual and eligibility characteristics, 1989-1995

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.
Income	44,355	45,548	43,331	46,085	44,032
Household size	2.24	2.80	1.76	2.47	2.20
Disable	0	0	0	0	0
Number of applications	1.03	1.03	1.02	1.02	1.03
Only lives in MC	0.25	0.30	0.21	0.36	0.23
Only works in MC	0.15	0.14	0.15	0.17	0.14
Both lives and works in MC	0.60	0.56	0.47	0.62	0.49
Number of observations	1,037	479	558	163	874

Notes: See Table 3

Table C3: The population of applicants: individual and eligibility characteristics, 1996

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	
Income	39,114	39,248	38,407	39,033	38,938	42,908
Household size	2.37	2.64	1.84	2.39	2.37	2.20
Disable	0.001	0.002	0	0.004	0	0
Number of applications	1.03	1.03	1.03	1.01	1.04	1.00
Only lives in MC	0.28	0.30	0.23	0.28	0.27	0.50
Only works in MC	0.09	0.11	0.05	0.16	0.05	0
Both lives and works in MC	0.63	0.59	0.72	0.56	0.68	0.50
Number of observations	831	538	263	284	517	30

Notes: See Table 3

Table C4: The population of applicants: individual and eligibility characteristics, 1997

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	38,042	38,194	37,489	37,881	38,073	39,732
Household size	2.35	2.57	1.82	2.45	2.30	2.19
Disable	0.002	0.001	0.003	0.002	0.002	0
Number of applications	1.04	1.04	1.03	1.03	1.05	1.13
Only lives in MC	0.28	0.29	0.24	0.28	0.27	0.28
Only works in MC	0.09	0.10	0.05	0.13	0.05	0.06
Both lives and works in MC	0.64	0.61	0.70	0.59	0.67	0.66
Number of observations	1,104	765	307	451	621	32

Notes: See Table 3

Table C5: The population of applicants: individual and eligibility characteristics, 1998

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	40,657	40,752	40,174	40,104	40,965	43,384
Household size	2.46	2.65	1.95	2.49	2.43	2.71
Disable	0.001	.001	0	.002	0	0
Number of applications	1.04	1.03	1.04	1.02	1.05	1.08
Only lives in MC	0.29	.30	.23	.31	0.26	0.46
Only works in MC	0.09	.10	.06	.14	0.06	0.08
Both lives and works in MC	0.62	.59	.71	.56	0.68	0.46
Number of observations	1,027	725	278	435	568	24

Notes: See Table 3

Table C6: The population of applicants: individual and eligibility characteristics, 1999

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	40,448	41,196	39,022	40,918	40,343	34,620
Household size	2.44	2.74	1.71	2.69	2.29	2.36
Disable	.001	.001	0	0	.002	0
Number of applications	1.03	1.04	1.02	1.02	1.04	1.00
Only lives in MC	0.25	0.27	0.19	0.28	0.23	0.27
Only works in MC	0.11	0.10	0.13	0.14	.08	0.09
Both lives and works in MC	.64	.63	.68	.58	.68	0.64
Number of observations	1,063	742	299	413	628	22

Notes: See Table 3

Table C7: The population of applicants: individual and eligibility characteristics, 2000

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	41,135	41,424	39,833	41,193	40,837	48,856
Household size	2.54	2.78	1.90	2.70	2.43	2.88
Disable	0	0	0	0	0	0
Number of applications	1.03	1.03	1.02	1.03	1.02	1.06
Only lives in MC	0.24	0.24	0.23	0.26	0.23	0.25
Only works in MC	0.07	0.08	0.07	0.11	0.06	0
Both lives and works in MC	0.69	0.68	0.70	0.64	0.71	0.75
Number of observations	773	542	215	286	471	16

Notes: See Table 3

Table C8: The population of applicants: individual and eligibility characteristics, 2001

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	42,228	42,803	40,649	42,030	42,330	42,505
Household size	2.47	2.70	1.84	2.52	2.43	2.56
Disable	0	0	0	0	0	0
Number of applications	1.03	1.04	1.01	1.03	1.04	1.03
Only lives in MC	0.26	0.28	0.21	0.27	0.26	0.18
Only works in MC	0.08	0.08	0.07	0.10	0.06	0.13
Both lives and works in MC	0.66	0.64	0.72	0.63	0.68	0.69
Number of observations	784	541	204	290	455	39

Notes: See Table 3

Table C9: The population of applicants: individual and eligibility characteristics, 2002

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	43,810	44,108	41,292	42,923	43,706	54,368
Household size	2.45	2.67	1.79	2.50	2.43	2.34
Disable	0.001	0	0.004	0	0.002	0
Number of applications	1.06	1.07	1.03	1.03	1.07	1.00
Only lives in MC	0.26	0.28	0.22	0.25	0.28	0.20
Only works in MC	0.08	0.09	0.06	0.14	0.05	0.03
Both lives and works in MC	0.66	.63	0.72	0.61	0.68	0.77
Number of observations	999	731	233	344	620	35

Notes: See Table 3

Table C10: The population of applicants: individual and eligibility characteristics, 2003-2004

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	41,677	41,647	42,403	42,803	41,373	35,759
Household size	2.58	2.74	2.09	2.59	2.61	1.44
Disable	0	0	0	0	0	0
Number of applications	1.18	1.19	1.12	1.15	1.19	1.33
Only lives in MC	0.26	0.28	0.21	0.30	0.26	0
Only works in MC	0.03	0.04	0	0.06	0.03	0
Both lives and works in MC	0.70	0.67	0.79	0.65	0.72	1.00
Number of observations	408	313	86	122	277	9

Notes: See Table 3

Table C11: The population of applicants: individual and eligibility characteristics, 2005

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	43,639	44,309	42,170	46,612	42,419	41,184
Household size	2.45	2.60	1.91	2.62	2.37	2.37
Disable	0.008	0.011	0	0.006	0.100	0
Number of applications	1.18	1.21	1.11	1.22	1.17	1.15
Only lives in MC	0.23	0.25	0.18	0.31	0.20	0.17
Only works in MC	0.04	0.05	0.03	0.06	0.03	0.07
Both lives and works in MC	0.72	0.70	0.79	0.63	0.76	0.76
Number of observations	498	361	96	157	300	41

Notes: See Table 3

Table C12: The population of applicants: individual and eligibility characteristics, 2006

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	44,068	44,188	43,893	44,673	43,836	43,347
Household size	2.43	2.59	1.84	2.57	2.33	2.66
Disable	0.008	0.008	0.006	.009	.007	0.021
Number of applications	1.54	1.52	1.54	1.54	1.53	1.53
Only lives in MC	0.25	0.26	0.20	0.26	0.24	0.28
Only works in MC	0.04	0.04	0.04	0.05	0.03	0.4
Both lives and works in MC	0.71	0.70	0.75	0.69	0.73	0.68
Number of observations	731	523	161	231	453	47

Notes: See Table 3

Table C13: The population of applicants: individual and eligibility characteristics, 2007-2015

	Total	Non-Cauc.	Cauc.	Afr. Am.	Non-Afr. Am.	Missing
Income	49,457	50,013	47,550	52,709	47,734	48,406
Household size	2.87	3.04	2.25	3.21	2.71	2.54
Disable	0.027	0.027	0.027	0.035	0.023	0.019
Number of applications	1.97	1.96	1.82	1.79	2.01	2.44
Only lives in MC	0.21	0.22	0.19	0.25	0.20	0.21
Only works in MC	0.02	0.02	0.03	0.02	0.02	0.04
Both lives and works in MC	0.76	0.77	0.77	0.73	0.79	0.75
Number of observations	1,606	1,207	294	542	959	105

Notes: See Table 3

D Additional statistics: Lottery

Table D1: Lottery participation by race and ethnicity

	Total	2007	2008	2009	2010	2011	2012	2013	2014	2015
African American	0.36	0.25	0.21	0.33	0.31	0.37	0.50	0.38	0.53	0.48
Asian	0.38	0.49	0.56	0.42	0.33	0.33	0.29	0.32	0.25	0.22
Caucasian	0.13	0.12	0.10	0.16	0.23	0.13	0.13	0.17	0.11	0.14
Hispanic	0.06	0.07	0.04	0.03	0.07	0.07	0.04	0.07	0.04	0.10
Native American	0.01	0	0	0.01	0	0	0	0	0	0.03
Missing	0.05	0.07	0.09	0.05	0.06	0.09	0.05	0.06	0.08	0.03
Number of observations	3,234	772	542	166	109	75	189	379	438	564

Notes: Observation totals are based on participants who are qualified (meet both household size and preapproval amount requirements) to participate in lotteries for the specified year.

Source: *DHCA*.

Table D2: Lottery entrance

	Total	Afr. Am.	Asian	Caucasian.	Hispanic	Nat. Am.	Missing
Number of lotteries	3.91	3.87	4.29	3.10	2.72	7.18	4.44
Number of observations	3,234	1,165	1,223	424	202	17	203

Notes: Observation totals are based on participants who are qualified (meet both household size and preapproval amount requirements) to participate in lotteries for the specified year. Lotteries are averaged across participants in each race group.

Source: *DHCA*.

Table D3: Purchase of lottery participants

	Total	2007	2008	2009	2010	2011	2012	2013	2014	2015
African American	0.41	0.24	0.29	0.28	0.30	0.46	0.59	0.41	0.53	0.37
Asian	0.31	0.45	0.41	0.50	0.40	0.26	0.17	0.26	0.24	0.31
Caucasian	0.12	0.21	0.10	0	0.13	0.05	0.15	0.18	0.10	0.11
Hispanic	0.09	0.03	0.08	0.11	0.10	0.13	0.05	0.11	0.08	0.13
Missing	0.07	0.07	0.12	0.11	0.07	0.10	0.05	0.05	0.06	0.07
Number of observations	406	29	49	18	30	39	41	74	72	54

Notes: Native Americans are not shown on table because they did not purchase any units during this time period.

Source: *DHCA*.

Table D4: Disqualified lottery participants

	Total	Afr. Am.	Asian	Caucasian	Hispanic	Nat. Am.	Missing
Mortgage preapproval	0.10	0.08	0.09	0.13	0.17	0	0.11
Household size	0.18	0.15	0.16	0.26	0.21	0.06	0.20
Number of observations	1,304	402	389	280	127	1	105

Notes: Observation totals include participants deemed ineligible for other reasons other than household size and mortgage preapproval as well. About 97 percent of participants were disqualified for the two reasons listed above. Source: *DHCA*.

Table D5: Lottery participation by development offering

Development	Afr. Am.	Asian	Caucasian	Hispanic
119	0.20	0.57	0.12	0.05
280	0.35	0.45	0.07	0.07
285	0.27	0.47	0.12	0.07
296	0.33	0.47	0.09	0.06
297	0.15	0.54	0.15	0.00
338	0.23	0.55	0.09	0.06
343	0.07	0.29	0.29	0.36
344	0.11	0.50	0.22	0.11
345	0.13	0.61	0.15	0.04
346	0.24	0.48	0.17	0.06
347	0.10	0.30	0.40	0.10
348	0.11	0.33	0.44	0.00
353	0.23	0.52	0.09	0.09
354	0.24	0.41	0.18	0.00
366	0.25	0.57	0.09	0.03
367	0.00	1.00	0.00	0.00
368	0.00	0.50	0.00	0.00
369	0.50	0.50	0.00	0.00
371	0.26	0.47	0.11	0.06
372	0.00	0.67	0.00	0.00
373	0.40	0.60	0.00	0.00
383	0.00	0.00	0.00	0.00
389	0.22	0.50	0.12	0.03
391	0.00	0.78	0.00	0.11
392	0.00	0.80	0.00	0.00
393	0.25	0.75	0.00	0.00
394	1.00	0.00	0.00	0.00
395	0.22	0.54	0.10	0.03
401	0.25	0.60	0.05	0.02
408	0.09	0.68	0.23	0.00
409	0.13	0.63	0.21	0.00
410	0.22	0.54	0.10	0.10
411	0.17	0.67	0.00	0.06
412	0.13	0.43	0.22	0.04
416	0.25	0.50	0.25	0.00
417	0.25	0.63	0.00	0.13
421	0.50	0.50	0.00	0.00
429	0.00	0.00	1.00	0.00

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Table D5 – *Continued from previous page*

Development	Afr. Am.	Asian	Caucasian	Hispanic
432	0.22	0.28	0.28	0.11
437	0.00	1.00	0.00	0.00
438	0.00	1.00	0.00	0.00
444	0.00	1.00	0.00	0.00
458	0.00	0.00	1.00	0.00
461	0.00	1.00	0.00	0.00
463	0.40	0.40	0.20	0.00
465	0.47	0.26	0.16	0.05
466	0.28	0.60	0.08	0.00
468	0.00	0.00	1.00	0.00
471	0.00	0.00	1.00	0.00
474	0.43	0.36	0.14	0.00
476	0.00	1.00	0.00	0.00
478	0.00	1.00	0.00	0.00
479	0.41	0.32	0.12	0.06
487	0.31	0.50	0.12	0.00
495	0.00	0.50	0.50	0.00
498	0.00	0.00	1.00	0.00
499	0.00	0.50	0.00	0.50
501	0.00	1.00	0.00	0.00
502	0.55	0.36	0.09	0.00
506	0.33	0.33	0.19	0.10
511	0.24	0.29	0.29	0.06
523	0.00	0.25	0.75	0.00
526	0.00	0.50	0.50	0.00
527	0.20	0.20	0.40	0.20
530	0.33	0.00	0.67	0.00
532	0.38	0.38	0.25	0.00
536	0.26	0.47	0.05	0.05
538	0.00	0.00	0.00	1.00
539	0.20	0.40	0.20	0.20
542	0.50	0.10	0.20	0.20
546	1.00	0.00	0.00	0.00
548	0.64	0.29	0.00	0.00
553	0.54	0.31	0.15	0.00
565	0.33	0.33	0.33	0.00
568	0.00	0.00	1.00	0.00
572	0.22	0.33	0.33	0.00

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Table D5 – *Continued from previous page*

Development	Afr. Am.	Asian	Caucasian	Hispanic
575	0.50	0.13	0.25	0.13
579	0.22	0.44	0.11	0.06
583	0.20	0.40	0.00	0.40
584	0.47	0.12	0.18	0.06
586	0.56	0.22	0.00	0.00
590	0.33	0.43	0.14	0.00
595	0.67	0.33	0.00	0.00
603	0.23	0.36	0.27	0.05
607	0.48	0.32	0.12	0.00
608	0.48	0.28	0.14	0.03
611	0.50	0.40	0.10	0.00
613	0.50	0.13	0.25	0.13
614	1.00	0.00	0.00	0.00
615	0.50	0.17	0.00	0.33
617	0.59	0.26	0.11	0.04
623	0.35	0.47	0.12	0.06
625	1.00	0.00	0.00	0.00
644	0.00	0.00	1.00	0.00
647	0.38	0.31	0.13	0.13
650	0.31	0.44	0.13	0.06
651	0.39	0.28	0.11	0.17
653	0.52	0.30	0.04	0.13
654	0.39	0.39	0.13	0.06
656	0.48	0.34	0.03	0.10
658	0.41	0.41	0.15	0.00
664	0.54	0.21	0.17	0.04
665	0.52	0.30	0.13	0.00
666	0.00	0.00	1.00	0.00
667	0.00	0.00	1.00	0.00
668	0.35	0.26	0.26	0.06
672	0.00	0.33	0.67	0.00
674	0.00	0.00	0.60	0.20
678	0.21	0.26	0.16	0.21
681	0.35	0.22	0.26	0.09
682	0.43	0.29	0.18	0.00
684	0.00	1.00	0.00	0.00
685	0.20	0.40	0.40	0.00
686	0.33	0.38	0.17	0.04

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Table D5 – *Continued from previous page*

Development	Afr. Am.	Asian	Caucasian	Hispanic
692	0.00	0.00	0.50	0.50
693	0.63	0.21	0.11	0.00
694	0.00	0.33	0.67	0.00
703	0.43	0.26	0.17	0.04
704	0.50	0.50	0.00	0.00
708	0.00	0.00	0.00	1.00
709	0.00	0.50	0.50	0.00
710	0.57	0.14	0.11	0.04
711	1.00	0.00	0.00	0.00
716	0.40	0.60	0.00	0.00
719	0.47	0.27	0.07	0.00
720	0.37	0.30	0.19	0.04
721	0.55	0.24	0.12	0.02
725	1.00	0.00	0.00	0.00
726	0.54	0.27	0.08	0.00
731	1.00	0.00	0.00	0.00
734	0.57	0.19	0.10	0.05
736	0.00	0.00	1.00	0.00
738	0.53	0.29	0.05	0.08
740	0.62	0.24	0.03	0.03
741	0.50	0.13	0.13	0.13
742	0.56	0.22	0.11	0.06
743	0.60	0.25	0.05	0.05
744	1.00	0.00	0.00	0.00
746	0.60	0.29	0.06	0.03
747	0.52	0.33	0.11	0.04
754	0.44	0.28	0.17	0.00
760	0.44	0.22	0.19	0.13
762	0.00	0.67	0.00	0.00
763	0.00	1.00	0.00	0.00
771	0.75	0.13	0.13	0.00
775	0.00	1.00	0.00	0.00
778	0.00	0.00	0.00	1.00
779	1.00	0.00	0.00	0.00
783	0.15	0.41	0.31	0.05
787	0.71	0.14	0.00	0.00
789	0.00	1.00	0.00	0.00
790	0.00	1.00	0.00	0.00

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Table D5 – Continued from previous page

Development	Afr. Am.	Asian	Caucasian	Hispanic
792	0.00	0.00	0.00	1.00
795	0.46	0.31	0.08	0.08
800	0.59	0.20	0.05	0.11
801	0.33	0.17	0.17	0.33
803	0.44	0.25	0.10	0.13
804	0.66	0.13	0.08	0.11
808	0.64	0.14	0.14	0.05
809	0.59	0.09	0.19	0.09
812	0.00	0.00	1.00	0.00
813	0.33	0.25	0.17	0.08
814	0.40	0.20	0.00	0.20
817	0.50	0.50	0.00	0.00
818	0.00	0.33	0.67	0.00
819	0.40	0.40	0.20	0.00
820	0.00	0.00	1.00	0.00
821	0.61	0.17	0.09	0.09
823	0.57	0.22	0.09	0.09
825	0.52	0.21	0.10	0.08
826	0.00	0.00	1.00	0.00
827	0.33	0.33	0.33	0.00
832	0.26	0.22	0.22	0.22
834	0.65	0.19	0.05	0.05
838	0.50	0.17	0.11	0.17
839	0.50	0.14	0.21	0.07
851	0.29	0.14	0.29	0.14
Standard deviation	0.27	0.27	0.27	0.17

Notes: This table shows that applicants are mostly dispersed across developments. The number of lottery participants for a development can be as low as 1 person.

Source: DHCA.