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IN PHILADELPHIA**

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Gentrification and Residential Mobility in Philadelphia

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Abstract

Gentrification has provoked considerable debate and controversy about its effects on neighborhoods and the people residing in them. This paper draws on a unique large-scale consumer credit database to examine the mobility patterns of residents in gentrifying neighborhoods in the city of Philadelphia from 2002 to 2014. We find significant heterogeneity in the effects of gentrification across neighborhoods and subpopulations. Residents in gentrifying neighborhoods have slightly higher mobility rates than those in nongentrifying neighborhoods, but they do not have a higher risk of moving to a lower-income neighborhood. Moreover, gentrification is associated with some positive changes in residents' financial health as measured by individuals' credit scores. However, when more vulnerable residents (low-score, longer-term residents, or residents without mortgages) move from gentrifying neighborhoods, they are more likely to move to lower-income neighborhoods and neighborhoods with lower values on quality-of-life indicators. The results reveal the nuances of mobility in gentrifying neighborhoods and demonstrate how the positive and negative consequences of gentrification are unevenly distributed.

Keywords: gentrification, residential mobility, credit scores, displacement

JEL Codes: D14, J11, J6, R23

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1. Introduction

Neighborhoods in many central cities have started to rebound because of recent demographic and economic shifts and renewed interest in urban living. In the city of Philadelphia, the total population bottomed out in 2006 and then began to rise after more than a half-century of decline. While gentrification had been taking place long before this recent revival, affluent residents are increasingly moving into once underinvested and predominantly low-income communities in Philadelphia. Investment and development in these neighborhoods has increased sharply, often accompanied by significant increases in housing prices and rents. The decreasing affordability of housing in these neighborhoods has raised concerns surrounding the residential displacement of existing residents and the lack of affordable housing for potential in-movers.

The term *gentrification* has often been used to describe such neighborhood changes that are characterized by the influx of new residents of a higher socioeconomic status relative to incumbent residents and rising housing values. For many, the term implies the displacement of long-term, often older or low-income, residents by younger and high-income residents. While studies of gentrification generally find evidence of neighborhood-level demographic shifts, the empirical evidence on the relationship between gentrification and residential displacement is far from conclusive. Early studies of displacement and gentrification typically lacked an appropriate comparison group to assess mobility in the absence of gentrification (Freeman, 2005). A handful of studies in recent years have attempted to address this issue using individual-level, longitudinal data and more comparable neighborhoods. These studies generally do not find evidence that less-educated, renting, minority, and lower-income households are displaced in gentrifying neighborhoods (Ellen and O'Regan, 2011; Freeman, 2005; Freeman and Braconi, 2004; McKinnish et al., 2010; and Vigdor, 2002).

In this paper, we contribute to this debate by examining the relationships between gentrification and both mobility patterns and financial health among residents in Philadelphia from 2002 to 2014. Existing studies of gentrification have various data limitations, including using very large spatial aggregations, lacking longitudinal data for individuals, or using broad definitions to capture gentrification; and nearly all have analyzed periods prior to 2000, before gentrification became rapid and widespread, increasing housing affordability pressures in many cities and neighborhoods. We overcome these data limitations by using a unique individual-level data set, the Federal Reserve Bank of New York Consumer Credit Panel/Equifax (hereafter noted as CCP), and more precise gentrification measures in the city of Philadelphia. By focusing on a single city, we can identify gentrification with more accuracy and examine various aspects of residential mobility. In this study, we track the residential location and financial health of a random sample of more than 50,000 adult residents in Philadelphia. We examine mobility rates, the quality of neighborhood moves, and the financial health among residents stratified by various subgroups, providing new and more comprehensive quantitative evidence of the consequences of gentrification.

Based on our measure, we identified a total of 56 of the 184 previously low-income census tracts in Philadelphia as gentrifying from 2000 to 2013. These tracts are primarily located in areas expanding from Center City or in areas that are adjacent to the University of Pennsylvania or Temple University. We find that, on average, residents in gentrifying neighborhoods have slightly higher mobility rates than residents in low-income neighborhoods that did not gentrify,

but the higher mobility rates are largely driven by residents who are younger and have high-credit scores and occur primarily in rapidly gentrifying neighborhoods. Moreover, residents who move from gentrifying neighborhoods are no more likely to move to lower-income neighborhoods compared with movers from nongentrifying, low-income neighborhoods. We also find that gentrification is associated with positive changes in residents' financial health: Residents in gentrifying neighborhoods experience an average increase of 11 points in their credit scores, compared with those who are not residents.¹

The empirical results further suggest that less advantaged residents generally gained less from gentrification than others, and those who were unable to remain in a gentrifying neighborhood had negative residential and financial outcomes in the gentrification process. While we find more vulnerable residents are no more likely to leave gentrifying neighborhoods, when they move, however, they have a higher risk of moving to lower-income neighborhoods or to neighborhoods with lower values on quality-of-life indicators. For example, low-score movers (below 580 or having no scores),² who generally have shorter credit histories or who were hit harder during the Great Recession, are more likely to move to neighborhoods with lower incomes, higher crime rates, schools with poorer performance, and/or higher unemployment rates, while high-score movers from gentrifying neighborhoods are more likely to move to significantly better neighborhoods. The quality of the destination neighborhoods is associated with movers' financial health as well: An individual's risk score declined 15 points in three years after moving into a lower-income neighborhood. Even for those who stay in gentrifying neighborhoods, more vulnerable populations experienced less improvement in their credit rating compared with other residents remaining in the neighborhoods.

This paper proceeds as follows. Section 2 reviews relevant literature on gentrification, and Section 3 provides a detailed description of the data sets used in the study. Using multivariate regression analysis, Section 4 explores the consequences of gentrification by examining the relationship among gentrification, residential mobility, and residents' financial well-being. Section 5 discusses results from a descriptive analysis of the experience of movers who moved out of gentrifying neighborhoods in Philadelphia, and we discuss our conclusions in the final section.

2. Background and Literature

Gentrification and Residential Displacement

The displacement of incumbent residents has been a central debate surrounding gentrification. Given the physical renewal and influx of middle- and upper-middle class residents to previous low-income neighborhoods that characterizes gentrification, many have argued that displacement is an inevitable consequence of gentrification. The neighborhood-level demographic changes taking place in gentrifying neighborhoods and anecdotal accounts suggest that displacement takes place as neighborhoods gentrify (Hartman, 1979), but empirical analyses have generally not found evidence of elevated rates of displacement compared with low-income neighborhoods

¹ The credit score used in our empirical analysis is the Equifax Risk score.

² Bostic, Calem, and Wachter (2005) show low-score individuals are disproportionately more likely to be from low-income and minority households.

that do not gentrify. These findings may be a result of the fact that gentrification can take place through infill development or in areas with high vacancy rates, as well as the fact that residents in these comparable neighborhoods generally have high mobility rates because of financial instability and eviction (Newman and Wyly, 2006; Slater, 2009). Further, incumbent residents may be willing to pay the increased costs that come with gentrification (Freeman et al., 2015).

The first set of studies to examine the relationship between gentrification and displacement examined differences in the characteristics of residents moving into and out of gentrifying neighborhoods (e.g., Henig, 1980; Spain et al., 1980), conducted surveys asking residents why they had moved but often without information on the previous residential location (e.g., Grier and Grier, 1978; Lee and Hodge, 1984), or focused on involuntary mobility rates or mobility rates, more broadly, as neighborhoods gentrified (e.g., Schill and Nathan, 1983). However, these studies lacked the necessary data to assess residential moves associated with gentrification or did not compare gentrifying neighborhoods with nongentrifying neighborhoods, limiting these studies from assessing if such moves would have occurred in the absence of gentrification (Freeman, 2005).

Recent studies have made important advances in our understanding of gentrification and displacement using improved data and nongentrifying neighborhoods as comparison groups. Vigdor (2002), Freeman and Braconi (2004), and Newman and Wyly (2006) examined individual moves in Boston from 1970 to 1998, New York City from 1991 to 1999, and New York City from 1991 to 2002, respectively. The studies find that lower-income and less-educated households in gentrifying neighborhoods were not more likely to move than similar households in all other neighborhoods. Newman and Wyly (2006) find some evidence of displacement among particular households (foreign-born, female-headed, poor, elderly, and public housing residents) and find that they tend to move to outer boroughs of New York City, but they show that many poor renters are able to stay in gentrifying neighborhoods.

A major limitation of the data used in these studies because of limited sample sizes is that they defined neighborhoods as large spatial aggregations comprising more than 100,000 residents, which is substantially larger than the way neighborhoods are generally operationalized in neighborhood studies, and likely attenuated their results (Freeman, 2005; Ellen and O'Regan, 2011). Moreover, these studies compared mobility patterns in gentrifying neighborhoods with all other neighborhoods, rather than an arguably more appropriate control group of low-income neighborhoods that did not gentrify (Freeman, 2005). Lastly, these earlier studies relied on survey responses to questions that asked about reasons for moves, but, as many scholars have pointed out, retrospective responses may not accurately capture residential moves resulting from gentrification (Freeman, 2005).

A handful of studies overcame these issues using alternative data sources that enabled them to operationalize neighborhoods as census tracts, which have an average of 4,000 residents, while using improved control neighborhoods and focusing on mobility rates, rather than survey responses indicating involuntary moves. Freeman (2005) examines mobility among a national sample of individuals during the 1980s and 1990s and does not find strong evidence that lower-income households are more likely to move or move involuntarily (based on retrospective survey responses) out of gentrifying neighborhoods relative to similar households in nongentrifying

neighborhoods. The gentrification captured in this period, however, was relatively slow and predates its intensification that took place in the late 1990s and into the 2000s (Ellen and O'Regan, 2011). In addition, because of sample size limitations, Freeman (2005) uses a liberal definition of gentrification that considers a large number of tracts to be gentrifying that are sometimes inconsistent with local knowledge.³

McKinnish et al. (2010) use confidential census data to examine mobility during the 1990s across large metropolitan areas and find no evidence that low-educated or minority householders are more likely to move out of gentrifying neighborhoods. However, they do find that blacks with lower education levels are more likely to be displaced from census tracts that are less than 50% black. However, the data used in this study were limited to observations in 1990 and 2000 and do not follow the same residents over time. Ellen and O'Regan (2011) improve upon these data limitations using the confidential American Housing Survey, which observes the same housing units over time. Thus, they are able to observe residential turnover in two-year intervals instead of 10-year intervals, which is more appropriate for rental markets in gentrifying neighborhoods, and can examine changes in the financial well-being of residents who remain in the units. They also do not find evidence of greater exit rates from gentrifying neighborhoods for minorities, poor residents, or renters compared with nongentrifying neighborhoods. Nonetheless, Ellen and O'Regan (2011) find that homeowners who did move away from gentrifying neighborhoods generally had lower incomes than those who remained. Finally, a recent study by Freeman et al. (2015) uses longitudinal data to examine evidence of displacement in England and Wales and finds little evidence of displacement.

Overall, the existing studies generally observe no statistically significant differences in mobility rates between gentrifying and nongentrifying neighborhoods (Freeman, 2005; McKinnish et al., 2010; Ellen and O'Regan, 2011).

Gentrification and Other Consequences

Although the empirical evidence on residential displacement in gentrifying neighborhoods is weak, many scholars have pointed to the indirect displacement that gentrification brings by reducing the affordable housing supply, as well as alternative forms of displacement that take place as neighborhoods gentrify. While less advantaged households may not move out of gentrifying neighborhoods, gentrification results in less advantaged residents being priced out of areas that they could have afforded originally, often from areas by the central business district, thereby making access to jobs and amenities more difficult for these residents (Newman and Wyly, 2006). In addition, the decrease in affordable housing opportunities in gentrifying neighborhoods can force lower-income residents to search for housing in more disadvantaged neighborhoods (Newman and Wyly, 2006). The aforementioned studies find that residents who move to gentrifying neighborhoods tend to be more socioeconomically advantaged than original residents in the neighborhoods (McKinnish et al., 2010; Ellen and O'Regan, 2011), which suggests that less advantaged residents may indeed be entering more disadvantaged neighborhoods. Because of data limitations, studies on displacement and gentrification using

³ See the Appendix comparing tracts identified as gentrifying using Freeman's (2005) measure with actual field surveys conducted by Hammel and Wyly (1996); see also Wyly and Hammel (1998, 1999) and the measures used in our analysis.

longitudinal data have not analyzed the types of neighborhoods to which residents in gentrifying neighborhoods move.

Others have argued that residents are more likely to pay more for housing costs in the context of gentrification. Residents who remain in gentrifying neighborhoods may incur additional housing costs, and those who move are subject to rising housing costs throughout the city as gentrification can increase housing costs in neighborhoods that are not gentrifying (Newman and Wyly, 2006; Slater, 2009). Counter to these expectations, McKinnish et al. (2010) find that income gains were greatest among black high school graduates, who make up a substantial proportion of the population of neighborhoods identified as gentrifying at the beginning of the study. Using a different data set, Ellen and O'Regan (2011) find that residents who remain in gentrifying neighborhoods experience greater income gains and increases in residential satisfaction compared with residents who remain in nongentrifying neighborhoods. In addition, Hartley (2013) sees increases in financial well-being among residents who both stay or move from gentrifying tracts. We further contribute to this debate by examining the types of neighborhoods to which various vulnerable residents move within the city, particularly for those who move out of gentrifying neighborhoods, and changes in the financial well-being for both movers and stayers. Although we only observe neighborhood characteristics and the financial well-being of residents in this study, we recognize that residential moves can also result in other negative consequences, such as the loss of social and family ties and access to amenities and resources from origin neighborhoods.

Lastly, many ethnographic accounts of gentrifying neighborhoods also document the political and cultural displacement that occurs as neighborhoods gentrify, alienating many of its less advantaged residents (e.g., Hyra, 2014; Martin, 2007; Zukin, 2010). Although the focus of this study is on residential displacement, we acknowledge that other forms of displacement also may occur as a result of gentrification.

Summary

To date, Freeman (2005), McKinnish et al. (2010), and Ellen and O'Regan (2011) have offered the best evidence on the issue of residential displacement in the U.S. The data and analysis employed in this study, which we describe in more detail in the following section, offer several advantages for contributing to this debate. In particular, we are able to trace residential moves from year to year and can examine residents' financial well-being and the types of neighborhoods to which residents move, which existing studies have been unable to do. We are also able to stratify households within neighborhoods because of our large sample size, which the data used by Freeman (2005) and Ellen and O'Regan (2011) precluded.

In addition, our analysis assesses gentrification during the 2000s. Although this period was severely affected by the housing crisis, we are able to capture moves during the intensification of the gentrification at the end of the 1990s and through the housing bubble. Newman and Wyly (2006) argue that displacement pressures are greater when housing market pressures tighten, which occurred in cities during the late 1990s and continued into the 2000s. Philadelphia was not affected as severely by the housing crisis, which allays some concerns with conducting the analysis for this period. Despite the housing collapse, in many cities, as in Philadelphia,

gentrification has continued seemingly unabated in recent years. Given the richness of our data set, we are also able to analyze moves before, during, and after the Recession.

3. Data and Methodology

Data: Gentrification Measures

Empirical studies of gentrification have little agreement on its definition and, relatedly, its operationalization. Sociologist Ruth Glass (1964) first coined the term *gentrification* to describe the socioeconomic upgrading of a working-class neighborhood through both physical renewal and the influx of new middle-class residents replacing the original working-class residents. Although this initial characterization implied the displacement of residents, the evidence on whether or not displacement occurs as a result of the influx of new residents and investment in previously low-income neighborhoods is mixed. Thus, we rely on a broader conception of gentrification as the socioeconomic and physical upgrading of a previously low-income neighborhood, characterized by the influx of higher socioeconomic status residents and an increase in housing prices.

Given the definitional debates, gentrification scholars also do not agree on how to best operationalize gentrification for quantitative studies. The majority of large sample studies use census- or administratively based variables. Such measures are less than perfect in capturing gentrification, as they can capture various forms of neighborhood change that may not be inherent to the physical and demographic changes associated with gentrification (e.g., poverty policy changes, housing price spillover) (Hwang and Sampson, 2014; Owens, 2012; Waldorf, 1991). Nonetheless, these data are conveniently available to the public and allow researchers to look at the same geographic space over time across many neighborhoods and/or cities. By relying on a single city in this study, we are also able to draw upon local knowledge and resources to validate our measures. See the Appendix for comparisons of our measures with alternative indicators.

We construct measures of gentrification using decennial U.S. Census data from 1980, 1990, and 2000 and American Community Survey (ACS) five-year estimates for 2009–2013 for Philadelphia census tracts. These data are harmonized to 2000 census tract boundaries using methods employed by Brown University’s Longitudinal Tract Data Base, which uses a combination of population and areal weighting. The data exclude 16 census tracts, which have fewer than 50 residents or have zero housing units during the entire period of analysis, resulting in a sample of 365 census tracts. Given that our study is focused on the changing affordability of the neighborhood and residential mobility outcomes, we measured gentrification by specifically concentrating on neighborhood housing prices and shifts in the socioeconomic status of residents.

Following most existing approaches, we use a threshold strategy in which neighborhoods are identified as being eligible to gentrify at the beginning of a time period and then we assess and compare changes among these eligible neighborhoods over a given time period. By definition, in order for tracts to gentrify, they have to have been lower-income at the beginning of the period. Thus, we consider tracts to be *gentrifiable* if they had a median household income below the

citywide median at the beginning of the period of analysis.⁴ We consider a tract to be *gentrifying* over a time period if it was gentrifiable at the beginning of the time period and experienced both an above citywide median percentage increase in either its median gross rent or median home value *and* an above citywide median increase in its share of college-educated residents. We rely on housing values and rents because they reflect the quality of various amenities, as well as investment, in the neighborhood. We include changes in *either* rents or home values because these changes do not necessarily occur in step with each other but nonetheless indicate changing affordability in a previously low-income neighborhood. Additionally, we include criteria for both demographic and price changes to deal with issues with past strategies of misidentifying gentrification in neighborhoods experiencing housing price spillovers without demographic changes. We rely on increases in the share of college-educated residents rather than incomes to capture young professionals who may have relatively lower incomes and to better distinguish an influx of new residents from incumbent upgrading (Freeman, 2005; Clay, 1979).⁵

Because the CCP data used in this study track individuals from 2002 to 2014, we consider tracts to be gentrifiable if their median household income from the census data was below the citywide median household income in the year 2000, and we consider tracts to be gentrifying if they met the criteria listed previously based on changes between 2000 Census estimates and ACS five-year estimates from 2009 to 2013. We considered a neighborhood to be *nongentrifying* if it was gentrifiable and did not meet the criteria listed previously. Nearly all studies of gentrification use distinct strategies to operationalize it, each with their own advantages and disadvantages. The Appendix contains comparisons between our measures and others. Figure 1 provides a map based on our measure. Of Philadelphia's 365 tracts with substantial population sizes, we categorized 56 of its 184 gentrifiable tracts as gentrifying from 2000 to 2013.

Gentrification is a dynamic process and can occur at varying paces, and some scholars argue that displacement may be more likely in the early stages of gentrification rather than later (Freeman, et al., 2015). Therefore, we also constructed more refined categories of gentrification to assess if mobility patterns matter at varying stages of gentrification. We constructed a separate category for census tracts that experienced gentrification prior to 2000 either over the 1990–2000 decade or over the 1980–2000 20-year period. We include this 20-year period because earlier gentrification tended to occur more slowly (Hackworth and Smith, 2001). We denote tracts that were not gentrifiable in 2000, having median household incomes above the citywide median income, as *old gentrification*. Among these tracts that were gentrifiable in 2000, we categorize those that were gentrifying from 2000 to 2013 as *continued gentrification*, and we categorize those that were nongentrifying from 2000 to 2013 as *stalled gentrification*. Tracts that have continued to gentrify are generally in the more advanced stages of gentrification. For tracts that were gentrifying from 2000 to 2013 but were not gentrifying before 2000, we classified them into three categories (*weak gentrification*, *moderate gentrification*, and *intense gentrification*) to indicate the pace of gentrification in these areas based on their quartiles of median rent prices or

⁴ We also constructed measures using the metropolitan area median income as the threshold for gentrifiable tracts, but, in Philadelphia, where the metropolitan area median household income far exceeds that of the incomes within Philadelphia, at least 80% of the tracts in any given decade are considered to be gentrifiable using this threshold. Thus, we present results using the citywide median as the threshold.

⁵ Including above citywide median percent increases in median incomes in addition to the share of college-educated residents only added one additional census tract to the pool of gentrifying neighborhoods.

home values according to the 2009–2013 five-year estimates. Figure 2 presents a map of the Philadelphia census tracts and their various gentrification categories, and Table 1 provides a detailed description of these categories.

Data: CCP

This study primarily relies on the CCP data, which consist of an anonymized 5% random sample of variables contained in the credit bureau records of U.S. consumers. The sample is constructed by selecting consumers with at least one public record or one credit account currently reported and with one of five numbers in the last two digits of their Social Security numbers (SSNs)⁶ (see details in Lee and van der Klaauw, 2010). The CCP data report the credit characteristics for sample members quarterly beginning in 1999. Because the CCP data have been rarely used in residential mobility studies (except Molloy and Shan, 2013; and Wardrip and Hunt, 2014), we carefully evaluated the representativeness of the CCP data and compared the mobility rates derived from the CCP data with that from the ACS data.

We find that the CCP data have many advantages in studying residential mobility for the whole nation and individual cities as well. First, because the CCP data include the census geography identifiers (block, tract, county, and state) associated with each consumer’s credit file, we are able to identify whether an individual has moved across neighborhoods and to track the origin and destination neighborhood of a mover. A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago in this study. Second, the age distribution and population estimates of the CCP sample are quite similar to those based on the ACS sample in Philadelphia, especially for individuals 25 years of age or older. Furthermore, the CCP data provide extensive information on consumer credit use and credit performance. We can observe how their financial status changes in relation to the characteristics of the neighborhood, including gentrification, and track what happened to preexisting residents who moved out of gentrifying neighborhoods. One widely used credit score, the Equifax risk score, reported in the CCP data has been used to stratify individuals and as a measure of an individual’s financial health in this study. The risk score, ranging from 280 to 850, which is indicative of the probability that an individual will repay his or her debts without defaulting, provides a summary measure of a person’s creditworthiness.⁷

Of course, a few caveats of the CCP data need to be discussed when using the data for residential mobility studies. First, the CCP data set only samples individuals with a credit history and a SSN, so individuals who have never applied for or qualified for a loan are not included.⁸ Thus,

⁶ The CCP data do not include actual SSNs. Equifax uses SSNs to assemble the data set, but the actual SSNs are not shared with researchers. In addition, the data set does not include any names, actual addresses, demographics (other than age), or other codes that could identify specific consumers or creditors.

⁷ A higher risk score represents a lower level of estimated credit risk of a consumer. A low risk score indicates the likelihood of the individual defaulting on any of his or her debt is higher, while no score suggests a thin file (too little information for a score to be estimated).

⁸ According to a report by the Consumer Financial Protection Bureau (CFPB), 26 million Americans (one in 10 adults) do not have any credit history with a nationwide consumer reporting agency as of 2015 (CFPB, 2015). However, the CCP data do include individuals with so-called thin files (containing only one or two trades or

the results on residential mobility may not represent the behavior of the individuals without credit records or SSNs, such as those who do not use credit at all or young people who have no credit history.⁹ Second, the mobility rates derived from CCP are slightly lower than those derived from the ACS data for at least two possible reasons: 1) People who moved within a census tract are not considered as movers based on our definition, and 2) young adults, like college students, may use their parents' home addresses, thus, relying on their credit reports will inevitably underestimate their actual mobility rates. However, the interneighborhood mobility rates, especially the interstate mobility rates, are quite similar to those reported in the ACS, which gives us more confidence in our methodology to identify interneighborhood moves. Finally, the sample design of the CCP data prevents us from tracking mobility for a very small share of newly added/dropped consumers to the panel. The CCP data try to constitute a nationally representative random sample of individual consumers in any given quarter by using a sampling approach that generates the same entry and exit behavior as present in the population. This is done by adding new individuals who develop a credit history or immigrate to the U.S. over time and by dropping consumers when they die, emigrate, or "age off," following a prolonged period of inactivity and no new items of public record.¹⁰

Keeping these caveats in mind, our evaluation suggests that the CCP data provide a unique sample at the individual level in identifying interneighborhood movers for the more financially independent individuals during the study period, which has been largely unexplored before. We made the following decisions to construct the study sample for our empirical analysis based on our evaluation of the data:

- Our study period begins in June 2002 and ends in June 2014. As the geographic information in the data prior to 2002 was reported to be less precise (Wardrip and Hunt, 2014), we decide to focus on cohorts after 2002.
- We excluded the 2005 cohort from the analysis because the mobility rate in 2005 was abnormally high likely due to the change in the geocoding system in that year.¹¹
- We dropped individuals who were recorded as "deceased" in the study sample.
- We dropped the observations with observation periods less than 12 months (last observation period–first observation period <12 mons), which were described as "fragments" in Wardrip and Hunt (2014).¹²

accounts), as well as individuals whose credit file only consists of a collection or public record item (such as bankruptcy) or only contains authorized user accounts or closed accounts.

⁹ The CCP data set has a significantly lower proportion of individuals 18–24 years old and a slightly higher proportion of older individuals (65+) because younger adults are less likely to have a credit history than older individuals. Although the younger population (18–24 years old) is slightly underrepresented in the CCP data, we still want to keep them in the analysis since the millennials are believed to be an important component in the gentrification process. We have, however, conducted additional analyses by excluding those young adults to check the robustness of the results.

¹⁰ We estimate that 1% to 3% of consumers in the origin sample were dropped, while a similar share of consumers was added to the panel each year.

¹¹ The mobility rate for the 2005 cohort (from 2004Q2 to 2005Q2) was abnormally high, likely because of the change in the vendor's geocoding system in 2004 based on the 2000 census data, instead of radical changes in residents' behavior.

- We dropped a few very young individuals (17 years old or younger) and very old individuals (84+ years) from the study sample.
- Finally, we used annual mobility rate with a focus on a shorter interval as the main outcome to mitigate the potential bias introduced by the attribution and adjustment of the study sample over time.

The 2002–2014 sample years are included in the analysis, and each sample member has been matched with the census geographies and data for the corresponding years. Tracts defined in the 2000 Census, which are available in the data, have been used for the whole study period. We are confident that CCP is a reliable data source for our study of residential mobility, especially for the 25- to 84-year-old population. We also, however, conducted a series of robustness checks by excluding the young age groups in some analyses.

Data: Neighborhood Quality Indicators

To assess changes in neighborhood characteristics associated with moves, each census tract was assigned an indicator value for each study year, enabling a comparison between movers’ origin and destination neighborhoods. The neighborhood indicators we examined include both standard census variables and original measures constructed for this research. Neighborhood socioeconomic characteristics are readily available at the tract level from the U.S. Census Bureau’s long-form questionnaire and the ACS. We harmonized these data to 2000 census tract boundaries and linearly interpolated these variables for each study year. The neighborhood economic indicators included in the analysis provide a profile of residents’ income and employment characteristics and the strength of the neighborhood housing market.

In addition to census variables, two original measures were developed to reflect other components of neighborhood quality of life, including violent crime rate and public school quality. The rate of violent crime¹³ per 1,000 residents was assigned at the tract level for all tracts within the Philadelphia-Camden-Wilmington metropolitan statistical area (MSA). Within the city of Philadelphia, the rate per 1,000 residents was calculated at the tract level using geocoded crime data from the Philadelphia Police Department and tract populations from the 2000 and 2009–2013 ACS (interpolated for the relevant years using the same method described previously). For the rest of the MSA, the violent crime rate was calculated at the municipality level for municipalities with populations over 25,500 in 2011 using data from the Federal Bureau of Investigation (FBI) Uniform Crime Reporting (UCR) Program. The remaining tracts were assigned the balance of the county violent crime rate (less any cities over the population threshold), also using data from the FBI UCR Program.

¹² Fragments usually occur when new records are created and subsequently merged with an existing record when the two records are found to correspond to the same individual. Some portion of fragments may also represent fictitious identities that were created to obtain credit fraudulently.

¹³ Our definition of violent crime includes non-negligent homicide, aggravated assault, and rape.

The indicator for public school quality is the sum of the percent of fourth grade students scoring proficient or above¹⁴ according to state-determined proficiency standards in 2011, as reported by each state for No Child Left Behind accountability purposes.¹⁵ Within Philadelphia, the indicator was assigned based on the performance of fourth graders in each catchment-based elementary school, as reported by the Pennsylvania Department of Education. In the remainder of the MSA, the indicator was based on the aggregate performance of fourth graders in each school district, as compiled by the Federal Education Budget project of the New America Foundation.¹⁶ These indicators were assigned at the census block level based on catchment and district boundaries. Analyses of movers' changes in public school quality are restricted to movers within the Philadelphia MSA.

Methodology: Gentrification and Residential Mobility

A first step toward understanding how gentrification might affect households is to observe whether gentrification is correlated with elevated residential mobility rates. We compare the behavior of residents in gentrifying neighborhoods with that of those in nongentrifying neighborhoods, excluding nongentrifiable neighborhoods from the analysis. We need to acknowledge that characteristics associated with residents' choices to live in gentrifying neighborhoods might also affect how they respond to gentrification. Although we control for other factors that are likely to be associated with the outcomes in the mobility analysis, we are limited in our ability to draw conclusions on the causal relationship between gentrification and displacement.

In our first set of analyses, residential mobility is the dependent variable of interest, which we measure by an interneighborhood move (*MOVE*) between time (year) $t-1$ and time (year) t . Given our interest in displacement, which implies an involuntary move, we examine the mobility pattern for various subpopulations in our analysis that may be more vulnerable to involuntary moves, which we describe in more detail later. We also consider whether residents move to neighborhoods that are economically worse off than the gentrifying neighborhoods in which they previously resided. Thus, we distinguish a move to a neighborhood with a lower median income than the origin neighborhood (*MOVE_DOWNWARD*) from other moves (moving up or moving to similar income neighborhoods).¹⁷

¹⁴ The sum of the percent of fourth grade students scoring proficient or above such that the ideal value would be close to 200, indicating that 100% of students scored proficient or above in both subjects.

¹⁵ The focus on the performance of fourth grade students was intentional; in the Philadelphia School District, students are able to start applying to special admission public middle schools at the end of fourth grade. Not only are these special admission schools typically higher performing, but they may be seen as better preparing students for applying for special admission public high schools later on, making the quality of catchment-based elementary schools important for a students' overall educational trajectory.

¹⁶ Standardized test data were not available for certain school districts.

¹⁷ Neighborhood household income quintiles, instead of the absolute values of neighborhood income, are used to compare the relative income level of different neighborhoods. The income quintiles are determined by the median incomes of all gentrifiable neighborhoods (interpolated based on the 2000 census and 2009–2013 ACS values for the years between 2000 and 2009).

The key independent variable of interest is our gentrification measure. We use binary and categorical versions of our measure in separate analyses. The literature has suggested a long list of factors that could influence residential mobility decisions, such as age, marital status, family status, tenure status, housing conditions, the length of time a household head has been residing in a current unit, employment opportunity, income and household size, race/ethnicity, and so on (e.g., Freeman, 2005; McKinnish et al., 2010; Ellen and O’Regan, 2011). While the CCP data have limited information on consumer demographics, we construct the following control variables, as provided in the CCP data: an individual’s initial risk score (at year $t-1$), an individual’s initial age (categorical), the number of householders with credit reports and SSNs (categorical),¹⁸ the number of years an individual has resided in the tract (categorical),¹⁹ whether the individual (or any householder) has at least one mortgage,²⁰ and whether the individual (or any householder) has at least one seriously delinquent (90+ days) account. To mitigate the differences in neighborhood conditions between gentrifying and nongentrifying neighborhoods, we further control for tract-level median household income, poverty rates, homeownership rates, and the share of non-Hispanic blacks, based on interpolated measures using 2000 Census data and 2009–2013 ACS five-year estimates, as well as distance measures (distance to City Hall and to two major universities, University of Pennsylvania and Temple University). Table 2 illustrates the means of the variables used in the analysis.

We use the following multivariate regression model to estimate the effect of gentrification on the likelihood of moving:

$$Pr(MOVE_i) = \alpha + \beta * GENTRIFY_i + \gamma * X_i + \delta * DISTANCE_i + \varepsilon * NBHD_i + \gamma * YEAR_i,$$

where:

- $MOVE_i$: indicator variable = 1 if an individual lives in a census tract different from where he or she had lived one year ago. The dependent variable will be $MOVE_DOWNWARD$ when the same model was used to examine the neighborhood outcome among movers.
- $GENTRIFY_i$ is the gentrification measure (binary or categorical).
- X_i includes the set of individual/household characteristics described previously, such as risk score, individual age, household size, mortgage status, and length of residency (in certain regressions).
- $DISTANCE_i$ includes distance measures to the city center and major institutions.
- $NBHD_i$ includes a set of neighborhood indicators (tract poverty rate, homeownership rate, share of African Americans, and median income when the outcome is $MOVE_DOWNWARD$).
- $YEAR_i$ is the year dummy for a particular cohort.

¹⁸ The CCP data also sampled all other individuals living at the same address as the primary sample member, which allows us to estimate the household size (not including those without credit history).

¹⁹ Because the CCP started in 1999, the data for this variable are not available for cohorts before 2004. We only include this measure in the regressions examining the experience of long-term residents (*gentrification and length in residency* in Tables 7 and 10).

²⁰ The measure of whether any household member has at least one mortgage serves as a proxy for homeowners, though it likely underestimates the number of homeowners because homeowners who did not use mortgages to purchase their homes or those who paid off their mortgages are not included.

We use linear probability regressions, rather than logistic regression models, which are more appropriate for binary variables, for ease of interpretation of the coefficients for interaction terms of different independent variables.²¹ We conduct separate analyses for pooled data and by cohort but report results from models using pooled data only for the sake of brevity. We focus on annual mobility rates, instead of tracking the whole panel over a longer period, to mitigate possible censoring issues induced by the dynamic nature of the panel.²² The unit of analysis is individuals who are in the original 5% CCP sample. We limit the sample to the original random sample to preclude counting moves by members of the same household more than once. The number of observations is about 50,000 per year, with a total of more than 550,000 person-years for the entire study period (Table 2).

In addition, certain households may be more susceptible to mobility than others in gentrifying neighborhoods. For example, individuals with low risk scores often have either little or poor credit history and were generally hit harder by the Great Recession; thus, they may be more vulnerable to financial challenges and displacement. Likewise, renters, or long-term residents, who either have much less control over their residential units or are more likely to be older and have reduced incomes, may be more susceptible to displacement. Therefore, we examine whether gentrification is associated with elevated mobility rates for residents with low risk scores, long-term residents (five years or more),²³ or residents with no mortgages. We include interaction terms for individuals' risk scores, length of time living in the neighborhood, and mortgage status with their neighborhood's gentrification status to test whether these groups are more likely to move or more likely to move to lower-income neighborhoods. A positive and statistically significant interaction term in the regression models would indicate that residents in a particular group and in a gentrifying neighborhood have a greater probability of the outcome variable relative to similar residents in a nongentrifying neighborhood and relative to other residents in a gentrifying neighborhood.

Methodology: Who Is Moving into Gentrifying Neighborhoods?

As several studies have pointed out, neighborhoods are dynamic entities, and who moves in can be just as important as who moves out in determining neighborhood change (Ellen, 2000; Galster, 1998; Freeman, 2005). For example, disadvantaged households may not necessarily have higher exit rates from gentrifying neighborhoods and aggregate-level socioeconomic shifts may be a result of in-movers' socioeconomic status. We compare the average age and risk scores for in-movers and out-movers from gentrifying and nongentrifying neighborhoods in Philadelphia. And using a multinomial regression model for all those who moved to Philadelphia during 2003–2014, we further assess what types of residents are more likely to move to different types of neighborhoods: gentrifying, nongentrifying, or nongentrifiable. Nongentrifying neighborhoods are the reference group. We present relative risk ratios, which compare the likelihood of moving into a gentrifying or a nongentrifiable neighborhood as opposed to a nongentrifying

²¹ The results from logistic regressions are very similar and are available upon request.

²² As mentioned early, a small share of old panel members are continuously lost, while new individuals who develop a credit history or immigrate to the U.S. are added to replenish the panel.

²³ The term *long-term residents* used in this paper represents those who have been living in the same neighborhood for five years or more.

neighborhood for movers with certain characteristics. A relative risk ratio greater than one generally means that a mover with that particular characteristic is more likely to move into a gentrifying (or nongentrifiable) neighborhood relative to a nongentrifying neighborhood, whereas a ratio of less than one means that someone is less likely to move into a gentrifying (or nongentrifiable) neighborhood relative to a nongentrifying neighborhood. Control variables include individual risk score, origin neighborhood type (gentrifying, nongentrifiable, nongentrifying, or from areas outside of Philadelphia), household size, age, mortgage status, and delinquency status.

Methodology: Gentrification and Residents' Financial Health

In addition to mobility rates, gentrification may affect other aspects of the well-being of residents. We further track the changes in the risk scores for stayers and movers in the gentrifying neighborhoods. An individual's risk score produced by Equifax is a measure of a person's financial health and creditworthiness, and it predicts the likelihood that a consumer will default on his or her debt within a certain period (usually within 18–24 months). Many credit characteristics have been used to compute borrowers' scores, but the precise models for computing are not disclosed to the public (Federal Reserve, 2007). Though the Federal Reserve (2007) study suggests none of the credit characteristics included in a credit scoring model serves as a proxy for race, ethnicity, gender, or income,²⁴ Bostic, Calem, and Wachter (2005) find that low-score individuals are disproportionately more likely to be low-income and minority by imputing credit scores for households in the Survey of Consumer Finance. Given that the Great Recession occurred during our study period and gentrification intensified in many neighborhoods in Philadelphia, we expect to see divergent credit score outcomes for different subpopulations and for residents in different neighborhoods.

We first identify all individuals living in the city of Philadelphia in a certain year and then compare their risk scores three years from their initial scores. Residents who had moved after the first observation year were dropped from the final sample, thereby excluding frequent movers, which helps reduce selection issues with assessing a neighborhood's effect on individual risk scores. We focus on the 2002–2011 cohorts, for whom we have their risk scores three years later in the data set. By only examining risk score changes between two time points, the model assumes that we have fully adjusted for baseline differences in the levels and trajectories of risk scores across individuals and therefore limits our ability to make causal inferences.

We use a linear regression model similar to the one used in the mobility analysis to examine the relationship between gentrification and changes in risk scores. The outcome variable is the risk score change, while control variables include the individual's initial risk score, individual/household characteristics, and distance measures, in addition to the gentrification measure, for which we use the binary and categorical measures in separate analyses. Similar to the mobility analysis, we include interaction terms for individuals' risk scores, length of time living in the neighborhood, and mortgage status with their neighborhood's gentrification status to test whether these groups experience the same level of improvement as other subpopulations.

²⁴ Credit scoring models do not use very fine geographic information as well.

In sum, our analytic strategy is to compare the mobility rates and the risk score changes between residents in gentrifying and nongentrifying neighborhoods. Furthermore, for all the empirical analyses, we examine if the experiences of disadvantaged residents are systematically different from the remaining population. Given that gentrification is an evolving and temporally uneven process, and our measure captures changes from 2000 to 2013, we are limited in our ability to assess whether residential mobility patterns or changes in individuals' financial health are a result of gentrification or whether individuals who move, move to lower-income neighborhoods, or experience changes in financial health select into particular types of neighborhoods in the first place. Nonetheless, our analysis allows us to shed light on the mobility and financial health patterns of individuals as their neighborhoods gentrify or remain relatively low income.

4. Empirical Results

Characteristics of Gentrifying Neighborhoods

First, we consider the characteristics of the neighborhoods that we identified as gentrifying. Table 3 shows how gentrifying, nongentrifying, and nongentrifiable neighborhoods in Philadelphia changed between 2000 and 2013,²⁵ though our discussion focuses on the comparison between gentrifying and nongentrifying neighborhoods. Home values and rents clearly increased more steeply in gentrifying neighborhoods. Likewise, levels of educational attainment grew more sharply in those gentrifying neighborhoods. This is not surprising, given that these three dimensions were used to define gentrifying neighborhoods. In addition, gentrifying and nongentrifying neighborhoods experienced different economic fates: The average increase in median household income was 41.9% from 2000 to 2013 in gentrifying neighborhoods, compared with a decrease of 18.2% in nongentrifying neighborhoods. There was also a significant decline of 4.3 percentage points in the poverty rate in neighborhoods classified as gentrifying, while there was an increase of 4.8 percentage points in nongentrifying neighborhoods, consistent with what might be expected in neighborhoods on the upswing.

Gentrifying neighborhoods recorded an increase of 2.3% in total population and an increase by 23% in the number of non-Hispanic white residents from 2000 to 2013. In contrast, lower-income neighborhoods that did not gentrify experienced a population loss (-1.9%) and a significant loss of non-Hispanic whites (-31.7%) during the same period. At the same time, the median age of residents in gentrifying neighborhoods declined by 0.7 years, while the median age of those in nongentrifying neighborhoods increased by 0.4 years. This pattern is consistent with what might be expected in gentrifying neighborhoods. Overall, from 2000 to 2013, gentrifying neighborhoods experienced a larger increase in total population, total non-Hispanic white population, home value, rent, educational attainment, and household income, and a greater decline in poverty rate than low-income, nongentrifying neighborhoods on average.

Do Residents in Gentrifying Neighborhoods Have a Higher Risk of Moving?

A comparison of the annual mobility rates suggests that residents in gentrifying neighborhoods had *higher* mobility rates compared with those in nongentrifying and nongentrifiable neighborhoods (Figure 3): Each year, about 10–15% of residents between 18–84 years old in

²⁵ We use 2013 for simplification; data for most indicators are actually based on the 2009–2013 ACS data.

gentrifying neighborhoods moved to different neighborhoods, almost 2–3 percentage points higher than those in nongentrifying tracts. The gap between gentrifying neighborhoods and nongentrifying neighborhoods did not change much during and after the housing crisis. As Figure 4 shows, individuals with low risk scores residing in gentrifying neighborhoods had slightly higher mobility rates (0.7 percentage points higher on average) during the study period (except one year) than those in nongentrifying tracts.

Multivariate regression results predicting the probability of moving and controlling for individual- and neighborhood-level characteristics confirm that residents in gentrifying neighborhoods have a slightly higher probability of moving. The coefficients of the *gentrify* variable reported in Table 4 and those summarized in Table 5 represent the change in the probability of moving if residing in a gentrifying neighborhood, relative to residing in a nongentrifying neighborhood. Residents living in nongentrifiable tracts are excluded from the analysis. Each column in Table 5 represents results from distinct models predicting different outcomes and among different subsamples, as indicated in the table. The remaining rows represent results for different outcomes and among different subsamples for models using the categorical gentrification measure. The coefficients in these columns represent the change in the probability of moving if residing in a neighborhood in that category of gentrification, relative to residing in a nongentrifying neighborhood.

For all residents, gentrification is associated with a slightly higher probability of moving (0.4 percentage points higher, significant at the 0.05 level), which is shown in the first row of the first column in Table 4 and in the summary table (Table 5).²⁶ As the annual mobility rate of residents in Philadelphia has been about 10%, the magnitude of the gentrification effect is not very big. However, when we examine various types of gentrification, the probability of moving is much higher in neighborhoods that gentrified more rapidly (*intense-gentrification*, 3.6 percentage points higher) or neighborhoods that had been gentrifying since before 2000 (*continued-gentrification*, about 1.7 percentage points higher). In contrast, the coefficients are generally insignificant for neighborhoods with weak gentrification, suggesting that residents in these neighborhoods do not have a significantly higher risk of moving than similar individuals in nongentrifying neighborhoods. Overall, the results confirm that residents in gentrifying neighborhoods have a slightly higher probability of moving compared with residents in nongentrifying neighborhoods, and these rates are largely driven by neighborhoods experiencing more intense levels of gentrification.²⁷

When we examine the mobility to lower-income neighborhoods among movers, rather than mobility rates in general, the results, which are displayed in the last two columns of Table 4 and the last five columns of Table 5, do not provide significant and consistent evidence of neighborhood downward mobility for residents moving from gentrifying neighborhoods. The coefficient for the *gentrify* variable is insignificant, and the coefficients for different types of gentrification are generally insignificant as well, with the exception of a slightly higher

²⁶ The coefficient becomes insignificant in one robustness check when only residents in nongentrifying tracts within a half mile were used as the comparison group, but the sign of the coefficient remains positive.

²⁷ Other control variables in the models of residential mobility perform as expected for the most part. Age, family size, years living in the neighborhood, having a mortgage, year dummy, and being delinquent on at least one account are important predictors of whether someone moves.

probability for movers from neighborhoods with a moderate level of gentrification and a lower probability for movers in neighborhoods experiencing *continued gentrification*.

While the results may seem counterintuitive, as we will show, movers from gentrifying neighborhoods are quite heterogeneous, consisting of many lower-income residents, as well as younger and high-score residents moving to more expensive neighborhoods, relative to movers from nongentrifying neighborhoods. Thus, it is not surprising that movers out of gentrifying neighborhoods are generally no more likely to move downward than those in nongentrifying neighborhoods.

What Are the Mobility Patterns for More Vulnerable Residents in Gentrifying Neighborhoods?

In the context of gentrification, we are particularly concerned with the experiences of more vulnerable residents (low-score, renting, and long-term residents). Table 6 displays the results from multivariate regression models that include interaction terms between the gentrification status of a neighborhood and individual-level indicators of vulnerability. We examine interactions in separate models for each type of indicator (risk score, mortgage status, and length of residency).

The results suggest that these less advantaged populations in gentrifying neighborhoods are generally no more likely to move than similar residents in nongentrifying neighborhoods, with the exception of the likely renters. Low-score residents (below 580) and long-term residents do not have an elevated rate of mobility that is expected, compared with similar residents residing in nongentrifying neighborhoods. Residents without mortgages (likely renters) in gentrifying neighborhoods have a probability of moving that is 1.6 percentage points higher than those in nongentrifying neighborhoods, but, among residents without mortgages, low-score residents in gentrifying neighborhoods are less likely to move.

When we examine the probability of moving to a lower-income neighborhood among movers, we find that vulnerable residents are more likely to move to lower-income neighborhoods. As Table 2 shows, on average, about 21% of all movers moved to neighborhoods with a median income lower than that of their origin neighborhoods. This percentage was higher in nongentrifiable neighborhoods and lower in low-income gentrifying and nongentrifying neighborhoods. However, regression results suggest that the probability of moving to lower-income neighborhoods is significantly higher (about 7.4 percentage points higher, Table 6) for the low-score outmovers from gentrifying neighborhoods. Gentrification is also associated with a higher probability of moving to a lower-income neighborhood for residents without mortgages in general, for low-score residents without mortgages, and for longer-term residents compared with similar residents in nongentrifying neighborhoods (Table 6).

When we consider the interaction terms between low-score status and types of gentrification in the mobility analysis, the finding in Table 7 confirms that low-score residents are significantly less likely to move out of neighborhoods with more intense levels of gentrification (3.2 percentage points less likely in neighborhoods with *intense gentrification* and 1.2 percentage points less likely in those with *continued gentrification*). But once they move, low-score movers from neighborhoods with more intense levels of gentrification are more likely to move into

lower-income neighborhoods (9.1 percentage points higher in neighborhoods with *intense gentrification* and 9.7 percentage points higher in those with *continued gentrification*). This result suggests a positive association between the intensity of gentrification and the risk of downward mobility among movers.

Overall, the results suggest that more vulnerable individuals (low-score individuals, low-score individuals without mortgages, or long-term residents) are not necessarily more likely to move, which is consistent with other recent findings (Freeman, 2005; McKinnish et al., 2010; Ellen and O'Regan, 2011). Results also suggest less advantaged movers from gentrifying neighborhoods do have a higher risk of downward mobility, and this result is consistent with the contention that the lack of affordable housing in gentrifying neighborhoods can force some lower-income residents to search for housing in more disadvantaged neighborhoods (Newman and Wyly, 2006). We suspect that there are likely two competing forces for disadvantaged residents in gentrifying neighborhoods: Gentrification may be increasing interneighborhood mobility as a result of rising rents and other costs, such as property taxes, and it may also be decreasing mobility because of increased residential satisfaction with increased amenities and rising home values that come with gentrification. As a result, more vulnerable residents are no more likely to move than others in general, but, if they are not able to remain in the neighborhood, they face a higher risk of moving to an economically worse-off neighborhood. Section 5 provides a more detailed discussion of other neighborhood outcomes for low-score movers.

Who Is Moving into Gentrifying Neighborhoods?

The previous discussion on neighborhood change focused on individuals moving out of gentrifying neighborhoods. Here we examine the characteristics of in-movers to, as well as out-movers from, gentrifying neighborhoods to further understand the sources of the neighborhood-level demographic shifts. Results suggest in-movers are more likely to be younger and have higher risk scores than out-movers in gentrifying neighborhoods, and they are more likely to have moved from higher value neighborhoods within or outside of Philadelphia. In-movers to gentrifying neighborhoods are generally younger than out-movers in gentrifying neighborhoods (about 1.3 years younger), while in-movers tend to have similar ages compared with out-movers in nongentrifying neighborhoods (slightly younger during the 2004–2008 period) (Figure 5). The average risk score of in-movers to the gentrifying neighborhoods is also slightly higher than that of out-movers (about 5 points higher on average) (Figure 6). In contrast, the average risk score of movers in the nongentrifying neighborhoods is quite stable, with the average score of out-movers being consistently higher than that of in-movers (about 8 points higher).

Figure 7 further shows that more low-score residents moved out of gentrifying neighborhoods each year than those who moved into these neighborhoods: The share of low-score out-movers is higher than that of in-movers in gentrifying neighborhoods across all cohorts, except the 2009 cohort. This pattern is stronger for movers without mortgages, where the share of low-score out-movers is consistently higher than that of in-movers and the magnitude of the difference is even larger (Figure 8). This helps explain the seemingly contradictory findings indicating a sharper decline in the share of low-score residents in gentrifying neighborhoods (Figure 9) but no elevated mobility rates among low-score residents in these neighborhoods. Thus, “indirect

displacement,” such that low-score residents face increasingly limited housing options in gentrifying neighborhoods, likely plays a more significant role in explaining the neighborhood-level upgrading in residents’ overall credit ratings in gentrifying neighborhoods. In short, outmovers from gentrifying neighborhoods are more likely to be replaced by in-movers who are younger and have higher credit ratings; this pattern, instead of higher rates of out-mobility by more vulnerable existing residents, helps explain the demographic changes occurring in gentrifying neighborhoods.

The results from the multinomial regression confirm that an individual’s age and risk score are associated with the probability of moving into a gentrifying neighborhood: Risk scores are positively associated with the likelihood of moving into such a neighborhood, whereas age is negatively associated with the likelihood of moving to a gentrifying neighborhood instead of a nongentrifying one (Table 8).²⁸ The types of origin neighborhoods of in-movers also matter. In-movers from economically better-off neighborhoods in Philadelphia (nongentrifiable neighborhoods or gentrifying), and those from areas outside of the city of Philadelphia are more likely to move into gentrifying neighborhoods. Therefore, the socioeconomic upgrading of the gentrifying neighborhoods seems to be at least partly driven by an influx of newcomers who are younger and financially better-off than residents who are leaving these neighborhoods or who are from neighborhoods better than or similar to the gentrifying neighborhoods.

These results also echo those of recent studies (Freeman, 2005; Ellen and O’Regan, 2011; McKinnish et al., 2010), which find in-movers to gentrifying neighborhoods to be of higher socioeconomic status than current residents. Preexisting residents may not necessarily have to move out of gentrifying neighborhoods, especially in neighborhoods experiencing less intense rates of gentrification, given the increased residential satisfaction that gentrification may bring, the financial and social costs related to moving, and gentrification through infill development. However, in-movers with greater choices of which neighborhoods to move to may be more sensitive to the amenities and relative affordability of housing in gentrifying neighborhoods. Overall, the results are more consistent with the notion that changes in the characteristics of in-movers are a more important force in determining the demographic changes in gentrifying neighborhoods.

What Is the Relationship Between Gentrification and the Financial Health of Existing Residents?

We also examine another possible consequence of gentrification: changes in the financial health of residents, as represented by residents’ risk scores. We find that gentrification is positively associated with residents’ risk scores, though the benefits are not equally distributed. In separate analyses, we compared the changes in risk scores of individuals staying in gentrifying neighborhoods with those staying in nongentrifying neighborhoods, and we compared changes in risk scores of individuals who moved out of gentrifying neighborhoods with those who stayed in gentrifying neighborhoods. We present results from these analyses for both our binary gentrification measure and the gentrification categories in Table 9. The results show that staying in a gentrifying neighborhood is associated with an average increase of 11 points in risk scores over three years relative to staying in nongentrifying neighborhoods. This is consistent with

²⁸ Younger and high-score movers are more likely to move to nongentrifiable neighborhoods as well (relative to nongentrifying neighborhoods).

Hartley's (2013) findings, which show an increase of 8 points over the period of 2001–2007. With the inflow of investment and improved infrastructure, stayers in gentrifying neighborhoods may see improved access to credit and credit performance, though the unobserved characteristics of these individuals that allow them to stay may correlate to their financial health as well.

Nonetheless, there is significant heterogeneity in stayers' improvements in risk scores across different types of gentrification (Table 9). Stayers in neighborhoods in the more advanced stages of gentrification experienced greater improvement in their risk scores, with an improvement of 23 points in neighborhoods undergoing intense gentrification, roughly doubling the coefficient for all types of gentrification. The improvement for residents in neighborhoods experiencing moderate or continued gentrification is about 11–12 points, similar to the average increase for all gentrifying neighborhoods. The association of risk score changes for residents in neighborhoods experiencing weak gentrification is still significant, but the magnitude is much smaller (an improvement of 3.1 points in three years).

There is significant heterogeneity in the improvement of risk scores among stayers as well (Table 9). Low-score stayers see greater improvement in their risk scores in general. Because their risk scores have a lower starting point, it is relatively easier for their score to improve. But the improvement is relatively less for low-score residents, longer-term residents, and those without mortgages in gentrifying neighborhoods. For example, our results predict that a low-score stayer in a nongentrifying neighborhood will experience an improvement of 62.5 points in three years, but the improvement will be 5.7 points lower for a similar resident in a gentrifying neighborhood.²⁹

Moreover, the improvement in risk scores is uneven across movers. A move itself may be expensive and can incur various costs, which could damage an individual's financial situation and credit rating. Results show that movers' risk scores decline slightly after moving (2.5 points on average) (Table 10). In separate models that include stayers in gentrifying neighborhoods and movers from gentrifying neighborhoods who then stayed in the new destination neighborhoods, relative to stayers, the risk scores of movers who moved within the city from gentrifying neighborhoods declined by 8.9 points in risk scores, but movers to areas out of the city showed an improvement of 5.8 points, as the middle two sets of columns show in Table 10. We also observe a similar pattern for movers to neighborhoods with different income levels: Movers who moved to lower-income neighborhoods experienced a significant decline in risk scores (15.1 points in three years) than did those who stayed in gentrifying neighborhoods. This may reflect both the effect of gentrification on individuals' financial well-being and the unobserved financial challenges faced by individuals who had to move to lower-income neighborhoods.

Robustness Checks

As mentioned earlier, there are concerns on how to operationalize gentrification, the representativeness of the CCP data of certain subpopulations, as well as the use of the right counterfactual for gentrifying neighborhoods. We conducted additional analyses using different gentrification measures, different subsamples, or different control groups to discern how

²⁹ Of course, such a comparison needs to take into consideration the generally greater improvement for residents in gentrifying neighborhoods (about 8.7 points higher on average).

sensitive the results are to some of our analytical decisions. For the sake of brevity, only the general patterns are discussed here, and the full results that are not included here are available upon request. When we use alternative gentrification measures, such as the measure considering home values and rents only or the measure further considering household income, the results are generally consistent. When the younger population — those 24 years old or younger who are less represented in the CCP data — is dropped from the sample, the results are quite consistent as well.

We also ran the mobility model and the risk score change model by cohort, instead of using the pooled data. The results from the risk score change model by cohort are quite consistent with those using the pooled data. The results are highly significant for all cohorts, with slight variation in the magnitude of the coefficients across cohorts. For the mobility analysis, the results vary considerably over time: The coefficients of the gentrification variable are positive and significant for three out of the nine cohorts after 2006 but are negative for the 2004 cohort and are insignificant for other cohorts. Moreover, the magnitudes of the coefficients vary across cohorts. Therefore, the finding that residents in gentrifying neighborhoods have slightly higher mobility rates than those in nongentrifying neighborhoods may not apply to certain cohorts.

Using all nongentrifying neighborhoods as the control group also may raise concerns with the selection issues. For example, nongentrifying neighborhoods may be farther from other amenities and have unobserved characteristics that make them less comparable with gentrifying neighborhoods. When restricting the analysis to residents in nongentrifying neighborhoods within a half-mile from the nearest gentrifying neighborhoods, which should be more comparable to gentrifying neighborhoods, as the control group, the results for mobility rates are less likely to be significant because of the reduced sample size, but the sign of the coefficients remains the same (see Table 5). But when the categorical variable (gentrification types) is used, the results of the mobility analysis are quite consistent in terms of the significance and magnitude of the coefficients.

Finally, it is possible that both the independent variable of low-score residents and the outcome variables are correlated with a third factor: The probability of updating an individual's address in a timely manner could be correlated to both his or her credit score and the mobility rate. No-score or low-score individuals may have fewer or no credit accounts, so the chance of having their addresses updated (and then being reported to the credit bureau) is likely to be lower. While we focus on similar individuals in gentrifying and nongentrifying neighborhoods, the possible correlation between the probability of having their addresses in the credit reports updated and individuals' risk scores could bias the estimates in the mobility analysis. As a robustness check, we replicated the mobility analysis using a sample of individuals whose addresses are more likely to be updated timely (those with at least two credit accounts) to mitigate the possible bias mentioned here. The results are quite consistent (see Table 5), except one coefficient of the categorical variable becomes insignificant and the magnitude of the coefficients of the dummy variable in the mobility analysis becomes slightly larger, which suggests that this concern at least does not bias our estimation upward.

5. Neighborhood Outcomes for Outmovers from Gentrifying Neighborhoods

To understand the experiences of outmovers from gentrifying neighborhoods, we examined how their destination neighborhoods compared with where they left on a set of economic, demographic, and quality-of-life indicators. Additionally, we looked at the distances of their moves. The findings presented are for movers aged 25–84 years old³⁰ from gentrifying neighborhoods, comparing their outcomes with those of movers from nongentrifying neighborhoods.

Neighborhood Economic Indicators

In the aggregate, both movers from gentrifying and nongentrifying neighborhoods saw significant (at the 0.05 level) improvements³¹ in each of the neighborhood economic indicators (Table 11), suggesting largely voluntary moves. Though direct comparison is limited, it is worth noting that the destinations of outmovers from gentrifying neighborhoods substantially outperform citywide indicators during this period.³² While movers from nongentrifying neighborhoods see a larger magnitude of improvement on most of the neighborhood economic indicators, their origin neighborhoods were significantly more distressed.

Two patterns become clear when we focus on the change in economic indicators for low-score movers. The first is that low-score movers are largely moving from neighborhoods with weaker economic indicators than middle- and high-score movers, reflecting a greater concentration of low-score movers in these areas. Second, on average, low-score movers from gentrifying neighborhoods tend to see little change in neighborhood economic indicators in their destination neighborhoods. Despite this, low-score movers did, on average, move to tracts with significantly higher median incomes, which may appear counterintuitive. However, the presence of students living in off-campus housing can skew income and poverty estimates produced by the Census Bureau and may be a confounding factor.³³ By contrast, low-score movers from nongentrifying neighborhoods, on average, saw significant improvement in neighborhood economic indicators, though, again, the baselines were substantially weaker.

While this analysis suggests that low-score movers, who are more likely than high-score movers to move within the city, had little to gain by moving from gentrifying neighborhoods, it is not

³⁰ We excluded 18- to 24-year-olds from this analysis for two major reasons. First, college students who move frequently may skew results, and while this was important to capture in the mobility analysis, it is likely to distract from the patterns this analysis is intended to examine. Second, certain indicators such as median home value and elementary school quality may be less relevant to this group and therefore not appropriate indicators of move quality.

³¹ The word *improvement* is used here to refer to the strength of the neighborhood housing market and employment characteristics, which may or may not translate to qualitative benefits for a given household.

³² From 2005 to 2012, the median household income ranged from \$36,259 to \$41,120 (compared with an average of \$58,351 in movers' destination tracts from 2003 to 2014), and median home value ranged from \$122,244 to \$166,500 (compared with an average of \$237,295).

³³ See U.S. Census Bureau, Alemayehu Bishaw. "Examining the Effect of Off-Campus College Students on Poverty Rates, SEHSD 2013-17." May 1, 2013, available at www.census.gov/hhes/www/poverty/publications/papers-bishaw.html.

immediately apparent that they are made worse off either. However, when the universe is restricted to those who move within Philadelphia (Table 12), it becomes clear that low-score intracity movers from gentrifying neighborhoods on average moved to tracts with significantly higher unemployment rates and lower home values (though these tracts were still largely higher income). This suggests that the quality of low-score intracity movers' moves was considerably worse than the aggregate suggests. Move quality was also significantly worse for low-score movers from intense and, to a lesser extent, continuing gentrification tracts compared with those moving from weak and moderate gentrification tracts (Table 13).

These results suggest that while most individuals moving out of gentrifying neighborhoods end up in neighborhoods with comparable or better economic conditions, low-score movers from gentrifying neighborhoods were the least likely to see improvements. Furthermore, within Philadelphia, many financially distressed movers moved to neighborhoods in which certain economic conditions were significantly worse.

Demographic Indicators

In addition to economic indicators, we included indicators for the share of residents identifying as non-Hispanic black and the share of adults³⁴ with a college degree to examine changes in demographic characteristics. In the aggregate, movers from gentrifying neighborhoods largely moved to tracts with similar shares of college-educated adults and somewhat lower shares of non-Hispanic black residents (see Table 11). However, low-score movers from gentrifying neighborhoods were more likely to move to tracts with a similar or, for intracity movers, higher concentration of non-Hispanic black residents and a substantially lower share of adults who have attained a college degree (see Table 12). This pattern reinforces existing demographic differences between low- and high-score movers' neighborhoods, suggesting that outmigration from gentrifying neighborhoods may have resulted in increased demographic sorting. Tracts undergoing intense gentrification were associated with the most disparate outcomes for high- and low-score movers, suggesting that the intensity of gentrification plays a significant role in the potential for demographic turnover.

Quality-of-Life Indicators

Our third set of indicators examines changes in neighborhood quality of life, as measured by the prevalence of violent crime and the performance of neighborhood public elementary schools. As a result of data constraints, this analysis focuses on movers who moved within the Philadelphia-Camden-Wilmington MSA.

In the aggregate, movers from gentrifying tracts moved to neighborhoods with lower rates of violent crime, though low-score movers started in neighborhoods with the highest rates and saw the least improvement (see Table 11). For low-score, intracity movers, the average rate of violent

³⁴ Adults aged 25 years or older³⁵ Gentrifying tracts were grouped into five neighborhoods clusters — Center City, West Philadelphia, Lower North, Riverwards, and South Philadelphia — based on geographic proximity and similarity in neighborhood characteristics. For more detailed information on these clusters, see companion publication titled *Gentrification and Residential Mobility in Philadelphia: A Practitioner's Summary* at www.philadelphiafed.org/community-development/publications/discussion-papers.

crime in their destination neighborhoods was virtually identical to that of their origin (see Table 12). Consumers in all score categories moving out of weak gentrification tracts saw significant declines in violent crime rates, including those who moved within Philadelphia. By contrast, low-score movers from intense gentrification tracts did not see a statistically significant change in violent crime rates in their destination neighborhoods and those moving within the city on average saw a significant increase (Table 13).

In terms of public school quality, movers' destination catchments generally had slightly better performing schools than their origin catchments (see Table 11). While low-score movers overall saw a modest improvement in public school performance, those moving within the city saw a modest decrease, though low-score movers' public school performance was generally weak in both origin and destination catchments (see Table 12). Again, outcomes were worst for intracity, low-score movers from intense gentrification tracts (Table 13).

These results suggest that changes in movers' neighborhood quality-of-life indicators reflect similar patterns as changes in neighborhood economic indicators. Again, low-score movers largely end up in neighborhoods that are similar to those that they left, or, if moving within the city, perform slightly worse on these indicators. By contrast, middle- and high-score movers are generally able to access neighborhoods with lower crime rates and higher-performing elementary schools.

Spatial Distribution of Movers from Gentrifying Neighborhoods

A majority (56.8%) of movers relocated within the city of Philadelphia and just over three-quarters moved within the Philadelphia-Camden-Wilmington MSA. However, most high-score movers left the city (Figure 10). While the proportion of those who stayed in or moved within a mile of their gentrifying neighborhood cluster³⁵ is comparable across all three risk score groups, the proportion who moved elsewhere within the city increases substantially as risk score declines. This suggests that vulnerable movers are more likely to be dispersed within the city, which is supported by the patterns mapped in Figure 11.

Move distances varied somewhat by the type of gentrification, though they were largely in-line with the overall pattern. Differences between the moving patterns of high- and low-score consumers were exaggerated in intense gentrification tracts, with a greater percentage of movers in each risk score group leaving the city and low-score, intracity movers dispersed further than their counterparts from other gentrifying tracts.³⁶ The distributions of movers from continued and moderate gentrification tracts were more consistent with the overall pattern.³⁷

³⁵ Gentrifying tracts were grouped into five neighborhoods clusters — Center City, West Philadelphia, Lower North, Riverwards, and South Philadelphia — based on geographic proximity and similarity in neighborhood characteristics. For more detailed information on these clusters, see companion publication titled *Gentrification and Residential Mobility in Philadelphia: A Practitioner's Summary* at www.philadelphiafed.org/community-development/publications/discussion-papers.

³⁶ Low-score consumers constitute a relatively small percentage of movers in intense gentrification tracts — roughly 18% compared with 33% in moderate gentrification tracts.

³⁷ There were an insufficient number of movers in each risk score and distance category from weak gentrification tracts to make meaningful comparisons.

In general, low-score movers were the most likely to move near their initial neighborhoods or elsewhere within the city, whereas those with higher scores were more likely to leave Philadelphia entirely. To the extent that certain types of moves are associated with specific life events — for example, a longer distance move is more likely to coincide with a new employment opportunity than a much shorter move³⁸ — this may reflect important differences in underlying reasons for moving. Relatedly, if there are greater barriers to leaving the city for low-score movers (e.g., suburban landlords who are more selective about tenant credit histories), these may also contribute to the observed patterns.

Neighborhoods Outcomes: Overall Picture

Three common themes emerged in assessing the neighborhoods to which movers from gentrifying neighborhoods moved. First, outcomes varied significantly between movers from different risk score groups. High-score movers and, to a lesser extent, mid-score movers tended to end up in neighborhoods with stronger economic and quality-of-life profiles, many of which were in Philadelphia suburbs or affluent tracts adjacent to their original neighborhood clusters. By contrast, the destinations of low-score movers overall tended to be similar to the tracts they left, if not slightly weaker on some economic indicators. Low-score, intracity movers by and large ended up dispersed throughout the city in neighborhoods with weaker performance on economic and quality-of-life indicators. These neighborhoods also had larger shares of non-Hispanic blacks, raising concerns about the potential for gentrification to reinforce within-city economic and racial disparities.

Second, the intensity of gentrification pressures plays a major role in the disparities between movers' outcomes. Even though Philadelphia is often considered a weak-market city with relatively low housing costs, there were existing pockets of intense gentrification in which the outcomes for low-score movers were worse.

Lastly, movers from gentrifying neighborhoods largely ended up in neighborhoods with more favorable economic and quality-of-life indicators than movers from nongentrifying neighborhoods, though it is worth noting that the differences were smallest for low-score movers. Still, this provides important context for interpreting the neighborhood outcomes results: While low-score movers from gentrifying neighborhoods did not see the same improvements in neighborhood quality as their higher-score counterparts, they did not appear to end up worse off than low-score movers from nongentrifying neighborhoods.

6. Summary

Gentrification has provoked considerable debate and controversy about its effect on neighborhoods and the people residing in them. Gentrification brings increased investment and middle-class households to previously distressed low-income neighborhoods. Gentrification also may be accompanied by improved public infrastructure and services, increased amenities, new

³⁸ Based on authors' calculation using the Current Population Survey data, in 2013–2014, 21.3% of intercounty movers older than 16 years of age cited a new job or job transfer as the primary reason for their move, compared with only 3.3% of intracounty movers in the same age category.

developments, and rehabilitated properties, potentially increasing the well-being and residential satisfaction of existing residents and enhancing the tax base of cities.

We find that gentrification is positively associated with a resident's financial health though there is significant heterogeneity in improvements in credit rating across neighborhoods and subpopulations. Given the disinvestment in many central cities over the past several decades, these potential benefits from gentrification cannot be overlooked. However, significant changes in gentrifying neighborhoods also may have negative consequences for disadvantaged residents.

Altogether, this study sheds light on the complex effects of gentrification on mobility and financial health. We find that gentrifying neighborhoods in Philadelphia, especially those with more intense level of gentrification, have higher mobility rates on average compared with nongentrifying neighborhoods, but more vulnerable residents in gentrifying neighborhoods are not especially susceptible to elevated rates of mobility. When more vulnerable residents move, however, they are more likely to move to less advantaged neighborhoods. For example, low-score movers, many of whom were hit harder during the recent housing crisis, are more likely to move to neighborhoods closer to their origin neighborhoods and neighborhoods with lower income, worse economic conditions, higher crime rates, and lower-performing public schools, while high-score movers are more likely to move to significantly better neighborhoods. Movers who moved to a neighborhood in a lower-income quintile also experienced a more significant decline in their credit scores.

Furthermore, vulnerable residents are less likely to move to gentrifying neighborhoods over the study period, indicating that housing in gentrifying neighborhoods became less available for less advantaged residents, thereby redistributing more vulnerable groups to more disadvantaged neighborhoods. Younger residents and residents with higher credit scores are more likely to move to gentrifying neighborhoods, whereas older residents and residents with low credit scores are more likely to move to nongentrifying neighborhoods. The decline in affordable housing for low-income households to enter these neighborhoods, coupled with the influx of more advantaged residents, likely play greater roles than the outmigration of low-income households in explaining the demographic changes of gentrifying neighborhoods in Philadelphia. This pattern may have long-term and significant effects on vulnerable populations in terms of housing and job opportunities, financial health, and opportunities for their children. Policymakers should anticipate these possible negative consequences from gentrification and develop strategies to mitigate the negative effects for the disadvantaged population and to ensure that urban development is inclusive.

Of course, the study is not without limitations. The data set used in this study does not include some extremely low-income residents and new immigrants who do not have any credit accounts or credit history. Thus, the results may not necessarily represent the experience of these individuals who are likely more vulnerable to displacement than others. Second, some household characteristics that may be useful in analyzing residential mobility, such as income and race, are not available in the data set. Finally, while the gentrification process in Philadelphia is similar to that in many other central cities across the country, it differs from other markets in many important ways, such as having a relatively stable local economy and housing market, a vibrant downtown, the existence of many strong anchor institutions, a large quantity of vacant lots for

development, and generous incentive programs available (such as the tax abatement) for new development. The pressure of displacement from gentrification may be higher in denser or more expensive markets such as New York City or some cities in California. Thus, the findings should not be generalized for the whole nation or cities that have significantly different market conditions. Nevertheless, as a case study, the empirical work provides timely evidence on gentrification and sheds light on both the benefits and negative consequences of gentrification.

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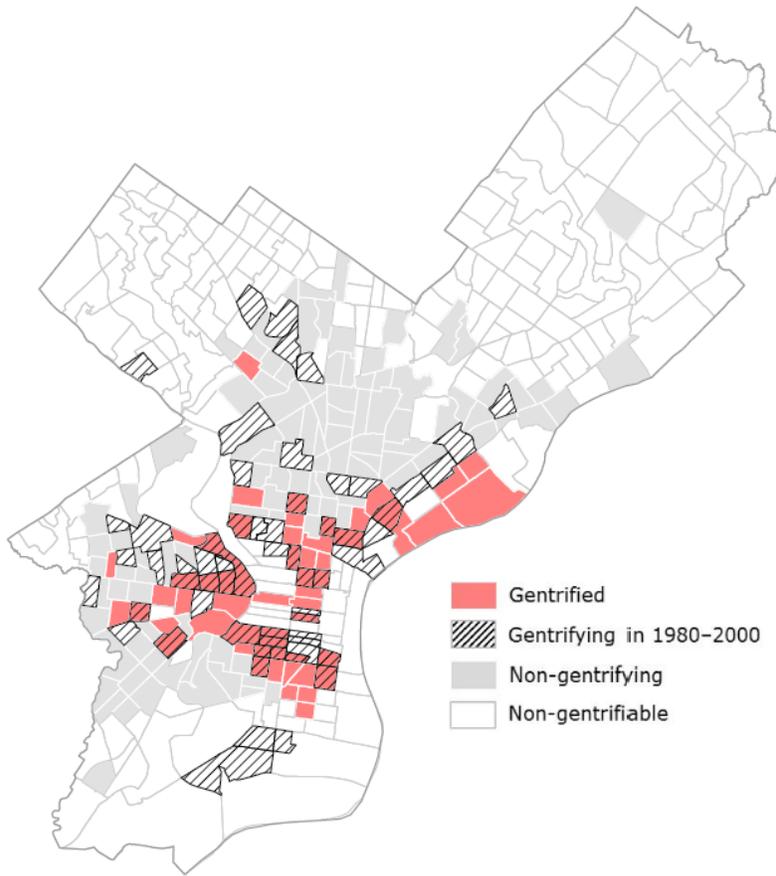


Figure 1 Gentrifying Neighborhoods in the City of Philadelphia (*binary measure*)
Source: Authors' definition based on 2000 Census and 2009-2013 ACS data; and U.S. Census TIGER/Line Shapefiles

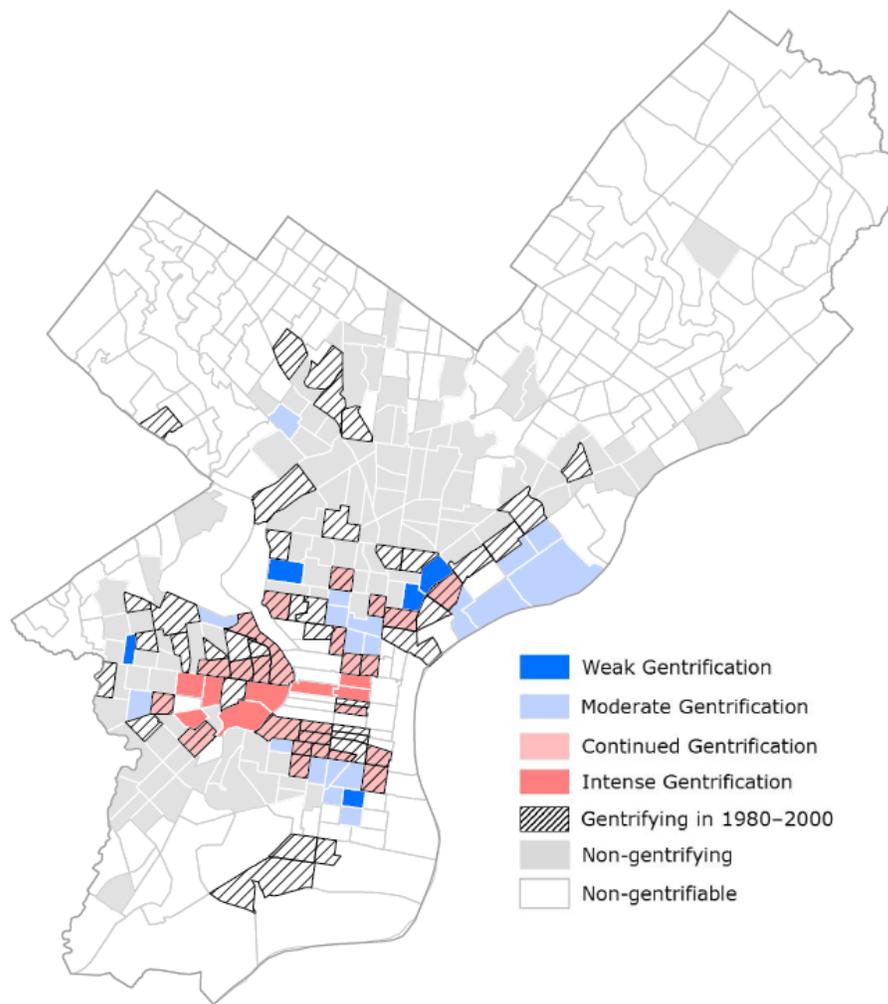


Figure 2 Gentrifying Neighborhoods in the City of Philadelphia (*categorical measure*)
 Source: Authors' definition based on 2000 Census and 2009–2013 ACS data; and U.S. Census TIGER/Line Shapefiles

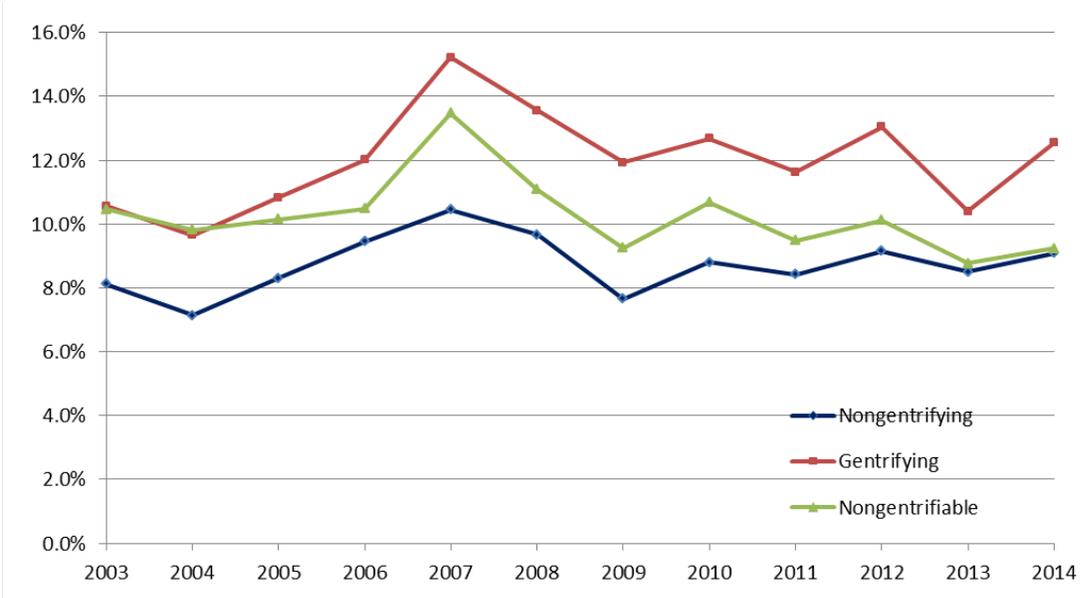


Figure 3 Annual Mobility Rate by Neighborhood Type, Philadelphia

Note: A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago; low-score residents include individuals with no risk scores or with risk scores below 580; authors' calculations using data from the FRBNY Consumer Credit Panel/Equifax

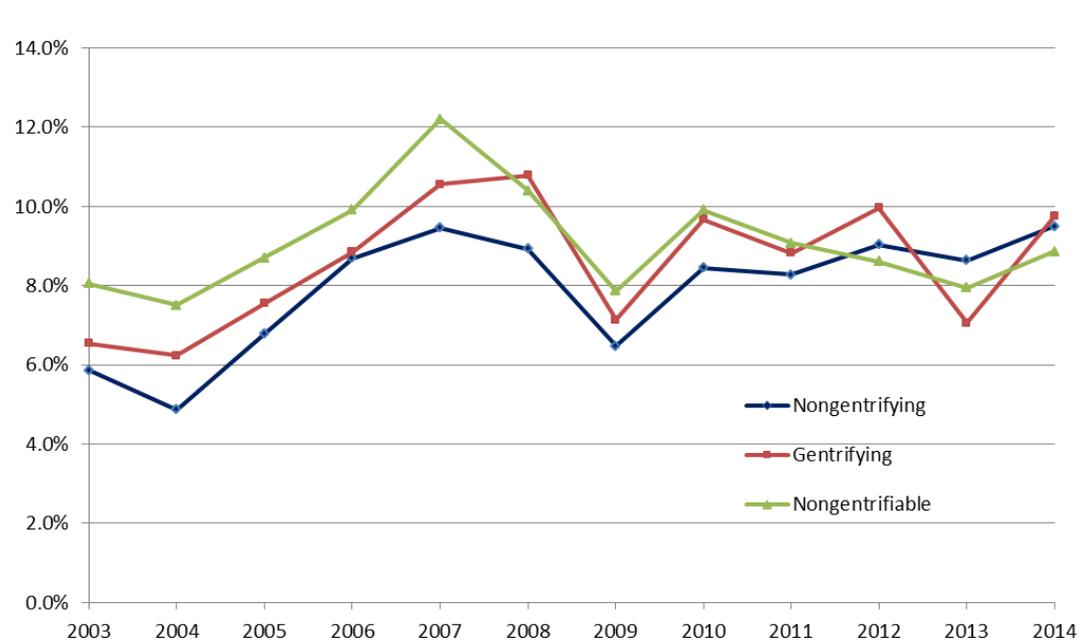


Figure 4 Annual Mobility Rate of Low-Risk Score Residents by Neighborhood Type, Philadelphia

Note: A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago; low-score residents include individuals with no risk scores or with risk scores below 580; authors' calculations using data from the FRBNY Consumer Credit Panel/Equifax

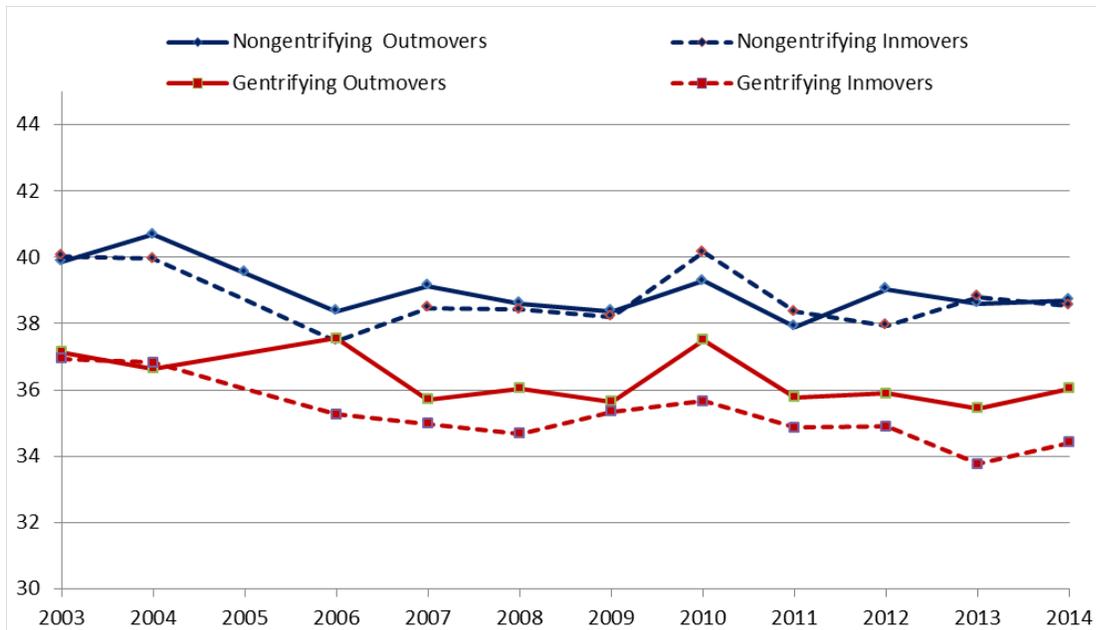


Figure 5 Mean Age of Movers in Gentrifying and Nongentrifying Neighborhoods, Philadelphia
 Note: A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago; individuals 18–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

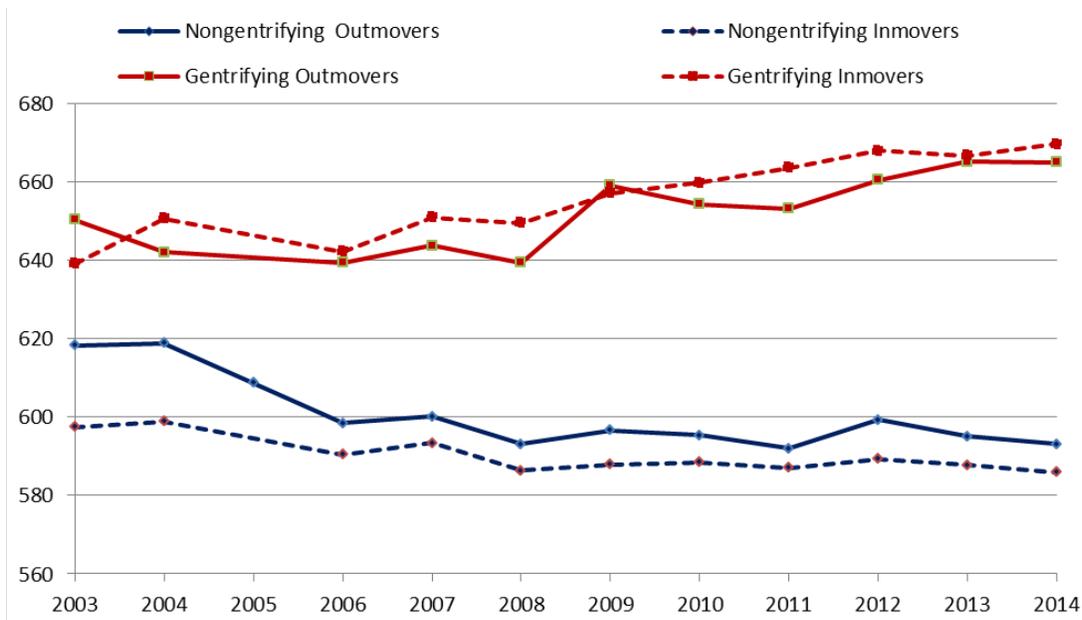


Figure 6 Mean Risk Score of Movers in Gentrifying and Nongentrifying Neighborhoods, Philadelphia
 Note: A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago; individuals 18–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

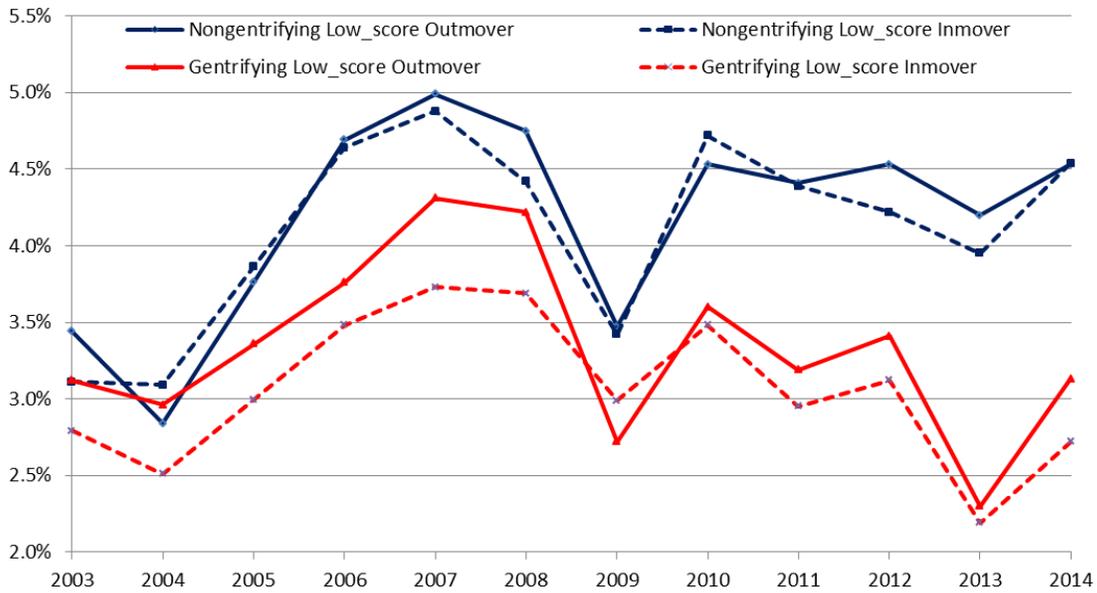


Figure 7 Share of Low-Score (<580) In-movers and Out-movers Among All Residents by Neighborhood Type in Philadelphia

Note: % of in-movers = number of in-movers between year $t-1$ and t divided by number of residents in year t ; % of out-movers = number of out-movers between year $t-1$ and t divided by number of residents in year $t-1$; individuals 18–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

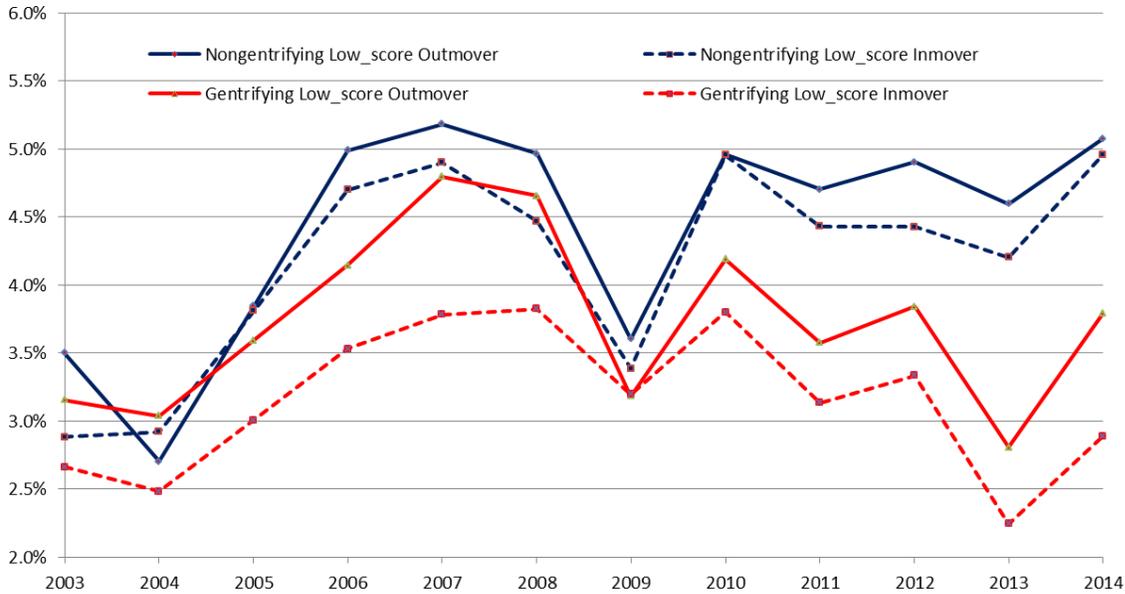


Figure 8 Share of Low-Score (<580) In-movers and Out-movers Among Residents Without Mortgages by Neighborhood Type in Philadelphia

Note: % of in-movers = number of in-movers between year $t-1$ and t divided by number of residents without mortgages in year t ; % of out-movers = number of out-movers between year $t-1$ and t divided by number of residents without mortgages in year $t-1$; individuals 18–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

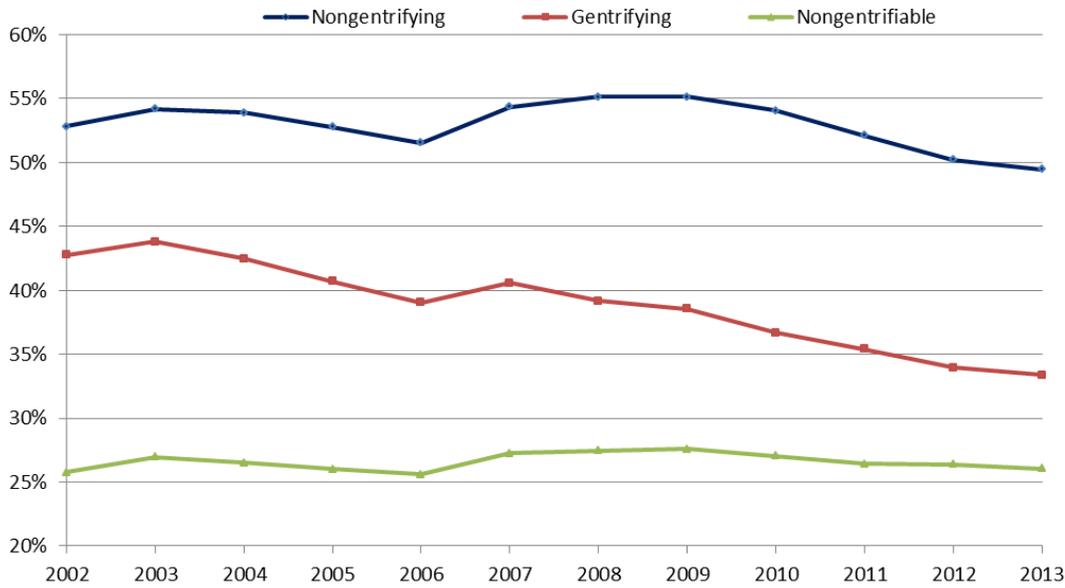


Figure 9 Share of Residents Who Are Low-Score (<580) by Neighborhood Type in Philadelphia
 Note: Individuals 18–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

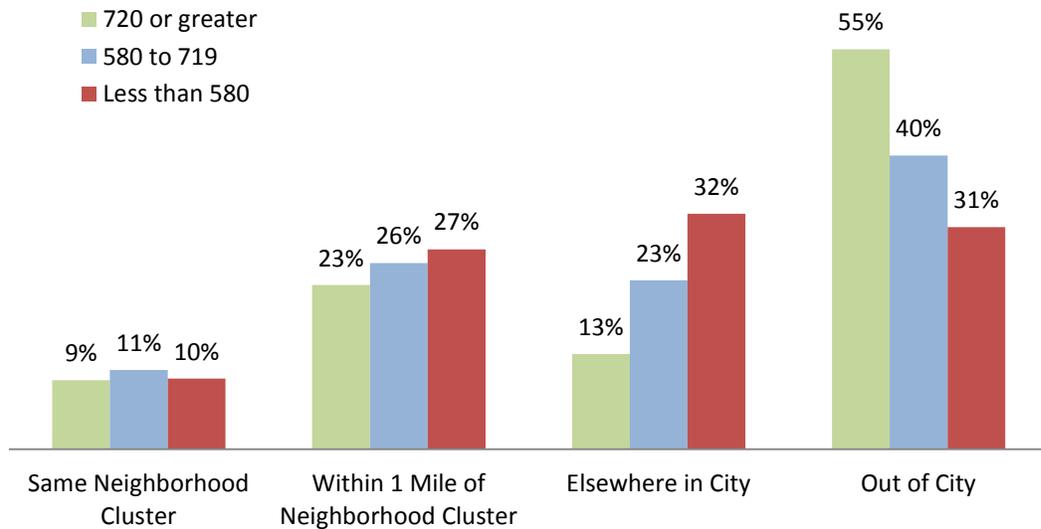
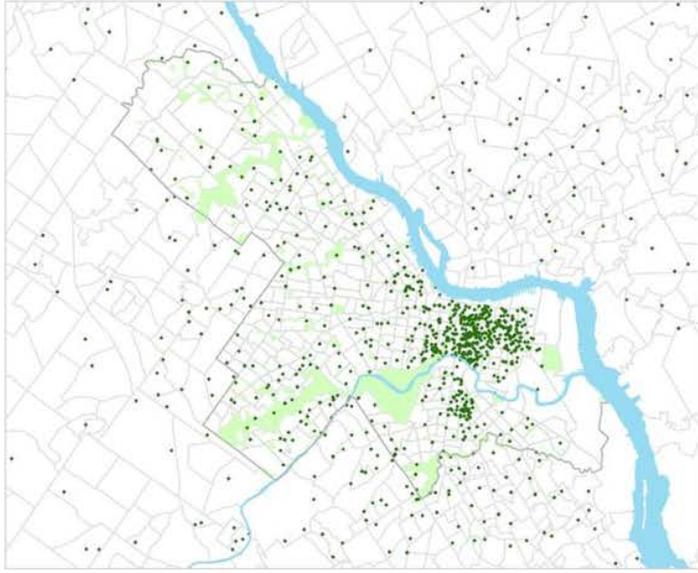
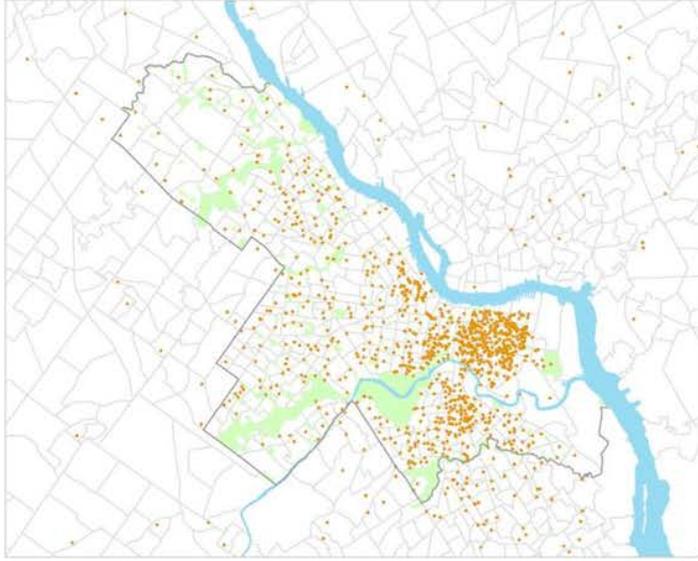


Figure 10 Distance Moved by Movers in Gentrifying Neighborhood Clusters by Risk Score Category, 2003–2014
 Note: A mover is defined as one who lives in a census tract different from where he or she lived one year ago; individuals 25–84 years old only; authors’ calculations using data from the FRBNY Consumer Credit Panel/Equifax

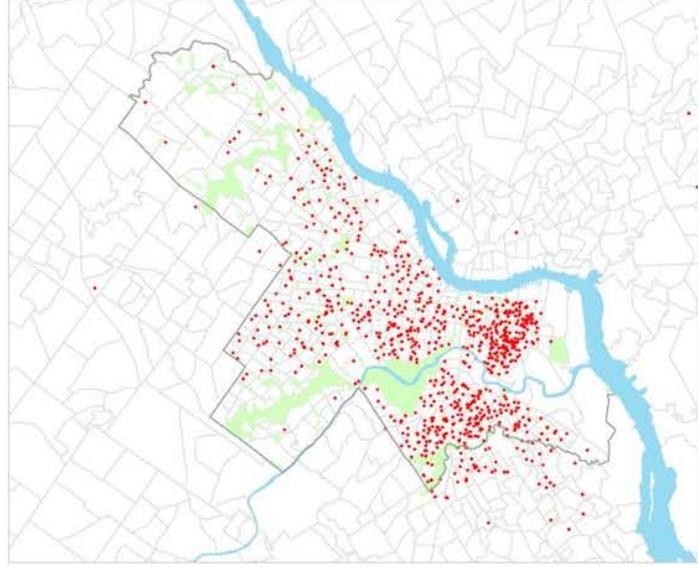
1 Dot = 2 Movers



Riskscore 720 or Greater



Riskscore 580 to 719



Riskscore Less than 580

Figure 11 Destination Tracts of Movers from Gentrifying Neighborhoods, 2003–2014

Note: Dots are randomly placed within destination census tracts and do not represent the exact location of any given mover. A *mover* is defined as one who lives in a census tract different from where he or she lived one year ago; individuals 25–84 years old only; authors' calculations using data from the FRBNY Consumer Credit Panel/Equifax and U.S. Census TIGER/Line Shapefiles

Table 1 Gentrification Measure (Categorical, by Stage of Gentrification)

	Categories	# of Tracts	Explanation
Nongentrifiable	Nongentrifiable	168	nongentrifiable in 1980, 1990, and 2000
	Old gentrification	13	pre-2000 gentrification (1980–2000 or 1990–2000) and no longer
Nongentrifying	Nongentrifying	105	nongentrifying, pre-2000 and 2000–2013
	Stalled gentrification	23	pre-2000 gentrification and not gentrifying 2000–2013
Gentrifying	Continued gentrification	24	pre-2000 gentrification and gentrifying 2000–2013
	Weak gentrification	5	gentrifying but in the bottom quartile of gentrifying tracts for rent and value in 2009–2013
	Moderate gentrification	19	gentrifying and in the 2nd or 3rd quartile for either rent or value in 2009–2013
	Intense gentrification	8	gentrifying and in the top quartile for rent or value in 2009–2013

Source: Authors' calculations use data from 1980, 1990, 2000 Census, and 2009–2013 American Community Survey.

Table 2 Descriptive Statistics

Variable	All Residents	Nongentrifying Tracts	Gentrifying Tracts	Nongentrifiable Tracts
Moved in one year	10.1%	9.0%	12.2%	10.3%
<i>moved within city</i>	5.9%	6.1%	7.1%	5.5%
<i>moved out of city</i>	4.3%	2.9%	5.1%	4.9%
<i>moved to a lower-income tract (movers)</i>	21.0%	16.7%	17.5%	24.3%
<i>moved to a higher-income tract (movers)</i>	41.4%	66.3%	57.5%	23.6%
Nongentrifying neighborhoods	33.0%			
Gentrifying neighborhoods	13.2%			
Nongentrifiable neighborhoods	53.9%			
<i>Equifax risk score</i>				
missing	9.2%	13.6%	10.9%	6.2%
290–579	27.1%	38.8%	27.1%	19.9%
580–649	17.7%	20.7%	17.9%	15.7%
650–749	23.2%	17.5%	24.1%	26.5%
750+	22.8%	9.4%	20.1%	31.7%
Mean Equifax risk score	650.8	604.6	646.4	677.9
<i>Age</i>				
18–24	8.6%	10.0%	9.0%	7.7%
25–34	21.4%	20.8%	25.2%	20.9%
35–44	18.9%	19.5%	19.4%	18.4%
45–54	18.8%	19.5%	17.3%	18.8%
55–64	14.9%	14.5%	13.3%	15.5%
≥65	17.4%	15.8%	15.8%	18.8%
<i>Household size (those with credit info)</i>				
1	19.0%	19.4%	24.7%	17.3%
2	28.0%	25.1%	27.8%	29.9%
3	23.4%	23.0%	20.7%	24.2%
4	14.9%	15.6%	12.8%	14.9%
5+	14.8%	16.9%	14.0%	13.7%
Having 1+ mortgages (whole household)	32.1%	19.2%	22.6%	42.4%
Having 1+ 90+day delinquent accounts (whole)	20.6%	27.0%	19.6%	17.0%
<i>Length in the tract</i>				
Less than 2 years in the tract	11.8%	11.1%	15.2%	11.5%
2–4 years in the tract	15.5%	15.5%	17.6%	14.9%
5+ years in the tract	72.7%	73.5%	67.2%	73.6%
Distance to City Hall (miles)	5.6	4.2	2.1	7.3
Distance to the university (miles)	4.2	2.5	1.7	5.9
Person years (2002-2003; 2005-2013)	550,261	181,453	72,454	296,354

Note: Authors' calculations using data from 2000 Census, 2009–2013 American Community Survey, and data from the FRBNY Consumer Credit Panel/Equifax

Table 3 Neighborhood Characteristics by Gentrification Status, Philadelphia

Initial Neighborhood Condition, 2000	Nongentrifying	Gentrifying	Nongentrifiable
Total population i	555,827	209,421	745,870
% of non-Hispanic white	16.0%	33.8%	64.8%
% of non-Hispanic black	65.4%	50.2%	24.9%
% of renters	42.7%	53.5%	33.6%
Median household income (in 2000 \$)	\$21,895	\$21,042	\$43,366
% of college-educated	8.4%	16.5%	27.8%
Median age	32.12	32.71	37.98
Median rent (in 2000 \$)	\$560	\$577	\$801
Change in Neighborhood Indicators, 2000–2013			
% change in total population	-1.9%	2.3%	3.5%
% change in non-Hispanic white	-31.7%	22.8%	-14.5%
% change in non-Hispanic black	-4.7%	-26.5%	17.7%
Average % change in median household income	-18.2%	41.9%	-7.2%
Average change in % college-educated	1.5%	16.4%	6.3%
Change in median age	0.35	-0.69	0.35
Average change in poverty rate (%)	4.8%	-4.3%	3.8%
Average change in median home value	65.8%	163.3%	61.0%
Average change in median rent	5.5%	42.6%	12.9%
% change in the share of cost-burdened	10.4%	5.3%	11.7%
Number of tracts	128	56	181

Note: A total of 16 tracts were excluded because of no or extremely small population.

Source: Authors' calculations using data from 2000 Census and 2009–2013 American Community Survey

Table 4 Gentrification and Residential Mobility, Linear Probability Regressions

	Move (Any Move) as the Outcome		Move Downward as the Outcome (Movers)	
	Coefficient	Standard Error	Coefficient	Standard Error
Gentrify	0.004**	0.002	-0.002	0.007
Equifax risk score				
no score	-0.054***	0.002	0.167***	0.012
<580	-0.011***	0.002	0.150***	0.009
580-649	0.012***	0.002	0.106***	0.009
650-749	0.026***	0.002	0.056***	0.008
individual age				
25-34	0.013***	0.002	-0.028***	0.007
35-44	-0.040***	0.002	-0.017**	0.008
45-54	-0.070***	0.002	-0.006	0.009
55-64	-0.091***	0.002	0.003	0.010
65+	-0.113***	0.002	0.005	0.011
age missing	-0.119***	0.004	-0.047	0.049
household size (proxy)				
2	-0.017***	0.002	-0.006	0.007
3	-0.021***	0.002	0.000	0.007
4	-0.020***	0.002	0.004	0.008
5+	-0.015***	0.002	0.013*	0.008
serious_delinq	-0.005***	0.001	-0.013**	0.006
Mortgage	-0.007***	0.001	-0.041***	0.006
Ppov	-0.001***	0.000	-0.001**	0.000
Pown	-0.001***	0.000	0.001***	0.000
Pnhblk	0.000***	0.000	0.001***	0.000
cityhall_dist	0.002**	0.001	0.013***	0.003
univcentroid_dist	-0.004***	0.001	-0.015***	0.004
Hhinc			0.009***	0.000
year dummy	yes		Yes	
R square	0.042		0.081	
Number of observations	262,172		25,161	

Note: From linear probability regressions using pooled data (2003-2014); ***, **, * , represent significant at 0.01, 0.05, or 0.1 level, respectively; estimation is based on data 2000 Census, 2009-2013 American Community Survey, and from the FRBNY Consumer Credit Panel/Equifax.

Table 5 Gentrification and Residential Mobility (Summary of Coefficients from Different Regressions)

	Move (Any Move) as the Outcome				Move Downward as the Outcome (Movers)				
	All individuals	Individuals with mortgages	Individuals without mortgages	Tracts within 0.5 mile as the control	All individuals	Individuals with mortgages	Individuals without mortgages	Tracts within 0.5 mile as the control	Consumers with 2+ accounts
gentrify	0.004**	-0.001	0.005***	0.002	-0.002	0.002	-0.002	0.002	-0.004
gentrification type (from a different model)									
continued									
gentrification weak	0.017***	0.000	0.022***	0.015***	-0.023**	-0.033*	-0.020*	-0.015**	-0.028***
gentrification moderate	-0.011***	-0.009	-0.011***	-0.010***	-0.002	0.014	-0.004	-0.007	0.004
gentrification intense	-0.005**	-0.006	-0.006**	-0.004*	0.020**	0.023	0.020*	0.021**	0.012
gentrification	0.036***	0.032***	0.034***	0.030***	-0.006	0.015	-0.016	0.005	-0.001
other controls	Yes	yes	yes	yes	Yes	Yes	Yes	Yes	Yes
R square	0.043	0.024	0.050	0.051	0.081	0.063	0.087	0.090	0.069
Number of observations	262,172	52,183	209,989	177,288	25,161	5,041	20,120	17,511	17,269

Note: From linear probability regressions using pooled data (2003–2014); results for “gentrify” and for other gentrification types are from different regressions; r-squares are for the model using the categorical variables only; ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively; control variables include Equifax risk score, household size, age, mortgage status, serious delinquency, distance to City Hall and universities, year dummies, and neighborhood indicators; estimation is based on data from 2000 Census, 2009–2013 American Community Survey, and the FRBNY Consumer Credit Panel/Equifax.

Table 6 Gentrification and Residential Mobility for Different Subpopulations (Summary of Coefficients from Different Regressions)

	Move (Any Move) as the Outcome		Move Downward as the Outcome (Movers)	
	Coefficient	Standard Error	Coefficient	Standard Error
gentrification & Equifax risk score				
Gentrify	-0.005	0.004	-0.050 ^{***}	0.016
score650-749	0.011 ^{***}	0.003	0.041 ^{***}	0.012
score580-649	0.003	0.003	0.078 ^{***}	0.012
score<580	-0.028 ^{***}	0.002	0.121 ^{***}	0.012
gentrify&score650-749	0.036 ^{***}	0.004	0.023	0.017
gentrify&score580-649	0.015 ^{***}	0.004	0.053 ^{***}	0.017
gentrify&score<580	-0.002	0.004	0.074 ^{***}	0.016
gentrification & mortgage status				
Gentrify	-0.009 ^{***}	0.003	-0.032 ^{***}	0.012
Nomortgage	0.002	0.002	0.028 ^{***}	0.007
gentrify&nomortgage	0.016 ^{***}	0.003	0.037 ^{***}	0.012
gentrification & Equifax risk score (residents w/o mortgages)				
Gentrify	0.003	0.004	-0.058 ^{***}	0.019
score650-749	0.017 ^{***}	0.003	0.042 ^{***}	0.015
score580-649	0.008 ^{***}	0.003	0.076 ^{***}	0.015
score<580	-0.026 ^{***}	0.003	0.125 ^{***}	0.014
gentrify&score650-749	0.037 ^{***}	0.005	0.026	0.020
gentrify&score580-649	0.007	0.005	0.058 ^{***}	0.021
gentrify&score<580	-0.010 ^{**}	0.004	0.082 ^{***}	0.020
gentrification & length in the tract				
Gentrify	0.072 ^{***}	0.004	-0.023 [*]	0.013
2-4 years in the tract	-0.023 ^{***}	0.003	0.018 [*]	0.010
5+ years in the tract	-0.038 ^{***}	0.003	0.038 ^{***}	0.009
gentrify&2-4 years in the tract	-0.048 ^{***}	0.005	-0.016	0.015
gentrify&5+ years in the tract	-0.080 ^{***}	0.004	0.044 ^{***}	0.013

Note: From linear probability regressions using pooled data (2003–2014); ^{***}, ^{**}, ^{*} represent significant at 0.01, 0.05, or 0.1 level, respectively; control variables include Equifax risk score, household size, age, mortgage status, serious delinquency, distance to City Hall and universities, year dummies, and neighborhood indicators; estimation is based on data 2000 Census, 2009–2013 American Community Survey, and from the FRBNY Consumer Credit Panel/Equifax.

Table 7 Gentrification Types and Residential Mobility of Low-Credit Score Residents (Based on Regressions Using All Residents in Gentrifying and Nongentrifying Neighborhoods)

	Move (Any Move) as the Outcome		Move Downward as the Outcome (Movers)	
	Coefficient	Standard Error	Coefficient	Standard Error
low_score (<580)	-0.007	0.001	0.051	0.006
continued gentrification	0.021***	0.003	-0.055***	0.010
weak gentrification	-0.010**	0.004	0.020	0.018
moderate gentrification	-0.003	0.003	0.008	0.011
intense gentrification	0.044***	0.004	-0.036***	0.013
continued gentrification & low_score	-0.012***	0.004	0.097***	0.015
weak gentrification & low_score	-0.003	0.007	-0.057**	0.029
moderate gentrification & low_score	-0.003	0.004	0.021	0.018
intense gentrification & low_score	-0.032***	0.007	0.091***	0.023
other controls	yes		yes	
R Square	0.037		0.075	
number of observations	262,172		25,161	

Note: From linear probability regressions using pooled data (2003–2014); ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively; control variables include risk score, household size, age, mortgage status, serious delinquency, distance to City Hall and universities, year dummies, and neighborhood indicators; estimation is based on data from 2000 Census, 2009–2013 American Community Survey, and the FRBNY Consumer Credit Panel/Equifax.

Table 8 Probability of Moving into Different Neighborhoods (Relative to Moving into a Nongentrifying Neighborhood)

	Gentrifying Tracts		Nongentrifiable Tracts	
	Relative Risk Ratio	Standard Error	Relative Risk Ratio	Standard Error
Equifax risk score				
no score (reference)				
<580	1.103	0.085	1.423***	0.082
580–649	1.643***	0.128	2.249***	0.131
650–749	3.516***	0.272	4.373***	0.256
≥750	6.203***	0.533	8.209***	0.552
individual age				
18–24	2.366***	0.173	1.397***	0.077
25–34	2.387***	0.163	1.801***	0.091
35–44	1.603***	0.116	1.394***	0.074
45–54	1.284***	0.098	1.223***	0.067
55–64	1.256***	0.103	1.144**	0.069
65+(reference)				
household size				
1 (reference)				
2	0.935	0.039	1.015	0.034
3	0.949	0.042	1.007	0.035
4	0.944	0.046	1.020	0.039
5+	0.839***	0.041	0.903***	0.034
serious_delinq	0.930*	0.038	0.978	0.029
Mortgage	1.094***	0.037	1.260***	0.034
from a gentrifying nbhd	3.110***	0.151	1.441***	0.059
from a nongentrifiable nbhd	2.168***	0.094	4.006***	0.122
from outside of Philadelphia	2.924***	0.117	3.060***	0.091
year dummy	yes			
Pseudo R2	0.095			
number of observations	52,092			

Note: From linear probability regressions using pooled data (2003–2014); reference group is moving into a nongentrifying neighborhood; ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively; estimation is based on data from 2000 Census, 2009–2013 American Community Survey, and the FRBNY Consumer Credit Panel/Equifax.

Table 9 Equifax Risk Score Change in Three Years for Individuals Staying in Gentrifying Neighborhoods (Relative to Stayers in Nongentrifying Neighborhoods; from Different Regressions)

	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Gentrify	11.302 ^{***}	0.528						
gentrification Types								
continued gentrification	11.607 ^{***}	0.718						
weak gentrification	3.111 ^{***}	1.126						
moderate gentrification	11.007 ^{***}	0.697						
intense gentrification	22.579 ^{***}	1.133						
gentrification & mortgage status								
Gentrify	15.651 ^{***}	0.948						
Nomortgage	1.401 ^{**}	0.560						
gentrify&nomortgage	-6.726 ^{***}	1.008						
gentrification & Equifax risk score								
Gentrify	8.728 ^{***}	1.053						
score650-749	4.279 ^{***}	0.834						
score580-649	10.136 ^{***}	0.840						
score<580	62.583 ^{***}	0.803						
gentrify&score650-749	4.443 ^{***}	1.341						
gentrify&score580-649	0.730	1.406						
gentrify&score<580	-5.736 ^{***}	1.244						
gentrification & length in the tract (2005-2011 cohorts)								
Gentrify	19.471 ^{***}	1.499						
2-4 years in the tract	1.970 ^{***}	1.046						
5+ years in the tract	0.439	0.937						
gentrify&2-4 years in the tract	-6.725 ^{***}	1.891						
gentrify&5+ years in the tract	-10.155 ^{***}	1.558						
other controls	yes	yes	yes	yes	yes	yes	yes	yes
R Square	0.196	0.197	0.175	0.156	0.188	0.188	0.188	0.188
Number of observations	120,578	120,578	120,578	120,578	120,578	120,578	120,578	94,190

Note: From linear probability regressions using pooled data; reference group is stayers in nongentrifying tracts; , , represent significant at 0.01, 0.05, or 0.1 level, respectively; control variables include Equifax risk score (continuous), household size, age, mortgage status, serious delinquency, distance to City Hall and year dummies; estimation is based on data from 2000 Census, 2009–2013 American Community Survey, and the FRBNY Consumer Credit Panel/Equifax.

Table 10 Equifax Risk Score Change in Three Years for Individuals Moved Out of Gentrifying Neighborhoods (Relative to Stayers in Gentrifying Neighborhoods, from Different Linear Probability Regressions)

	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
any move	-2.489***	0.978				
Move within/out of city						
move within City	-8.898***	1.234				
move out of City	5.828***	1.383				
Move downward or upward						
move to a lower-income tract			-15.084***	2.153		
move to a higher-income tract			2.109*	1.214		
other controls	yes		yes		Yes	
R Square	0.152		0.153		0.166	
Number of observations	38,985		38,985		38,985	

Note: Reference group is stayers in nongentrifying tracts; β_1 , β_2 , β_3 represent significant at 0.01, 0.05, or 0.1 level, respectively; control variables include Equifax risk score (continuous), household size, age, mortgage status, serious delinquency, and distance to City Hall; estimation is based on data from 2000 Census, 2009–2013 American Community Survey, and the FRBNY Consumer Credit Panel/Equifax.

Table 11 Change in Neighborhood Indicators Between Origin and Destination Tracts, All Moves from Gentrifying and Nongentrifying Tracts 2003–2014

	Gentrifying			Nongentrifying		
	Origin	Destination	Difference	Origin	Destination	Difference
Neighborhood Economic Indicators						
Median Income						
All Movers	\$36,362	\$58,351	\$21,989***	\$27,042	\$43,459	\$16,417***
Risk Score <580	\$33,000	\$44,813	\$11,812***	\$26,543	\$38,185	\$11,641***
Poverty Rate						
All Movers	30.1%	17.9%	-12.2%***	37.6%	24.5%	-13.1%***
Risk Score <580	32.1%	24.1%	-8.0%***	38.0%	27.7%	-10.3%***
Unemployment Rate						
All Movers	12.7%	11.1%	-1.6%***	20.8%	15.2%	-5.6%***
Risk Score <580	14.7%	14.6%	-0.1%	21.6%	16.9%	-4.7%***
Median Home Value						
All Movers	\$197,594	\$237,395	\$39,801***	\$80,434	\$140,238	\$59,804***
Risk Score <580	\$158,957	\$155,657	-\$3,299	\$75,973	\$118,686	\$42,713***
Median Rent						
All Movers	\$787	\$905	\$118.1***	\$605	\$736	\$131***
Risk Score <580	\$709	\$754	\$45.1***	\$591	\$690	\$98.8***
Demographic Indicators						
Percent Non-Hispanic Black						
All Movers	34.6%	28.4%	-6.2%***	64.4%	46.5%	-18.0%***
Risk Score <580	47.7%	46.3%	-1.4%	68.7%	53.9%	-21.0%***
Percent College-Educated Adults						
All Movers	36.0%	34.7%	-1.3%***	10.5%	18.8%	8.4%***
Risk Score <580	28.3%	21.7%	-6.6%***	9.0%	15.7%	6.6%***
Quality of Life Indicators						
Rate of Violent Crime per 1,000 Residents						
All Movers	7.7	5.7	-2.0***	12.0	7.9	-4.1***
Risk Score <580	9.0	8.0	-1.0***	12.2	8.9	-3.4***
Combined Share of 4th Grade Students Proficient in Math and Reading						
All Movers	112.0	119.4	7.5***	98.8	101.7	22.8***
Risk Score <580	80.2	102.9	2.9**	77.5	95.7	18.2***

Note: Indicator values represent the averages of the values associated with movers' origin tracts compared with the averages in their destination tracts; ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively. Authors' calculations using data from 2000 census, 2009–2013 American Community Survey, Philadelphia Police Department, FBI Uniform Crime Reporting Program, Pennsylvania Department of Education and the Federal Education Budget Project of the New America Foundation. Rate of violent crime per 1,000 residents calculated at the tract level.

Table 12 Change in Selected Neighborhood Indicators Between Origin and Destination Tracts, All Intracity Moves by Consumers with Equifax Risk Scores Below 580 in Gentrifying and Nongentrifying Tracts 2003–2014

	Gentrifying			Nongentrifying		
	Origin	Destination	Change	Origin	Destination	Change
Neighborhood Economic Indicators						
Median Household Income	\$32,000	\$35,560	\$3,560***	\$26,351	\$31,960	\$5,608***
Unemployment Rate	15.3	17.5	2.2***	21.8	19.2	-2.6***
Median Home Value	\$151,570	\$116,044	-\$35,526***	\$74,813	\$95,378	\$20,565***
Demographic Indicators						
Percent Non-Hispanic Black	51.6%	58.8%	7.2%***	68.5%	62.5%	-6.0%***
Percent College-Educated Adults	26.4%	16.9%	-9.5%***	8.6%	12.1%	3.5%***
Quality of Life Indicators						
Rate of Violent Crime per 1,000 Residents	7.9	7.2	-0.8	12.2	9.4	-2.8***
Combined Share of 4 th Grade Students Proficient in Math and Reading	109.7	104.5	-5.2***	79.4	91.0	11.6***

Note: ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively. Authors' calculations using data from 2000 Census, 2009–2013 American Community Survey, Philadelphia Police Department, FBI Uniform Crime Reporting program, Pennsylvania Department of Education and the Federal Education Budget Project of the New America Foundation. Rate of violent crime per 1,000 residents calculated at the tract level.

Table 13 Change in Selected Neighborhood Indicators Between Origin and Destination Tracts by Gentrification Type, All Moves by Consumers with Risk Scores Less Than 580, 2003–2014

	All Movers			Intracity Movers		
	Origin	Destination	Change	Origin	Destination	Change
Neighborhood Economic Indicators						
Median Household Income						
Intense Gentrification	\$38,309	\$52,491	\$14,181***	\$37,564	\$38,767	\$1,203
Continued Gentrification	\$35,647	\$44,593	\$8,946***	\$34,978	\$36,330	\$1,352
Moderate Gentrification	\$30,950	\$44,177	\$13,227***	\$30,123	\$35,036	\$4,913***
Weak Gentrification	\$21,576	\$36,791	\$15,215***	\$21,554	\$31,184	\$9,630***
Unemployment Rate						
Intense Gentrification	10.3	12.7	2.3***	10.4	16.0	5.6***
Continued Gentrification	14.1	14.6	0.5	14.4	17.6	3.2***
Moderate Gentrification	14.6	14.5	-0.1	15.3	17.2	1.9*
Weak Gentrification	23.0	17.3	-5.7***	23.1	19.5	-3.6***
Median Home Value						
Intense Gentrification	\$238,049	\$188,953	-\$49,096***	\$236,604	\$133,682	-\$102,922***
Continued Gentrification	\$178,044	\$160,021	-\$18,023***	\$170,115	\$119,415	-\$50,700***
Moderate Gentrification	\$126,374	\$147,746	\$21,373***	\$124,925	\$113,109	-\$11,816***
Weak Gentrification	\$70,316	\$114,930	\$44,613***	\$69,706	\$94,687	\$24,980***
Quality of Life Indicators						
Rate of Violent Crime per 1,000 Residents						
Intense Gentrification	7.0	6.9	-0.2	6.9	8.5	1.5**
Continued Gentrification	9.2	8.3	-0.9***	9.4	9.5	0.2*
Moderate Gentrification	8.5	7.7	-0.9***	8.8	9.0	0.2
Weak Gentrification	12.3	9.3	-2.9***	12.2	10.3	-1.9***
Combined Share of 4th Grade Students Proficient in Math and Reading						
Intense Gentrification	121.3	108.1	-13.2***	118.7	94.5	-24.3***
Continued Gentrification	97.8	100.0	2.2	97.2	89.9	-7.3***
Moderate Gentrification	94.4	103.5	9.2***	92.4	91.2	-1.2
Weak Gentrification	85.5	95.1	9.6***	85.7	87.7	2.1

Note: ***, **, * represent significant at 0.01, 0.05, or 0.1 level, respectively Authors' calculations using data from 2000 Census, 2009–2013 American Community Survey, Philadelphia Police Department, FBI Uniform Crime Reporting Program, Pennsylvania Department of Education and the Federal Education Budget Project of the New America Foundation. Rate of violent crime per 1,000 residents calculated at the tract level.

Appendix. Gentrification Measures

Construct Validity

Gentrification is the process by which low-income central city neighborhoods undergo reinvestment and renewal and experience an influx of middle- and upper-middle class residents (Smith, 1998). Using data from the 1980, 1990, and 2000 U.S. Census and the 2009–2013 American Community Survey (ACS) five-year estimates, we identified gentrification among Philadelphia census tracts based on census boundaries from the year 2000. We exclude from the analysis 16 census tracts with fewer than 50 residents or zero housing units. Although some scholarship has examined gentrification in small towns and suburban areas, gentrification has primarily been considered an urban phenomenon in the literature (Brown-Saracino, 2010; Freeman, 2005). For this reason, and to take advantage of the benefits of focusing on a single housing market, we limit our analysis to the city of Philadelphia.

By our working definition of gentrification, a neighborhood must begin a period with relative disadvantage. We consider tracts to be *gentrifiable*, or eligible to gentrify, if they have a median household income below the citywide median income at the beginning of the time period of analysis. Other studies use alternative thresholds: the 40th percentile or median of the median household income in a metropolitan area (e.g., Bostic and Martin, 2003; Freeman, 2005), the 40th percentile of tracts' relative income ratios (the ratio of the average household income in a tract to the metropolitan area average income) in a metropolitan area (e.g., Ellen and O'Regan, 2011), or the 20th percentile of national average family income (e.g., McKinnish et al., 2010).

All thresholds have their own strengths and weaknesses and include or exclude neighborhoods using arbitrary thresholds. Given the wide variation in income across the U.S., we limit our measures to local indicators. Because the suburbs of Philadelphia are much wealthier than the city of Philadelphia on average, metropolitan area thresholds include many wealthier tracts relative to the remainder of the city and do not provide us with the best comparisons between tracts that gentrify and those that do not. In 2000, over 87% and 70% of Philadelphia census tracts were below the metropolitan area median and 40th percentile incomes, respectively. The relative income ratio threshold excludes 10% of tracts considered to be gentrifiable by the citywide median threshold.

The maps in Figure A1 illustrate tracts considered gentrified using our main criteria among various ways of defining the threshold of gentrifiable tracts. As the maps illustrate, using the metropolitan area median income thresholds consider many more neighborhoods as gentrifying compared with using the citywide median income threshold, while the relative income threshold considers a similar number of tracts to be gentrifying as using the citywide median income threshold. These additional tracts that are identified as gentrifying when using the metropolitan area income thresholds began gentrifying many decades ago (e.g., Germantown) or have been stable working- and middle-class neighborhoods (e.g., Manayunk) that have experienced increases in home values and an influx of young professionals in the last decade.

We consider a neighborhood to be gentrifying over a time period if it was gentrifiable at the beginning of the time period, had an above citywide median percentage increase in either its median gross rent or median home value among gentrifiable tracts, and had an above citywide median increase in its share of college-educated residents among gentrifiable tracts over the selected time period. We also constructed measures replicating alternative census-based strategies that have been used in other studies to identify gentrification. For example, Bostic and Martin (2003) and Freeman (2005) each constructed comprehensive measures intended to capture the features distinct to gentrification.

Bostic and Martin (2003) based their strategy on Wyly and Hammel's (1999) results from discriminatory analysis that Wyly and Hammel (1999) conducted to identify which census variables best mapped onto their field surveys. Bostic and Martin (2003) consider a census tract to be gentrifiable if the household median income in the tract is less than the metropolitan median income.³⁹ Using characteristics that Wyly and Hammel (1999) identified as most effective in identifying gentrified neighborhoods, Bostic and Martin (2003) ranked each census tract by the following factors: share of persons 25 and older with a college degree at the end of the period, share of persons 25 and older with some college education at the end of the time period, ratio of average household income at the end of the period to average household income at the beginning of the period, homeownership rate at the end of the period, share of workers that are in professional or managerial occupations at the end of the period, change in the share of residents aged 30 to 44 years old, and poverty rate at the end of the period. The last measure is reverse ranked. Bostic and Martin (2003) also included the black population share and white nonfamily households in their measure, but we do not include these measures to be consistent with our definition of gentrification, which requires socioeconomic, not racial, transformation. Bostic and Martin (2003) then ranked each tract for each variable and calculated the average rank across these measures, and they considered the tracts with the top average ranks to be gentrifying.

Although the strategy considers many factors, it gives everything equal weight and averages all of the factors, which obscures changes that would be consistent with the definition of gentrification but may not be consistent in magnitude and direction across all of the different variables. Indeed, there is a lot of variation between how tracts rank on the various indicators. For example, a tract may experience increases in income and the share of professional and managerial workers but may not see changes in homeownership rates or declines in poverty rates within the same time period.

Freeman (2005) considered a tract to be gentrifiable if it had a median household income less than the 40th percentile of the metropolitan area household income and a share of housing built within the last 20 years less than the 40th percentile of the share for the metropolitan area. Freeman (2005) considered a tract to have gentrified if the share of persons 25 years and over with a college degree increased by more than the median increase for the metropolitan area and the median housing value increased from the beginning to the end of the time period. In general,

³⁹ The text of Bostic and Martin's (2003) publication states that they replicated Wyly and Hammel's (1999) strategy, but Wyly and Hammel (1999) used the citywide median income, rather than the metropolitan area median income. In replicating Bostic and Martin's (2003) strategy, we constructed measures using the citywide median income as thresholds for whether or not neighborhoods were gentrifiable.

this strategy is less conservative than others and considers a large proportion of tracts to have gentrified because the share of residents with college educations and home values generally increased across time.

We also include a measure that was used to identify gentrification in Chicago in a recent report by the Voorhees Center (Voorhees Center, 2014) at the University of Illinois at Chicago (UIC). This strategy calculates a neighborhood change score by taking the difference between the number of variables for which the tract is above the city average for the share of college-educated residents, median household income, homeownership rate, median home value, the share of residents enrolled in private school, and share of residents in professional or managerial occupations, as well as the number of variables for which the tract is above the city average for the share of residents over 65 years old, share of residents aged 5–19 years old, poverty rate, and share of female-headed households.⁴⁰ Tracts are considered to be gentrified if they had a score less than or equal to 5 at the beginning of the time period and greater than 5 by the end of the time period and had an increase in score by more than 3 points.⁴¹ Similar to Bostic and Martin's (2003) measure, the UIC index gives all variables equal weight. Moreover, it only compares neighborhood characteristics with the citywide average rather than considering within-neighborhood changes. Such criteria only consider neighborhoods at the highest end of the distribution of scores to be gentrifying. While a few of the indicators were not exactly identical to those used in the original construction of these measures, we do not believe that they would substantially alter the results, given that the substitutions are highly correlated with the relevant variables in Philadelphia.

McKinnish et al. (2010) and Ellen and O'Regan (2011) use measures that focus primarily on income. As previous studies on gentrification have shown, changes in income do not necessarily capture the characteristics of gentrification as defined previously. Nonetheless, we constructed these measures for comparison. McKinnish et al. (2010) consider a tract to be gentrifying if it experienced an increase in the average family income by at least \$10,000 over the time period and began the period in the bottom quintile of the national average family income. We use median household income instead since that data are available from the Longitudinal Tract Database, and, for the reasons described previously, we use the metropolitan median household income as the threshold for identifying gentrifiable tracts in replicating this measure. Ellen and O'Regan (2011) consider a tract to be gentrifying if it experienced a positive gain in the ratio of the average household income in the tract to the metropolitan area average income over a time period and began the time period in the bottom 40th percentile of the relative income ratio. They also distinguish tracts that experienced a gain of at least 5 percentage points over the decade as experiencing a large gain.

⁴⁰ The index also used the share of whites, blacks, and Latinos. For reasons described earlier, we do not include race variables.

⁴¹ The UIC index, which had three additional variables, considered tracts to be gentrified if they had a more than 4-point increase and had a score at least below 7 at time t and above 7 at time $t + 1$.

The maps in Figure A2 depict the neighborhoods that we identified as gentrifying with our strategy compared with these other strategies. While there is considerable overlap between some measures, particularly Bostic and Martin's rankings, as well as Ellen and O'Regan's (2014) measure, there are also substantial differences. The measures described previously were generated for studies examining a large number of metropolitan areas across the U.S. or for other cities (e.g., Chicago). For example, McKinnish et al.'s (2010) measure identifies very few tracts as gentrifying in Philadelphia. This is likely because income increases are less steep in Philadelphia compared with national averages, and thus a \$10,000 income increase threshold is less likely in Philadelphia.

In general, compared with Bostic and Martin's rankings and the UIC change scores, tracts that we identify as gentrifying have higher ranks and greater change scores than those that we identify as nongentrifying. There is also some variation, however, such that some tracts that we identify as gentrifying are ranked lower than others that we consider nongentrifying. Similarly, some tracts that we identify as gentrifying have negative change scores, and some tracts that we consider nongentrifying have positive change scores.

Compared with Freeman's (2005) measure, we consider far fewer tracts as gentrifying, largely due to differences between our criteria and Freeman's criteria in considering whether or not tracts are gentrifiable. For tracts that both measures consider gentrifiable, all tracts that we consider to be gentrifying are also gentrifying by Freeman's measure. Freeman's measure, however, also considers many additional tracts that are gentrifiable by both standards as gentrifying, and these tracts are largely inconsistent with local knowledge of gentrification. Although nearly all tracts that McKinnish et al. (2010) identify as gentrifying are also gentrifying by our measure, many tracts that our measure considers to be gentrifying did not experience substantial income gains to meet McKinnish et al.'s (2010) criteria.

Lastly, Ellen and O'Regan's (2014) measure considers more tracts to have experienced gains. In general, though, our measure produces similar results. Over 75% of tracts that our measure identifies as gentrifying also experienced gains by Ellen and O'Regan's (2014) measure; however, 28 tracts experienced smaller gains in the relative income ratio used by Ellen and O'Regan (2014), but we consider them to be nongentrifying.

External Validity

Several scholars have noted the shortcomings of using census-based variables for identifying gentrification. Owens (2012) finds that socioeconomic ascent based on commonly used census-based indicators of gentrification captures various forms of neighborhood change, many of which are not inherent to the direct indicators of neighborhood upgrading associated with gentrification. Comparing census variables with results from gentrification field surveys, in which surveyors looked for evidence of new construction and renovation, Wyly and Hammel (1999) find that tracts identified as gentrifying correlated with socioeconomic census variables in the expected directions, but around 10% of tracts were also incorrectly classified as gentrifying when using only these census variables to identify gentrification. Moreover, Barton (2014) demonstrates that Bostic and Martin's (2003) and Freeman's (2005) census-based strategies

identify gentrification in distinct areas from both each other and well-known gentrifying areas identified in newspaper content in New York City.

To address these issues, some scholars have employed alternative strategies for identifying gentrification, such as filed building permits, home loans, coffee shop counts, field surveys, and newspaper content (Barton, 2014; Hammel and Wyly, 1996; Helms, 2003; Hwang and Sampson, 2014; Kreager et al., 2011; and Papachristos et al., 2011), but these measures either capture narrow aspects of gentrification or only capture a single time point. Thus, these measures limit the ability to compare many neighborhoods across time. Figure A3 compares our measure with the field surveys conducted by Wyly and Hammel in Philadelphia in 1998. Based on other analyses, these measures best capture gentrification that took place during the 1970s and 1980s. The maps indicate that most of the tracts that were gentrifying at the time of the survey were not gentrifiable in 2000.

Although our measure is consistent with qualitative accounts of gentrification in Philadelphia based on discussions with practitioners and local press, we also assess the external validity of our gentrification measure by comparing it with demographic and housing characteristics from the 2009–2013 American Community Survey, coffee shops per capita, and building permits per 100 housing units. Table A1 displays the average tract characteristics between neighborhoods that we categorize as gentrifying versus those that are not gentrifying and results from two-sample t-tests.

As the table illustrates, our measure is consistent with characteristics often associated with gentrification. Compared with nongentrifying tracts, gentrifying tracts had greater levels and increases in the shares of whites, college-educated residents, and professionals, as well as median home values and rents. In addition, gentrifying tracts had lower levels and greater decreases in the share of blacks, the share of children, and poverty rates by the end of the analysis period. Gentrifying tracts also had smaller declines in homeownership. There were no differences in vacancy rates and the share of elderly residents, however. Our measure is also consistent with alternative indicators of gentrification. Gentrifying neighborhoods had far greater numbers of building permits per 100 housing units and coffee shops per 100 residents, as well as greater increases in the number of coffee shops, consistent with accounts documenting the commercial transformations associated with gentrification (Papachristos et al., 2011). Overall, these findings further support the external validity of our gentrification measure.

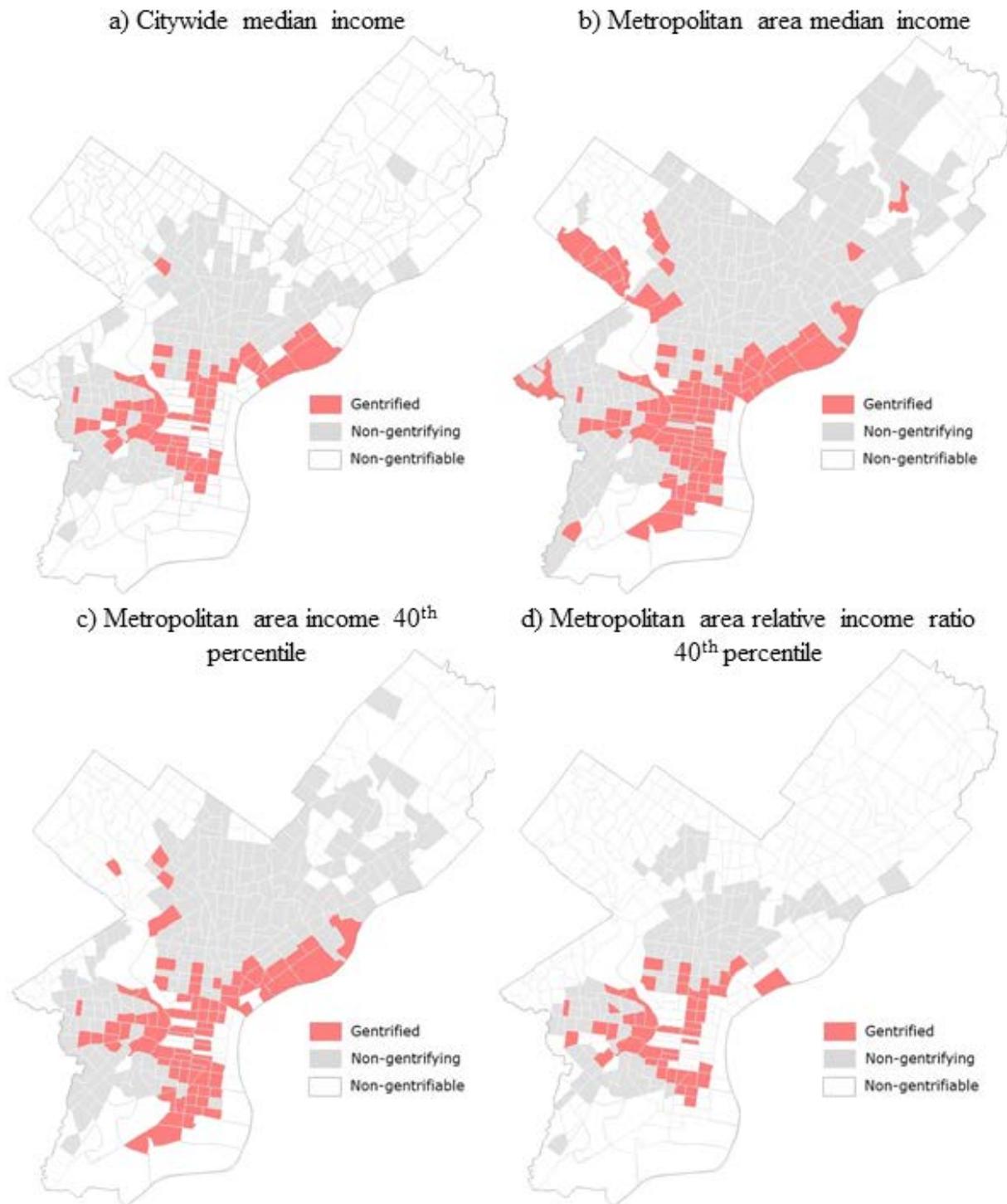


Figure A1 Philadelphia Gentrification Based on Various Threshold Specifications for Whether Tracts Are Gentrifiable

Note: Authors' calculations using data from 2000 Census and 2009–2013 American Community Survey (ACS)

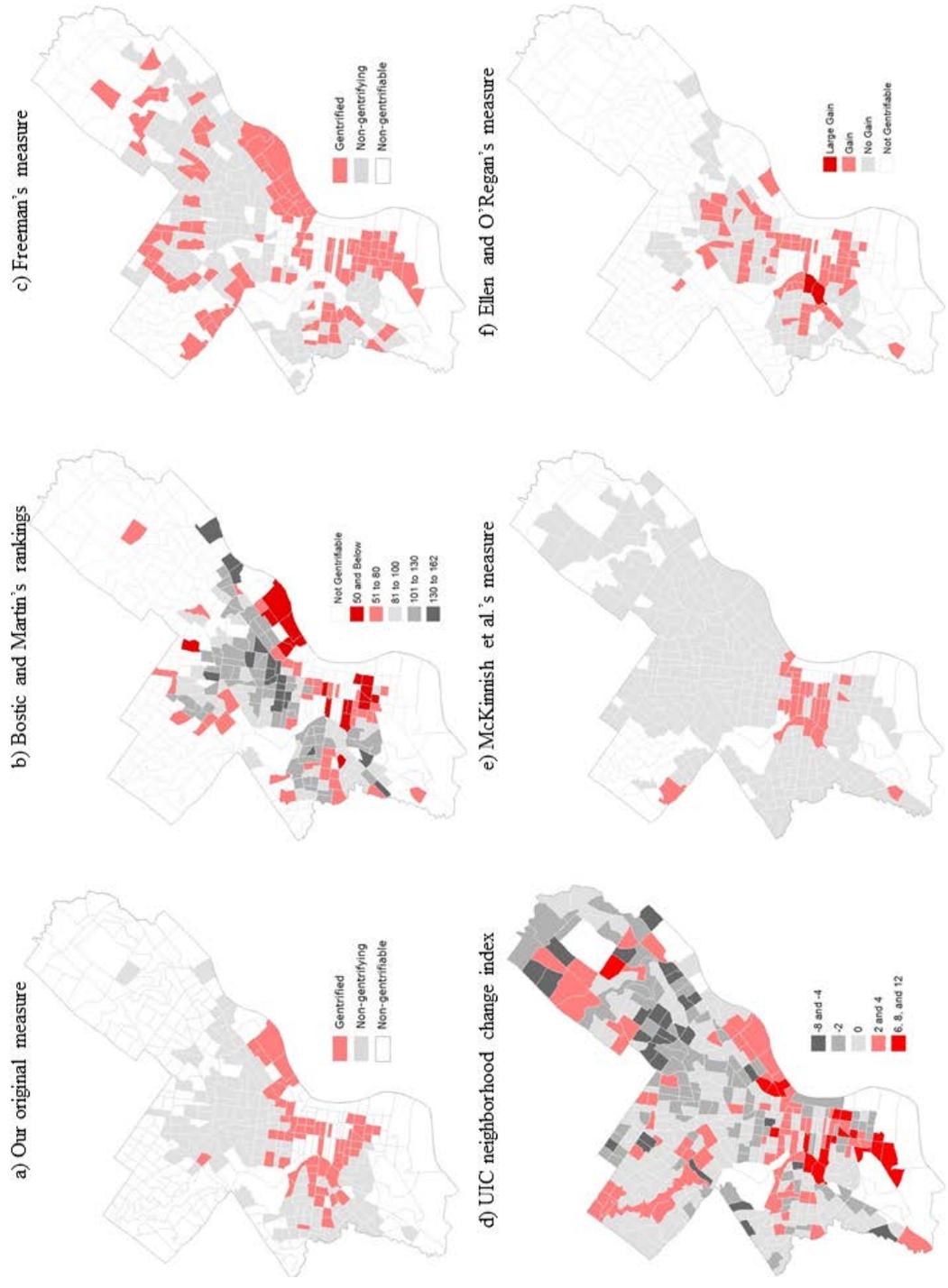


Figure A2 Comparison of Various Gentrification Measures
 Note: Authors' calculations using data from 2000 Census and 2009–2013 American Community Survey (ACS)

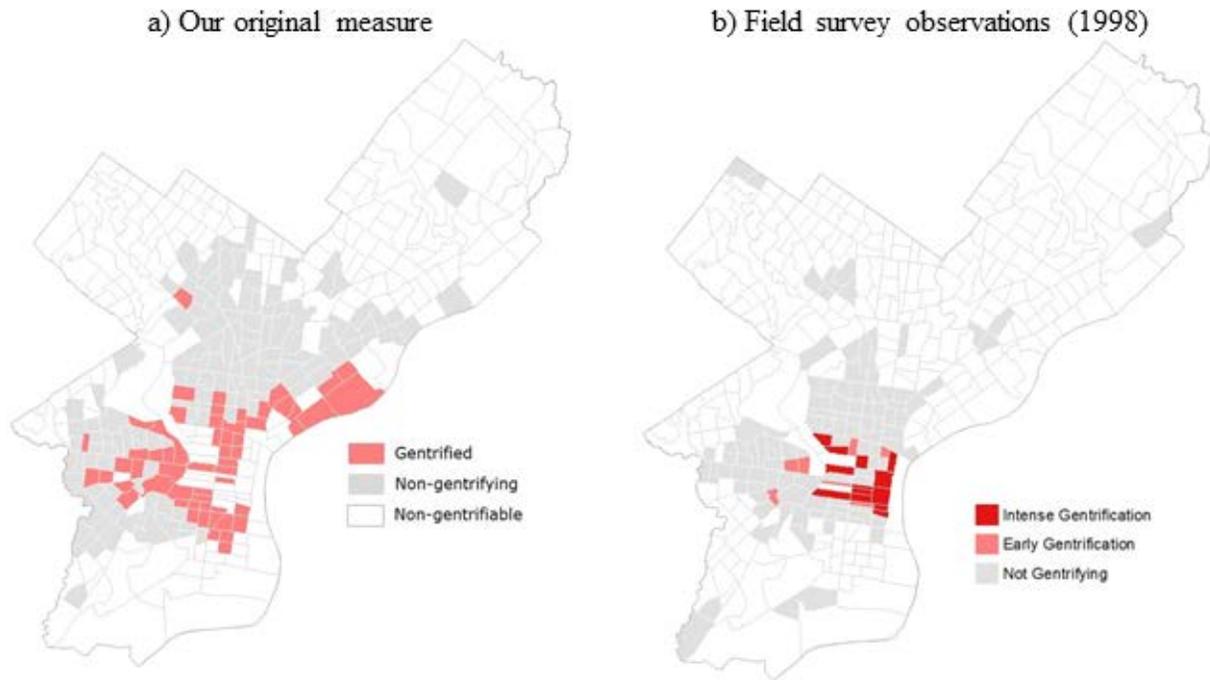


Figure A3. Gentrification Defined by Our Measure and Field Surveys Conducted in 1998
 Note: Authors' calculations using data from 2000 Census , 2009–2013 American Community Survey (ACS), and Wyly and Hammel's gentrification data (<http://ibis.geog.ubc.ca/~ewyly/data.html>)

Table A1. Comparing Gentrifying and Non-Gentrifying Tracts Along Indicators of Gentrification

	Mean (gentrifying)	Mean (Nongentrifying)	T-statistic	P-value
% non-Hispanic white, 2013	41.46	12.90	7.49	0.00
Change in % non-Hispanic white, 2000-2013	7.42	-5.36	5.49	0.00
% non-Hispanic black, 2013	36.58	64.26	-5.46	0.00
Change in % non-Hispanic black, 2000-2013	-13.73	-0.39	-6.21	0.00
% homeownership, 2013	40.02	45.71	-1.95	0.05
Change in % homeownership, 2000-2013	-3.38	-9.90	5.14	0.00
% vacant units, 2013	17.28	17.50	-0.22	0.82
Change in % vacant units, 2000-2013	1.05	2.43	-1.04	0.30
% under 18 years old, 2013	16.08	26.16	-8.30	0.00
Change in % under 18 years old, 2000-2013	-7.08	-4.18	-3.05	0.00
% over 65 years old, 2013	10.74	10.74	0.00	1.00
Change in % over 65 years old, 2000-2013	-2.52	-1.74	-1.32	0.19
% below poverty, 2013	30.87	39.32	-3.79	0.00
Change in % below poverty, 2000-2013	-4.25	4.80	-4.81	0.00
Median household income, 2013	35,966	24,750	5.60	0.00
% change in median household income, 2000-2013	41.90	-18.18	3.76	0.00
% college-educated, 2013	32.92	9.89	8.90	0.00
Change in % college-educated, 2000-2013	16.42	1.47	11.81	0.00
% in professional/managerial occupations, 2013	41.34	22.61	8.00	0.00
Change in % professional/managerial occupations, 2000-2013	11.95	1.55	7.12	0.00
Median home value, 2013	199,431	85,708	7.95	0.00
% change in median home value, 2000-2013	163.28	65.79	6.69	0.00
Median gross rent, 2013	786	587	4.21	0.00
% change in median gross rent, 2000-2013	42.58	5.45	2.88	0.01
Building permits issued per 100 units in 2013	0.57	0.20	3.27	0.00
Change in building permits issued per 100 units, 2009-2013	-0.21	-0.13	-0.92	0.36
Coffee shops per 100 residents, 2012	0.04	0.00	2.77	0.01
Change in coffee shops per 100 residents, 2006-2012	0.02	0.00	1.90	0.06

Notes: Means presented are averages across tracts. Data come from the 2000 US Census, 2009-2013 ACS 5-year estimates, Philadelphia Licenses and Inspections, and ESRI Business Directory data. Dollar values are in 2013 constant dollars.

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