Finding Home When Disaster Strikes: Dust Bowl Migration and Housing in Los Angeles*

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Abstract

When natural disasters strike, the impact on housing markets can be far-reaching. This paper explores the unique dynamics of natural disaster-induced migration on the housing market, focusing on Los Angeles—the top destination of the 1930s Dust Bowl (DB) migrants. We employ U.S. Census-linked and geocoded address data to show that the arrival of "Dust Bowlers" significantly impacted the city's housing market. We find that houses inhabited by Dust Bowl migrants had lower growth rates in prices and rents over the decade. We also find that houses inhabited by non-migrants had higher depreciation of their values the closer they were to Dust Bowl migrants. We also find that neighborhoods that received more Dust Bowl migrants had lower growth rates of house values and rents over the decade. Our research contributes to a better understanding of how natural disaster-induced migration shapes housing markets and underscores the need to consider the specific context of mass migrations when studying their effects.

Keywords: Real Estate, Housing, Immigration, Disaster-induced displacement
JEL Classification: R21; R23; R31; Q54

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1 Introduction

The effects of climate change are expected to increase the frequency and severity of climate-related disasters, such as floods, droughts, and hurricanes. This upsurge in natural disasters will force more people to leave their homes and relocate to different regions. On the one hand, recent research argues that migration is a crucial mechanism in lessening the adverse welfare effects of these disasters (Desmet and Rossi-Hansberg, 2015; Cruz and Rossi-Hansberg, 2021; Bilal and Rossi-Hansberg, 2023). However, the influx of climate migrants can have substantial consequences for the economies of the areas receiving them. Understanding the economic implications of in-migration resulting from climate disasters, especially on housing markets, is vital for local authorities and policymakers to effectively prepare for the potential influx of migrants escaping natural disasters.

This study investigates the impact of the migration of people from areas affected by the Dust Bowl in the 1930s on the housing market in Los Angeles. The 1930s American Dust Bowl, marked by a severe drought and subsequent dust storms, caused extensive damage to the U.S. Great Plains during that decade. Widely regarded as the most severe natural disaster in U.S. history, it prompted a substantial movement of migrants from the Great Plains during that period. Our focus on Los Angeles stems from its significance as the primary destination for immigrants from Dust Bowl areas.[1]

This research explores the housing market implications of a substantial influx of migrants fleeing the prolonged natural disaster of the Dust Bowl. However, conducting this study poses challenges, requiring detailed address-level information to observe changes over a decade. To overcome this, we employ a variety of methods to create a new sample of houses in Los Angeles. This allows us to (i) examine house and resident characteristics from U.S. Census records, including rents and house values; (ii) assess their geographic locations, and (iii) establish connections between houses across the 1930 and 1940 Censuses. This sample serves as the basis for analyzing the impact on house values and rents for residences inhabited by Dust Bowl migrants.

Utilizing the available data, we assess the impact of receiving Dust Bowl migrants on housing variables at the address level, making comparisons within the same neighborhood. Subsequently, we explore spillover effects by estimating the impact at the neighborhood level and on addresses inhabited by non-migrants. Initially, our findings reveal that, within neighborhood,

[1] This trend found literary representation in Steinbeck's (1939) acclaimed novel "The Grapes of Wrath," narrating the journey of an Oklahoma family migrating to California in search of employment and higher wages.

houses occupied by Dust Bowl migrants experienced lower growth rates in both values and rents throughout the 1930s compared to other Los Angeles residents. On average, the presence of a Dust Bowl family reduced the house value growth rate by approximately eight percentage points over the decade, and the rent growth rate diminished by three percentage points, relative to other families in the same neighborhood.

Furthermore, our analysis uncovers evidence of adverse effects on the evolution of house prices of non-migrant families. Firstly, when examining individual addresses, homes occupied by non-migrants situated at a greater distance from Dust Bowl migrants demonstrate higher growth in value compared to other houses within the same neighborhood. This pattern suggests a nuanced preference among local residents regarding their residential choices in proximity to Dust Bowl migrants. Additionally, at the neighborhood level, we observe that areas experiencing a higher influx of Dust Bowl migrants exhibit diminished growth rates in both house values and rents.

Taken together, our results suggest that the influx of Dust Bowl migrants into Los Angeles during the 1930s had a significant and multifaceted impact on the local housing market. The presence of migrants not only affected the housing value and rent growth rates of properties they directly occupied, but also influenced the perceived attractiveness and economic dynamics of their neighborhoods.

Related Literature. Our paper relates to the literature studying the impacts of migration on housing and neighborhood dynamics. In general, previous studies show that migration generally increases the demand for housing in the destination, which, in the short run, translates into higher prices (Saiz, 2003, 2007; Greulich et al., 2004; Howard, 2020).[2] A branch of this literature focuses on how the arrival of minority populations influences neighborhood dynamics and housing markets (Boustan, 2010; Saiz and Wachter, 2011; Moraga et al., 2019; Shertzer and Walsh, 2019; Akbar et al., 2022). In particular, many of these studies find that house prices can decrease in response to the arrival of people from a different race, ethnicity, culture, or country if the arriving group is perceived as "undesirable" to incumbent residents. We contribute to this body of literature in two key ways. First, we examine the impact on housing resulting from the arrival of people displaced by a long-lasting natural disaster. Second, we focus on

[2] See Jia et al. (2023) for a recent review of the research on internal migration in the U.S. and its interactions with housing markets.

the arrival of Dust Bowl immigrants, who were often subject to discrimination but not based on race or ethnicity since they were mostly white US-born.

Our research also aligns with the literature addressing migration prompted by natural disasters and its implications for both migrants and the economies of the areas they move to. The majority of existing studies investigate the effects of climate disaster-induced migration on various aspects, including income, health, education, and political preferences (McIntosh, 2008; Imberman et al., 2012; Deryugina et al., 2018; Boustan et al., 2020; Deryugina and Molitor, 2020). For example, Bazzi et al. (2023) demonstrates that the migration of individuals, particularly from Dust Bowl areas, played a significant role in shaping the cultural and political preferences of the overall population in the destination regions, particularly in the Southern United States. However, there is a notable scarcity of research focusing on the impact of natural disaster-induced arrivals on housing and the dynamics of neighborhoods in the destination city. Our study is more closely aligned with the findings of Daepp et al. (2023), who observed a decrease in house prices in Texas after the arrival of individuals displaced by Hurricane Katrina. We contribute to this literature by examining the consequences of the most severe natural disaster in U.S. history, the American Dust Bowl of the 1930s.

Our study is also connected to the existing literature on the economic consequences of the 1930s American Dust Bowl (Hornbeck, 2012, 2022; Moscona, 2022; Noghanibehambari and Fletcher, 2022). We contribute to this literature by specifically examining its impact on the housing markets of the largest destination of migrants, Los Angeles, CA.

2 Historical Background

2.1 The American Dust Bowl of the 1930s

The 1930s American Dust Bowl was one of North America's most severe environmental disasters in the twentieth century.[3] While it predominantly affected the Great Plains—especially Oklahoma, Texas, New Mexico, Colorado, and Kansas—it also damaged farther states like South Dakota, Montana, Wyoming, and Nebraska. Traditionally known as "America's breadbasket," this region faced several years of relentless dust storms, exacerbated by severe drought and decades of extensive farming without crop rotation and other soil conservation techniques. These

[3] An excellent summary of the unique aspects of the Dust Bowl is in Hansen and Libecap (2004). This background section draws heavily on their description and sources.

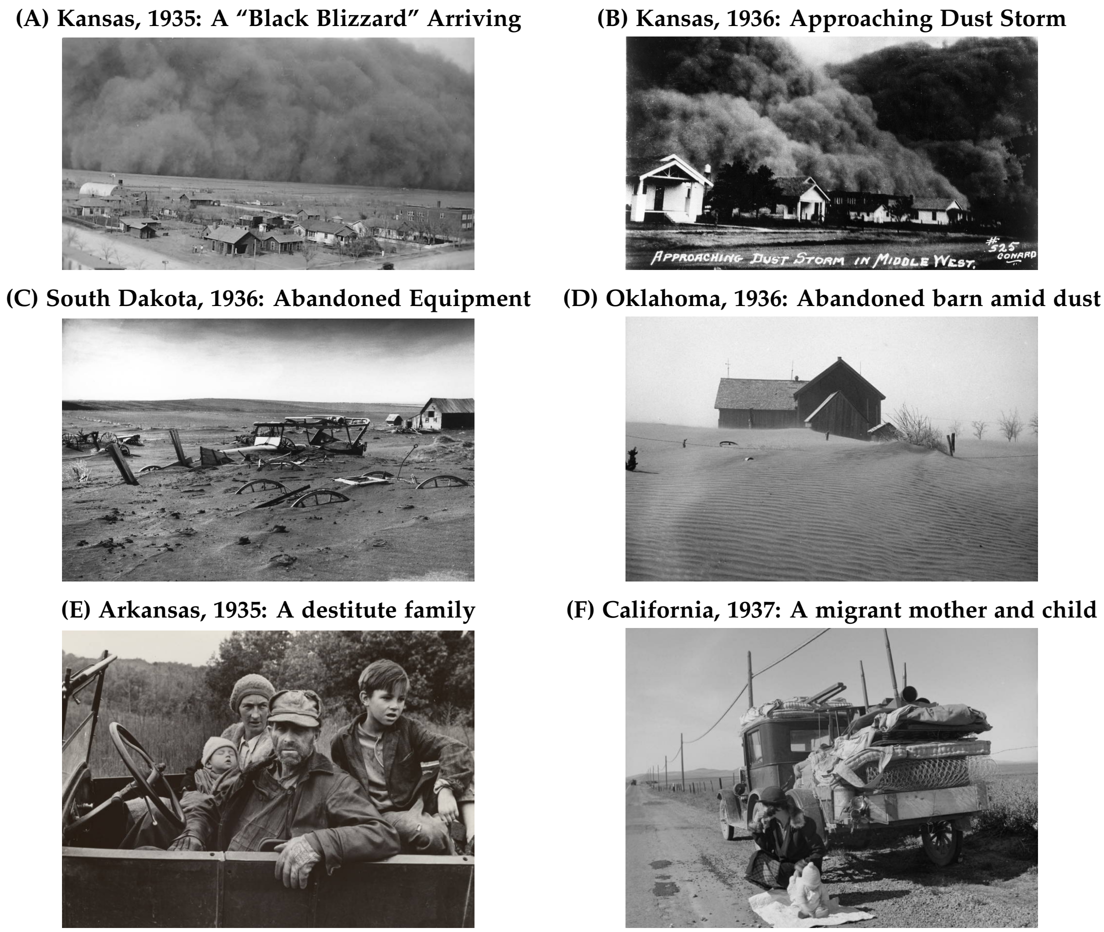

Figure 1. The 1930s Dust Bowl Climate Disaster through Historical Photographs. Photograph credits in each panel: (A) FDR Library Digital Archives; (B) Kansas Historical Society; (C) USDA (via Wikimedia Commons); (D) Arthur Rothstein for the Farm Security Administration (via Library of Congress); (E) Ben Shahn for the FSA (via NY Public Library); (F) Dorothea Lange for the FSA (via Library of Congress).

conditions led to the erosion of the topsoil, creating massive dust clouds, sometimes called "black blizzards," that blanketed the land. Panels A through D in Figure 1 show historical photographs capturing the extent of wealth destruction caused by the devastating events. This phenomenon caused extensive damage to farmland, crops, homes, infrastructure, and equipment, turning once-fertile fields into barren wastelands.

The socio-economic impact of the Dust Bowl was profound and far-reaching. There was also a significant increase in the incidence of respiratory diseases (e.g., asthma, dust pneumonia). Drought, dust, and economic hardship of the Depression forced thousands of families to abandon their farms. These displaced families, often called "Dust Bowl refugees," embarked on arduous journeys toward the West, particularly California, searching for work and better living conditions. Figure 1 also shows two families and their children migrating from the Great Plains depicted in some of the most iconic Depression-Era portraits by acclaimed photographers Ben Shahn (Panel E) and Dorothea Lange (Panel F) for the Farm Security Administration.

This mass migration reshaped the demographic and cultural landscape of the United States. The terms "Okies" and "Arkies," initially referring to those from Oklahoma and Arkansas but later used for all migrants from the Dust Bowl region, became synonymous with the struggle of these individuals.[4] In their new communities, these migrants often faced exclusion from social and cultural activities and hostility from established residents who perceived them as threats to local jobs and social order.

Perhaps the best symbol of the Dust Bowl's profound impact on American history and culture is John Steinbeck's classic novel *"The Grapes of Wrath"* (Steinbeck (1939)). Published in 1939, the book was a remarkable success in American pop culture. The novel provides an intimate portrayal of the struggles faced by one Oklahoma family, the Joads, as they journeyed westward to California. Steinbeck's vivid depiction of their journey and the broader plight of Dust Bowl migrants struck a chord with readers, becoming a critical and commercial success.[5] The book became a defining piece of American literature and culture, as inequality and human rights themes resonated deeply during the Great Depression Era.[6] The crowning of Steinbeck's (1939) masterpiece came in 1962 when it was cited prominently by the Nobel Committee, awarding him the Nobel Prize in Literature for *"his realistic and imaginative writings, combining as they do sympathetic humor and keen social perception."* Our sample focuses on the period that precedes the novel's influence in American culture and, therefore, is not impacted by the labor policies adopted due to its remarkable success.

2.2 Los Angeles: The Arrival of Dust Bowl Migrants

Figure 2 shows the top 20 county destinations for Dust Bowl migrants during the Great Depression. It shows that the Joads in Steinbeck's (1939) novel were not an exception. Many migrants saw California—especially Los Angeles—as a place of opportunity to escape the poverty and hardships of the Dust Bowl region (Todd et al., 1940). By far, Los Angeles County was the

[4]The Library of Congress' Dust Bowl Collection has several accounts of stigmatization. Many faced derogatory remarks due to their accent, appearance, and cultural practices.

[5]A year after its debut, the novel was turned into a movie directed by John Ford with Henry Fonda as Tom Joad.

[6]The novel's impact on American culture was so significant that it not only won the National Book Award and the Pulitzer Prize but also influenced subsequent labor policy changes aimed at improving the lives of the poor and dispossessed. First Lady Eleanor Roosevelt, upon reading the book, called for congressional hearings that resulted in reform to labor laws governing migrant camps.

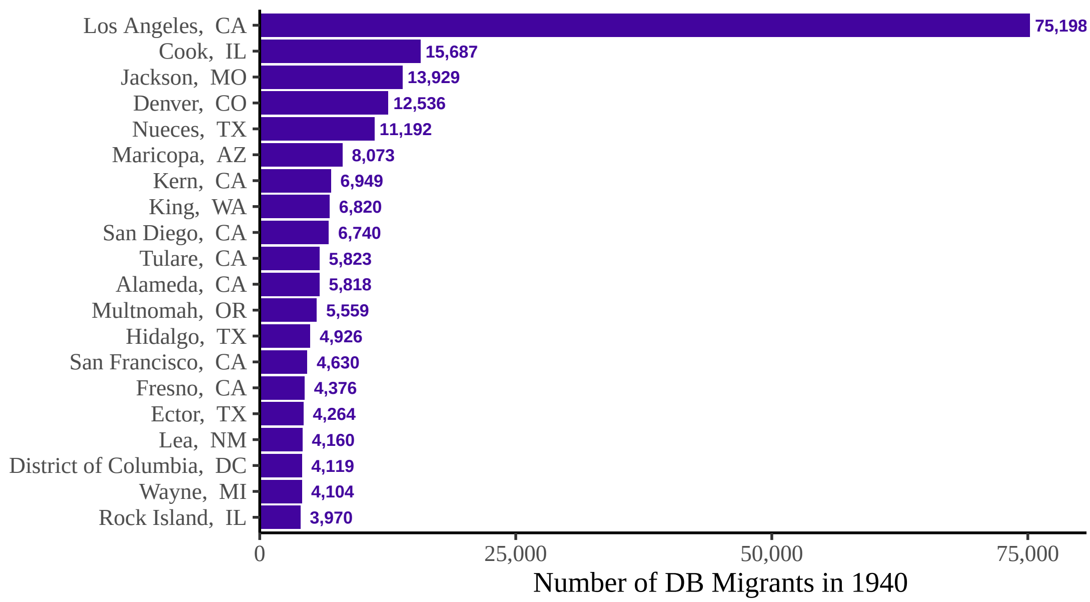

Figure 2. Top 20 Destinations of Dust Bowl Migrants. This figure focuses on the top 20 counties receiving DB migrants in the 1930s. It plots the number of migrants a county received in the 1930s as seen from the 1940 Census. Dust Bowl migrants were identified based on their county of origin in 1935, according to the 1940 Census. Counties mostly affected by the Dust Bowl disaster are defined as in Hornbeck (2012).

most common destination for those who left the Great Plains. Figure 2 shows that over 75,000 Dust Bowl migrants lived in Los Angeles County in the 1940s. They represented about 5.34% of the local LA working-age population in 1935 and more than a fifth (22.5%) of the total internal immigration flow to LA between 1930 and 1940.

These outstanding magnitudes also explain why we focus on Los Angeles to study the housing consequences of climate-forced migration. Beyond the availability of detailed historical and geographical information about LA, its local housing market was more likely to feel the effects of a massive influx of climate migrants than anywhere in the country. The Chicago area was the second largest destination of Dust Bowlers, although Cook County, Illinois, received less than one-third as many immigrants. Naturally, the literature on the Dust Bowl migration has investigated the prominence of California as a destination. For instance, Long and Siu (2018) argues that the Californian "pull factor" was similar for Dust Bowlers and non-DB migrants. The strength of its pull factor is consistent with California's economic boom in the first half of the 20th century. This feature helps our empirical setting, as we benefit from the fact that the DB as a "push factor" is plausibly exogenous.

Despite the clear preponderance of Californian counties in the top 20 (e.g., Kern, San Diego, Tulare, Alameda, San Francisco, and Fresno), other locations on the West Coast (e.g., Denver, Colorado; Multnomah County, Oregon, in the Portland area; and King County, Washington in the Seattle area) and the American Midwest (Cook County, Illinois; Jackson County, Missouri, in the Kansas City area) also received a remarkable number of DB migrants.

We now focus on the geography of Dust Bowl migration within LA County. In both panels of Figure 3, we divide Los Angeles County into $(0.5)^2$-mile grids.[7] Panel A shows which areas of the county were more populated in 1930, before the arrival of DB migrants. Panel B shows the presence of DB families in 1940 as a share of total households in each grid-level neighborhood. Dust Bowl migrants found homes in virtually every part of LA County. Most neighborhoods had at least one head of household that came from Dust Bowl-affected areas, with a moderate concentration in neighborhoods close to the city center, where between 5 and 10% of the heads of household came from Dust Bowl-affected areas. Some neighborhoods had a concentration above 10% of Dust Bowl households, as represented by the yellow grids in Panel B. Interestingly, these high-share grid neighborhoods were located in low-density areas, distant from the city center, mainly in the North of Los Angeles.

3 Data

House-Level Information. Our paper is fundamentally based on the individual-level information on the Los Angeles population from the 1930 and 1940 U.S. censuses from the IPUMS Restricted Complete Count Data (Ruggles et al., 2020) and the Urban Transition Historical GIS Project from Logan et al. (2023). This rich micro-level information allows us to observe individual and household characteristics such as age, race, and ethnicity, among other demographic information. Most importantly, the census information allows us to precisely determine each person's address in 1940s Los Angeles. We limit our analysis to only heads of households not living in group quarters, and we assume that the head of household characteristics are representative of their household.

Studying the housing consequences of the arrival of Dust Bowl migrants in Los Angeles requires detailed information on houses before and after the event. One challenge is tracking houses across the two decennial censuses, which we handle using the automated matching algorithm to link addresses across the 1930 and 1940 Censuses from Cortes and Sant'Anna (2023). The technique is based on exact matches inspired by recent advances in the economic

[7] We detail the precise definition of grid-level neighborhoods in Section 3.

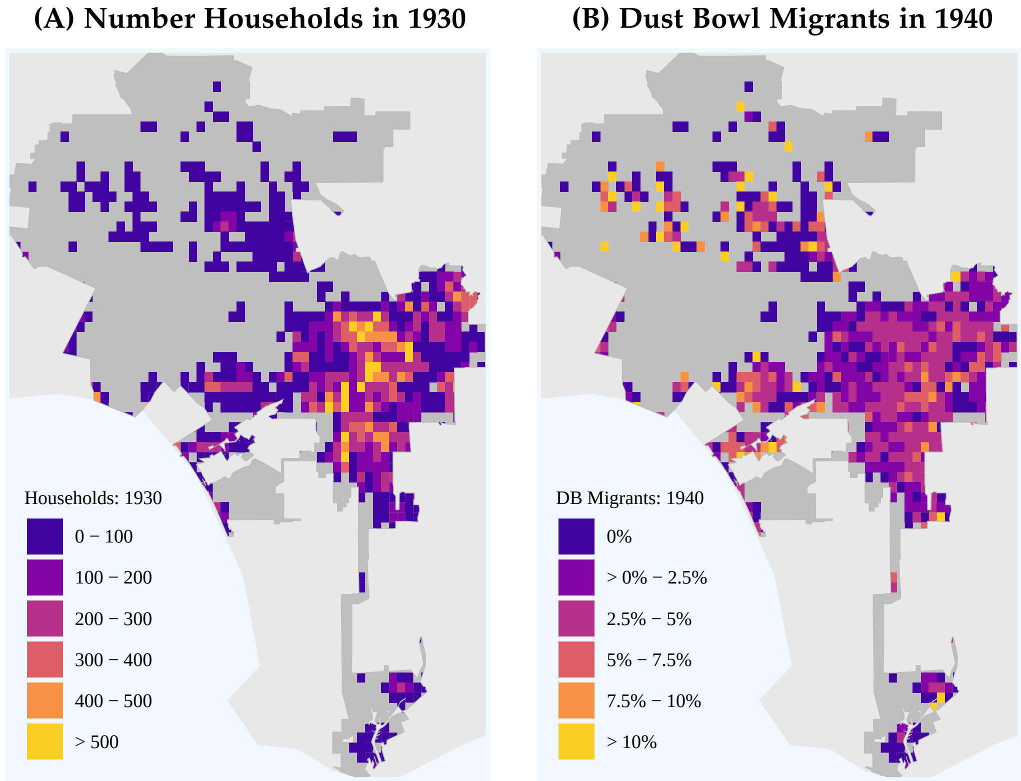

Figure 3. The Geography of Dust Bowl Migration to Los Angeles: Grid-Level Evidence. This figure provides maps of the geographic concentration of Dust Bowl migrants in Los Angeles. In both panels, grids have $(800)^2$ meters, which is approximately $(0.5)^2$ miles. Lighter colors represent higher numbers. Panel A shows the number of households in 1930 for each grid-level neighborhood. Panel B depicts the location of Dust Bowl migrants as a share of the grid-level population.

history literature that links *individuals* across censuses using their names (Abramitzky et al., 2012, 2014, 2021). Adapting this strategy to addresses, Cortes and Sant'Anna (2023) use a similar strategy to Akbar et al. (2022) and match addresses across censuses based on the state, city, street name, and house number as shown in the census records. Using this approach, we observe the evolution of house values, rents, and residents' characteristics in the exact same address over the ten years in Los Angeles.

We contribute to this literature by determining the latitude and longitudes of the addresses in the 1930s and 1940s Los Angeles. Appendix A presents the details of our geocoding approach. This novel information on the spatial position of the addresses allows us to perform spatial analysis and, most importantly, delineate consistent measures of neighborhoods across the two censuses that allow us to control for unobservable neighborhood characteristics and amenities. By combining these approaches, we obtain a sample of over 69,000 addresses that we can successfully link across the two censuses, observe their geolocation, and their information on values, rents, and resident characteristics.

Main Variables. Our main dependent variables are house values and the monthly rent paid by households in each address obtained from the Census data (Ruggles et al., 2020).[8] In the case of multi-family units, they represent the median value of the house or the median rent.

Our main explanatory variable indicates whether a given address was occupied by a migrant from the Dust Bowl area. We follow Hornbeck (2022) and define immigrants from the Dust Bowl areas as any household's head who declared to be living in 1935 in counties affected by the Dust Bowl. The Dust Bowl affected areas were defined as in Hornbeck (2012). We also define *other internal migrants* as any household head who declared living in any county other than the Dust Bowl areas in 1935.

In the case of multi-family addresses, we consider the address to have received Dust Bowl migrants if at least 5% of the household's head declared to be living in the Dust Bowl area in 1935. Other variables of interest include individual characteristics, such as gender, marital status, occupation, race, age, education, and country of origin. Again, in the case of multi-family units, these demographic characteristics represent shares of households in a given address.

Table 1 shows the descriptive statistics, comparing our sample of linked-geocoded addresses with the complete Census data and grouping observations into all residents, internal migrants (any U.S.-born from outside of Los Angeles county), and Dust Bowl migrants. It is important to notice that the linked-geocoded sample seems representative of the full count censuses. In panel A, the only important difference pertains to the share of Dust Bow migrants from low-erosion areas, which is underrepresented in the linked-geocoded sample. The share of homeowners and households living in multi-family units is also underrepresented, as displayed in panel B. Panel C shows that average rents are similar across samples, while average house prices diverge slightly.

[Insert Table 1 About Here]

Neighborhoods. Another challenge in studying the impacts of immigration on housing is to be able to measure neighborhood characteristics and amenities. To measure accurate neighborhood

[8] The U.S. censuses contain the reported amount of the household's monthly contract rent payment in dollars. It includes the amount for which the landlord expected to receive for the unit. This amount includes utilities, fuels, and other expenses only if they were included in the rental contract.

characteristics and map them into the census data, we adopt a strategy of using neighborhood-level fixed effects to account for non-observed characteristics that could be associated with housing variables and the location decision of Dust Bowl migrants.

One commonly adopted approach to delineate neighborhoods with historical census data is to use the enumeration districts available from the census data. An enumeration district is an area that an enumerator (census taker) could completely cover within two weeks in cities and four weeks in rural areas. We use information on enumeration districts geocoded from the Urban Transition Historical GIS Project from Logan et al. (2023).

There are at least two limitations in using enumeration districts as measures of neighborhoods in our setting. First, they comprise areas that are not consistent across censuses. Therefore, enumeration districts would limit our ability to directly assess the effects of the arrival of Dust Bowl migrants in the same neighborhood over time. Second, because these areas were tied to the houses that one enumerator could collect, the enumeration districts are highly inconsistent regarding their area. One enumeration district could encompass one or a few blocks for densely populated areas, while in less dense populated areas, it could encompass a large area. This size inconsistency also limits our ability to account for unobserved neighborhood amenities or other geographic characteristics using fixed effects, with likely more pronounced measurement errors in larger districts.

To address these issues and leverage our geocoded information on addresses, we define neighborhoods by splitting the city of Los Angeles into grid-cells of the same size, except in the border where the cell may be divided. We work with two grid-cell sizes. *grid-level neighborhoods* are defined as grid cells of 30 arc seconds, approximately one kilometer near the equator.[9] The size of the grid-level neighborhoods was chosen to match commonly used rasters, providing additional geographical information on the neighborhoods.[10] Figure 4 illustrates the area of a grid-level neighborhood. Using the linked, geocoded sample of addresses, we can determine the position of each address in each grid. When assessing the spillover effects, we consider sub-divisions of the grid-level neighborhood of 10 arc seconds or approximately 300 meters near the equator.

[9] In Los Angeles, 30 arc seconds is approximately 770 meters or 0.48 miles.

[10] For example, we obtain information about temperature and precipitation from rasters of the same size from PRISM Climate Group (2014).

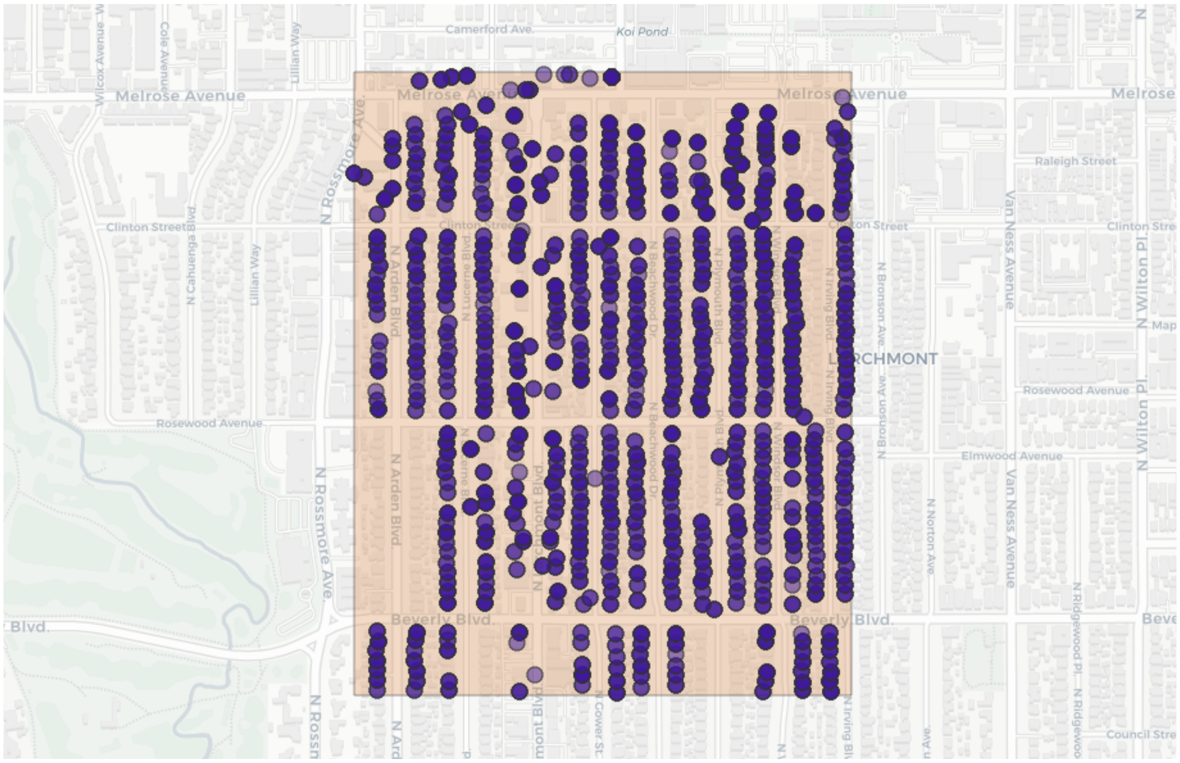

Figure 4. Geocoded Grid-Level Neighborhood Area. This figure shows an example of the area encompassing a grid-level neighborhood. The points represent the addresses in today's Los Angeles that we can successfully geocode from 1930.

4 Addresses Occupied by Dust Bowl Migrants

4.1 Address Selection

Before discussing the effects of Dust Bowl migration on housing variables, we study the correlation between treated addresses and their characteristics in 1930, including demographic information about the previous residents. In Figure 5, we plot the point estimate and 95% confidence intervals of linear regressions where one of the variables listed in the vertical axis is the response variable, and an indicator variable of either Dust Bowl migrants (Panel A) or other internal migrants (Panel B) residents is the explanatory variables.[11] Since the explanatory variables are binary, we can interpret these values as a test of mean differences.

The results suggest that many pre-existing characteristics of an address are associated with the presence of both types of internal migrants in 1940. Both types of internal migrants are positively correlated with the number of residents in the address, suggesting that they tend to occupy multi-family addresses. Addresses with a larger presence of US-born, white resi-

[11] For this figure only, the response variables are standardized.

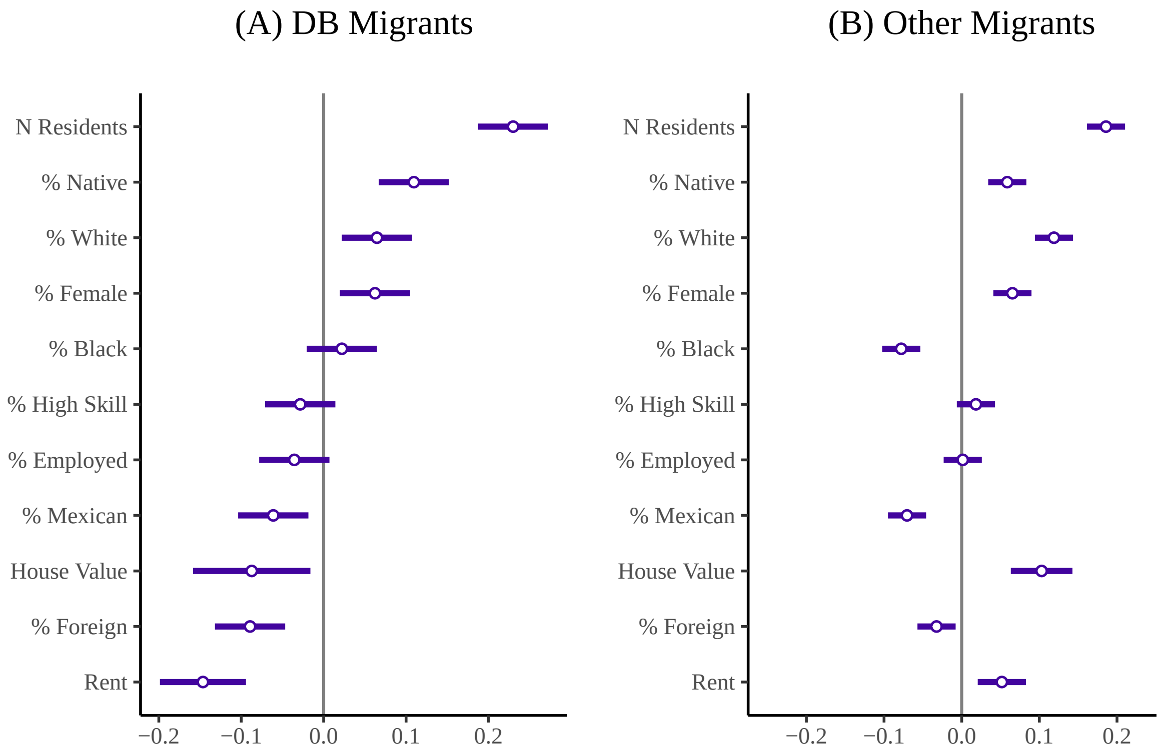

Figure 5. Correlations in Addresses Selected: Dust Bowl Migrants vs. Other Migrants. Panel A shows the correlations for Dust Bowl migrants. Panel B shows the correlation for Other Migrants.

dents, tend to be attractive to Dust Bowl and other internal migrants as well. Addresses with larger shares of Mexican immigrants or other foreign-born tend to be less likely to be inhabited by both types of internal migrants. This is an interesting pattern, suggesting that migrants don't seem to be "replacing" minorities.

The most striking difference between the two types of migrants is with respect to housing values and rents. Figure 5 shows that, while other internal migrants are associated with more expensive houses and higher rents, Dust Bowl migrants were likely to occupy addresses with lower rents or values, on average.

4.2 Dust Bowl Migrants and Housing Outcomes

Our first question is whether the presence of Dust Bowl migrants in an address influenced its value or rent evolution over the 1930s decade. We infer the marginal effect of Dust Bowl migrants on housing variables by estimating β in the following regression equation:

$$\Delta y_{i,n} = \alpha_n + \beta \cdot D_{i,n} + \gamma' X_{i,n,1930} + \epsilon_{i,n}. \tag{1}$$

The dependent variable $\Delta y_{i,n}$ is the change in the logarithm of the housing variable in address i in neighborhood n between 1930 and 1940. The estimates are potentially conditional on neighborhood fixed effect (α_n) and address pre-treatment characteristics ($X_{i,n,1930}$). The variable $D_{i,n}$ indicates if the head of the household was living in a Dust Bowl county in 1935.

The unbiased estimation of β must satisfy the conditional independence assumption $(D_{i,n} \perp\!\!\!\perp \epsilon_{i,n}) \mid X_{i,n,1930}$, where $X_{i,n,1930}$ includes the characteristics of the head of the household (high skill, married, single, employed, female, white, black, foreign, Mexican), median age, number of residents, and the dependent variable in 1930. In other words, we need the evolution of housing variables not correlated with any other variable affecting the housing choices of Dust Bowl migrants beyond the pre-existing conditions $X_{i,n,1930}$. One common source of concern is that individuals' housing choices are often associated with neighborhood characteristics and amenities that are not observable. To overcome this issue, we allow α_n to be neighborhood-specific so that our coefficients provide within-neighborhood estimates. In this case, the conditional independence assumption is more plausible since, within neighborhoods, there is a limited pool of houses individuals can choose from. In addition, observations are expected to be spatially correlated. Therefore, we present standard errors clustered at the grid-level neighborhood.

The main results are presented in Table 2. Column (1) is a simple OLS estimate of β. Column (2) controls for pre-treatment address characteristics, while columns (3) and (4) add neighborhood fixed effects, as measured by the grid-level neighborhoods or enumeration districts, respectively. Columns (5) to (8) repeat the specifications in Columns (1) to (4) but restrict the sample to internal migrants.

The results show that addresses with similar pre-treatment conditions that received Dust Bowl migrants observed lower growth rates in both prices and rent throughout the decade. One possible explanation for these results is that Dust Bowl migrants self-selected into neighborhoods where amenities worsened throughout the decade. Previous studies have shown that displaced migrants tend to move to poorer neighborhoods (Desmond and Shollenberger, 2015). Nonetheless, columns (3) and (4) show that this effect is observed even within neighborhoods. In other words, Dust Bowl migrants lived in units whose values and rents had lower growth rates relative to other residents within the same neighborhood.

In particular, receiving a Dust Bowl family reduced the growth rate of house prices by about eight p.p. in the decade, whereas the growth rate of rents diminished by three p.p. in the decade. When we restrict the sample to only internal migrants, the effect on rents is even stronger, while the effect on house values is weaker and not statically different from zero. It is also important to highlight that our results are similar across the two specifications that use different neighborhood definitions, namely the grid-level neighborhood and the enumeration district.

[INSERT TABLE 2 ABOUT HERE]

4.3 Distance to Dust Bowl Migrants and Housing Outcomes

The results from Section 4.2 show that the presence of Dust Bowl migrants was associated with a lower growth rate of house values and rents. One natural follow-up question is whether the presence of Dust Bowl migrants also influenced the evolution of house prices of incumbent non-migrant Angelinos.

To test this, we leverage the geocoded address sample and compute the average distance to Dust Bowl families for each address with only non-migrant households. The idea is to test whether the evolution of incumbent residents' house prices was affected depending on how close they were to Dust Bowl migrants. The strategy is to estimate the parameters in a linear regression similar to Equation (1) where the explanatory variable is the average distance to Dust Bowl migrants (in log) in a sample with only non-migrants households.

$$\Delta y_{i,n} = \alpha_n + \beta \cdot Distance_{i,n} + \gamma' X_{i,n,1930} + \epsilon_{i,n}. \tag{2}$$

The dependent variable $\Delta y_{i,n}$ is the change in the logarithm of the housing value or rent in address i in neighborhood n between 1930 and 1940. The variable $Distance_{i,n}$ indicates the log average distance to Dust Bowl families of house i. The rest of the variables are defined as before. We restricted the sample to houses that were inhabited solely by non-migrant families.

The results are presented in Table 3. Columns (1) to (3) use the log difference of house values between 1930 and 1940, while columns (4) to (6) use the log difference of rents between the decade. We include the grid-level neighborhood fixed effects in all specifications. We find that the proximity to Dust Bowl migrants is associated with lower growth rates in house values. More specifically, we find that on average, addresses of incumbent Angelinos that were farther to Dust Bowl families by 1 percent had a 1.3 p.p. higher growth rate in the decade. It is important to stress that the estimated effects are within the neighborhood, such that neighborhood selection is not biasing our estimates. The estimates for rents are not statistically significant.

[INSERT TABLE 3 ABOUT HERE]

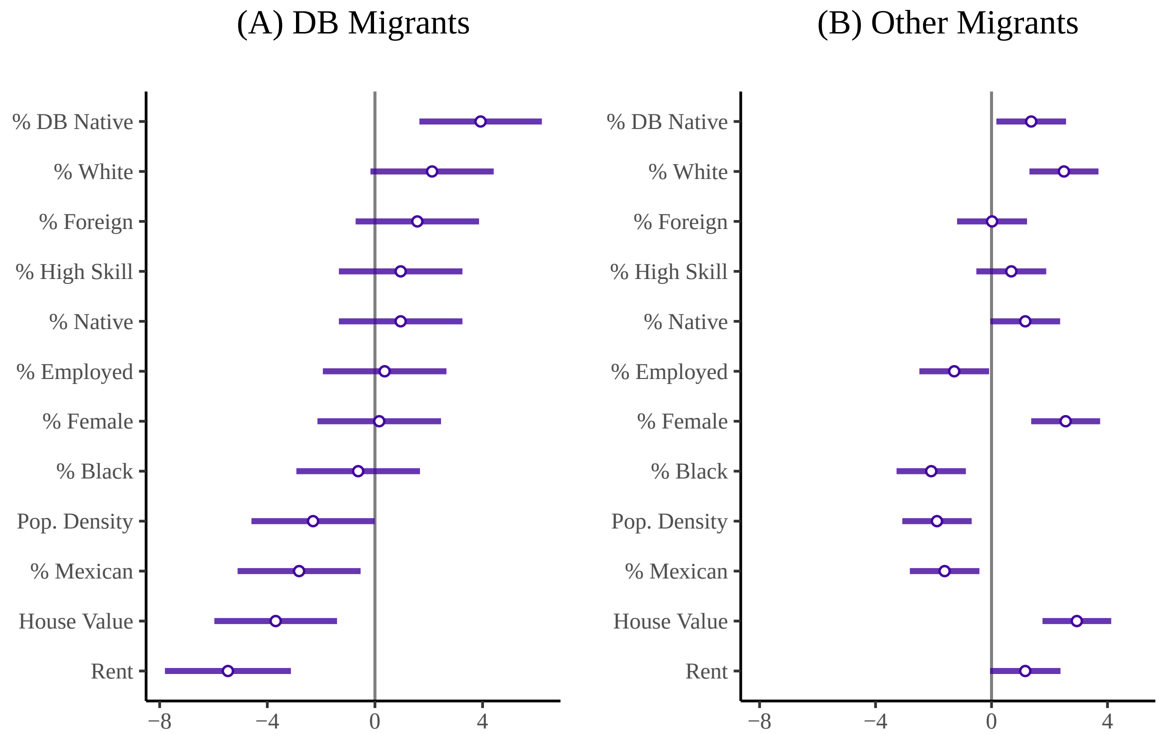

Figure 6. Correlations in grid-level neighborhoods: Dust Bowl Migrants vs. Other Migrants. Panel A shows the correlations for Dust Bowl migrants. Panel B shows the correlation for Other Migrants.

5 Neighborhood-level Results

5.1 Neighborhood Selection

Next, we examine how the arrival of Dust Bowl migrants affected neighborhoods. Before estimating marginal effects on neighborhood variables, we present the correlation between Dust Bowl migration and these variables before the natural disaster as in Section 4.1. At the neighborhood level, we adopt a measure for the presence of Dust Bowl migrants as a continuous variable: the share of household heads from the Dust Bowl area among all households in a given neighborhood.

Correlations presented in Figure 6 indicate a similar pattern to the one observed at the address level in Section 4.1. Areas that received more Dust Bowl migrants had lower house values and rents in 1930, on average. The opposite is observed in areas that received more migrants from other regions. The remaining variables present similar patterns between both types of migrants: they tend to select neighborhoods with more native, female, white, and unemployed household' heads, and less dense areas. One important characteristic is the share of household's heads that were born in states that would later be affected by the Dust Bowl. Dust Bowl and other migrants were both more likely to move to areas with more Dust Bowl natives.

5.2 The Impact of Dust Bowl Migration on Neighborhoods

In this section, we estimate the marginal effect of receiving more Dust Bowl migrants on the evolution of housing variables across neighborhoods. The regression analysis is similar to the one performed in Section 4.2. We estimate the following equation:

$$\Delta y_n = \alpha + \beta \cdot D_n + \gamma' X_{n,1930} + \epsilon_n. \tag{3}$$

The dependent variable $\Delta y_{i,n}$ is the change in the logarithm of the mean housing outcome variable in neighborhood n between 1930 and 1940. The pre-treatment characteristics are at the neighborhood ($X_{n,1930}$) and include average temperature, precipitation, elevation, distance to the coast, the log of population density, and the share of high-skill, married, single, employed, female, white, black, foreign, Mexican, and other internal migrants as control variables. The variable D_n is a continuous variable representing the share of Dust Bowl migrants among the household heads that lived in the neighborhood n. Finally, $X_{i,n}$ now includes the

The results are presented in Table 4. Columns (1) to (4) pertain to estimations at the sub-division level, whereas Columns (5) to (8) pertain to grid-level neighborhoods. Standard errors are clustered using Conley (1999) in all specifications. In all columns, observations are weighted by the number of families in each neighborhood, except in columns (4) and (8), where we use the inverse probability weighting, where the propensity score is computed using the control variables included in $X_{i,t}$. Specifically, we use the algorithm proposed by Zhu et al. (2015) since our treatment variable is continuous.

[Insert Table 4 About Here]

Estimates in Table 4 suggest a robust negative association between the presence of Dust Bowl migrants and housing price growth. The same is true with regard to rents, although the effects are smaller and not statistically significant when using the inverse probability weighting. From column (3), we find that a 10 p.p. increase in the share of Dust Bowl migrants reduces the growth rate in house prices at a sub-division by about 0.15 p.p. over the decade on average. The same increase in the share of Dust Bowl migrants reduced the growth rate of rents by about 0.07 p.p.

on average over the decade. Results at the grid-level neighborhood are similar. Column (7) shows that a 10 p.p. increase in the share of Dust Bowl migrants reduces the growth rate in house prices by about 0.17 p.p. and reduces the growth rate in rents by about 0.13 p.p. on average.

In columns (4) and (8), we use the inverse probability weighting procedure from Zhu et al. (2015) as an alternative approach to address endogeneity concerns. We find that a 10 p.p. increase in the share of Dust Bowl migrants reduces the growth rate in house prices between 0.11 p.p. and 0.18 depending on whether we are using sub-divisions or grid-level neighborhoods. We do not find a statistically significant coefficient for rents.

6 Robustness and Extensions

In this section, we delve deeper into the robustness of our main findings through a series of alternative estimation approaches. The robustness checks are crucial in demonstrating the validity of our conclusions.

We begin by revisiting the specification from Columns (3) and (6) of Table 2. In Columns (1) and (4) of Table 5, we employ the Doubly Robust estimator proposed by Sant'Anna and Zhao (2020). This approach recognizes that, when $\alpha_n = \alpha$ for n, the estimation of β in Equation (1) is the difference-and-difference estimator with control variables. The Doubly Robust (DR) estimator is valuable in our context since it produces consistent estimates for the ATT, while alleviating some concerns from potential model misspecifications. When using the DR estimator, our results are very similar from Table 2, but with slightly larger magnitudes.

Hornbeck (2012) and Hornbeck (2022) show that the level of soil erosion of the areas from which Dust Bowl migrants fled was an important measure of the intensity of the natural disaster, which had important implications. For instance, Hornbeck (2022) shows that people who migrated from the areas with higher erosion levels had fewer years of education than other migrants. Considering the existing evidence that migrants from the more eroded areas could be different in some dimensions, we estimate an alternative to Equation (1), where we replace the dummy variable for migrants from the entire Dust Bowl area with another dummy variable that equals one if the family migrated from the counties with medium or high erosion levels as measured by Hornbeck (2012). Columns (2) and (5) of Table 5 presents the results. We find that receiving a Dust Bowl family from medium-high erosion areas reduced the growth rate of house prices by about eleven p.p. in the decade relative to other similar families in the same neighborhood. The coefficient for rents, however, is only statistically significant in column (5), when the reference group is the other internal migrants.

Another robustness test we perform is to use Conley standard errors instead of clusters by neighborhood (Conley, 1999). With clustered standard errors, we assume that model errors are uncorrelated across neighborhoods. This may not be a plausible assumption, especially considering our setting where we estimate effects on housing. To address this, we use Conley (1999) standard errors that provide a robust variance matrix estimate in the presence of spatial correlation. Columns (3) and (6) form Table 5 repeat the point estimates from Table 2 with Conley standard errors. We conclude that the results are robust even after accounting for spatial correlation.

[Insert Table 5 About Here]

In Table 6, we repeat the neighborhood level analysis but use the percentile of neighborhoods in terms of house values and rents. This variable indicates the share of houses with values or rents below a given unit. For example, if a house is in the percentile rank 0.8 with respect to values, 80% of the houses have a value below that house. The results show that neighborhoods that received more Dust Bowl migrants fell in the ranking. Specifically, looking at Column (2), an increase in 10 p.p. in the share of Dust Bowl migrants decreases the position in the value ranking by 0.06 p.p, while the position in the rent ranking declined by 0.1 percentage points.

[Insert Table 6 About Here]

7 Concluding Remarks

In this paper, we estimate the effect of the inflow of Dust Bowl migrants on the Los Angeles housing market during the 1930s. Our research delves into the complexities of how a significant influx of migrants, displaced by a major natural disaster, can shape the dynamics of housing markets in their destination cities. Utilizing detailed address-level historical data, we are able to assess, within neighborhoods, the direct effect on properties occupied by Dust Bowl migrants and broader effects on the surrounding areas.

Our findings reveal a clear pattern of decreased growth in house values and rents in properties occupied by Dust Bowl migrants compared to other residences in the same neighborhoods. This decrease was not limited to the migrant-occupied properties but also extended to the neighborhoods with higher migrant populations. Furthermore, we find that homes occupied by non-migrants, but located more distant from Dust Bowl migrant families, experienced a relative higher growth in their value. This suggests a marked preference among local residents to distance themselves from the migrants, reflecting deeper social and economic ramifications of this migration wave. Overall, our findings provide insights into the housing market consequences of the arrival of Dust Bowl migrants during the Great Depression era.

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Tables

Table 1. Descriptive Statistics. This table displays summary statistics for all residents and different breakdowns of migrants, non-migrants, and Dust Bowl migrants. Panel A compares the full count census with our linked sample of houses. Panel B shows how the characteristics of individuals varied by conditioning on different samples. Panel C focuses on the house characteristics of different samples.

Variables	Count	Mean	Std. Dev.	Min	Max
Migration and Population Movement					
DB Migrants	69,492	0.09	0.27	0.00	1.00
Other Internal Migrants	69,492	0.10	0.30	0.00	1.00
Housing Outcomes					
Δ Value	24,498	-0.74	0.74	-8.40	6.16
Δ Rent	25,364	-0.42	0.73	-7.69	6.55
Value 1930 ('000 1930 $)	35,654	690.01	965.49	0.67	49,983.08
Rent 1930 ('000 1930 $)	33,627	5.46	35.50	0.17	832.75
Employment and Skill Level Shares					
High Skill 1930	69,492	0.54	0.48	0.00	1.00
Employed 1930	69,492	0.76	0.41	0.00	1.00
Ethnicity and Nationality Shares					
White 1930	69,492	0.94	0.24	0.00	1.00
Black 1930	69,492	0.02	0.14	0.00	1.00
Native 1930	69,492	0.74	0.43	0.00	1.00
Foreign 1930	69,492	0.23	0.41	0.00	1.00
Mexican 1930	69,492	0.03	0.17	0.00	1.00
Address Characteristics					
N. Families 1930	69,492	1.27	2.05	1.00	246.00

Table 2. Effects of Dust Bowl Migration in Houses Values and Rents. Robust standard errors clustered at the level of macro-neighborhoods in parentheses. Housing controls include the indicator variables for high skill, married, single, employed, female, white, black, foreign, Mexican and the log of number of residents and the initial dependent variable in 1930. * p < 0.10, ** p < 0.05, *** p < 0.01

	Full Sample				Only Migrants			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - Dependent Variable: Δ log(House Values)								
Dust Bowl Migrant	–0.043	–0.099**	–0.082*	–0.078*	0.048	–0.040	–0.029	0.033
	(0.065)	(0.050)	(0.047)	(0.047)	(0.071)	(0.054)	(0.073)	(0.063)
Observations	24,498	24,498	24,498	24,498	1,167	1,167	1,167	1,167
Dep. Var. mean	–0.74	–0.74	–0.74	–0.74	–0.82	–0.82	–0.82	–0.82
Cluster Groups	837	837	837	837	445	445	445	445
Panel B - Dependent Variable: Δ log(Rents)								
Dust Bowl Migrant	0.032	–0.044***	–0.029**	–0.025*	0.013	–0.072***	–0.048***	–0.035**
	(0.020)	(0.015)	(0.014)	(0.014)	(0.022)	(0.016)	(0.017)	(0.017)
Observations	25,364	25,364	25,364	25,364	5,318	5,318	5,318	5,318
Dep. Var. Mean	–0.42	–0.42	–0.42	–0.42	–0.4	–0.4	–0.4	–0.4
Cluster Groups	703	703	703	703	545	545	545	545
Controls		✓	✓	✓		✓	✓	✓
Grid-Neighborhood FE			✓				✓	
Enum. District FE				✓				✓

Table 3. Distance to Dust Bowl families and Housing Prices. Robust standard errors clustered at the level of grid-level neighborhoods in parentheses. Pre-conditions controls include the indicator variables for high skill, married, single, employed, female, white, black, foreign, Mexican and the log of number of residents in 1930. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	Δ log(House Values)			Δ log(Rents)		
	(1)	(2)	(3)	(4)	(5)	(6)
log(Avg. Distance to Dust Bowl migrants)	1.32*	1.38***	1.33**	0.305	-0.104	-0.138
	(0.709)	(0.525)	(0.519)	(0.817)	(0.561)	(0.556)
Observations	23,331	23,331	23,331	20,046	20,046	20,046
Dep. Var. mean	-0.73	-0.73	-0.73	-0.43	-0.43	-0.43
Cluster Groups	830	830	830	668	668	668
Controls:						
Initial y		✓	✓		✓	✓
Pre-Conditions			✓			✓
Grid-Neighborhood FE	✓	✓	✓	✓	✓	✓

Table 4. Spillover Effects of Dust Bowl Migration at the Neighborhood Level. Robust standard errors clustered at the level of grid-neighborhoods in parentheses Columns (1) to (4). Conley standard errors in Columns (5) to (8). Geography controls include average temperature, precipitation, elevation, and distance to the coast. Neighborhood characteristics controls include the share of high skill, married, single, employed, female, white, black, foreign, Mexican, and the log of population density in 1930. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	Sub-Division				Grid-Neighborhood			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - Dependent Variable: House Values								
Share of Dust Bowl Migrants	–1.67***	–1.63***	–1.45***	–1.14*	–2.78***	–2.81***	–1.67***	–1.80*
	(0.574)	(0.487)	(0.427)	(0.661)	(1.07)	(0.951)	(0.548)	(0.938)
Observations	2,795	2,795	2,795	2,674	699	699	699	672
Dep. Var. mean	–0.8	–0.8	–0.8	–0.81	–0.72	–0.72	–0.72	–0.73
Panel B - Dependent Variable: Rents								
Share of Dust Bowl Migrants	–0.498**	–0.540***	–0.664***	–0.0004	–0.778	–0.931**	–1.27***	–0.545
	(0.196)	(0.156)	(0.152)	(0.302)	(0.573)	(0.436)	(0.379)	(0.693)
Observations	2,809	2,809	2,809	2,674	688	688	688	672
Dep. Var. mean	–0.34	–0.34	–0.34	–0.34	–0.31	–0.31	–0.31	–0.31
Weights:	N Families	N Families	N Families	IPW	N Families	N Families	N Families	IPW
Controls:								
Initial y	✓	✓	✓		✓	✓	✓	
Geography		✓	✓			✓	✓	
Neighborhood Characteristics			✓				✓	

Table 5. Robustness to Alternative Estimations. Robust standard errors clustered at the level of macro-neighborhoods in parentheses, except in Columns (3) and (6) where Conley standard errors are presented. All columns control for pre-conditions and include macro-neighborhood fixed effects. * p < 0.10, ** p < 0.05, *** p < 0.01

	Full Sample			Only Migrants		
	(1)	(2)	(3)	(4)	(5)	(6)
	DR	HM	Conley	DR	HM	Conley
Panel A - Dependent Variable: Δ log(House Values)						
Dust Bowl Migrant	-0.102**	-0.111**	-0.082*	-0.048	-0.108	-0.029
	(0.049)	(0.055)	(0.050)	(0.055)	(0.068)	(0.089)
Panel B - Dependent Variable: Δ log(Rent)						
Dust Bowl Migrant	-0.043***	-0.033	-0.029**	-0.066***	-0.040*	-0.048***
	(0.014)	(0.020)	(0.014)	(0.016)	(0.023)	(0.017)

Table 6. Robustness: Percentile Ranking. Robust standard errors clustered at the level of macro-neighborhoods in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

	Sub-Division		Grid-Level Neighborhood	
	(1)	(2)	(3)	(4)
Panel A - Dependent Variable: House Values				
Share of Dust Bowl Migrants	-0.430***	-0.643***	-0.539	-1.06**
	(0.156)	(0.146)	(0.452)	(0.492)
Observations	2,795	2,795	699	699
Panel B - Dependent Variable: Rents				
Share of Dust Bowl Migrants	-0.090	-0.346***	-0.226	-0.864***
	(0.092)	(0.091)	(0.312)	(0.286)
Observations	2,809	2,809	688	688
Controls:				
Initial y		✓		✓
Geography	✓	✓	✓	✓
Neighborhood Characteristics	✓	✓	✓	✓

Internet Appendix to
"Finding Home When Disaster Strikes: Dust Bowl Migration and Housing in Los Angeles"

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Appendix A Geocoding and Address Linking Methods

In this section, we describe the procedure for geocoding property addresses from 1930 and 1940.

We use geographic information on the addresses in Los Angeles in 1930 and 1940 from the Urban Transition Historical GIS Project from Logan et al. (2023). We complement the existing data by geocoding the addresses. To perform the geocoding of addresses, we use the *tidy-geocoder* R package and search for the 1930 and 1940 addresses using the ArcGIS and Open Street Maps services. After collecting the latitudes and longitudes of each address, we then eliminate from the sample all the addresses for which the distance between the coordinates obtained from each method exceeds 100 meters.

Using this methodology, we are able to retrieve coordinates for a substantial number of the addresses. For 1940, we are able to geocode 64.24% of identifiable addresses, which were inhabited by 66.05% of individuals living in identifiable homes or 56.71% of total individuals from Los Angeles. For 1930, we geocoded 65.37% of identifiable addresses, which were inhabited by 63.96% of individuals living in identifiable homes or 62.46% of total individuals from Los Angeles.

In the next step, we combine the sample of geocoded addresses with the sample of addresses that we can link between the two censuses, using the linking algorithm from Cortes and Sant'Anna (2023). From this, we obtain 47,852 addresses that we can link and geocode. We then complement this sample by inputting the latitude-longitude from either year for the cases when we only obtain the coordinates in one census but not the other. This is primarily due to inconsistencies in how the address is written in each census. This procedure increases the number of addresses with complete latitude and longitude information to 69,492.

Table A.1 displays means and number of observations of several variables used in our empirical analysis for the full-count 1940 Census *vis-à-vis* our linked and geocoded sample. We also present mean differences in column (5), showing that the differences are relatively small.

Table A.1. Sample Comparison: Full Count *vs.* Linked Address Samples. This table displays means and observation counts for the 1940 Full-Count Census and the Address-Linked sample using the house-linking algorithm developed in Cortes and Sant'Anna (2023).

	Linked Sample		Full Count Sample		Full – Linked
	N	Mean	N	Mean	ΔMean: (4) − (2)
	(1)	(2)	(3)	(4)	(5)
Other Internal Migrants	69,492	0.10	452,732	0.14	0.04
DB Migrants	69,492	0.03	452,732	0.04	0.01
Female	69,492	0.21	452,732	0.22	0.01
Single	69,492	0.06	452,732	0.10	0.04
White	69,492	0.96	452,732	0.94	-0.02
Age	69,492	48.42	452,732	46.51	-1.91
Employed	69,492	0.66	452,732	0.69	0.03
House Value (1940 $)	34,179	4,133.05	164,217	4,854.94	721.89
Rent Value (1940 $)	37,035	52.07	258,383	56.94	4.86