

Lending in the Modern Era: Does Racial Composition of Neighborhoods Matter When Individuals Seek Home Financing? A Pilot Study in New England

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This article explores the relationship between racial composition of neighborhoods and approval and origination of mortgages. It measures independent *neighborhood* effects, above and beyond applicant race effects preceding the recent housing market crisis for rental and owner-occupied homes. Mortgage applications are selected from the dozen most populated metropolitan areas in New England. Applications are linked to corresponding neighborhood data and generalized linear mixed modeling is applied. Data include prehousing market crash Housing Mortgage Disclosure Act data matched to American Community Survey 5-year data for over one million applications. Findings indicate, although controlling for income, gender, and race of the applicant, poverty and tenure, and additional socioeconomic variables, *neighborhood racial composition* has a statistically significant effect on whether mortgages are approved and originated. Minority presence is correlated with a negative effect on mortgage origination regardless of race of the individual loan applicant. More specifically, whites' applications are also turned down in minority neighborhoods, especially black neighborhoods.

INTRODUCTION

The recent housing foreclosure crisis warrants further investigation into lending practices and the criteria by which mortgage credit is issued (Rugh and Massey, 2010). Research is lacking on the mortgage crisis at the neighborhood level (Vesselinov and Beveridge, 2011). Minority neighborhoods were disproportionately affected by the housing market crash, meriting inquiry into lending patterns leading up to this tumultuous economic period (Spader and Quercia, 2008; Vesselinov and Beveridge, 2011). Owners residing in minority neighborhoods, particularly those with large black and Hispanic populations, have been damaged by the crisis more so than owners in white neighborhoods (Hernandez, 2009; Vesselinov and Beveridge, 2011). Neighborhood racial composition may have had a significant role in the housing market crash (Been et al., 2009; Vesselinov and Beveridge, 2011). This study examines the relationship between neighborhood racial composition and mortgage origination preceding the housing market crash.

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Origination is the step in the complex mortgage lending process where the loan has been approved by the lending entity, accepted by the applicant, and funded. Allegations of racial discrimination suggest neighborhood disparities in mortgage loan origination should be examined and the growth of new and specialized datasets allow for more accurate analyses (Berkovec et al., 1994). Developments in securitization and exotic loan products suggest minorities and minority neighborhoods may have become more desirable clients during the housing market crisis compared to previous years (Immergluck, 2009; Rugh and Massey, 2010).

This study examines mortgage lending in the New England region of the Northeast United States. This region encompasses three of the four most densely populated states in the country (U.S. Census Bureau, 2010). The Northeast has been previously examined for ecological neighborhood patterns as one of the four main Census regions (South and Crowder, 1997). Neighborhood theorists generally agree that the Northeast is home to some of the most racially unequal neighborhoods, in which segregation has stubbornly persisted (Adelman, 2004; Farley and Frey, 1994; Massey, 1990; Timberlake, 2002; Wilkes and Iceland, 2004). But neighborhood level research in the Northeast region has focused on the New York area, excluding the New England region (e.g., Furman Center, 2010; Madar and Glasshauser, 2011; Schuetz et al., 2008). This research fills that gap by examining whether neighborhood racial composition has a negative effect on mortgage origination in the New England region of the Northeast. The Northeast and the Midwest have typically been compared for their housing regulations, that is, zoning ordinances, restrictive covenants, land use regulations (Iceland and Nelson, 2008; South and Crowder, 1997), restricted housing options in disadvantaged areas (South and Crowder, 1997), more established residential patterns (Iceland and Nelson, 2008), and high levels of segregation (Adelman, 2004; Farley and Frey, 1994; Iceland and Nelson, 2008; Iceland and Wilkes, 2006; Massey, 1990; Timberlake, 2002; Wilkes and Iceland, 2004). For these reasons, the results of this analysis suggest similar patterns could be found in the Midwest.

THEORY

The theoretical basis for this study is grounded in institutional lending practices. Despite the housing boom and growth of innovative lending instruments such as “no down payment loans” of the early 21st century, I hypothesize that minority neighborhoods, particularly predominantly black neighborhoods, experienced difficulty originating mortgages based on persistent institutional practices. I expect the negative minority neighborhood effect will be apparent above and beyond individual applicant race effects because of the severe institutional discrimination against investment in minority neighborhoods.

Institutional discrimination occurs when organizations such as the federal government, real estate agencies, and banks, follow practices which categorically exclude, harm, or disadvantage minorities (Massey and Denton, 1993). These actions can manifest as intentional or unconscious discrimination (Feagin and Sikes 1995; Immergluck 2004). It can occur on a local level in the form of zoning restrictions and on a national level in the form of federal housing policies which discourage investment in predominantly minority cities although encouraging it in predominantly white suburbs (Shapiro 2004; Oliver and Shapiro 1995). Institutional discrimination has helped maintain separate and

unequal neighborhoods for whites and minorities by encouraging lending only to applicants whose race matched that of the neighborhood, steering minorities out of white communities, promoting white flight, limiting investment in black neighborhoods, redlining, statistical discrimination, segregation, and other forms of lending discrimination (Galster 1990; Immergluck 2009; Massey and Denton 1993; Oliver and Shapiro 1995; Ross and Yinger 2002). The Federal Reserve cites racial steering and borrowers' limited choices of mainstream lenders in minority neighborhoods among the top reasons for the ecological relationship between individual homebuyers, financial institutions, and neighborhood level lending disparities (Federal Reserve 2005, 2006, 2009).

Racial disparities in access to homeownership and fair credit have been well documented (e.g., Bianchi et al. 1982; Calem, Gillen, & Wachter 2004; Hill 2005; Reid 2005; Spader and Quercia 2008; Vesselinov and Beveridge 2011; Wachter and Megbolugbe 1992). Historically minority neighborhoods have been denied loan applications because of supposed inherent risk (Immergluck 2004; Massey and Denton 1993; Wilson and Taub 2006) and minority neighborhoods or those presumed to become minority over time have been regarded as undesirable by organizations integral to the housing market such as the Federal Housing Authority (FHA, Oliver and Shapiro 1995). Even without conscious racial intent, racial disparities manifest themselves under the *cultural affinity* model, which suggests white brokers are more likely to trust white borrowers and encourage them to provide compensating information to supplement holes in their mortgage applications while holding minorities to rigidly standard guidelines (Holloway 1998; Hunter and Walker 1995). Restrictive covenants and zoning regulations favoring single-family over multifamily units further establish rigid guidelines that adversely impact many minority urban neighborhoods (Squires and O'Connor 2001).

MINORITY NEIGHBORHOODS AND LENDING PRACTICES

Historically, housing policies have been tied to the concentration of minorities, particularly blacks, in highly segregated and impoverished areas (Carr and Kutty 2008; Immergluck 2009; Massey and Denton 1993; Massey and Kanaiaupuni 1993; Squires et al. 2009; Wilson 1997). Presently, if racial composition has a significant effect on the outcome of a mortgage application, when income and other economic and housing variables are controlled for, it is subject to analysis for possible discriminatory bias under the Fair Housing Act of 1968 (Massey and Denton 1993; Immergluck 2004). The large majority of mortgage applications, regardless of applicant race, fail to meet at least one of the secondary market standards, such as debt-to-income ratio (Munnell et al. 1996).¹ Subsequently, lenders have considerable discretion in deciding how they compensate for these failings, affording the opportunity for subjective insight and, in some instances, discrimination (Munnell et al. 1996).

The Housing Mortgage Disclosure Act (HMDA) mandates certain lending institutions report individual application data from all mortgages (FFIEC 2009a; b). HMDA (1975) was created in part to alleviate the unequal credit distribution between racial groups (Immergluck 2009; Squires et al. 2009). HMDA data can help uncover whether discriminatory lending patterns *may* exist. Analysis of HMDA data is often the first step leading to more in-depth evaluations to determine if unlawful discrimination occurred. The data also provide the government with the opportunity to locate high need areas for which

they may encourage private investment to fill this void. HMDA is one of the richest samples of domestic loan applications publicly available in the United States (Immergluck 2004; Immergluck 2009). HMDA data have allowed for researchers to demonstrate that minority neighborhoods continue to be undercapitalized relative to financially similar white neighborhoods (Rugh and Massey 2010).

Higher minority population is related to higher vacancy rates, fewer large homes, and a higher share of relatively old and structurally inadequate homes (Bianchi et al. 1982; Flippen 2004). Flippen (2004) finds that a high proportion of blacks in neighborhoods depresses home values beyond the association with poverty. Both the mean and median values of minority homes are lower than those of whites. Minority homeowners experience more difficulty acquiring initial home equity and recovering accumulated equity than do white homeowners (Bianchi et al. 1982; Flippen 2004; Hill 2005). These outcomes may factor into the mortgage market, influencing lenders' decisions to invest in minority neighborhoods. Borrowers in black neighborhoods and loans made in them carry significantly worse unobserved neighborhood characteristics than those in predominantly nonblack neighborhoods. Chan et al. (2010) correlate these characteristics with the tendency of lending institutions (brokers, lenders, underwriters) to treat black neighborhoods differently than nonblack neighborhoods.

In terms of understanding lending as a social process, disentangling discrimination from market factors is a complicated feat. Neighborhood racial composition may be a latent factor in a purchaser's decision of where to buy their home or a lender's decision to deny a loan. Deteriorating properties and lack of pride in home ownership is often cited as a reason why lenders deny loans in minority neighborhoods (Oliver and Shapiro 1995). It is difficult to quantify these characteristics, such as housing stock condition and "pride" in ownership, and therefore hard to disentangle any possible discrimination with tangible reasoning for lack of investment. Mortgages are supposed to be offered on the basis of economic criteria that determine risk, such as income and property appreciation assessments. If an extraordinary amount of risk is determined for minority neighborhoods beyond any realized, actual economic risk, a lender can be held liable for illegal bias. Unfortunately, the history of US banking and credit markets is saturated with systematic exclusion and segmentation based on race and geography (Immergluck 2004).

This study examines owner-occupied and rental mortgage applications. This is an important contribution because neighborhoods, particularly those with sizable minority populations, include numerous homes that are not owner-occupied, in which the landlord's race may not match that of the neighborhood. This is particularly the case in urban areas in which owner occupancy rates fall well under 50 percent. Whites are significantly more likely to own homes than blacks (Hill 2005). Blacks are only about 60 percent as likely as non-Hispanic whites to own their home² (U.S. Dept. of Commerce 2011). Little research has focused on the neighborhood racial composition of where minorities settle (Friedman and Squires 2005). In an analysis of conventional home purchase loans in over 100 metro areas, Friedman and Squires (2005) found whites not only accounted for the majority of loans made in white neighborhoods, but whites also purchased homes in *racially integrated* neighborhoods more frequently than minorities. Although whites did make home purchases in *predominantly minority* neighborhoods, minorities accounted for more of the conventional home loans than whites.

Residents of predominantly minority neighborhoods are more likely to receive subprime loans than their white counterparts (Calem, Hershaff, & Wachter 2004) and the predatory nature of such loans undermines the revitalization of these neighborhoods (Calem, Gillen, & Wachter 2004). Because of the incentive structure by which brokers earn larger profits off of loans with higher interest rates, and hidden fees, brokers sometimes recommend subprime loans to mortgage applicants. This practice particularly exploits disadvantaged communities because prospective buyers with low levels of education and little financial knowledge are the most likely to accept such loans. Mainstream, prime lenders may in fact be avoiding lending in segregated, low-income areas on a whole (Squires et al. 2009). Previous research indicates that minorities have had difficulty securing credit and fixed interest loans in minority neighborhoods and entering into homeownership (Holloway 1998; Shlay 2005; Hanlon 2009). It is not clear whether this is a function of the minority neighborhood, the race of the applicant, or a combination of these factors.

PREVIOUS CASE STUDIES

The racial and ethnic composition of America has changed considerably in recent decades since the prominent work on neighborhood racial and ethnic composition and mortgage origination was published. In a multilevel analysis of mortgage applications in Columbus, OH, Holloway (1998) found blacks were highly disadvantaged in predominantly white neighborhoods and whites were highly disadvantaged in predominantly black neighborhoods as compared to neighborhoods of their own race. Holloway concludes the effect of race is heavily dependent on the neighborhood context. The study is limited in that it only considered one Midwestern metropolitan area, only compared whites and blacks, and relied on 1992 HMDA data.

The pivotal *Atlanta Journal-Constitution* series, *The Color of Money* (1988), revealed that majority black neighborhoods in Atlanta received far fewer investment dollars than majority white neighborhoods of similar incomes, highlighting a racially specific lending disparity (Wyly and Holloway 1999). Twice as many loans were made in predominantly white owner-occupied neighborhoods as were made in similar black owner-occupied neighborhoods. This study is limited because it only compared blacks and whites, did not control for various socioeconomic factors such as neighborhood income level, considered just one Southern city, and, finally, was based on lending patterns found during the 1980s, which have changed considerably in the past several decades.

Squires and Velez (1987) conducted an analysis in the late 1980s focusing on Milwaukee and other metro areas comparing urban and suburban areas. They found negative effects of minority racial composition on lending, particularly in integrated areas. The coefficient for neighborhood racial composition was not linear; integrated neighborhoods received fewer mortgage loans than either predominantly white or predominantly minority neighborhoods. Although this study discovered racial neighborhood biases, it did not consider if the outcomes varied by applicant race or ethnicity and simply determined that an *overall* bias existed.

Avery and Buynak found similar patterns of disinvestment in integrated neighborhoods in their 1981 study. Departing from Squires and Velez, they found predominantly black neighborhoods also experienced disinvestment by mortgage lending entities. The observed impact was marginal.

In a 1980 study of mortgage lending in Chicago, Listokin and Casey determined racial neighborhood composition has a significant relationship with the volume of loans made in an area when controlling for economic differences. This study is limited because it is over 30 years old and only considered one city.

DATA AND METHODS

Neighborhood level data were drawn from census tracts to assess neighborhood characteristics. Tracts are outlined to be homogeneous in terms of economic and population characteristics and living conditions (U.S. Census Bureau 2000) and represent the closest approximation of neighborhoods that available data allow for (Friedman 2008; Jargowsky 1997). The tract level data are drawn from American Community Survey (ACS) 2005–2009 estimates. HMDA data were selected from the year 2006. The year 2006 was selected because it represents the most recent mortgage lending before the market intensely tightened. More recent data were initially selected; however, a marked decrease in mortgage activity, including loan originations, suggested that macroeconomic factors were influencing mortgage lending. For instance, in 2007, the number of mortgage applications (federally reported) dropped by nearly 48 percent from the year prior and the number of mortgage originations decreased by 45 percent, whereas the number of applications and originations were relatively stable between 2005 and 2006. Consequently, 2006 was selected as having the most recent and representative data. A limitation of this study is that, because of the recent fluctuations in the mortgage market, it is difficult to predict how representative these data may be. Because of the popularity of subprime lending during this period and its prevalence among minority neighborhoods, it can be assumed that minority neighborhoods received more credit in 2006 than in a more conservative lending climate.

HMDA data were pulled for New England Metropolitan Statistical Areas (MSAs) including over 2,000 census tracts. MSAs have a core urban area with a population of at least 50,000, consist of one or more counties including the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core. The dozen most populated New England cities and surrounding metro areas selected for this analysis include: Boston, Cambridge, Lowell, Worcester, and Springfield, MA; Hartford, New Haven, Stamford, Bridgeport, and Waterbury, CT; Manchester, NH; and Providence, RI. The selected metros have a total population of nearly 11 million and the data include over one million loan applications.

The HMDA data were geo-coded with a unique identifier representing the specific state, county, and tract of each case and matched to tract level ACS data. The ACS file added 80 socioeconomic variables to the HMDA application data. Next, Chi-square tests of independence were conducted to estimate the statistical value of including various data in the model. Variables were carefully selected for inclusion in the model.

APPLICANT LEVEL VARIABLES

HMDA data include a variable called *action*. This variable indicates the outcome of the loan application. Loans with an action of “loan originated” were classified with a score of

Table 1. Reason for Denial by Neighborhood Racial Composition

Reason	Low Minority		Average Minority		Above Average Minority		Majority Minority	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Credit	13,192	23.30	2,469	23.22	3,899	24.74	4,163	25.17
Employment history	520	0.92	95	0.89	139	0.88	181	1.09
Debt-to-income ratio	9,303	16.43	1,707	16.06	2,495	15.83	2,436	14.73
Collateral	8,880	15.69	1,623	15.27	2,308	14.64	2,251	13.61
Insufficient cash	635	1.12	107	1.01	164	1.04	199	1.20
Unverifiable information	1,970	3.48	423	3.98	652	4.14	777	4.70
Application incomplete	8,242	14.56	1,498	14.09	1,930	12.24	1,826	11.04
Insurance denied	31	0.05	2	0.02	9	0.06	8	0.05
Other	13,839	24.45	2,708	25.47	4,166	26.43	4,699	28.41
Total	56,612	100.00	10,632	100.00	15,762	100.00	16,540	100.00

(1). *Action* was renamed *originate* to clearly identify which loans were not originated (score of 0) and which loans were originated (score of 1). Loans with a score of 1 on *originate* were not only approved by the banking entity, but had been accepted by the applicant and implemented. Loans with a score of 0 included those which had been closed by the lender, or denied at preapproval, or denied. This variable clearly defines which mortgages were successfully approved and funded and which mortgages were unsuccessful. Loans in which the application was approved but not accepted, application withdrawn by applicant, and preapproval request approved but not accepted were excluded from the final models because they do not represent either accepted or denied loans. Although it is possible these loans did not complete the process and were not funded because of discriminatory processes, there is no way to know if the applicant perceived discrimination and subsequently closed the loan, therefore these loans were suppressed. Discrimination by realtors, banks, and lenders in the home buying process may occur at various stages including, but not limited to, the preapproval stage and the underwriting stage (Anong et al. 2007; Fischer 2008; Squires and O'Connor 2001; Wilkes and Iceland 2004). Rather than select "loan approval" as the dependent variable, I selected "originate" so as to comprehensively examine which applications make it through the *entire* mortgage process, including approval and funding.

Applicant credit score is not available in HMDA data. Banks successfully argued for its exclusion from the reporting requirements as too burdensome (Fishbein 2003). This limitation of mortgage analyses is common (Charles and Hurst 2002), because credit score is typically unavailable to the public. Without credit score, this analysis is subject to omitted-variable bias (Holloway 1998). Some previous literature finds a relationship between credit score and neighborhood racial composition (e.g., Holloway 1998; Van Order and Zorn 2000). However, even when credit is controlled, discrepancies by race persist (Charles and Hurst 2002). Precedent has been set in using HMDA or other similar government reported data (i.e., FHA filings, American Housing Survey) to identify disparities in the mortgage market despite lack of individual credit scores (e.g., Berkovec et al. 1994; Krivo and Kaufman 2004; Squires and Velez 1987; Squires and O'Connor 2001).

In an effort to determine the relationship between credit and racial neighborhood composition, I examined the HMDA data on *reasons for denial*, which include credit (see Table 1). The proportion of mortgages denied on credit grounds varied negligibly by

race of the neighborhood, suggesting the relationship is small. Furthermore, Chi-square tests of independence were run with “denied for credit” and the minority composition variables. Although there were significant relationships between denied for credit and low percent minority and majority minority neighborhoods, there was no significant association with either the average minority neighborhood level or the above average minority neighborhood level. Subsequently, it is quite unlikely that the relationship between neighborhood racial composition and origination is entirely because of credit.

Applicant *gender* was included in the regressions as a control variable. As more households are headed by single females, particularly minority households (McClanahan and Percheski 2008), it is important to control for any impact this may have on the family’s ability to enter into a mortgage. In addition to gender, *applicant income* was held as a control.

A dummy variable called *rental vacation second home* (vs. owner-occupied) was included to control for housing tenure. This variable is included because homeowners are assumed to be more invested in their properties; therefore, owner-occupied mortgage applications may be looked upon more favorably than rental properties. Furthermore, Harris (1999) finds that predominantly black neighborhoods with mostly rental units lose equity more quickly than owner-occupied dwellings in black neighborhoods, again suggesting investment is more lucrative in owner-occupied neighborhoods.

NEIGHBORHOOD LEVEL VARIABLES

The independent variable of interest includes a series of variables which were transformed from the HMDA data point called *minority population percent*. The inclusion of a neighborhood racial composition variable may identify patterns in which credit is being withheld by direct or indirect discrimination toward minority neighborhoods (Massey and Denton 1993; Squires and O’Connor 2001). HMDA qualifies “minority” as anyone who is not non-Hispanic white, therefore Hispanics are included in the minority population. Figures were centered on the population mean and divided into four distinct groups. Populations within 10 percent of the mean were labeled *average minority*, below this criteria were labeled *below average minority*, populations above average but below 50 percent were labeled *above average minority*, and, finally, populations over 50 percent minority were categorized as *majority minority*. These new variables were dichotomous and the comparison group left out of the model was *average minority*. The advantage of recoding the minority population variable is to obtain a more precise understanding how small minority populations affect the loan outcome as compared to average, high, or majority minority populations (see Alba et al. 2000 for example constructing independent variables as categorical dummies). Previous literature has examined neighborhood racial compositions in a proportional manner to explain integration or dissimilarity (e.g., Ellen 1998; Massey and Denton 1987). In addition to these minority variables, to obtain more granular detail I ran models with variables for each racial and ethnic group including black, Hispanic, Asian, and white (reference) populations.

The variable *tract level median income as compared to MSA median income* was included in the equation to help control for the social status of the neighborhood for which the financing was requested. Neighborhood income provides neighborhood class status characteristics (Galster 2001).

Level of education for residents of the tract was available ranging from little-to-no education to professional and doctorate degrees. I recoded the education categories into two simplified groups: *high school or less* and *college*. Neighborhood education is important to the model because it provides class status characteristics of the resident population (Galster 2001).

A variable was included to control for the influence of a foreign born population. As a continuous variable, the foreign born population was mean centered (*xforeign*). Recent immigrants commonly reside in ethnic enclaves surrounded by neighbors of the same race and ethnicity (Nee et al. 1994; Portes and Manning 1986; Wilkes and Iceland 2004), and these concentrated immigrant enclaves can uniquely impact neighborhoods (Alba et al. 2000; Krivo et al. 2009; Portes and Zhou 1993).

The variable *manufacturing* was created further to control for socioeconomic status and other factors associated with old manufacturing communities such as heightened segregation and neighborhood decline. This Census variable indicates the proportion of neighborhood residents who work in manufacturing. Wilkes and Iceland (2004) indicate that manufacturing communities, particularly those in the Northeast and Midwest, are especially segregated. Although educated and prosperous blacks may have more opportunity to move out of inner-city ghettos, few minorities can afford to move out of declining manufacturing centers (Wilkes and Iceland 2004; Wilson 1980). By including this variable, declining manufacturing neighborhoods common to New England should not have an independent effect on loan origination. Although this is not a perfect proxy for class or neighborhood decline, combined with neighborhood educational level, income, and other attributes, the occupational variable *manufacturing* helps to account for neighborhood level effects (Galster 2001).

METHODS

The analysis uses variables on two levels, the neighborhood and the applicant. To control for variation across neighborhoods, generalized linear mixed modeling (GLMM) is applied. Precedent has been set using multilevel models to accurately depict neighborhood effects (e.g., Garner and Raudenbush 1991; Sampson et al. 1997; Raudenbush and Sampson 1999).

When data are nested, as in students within schools or mortgage applicants within neighborhoods, GLMM is preferred. GLMM provides a statistical framework for hierarchical analyses (Berkey et al. 1995; Morris and Normand 1992; Raudenbush and Bryk 1985; Raudenbush and Bryk 2002). The dependent variable of my analysis, *originate*, is at the lowest level (applicant) and the independent variables are on both levels making the data suitable for GLMM. Furthermore, the data groupings are mutually exclusive and appropriately grouped for GLMM.

Even though hierarchical structures are present among neighborhood mortgage studies and found steadily across social research, prior studies have typically failed to deal with them effectively (Raudenbush and Bryk 2002). This study contributes to the field by addressing this limitation using GLMM for this mortgage analysis. Previous analyses which did not address hierarchical structures in the data are subject to misestimated precision, aggregation bias, and unit analysis problems (Raudenbush and Bryk 2002).

GLM models can also be referred to as hierarchical linear models, random effects models, multilevel linear models, random coefficient models, or covariance components models (Dempster et al. 1981; Goldstein 1995; Longford 1993; Raudenbush and Bryk 2002; Singer 1998). All such models can efficiently process complex models which have a hierarchical or nested structure (SPSS 2005). Hierarchical models allow for the interpretation of contextual effects on individual outcomes. Outcomes in GLMM are understood as the sum (linear) of random and fixed effects. Random effects impact only the covariance of the data structure and occur randomly because of sampling; whereas fixed effects impact the population mean, such as the effect of a medicine on a population (SPSS 2005). Although the fixed effects remain the core interest of most research studies, covariance must be adjusted for (SPSS 2005).

Because of the dichotomous nature of the dependent variable and nested structure of the data, a mixed model with binomial distribution and logit link was applied (Hedeker 2005; SPSS 2010). The logit link is a transformation of the dependent variable which allows estimation of the model, stated here: $\text{Logit } f(x) = \log[x/(1-x)]$. This form of binary logistic regression includes fixed effects which are the predictor or factor variables and random effects whose values can be considered a random sample from a larger population (SPSS 2010). Because the neighborhoods are nested within counties and states, the random effects blocks for this model include state*county*tract. The model assumes the data are structured by state, county, and tract and controls for this accordingly.

Logistic regression has been used in previous research on race and homeownership such as Bocian et al.'s (2008) study that integrated individual, loan, and property characteristics to determine the significance of race in the allocation of high-cost loans. Logistic regression is an extension of multiple regression and allows for a clear understanding of the relationship between a binary dependent variable and an independent variable in a controlled model (George and Mallery 2007). See Table 2 for descriptive statistics of model variables.

RESULTS

FIXED EFFECTS

The independent variable of interest in this analysis was minority composition. As described in detail in the DATA AND METHODS Section, the variable was segmented into four indicator variables ranging from *low minority* to *majority minority*. See Appendix A for fitted model. The dependent binary variable was *originate*, indicating whether or not the loan was originated. All levels of minority composition ranging from *low minority* to *majority minority* had highly significant relationships with loan origination at the 99 percent confidence level above and beyond applicant race effects. In the controlled model, *low minority* worked as an insulating factor in the loan origination process. Neighborhoods with *low minority* concentrations were 5 percent more likely to have a loan approved compared to neighborhoods with *average minority* compositions ($p < 0.01$). *Above average minority* neighborhood concentrations predicted that applicants were 9 percent less likely to be approved ($p < 0.01$). *Majority minority* had a large negative predictive effect on loan origination. Applicants applying for loans in neighborhoods with over 50 percent minority populations were nearly 23 percent less likely to be approved than applications in neigh-

Table 2. Descriptive Statistics ($n = 833, 294$)

	Minimum	Maximum	Mean	SD
Neighborhood variables				
Racial composition				
Lowminority	0.00	1.00	0.6315	0.4824
Avgminority	0.00	1.00	0.1061	0.3080
Aboveavgminority	0.00	1.00	0.1372	0.3441
Majminority	0.00	1.00	0.1252	0.3309
Neighborhood racial and ethnic populations				
Non-Hispanic White	0.00	100.00	75.7675	24.6648
Black	0.00	98.02	8.6299	15.0558
Hispanic	0.00	93.39	9.9864	13.7387
Asian	0.00	68.77	3.8521	5.0393
Income compared to metropolitan area (MSA) average				
Neighborhood income 0–50 percent of MSA average	0.00	1.00	0.0601	0.2377
Neighborhood income 51–75 percent of MSA average	0.00	1.00	0.1678	0.3737
Neighborhood income 75–125 percent of MSA average	0.00	1.00	0.5790	0.4937
Neighborhood income greater than 125 percent of MSA average	0.00	1.00	0.1922	0.3940
Education level				
High school or less	0.00	1.00	.7360	.4408
College	0.00	1.00	.2779	.4480
Employed in manufacturing				
Low manufacturing	0.00	1.00	0.1634	0.3697
Average manufacturing	0.00	1.00	0.6580	0.4744
High manufacturing	0.00	1.00	0.1719	0.3773
Foreign born (mean centered)	-13.69	54.94	0.0000	10.7841
Applicant variables				
Female	0.00	1.00	0.3569	0.4791
Applicant race/ethnicity				
Non-Hispanic White	0.00	1.00	.6253	.4841
Black	0.00	1.00	0.0819	0.2743
Hispanic	0.00	1.00	0.0835	0.2766
Asian	0.00	1.00	0.0243	0.1541
Applicant income				
Below median	0.00	1.00	0.1758	0.3807
Median income	0.00	1.00	0.2175	0.4125
Above median	0.00	1.00	0.6067	0.4885
Rental, vacation, second home	0.00	1.00	0.0642	0.2452
Denied due to credit	0.00	1.00	0.1958	0.3968

Note: Original $N = 1,013,824$; cases removed because Action = 6, "loan sold on secondary market."

neighborhoods with *average minority* compositions ($p < 0.01$). Neighborhoods with higher than average black populations experienced a 12.4 percent lower likelihood of loan approval compared to neighborhoods with average black populations. Those with higher than average Hispanic populations were also disadvantaged compared to neighborhoods with average levels of Hispanics (-9.8 percent, $p < 0.01$). Concentrations of Asians actually helped loan approval, in that neighborhoods with higher than average Asian populations experienced a 6 percent greater likelihood of loan approval ($p < 0.01$). It is important to highlight, Asians comprise less than 4 percent of the sample, whereas black and Hispanic populations comprise a total of nearly 20 percent of all applicants in the sample.

Not only do most minorities have trouble getting loans in minority neighborhoods, but so do whites. The findings indicate that lenders may be avoiding investment in mi-

Table 3. Neighborhood Fixed

	<i>B</i>	S.E.	<i>t</i>	Significance	Exp(<i>B</i>)
Intercept	0.578	0.057	10.172	0.000**	1.782
LowMinority	0.050	0.019	2.595	0.009**	1.051
AboveAvgMinority	-0.111	0.023	-4.819	0.000**	0.895
MajMinority	-0.259	0.028	-9.255	0.000**	0.772
BlackPopulation ^a	-0.124	0.016	-7.577	0.000**	0.883
Hispanic population ^b	-0.098	0.018	-5.576	0.000**	0.906
Asian population ^c	0.056	0.013	4.281	0.000**	1.058
High school or less	-0.281	0.016	-17.729	0.000**	0.755
LowMF	0.048	0.015	3.220	0.001**	1.050
HighMF	-0.082	0.015	-5.356	0.000**	0.922
xforeign	0.000	0.001	0.003	0.997	1.000
Tract to MSA income 0–50	-0.198	0.029	-6.859	0.000**	0.820
Tract to MSA income 50–75	-0.165	0.020	-8.235	0.000**	0.848
Tract to MSA income 125 plus	0.098	0.018	5.543	0.000**	1.103

* $p < 0.05$, ** $p < 0.01$.

Model compared to: average minority population, white male applicant with average income for an owner occupied home in a college educated neighborhood with average levels of manufacturing and average income.

^aCompared to neighborhood with the average black population, all other minority neighborhood composition variables removed.

^bCompared to the average Hispanic composition, all other minority neighborhood composition variables removed.

^cCompared to the average Asian composition, all other minority neighborhood composition variables removed.

Table 4. Applicant Fixed

	<i>B</i>	S.E.	<i>t</i>	Significance	Exp(<i>B</i>)
Intercept	0.578	0.057	10.172	0.000**	1.782
Female	-0.070	0.006	-11.383	0.000**	0.932
Applicant Black	-0.358	0.011	-32.787	0.000**	0.699
Applicant Hispanic	-0.305	0.010	-29.402	0.000**	0.737
Applicant Asian	0.071	0.019	3.727	0.000**	1.074
Below median income	-0.301	0.009	-33.190	0.000**	0.740
Above median income	0.123	0.007	16.344	0.000**	1.130
Rental Vacation Second Home	0.042	0.013	3.318	0.000**	1.043

* $p < 0.05$, ** $p < 0.01$.

Model compared to: average minority population, white male applicant with average income for an owner occupied home in a college educated neighborhood with average levels of manufacturing and average income.

minority neighborhoods regardless of the applicant's ability to pay. Neighborhood racial composition had nearly as large an impact on whether the loan was approved and originated than important financial factors such as the applicant's income, as well as class-specific neighborhood variables such as neighborhood educational level. Table 3 describes the outcomes of the neighborhood variables, including the key variable of interest: *neighborhood racial composition*. Table 4 describes the outcomes of the applicant level variables.

The influence of control variables will now be described. The *gender* variable indicated that women were less likely to be approved than men, controlling for income and neighborhood characteristics ($p < 0.01$). Women were 7 percent less likely to be successful originating their mortgage than were men of the same means. The gender impact is marginal compared to the much greater impact neighborhood racial composition has on mortgage origination.

The fixed effect of *applicant black* was quite strong, indicating that all else controlled, blacks were 30 percent less likely to have their loan originated than whites ($p < 0.01$).

Many studies have found that blacks have a more difficult time obtaining fair credit and are less likely to be homeowners (Massey and Denton 1993; Calem, Gillen, & Wachter 2004; Hill 2005; Reid 2005; Spader and Quercia 2008; Bianchi et al. 1982; Wachter and Megbolugbe 1992). Hispanics were 26 percent less likely to originate their mortgage than were similar non-Hispanic white candidates, holding all else constant ($p < 0.01$). Asians were the only group to exceed whites in their likelihood of loan origination at 7 percent more likely to originate than whites, with all else held constant ($p < 0.01$). The significant negative neighborhood racial composition effect (majority minority, -23 percent) above and beyond the applicant race effect (black, -30 percent), suggests *both* applicant race and neighborhood racial composition have considerable impacts on the mortgage origination process.

Neighborhood educational level had significant effects on loan origination. Education has been previously proven to be an insulator against subprime loans and a detriment to mortgages for the low educated (Squires et al. 2009). Neighborhoods in which the majority of residents had high school education or less were 24 percent less likely to be approved for loans than neighborhoods in which residents had some college or a college degree ($p < 0.01$). Neighborhoods with high school educated residents (or less) experienced a similar negative relationship with mortgage origination as did majority minority neighborhoods (-24 percent vs. -23 percent, respectively).

Having high proportions of residents in the manufacturing industry lessened the likelihood that a loan be approved compared to neighborhoods with average levels of manufacturing laborers. *High manufacturing* communities were 8 percent less likely to have a loan application approved ($p < 0.01$). In the same respect, having a low level of workers in manufacturing insulated loan candidates; in fact, these *low manufacturing* neighborhoods were 5 percent more likely to have loans approved than were neighborhoods with average levels of manufacturing ($p < 0.01$). This is not a surprising finding, as Wilson (1980, 1990, 1997) has written seminal works depicting the decline of manufacturing in the United States, particularly in the Midwest and New England regions, and how this decline has led to growth of a “truly disadvantaged” underemployed class of people. Neighborhood minority population had larger negative effects on loan approval and origination than did manufacturing population.

In the final mixed effects model, the *foreign born* population did not have a significant effect ($p = 0.997$).

The income of the applicant was not surprisingly related to loan origination. Applicants whose income fell below the median income range were 26 percent less likely to have their loan originated than those whose income fell within the median range ($p < 0.01$). Applicants with above median income were significantly more likely to be approved for loan origination (13 percent, $p < 0.01$). Income, which should be the *most* central consideration in an applicant’s suitability for a mortgage loan, had similar coefficients to the neighborhood racial composition variables, suggesting neighborhood racial composition may be an important factor in the mortgage origination process.

Neighborhood poverty and income also had large negative relationships with origination. Poverty and tract income as determined by tract income as a proportion of MSA median income possessed negative results for each level of income below the average. More specifically, tracts with incomes of *0–75 percent of MSA income* were significantly disadvantaged compared to tracts in which incomes fell at or slightly above MSA income. Applicants for which neighborhood income fell between *0–50 percent of MSA median in-*

come had an 18 percent lesser likelihood that their loan would be originated as compared to neighborhoods with incomes near or just above MSA median income ($p < 0.01$), and applicants for which income fell between 50–75 percent of MSA were 15 percent less likely ($p < 0.01$). Conversely, wealthier neighborhoods, those with incomes at least 25 percent or more above the MSA median income, were significantly more likely to have loans approved (10 percent, $p < 0.05$). Neighborhood racial composition has a greater negative impact on loan approval and origination than does neighborhood poverty.

The owner-occupied dummy variable presented an interesting outcome in terms of loan origination. The loans for owner-occupied properties were actually 4 percent less likely to be approved than were nonowner occupied properties ($p < 0.01$). This surprising finding may be because of a variety of market factors. It is possible that individuals who seek loans for rental, vacation, and second properties are better off on a variety of measures than applicants who are seeking a loan for their primary residence and this contributes to their higher success rate in loan origination. This finding is nevertheless counterintuitive because owner-occupied loans are commonly assumed to be less risky than second home loans (Green and Wachter 2007; Immergluck 2009). I tested the relationship between owner occupancy and income and found the variables to be significantly related. More specifically, the large majority of *rental, vacation, or second property* loan applications (>60 percent) were applied for by individuals who earned over \$100,000 annually, whereas fewer than one-third of owner-occupied loan applications were applied for by individuals earning under \$100,000 annually. Neighborhood racial composition emitted a larger effect on loan outcome than housing tenure.

Table 5. Random Effects

	Estimate	S.E.	Significance	95 percent Confidence Interval	
				Lower	Upper
Var(Intercept)	0.040	0.002	0.000**	0.036	0.044

* $p < 0.05$, ** $p < 0.01$.

RANDOM EFFECTS

The random effects which occur randomly because of sampling include *state*county*tract*. The random effect intercept = 0.040, ($p < 0.001$) with standard error 0.002. This random effect impacts the covariance of the data structure and the total outcome in GLMM may be interpreted as the sum of the above random and fixed effects. Table 5 describes the random effects.

CONCLUSION

The statistically significant findings indicating neighborhood racial composition influences loan outcomes suggest that an expanded, national study is warranted. Although HMDA data may not be sufficient on their own to prove unlawful discrimination, strengthened with ACS data in this analysis, they offer a powerful tool to identify patterns that warrant further investigation (Immergluck 2004). This prehousing

market crash (2006) study of all loan applications in New England finds there is in fact a negative relationship between racial and ethnic composition of the neighborhood and loan origination regardless of race of the applicant or other demographic and economic factors. It cannot conclusively be determined from this study that discrimination accounts for the large negative disparity in lending between minority and white neighborhoods. Past research has found neighborhood racial composition to be a proxy for both unobserved characteristics and very local economic conditions (Chan et al. 2010). Established minority neighborhoods are typically located in central cities where housing stock is older and more likely to be multiunit, such as two or four family homes (Munnell et al. 1996). The probability of denial increases for multiunit homes, hindering investment in neighborhoods stocked with such homes. Other unobserved reasons for variations in credit offered which may be correlated with neighborhood racial composition or borrower race include loan-to-value ratio, housing indebtedness, wealth, job history, and stability of income or employment and condition of the property (Berkovec et al. 1994; Calem, Gillen, & Wachter 2004; Pedersen and Delgadillo 2007). The mortgage industry treats nonblack neighborhoods differently from black neighborhoods because of borrower and loan characteristics that are both more prevalent in black neighborhoods and correlated to higher default risk (Chan et al. 2010). Van Order and Zorn (2000) confirm the higher the neighborhood black population, the higher the default risk. Recent scholarship also finds foreclosures to be more prevalent in minority neighborhoods (Vesselinov and Beveridge 2011), particularly in highly segregated black communities (Rugh and Massey 2010). Lenders are less likely to proceed with a mortgage loan if they perceive a greater default and foreclosure risk than that in another neighborhood.

The results are disheartening for the future of minority neighborhoods. In New England, investment in minority neighborhoods is significantly less likely to be approved than investment in white neighborhoods. This study highlights that *all* applicants regardless of race are more likely to be turned down in a minority neighborhood than in a white neighborhood. The more racially segregated the neighborhood, the lower the likelihood the mortgage would be approved and originated. In fact, neighborhoods most likely to receive approvals were the most homogeneous white neighborhoods—those with lower than average minority populations. These findings indicate that the economic viability of racially segregated minority neighborhoods may be at risk as lenders hesitate to invest, even to qualified applicants. America's lending system, entrenched with institutional discrimination, whether purposive or passive, impacts these neighborhood lending disparities.

The highly significant negative effect of minority racial composition in New England evokes questions as to whether this debilitating trend could be happening in other regions of the country. Although the results from this regional study should not be interpreted as representative of national trends in minority neighborhoods, it is possible that similar trends may exist in the Midwest, but further study is needed. If these trends held nationwide, majority minority cities such as Chicago, Detroit, Birmingham, and Washington D.C. could be experiencing an avoidance of banking entities to invest in many neighborhoods throughout the cities. If neighborhood racial composition has as large a negative effect on lending nationwide as it does in New England, future policies should seek to incentivize lending in minority neighborhoods in an effort to prevent urban decline. Since the passage of the Community Reinvestment Act in 1977, \$4.7 trillion

dollars have been dedicated to community reinvestment objectives nationwide (Squires 2002; NCRC 2007); however, this analysis suggests that despite previous initiatives, minority neighborhoods are substantially less likely to receive mortgage credit and investment than white neighborhoods, especially neighborhoods with higher than average African American populations. Although credit may be more available to minorities now than before fair housing legislation, it is clear that minority neighborhoods remain exceptionally disadvantaged and the negative effects increase linearly as the neighborhood racial segregation increases.

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Notes

¹ The secondary market is the market for the sale of securities or bonds collateralized by the value of mortgage loans. Banks and other mortgage making entities consider secondary market standards when issuing mortgages because such standards determine the price they may set when selling the mortgage in a mortgage-backed security (MBS). Risky mortgages meet fewer secondary market standards and are therefore less profitable when restructuring the debt as an MBS.

² Author's calculation as of the fourth quarter of 2010. Ratio of black homeownership rate (44.8) to non-Hispanic white homeownership rate (74.2).

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APPENDIX A

GENERALIZED LINEAR MIXED MODEL

ORIGINATE [structured on state*county*tract] $\ln[p/(1-p)] = \beta_0 +$

Level 1: γ_{11} Female + γ_{12} ApplicantBlack + γ_{13} ApplicantHispanic + γ_{14} ApplicantAsian + γ_{15} Below Md Income + γ_{16} Above Md Income + γ_{17} RentalVacationSecond

Level 2: γ_1 LowMinority + γ_2 AboveAvgMinority + γ_3 MajMinority + γ_4 Neighborhood Income 0–50 percent of MSA Average + γ_5 Neighborhood Income 51–75 percent of MSA Average + γ_6 Neighborhood Income greater than 125 percent of MSA Average + γ_7 High School or Less + γ_8 Low Manufacturing + γ_9 High Manufacturing + γ_{10} Foreign Born

Random effect: State*County*Tract

Supplementary model replaces γ_1 LowMinority + γ_2 AboveAvgMinority + γ_3 MajMinority with γ_1 BlackPopulation + γ_2 HispanicPopulation + γ_3 AsianPopulation.

Ofreciendo préstamos en la era moderna: ¿es la composición racial de los vecindarios importante cuando las personas buscan financiamiento para sus viviendas? Un estudio piloto en Nueva Inglaterra (Meghan Kuebler)

Resumen

Este artículo explora la relación entre la composición racial de los vecindarios y la aprobación y generación de hipotecas de vivienda. El mismo mide los efectos independientes del *vecindario* como variable más allá de los efectos de la raza del solicitante del préstamo antes de la reciente crisis económica en el sector de viviendas de alquiler y de viviendas ocupadas por sus propietarios. Las solicitudes de hipotecas estudiadas fueron seleccionadas en las doce áreas metropolitanas más pobladas de Nueva Inglaterra en el Este de los Estados Unidos. Dichas solicitudes se analizaron en conjunto con otros datos correspondientes a nivel del vecindario utilizando el método de modelos lineales generalizados mixtos. Los datos incluyen información del “Housing Mortgage Disclosure Act” (Ley de Divulgación de las Hipotecas de Vivienda) antes del desplome del mercado hipotecario de la vivienda combinada con cinco años de la “American Community Survey” (Encuesta Comunitaria de Estados Unidos) incluyendo más de un millón de solicitudes. Los resultados indican que, controlando las variables de ingreso, género y raza de la persona solicitante, pobreza y otras variables socio-económicas, la *composición racial del vecindario* tiene un efecto estadísticamente significativo en la aprobación y generación de hipotecas. La presencia de minorías raciales está correlacionado de manera negativa con la generación de hipotecas independientemente de la raza del solicitante del préstamo. Las solicitudes de préstamos por parte de personas blancas también son rechazadas en los vecindarios donde predominan las minorías raciales, especialmente en los vecindarios afroamericanos.