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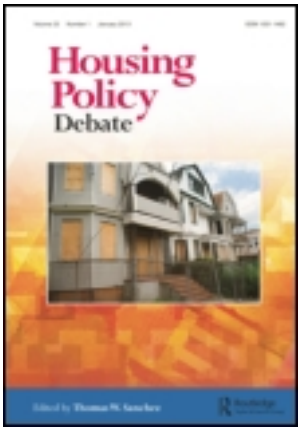

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Metropolitan Segregation and the Subprime Lending Crisis

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Metropolitan Segregation and the Subprime Lending Crisis

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Unsustainable high-cost lending was a major contributor to one of the worst financial crises in U.S. history. While several studies examine individual- and community-level predictors of high-cost lending, little research has tested for the possible causal effect of racial segregation. Using two-stage least squares statistical models, we find evidence that even after controlling for percentage minority, poverty, unemployment, low credit scores, home value escalation, and bank branch accessibility, black/white segregation is a significant predictor of the proportion of subprime loans originated in the largest 200 U.S. metropolitan areas. We also find that increased black education levels are important protective factors, while greater shares of mortgages originated by independent mortgage companies increase the risk for subprime lending. We find no evidence for an effect of Hispanic/white segregation on subprime lending. This research suggests that policy initiatives aimed at limiting high-cost lending should address the context of black/white segregation, education, and financial reform.

Keywords: segregation; high-cost loans; subprime crisis

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Subprime lending, coupled with rising defaults and record foreclosure rates, has gripped the nation since 2008.[1] Blame is being directed at ill-informed consumers, lax underwriting by loan originators, failure of regulatory agencies, predatory lending practices, greedy investors, misguided appraisers and credit rating agencies, job loss in economically distressed regions, and a range of other institutional and individual factors (Aalbers, 2009, 2011; Baily, Elmendorf, & Litan, 2008; Engel & McCoy, 2011; Gramlich, 2007). Virtually ignored in this debate is the role of structural and contextual forces, most notably various trajectories of inequality, uneven metropolitan development, and racial segregation.[2] While there is widespread recognition that lower income households and communities, racial minorities, women, and other vulnerable populations were initially the hardest hit, the context of racial segregation as a predictor of subprime lending, and as an explanation for the variance in such lending across cities and communities, has not received sufficient attention (Engel & McCoy, 2008; Squires & Hyra, 2010). Yet, there are theoretically plausible reasons

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why the segregation of minorities may establish a context in which these lending practices would flourish.

There are at least four reasons why segregated cities might be more susceptible to high-cost mortgage products.[3] First, in segregated cities, minority communities are more isolated and may be less experienced with purchasing financial products. Many segregated minority neighborhoods had traditionally been redlined, where credit for home purchases was denied (Howell, 2006; Jackson, 1985; Munnell, Tootell, Browne, & McEneaney, 1996; Stuart, 2003). The historic legacy of loan denial has resulted in a lack of experience with the mortgage process in communities formerly redlined (Squires, 2008b). Without experience and knowledge of the financial industry, people living in segregated minority neighborhoods may be more likely to accept high-cost loan terms. Second, mainstream, prime lenders might avoid segregated, low-income areas. Without competition among lending institutions, borrowers, regardless of their financial education level, may have little choice other than high-cost loan products (Been, Ellen, & Madar, 2009). Third, subprime lenders might target segregated areas with marketing strategies, exploiting and amplifying differences in financial education levels and the lack of access to prime lenders (Engel & McCoy, 2011; Fisher, 2010; Rugh & Massey, 2010). Finally, lenders may place a higher risk-based premium for those living in low- and moderate-income, segregated areas (Howell, 2006). In more segregated cities, there may be more at-risk areas (or at least the perception of greater risk) and at-risk borrowers in these communities, which might affect the city's overall proportion of high-cost loans. These mechanisms may explain why segregation may contribute to variation in subprime lending across cities.

There is evidence that high-cost loans are originated in ways that disproportionately affect minority borrowers and segregated neighborhoods. In 2006, 54% of African American, 47% of Hispanic, and 18% of white mortgage recipients received a high-priced loan (Avery, Brevoort, & Canner, 2007).[4] Moreover, in census tracts where the population was at least 80% minority, 47% of borrowers obtained high-priced loans, compared with 22% of borrowers in communities where racial and ethnic minorities accounted for less than 10% of the population. The intent of this research is to investigate whether racial segregation is causally linked with the allocation of subprime loans across metropolitan areas.

While there is a small but growing body of literature on the effect of racial segregation on subprime lending (Been et al., 2009; Bond & Williams, 2007; National Community Reinvestment Coalition [NCRC], 2005), this investigation is different from, and builds on, prior research in three important ways. First, we test whether black and Hispanic segregation, measured via both the dissimilarity and isolation indices, predict the metropolitan proportion of high-cost loans. Prior studies investigate whether segregation influences individual probabilities of obtaining a subprime loan (e.g., Been et al., 2009). While it is important to understand how segregation affects individual borrowers, subprime lending and associated foreclosures can have disastrous consequences for entire communities, cities, and states (Immergluck & Smith, 2005; Joint Economic Committee, 2007), and it is important to move beyond individual-level analyses to understand how segregation affects the spatial geography of high-cost loans across metropolitan America.

Second, our models incorporate important control variables absent from prior studies. For instance, we control for bank branch accessibility and the channel of origination, which have been shown to influence the price of mortgage credit

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(Ergungor, 2007; Reid & Laderman, 2009). It is important to determine whether the effect of segregation remains robust with the inclusion of these control variables.

Finally, and most important, this study addresses the directionality of the relationship between segregation and subprime lending. Some researchers argue that segregation affects subprime lending (Been et al., 2009; NCRC, 2005), while others suggest that that direction of the relationship is reversed (Bond & Williams, 2007). By using instrumental variables (IVs) estimated via two-stage least squares (2SLS) statistical models, we address endogeneity issues to better establish segregation's effect on subprime lending patterns.[5]

Based on analysis of data from the 2006 Home Mortgage Disclosure Act (HMDA) report, the 2006 American Community Survey (ACS), the 2006 Federal Deposit Insurance Company (FDIC) Summary of Deposit file, 2006 credit information, and the 2000 Census, we find evidence that black/white segregation is a causal predictor of the share of subprime loans originated at the metropolitan level. We also find that increased black educational levels are important protective factors, while greater mortgage market share controlled by independent mortgage companies (IMCs) increases the risk for subprime lending. The results of this study, and others (e.g., Rugh & Massey, 2010), strongly suggest that racial segregation is one of the important elements to understanding the U.S. subprime foreclosure crisis.

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Subprime Lending and the Current Economic Crisis

It is critical to investigate subprime lending patterns because these loans are associated with one of the country's worst financial crises. In 2006, at the subprime height, these loans consisted of 28% of the mortgage market (Avery et al., 2007). Many of these high-cost loans were pooled into mortgage-backed securities, which spawned other debt-related financial products, such as credit default swaps (Morris, 2008; Wyly, Moos, Hammel, & Kabahizi, 2009). In 2007, subprime-investment instruments, and other real estate debt products, began to lose value partly because of mounting high-cost loan defaults and related foreclosures (Kirk & Hyra, 2011). Millions of people were affected; many who took out subprime loans lost their homes to foreclosure (Bocian, Li, & Ernst, 2010), scores of homeowners located in close proximity to foreclosed properties saw their home values plummet (Immergluck & Smith, 2006; Kobie & Lee, 2011; Lin, Rosenblatt, & Yao, 2009; Schloemer, Li, Ernst, & Keest, 2006), and those financial companies that originated high-priced loans or were overleveraged with real estate debt financial products collapsed.

The U.S. subprime foreclosure crisis was associated with credit restrictions and diminished consumer confidence, which devastated the broader national and international economies. Without access to credit and lower consumer spending, many U.S. firms laid off workers in droves. Between December 2007 and December 2009, unemployment rose from 5% to 10% (U.S. Bureau of Labor Statistics, 2010). In 2008 and 2009, the U.S. government responded to the broader economic crisis by deploying over $13.9 trillion in loans, assets and liability guarantees, and asset purchases to prevent the further demise of the U.S. economy (French, 2009). Not only was this a monumental U.S. calamity, but because high-cost mortgage-backed securities and other related debt instruments were bought by international investors, this financial turmoil eventually also triggered a worldwide economic slowdown (Sassen, 2009).

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An Overview of Mortgage Lending in Minority Neighborhoods

In the first half of the 20th century, lenders used neighborhood racial composition as a key determinant for loan underwriting. Loan applications from minority neighborhoods were often denied based on the premise that these areas were in decline. Lenders denied home loan applications from predominately black communities because it was assumed that home values in these areas would decline below an acceptable risk level. This practice of loan denial based on the racial composition of the neighborhood was known as redlining (Howell, 2006). An example of redlining included the Federal Housing Administration's denial of loan guarantees in black neighborhoods in the 1930s, which was not officially made illegal until the passage of the Fair Housing Act of 1968 (Jackson, 1985; Massey & Denton, 1993). Redlining in the public and private lending markets contributed to the unequal distribution of credit by race, and the Fair Housing Act, as well as the Equal Credit Opportunity Act of 1974, attempted to reduce this inequity (Stuart, 2003).

To assist in the enforcement of mortgage lending laws, the HMDA of 1975, as subsequently amended, mandates that most mortgage lenders submit their individual loan-level application data to the federal government. Today HMDA reports include substantial information on loan applications, including the race, gender, and income of the applicant; the dollar amount; the type of loan applied for (with pricing data included for selected high-priced loans); the disposition of the application (i.e., whether it was approved or denied); and the census tract in which the home is located. These data are available to the general public for analysis. The loan data allow for an assessment of bank lending patterns, making it easier to detect potentially discriminatory lending patterns.

In 1977, the Community Reinvestment Act (CRA) was enacted. This law mandates that federally chartered depository institutions be responsive, consistent with safe and sound lending practices, to the credit needs of their entire service areas, including low- and moderate-income communities. Lenders with inadequate CRA records can be denied authority by the federal government to open additional branches, merge with other financial institutions, or make other changes to their business operations. The Equal Credit Opportunity Act, HMDA, and CRA were all designed, in part, to alleviate inequities in credit allocation among racial groups (Holloway, 1998).

In 1980, the lending environment drastically changed. The Depository Institutions Deregulation and Monetary Control Act altered the mortgage pricing guidelines for national lenders. By facilitating the charging of varying rates and fees, this act laid the groundwork for risk-based pricing in mortgage lending (B. C. Smith, 2007).[6] Prior to this act, borrowers whose loan applications were accepted typically received similar interest rates, but with risk-based pricing, those with more default risk factors, such as lower credit scores, down payments below 20%, and higher loan-to-value and debt-to-income ratios, receive higher rates (Chomsisengphet & Pennington-Cross, 2006; Fellowes, 2006; Getter, 2006; White, 2004). These new pricing practices, products, and underwriting procedures opened homeownership opportunities to a new set of borrowers. However, it also created the potential for a new type of lending discrimination, reverse redlining, where high-cost loan products are disproportionately concentrated in low-income, minority communities.

Predictors of Subprime Lending

In 2000, a study commissioned by the U.S. Department of Housing and Urban Development (HUD) indicated that low-income communities of color, compared

with other low-income neighborhoods, received a disproportionately larger share of high-cost loans (Bunce, Gruenstein, Herbert, & Scheessele, 2001). In Atlanta, New York, Boston, and Baltimore, even after controlling for the community's income level, African American areas had a higher proportion of subprime loans. The evidence from these cities suggests that lenders were inappropriately targeting minority neighborhoods and that subprime lenders were serving areas that prime lenders neglected.

Though compelling, these initial HUD studies had several limitations. First, they did not control for credit score. Minority areas could have received more subprime loans because borrowers in these communities were more likely to have impaired or blemished credit records. Second, these studies used a crude proxy for subprime loans; a loan was labeled subprime if the originator's Web site indicated that the company was a subprime lender. The actual loan rates and terms were not available or assessed in the HUD-sponsored research. Last, the HUD reports were based on four cities, which might not have been representative of subprime lending patterns throughout the rest of the country.

To address some of the limitations of the HUD report, Calem, Hershaff, and Wachter (2004) expanded the number of cities to seven (Atlanta, Baltimore, Chicago, Dallas, Los Angeles, New York, and Philadelphia) and accounted for several individual and neighborhood credit risk factors. They found that even after controlling for neighborhood credit score, the neighborhood share of minorities was still positively associated with subprime lending. They also discovered that elevated neighborhood education levels were associated with a lower probability of subprime lending. While this study suggests the presence of reverse redlining, other scholars argue that the research did not account for important loan characteristics, such as loan-to-value and debt-to-income ratios, that might explain the racial disparities in high-cost lending (Avery, Brevoot, & Canner, 2006; Courchane, 2007; Edelberg, 2009).

A subsequent study by Avery et al. (2006) incorporated additional loan characteristics. The distinct advantage of Avery et al.'s study is that they had a more accurate indicator of subprime loans. In 2004, the HMDA (Regulation C) was altered, requiring banks to indicate pricing information on selected high-cost loans. For such loans, banks had to report the spread between the loan's annual percentage rate (APR) and the rates on Treasury securities with comparable maturities when the APR was 300 basis points above a comparable Treasury note for first-lien loans and 500 basis points for second-lien loans.[7] Avery et al. found, using 2005 HMDA data, that even after controlling for a variety of individual and loan characteristics, black and Hispanic borrowers were more likely than whites to receive high-cost loans. A year later, Avery et al. (2007) replicated this study with 2006 HMDA data and found similar results.[8]

Other studies suggest that unemployment, poverty, and bank branch access are associated with subprime lending. A study by Lanzerotti (2006) indicates that in California, high-cost loans tend to concentrate in census tracts with a high percentage of those unemployed and below the poverty line. In another investigation, Federal Reserve economist Ergungor (2007) shows that, while controlling for a host of factors, the more bank branches within a 10-mile radius of a low- and moderate-income neighborhood, the lower, on average, the price of credit. Ergungor's results indicate that a 1 standard deviation increase in branch access is associated with a 27 basis-point drop in the price of credit.

Property value escalation is another important predictor of high-cost lending and foreclosures (Reid & Laderman, 2009; Rugh & Massey, 2010). Reid and

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Laderman's research in California demonstrates that property value increase over a prior two-year span was associated with a greater likelihood that an individual in that area received a high-cost loan. Further, Rugh, and Massey show that prior property value increase, as measured by the Federal Housing Finance Agency's (FHFA) housing price index (HPI) in the top 100 metropolitan areas, was associated with greater numbers of foreclosures. Based on these studies, one would expect that areas with booming housing markets would experience greater subprime lending rates.

Reid and Laderman's (2009) study also indicates that the channel of origination predicts subprime lending. They show that even after controlling for important individual and community characteristics, those who received their mortgages through IMCs, compared with regulated lenders, were more likely to receive higher cost loans. IMCs are nonbank entities that fall outside federal regulatory oversight. In Reid and Laderman's study, people who received a loan from an IMCs were more likely to have a high-cost loan than were people who worked with a traditional bank. However, there is a disproportionate racial effect in that African Americans and Hispanics had an even higher likelihood of receiving a high-cost loan from an IMCs than were similarly situated whites. This research suggests that the channel of origination and the market penetration of IMCs may relate to metropolitan patterns of high-cost lending.

As noted, a few studies have investigated the relationship between segregation and subprime lending. A 2005 study by the NCRC, using 2003 data from 177 metropolitan areas, suggests that greater black/white segregation is associated with higher subprime-to-prime loan ratios among black borrowers. The NCRC study also explored Hispanic/white segregation but this variable was a non-significant predictor of subprime-to-prime loan ratios among Hispanic borrowers. While the NCRC study suffers from some methodological shortcomings, such as assuming that all loans originated by identified subprime lenders were high-cost loans (the same assumption made by the early HUD studies), it was one of the first to investigate the relationship between black and Hispanic segregation and sub-prime lending.

In a subsequent study, Been et al. (2009) use 2006 HMDA data to conduct a national and a within-city (New York) analysis of segregation and its effect on individual probabilities of receiving a high-cost loan. The national component of their investigation, which includes 200 metropolitan areas, found a positive association between metropolitan segregation (using both black and Hispanic dissimilarity and isolation indices) and the likelihood of receiving a high-cost loan for individual black and Hispanic borrowers. Moreover, their New York City analysis shows that as a neighborhood's percentage of minorities increases, the likelihood of white, black, and Hispanic borrowers receiving a high-cost loan becomes greater. One limitation of this study is that it did not include important high-cost loan predictors such as credit score, bank branch access, or the prevalence of IMCs. Additionally, this investigation explores the likelihood that an individual receives a high-cost loan, and does not investigate whether segregation influences the prevalence of subprime loans across metropolitan areas.

While these prior studies suggest that heightened levels of segregation lead to increased subprime origination rates, the relationship might be reversed. Bond and Williams's (2007) study investigates the effect of subprime lending on segregation. Their results indicate that the source of credit and type of loan determine whether subprime lending is linked with increases or decreases in black/white segregation.

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They demonstrate that in areas where minorities receive a disproportionate amount of loans from traditional lenders, black/white segregation decreases. They also find evidence that when minorities receive greater proportions of loans from subprime and manufactured housing lenders, segregation does not decrease and, in some models, actually increases slightly.

In this article, we test segregation's effect on the metropolitan proportion of subprime lending. We assume that segregation relates to a variety of mechanisms, such as a lack of experience with financial transactions and subprime lender targeting, which lead to greater geographic susceptibility to subprime originations. We hypothesize that there will be a significant positive effect of segregation on metropolitan subprime lending rates.

Data and Methodology

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The unit of analysis is the metro core-based statistical area (CBSA), which proxies for the metropolitan region.[9] The CBSA is a collective term for both metro and micro areas. A metro area contains a core urban area of 50,000 people or more, and a micro area contains an urban core of between 10,000 and 50,000 people. Each metro or micro area consists of one or more counties and includes 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. We assess only the largest 200 metro CBSAs and not the micro areas because we are concerned with segregation and lending patterns in more populated metropolitan areas. Metro CBSAs cover extensively a city's outlying suburban areas, and we are interested in investigating this level of geography because studies have shown that in many metropolitan areas, much of the subprime (Kingsley & Pettit, 2009) and foreclosure concentration (Immergluck, 2010) is in outer suburbs.

We chose to assess the predictors of high-cost loans at the metro CBSA level because we assume that segregation might increase the risk of subprime lending for all residents in highly segregated regions. Two lines of evidence support this assertion. First, Been et al.'s (2009) study indicates that segregated neighborhoods in New York City increase, although at different levels, the likelihood that black, Hispanic, and white borrowers in those neighborhoods will obtain a high-cost loan. Thus, segregation may relate to subprime targeting, which might have spillover effects to everyone, although disproportionately, in a targeted neighborhood. Second, other forms of inequality, such as income inequality, reduce the health of the entire society, not just those who are poor (Subramanian & Kawachi, 2004; Wilkinson, 1996). Just as income inequality affects the health of the entire society, segregated metropolitan areas might become more susceptible to high-cost loans.[10]

To explore our primary question, we assembled a dataset from a variety of sources including HMDA, the ACS, Census data, Equifax, FDIC, and the FHFA. The HMDA, ACS, Equifax, and FDIC data were all collected for 2006, the Census data were from 2000, and the FHFA HPI data were derived from 1995 to 2006. The dependent variable is the natural log of the percentage of originated first-lien mortgage loans that were high-cost according to 2006 HMDA reports.[11] To determine the percentage of subprime loans, we summed the number of prime and subprime home-purchase and refinance first-lien mortgage loans for owner-occupants and divided the number of subprime loans by the total number of loans. This number was derived for each metro CBSA. As Figure 1 shows, in 2006 there

was great variation in the proportion of subprime loans across metropolitan areas. In this figure, the darker the color, the greater the percentage of subprime loans.

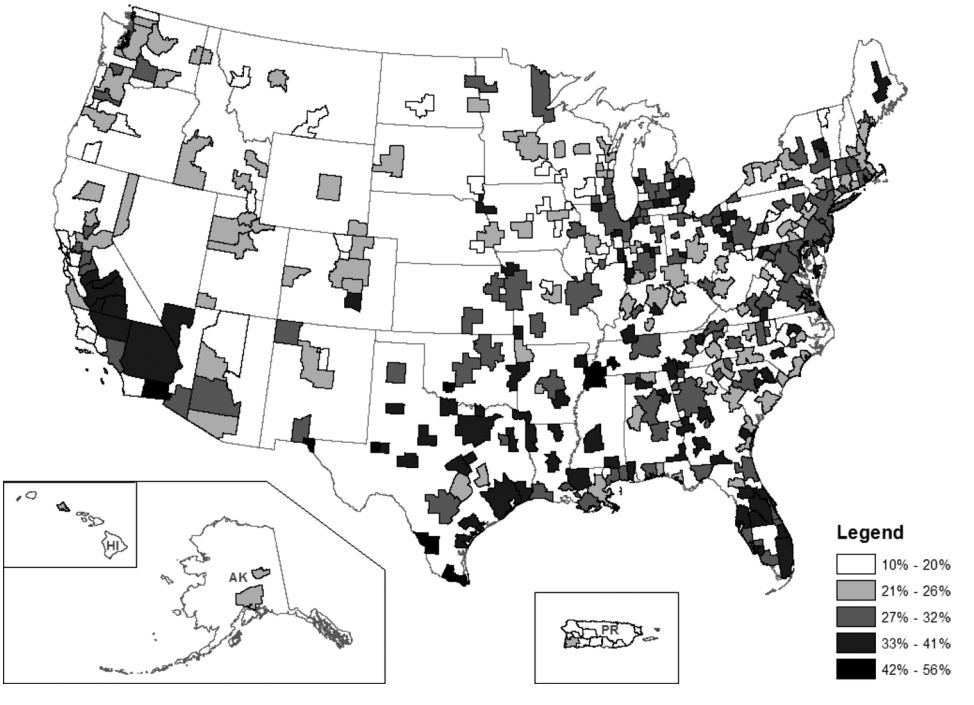
The primary independent variable is racial segregation, as determined by the black and Hispanic dissimilarity indices (Cashin, 2004; Massey & Denton, 1988; Timberlake & Iceland, 2007). The *D* (*D*) indicates how unevenly two mutually exclusive groups, in this case blacks and whites, and Hispanics and whites, are distributed within a geographic area. The formula for calculating *D* between whites and racial or ethnic group *X* is

$$Dwx = \frac{1}{2}\sum_{j=1}^{J}\left|\frac{w_j}{W} - \frac{x_j}{X}\right|$$

where w_j is the population of whites in tract *j*, *W* is the total population of whites in the CBSA, x_j is the population of group *X* (blacks or Hispanics) in tract *j*, and *X* is the total CBSA population of group *X* (blacks or Hispanics).

D can be thought of as the extent to which one group or the other would have to move to achieve racial representation in each of the area's census tracts proportionate to the composition of the two groups in the broader region. For instance, if African Americans made up 20% of the population within a metro CBSA, the black *D* tells us the percentage of African Americans, or whites that would have to move to have African Americans be 20% of the population in each of the metro CBSA's census tracts. Thus, a 65 score on the black *D* means that 65% of African Americans or whites would have to move to achieve an even distribution of blacks and whites throughout

Figure 1. Percentage of high-cost, first-mortgage loans by metropolitan area.



Source. Home Mortgage Disclosure Act, 2006.

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the region.[12] The higher the D, the more the region is segregated. Black and Hispanic Ds were derived from the 2000 Census.[13]

We also test all our models using another measure of segregation, the isolation (ISO) index. This segregation measure estimates the extent to which a racial or ethnic group is exposed only to their own group, where exposure refers to the extent or degree of contact and interaction among individuals (Massey & Denton, 1988). The ISO index is calculated for a racial or ethnic group X by:

$$\mathrm{ISO}xx = \sum_{j=1}^{J} \left| \frac{x_j}{X} \cdot \frac{x_j}{t_j} \right|$$

where x_j is the population of group X in tract j, X is the total population of group X in the CBSA, and t_j is the total population of tract j. ISO is interpreted as the average percentage of members of one's own racial or ethnic group who reside in their neighborhood or census tract. For example, an ISO of 80 for African Americans would mean that the typical African American resides in a tract that is 80% black (Timberlake & Iceland, 2007). The higher the ISO index, the more isolated a particular group is from all other racial and ethnic groups in the CBSA. We use both the dissimilarity and ISO indices to demonstrate the robustness of segregation on the prevalence of subprime loans.[14]

Our control variables have been identified in previous research as significantly related to the probability of subprime lending. These metropolitan-level measures include the percentage minority, the percentage black (and Hispanic), the percentage black (and Hispanic) below the poverty level, the percentage black (and Hispanic) unemployed (16 years or older), the percentage black (and Hispanic) with a college degree or higher, the percentage of consumers with low credit scores (<639), and the change in the HPI.[15] We also constructed a financial access measure, the number of bank branches per 1,000 residents, and a channel of origination indicator, the percentage of mortgages originated by IMCs. To account for the possibility of regional variation, we include a series of geographic dummy variables (i.e., South, Midwest, and West), with the Northeast excluded and serving as a reference point.[16]

Table 1 displays the source, mean, standard deviation, and correlation with other predictors for each variable (excluding the regional dummies). Overall, the average metropolitan subprime lending rate is 27.6%. This subprime lending rate is positively associated with all of the segregation measures, except for the Hispanic/white D. Other predictors positively associated with subprime lending include the percentage black (and Hispanics), percentage black (and Hispanics) below the poverty line, percentage black (and Hispanics) unemployed, home value escalation, percentage with low credit scores, and percentage of loans originated by IMCs. Higher educational levels, for both African Americans and Hispanics, and bank branch accessibility are negatively associated with subprime lending.

Analytic Strategy

We utilize IVs, estimated via 2SLS, to assess the effect of segregation on subprime lending. A key assumption of standard regression models is that a given treatment or independent variable is uncorrelated with the model's error term. This is known as the exogeneity assumption. In contrast, the problem of endogeneity occurs when an

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Table 1. Descriptive statistics and correlations for the largest 200 U.S. core-based statistical areas.

	Variable	Source	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	% high-cost loans	HMDA	27.6	6.9	1.000																
2.	Dissimilarity black	Census	51.4	12.7	0.288	1.000															
3.	Dissimilarity Hispanic	Census	35.7	11.6	−0.025	0.177	1.000														
4.	Isolation black	Census	30.7	21.0	0.348	0.708	−0.091	1.000													
5.	Isolation Hispanic	Census	18.6	19.3	0.211	−0.217	0.564	−0.357	1.000												
6.	% black	Census	11.7	10.6	0.322	0.283	−0.250	0.827	−0.346	1.000											
7.	% Hispanic	Census	11.0	15.7	0.294	−0.297	0.296	−0.387	0.935	−0.309	1.000										
8.	% black poverty	Census	25.7	6.4	0.392	0.308	−0.200	0.156	−0.165	0.064	−0.082	1.000									
9.	% Hispanic poverty	Census	22.3	6.1	0.189	0.037	0.338	−0.169	0.263	−0.177	0.240	0.414	1.000								
10.	% black unemployment	Census	6.8	1.9	0.183	0.212	0.026	0.081	−0.046	−0.005	−0.072	0.409	0.205	1.000							
11.	% Hispanic unemployment	Census	5.7	1.9	0.011	−0.158	0.211	−0.338	0.278	−0.344	0.248	0.195	0.451	0.438	1.000						
12.	% black education	Census	14.6	6.1	−0.476	−0.407	0.025	−0.368	0.174	−0.251	0.185	−0.511	−0.115	−0.210	−0.061	1.000					
13.	% Hispanic education	Census	14.3	7.4	−0.212	0.131	−0.545	0.280	−0.520	0.284	−0.401	0.069	−0.203	−0.086	−0.284	0.226	1.000				
14.	Change in HPI	FHFA	2.4	2.6	0.224	−0.119	−0.127	−0.201	0.333	0.173	0.343	0.182	0.313	0.202	0.403	−0.133	−0.163	1.000			
15.	% low credit	Equifax	28.1	5.4	0.640	−0.042	−0.211	0.403	0.119	0.647	0.242	0.136	0.088	0.001	−0.157	−0.254	−0.058	0.077	1.000		
16.	Branch access (per 1,000)	FDIC	0.3	0.1	−0.148	0.310	−0.217	0.184	−0.567	0.072	−0.556	0.249	−0.078	0.074	−0.241	−0.160	0.315	−0.364	−0.202	1.000	
17.	% IMC	HMDA	31.0	8.8	0.147	−0.296	0.160	−0.167	0.510	−0.080	0.482	−0.337	−0.057	−0.167	0.052	0.280	−0.240	0.337	0.165	−0.642	1.000

Note. $N = 200$. FDIC = Federal Deposit Insurance Company. FHFA = Federal Housing Finance Agency. HMDA = Home Mortgage Disclosure Act. HPI = Housing Price Index. IMC = Independent Mortgage Company.

independent variable is correlated with the error term in a regression model. Why might they be correlated? Two key reasons are omitted variables and measurement error. A third reason is simultaneity. As noted, prior research suggests that the relationship between metropolitan segregation and subprime lending may be bidirectional (Bond & Williams, 2007). The 2SLS procedure, if an appropriate IV is chosen, addresses the simultaneity issue. For an instrument, we utilize the number of municipal governments for each CBSA, constructed from the 1997 Census of Governments. We assume that the number of municipal governments only affects subprime lending indirectly through segregation. Following Tiebout (1956), the rationale is that the number of local governments in a metropolitan area is directly related to variation in the types of government services provided throughout the metropolitan area as well as corresponding tax rates. In theory, people sort into geographic areas based on their willingness to pay for government services. Thus, the number of municipal governments influences the sorting of populations, including sorting by race. Although this cannot be directly proven, other scholars have similarly used the number of municipal governments as an IV for segregation to address simultaneity and other endogeneity concerns, such as omitted variable bias and measurement error (Carruthers & Ulfarsson, 2002; Cutler & Glaeser, 1997; Dawkins, 2005).

In stage 1 of the 2SLS procedure, we model our key independent variable, segregation, as a function of the IV (i.e., the number of municipal governments) and the other covariates described previously.[17] The second stage of the two-stage estimation process models our dependent variable, the natural log of the percentage of high-cost loans in a CBSA, as a function of the predicted segregation measure from the first stage and the covariates.

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Results

Table 2 displays the black/white dissimilarity and ISO models. The most important finding is that black/white segregation, whether measured by dissimilarity or ISO indices, is a statistically significant positive predictor of the percentage of high-cost lending. A 1 point increase in either black/white dissimilarity or black ISO corresponds to a 4% increase in the percentage of loans which are high cost in a CBSA: $\exp(0.004) = 1.004$. The models strongly suggest that increased levels of segregation lead to greater proportions of subprime lending.

These models also show other consistent results. In these models, the geographic dummy variables suggest that the Midwest, compared with the Northeast, has a greater proportion of subprime loans, and the West, compared with the Northeast, has a lower proportion. The percentage of black residents in poverty, of residents with low credit scores, and the IMCs mortgage market share are associated with greater subprime lending, while black education and bank branch accessibility are negatively associated with the share of high-cost loans. Note, when including these relevant covariates of subprime lending, we have accounted for the positive zero-order relationship between the percentage of black population and subprime lending observed in Table 1. In other words, inclusion of factors such as segregation, credit scores, and socioeconomic characteristics explains why subprime loans are concentrated in black communities. Thus, net of other covariates, we find a negative relationship between subprime lending and the percentage of black population.

Table 3 displays the Hispanic/white dissimilarity and ISO models. Results reveal that Hispanic segregation, whether measured by dissimilarity or ISO, does not

Table 2. Two-stage least squares instrumental variable estimates of the effects of black/white segregation on high-cost lending.

	Dissimilarity		Isolation	
	Coefficient	Robust SE	Coefficient	Robust SE
Dissimilarity black	0.004	(0.002)*		
Isolation black			0.004	(0.002)*
% black	−0.008	(0.002)***	−0.013	(0.003)***
% black poverty	0.005	(0.002)*	0.006	(0.002)*
% black unemployment	0.011	(0.007)	0.012	(0.007)†
% black education	−0.008	(0.002)**	−0.008	(0.002)***
Change in HPI	0.006	(0.005)	0.006	(0.005)
% low credit	0.031	(0.004)***	0.031	(0.004)***
Branch access	−0.425	(0.195)*	−0.419	(0.207)*
% IMC	0.009	(0.002)***	0.008	(0.002)***
South	0.071	(0.036)*	0.049	(0.035)
Midwest	0.112	(0.032)***	0.098	(0.034)**
West	−0.164	(0.054)**	−0.189	(0.048)***
Intercept	2.007	(0.184)***	2.175	(0.151)***
Model fit (BIC)	−169.079		−158.963	

Notes. $N = 200$. BIC = Bayesian information criterion. HPI = housing price index. IMC = independent mortgage company. SE = standard error.
†$p \leq .10$, *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 3. Predictors of high-cost lending: Hispanic/white segregation models.

	Dissimilarity		Isolation	
	Coefficient	Robust SE	Coefficient	Robust SE
Dissimilarity Hispanic	0.006	(0.005)		
Isolation Hispanic			0.007	(0.007)
% Hispanic	0.001	(0.001)	−0.006	(0.007)
% Hispanic poverty	−0.001	(0.003)	0.001	(0.003)
% Hispanic unemployment	0.015	(0.010)	0.013	(0.009)
% Hispanic education	−0.002	(0.005)	−0.004	(0.004)
Change in HPI	0.020	(0.006)***	0.020	(0.006)***
% low credit	0.029	(0.005)***	0.027	(0.004)***
Branch access	0.059	(0.289)	−0.027	(0.242)
% IMC	0.006	(0.002)**	0.005	(0.002)*
South	0.102	(0.063)	0.082	(0.051)
Midwest	0.210	(0.055)***	0.195	(0.048)***
West	−0.180	(0.094)†	−0.231	(0.058)***
Intercept	1.926	(0.440)***	2.187	(0.227)***
Model fit (BIC)	−79.184		−92.257	

Notes. $N = 200$. BIC = Bayesian information criterion. HPI = housing price index. IMC = independent mortgage company. SE = standard error.
†$p \leq .10$; *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

predict a metropolitan's share of subprime loans. The Hispanic segregation models indicate that the changing HPI, percentage with a low credit score, and proportion of loans originated by IMCs are predictive of subprime lending.

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Discussion

John Relman, a prominent civil rights attorney, asserted that "reverse redlining arises in cities where there are racially segregated residential living patterns" (Relman, 2008, p. 637). Our results support Relman's observation and suggest that racial segregation is an important predictor of the proportion of metropolitan area mortgage loans that are subprime. These results, along with other studies (Been et al., 2009; Bond & Williams, 2007; Rugh & Massey, 2010), suggest that race is an important determinate of the geography of subprime loans and related foreclosures.

While black/white segregation predicts the proportion of high-cost loans, Hispanic/white segregation did not. This finding is consistent with some prior subprime and foreclosure research (i.e., NCRC, 2005; Rugh & Massey, 2010). The lack of a significant finding for Hispanic/white segregation might relate to the fact that black/white segregation, on average across the metro CBSAs, is more intense than Hispanic/white segregation. However, this does not mean that Hispanic/white segregation is irrelevant to subprime lending. For instance, studies have found that highly segregated Hispanic metropolitan areas increase the likelihood that a Hispanic in that area will receive a subprime loan (e.g., Been et al., 2009).[18] It might be that Hispanic/white segregation increases the propensity for individual Hispanics to receive high-cost loans, but it does not consistently predict a metropolitan's share of subprime loans.

Beyond segregation, the penetration of IMCs into a region's mortgage market is association with the prevalence of subprime mortgages. In all of our models, the percentage of loans originated by IMCs was a significant predictor of a metropolitan's share of high-cost loans. Prior research has shown that when an individual obtains a loan through an IMCs, compared with a mainstream lender, it increases his or her likelihood of receiving a high-cost loan (Reid & Laderman, 2009). Our research suggests that the channel of origination, indicated by IMCs market penetration, is important for understanding a metropolitan's proportion of subprime loans.

Besides the segregation and IMCs findings, we had some other surprising and provocative results. First, we expected that bank branch access would be a significant predictor of high-cost lending; however, our evidence suggests that the effect of bank access is inconsistent. The black/white segregation models indicated that this was a significant subprime predictor, while the Hispanic segregation models did not. It is important to note that our measure of bank branch access was at the metro CBSA level, while prior studies construct this measure at the community level (e.g., Ergungor, 2007). Branch accessibility might be more meaningful in predicting the price of mortgage credit and the allocation of subprime loans at the community level.

Second, we expected that a booming metropolitan housing market (i.e., escalating property values) would be associated with an increased percentage of high-cost loans. We found this relationship to be statistically significant in our Hispanic segregation models but not for black segregation. Our expectations were based on Reid and Laderman's (2009) study, which found that property value appreciation over a prior two-year period was an important predictor of subsequent subprime lending, as well as Rugh and Massey's (2010) research, which found that a changing HPI predicted a metropolitan's amount of foreclosures. The conflicting results between our study and others might stem from different sample selection. For instance, Reid and Laderman restricted their study to California loans, and Rugh

and Massey investigated changing housing prices in the largest 100 metros, while our sample consisted of the top 200. Despite these sampling differences, these inconsistent results suggest that further research is needed to better understand the ways in which escalating housing prices relate to subprime and foreclosure concentration among different racial and ethnic groups.

While past research has shown that segregation is linked with poor outcomes for African Americans (Acevedo-Garcia, Lochner, Osypuk, & Subramanian, 2003; Carr & Kutty, 2008; Williams & Collins, 2001), this study suggests that segregation might have negative consequences for all residents of a metropolitan area. Black/white separation and ISO are associated with a larger total share of subprime loans. Subprime loans, compared with prime loans, are more likely to default (Avery et al., 2007; Coulton et al., 2008; Immergluck & Smith, 2005; Pennington-Cross & Ho, 2006; Quercia, Stegman, & Davis, 2007), and foreclosures are associated with decreased property values in proximate areas (Immergluck & Smith, 2006; Kobie & Lee, 2011; Lin et al., 2009; Schloemer et al., 2006). Metropolitan areas with larger shares of subprime mortgages will likely have greater foreclosures, lower property values, and less property tax revenue. Lower tax revenues could affect an area's economic and social program spending (Joint Economic Committee, 2007; U.S. Conference of Mayors, 2007), which may affect more than just those minorities who disproportionately receive subprime loans.[19]

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Further Research

Our evidence strongly suggests an association between black/white segregation and proportions of subprime lending; however, we know little about the specific mechanisms by which residential segregation leads to higher rates of subprime lending. Several pathways at the neighborhood level might link the segregation of African Americans to higher proportions of metropolitan high-cost lending. It is quite possible that the spatial separation of African Americans relates to marketing and targeting subprime strategy by lenders (Engel & McCoy, 2011; Fisher, 2010; Howell, 2006), and this targeting might actually increase the probability of receiving a high-cost loan for all who live within these targeted areas. For instance, Been et al. (2009) found that segregated black neighborhoods in New York City increase the likelihood that whites and blacks within these neighborhoods would receive a subprime loan. Thus, segregation might be related to a particular type of subprime marketing strategy that disproportionately affects minorities but affects all, and thus increases the proportions of high-cost loans in the broader region.

It is also possible that prime lenders are reluctant to make loans in segregated areas, and thus little choice is given to borrowers in these neighborhoods. Wyly et al. (2009) show a positive relationship between loan denials and subprime lending rates. It is plausible that subprime lenders might not have specifically targeted minority communities, but they might have been the only willing lender. The association of IMCs with subprime lending, combined with Wyly et al.'s (2009) findings, suggests that subprime lenders might not have targeted these areas but are filling a mainstream lender void in minority communities. A lack of mainstream lending in segregated communities might affect the price of credit for all who live within these areas. Further research is needed to determine the extent to which segregation affects the lending patterns of both prime and subprime lenders.

Finally, the effect of education begs the question of whether a lack of financial knowledge in segregated, minority communities might have also contributed to the higher proportions of subprime lending in more segregated regions. We found that higher black education at the metropolitan level was associated with lower shares of subprime lending. Segregation has been associated with lower levels of general education for isolated populations (Carr & Kutty, 2008), and this might make this population more susceptible to subprime lenders (Squires, 2008b). Future studies need to more rigorously explore the relationships among segregation, education, and subprime lending, as well as other potential mechanisms that might link segregation to high-cost loan prevalence.

While this study provides evidence for the importance of segregation in predicting the metropolitan geography of high-cost loans, there are some potential shortcomings. The segregation indices, as well as some of our control variables, were derived from the 2000 Census data. This could be problematic because our lending data are from 2006 and the segregation levels in the metropolitan regions between 2000 and 2006 might have changed. Furthermore, this study did not account for some metropolitan characteristics, such as municipal regulations (e.g., local anti-predatory lending laws; Bostic, Engel, McCoy, Pennington-Cross, & Wachter, 2008) and racial prejudice, which might affect both segregation and subprime lending rates (Rugh & Massey, 2010).

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Policy Recommendations

Although there are several reasons why subprime lending proliferated amid various approaches that might ameliorate such lending, our findings suggest three potential avenues of policy focus that might decrease a metropolitan area's vulnerability to subprime lending. We propose provisional policy recommendations intended to up or down (1) decrease black/white segregation, (2) educate borrowers, and (3) regulate the IMCs lending industry.

Housing policies of the past have been linked with the segregation of minorities, particularly African Americans (Carr & Kutty, 2008; Massey & Denton, 1993; Massey & Kanaiaupuni, 1993), and there are some housing reforms that might better integrate metropolitan America. Today, much of the distressed public housing that once segregated African Americans in inner-city neighborhoods is being razed (Goetz, 2003; Hyra, 2008). Residents of these demolished buildings, who are disproportionately African American, are receiving rent subsidies to obtain private-market rental units (Goetz, 2011). Evidence suggests that voucher holders are ending up in other highly segregated African American communities (Kingsley, Johnson, & Pettit, 2003; Pendall, 2000b). To prevent the continuing concentration of poverty and racial disadvantage, the HUD's Housing Choice Voucher program should be reformed to provide greater opportunities for recipients to find units in less segregated and impoverished neighborhoods. Some research suggests that this can be accomplished through assigning mobility counselors, who provide premove counseling, to voucher recipients and offering housing providers information on the voucher program (e.g., Cunningham & Sawyer, 2005; Turner & Briggs, 2008).

The Low Income Housing Tax Credit (LIHTC) program and inclusionary zoning laws are two mechanisms for increasing the number of affordable rental units in nonpoverty neighborhoods for voucher recipients. Traditionally, housing developments in low-income communities are given preferences for LIHTCs. This

circumstance may indirectly increase or sustain prior levels of segregation by placing low-income residents and units in an already low-income community. To open up housing opportunities for low-income families, affordable housing developments in middle- and upper-income communities should be given priority for LIHTCs. Inclusionary zoning laws can also increase the stock of affordable housing in low-poverty areas, which might reduce black/white segregation patterns (Nelson, Sanchez, & Dawkins, 2004; Pendall, 2000a; Rothwell & Massey, 2009). These local laws require new developments to set aside a certain percentage of units for affordable housing. The federal government could provide financial incentives for municipalities to adopt zoning laws that promote the construction and redevelopment of affordable units.

Housing market discrimination clearly contributes to black/white segregation. To more effectively enforce fair housing laws already in place, elements of the once-proposed Housing Fairness Act of 2010 (H.R. 476) should be reconsidered. This bill would have provided millions of dollars to support paired-testing programs nationwide. In paired-testing investigations, equally qualified white and nonwhite auditors posing as homebuyers or renters approach housing providers, such as real estate and rental agents, mortgage lenders, and insurance agents, and inquire about the availability of the same or similar housing units or housing-related services like home insurance or mortgage loans. Such investigations have routinely revealed discrimination in approximately one out of every five initial visits to real estate or rental agents. Discrimination in insurance and mortgage lending has also been documented using similar investigative techniques (S. Smith & Cloud, 1997; Squires, 2008a; Squires & Chadwick, 2006; Turner et al., 2002; Turner & Skidmore, 1999). If the real estate, mortgage, and insurance industries knew these investigations were going to occur more frequently, incidents of discrimination and levels of segregation might be reduced.

Evidence from this study and others (e.g., Calem et al., 2004) suggest that the level of black education is associated with a decrease in subprime lending. Population levels of formal educational attainment are, of course, rough proxies for knowledge of the mortgage market. But programs that increase the population-level financial competencies could be one step toward protecting people from lenders peddling predatory subprime loans. An expansion of financial literacy programs, focused specifically on negotiating the lending environment and increasing credit scores, in African American communities might reduce a metropolitan's share of high-cost loans.

This study has implications for regulatory reforms of mortgage lenders. Federal and state oversight over the IMCs, the unregulated entities that originated the bulk of subprime mortgages (Avery et al., 2007), might reduce high-cost lending. IMCs are typically structured in an originate-to-sell business model, where once they make a loan, they sell it off to secondary mortgage market investors. Origination fees and loan sale premiums generate revenue for IMCs, and these secondary market transactions eliminate default risk for the originator. Some suggest that the originate-to-sell versus the originate-to-hold business strategy incentivizes IMCs to originate high-cost loans to obtain higher yield sale premiums (Wyly et al., 2009). Reducing secondary market incentives for IMCs might help decrease some of the risky high-cost lending.

Conclusion

Since 2008, lenders, regulators, elected officials, and residents generally have witnessed and been victimized by unprecedented turmoil in the U.S. housing,

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banking, and related industries. That turmoil has spread worldwide. The decline in property values, coupled with record-level foreclosure rates, has crippled mortgage companies, commercial banks, and investment banks and threatened the stability of the U.S. financial system. Trillions of dollars in federal support were needed to prevent the collapse of the entire financial system. Even with this massive capital injection, America is still facing the fallout from this crisis, which can be directly linked to the proliferation and securitization of subprime mortgages. While a host of individual, community, and institutional factors are related to high-cost lending, this research suggests that black/white segregation is an important dynamic in understanding the metropolitan geography of subprime loans.

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Notes

1. There is an important difference between legitimate subprime lending and predatory lending, but the line between them is not always clear. Most predatory lending occurs in the subprime market. Fannie Mae and Freddie Mac have estimated that between one-third and one-half of those receiving subprime loans would qualify for prime loans (Engel & McCoy, 2002). Subsequent analyses show that 55% in 2005 and 61% in 2006 of subprime borrowers would have likely qualified for prime loans (Brooks & Simon, 2007). Despite the distinction between subprime and predatory lending, it is likely the case that initiatives to reduce one will reduce the other.
2. While segregation has decreased since the 1960s, it still persists in most cities, and at hypersegregated levels in many (Fischer, Stockmayer, Stiles, & Hout, 2004; Logan, Stults, & Farley, 2004; Timberlake & Iceland, 2007; Wilkes & Iceland, 2004).
3. In this article, the terms *high-cost*, *subprime*, and *high-priced loans* are used interchangeably.
4. It is important to note that controlling for individual, loan, and community characteristics reduces the subprime lending gap between people of color and whites but does not explain it away (see Avery et al., 2007; Bocian, Ernst, & Li, 2008; Courchane, 2007; Reid & Laderman, 2009).
5. A recent study by Rugh and Massey (2010) uses 2SLS models to investigate the causal effect of segregation on foreclosures. While understanding the connection between segregation and foreclosures is important, it is also vital to investigate the relationship between segregation and subprime loans because high-cost loans are important precursors to foreclosures (Coulton, Chan, Schramm, & Mikelbank, 2008; Immergluck & Smith, 2005).
6. Following the Depository Institutions Deregulation and Monetary Control Act of 1980, the passage of the Alternative Mortgage Transaction Parity Act in 1982, which allowed lenders to use variable interest rates and balloon payments, and the Tax Reform Act of 1986, which allowed interest rate mortgage deductions, facilitated, to some extent, the emergence of the subprime market. Some also argue that the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 contributed to the evolution of the subprime market (Aalbers, 2009; Weicher, 2007).
7. In the subprime literature, there is a debate as to what is a subprime loan, but most studies after 2005 use the high-cost loans flagged in HMDA as a proxy for subprime loans.

8. In addition to these studies, others attempted to investigate whether mortgage-pricing differentials between whites and minorities are justified relative to standard risk-based pricing and underwriting factors. A study by Courchane (2007) demonstrates that up to 90% of the APR gap for African Americans and 85% of the gap for Hispanics is explained by observable differences in underwriting, costs, and related market factors. Edelberg (2009) discovered that after controlling for the financial cost of issuing debt, the likelihood of price differential between whites and minorities decreased after 1995, when risk-based pricing became more prevalent. These studies suggest that lending institutions might not be allocating higher debt prices in a discriminatory way. However, it is important to note that in these studies, racial price disparities are not fully eliminated.
9. Metropolitan and micropolitan statistical areas are geographic entities defined by the U.S. Office of Management and Budget for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics (see http://www.census.gov/population/www/estimates/metroarea.html, accessed July 24, 2010).
10. Rugh and Massey's (2010) analysis of the effect of segregation on foreclosures also assumes the spillover logic for they assess the influence of metropolitan segregation on metropolitan foreclosure levels.
11. Loans are defined as high-cost when the APR is 300 basis points above a comparable Treasury note.
12. The dissimilarity and isolation indices each range from 0 to 100 when reported as a percentage. The closer each index is to 1, the higher the level of segregation.
13. The 2000 Census is the most recent available dataset that can be used to accurately construct these indices.
14. These indices are standard segregation measures (Massey & Denton, 1988) and have been used in recent studies exploring the effect of segregation on subprime lending (Been et al., 2009) and foreclosures (Rugh & Massey, 2010).
15. Following Rugh and Massey (2010), we compute a measure of the housing price increase in each CBSA by dividing the ratio of the average annual increase in the FHFA's HPI from 2000 to 2006 by the average annual increase from 1995 to 1999. The HPI is a weighted, repeat-sales index that measures price changes in repeat sales or refinances on the same properties. By using the 1995–1999 HPI increases in the denominator, we construct a variable that measures the change in prices during the housing boom of the 2000s relative to a previous time period.
16. Some of the CBSAs were in two geographic regions, and CBSAs were labeled for the region in which the majority of their census tracts were located.
17. We utilize four different measures of segregation in our analyses—black dissimilarity, Hispanic dissimilarity, black isolation, and Hispanic isolation—and estimate separate 2SLS models for each respective segregation index.
18. Been et al.'s (2009) study did not assume a positive linearity relationship between segregation and high-cost lending. They assessed the effect of segregation on high-cost lending by dividing metropolitan areas into low, medium, and highly segregated areas. In their models, assessing high-cost home purchase loans, they found an effect for black/white segregation in all three levels of metropolitan segregation, while the effect for Hispanic/white segregation was only significant in highly segregated areas. In this study, and in other studies (NCRC, 2005; Rugh & Massey, 2010), the effect of black/white segregation on subprime lending is more robust, while the effect of Hispanic/white segregation is inconclusive.
19. We do not present direct evidence that minorities in more segregated metropolitan areas are disproportionately receiving subprime loans, but based on prior research, such as the studies referenced in the literature review section, this is likely the case.

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