The Neighborhood Distribution of Subprime Mortgage Lending

Paul S. Calem
Division of Research and Statistics
Board of Governors of the Federal Reserve System

Kevin Gillen
The Wharton School
University of Pennsylvania

Susan Wachter
The Wharton School
University of Pennsylvania

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by

Paul Calem, Kevin Gillen, and Susan Wachter

Subprime lending in the residential mortgage market, characterized by relatively high credit risk and high interest rates or fees, has developed over the past decade into a prominent segment of the market (Temkin 2000). Research to date indicates that there is geographical concentration of subprime mortgages in Census tracts where there are high concentrations of low-income and minority households. The growth in subprime lending represents an expansion in the supply of mortgage credit among households who do not meet prime market underwriting standards. Nonetheless, its apparent concentration in minority and lower-income neighborhoods has generated concerns that households in these areas may not be obtaining equal opportunity in the prime mortgage market, and that such lending may undermine efforts to revitalize minority and lower-income areas, to the extent that it is associated with so-called predatory practices.

This paper extends the literature on the spatial distribution of subprime lending, examining, in particular, the robustness of previous findings of minority and low-income concentration. We add to the existing literature in several respects. First, we conduct the analysis at the individual city level, selecting Chicago and Philadelphia as the subject of the study. The city-level analysis allows us to identify factors associated with within-city concentrations of subprime loans and eliminates the need to control for systematic differences in lending patterns across cities. Second, we investigate the spatial concentration of subprime lending across Census tracts within each city more closely than previous studies, by examining its spatial association with risk measures along with tract demographic variables. The incorporated tract-level risk variables include the proportion of individuals (of borrowing age) that have low credit ratings and the proportion without ratings, based on data from a major national credit bureau. Third, we supplement the analysis of subprime distribution across Census tracts with a logit regression

analysis at the borrower level, where we relate whether the loan obtained was subprime to both tract and borrower characteristics.

Because our set of risk measures is far from exhaustive, reflecting data limitations, the measures are largely indirect and the analysis cannot determine whether minorities have equal access to the prime mortgage market. Rather, our goal is to provide a broad overview of within-city, cross-neighborhood subprime lending patterns, making the fullest possible use of available data.

The paper is organized as follows. In the next section, we summarize previous studies and present an overview of broad national patterns with respect to subprime lending. The third section outlines our approach to analyzing the issue of neighborhood concentrations, and the fourth describes the data for the analysis. Section five presents our results and section six concludes.

2. Literature Review and Background

Several previous studies have examined the frequency of subprime borrowing relative to prime borrowing in residential mortgage markets in relation to borrower or neighborhood characteristics. All such studies as well as the present study rely on data on the individual characteristics of mortgage loans and borrowers that are collected by the Federal Financial Institutions Examination Council (FFIEC), in accordance with the Home Mortgage Disclosure Act (HMDA). Under HMDA, all lending institutions located within a metropolitan statistical area and with assets in excess of about 30 million dollars are required to file loan registers with the FFIEC providing information on each mortgage loan application. Reported information includes type of loan (conventional or federally insured), the purpose of the loan (home purchase, home improvement, refinance, or multifamily dwelling), the dollar amount of the loan, the census tract where the dwelling securing the loan is located, and whether the loan application was approved or denied. The HMDA disclosure records also provide information on the applicant's

income, gender, and race or ethnicity. Finally, each loan application is coded for the identification of the lending institution to which the applicant applied.

The HMDA data do not separately identify subprime loans. All previous studies as well as our study rely on the Department of Housing and Urban Development's (HUD) list of lenders that specialize in the subprime market and use loans originated by these institutions as a proxy for subprime loans, while all other loans are treated as non-subprime. This list was created from trade publications and other sources, based upon those subprime lenders who report under HMDA. It should be noted that there is potential measurement error due to the omission of smaller lenders that do not report under HMDA and to inability to classify those lenders that originate both types of loans.

All previous studies find significant concentration of subprime lending among minority borrowers or within neighborhoods where minority households predominate. Bunce *et. al* (2000) calculate relative frequencies of subprime refinance lending in predominantly minority neighborhoods and low- or moderate-income neighborhoods nationally and for five individual metropolitan areas (New York, Chicago, Baltimore, Atlanta, and Los Angeles) in 1999, without control variables. They find that on average nationwide, subprime loans were three times more frequent in low-income neighborhoods than in upper income neighborhoods and five times more frequent in predominantly black neighborhoods than in predominantly white neighborhoods. They also find that one in every two refinance loans in black neighborhoods were subprime, compared to only one in every 10 in white neighborhoods.[1]

 Canner, Passmore, and Laderman (1999) report that in 1998, 6.8 percent of mortgage loans to low or moderate-income households, 12 percent in low- or moderate-income areas, and 15.6 percent of mortgage loans to black households or in predominantly black neighborhoods were subprime, compared with 6 percent of mortgage loans overall. Moreover, they present

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[1] In New York, 60 percent of refinance loans in predominantly black neighborhoods were subprime, 52% in Chicago, 49 % in Baltimore, and 33% in Atlanta and Los Angeles.

evidence that subprime lending has increased the number of loans to low- or moderate-income and minority households and to residents of low- or moderate-income and predominantly minority neighborhoods. They report that more than one-third of the growth in overall lending to predominantly minority tracts between 1993 and 1998 was due to increases in subprime lending, and about one-fourth for lower income tracts. Similar patterns are demonstrated for manufactured housing loans. Immergluck and Wiles (1999) also provide an analysis of lending patterns over time, focusing on Chicago in the late 1990s. They find that subprime lending had been increasing in share in neighborhoods with high concentration of minorities. Neither study controls for other factors such as risk.

Scheessele (2002) identifies the type of neighborhoods in the nation as a whole where borrowers are likely to rely on subprime loans for refinancing. He finds that even after controlling for several neighborhood characteristics (but not for the spatial distribution of credit ratings), the percentage of African Americans is positively related to the share of subprime refinance.

Pennington-Cross, Yezer, and Nichols (2002) conduct an analysis of the factors associated with whether a borrower obtained a subprime, prime, or FHA mortgage when obtaining a home purchase loan, using nationwide data from 1996. The analysis controls for individual borrower credit risk using data from a major national credit bureau that was merged into the HMDA data by matching the original loan amount, Census tract, and identity of the lending institution. The analysis relates differences across metropolitan statistical areas (MSAs) to MSA level variables, but only includes one tract level variable: a dummy variable identifying "underserved" (low income and predominantly minority) neighborhoods. The study finds that the subprime market does not primarily provide mortgages to these "underserved" neighborhoods or to lower income borrowers; rather, it primarily serves higher risk borrowers. In addition, the study finds that black and Asian borrowers have a higher probability (.8-1.6 percentage points) of

using the subprime market. This is a big increase on a relatively small base: only 2.4 percent in the sample used the subprime market.

Our study is closest in spirit to Scheessele (2002), in that we focus on the relative frequency of subprime loans by neighborhood in relation to demographic composition of the neighborhood, controlling for neighborhood risk measures derived from Census data. In contrast to Scheessele (and also in contrast to Pennington-Cross, *et. al*), we conduct the analysis at the individual city level, control for a wider variety of neighborhood characteristics including the distribution of individual credit ratings, and estimate both tract-level and borrower-level equations.

3. Methodology

We conduct a systematic investigation of city-level subprime lending patterns, testing for associations with demographic variables and with measures of risk in a multivariate regression framework. We select two cities for analysis: Philadelphia, Chicago, which represent, respectively, large cities with substantial minority populations, a large number and wide variety of mortgage lending institutions, and a substantial, but not unusually high, amount of subprime mortgage lending activity.[2] Moreover, in each city, there is a substantial, but not unusually high concentration of subprime lending in minority areas.[3] The housing and mortgage markets are sufficiently different in Philadelphia and Chicago, however, that it is not redundant to study both

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[2] We do not consider the entire MSAs but restrict attention to census tracts within each city as defined as a political entity.
[3] For instance, define the relative penetration of subprime in high-minority tracts for a given city to be the percent of subprime loans in tracts where more than 80 percent of the population is minority, divided by the percent of all loans in these tracts. Similarly, define the relative penetration of subprime in low- or moderate-income tracts for a given city to be the percent of subprime loans in tracts where median income is less than 80 percent of the MSA median income, divided by the percent of all loans in these tracts. In the case of refinance loans, the mean across MSAs of the relative subprime penetration in high minority (respectively, low- or moderate-income) areas is about 2.7 (1.8). In the Philadelphia MSA, it is 3.2 (2.6), and in the Chicago MSA it is 3.1 (2.3). In the case of purchase loans, the mean across MSAs of the

cities. For similar reasons, these two cities have often been the focus of previous studies of

neighborhood lending patterns.[4]

We analyze the relative frequency of subprime borrowing across neighborhoods within

each city at two levels: the tract level, where the dependent variable is the percentage of tract

loans that are subprime, and the borrower level, where the dependent variable is whether the loan

obtained is subprime. At each level, we conduct the analysis for each of two loan types: home

purchase and refinancing and estimate several specifications. For reasons discussed below, in the

case of Philadelphia we repeat the borrower-level, logit analysis after excluding loans originated

by depository institutions that historically participated in the Delaware Valley Mortgage Plan

(DVMP), a local affordable lending program.[5]

We estimate four specifications for the tract-level regression equations with: (1)

neighborhood demographic variables only, (2) neighborhood demographic variables plus a

measure of credit risk, (3) these plus neighborhood proxies for property risk, and (4) all of these

plus a proxy for availability of prime conventional loans. For the borrower-level logit analysis,

we estimate three specifications that include the explanatory variables in (2), (3) and (4),

respectively, along with borrower level characteristics derived from HMDA data.

This approach is based on the hypothesis that a financial institution's mortgage lending

decisions are a function of risk and return factors that affect the expected net present value (NPV)

of the loan. To maximize profits, financial institutions are assumed to accept loan applications

whenever a loan's NPV exceeds zero. Subprime lenders are willing to bear higher levels of credit

and collateral risk because of the higher interest rate or fees associated with these loans; hence,

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relative subprime penetration in high minority (respectively, low- or moderate-income) areas is about 4.5
(2.7). In the Philadelphia MSA, it is 6.4 (3.7), and in the Chicago MSA it is 5.7 (2.5).
[4] See, for example, Immergluck and Wiles (1999), Calem and Wachter (1999), Schill and Wachter (1997).
[5] The DVMP was a community reinvestment program that was initiated in 1977. The three main elements
of the program were flexible lending criteria, "second-chance" review of applications slated for rejection,
and aggressive marketing and outreach on the part of participating lenders. Participating banks made a
commitment to apply program guidelines and to jointly review their lending policies, procedures, and
performance. Although it officially disbanded in 1998, individual institutions continued to apply affordable

subprime share should be positively correlated with risk. Thus, our empirical specifications

employ measures of borrower and location characteristics that are hypothesized to affect the

loan's risk through their expected impact on mortgage loss attributable to default.

In this context, demographic variables may proxy for omitted risk factors or for different

levels of demand for subprime loan products across neighborhoods with different demographic

compositions, or may capture the effects of possible discrimination at the neighborhood level.

Likewise, the relative availability of prime conventional loans may reflect omitted risk factors.

Thus, for each city and for each product category, we estimate regression equations for

percentage of mortgages in a census tract that is subprime, including in alternative specifications

some or all of the following right-hand side variables:

$$PCT\_Sub_i = \alpha_0 + \alpha_1 D_i + \alpha_2 C_i + \alpha_3 N_i + \alpha_4 S_i + \varepsilon_i$$

where PCT_SUB$_i$ is the percent of loans originated in census tract i that are subprime, D is a

vector of demographic variables, including, in particular, the percentages of home owners that are

African American, Hispanic, and Asian-American, respectively. C is a vector of measures of the

credit risk associated with individuals in the tract, and N is a vector of other neighborhood risk

variables. S measures the availability of prime conventional mortgages, and ε is a well-behaved

disturbance term. The equations are estimated by OLS, weighted by the number of owner

occupied units in the tract as reported in the 1990 U.S. Census.

For the borrower-level analysis, we follow Pennington-Cross *et al*. and hypothesize that

individual households maximize their welfare by choosing the least cost mortgage. We model the

bivariate choice between prime and subprime, where households finance their home purchases

and refinance their mortgage loans through less costly prime lenders, unless their risk profile

makes them ineligible for such loans. We do so by specifying logistic regression equations,

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home lending policies and procedures developed through participation in the program. See Calem

where the dependent variable is whether the *j*th individual uses a subprime or non-subprime

mortgage. We include some or all of the tract-level variables D, C, N, and S on the right-hand

side in alternative specifications, additionally including in each specification a vector Z of

individual borrower characteristics:

$$\Pr[subprime]_j = \beta_0 + \beta_1 D_j + \beta_2 C_j + \beta_3 N_j + \beta_4 S_j + \beta_5 Z_j + \varepsilon_j$$

4. Data and Variables for the City-Level Analysis

We use four main sources of data for the analysis. First, for individual characteristics of

mortgage loans and borrowers in each City, we use HMDA data for the year 1999. From these

data, we also derive several tract level variables. Second, we use the Department of Housing and

Urban Development's (HUD) list of lenders that specialize in the subprime market to uniquely

code each loan as being subprime or not. Third, we use 1990 and 2000 Census data to construct

tract demographic variables and neighborhood risk measures. Fourth, we use information on the

distribution of credit ratings within tracts available from CRAWiz®, a product of PCI Services in

Boston that provides comprehensive, geography-based information. Finally, we obtained data on

foreclosure activity by tract from First American Real Estate Solutions of Chicago, IL.

From the 1990 Census, we create five tract-level demographic variables. Three of these

variables respectively represent the proportion of African-American, Hispanic, and Asian-

American households among those that own homes in the tract (PCT_OWN_BLACK,

PCT_OWN_HISP, PCT_OWN_ASIAN). The fourth is the percent of the tract population over

25 years of age with at least a bachelor's degree (PCT_COLLEGE). College graduates may be

more financially sophisticated and, hence, may make greater effort to obtain a lower-rate

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(1993,1996) for further description of the DVMP.

mortgage, or on average may be less risky borrowers.[6] The final demographic variable is the log of median family income (LN_MED_INCOME) in the tract.

An innovation in our study is inclusion of two measures pertaining to the credit ratings of individuals within a tract. Specifically, we include the proportion of individuals 18 years of age or older with "very low credit scores" (PCT_VHIGH_RISK) and the proportion with "no credit bureau information" (PCT_NOINFO). As noted, these measures were obtained from CRAWiz[®]; they are derived from 1999 data from the credit bureau Experian.

In addition, neighborhood risk variables are constructed using data from several sources. A proxy for the price of risk in real estate investment, the tract's capitalization rate (CAP_RATE), defined as a ratio of the tract's annualized median rent divided by the median house value is constructed using 1990 Census data. A larger value for this measure is consistent with lower expected price appreciation or more uncertain future house prices and, hence, indicates increased credit risk. A measure of housing turnover in a Census tract (PCT_TURNOVER) is constructed using 1999 HMDA data combined with 1990 Census data, by dividing number of home purchase loans from HMDA by number of owner occupied housing units from the Census. Neighborhoods with little turnover will tend to have more uncertain housing values and, hence, represent greater credit risk (Ling and Wachter 1997; Lang and Nakamura 1993; Calem 1996). It should be noted that we experimented with additional demographic and neighborhood risk variables from Census data, such as the percent of households that are homeowners and headed by a person over age 65, but these variables yielded no additional insights. Finally, for the Philadelphia and Chicago analyses, each tract's foreclosure rate was calculated as the number of foreclosures in 1999 divided by the number of owner occupied units from the 1990 Census (FRCLSR_RATE). Number of foreclosures was obtained from 1999 Sheriff's sales data purchased from First American Real Estate Solutions.

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[6] Lax *et. al* present evidence on the relationship between search behavior and subprime borrowing.

The aggregate denial rate as reported in HMDA data for non-subprime conventional loans (PCT_CVTL_NONSUB_DENIED) is used as our proxy for availability of such loans. Note that this measure may also proxy for omitted risk variables.

Finally, a number of borrower characteristics from HMDA data are used as independent variables in our borrower-level logistic regressions. Specifically, we employ dummies on the borrower's racial and gender characteristics (BLACK, HISPANIC, ASIAN, FEMALE)[7], and log of borrower income (LN_INCOME).

Tract-level variable definitions are summarized in table 1a and borrower-level variable definitions are summarized in table 1b. Descriptive statistics (means and standard deviations) for Philadelphia and Chicago tract-level variables are provided in table 2, by loan category (home purchase or refinance). In addition, the table provides relative penetration rates of subprime in high-minority and low-income tracts. By these measures, the housing markets in these two cities are quite different. For instance, housing is more expensive in Chicago, as indicated by the fact that Chicago's average loan amount is approximately twice that of Philadelphia's. Although Chicago's lower mean cap rate and higher housing turnover rate suggests that it is the relatively less risky market overall, its foreclosure rate is nearly five times that of Philadelphia's. This may be explainable by the concentration of Chicago's foreclosures into a relatively few neighborhoods; for instance, the maximum foreclosure rate for any one tract in Chicago is 10%, whereas the maximum foreclosure rate for a Philadelphia tract is approximately 3%.

Compared with home purchase mortgages, loan amounts for home refinance loans in both cities are naturally lower. Also, the subprime share of mortgages (PCT_SUB) in the average neighborhood is significantly higher for refinance than it is for home purchases, in both cities.

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[7] "White" and "Male" are the omitted categories for the estimations. Observations where the borrower's race was "other" or gender was "unknown" were dropped from the sample.

Table 3 shows the share of subprime mortgages in each city by borrower race and income category. The incidence of subprime financing clearly is highest among African-Americans and among lower income borrowers.

5. Results

Tables 4 and 5 present the results from the analysis of refinance loans. Tables 4a through 4d provide tract–level regression results and borrower-level logit results for refinance loans, first for Philadelphia (panels a and b) and then for Chicago (c and d). Table 5 provides the results for home purchase loans, with the same ordering of panels.[8]

Many findings are quite robust across cities. In particular, the proportion of individuals with low credit scores and the proportion without credit records mostly are statistically significant with the expected signs (especially in the case of refinance loans), indicating that increased credit risk of individuals in a neighborhood is associated with a larger subprime share. Moreover, these variables account for a substantial part of the measured association between percentage African American homeowner population and subprime share from the regression with only demographic variables are included—accounting for almost half of this association in the case of refinance loans.[9]

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[8] We also estimated a specification of both the tract-level and borrower-level equations for each city and product where we replaced tract median income with a dummy variable denoting whether or not a census tract is relatively "underserved" by traditional mainstream lenders. Consistent with HUD's definition, we set this variable equal to 1 if either the tract's median family income is less than 90% of MSA median income, or the tract's median family income is less than 120% of MSA median income and the tract's population is more than 30% minority. In general, we did not find a statistically significant association between underserved tract and the dependent variable.

[9] For instance, in Philadelphia, the estimated coefficient on PCT_OWN_BLACK declines from .41 to .23 with inclusion of the tract credit rating measures. The credit rating measures have somewhat less explanatory power with respect to home purchase loans compared to refinance loans. This is not surprising, since the tract credit rating measures, may more closely proxy for characteristics of refinance borrowers than home purchase borrowers, since the latter will tend to be much more recent residents of the neighborhood. Even in the case of home purchase loans, however, the tract credit rating measures account for a substantial part of the measured association between percentage African American homeowner population and subprime share.

Even after inclusion of the full set of explanatory variables in the tract-level regressions, however, the percent of African American homeowners is strongly, positively correlated with subprime share of neighborhood loans for both cities and both loan products. In the case of refinance loans, a tract where homeowners all are African American has about a 21 percent higher subprime share in Philadelphia and a 24 percent higher share in Chicago compared with a tract where homeowners all are white.

In the borrower-level, logit equations, the percent African American homeowners remains statistically significant and positively related to subprime share of purchase and refinance loans only in Chicago. For both cities and both loan products, we find a statistically significant relationship such that African-American borrowers, regardless of the racial composition of their neighborhood, have relatively high likelihood of obtaining a subprime compared to a prime loan. In addition, we observe a degree of consistency with respect to Asian-American borrowers, who exhibit relatively high odds of subprime vs. prime borrowing for purchase loans in Philadelphia and for both refinance and purchase loans in Chicago.

In Philadelphia, in the case of refinance loans with the full sample of lenders, percentage African-American is statistically significant and inversely associated with odds of subprime vs. prime borrowing, apparently contradicting the positive associations found for African-American borrowers. One possible explanation is that community reinvestment type loans by depository institutions may constitute a disproportionate share of lending in predominantly minority neighborhoods of Philadelphia, crowding out subprime. We re-estimated the logit equation specifications after excluding loans by institutions associated with the DVMP in order to test this hypothesis. Consistent with the hypothesis, we find that PCT_OWN_BLACK is not statistically significant in this case (results are shown only for the specification with the full set of explanatory variables.) [10]

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[10] A similar pattern is observed with respect to percent Hispanic homeowners (inverse association with odds of subprime vs. prime borrowing) and Hispanic borrowers (positively association) for refinance loans

For both cities and both loan products, percent of the tract population over 25 years of age with at least a bachelor's degree is often statistically significant and consistently exhibits its expected, inverse association with subprime share and relative likelihood of being a subprime borrower. Tract median income generally does not exhibit statistical significance in the tract-level regressions after inclusion of neighborhood risk measures, nor in the borrower-level logit equations except in the case of purchase loans in Chicago. In the logit equations for refinance, borrower income consistently is statistically significant and inversely associated with the odds of subprime vs. prime borrowing. In contrast, in the logit equations for purchase loans, borrower income or tract median income, when statistically significant, are positively associated with odds of subprime vs. prime borrowing.

Proxies for property risk, when statistically significant, exhibit their expected relationship to subprime share within a tract or to odds of subprime vs. prime borrowing, although the specific relationships that are statistically significant vary across cities and product categories. For instance, both in Philadelphia and Chicago, the ratio of median rent to median house value (CAP_RATE) is statistically significant in the estimated logit equations for refinance loans. In both cities, however, it is replaced as a statistically significant variable by the housing turnover rate and foreclosure rate in the logit equations for home purchase loans. The denial rate on conventional non-subprime loans, which may measure the availability of such loans or may be a proxy for excluded risk factors, generally is statistically significant and exhibits the expected, positive relationship to subprime share or relative likelihood of subprime borrowing.

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in Philadelphia. In addition, we observe a statistically significant, inverse association between Hispanic borrower and odds of subprime borrowing in the logit equations for purchase loans in Philadelphia. These patterns may also reflect the impact of affordable lending or community development programs targeted to the Hispanic community.

6. Conclusion

This paper extends the existing literature on subprime lending by more closely examining how lending activity for this segment of the market varies across neighborhoods within cities. For the two cities that served as the focus of our analysis, neighborhood risk composition is a strong indicator of the share of subprime borrowing within a tract and of the relatively likelihood that a borrower will obtain a subprime loan. Neighborhood risk measures account for a substantial part of the overall association between demographic variables and subprime share of tract loans. For instance, results indicate that in both cities, about half of the increase in subprime lending found to be associated with an increase in percent African-American homeowner population across neighborhoods is explained by the spatial distribution of individual credit ratings.

Even after inclusion of the full set of explanatory variables in the tract-level regressions, in both cities we find a strong geographic concentration of subprime lending in those neighborhoods where there is a large population of African-American homeowners. In the borrower-level logit equations, we find a statistically significant relationship such that African-American borrowers, regardless of the neighborhood where they are located, have relatively high likelihood of obtaining a subprime compared to a prime loan. We also observe a degree of consistency with respect to relatively high odds of subprime vs. prime borrowing for Asian-American borrowers.

The results do not necessarily indicate, however, the occurrence of unequal treatment or violations of fair lending laws, because other plausible explanations for these findings can be offered. In particular, although we have attempted to make the best possible use of available data to highlight broad patterns, our empirical equations control only indirectly and quite imperfectly for borrower- and property-related risk factors. For example, we do not incorporate individual borrower credit scores; measures of non-housing indebtedness and stability of employment or income; the loan-to-value ratio; and measures of condition of the property, any or all of which

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may be correlated with tract racial composition or borrower race. Moreover, we do not fully control for the demand side of the market.

We obtain some evidence that less-educated persons exhibit a relative lack of sophistication and/or knowledge about the variety of mortgage products available to them, and may thus turn to subprime. Overall, the findings suggest that concerns about potential disparate access to prime loans among African-American borrowers cannot be dismissed.

Table 1a. Tract-level Variable Definitions

Variable	Definition
PCT_SUB	Subprime as a Pct. of Loans Originated in the Tract
PCT_VHIGH_RISK	Pct. of Tract Population Very High Risk
PCT_NOINFO	Pct. of Tract Population With No Credit History
PCT_OWN_BLACK	Pct. of Tract Homeowners Black
PCT_OWN_HISP	Pct. of Tract Homeowners Hispanic
PCT_OWN_ASIAN	Pct. of Tract Homeowners Asian
PCT_COLLEGE	Pct. of Tract Pop. 25+ Years of Age with a Bachelor's Degree
FRCLSR_RATE	Foreclosure Rate
PCT_TURNOVER	Turnover Rate of Tract Housing Stock
CAP_RATE	Median Rent / Median House Value
LN_MED_INCOME	Log of Tract Median Income
PCT_CVTL_NONSUB_DENIED	Denial Rate of Non-subprime Conventional Loans

Table 1b. Loan-level Variable Definitions	
Variable	**Definition**
SUB_ORGNTD	Dummy if Loan is Subprime
BLACK	Dummy if Borrower is Black
HISPANIC	Dummy if Borrower is Hispanic
ASIAN	Dummy if Borrower is Asian
LN_INCOME	Log of Borrower Income

Variable	Philadelphia Purchases	Philadelphia Refinance	Chicago Purchases	Chicago Refinance
Table 2. Summary Statistics, Census Tracts **Means and Standard Deviations**				
PCT_SUB	13.9 15.3	41.6 26.3	15.3 21.0	30.8 24.6
PCT_VHIGH_RISK	27.2 10.3	27.2 10.3	25.6 10.6	25.6 10.6
PCT_NOINFO	17.4 8.1	17.4 8.1	24.1 10.0	24.1 10.0
PCT_OWN_BLACK	36.6 40.9	36.5 40.9	38.4 45.1	38.4 45.1
PCT_OWN_HISP	3.3 9.3	3.3 9.3	13.4 21.0	13.4 21.0
PCT_OWN_ASIAN	1.6 5.1	1.6 5.1	3.0 8.4	3.1 9.1
PCT_COLLEGE	18.0 19.0	18.0 19.0	16.9 18.7	16.9 18.7
FRCLSR_RATE	0.22 0.27	0.22 0.28	1.0 1.2	1.0 1.2
PCT_TURNOVER	3.7 3.3	3.7 3.3	9.0 18.7	9.0 18.7
CAP_RATE	12.5 7.8	12.5 7.8	7.7 4.1	7.7 4.1
LN_MED_INCOME	31.8 17.9	31.8 17.9	30.1 17.3	30.1 17.3
LN_AVG_AMOUNT	68.5 45.5	57.6 38.3	135.3 59.9	115.7 54.1
PCT_CVTL_ NONSUB_DENIED	14.4 17.1	29.9 15.6	14.0 14.5	18.0 12.0
Number of Tracts in Sample	**367**	**367**	**866**	**866**

Table 3. Percent of Loans that are Subprime, By Borrower Race and Income				
Variable	**Philadelphia Purchases**	**Philadelphia Refinance**	**Chicago Purchases**	**Chicago Refinance**
Black	13.7%	60.3%	21.4%	51.8%
Hispanic	4.4%	42.2%	4.5%	17.7%
Asian	0.5%	23.5%	3.8%	12.7%
White	5.1%	18.7%	2.6%	10.1%
Income<$25k	9.0%	57.7%	13.3%	48.3%
$25k<=Income<$36k	9.3%	44.8%	10.0%	39.3%
$36k<=Income<$50k	7.5%	32.1%	8.1%	29.4%
$50k<=Income	6.3%	17.7%	4.7%	16.8%
Overall Subprime Market Share	**8.0%**	**33.8%**	**6.3%**	**25.5%**

Table 4a. Tract-Level WLS Regression Results for Philadelphia Refinance Loans				
Variable	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**
Intercept	119.07523	25.62059	8.80891	-3.77468
	4.29	0.76	0.27	-0.12
Pct_Own_Black	0.40992	0.22193	0.21631	0.20783
	18.83	7.16	6.8	6.83
Pct_Own_Hisp	0.44683	0.20065	0.09294	0.09177
	4.71	2.14	1.03	1.06
Pct_Own_Asian	0.11591	0.06343	0.1616	0.01378
	0.58	0.35	0.93	0.08
Pct_College	-0.28384	-0.15565	-0.07815	-0.02817
	-4.79	-2.66	-1.34	-0.5
Ln_Med_Income	-8.59329	-2.16239	-1.1101	-0.33532
	-3.19	-0.69	-0.37	-0.12
Pct_Vhigh_Risk		0.86207	0.70459	0.57703
		6.24	4.79	3.97
Pct_NoInfo		0.5686	0.27474	0.32054
		2.7	1.3	1.58
Frclsr_Rate			4.41487	2.68465
			1.59	1
Pct_Turnover			0.49397	0.35484
			2.19	1.63
Cap_Rate			0.86154	0.7631
			5.82	5.32
Pct_Cvtl_Denied				0.29612
				5.08
Adj. R^2	0.7111	0.7577	0.7834	0.8002

Variable	Est. Coeff. t-Score	Est. Coeff. t-Score	Est. Coeff. t-Score	Est. Coeff. t-Score
Intercept	88.34852	16.8871	13.56134	5.0078
	7.2	1.01	0.79	0.3
Pct_Own_Black	0.40628	0.25649	0.23776	0.24077
	35.82	11.15	10.41	10.9
Pct_Own_Hisp	0.10011	-0.04055	-0.03383	-0.03064
	4.1	-1.42	-1.2	-1.13
Pct_Own_Asian	-0.0923	-0.12597	-0.02846	0.01097
	-1.88	-2.66	-0.45	0.18
Pct_College	-0.11511	-0.09601	-0.04086	-0.02026
	-4.18	-3.34	-1.29	-0.66
Ln_Med_Income	-6.96713	-1.5093	-1.54269	-0.95447
	-5.94	-0.99	-0.98	-0.63
Pct_Vhigh_Risk		0.49475	0.32644	0.22799
		6.15	3.89	2.75
Pct_NoInfo		0.4589	0.39504	0.33927
		5.81	5.03	4.45
Frclsr_Rate			1.80134	1.42606
			3.83	3.13
Pct_Turnover			-0.06784	-0.05692
			-2.22	-1.93
Cap_Rate			0.89055	0.91273
			7.01	7.43
Pct_Cvtl_Denied				0.32443
				7.11
Adj. R^2	0.7867	0.804	0.8252	0.8369

Table 4b. Tract-Level WLS Regression Results for Chicago Refinance Loans

Table 4c. Loan-Level Logistic Regression Results for Philadelphia Refinance Loans
(Last column is after exclusion of lenders associated with the DVMP)

Variable	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq
Intercept	-1.9666	-1.2367	-1.2298	-3.4786
	0.2373	0.4639	0.4667	0.0667
Pct_Own_Black	-0.00211	-0.00356	-0.00358	-0.00232
	0.1415	0.032	0.033	0.2183
Pct_Own_Hisp	-0.00944	-0.0134	-0.0135	-0.0139
	0.0221	0.0015	0.0015	0.0056
Pct_Own_Asian	0.0136	0.0149	0.0147	0.0127
	0.2217	0.1822	0.1891	0.2937
Pct_College	-0.0119	-0.00504	-0.0052	-0.0153
	<.0001	0.1337	0.1248	<.0001
Ln_Med_Income	0.185	0.1084	0.109	0.4117
	0.2289	0.4887	0.4865	0.0192
Pct_Vhigh_Risk	0.0384	0.0354	0.0356	0.0304
	<.0001	<.0001	<.0001	0.0003
Pct_NoInfo	0.0464	0.0248	0.0262	0.035
	<.0001	0.0373	0.0292	0.011
Frclsr_Rate		0.2001	0.2003	0.214
		0.2522	0.2529	0.2842
Pct_Turnover		-0.0202	-0.0204	-0.00268
		0.3416	0.338	0.903
Cap_Rate		0.0328	0.0315	0.0338
		<.0001	<.0001	0.0002
Pct_Cvtl_Denied			-0.00053	-0.00241
			0.8374	0.4199
Black	0.9528	0.9644	0.9621	1.151
	<.0001	<.0001	<.0001	<.0001
Hispanic	0.3563	0.3579	0.355	0.8277
	0.0131	0.0131	0.0138	<.0001
Asian	-0.0777	-0.0861	-0.0878	0.0339
	0.6697	0.6379	0.6317	0.8657
Ln_Income	-0.6843	-0.6751	-0.679	-0.7947
	<.0001	<.0001	<.0001	<.0001
C Value	0.795	0.797	0.796	0.822

Table 4d. Loan-Level Logistic Regression Results for Chicago Refinance Loans

Variable	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq
Intercept	-0.8185	0.0313	-0.3047
	0.2777	0.9687	0.7038
Pct_Own_Black	0.00283	0.00242	0.00261
	0.0032	0.0141	0.0081
Pct_Own_Hisp	0.00107	0.00122	0.00113
	0.3992	0.3473	0.3834
Pct_Own_Asian	-0.00397	0.000052	0.00114
	0.1045	0.9845	0.6662
Pct_College	-0.0118	-0.00865	-0.00785
	<.0001	<.0001	<.0001
Ln_Med_Income	0.00919	-0.0842	-0.0625
	0.8919	0.2451	0.3896
Pct_Vhigh_Risk	0.0236	0.017	0.0123
	<.0001	<.0001	0.0013
Pct_NoInfo	0.0208	0.0175	0.0162
	<.0001	<.0001	<.0001
Frclsr_Rate		0.083	0.069
		<.0001	0.0007
Pct_Turnover		-0.00303	-0.00266
		0.0254	0.0497
Cap_Rate		0.0255	0.0226
		0.0002	0.0008
Pct_Cvtl_Denied			0.0154
			<.0001
Black	1.0788	1.0543	1.0378
	<.0001	<.0001	<.0001
Hispanic	0.021	0.0208	0.00492
	0.6714	0.6768	0.9214
Asian	0.2172	0.2069	0.1881
	0.0314	0.0423	0.0653
Ln_Income	-0.4646	-0.4505	-0.4477
	<.0001	<.0001	<.0001
C Value	0.797	0.797	0.797

Table 5a. Tract-Level WLS Regression Results for Philadelphia Purchases				
Variable	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**	**Est. Coeff. t-Score**
Intercept	2.18103	-45.19167	-62.31323	-66.97451
	0.09	-1.39	-1.93	-2.07
Pct_Own_Black	0.20208	0.13249	0.10677	0.10693
	10.31	4.38	3.22	3.23
Pct_Own_Hisp	0.1324	0.0264	-0.05099	-0.03967
	1.56	0.29	-0.56	-0.43
Pct_Own_Asian	0.05065	0.03942	0.08598	0.06971
	0.29	0.22	0.49	0.4
Pct_College	-0.22548	-0.18585	-0.11435	-0.12316
	-4.25	-3.28	-1.88	-2.02
Ln_Med_Income	0.86059	4.40221	5.96338	6.42083
	0.36	1.45	1.97	2.11
Pct_Vhigh_Risk		0.27937	0.20018	0.16367
		2.07	1.34	1.09
Pct_NoInfo		0.33941	0.14067	0.18021
		1.65	0.65	0.83
Frclsr_Rate			1.80447	1.74459
			0.67	0.65
Pct_Turnover			-0.48755	-0.45341
			-1.01	-0.94
Cap_Rate			0.5625	0.49282
			3.55	3.02
Pct_Cvtl_Denied				0.08926
				1.81
Adj. R²	0.3782	0.3948	0.4162	0.4202

Table 5b. Tract-Level WLS Regression Results for Chicago Purchases

Variable	Est. Coeff. t-Score	Est. Coeff. t-Score	Est. Coeff. t-Score	Est. Coeff. t-Score
Intercept	43.69015	-16.29044	0.12862	4.98341
	2.83	-0.81	0.01	0.24
Pct_Own_Black	0.28799	0.22526	0.203	0.1969
	20.03	7.46	6.73	6.64
Pct_Own_Hisp	-0.01358	-0.09162	-0.08964	-0.09148
	-0.45	-2.51	-2.45	-2.53
Pct_Own_Asian	0.02048	0.00749	0.0428	0.03456
	0.34	0.12	0.53	0.44
Pct_College	-0.08416	-0.0941	-0.05456	-0.03946
	-2.45	-2.61	-1.35	-0.99
Ln_Med_Income	-3.60591	1.33083	-0.24001	-0.75987
	-2.45	0.72	-0.12	-0.4
Pct_Vhigh_Risk		0.15016	-0.08783	-0.13383
		1.45	-0.8	-1.24
Pct_NoInfo		0.41424	0.40456	0.38796
		4.49	4.37	4.25
Frclsr_Rate			3.40681	3.38102
			5.5	5.55
Pct_Turnover			-0.09144	-0.0905
			-2.25	-2.27
Cap_Rate			0.36434	0.42152
			2.2	2.58
Pct_Cvtl_Denied				0.12175
				2.94
Adj. R²	0.5356	0.5466	0.5778	0.591

Table 5c. Loan-Level Logistic Regression Results for Philadelphia Purchase Loans
(Last column is after exclusion of lenders associated with the DVMP)

Variable	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq
Intercept	-7.4529	-5.6664	-5.4854	-5.4185
	0.0003	0.0102	0.0133	0.0148
Pct_Own_Black	-0.00002	-0.00222	-0.00292	-0.00356
	0.9901	0.2956	0.1656	0.0961
Pct_Own_Hisp	-0.0107	-0.0162	-0.0163	-0.0185
	0.1322	0.027	0.0264	0.0139
Pct_Own_Asian	0.0048	0.0012	0.00107	0.00187
	0.7329	0.9342	0.9393	0.8974
Pct_College	-0.0392	-0.0278	-0.0266	-0.0258
	<.0001	<.0001	<.0001	<.0001
Ln_Med_Income	0.1983	0.0673	0.0434	0.0604
	0.298	0.7397	0.8313	0.7677
Pct_Vhigh_Risk	0.054	0.042	0.0404	0.0368
	<.0001	<.0001	<.0001	0.0002
Pct_NoInfo	0.0382	0.0131	0.0137	0.0236
	0.0045	0.4035	0.3819	0.1364
Frclsr_Rate		0.7427	0.7359	0.797
		0.0015	0.0014	0.0009
Pct_Turnover		-0.116	-0.1135	-0.1077
		0.0012	0.0015	0.0027
Cap_Rate		0.0214	0.0177	0.026
		0.036	0.0843	0.0122
Pct_Cvtl_Denied			0.011	0.00902
			0.0033	0.0172
Black	0.2823	0.3726	0.3599	0.384
	0.0023	0.0002	0.0003	0.0001
Hispanic	-0.6405	-0.5751	-0.5745	-0.4581
	<.0001	0.0005	0.0005	0.0058
Asian	0.4929	0.5463	0.5524	0.7013
	0.0012	0.0004	0.0003	<.0001
Ln_Income	0.4185	0.4381	0.4409	0.3538
	<.0001	<.0001	<.0001	<.0001
C Value	0.742	0.746	0.748	0.754

Table 5d. Loan-Level Logistic Regression Results for Chicago Purchase Loans

Variable	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq	Est. Coeff. Pr>ChiSq
Intercept	-6.7719	-6.5842	-6.5037
	<.0001	<.0001	<.0001
Pct_Own_Black	0.00788	0.00671	0.00676
	<.0001	<.0001	<.0001
Pct_Own_Hisp	-0.00219	-0.00311	-0.00267
	0.3225	0.1843	0.2542
Pct_Own_Asian	-0.00932	-0.00216	-0.00197
	0.0076	0.6102	0.6402
Pct_College	-0.0175	-0.0105	-0.0102
	<.0001	0.0004	0.0005
Ln_Med_Income	0.2951	0.2554	0.2454
	0.0009	0.0216	0.0284
Pct_Vhigh_Risk	0.0209	0.011	0.00736
	0.0001	0.0675	0.2294
Pct_NoInfo	0.0346	0.0395	0.0375
	<.0001	<.0001	<.0001
Frclsr_Rate		0.1747	0.1683
		<.0001	<.0001
Pct_Turnover		-0.00992	-0.00947
		<.0001	<.0001
Cap_Rate		0.0137	0.0146
		0.1992	0.1771
Pct_Cvtl_Denied			0.00932
			0.0007
Black	0.956	0.8671	0.8609
	<.0001	<.0001	<.0001
Hispanic	0.0215	-0.00213	-0.0156
	0.803	0.9805	0.858
Asian	0.3235	0.2739	0.2693
	0.0238	0.0615	0.066
Ln_Income	-0.085	-0.0505	-0.0443
	0.0693	0.2896	0.354
C Value	0.795	0.795	0.796

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