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Loan Characteristics, Borrower Traits, and Home Mortgage Foreclosures: The Case of Sioux Falls, South Dakota

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Abstract: Foreclosure starts on loans made between 2004 and 2007 in Sioux Falls, South Dakota, are examined using a combination of local and Home Mortgage Disclosure Act (HMDA) data, expanding on previous research restricted to a single year's loans using an alternative methodology. Specifically, foreclosed loans are identified from local *lis pendens* records, and loans are matched with corresponding records in the HMDA database to provide borrower and loan characteristics for further analysis. The research employs limited dependent variable models to assess the effect of loan, demographic, and neighborhood characteristics on the likelihood of foreclosure. Key loan characteristics such as subprime interest rate, loan-to-value ratio, and additional loans at the time of the mortgage were found to have a significant effect on foreclosure starts. Minority borrowers were also found to have a significantly higher probability of foreclosure.

1. Introduction

The causes and macroeconomic effects of the questionable lending practices of the period leading up to the Great Recession have been widely discussed and documented. Much has been made of the reverberation through the economy of the effect of the "toxic portfolios" of low-grade mortgages. While a large portion of the American population was effected by the recession, among those most significantly affected were the recipients of mortgages, often without sufficient credit standards and carrying onerous terms, for properties whose values were often inflated by the low credit standards. As a consequence, foreclosures rose significantly during and after the Great Recession.

Numerous studies have addressed foreclosure, both before and after the 2008-2009 recession. While some have taken a national focus, many have focused on a particular metropolitan area, usually larger cities. The current analysis focuses on the smaller MSA case of Sioux Falls, South Dakota, to see whether

tendencies noted elsewhere are evident in a less populous metropolitan area with more recent growth in its minority population.

A brief literature review is provided in the next section and is followed by an informal model of foreclosures. The next section briefly documents the study area and the data used in the study. This is followed by modeling results, the presentation of selected borrower profile default probabilities, and the conclusion.

2. Literature review

Prior foreclosure literature includes a number of methods and foreclosure influences. A variety of characteristics of loans (including terms, lender, and loan-to-value ratios), properties, borrowers (race, ethnicity, income, age, gender, household size), and neighborhoods (typically averages or percentages of borrower and property characteristics) are included.

Analyses vary from limited dependent variable statistical models of individual loans, regression models of foreclosure rates, group comparison inferential statistics, and descriptive statistics. Dependent variables range from foreclosure rates to individual foreclosure starts, completed foreclosures, including sheriff's sales or other resolutions (e.g., Pennington-Cross, 2010; Ambrose and Capone, 1998; Kashian and Cebula, 2015), or even simply number of loans of different types. Of most interest for this research are those that focus on differential effects on neighborhoods and minority borrowers.

Brown (2010) provides a summary of typical models of foreclosure and selected empirical results with his analysis of the effects of homebuyer education. In discussing the "options perspective" on default and foreclosure and reviewing prior literature, Brown notes that, despite strong expectations of a link between loan-to-value (LTV) ratio and default, empirical evidence is quite mixed. He also notes that neither age nor number of dependents has a clear effect across empirical analyses. Minority status, whether measured by neighborhood characteristics or individual borrower characteristics, shows a consistent positive effect on foreclosure likelihood. In Brown's analysis from a Tennessee loan program, higher credit scores and lower LTV ratios were found to significantly reduce the likelihood of foreclosure. Minority effects were mixed, with the analysis of one loan type finding a significantly higher foreclosure likelihood for black borrowers and another finding a significantly lower likelihood. The model with a Hispanic identifier found a lower foreclosure probability.

Rose (2006) focuses on subprime mortgages in the Chicago metropolitan area. Using data purchased from a commercial financial information firm, Rose examines more than 30,000 loans, including both fixed- and variable-rate loans for refinancing and purchase. While particular predatory lending practices (prepayment penalty, balloon payment, low/no documentation) did increase foreclosure start likelihood in some cases, the primary conclusion from the study was that "the relationship between predatory lending practices and foreclosure rates is more complicated than the arguments for restricting their use suggest" (p. 1). Higher FICO score consistently decreased the likelihood of a foreclosure start, but a greater LTV ratio *decreased* the likelihood of a foreclosure start for three of four loan types. Borrower income was positively related to foreclosure likelihood

in most models, significantly in one case. Neighborhood percent black had a positive effect on foreclosure likelihood in every model, but Hispanic percentage was mixed and never statistically significant. Education was perhaps the most significant demographic characteristic, with neighborhood percentage with a high school education typically having a stronger effect than race or ethnicity and statistically significant in three of four cases.

Immergluck and Smith (2005) provide a summary of prior studies documenting subprime lending effects on foreclosure rates and their disproportionate impact on minority neighborhoods and analyze foreclosure and Home Mortgage Disclosure Act (HMDA) data for the Chicago metropolitan area. Controlling for neighborhood characteristics, they demonstrate the clear impact of subprime lending on foreclosure rates. The effect of demographic characteristics is sensitive to model specification, with a significant positive black minority percentage effect on foreclosures in some models. The only significant Hispanic effects indicate a decrease in foreclosures.

Coulton *et al.* (2008) analyzed foreclosures in Cleveland and Cuyohoga County from 2005-2008. Matching HMDA records to local mortgage and court records, they found significant effects of race/ethnicity and income on foreclosure. They also identified an effect of subprime lending terms, but not necessarily by subprime lenders.

Sorenson *et al.* (2012) examined foreclosures as a function of lending practice and characteristics of borrowers. The study used a limited set of foreclosures in 2007 derived from a very time-intensive process in local government offices, which included inspecting *lis pendens* in the Register of Deeds office to get civil court case numbers, then getting access to view the case records in the county Clerk of Courts office, and finally typing data in to spreadsheets. Results of logistic regression models for foreclosure starts revealed a statistically significant increase in foreclosure probability for minority borrowers with an odds ratio of 3.76. A subprime loan interest rate significantly raised the probability of foreclosure (odds ratio of over 6), while a simple subprime lender indicator was not statistically significant.

Allen studied foreclosures in Minneapolis to analyze the effect of nativity on foreclosure. To avoid difficulties with matching to HMDA data, Allen procured household information from school district data. Combining data for foreclosures with a sample of non-foreclosed properties, Allen analyzed both re-

finance loans and home purchase mortgages in a series of models beginning with only race/ethnicity/nativity and ultimately including loan terms. Native-born minorities and foreign-born Hispanics both consistently exhibited statistically significant higher foreclosure likelihoods. Amount of time in ownership prior to foreclosure and an adjustable-rate mortgage were also found to influence the likelihood of foreclosure.

The nativity question was also addressed by Cahill and Franklin (2013). Foreclosures in the Miami MSA were analyzed using foreclosure rates for zip code areas. Independent variables included average property and household demographic characteristics, including race and nativity. OLS regression analyses revealed that only selected racial and ethnic groups were related to foreclosure rates, with some of them actually decreasing foreclosure rates. Higher education levels reduced foreclosure rates, and binary variables for particular age groups outside of the 25-34 cohort led to lower foreclosure rates. Depending on the specific model, lower foreclosure rates were found for both recent (since 2000) and more distant (1980-89) immigrant percentages.

Simpler analyses, often descriptive statistics and cross-tabulations, also provide useful information about the incidence of foreclosure and subprime lending. Nesiba et al. (2012), for example, demonstrated that minority and low-income Sioux Falls neighborhoods experienced higher foreclosure rates from 2007-2010 and that many of the financial institutions with higher percentages of foreclosed loans were identified as subprime lenders. Bocian et al.'s (2011) study of millions of observations did HMDA matching using an intriguing yet questionable method of matching loan data to HMDA data by loan amount and census tract but not by lender. Their research found both higher rates of receiving riskier loans and higher foreclosure likelihoods for African Americans and Latinos.

3. Model

As illustrated in the large literature on foreclosures, a number of influences potentially affect the probability of foreclosure, including borrower, loan, and neighborhood characteristics. Given the available data and time constraints, only limited characteristics of loans are available, but all demographic characteristics from HMDA data are available, albeit with significant unreported data, and numerous characteristics of neighborhoods are known for census tracts.

Subprime interest rates potentially reflect both the credit-worthiness of the borrower and the payment burden of a loan. Since both of these influences increase the likelihood of default, the subprime interest rate is included as a determinant of foreclosure start probabilities. The loan-to-value ratio primarily captures homeowner equity and, hence, the likelihood of allowing a mortgage to lapse into default. In addition, the presence of supplemental loans at the time of purchase, presumably down-payment loans, also indicate limited home-owner investment in the home. The loan-to-income ratio captures ability to service the mortgage debt, with higher ratios potentially indicating a greater likelihood of default. Total loan amount, with the higher associated payment obligation, may also be considered as an increased risk factor in difficult economic times, although higher loan amounts can certainly be more manageable for higher-income borrowers.

The key demographic characteristic of interest is minority status. Given the findings of earlier studies, we expect a positive effect on foreclosure likelihood. Applicant gender could potentially affect foreclosure likelihood through either loan terms or payment behavior. If discrimination in lending terms exists, female borrowers could experience higher foreclosure rates due to more burdensome terms. Borrower income may function in a manner similar to gender, with potentially more burdensome loan terms for lower-income borrowers. Income and minority status are also included in terms of neighborhood characteristics, as lenders may consider properties in such neighborhoods to be riskier.

Bringing together the influences on the probability of a foreclosure start and following from Sorenson et al. (2012), we can postulate the following simple model with expected signs:

$$P(\text{Foreclosure}) = f(\text{loan-to-income ratio (+),} \\ \text{loan-to-value ratio (+),} \\ \text{supplemental loan (+),} \\ \text{subprime interest rate (+),} \\ \text{loan amount (+);} \\ \text{co-applicant (-),} \\ \text{gender (?),} \\ \text{applicant income (-),} \\ \text{minority (+),} \\ \text{tract median income (+),} \\ \text{tract minority percentage (+),} \\ \text{error)}$$

4. Study area and data

The current study focusses on lending in Sioux Falls, South Dakota. Sioux Falls is the largest city in the state, with an MSA population of 208,484 in 2012. The city has a vibrant economy which has generated a population growth rate of 27% between 2000 and 2012. As shown in Table 1, the city has also experienced rapid growth of its minority population, with the Hispanic population growing by more than 150%

since 2000 and the black population more than tripling. Sioux Falls is located in parts of two counties, Minnehaha and Lincoln, with much of the more recent growth concentrated in the southern portion – part of Lincoln County. The largest component, however, is the Minnehaha County part of the city. Given the need to spend extensive time working with county-specific data, only the larger Minnehaha portion of Sioux Falls is used.

Table 1. Sioux Falls MSA population, growth, and diversity.

	Population by Race/Ethnicity			2000-2012 Growth	Share of Population by Race/Ethnicity		
	2000	2010	2012		2000	2010	2012
Total Population	187,151	228,264	237,251	27%	na	na	na
Am. Indian or Alaska Native	2,853	4,239	4,664	63%	1.50%	1.90%	2.00%
Asian or Pacific Islander	1,701	3,098	3,358	97%	0.90%	1.40%	1.40%
Black	2,487	6,749	7,773	213%	1.30%	3.00%	3.30%
Hispanic	3,437	7,746	8,729	154%	1.80%	3.40%	3.70%
Two or More Races	1,732	3,820	4,243	145%	0.90%	1.70%	1.80%
White	174,941	202,612	208,484	19%	93.50%	88.80%	87.90%

Note: Racial-group populations are non-Hispanic.

Loan and foreclosure data from 2004-2014 were provided by First Dakota Title, which maintains what is essentially a duplicate of the Minnehaha County Register of Deeds data on all recorded mortgages and lis pendens in Minnehaha County. Properties are identified by legal description (addition/block/lot/other id; township/range/quarter).

Foreclosure starts were identified by combining the mortgage and lis pendens data and looking at all records on properties on which a lis pendens was filed. The mortgage records were inspected to identify the preceding loan for which the lis pendens was likely filed. Loans were then identified as clear foreclosures, loans in good standing, 'ambiguous' cases where it was too difficult to confidently assign the foreclosure to a particular loan, commercial loans, and loans secondary to the foreclosed loan – either a down payment, closing, or home equity loan.

In order to prepare the loans for matching to sales and HMDA data, identification of the census tract was necessary. This involved the use of the City of Sioux Falls GIS department's list of all properties with legal description, street address, and census

tract, both 2000 and 2010. Inspection of the data sets indicated that matching individual properties would be difficult given the many differences in naming conventions, especially addition/subdivision names and more specific lot information below the simple addition/block/lot format. Instead, additions were matched up, which itself required numerous assignments where the mortgage data listed subdivisions as additions, and then census tracts were assigned for those additions that were entirely in a single census tracts. Fortunately, this procedure still preserved in the dataset the vast majority of properties in the Minnehaha County part of Sioux Falls. The data were then matched to sale information on properties using data from the Minnehaha County Department of Equalization.

The mortgage data, with foreclosure start loans indicated and commercial, ambiguous, and secondary loans deleted, were merged with the HMDA data by census tract and loan amount. If a one-to-one match of lender was found for a tract-amount combination and the loan was for a home purchase, it was included in the dataset. This final dataset was used for

subsequent analysis. This is distinctly different from the previous analysis of the 2007 data where known foreclosures were identified, foreclosed loans without a match in the corresponding tract-amount combination were purged, and then all other loans were kept in the database for analysis. The current study only included loans where a clear match existed, eliminating numerous cases where loans were identified in only one of the two databases.

The data matching procedure yielded a dataset of 2,614 observations, of which 205 were foreclosures.

The variables used in the analysis are summarized in Table 2. Loan amount refers only to the primary mortgage. However, the loan-to-value and loan-to-income ratios were computed using the sum of the primary mortgage and any supplemental loans taken around the same time as the mortgage. These supplemental loans are presumed for the most part to be downpayment loans and represent an additional obligation of the borrower. A binary variable for multiple loans was also created to note whether a supplemental loan was or was not issued.

Table 2. Descriptive statistics.

Numerical Variables:		Full Sample	Foreclosure Starts	Non-Foreclosures
<i>Loan Amount</i>	Mean	125624	120174	126088
	Std. Deviation	46488	43306.71	46727.59
	Range	[35000,365000]	[48500,286528]	[35000,365000]
	n	2614	205	2409
<i>Applicant Income (\$000s)</i>	Mean	53.4	45.1	54.1
	Std. Deviation	32.8	19.4	33.6
	Range	[2,442]	[16,150]	[2,442]
<i>Loan-to-Income Ratio</i>	Mean	2.70	2.86	2.69
	Std. Deviation	1.37	0.94	1.41
	Range	[0.24,49.55]	[0.77,6.45]	[0.24,49.55]
<i>Loan-to-Value</i>	Mean	90.7	97.8	90.1
	Std. Deviation	14.7	7.8	15.0
	Range	[16.8,145.9]	[50,145.9]	[16.8,131.8]
<i>Tract Median Income as % of SF</i>	Mean	108.9	101.5	109.5
	Std. Deviation	23.3	23.0	23.2
	Range	[71.99,159.51]	[72,159.5]	[72,159.5]
<i>Census Tract Minority %</i>	Mean	7.28	9.19	7.12
	Std. Deviation	5.14	5.70	5.05
	Range	[2.15,23.71]	[2.15,23.71]	[2.15,23.71]
Binary Variables:		% of Full Sample	% of Foreclosure Starts	% of Non-Foreclosures
<i>Foreclosure Start</i>		7.8%	100%	0%
<i>Subprime Interest Rate</i>		6.8%	22.0%	5.5%
<i>Multiple Loans</i>		19.8%	37.1%	18.3%
<i>Minority Applicant</i>		3.8%	7.6%	3.5%
<i>Male Applicant</i>		67.9%	70.3%	67.7%
<i>Co-applicant</i>		46.1%	34.5%	47.1%

Applicant income, gender, minority status, and existence of co-applicant were taken from the HMDA database. The HMDA database tracks both race and Hispanic ethnicity, so initial variables were constructed to track racial minority (Black and Native American only) and Hispanic origin, but after seeing the low numbers of minority cases, a single minority variable was created to include anyone who was Black, Native American, and/or Hispanic. Other, smaller, minority groups were not included in the analysis. Tract income, as a percentage of MSA income, and minority percentage were also taken from the HMDA database.

The HMDA database was also used to create the indicator of a subprime interest rate. Using the field where lenders indicate whether an interest rate was at least three percentage points above a comparable treasury security, the subprime interest rate variable was set to one for the higher-interest loans and zero otherwise. The loan-specific variable was chosen rather than a designated 'subprime lender' variable due to findings in earlier work (Sorenson et al., 2012) that indicated the superior model performance of the loan-specific variable.

The average loan in the database was for about \$125,000, with the size of loans limited to the \$35,000 to \$365,000 range. As the group statistics illustrate, average loan size was similar for non-foreclosures and foreclosure starts. Average income was just about \$50,000, with a lower average income and less variability for foreclosure starts. Loan-to-income ratios averaged between 2.5 and 3 in both groups. Loan-to-value ratios were much higher for the foreclosure starts, averaging close to 98% of the value of the home for the foreclosure starts and only 90% for the non-foreclosures. The neighborhood variables show that average incomes were lower and minority percentages higher in the foreclosure start group, although variation is limited and the higher minority percentage average does not even exceed ten percent.

About eight percent of the loans in the database were foreclosure starts, as indicated in the binary variable section of Table 2. Seven percent of loans had a subprime interest rate, but 22% of foreclosures starts were from such loans and only 5.5% of non-foreclosures had subprime interest rates. Roughly twenty percent of all mortgages had at least one supplemental loan around the same time as the mortgage. Multiple loans were present in more than a third of the foreclosures and slightly less than a fifth of non-foreclosures. Minorities constitute about four percent of the overall sample, but they are almost twice that percentage of the foreclosure group. The primary applicant was male in two-thirds of loans, with a slightly larger proportion among the foreclosures. Slightly under half of all loans had a co-applicant, but only about a third of foreclosure starts had a co-applicant.

Descriptive statistics by minority status are listed in Appendix Table A1. The 91 minority borrowers had loan amounts, incomes, and loan-to-income ratios similar to non-minorities. However, minority borrowers averaged almost three percentage points higher in loan-value ratio and tended to live in neighborhoods with lower median incomes and higher minority percentages. About fifteen percent of the loans to minorities resulted in a foreclosure start and about fourteen percent had subprime interest rates; both percentages are more than double the non-minority rates. The primary applicant is more likely to be male for minority mortgages, and a co-applicant is more common. Interestingly, a significantly lower percentage of minority mortgages had additional loans at the time of the mortgage.

Before fitting the multivariate models, it is instructive to examine some univariate risk measures for the binary variables. As shown in Table 3, one quarter of loans with subprime interest rates resulted in a foreclosure start. Compared to other mortgages, the relative risk is almost four, with an odds ratio of 4.85.

Table 3. Percentage of loans foreclosed by loan and borrower characteristic.

Loan Characteristics:	# of loans	Foreclosed	% Foreclosed	Relative Risk	Odds Ratio
<i>Subprime Interest Rate</i>	177	45	25.42	3.87	4.85
<i>Multiple Loans</i>	517	76	14.7	2.39	2.63
Borrower Characteristics:	# of loans	Foreclosed	% Foreclosed	Relative Risk	Odds Ratio
<i>Gender Male</i>	1702	137	8.05	1.12	1.13
<i>Co-applicant</i>	1178	69	5.86	0.62	0.59
<i>Minority</i>	91	14	15.38	2.05	2.24

Multiple-loan mortgages were foreclosed almost fifteen percent of the time, more than double the rate of other loans. Loans to males had a slightly higher foreclosure rate, while loans with co-applicants had only about sixty percent the foreclosure rate of other loans. As discussed above, loans to minorities resulted in foreclosure roughly twice as often as loans to non-minorities.

5. Empirical results

5.1. Model estimations

The modeling of foreclosure probability was done in two steps to assess the relative influence of loan terms and demographic characteristics. The initial model included income, loan amount, the loan-to-income and loan-to-value ratios, subprime interest rate, and presence of multiple loans. The expanded model added minority status, gender, co-applicants, and neighborhood characteristics. Logistic regression was used to fit the foreclosure models, with the results shown in Table 4.

The initial model finds statistically significant positive influences on foreclosure probability from a subprime interest rate, the loan-to-value ratio, and multiple loans. Applicant income has a negative effect significant only at the 0.10 level (0.05 if one uses a one-tailed hypothesis test). Loan amount and loan-to-income are not statistically significant.

The expanded model exhibits very robust results relative to the variables in the initial model, with very similar coefficients and a nearly identical pattern of statistical significance. The most notable change is the decline in p-value on the multiple loan variable, but it is still significant at the 0.05 level. The minority status coefficient is positive and statistically significant at the 0.05 level. The signs are as expected on the neighborhood and co-applicant variables, but none of them are statistically significant. The pseudo-R² for the expanded model is 0.1097, about one percentage point higher than the initial model and of reasonable magnitude for logistic regressions of foreclosure.

5.2. Odds ratios

The effects of the foreclosure influences can be further understood through odds ratios and confidence intervals, as shown in Table 5. Focusing on Model 2, we can see the subprime interest rate odds ratio point estimate is nearly 4, with a lower bound of 2.6 and upper bound of about 6. Multiple loans has a point estimate of about 1.5, with a lower bound near 1 and

upper bound near 2. Minority status has an odds ratio of about 2, with a lower bound near 1 and upper bound of 3.6.

Table 4. Logistic regression model results.

	<i>Model 1</i>	<i>Model 2</i>
<i>Intercept</i>	-7.4827*** <.0001	-7.882*** <.0001
<i>Applicant Income</i>	-0.0189* 0.0527	-0.0175* 0.0503
<i>Loan Amount</i>	4.1E-06 0.3136	5.4E-06 0.1677
<i>Loan-to-Income Ratio</i>	-0.1293 0.4107	-0.1069 0.4185
<i>Subprime Interest Rate</i>	1.4085*** <.0001	1.3775*** <.0001
<i>Loan-to-Value</i>	0.0584*** <.0001	0.0569*** <.0001
<i>Multiple Loans</i>	0.4387*** 0.008	0.3967** 0.0259
<i>Minority Borrower</i>		0.6577** 0.0425
<i>Male Applicant</i>		0.2937 0.1065
<i>Co-applicant</i>		-0.2098 0.2737
<i>Tract Median Income as % of SF</i>		-0.0006* 0.9192
<i>Census Tract Minority %</i>		0.021 0.2842
Somers' D	0.454	0.479
Gamma	0.460	0.483
c	0.727	0.739
ρ ²	0.1003	0.1097
n	2504	2266

Notes: ***, **, and * indicate 0.01, 0.05, and 0.10 two-tailed significance, respectively. Italicized numbers are Wald χ^2 statistic p-values.

5.3. Foreclosure probability for different borrowers

Selected profiles were developed to better illustrate the effect of different influences on foreclosure. The profiles are based on: 1) typical values, i.e., using averages of numerical variables and modes of binary variables; 2) high-risk values, i.e., accentuating those influences known to increase foreclosure probability; and 3) low risk values, which emphasize the absence of high-risk characteristics. The profiles and results

of computing foreclosure probabilities for the profiles are shown in Table 5. For a typical mortgage, there is about a 5% chance of foreclosure. For a high-risk mortgage, based on characteristics such as lower

income, a subprime rate, high loan-to-value, multiple loans, and a minority borrower, the chance of foreclosure rises to 63%. The low-risk profile has only a 1.7% chance of foreclosure.

Table 5. Odds ratios and 95% confidence intervals.

Variable:	Model 1			Model 2		
	Point Estimate	Lower Bound	Upper Bound	Point Estimate	Lower Bound	Upper Bound
Applicant Income	0.981	0.963	1.000	0.983	0.966	1
Loan Amount	1.000	1.000	1.000	1	1	1
Loan-to-Income Ratio	0.879	0.646	1.196	0.899	0.694	1.164
Subprime Interest Rate	4.090	2.748	6.087	3.965	2.59	6.071
Loan-to-Value	1.060	1.037	1.083	1.059	1.034	1.083
Multiple Loans	1.551	1.122	2.144	1.487	1.049	2.108
Minority Borrower				1.93	1.023	3.644
Male Applicant				1.341	0.939	1.916
Co-applicant				0.811	0.557	1.18
Tract Median Income %				0.999	0.988	1.011
Census Tract Minority %				1.021	0.983	1.061

Table 6. Predicted foreclosure probabilities for selected hypothetical loan/borrower profiles.

	Model Parameter	Descriptive Statistics		Profiles		
		Mean	Range	Typical	High Risk	Low Risk
Applicant Income	-0.0175	53.4	[2,442]	53.4	10	100
Loan Amount	5.44E-06	125624	[35000,365000]	125624	50000	200000
Loan-to-Income Ratio	-0.1069	2.70	[0.24,49.55]	2.70	5	2
Subprime Interest Rate	1.3775	0.07	[0,1]	0.00	1	0
Loan-to-Value	0.0569	90.7	[16.8,145.9]	90.7	100	80
Multiple Loans	0.3967	0.20	[0,1]	0.00	1	1
Minority Borrower	0.6577	0.04	[0,1]	0.00	1	0
Male Applicant	0.2937	0.68	[0,1]	1.00	1	0
Co-applicant	-0.2098	0.46	[0,1]	0.00	0	1
Tract Median Income as % of SF	-0.00057	108.9	[71.99,159.51]	108.9	72	160
Census Tract Minority %	0.021	7.28	[2.15,23.71]	7.28	23.71	2.15
Probability of Foreclosure Start				0.0532	0.6349	0.0169

6. Conclusion

The study of foreclosures in Sioux Falls provides an interesting view both of the lending and foreclosure experience in close proximity to the Great Recession and the circumstances of a smaller but growing and diversifying metropolitan area. The combination of numerous local data sources with the national

HMDA database allowed for the inclusion of valuable loan and borrower characteristics. The models illustrated effects found in much prior research: loan characteristics such as subprime rates, high loan-to-value ratios, and multiple loans exhibit a significant effect on the probability of a foreclosure start. The

loan-to-value finding is arguably stronger here than in many prior studies, perhaps due to the careful inclusion of multiple loans.

Minority status was also found to contribute to foreclosure likelihood, even after controlling for the loan characteristics. Whether omitted factors such as general credit worthiness, income stability, or property value can explain the minority effect, or whether it might be attributed to omitted loan terms or differential treatment in handling problem loans is difficult to say. Those determinations might provide the foundation of further research, which could dig deeper into the specifics of other loan terms and possibly examine patterns of lender behavior.

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Appendix.

Table A1. Descriptive statistics by minority/non-minority.

Numerical Variables:		Full Sample	Minority Borrower	Non-Minority
<i>Loan Amount</i>	Mean	125624	120340	126370
	Std. Deviation	46488	50200	46181
	Range	[35000,365000]	[36000,315000]	[35000,365000]
	n	2614	91	2280
<i>Applicant Income</i>	Mean	53.4	50.7	53.7
	Std. Deviation	32.8	31.1	33.3
	Range	[2,442]	[18,250]	[2,442]
<i>Loan-to-Income Ratio</i>	Mean	2.70	2.62	2.71
	Std. Deviation	1.37	0.93	1.41
	Range	[0.24,49.55]	[0.87,5.93]	[0.24,49.55]
<i>Loan-to-Value</i>	Mean	90.7	93.3	90.5
	Std. Deviation	14.7	10.2	15.0
	Range	[16.8,145.9]	[50,110]	[16.8,145.9]
<i>Tract Median Income as % of SF</i>	Mean	108.9	102.2	109.1
	Std. Deviation	23.3	20.51	23.21
	Range	[71.99,159.51]	[71.99,138.46]	[71.99,159.51]
<i>Census Tract Minority %</i>	Mean	7.28	9.91	7.15
	Std. Deviation	5.14	6.242	5.053
	Range	[2.15,23.71]	[2.64,23.71]	[2.15,23.71]
Binary Variables:		% of Full Sample	% of Minority Borrowers	% of Non-Minorities
<i>Foreclosure Start</i>		7.8%	15.4%	7.5%
<i>Subprime Interest Rate</i>		6.8%	14.3%	6.6%
<i>Multiple Loans</i>		19.8%	13.2%	19.2%
<i>Minority Applicant</i>		3.8%	100.0%	0.0%
<i>Male Applicant</i>		67.9%	79.1%	67.4%
<i>Co-applicant</i>		46.1%	53.8%	46.8%