Disaster Lending: "Fair" Prices, but "Unfair" Access*

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Abstract

The use of risk-insensitive loan pricing by the Small Business Administration's disaster loan program leads to significantly higher loan denials in areas with greater need for price discrimination: high minority share, high subprime share, and high income inequality areas. Borrowers that would likely receive a loan at a higher interest rate under a risk-sensitive pricing mechanism are instead denied credit altogether. Our findings highlight the importance of using market prices as a mechanism to allocate credit across borrowers, a feature that is often absent from government lending programs around the world. Programs that limit the use of this mechanism to ensure a "fair" price of credit across borrowers may have unintended "unfair" consequences on the quantity of credit to marginal borrowers.

Keywords: credit access, discrimination, income inequality, government lending, unintended consequences

JEL Classification: G21, G28, H81, H84

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1 Introduction

Prices play a central role in the efficient allocation of resources in market-based economies. Credit markets are no different. Interest rates on loans are supposed to reflect the credit risk of borrowers, with riskier borrowers paying higher prices on their loans. Almost all theoretical and empirical work in banking is grounded in this basic idea. In contrast, a number of lending programs conducted by government agencies and development banks around the world are inherently risk-insensitive. These lending programs typically offer a subsidized rate of interest to their intended recipients without (or with limited) risk-based pricing. In many cases, the price is fixed: all borrowers who receive credit do so at the same rate.

While such programs may come across as "fair" in the sense that they treat all their borrowers equally in terms of pricing, they may end up being "unfair" to some borrowers who are likely to receive credit only under a risk-sensitive mechanism. Just like a market with a price ceiling on goods or services, there is likely to be excess, unmet demand in these programs.[1] Given the state of credit applicants in most situation of government aid, the risk-insensitive pricing scheme can be especially costly for those rationed. On the other hand, given the government's goal of alleviating frictions in access to credit for marginal borrowers, it is possible that government lending programs are especially effective in reaching such marginal borrowers. Thus a clear understanding of who receives credit in these programs and who gets denied is important from both an academic viewpoint and a policy perspective. However, there is limited empirical research on the lending decisions of government programs. Our paper takes one of the first steps toward filling this gap in the literature by examining credit allocation decisions in an important lending program of the U.S. government: disaster loans provided by the Small Business Administration (SBA).[2]

[1] At a broad level, our work relates to one of the oldest debates in economics about the trade-offs involved in a fixed price system versus a market price system. In labor economics, for example, dating back at least to Stigler (1946), there have been numerous studies evaluating the costs and benefits of minimum wage legislation. A related issue arises in health insurance policy (e.g., Bundorf, Levin, and Mahoney, 2012).

[2] We focus on the disaster loan program because of data availability. But the application of our work is much broader. The U.S. government currently has over 50 loan programs covering a wide range of borrowers: farmers,

The SBA's main objective is to provide access to credit for households and businesses that are victims of natural disasters such as hurricanes, fires, and earthquakes. Loans are granted at a subsidized, but fixed rate of interest to all borrowers who qualify. SBA officers screen loan applications to assess whether the borrower is expected to pay back the loan at the given fixed rate of interest. Borrowers who are deemed creditworthy at that particular rate are granted credit; others are denied. The significant screening of applicants is evidence the SBA cares about potential losses on loans. For high-risk borrowers, the lower expected future payments cannot be offset by charging a higher interest rate. Thus, some borrowers who may be creditworthy at a high interest rate are simply denied the credit. Said differently, some high default risk loans that are likely to be zero or positive NPV projects only at a higher interest rate are simply rejected. Since these loans provide support to borrowers at a time of acute need for funds – after natural disasters – denial is likely especially costly to these high-risk borrowers.

Using a Freedom of Information Act request, we obtained detailed information on the credit allocation decisions under this program for a large set of natural disasters. The data covers over 1.5 million loan applications across the United States between 1991 and 2015 and allows us to conduct our empirical analysis at a granular level. More importantly, while most publicly available databases of government lending programs only have information on loans that have been approved, our data set allows us to analyze the approval/denial decisions for these government loans.

We test for the effect of risk-insensitive loan pricing by comparing the loan denial rates of applicants from areas with high need for price discrimination (NPD) to the loan denial rates of applicants from areas with low NPD. High NPD areas have a larger percentage of borrowers who are likely to be below the SBA's credit quality threshold. Since the SBA's lending program does not allow interest rates to adjust upward for such borrowers, they may

veterans, students, small business owners and homeowners. See https://www.govloans.gov/loans/browse-by-category for further details.

face a greater denial rate.

It is well known that, even in private lending markets, areas with higher credit risk are likely to have more credit rationing (Stiglitz and Weiss, 1981). The core idea behind this channel is that raising the interest rate beyond a point can result in adverse selection in the borrower pool: at very high interest rates only the inferior, credit-unworthy borrowers take loans. Hence, banks do not raise interest rates beyond a point, and credit rationing arises even in market equilibrium under asymmetric information. Previous literature documents private markets providing lower access to credit for minorities (see, e.g., Munnell, Tootell, Browne, and McEneaney, 1996). Because we are interested in whether (lack of) risk-sensitive pricing exacerbates the differential access of credit available to marginal borrowers, we focus on the excess credit rationing of these groups in the SBA disaster loan program compared with programs with risk-based loan pricing. More specifically, we use the denial rate in the private home mortgage market as our baseline loan request rejection rate, i.e. a sufficient statistic of private market rationing. The private home mortgage market denial rate, obtained from the Home Mortgage Disclosure Act (HMDA) database, captures variation in denial rates due to both observable and unobservable differences in the credit quality distribution across counties and, therefore, is a reasonable counterfactual denial rate under risk-sensitive pricing.

We focus particularly on HMDA refinancing loans because this is the private market lending category that is closest to SBA home loans: both these loans are geared toward borrowers who are already home owners. We further fine-tune our control sample by focusing on Federal Housing Administration (FHA) loans to produce a better estimate of the counterfactual. FHA loans are issued by private banks, but insured by the government with an important difference that these loans are priced with risk-sensitive rates. More importantly, the borrower pool in the FHA loan program is very similar to borrowers who reside in areas with high NPD. Because FHA and SBA exhibit similarities with respect to incentives and constraints, comparing the denial rates across these two programs allows us to tease out the difference

that arises due to lack of risk-based pricing, while holding fixed the quality of the borrower pool and other incentives of the government agencies.

We use three proxies for NPD: areas with higher share of minority population, areas with a large share of subprime borrowers based on FICO scores, and areas with higher income inequality. Motivated by prior literature, we primarily focus on the minority share of the applicant's county as our key NPD measure. We do so because, unlike subprime share or income inequality, it captures both hard and soft information about the borrower pool. For example, Bayer, Ferreira, and Ross (2016) show that minority borrowers default at a higher rate conditional on observables like credit score. This can be potentially due to unobserved credit risk factors such as lower levels of wealth or weaker access to informal financing networks like friends and family. In private markets we would expect higher interest rates in high minority share areas since the interest rate can be adjusted based on the borrower's "true" credit quality. In contrast, these borrowers are likely to be denied credit under the SBA's program since, by construction, its rates are inflexible. Additionally, the use of minority share allows us to document the disparate impact of the risk-insensitive interest rates across demographic groups. Fair access to credit for minority borrowers has been one of the central themes of U.S. banking regulation over the past fifty years. A number of government agencies enforce regulations, like the Fair Housing Act (1968) and the Equal Credit Opportunity Act (1974), that are intended to ensure private lenders are providing fair access to credit across borrowers of different race, religion, gender, etc. But how does the government's own direct lending to its citizens fare on this dimension? Our study allows us to speak to this question.

We find that the SBA denies loan applications at a significantly higher rate in counties with a greater need for price discrimination even after controlling for the HMDA private-market denial rate. The result holds for each of the three proxies of NPD we use: subprime share, minority share, and income inequality of the county. But the results are strongest for counties with larger minority population share. The result is not explained by the per capita income of borrowers, or the extent of losses incurred in the disaster. A one-standard-deviation increase

in minority population is associated with a denial that is 3.3 percentage points higher for home loans. These effects are large: the average denial rate in our sample is 46%. Thus, borrowers who reside in these areas are about 7% less likely to get a loan when disaster strikes, as compared with borrowers who live in an area that has a one-standard-deviation lower minority population share. These correlations are strong and robust: they hold across different sample periods, they are not explained by certain types of natural disasters (e.g., hurricane versus flooding), they hold for both big and small disasters, and they hold when the effective subsidy (i.e., the difference between market rate and disaster loan rate) in these loans is high or low. In sum, these results provide evidence that the disaster loans are not reaching borrowers in high minority areas at the same rate as low minority areas. To the extent that minority borrowers are likely to have higher marginal utility from funds at the time of disaster, these results are even more important in economic terms.

We show that the SBA loan denial rate remains significantly higher in counties that have a larger minority population even after controlling for the corresponding denial rate in FHA loans. There is no evidence the FHA denies loans at a higher rate in areas with greater need for price discrimination. For high minority share counties, the relative SBA denial rate is 8 percentage points higher than in the low minority share counties. These results paint a clear picture. Despite some concerns and issues surrounding the behavior of private markets in providing "fair" access to credit, private markets and risk-sensitive government loan programs grant loans to a significantly larger fraction of borrowers in higher minority areas as compared with the SBA's risk-insensitive lending program. To the extent a key goal of the government is to provide equal access to credit for all demographic groups, the SBA fares worse in achieving this goal than private market lenders and a risk-sensitive government loan program.

An alternative explanation of our result is the possibility of taste-based discrimination. If the government's loan officers are prejudiced against minorities, we would expect higher denial rates in minority areas. In a seminal contribution, Becker (1957) argues that profit

motivations can eliminate such discrimination in the marketplace. The lack of a profit motive for the SBA and its loan officers removes this market-based discipline, and our next test examines whether taste-based discrimination could be driving the results. We investigate this by examining the default performance of approved disaster loans. In the context of the labor market, Becker (1957) argues that if minorities are discriminated against due to employer taste (i.e., distaste for minorities), then, conditional on getting the job, minority performance should be relatively better. We apply the same idea to the lending market. If there exists taste-based discrimination in the SBA program against applicants from high minority areas, then the marginal approved borrower in these areas should be of relatively higher quality. Hence, lower ex post default rates for high minority areas would support active taste-based discrimination. We do not find such evidence. We find that areas with a higher share of minority population have in fact slightly higher default rates, suggesting that taste-based discrimination is not driving our results.

We provide some context on the economic importance of our results by estimating the additional loans that would have been approved in areas with a higher minority population had these areas experienced similar denial rates as lower minority population areas. If applicants, conditional on similar income, in all quartiles of minority population were to receive loans at the same approval rate as the first quartile (i.e., lowest minority population), our estimates show that about 44,000 additional homeowners would have received loans, which adds up to a grand total of about $1.5 billion. This is economically large, especially because these loans are denied in the wake of a natural disaster, when the marginal value of credit is especially high.

Overall, our paper documents important disparities in access to government-provided credit across areas with different racial composition. Further, our results highlight important unintended consequences of the risk-insensitive pricing schemes that are typically employed by government lending programs. Clearly, there are some benefits of risk-insensitive pricing, like the perception of fairness and perhaps allowing for faster processing of loans. Indeed, the

SBA's stated purpose is to provide "affordable, timely and accessible financial assistance." However, these benefits come at a significant cost in terms of a higher denial rate than would be observed under a risk-sensitive pricing scheme. The excess denial rates are especially severe for the populations that are often the intended target of government assistance: areas with higher minority populations.

Our work relates to government intervention in setting prices in a number of contexts, such as the labor market, health insurance market, or rental markets, to name a few (see Stigler (1946) and Bundorf et al. (2012) for example). Rose (2014) provides a recent synthesis of the literature on the consequences of price and entry controls on a broad spectrum of industries. Closer to our paper is recent work on the mortgage market, where risk-insensitive products are usually associated with government-sponsored enterprises (GSEs): the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation. These GSEs can affect borrower access to credit through their role in the secondary market for residential mortgages. Specifically, GSEs can discourage regional risk-sensitive pricing. Hurst, Keys, Seru, and Vavra (2016) show that the GSEs charge uniform prices across different areas even though there is significant variation in predictable default risk across regions. Kulkarni (2016) explores the interactions between the GSEs uniform pricing policies and how they affect credit availability to borrowers in regions with borrower-friendly laws. Adelino, Schoar, and Severino (2016) argue that the credit expansion before the 2008 crisis was driven by inflated optimism about home prices, making lenders insensitive to borrower and loan characteristics. Our paper contributes to the underlying research theme of this literature.

2 SBA Disaster Loan Program

The Small Business Administration (SBA) Disaster Loan Program provides loans to businesses and individuals (homeowners and renters) who are victims of disasters declared by the President or the SBA. Since program inception, over 1.9 million loans totaling over $47

billion have been approved by the SBA (Lindsay, 2010). For individuals, loans are available to repair or replace real estate and personal property. For businesses, there are two types of loans available: business physical disaster loans and economic injury disaster loans (EIDL). The business physical disaster loans can be used to repair or replace real property, machinery, equipment, fixtures, inventory, and leasehold improvements.[3] The economic injury disaster loans are made available if the business "is unable to meet its obligations and to pay its ordinary and necessary operating expenses."[4] The SBA's loans cover only the uninsured portion of loss.[5]

In the wake of a disaster, the SBA must process loan applications, perform inspections, make lending decision, contract with borrowers, and disburse funds. The SBA assesses applicants' creditworthiness when determining whether or not to approve the loan. The lending decision is based on a number of factors: an acceptable credit history, an ability to repay loans, and collateral if collateral is available. The loan processor cannot use an applicant's race, color, national origin, or gender in making a loan decision. During the loan review process, an appraiser will verify the applicant's losses, and the loan will be made for a maximum of the approved losses. The losses are appraised before the approval determination, which allows us to observe the size of the loss for both approved and denied loans.

Although loan performance is considered in the screening process, the SBA does not price loans differentially according to applicant risk. The loan interest rate is determined by a statutory formula based on the government's cost of borrowing. Within a borrower type (individual, business, or nonprofit) there are only two possible interest rates that are charged: a lower rate for borrowers who do not have credit available elsewhere and a higher rate for borrowers who do have credit available elsewhere. For individuals determined to

[3]Additional funds are available to make improvements that will reduce the risk of future damage (up to 20% above real estate damage).

[4]`https://disasterloan.sba.gov/ela/Information/EIDLLoans`

[5]Individuals and businesses are encouraged to apply before receiving an insurance settlement. If the applicant has not received their insurance settlement, then the SBA will make a loan for the full amount of loss provided the insurance check is assigned to the SBA.

have credit available elsewhere, the statutory rate is the government's cost of borrowing on similar maturity debt obligations plus an additional charge not to exceed 1

The SBA is not a profit-maximizing institution, as evidenced by the subsidized interest rates on the disaster loans. Instead, the evidence is consistent with the SBA balancing the amount of capital allocated to borrowers in need against the budgetary costs incurred by increasing capital availability at subsidized rates. The fact that the SBA screens applicants based on their creditworthiness indicates that the SBA cares to some extent about the performance of its loan portfolio. Anecdotal evidence indicates there is significant scrutiny of the SBA disaster loan program's performance in both its efficiency in allocating capital and overall budgetary costs. For example, a 1997 congressional budget office report raised concerns about the SBA disaster loan program's budgetary costs and suggested increasing the interest rate on loans to reduce the overall budgetary costs (Congressional Budget Office (1997)). The available evidence suggests that the amount of capital the SBA provides through the disaster loan program is constrained by budgetary concerns. This constraint combined with the inflexibility in interest rates will lead to greater denials of borrowers of marginal credit worthiness than if the SBA were allowed to adjust interest rates based on borrower credit quality. We discuss this idea further in the next section.

3 Research Design

The role of price in allocating resources across different projects in an economy is a central concept in economic theory. Credit markets are no different. When lenders are able to charge interest rates based on the risk profile of the borrowers, more borrowers will have access to credit. Fixed-price lending programs, on the other hand, ration some borrowers from the market: once the expected loss rate on the loan exceeds the rate the lender can charge, the borrower is simply denied credit rather than charged a higher rate commensurate with their risk. The importance of risk-sensitive pricing in allocating credit to high-risk borrowers

motivates our key hypothesis: areas with higher fractions of borrowers with default risk above the SBA's default-risk cutoff point or borrowers that require a greater collection of soft information to determine credit quality have higher denial rates due to risk-insensitive pricing.

Our core idea is summarized in Figure 1. The graph plots the market-determined interest rate as a function of borrower credit risk. All borrowers below the credit threshold denoted by *Market Threshold* are denied credit even with a risk-sensitive pricing mechanism. This happens because the lender is unable to observe the true credit quality of borrowers, and hence it denies credit to borrowers with very high observed credit risk. We also plot the SBA's interest rate as a function of credit risk. The SBA function is a flat line below the market interest rate since the SBA prices its loans at a subsidized rate that is below the market rate for all borrowers.[6] The SBA makes all loans that are above the threshold denoted by *SBA Threshold*. This threshold is determined by the maximum subsidy SBA is willing to pass on to borrowers. For borrowers that fall below this threshold, SBA simply refuses credit instead of adjusting its price. Thus, there are excess denials in SBA lending compared with the private market benchmark. Our empirical tests are aimed at teasing out this excess denial by exploiting variation across areas that differ in terms of the fraction of the population that falls below this threshold.

This discussion also underscores the empirical difficulty in estimating the effect of risk-insensitive pricing on the SBA's credit allocation decision. The goal of an ideal research design is to estimate the proportion of borrowers that fall between the market threshold and the SBA threshold. We do not observe these thresholds. A positive correlation between areas with higher *NPD* and SBA loan denial rate could simply be capturing the fact that in such markets private lenders also ration credit at higher rates. We need to account for this effect. Our setting is attractive because we are able to observe the credit allocation decision

[6]Our main idea remains the same if the SBA rate is above the market determined rate for the best risk borrowers, however this is not the case.

in the private lending market for the same areas, namely the approval/denial decision in home mortgage loans made to practically all U.S. borrowers by all private lenders. For every county, we are able to obtain data on denial rates for all borrowers in the HMDA data set for non-disaster years. Our primary analysis controls for the denial rate in the HMDA database for all refinancing loans made in that county in the most recent non-disaster year. The idea behind this test is simple: if the HMDA denial rate is a sufficient statistic of private market rationing, then we should be able to detect the effect of the *NPD* variable using the following regression model estimated with all SBA loans:

$$deny_{i,c,t} = \alpha + \psi NPD_{c,t} + \rho(HMDA\ \ Denial)_{c,t} + \Gamma X_{i,c,t} + \delta_{d,t} + \zeta_s + \epsilon_{i,c,t} \tag{1}$$

$deny_{i,c,t}$ is an indicator variable equal to one if loan application i, originated from county c in year t, was denied. $NPD_{c,t}$ is the need for price discrimination in county c at time t. We use three proxies for need for price discrimination: the minority share, the subprime share, and the income inequality (Gini coefficient) of the application county. These three proxies should capture the left tail of the credit quality distribution for the county. For most of our analysis, we focus on minority share because it is empirically the strongest predictor of loan denial. $HMDA\ Denial_{c,t}$ is the private-market denial rate for county c in the year before the disaster year t. This variable will capture the baseline credit rationing in the home mortgage market. $X_{i,c,t}$ includes county- and loan-level control variables, which we discuss in greater detail in Section 4.

We include state fixed effects (ζ_s) to separate out the effect of any state-by-state differences in the implementation of SBA disaster loans. As noted earlier, these loans come under the federal program, and therefore they have the same terms for all borrowers irrespective of where the disaster strikes. However, there may be a concern about differences in the implementation at the state level, which we absorb with state fixed effects. We also include a fixed effect that is *disaster-type* $\times$ *year* specific (denoted $\delta_{d,t}$). This fixed effect, by construction, soaks

away variations that are specific to a certain type of disaster (say hurricanes) in a given year (say 2005). Inclusion of these fixed effects in the model allows us to control for differences in lending policies across different types of disasters, say earthquake relief of hurricane relief. At the same time, by interacting with year of disaster, we are able to remove the effect of macroeconomic trends, including issues such as budgetary constraints of the government or variation in national policies concerning these programs. In the end, this specification allows us to exploit the cross-sectional variation in the need for price discrimination across different counties, holding fixed statewide differences and time-varying disaster-type differences in SBA's lending policies.

In some tests, we use the denial rate of Federal Housing Authority program loans as our counterfactual measure of loan denial instead of the broader HMDA denial rate. The FHA sample is a relatively ideal counterfactual for our study for a number of reasons. First, FHA loans are also provided by the government, so the FHA should have similar incentives and constraints as the SBA. Second, FHA loans are priced with risk-sensitive rates, so we are comparing a risk-insensitive loan program to a risk-sensitive loan program. Third, the borrower pool in the FHA loan program is very similar to borrowers who reside in areas with high NPD. Hence, by comparing the denial rates across these two programs, we are able to tease out the difference in the denial rate that arises due to lack of risk-based pricing, while holding fixed the quality of borrower pool and the incentives of the lender.

We also perform tests that examine differences in ex post loan performance across groups. As we will describe more in the results section, taste-based discrimination has implications for the relative performance of approved loans. Specifically, this theory would predict better default performance (i.e., lower default rates) in high minority areas.

4 Data and Sample

We obtained the data on SBA Disaster individual loans through a Freedom of Information Act request. A key feature that distinguishes our data from the publicly available disaster data is that we have loans that were denied in addition to those that were approved. Our final data set includes around 1.2 million loan applications from 1991 to 2015. These data include the state and county of the applicant, the applicant's verified loss as a result of the disaster (e.g., property damage), the disaster description (e.g., Hurricane Andrew), the loan approval or denial decision (*SBA Denial*), and default (i.e., chargeoff) data on approved loans.

Table 1, Panel A, presents the number of applications and denial rates across different types of disasters. Nearly half of the applications in our sample are from hurricanes. The broad category of "severe weather" has nearly one-third of our applications. These loan applications are in response to disasters including tornadoes, severe thunderstorms, hail, and flooding. There are also a substantial number of applications following earthquakes, with the majority of those coming in response to the 1994 Northridge earthquake in Los Angeles, California. As we can see from the table, there is some variation in the denial rate across different types of disasters, but it is broadly in the range of 40-50%: thus a number of loan applicants are denied credit in the disaster loan market.

In Panel B of Table 1, we list the top ten disasters in terms of number of loan applications in our sample. Hurricane Katrina, is the largest disaster, with nearly a quarter of a million applications. While some of the largest disasters cluster around 2004-2005, there is clearly variation in the timing of disasters over time. This variation allows us to separate out the effect of macroeconomic trends from the main effect we are interested in.

Figure 2 shows the geographical variation in the number of applications during our sample period, with the largest number of applications coming from the Gulf Coast and California. Figure 3 presents the time series of applications and denial rates during the sample. The

denial rate varies in the range of 30-60% over the sample period.

We obtain data on private-market lending from the the Home Mortgage Disclosure Act (HMDA) data for the years 1991-2015. These data include the vast majority of home purchase and refinancing loan applications and lending decisions in the U.S. for that time period. To most closely mirror the SBA applicants (most of whom already own their home), we focus on the HMDA refinancing applications. From these applications, we compute the county-level denial rate for refinancing loans during the most recent year in which the county did not experience a disaster and match this to the relevant SBA loan applications in that county. The HMDA denial rate at the county level (*HMDA denial*) serves as our control for the baseline variation in denial rates in private markets.[7] We also use the denial rate of loans made through the FHA program. The HMDA database indicates whether or not a loan is an FHA loan.

We use three key explanatory variables in our tests. We refer to them broadly as the *Need for Price Discrimination* or *NPD* measure. Our first measure is the fraction of the minority population in the county from the Census. The use of this variable as a proxy for NPD is motivated by a large literature on racial differences in lending markets. The second *NPD* measure is the percentage of individuals with Equifax subprime credit scores in a county, which is only available from 1999 onwards. This data is from the St. Louis Federal Reserve (FRED) database. The third *NPD* measure is the level of income inequality in the area. Such areas have borrowers on both extremes of the income distribution, and thus the underlying credit dispersion is likely to be higher. We use the county-level Gini index from the U.S. Census and American Community Survey data to measure income inequality. We obtain this measure for 1990, 2000, and 2010. We assign the 1990 Gini measure for disasters during 1991-1999, the 2000 Gini measure for disasters during 2000-2009, and the 2010 Gini measure for disasters during 2010-2015.

The U.S. Census data also provides county population, and the St. Louis Federal Reserve

[7]The results are similar using contemporaneous year or averages of two or three prior years.

(FRED) database provides the county-level per capita income data. In addition, we obtain data on verified losses incurred by the borrower from the SBA database. Verified losses are determined by SBA appraisers.

Table 2 presents summary statistics for the variables used in our regression analysis. All dollar amounts are adjusted to year 2000 dollars. There is substantial variation in the subprime share, minority share, Gini, income, and population of the counties in the sample. The SBA denial rate of 46% is considerably higher than the average HMDA denial rate of 21% and FHA denial rate of 12%.

5 Results

5.1 SBA Denial Rate Across Areas

We begin our analysis by documenting the relationship between the approval/denial decision by the SBA and the need for price discrimination (NPD) in the disaster-struck county. The regression is specified according to Equation 1. Our initial tests examine two measures of NPD: the subprime share of the county and the minority share of the county. We standardize all continuous independent variables to have mean zero and unit standard deviation, and we cluster the standard errors at the county level.

Table 3 presents the results. The results using subprime (minority) share as the NPD proxy are presented in columns (1)-(3) ((4)-(6)).[8] In columns (1) and (4), we present results for the base specification before including controls. We find that a one-standard-deviation higher subprime share is associated with an increase of 3.8 percentage points (p-value$<$0.01) in the loan denial rate. Similarly, a one-standard-deviation higher minority share is associated with a denial rate that is 4.6 percentage points higher. These results suggest that areas with greater NPD experience significantly higher loan denial rates.

[8]The number of observations decreases because we only have subprime share data from 1999 onwards.

We next include controls for per capita income, population, verified loss, and the HMDA denial rate. The HMDA denial rate is the denial rate in the most recent year without a disaster as described in Section 4. The underlying identifying assumption is that conditional on the HMDA denial rate, there is no remaining unobserved credit rationing that would occur with risk-sensitive pricing that correlates with both minority share and the denial rate in disaster loans. The comprehensive nature of the HMDA data set and the comparability of lending products in the HMDA loan market and SBA disaster loans provide support for this assumption. In columns (2) and (5), we report the results for the main regression, including these control variables. As expected, areas with higher private market denial rate experience higher denial rates in the SBA program, but the inclusion of the HMDA denial rate and other control variables does not mitigate our results. The point estimates on the NPD proxy slightly decrease to 2.3 and 3.3 percentage points (p-value$<$0.01) for subprime and minority share, respectively. These coefficients estimates are highly significant and economically important.

In columns (3) and (6), we examine the effect across NPD quartiles. The effect increases monotonically as one moves from the lowest to highest quartile of NPD. We find counties in the highest subprime share quartile have a denial rate that is 4.3 percentage points (p-value$<$0.02) higher than the lowest bracket, depending on the specification. Similarly, we find a denial rate that is 8.3 percentage points (p-value$<$0.01) higher in the highest minority share counties relative to the lowest minority share counties. This effect is economically large. Compared with the sample average denial rate of around 46%, applicants from counties with the highest minority share have close to an 18% higher chance of being denied.

We include both the subprime share of the county and the minority share of the county in the regression presented in column (7). We find that the minority share of the county remains economically and statistically highly significant, while subprime share is insignificant. Areas with high minority share have been shown to have lower wealth, lower income, and more volatile employment. These dimensions will only be partially captured in credit score. Minority share may, therefore, better capture the left tail of the overall credit quality

distribution. Due to its documented ability to capture the left tail of the distribution, we use minority share as our main proxy of NPD throughout the remainder of the paper.

5.2 Difference-in-Differences: SBA versus HMDA

To further contrast the decision making between government and private lending programs, we present a simple difference-in-difference estimation for SBA versus HMDA lending across areas with different racial composition. We construct a data set at the level of county-disaster-year and compute the SBA denial rate for the dependent variable. For each observation, we then create a corresponding observation where we replace the SBA denial rate with the county's HMDA denial rate, as described earlier. Thus, for each county-disaster-year we have two observations: one with the SBA denial rate and one with the HMDA denial rate. We then estimate the following regression specification:

$$\begin{aligned} \textit{denial rate}_{i,p,c,t} =& \alpha + \delta \mathbb{1}[SBA]_{i,p,t} + \psi \textit{Minority}_{c,t} \\ &+ \theta(\mathbb{1}[SBA_{i,p,t}] \times \textit{Minority}_{c,t}) + \Gamma X_{i,p,c,t} + \epsilon_{i,p,c,t} \end{aligned} \tag{2}$$

In this specification, $\hat{\delta}$ is the fixed difference in SBA and HMDA rates and the estimate of interest is $\hat{\theta}$, which indicates the differential sensitivity in denial rates to minority share between the SBA and HMDA lenders, where $\hat{\theta} > 0$ indicates that the positive relationship between racial composition and denial rates is even stronger in the government-directed SBA program as compared with the private-market HMDA counterpart.

Table 4 presents the results. The results in column (1) indicate that a one-standard-deviation increase in minority share is associated with a denial rate that is 2.7 percentage points higher in the pooled sample of HMDA and SBA denial rate observations. In column (2), we include the SBA dummy variable. There is still a significant relationship between minority share and denial rates after controlling for the level difference in denial rates across

SBA and HMDA loans. The SBA denies loans at a much higher rate than in the private market with a coefficient on the SBA dummy of 0.209 (p-value$<$ 0.01). In column (3), we include the interaction between the SBA status and minority share. The coefficient on minority share, which now captures the relationship between minority share and loan denials in the private market, is only 0.013 (p-value$<$ 0.01). The private market does deny loans to higher minority areas at a greater rate. Of particular interest is the coefficient on the interaction between SBA status and minority share, which is 0.027 (p-value$<$0.01). Thus, a one-standard-deviation increase in minority share increases the likelihood of denial by about three times as much for SBA loans as compared with private-market loans.

The difference between the SBA and private market are even more stark when examining the quartiles of minority share. Results are presented in columns (4)-(6). In column (6), we see that for the private market, the difference in denial rate between the highest quartile and lowest quartile minority share areas is not significant. The coefficient on the highest quartile dummy is only 0.012 (p-value=0.12). For the SBA, on the other hand, the relationship between minority share and relative denial rates is monotonically increasing. The highest quartile minority share areas have a relative denial rate that is 6.5 (p-value$<$ 0.01) percentage points higher than the low minority quartile areas. In sum, a higher minority share corresponds to higher denials in both government-directed and private markets, but the effect is much larger in government-directed lending.

5.2.1 Federal Home Authority Program

We next compare the denial rates in the SBA disaster loan program to the denial rates in the Federal Home Authority (FHA) loan program to further tease out the risk-insensitive loan channel. By comparing SBA loans to FHA loans, we minimize any concerns about potential differences between the SBA and private market lenders and potential concerns about differences in the borrower pool between the SBA and HMDA. The FHA is a government

program and should face similar incentives and constraints as the SBA. The pool of FHA borrowers is likely riskier than the general population and may better represent the pool of SBA borrowers. The important difference between the two programs is that the FHA uses risk-sensitive loan pricing, while the SBA uses risk-insensitive loan pricing. We run the same difference-in-differences analysis as in Table 4, but with the FHA denial rate instead of the HMDA denial rate.

Table 5 presents the results. A similar pattern emerges as in the previous tests, except the difference between the SBA and the market benchmark are even more striking. Examining the results in column (3), we see the coefficient estimate on *zMinority* is -0.000 ($p-value$=0.99). This indicates there is no relationship between minority share and loan denial in the FHA loan program. In other words, this government-sponsored risk-sensitive loan program is providing access to credit across the spectrum of borrowers. This non-relationship may be expected for a government program that is likely highly sensitive to the issue of fair credit access and has the flexibility to change prices.

The SBA program displays an even more significant relationship between minority share and loan denial when compared with the FHA loans. The coefficient on the interaction between *Minority* and the SBA dummy in column (3) indicates that SBA's relative denial rates increase by 3.5 percentage points with a one-standard-deviation increase in a county's minority share. Examining the quartile regression in column (6), we see the relative SBA denial rate is monotonically increasing in minority share. SBA applications from high minority share counties are 8 percentage points more likely to be denied a loan than applications from low minority share counties relative to the denial rates in the FHA program.

The difference in denial rates between the SBA and FHA are unlikely to be explained by differences in incentives across lenders or differences in applicant type. By comparing two government programs with relatively similar borrower pools, these tests provide further evidence on the disparity in denial rates across high and low need for price discrimination

areas that is due to the SBA's risk-insensitive pricing mechanism.

5.3 Risk-Insensitive Pricing Versus Discrimination

The previous results show that the differential denial rate between high- and low-minority share areas is not explained by the denial rates in the private market. There are two potential explanations for the observed pattern: it is due to the risk-insensitive pricing feature of the SBA loan program or due to taste-based discrimination. We examine each of these explanations in turn.

To provide further evidence on the risk-insensitive pricing channel, we examine the relationship between the county's Gini index (i.e., income inequality) and SBA denial rates by performing a similar test to the minority regressions except with Gini as the cross-sectional variable of interest. The motivation for using Gini is that higher Gini areas will, by construction, have a greater dispersion in credit quality and, therefore, greater need for price discrimination in lending markets. If higher Gini areas experience greater relative denial rates in the SBA program versus the FHA program, then this is consistent with risk-insensitive pricing leading to greater denial rates. These tests should also minimize concerns that minority population is not measuring NPD, but rather is related to some other unobserved factor unrelated to NPD that correlates with the denial decision.

We present the results in Table 6. We find that the need for price discrimination is strongly related to SBA denial rates. A one-standard-deviation increase in income inequality is associated with a denial rate that is 2.5 percentage points higher for SBA loans relative to FHA loans. There is no relationship between Gini and FHA denial rates. In column (4) we include both Gini and minority share plus each variable's interaction with the SBA dummy. We find that each has an independent relationship with SBA denial rates. The coefficient on minority share drops from 0.035 to 0.03 (p-value< 0.01), and the coefficient on Gini drops from 0.025 to 0.011 (p-value$= 0.02$). This result shows that the need for price

discrimination is an important determinant of denial rates in a risk-insensitive loan pricing program even after controlling for minority share. Taken together with our main results, these tests provide strong support that borrowers from areas with a greater need for price discrimination experience much higher denial rates.

Next, we examine the second potential channel: taste-based discrimination (i.e., prejudice) against minority borrowers. While it is hard to empirically assess this important question with observational data, there are predictions that arise from taste-based discrimination that can be tested with the ex post default performance of these loans. If minority borrowers are denied credit because of prejudice, then conditional on getting a loan, the average minority borrower is likely to be of better credit quality. Said differently, borrowers in those areas need to cross a higher hurdle to obtain credit. Given this higher hurdle, those approved in these areas would have a lower default rate under this hypothesis. We estimate an OLS default model with minority and income inequality as the explanatory variables, and Table 7 presents the results. We do not find any evidence that high minority share areas default at a lower rate. These results suggest that taste-based discrimination in SBA lending is quite unlikely.

5.4 Discussion of Potential Alternative Explanations

An underlying assumption in our main tests is that any difference between the pool of SBA applicants and the pool of private market applicants does not systematically differ with NPD (after controlling for other important covariates). In other words, there is no concerning differential selection. Differential selection into the applicant pool can manifest in two main ways: (1) differential loss rates in natural disasters, and (2) differential supply of alternative sources of funding. We address each of these concerns. We also discuss whether differences in the level of unbanked citizens or ability to produce the proper paperwork across low and high NPD areas is affecting our tests.

Differential Sensitivity: Are high minority areas more sensitive to disasters than low minority areas? That is, even for observably identical areas, is the underlying credit quality of high minority areas disproportionately damaged by natural disasters? If the credit quality distribution shifts more for high minority areas, then our pre-disaster HMDA and FHA controls will not pick up this relative change in credit quality. To address this potential concern, we examine changes in the credit quality distribution from pre- to post-disaster across high and low minority counties. Specifically, we test whether the change in subprime share from one year before a disaster to one year after a disaster is related to the share of minorities. If high minority areas are more negatively impacted, we should see a positive and significant coefficient regressing the change in subprime share on the minority share. Table 8 presents the results of this regression where the dependent variable is $(Subprime_{i,c,t+1} - Subprime_{i,c,t-1})$ and is measured in percentage points. We find negative point estimates on the minority share, and they are economically and statistically insignificant. Therefore, we find no evidence that a differential sensitivity of credit quality to natural disasters in high minority areas is driving our results.

A related concern is that high minority areas may experience greater losses during natural disasters. By including the appraised loss in all regressions, we control for any differences in losses driving our results. It is highly unlikely that differential sensitivity to natural disasters is driving the large differences in denial rates across low and high NPD areas.

Alternative sources of funding: Next, we discuss why potential differences in the supply of alternative sources of capital cannot explain our results. The alternative sources of funding could be: private market credit access, self-financing, financing through informal networks, or insurance proceeds. Additionally, there may be variation in the level of collateral across low and high NPD areas. There are a few reasons why any differences on these dimensions are unlikely to be driving our results. First, we control for the private market and FHA denial rates, which should capture most of this variation in alternative sources of capital. Second, if

low NPD areas have greater access to alternative sources of funding, then this should bias our tests against finding a result. For example, assume that in the low NPD areas, a larger percentage of the potential SBA applicant pool has greater access to alternative funding and do not apply for an SBA loan. This will lead to a relative *decrease* in the average applicant credit quality in the low NPD areas compared to the counterfactual private market applicant pool. In other words, in the low NPD areas only the "bad" credit quality types apply to SBA, while all types apply in the private market. In the high NPD areas, fewer potential applicants are able to self-finance, and the pool should be fairly comparable to the private market applicant pool. The relative denials (SBA compared with the private market) should, therefore, be higher in the low NPD areas if this is the case. In sum, the most likely selection bias issue will bias our tests against finding our result.

Additionally, it is unlikely those in need of funding will opt for a private market option since the SBA loan financing terms will almost always dominate. The SBA statutory rate for borrowers with "Credit Available Elsewhere" (the highest rate) is at most one percentage point above the government's cost of borrowing for similar maturities. There is little concern potential applicants of a certain quality are applying for private market loans post-disaster. This may not be obvious considering the fact that 80% of SBA loans are granted at the "No Credit Available Elsewhere" interest rate. Even for these applicants, the SBA was likely the first place they applied. The "No Credit Available Elsewhere" determination is made by the SBA based on the applicant's assets, income, and credit history. The SBA does not require borrowers to apply for private market loans before applying to the SBA or consider the results of private market lending decisions when determining the "No Credit Available Elsewhere" designation. These are not applicants that were already turned down by private market lenders. We do not expect adverse selection on this dimension; if it is there, it should most likely bias against our results.

Lack of paperwork or banking history: A related concern may be that applicants from high

minority areas are unable to produce the necessary paperwork to receive a loan or do not have a banking history. This is also unlikely. The vast majority of SBA applicants are homeowners, which means they have likely obtained a mortgage in the past. This rules out a number of these alternatives since having a bank account and the ability to produce the necessary paperwork are near requirements to qualify for a mortgage. In sum, the fact that most SBA applicants are existing homeowners helps eliminate a number of potential alternative explanations for our results.

5.5 Economic Significance

To further illustrate the economic importance of the results, we provide an estimate of the credit that would have been extended if all counties were in the lower minority share quartile. To do this, we multiply the number of loan applications in the 2nd, 3rd, and 4th quartiles of minority share by the difference in approval rates between these counties and the lowest quartile counties. We use the estimates in column (6) of Table 5 as the estimated differences in approval rate. This calculation provides an estimate of the additional loans that would have been available to borrowers in higher minority counties had they experienced the same denial rate as the low minority counties. We then multiply these numbers by the average loan amount for approved loans to get a rough idea of the dollar amount (year 2000 dollars) of "missing" loans. Table 9 shows the computation.

The calculation suggests that about $1.58 billion of additional loans would have been granted under typical, private market conditions where the price is flexible according to the riskiness of the borrower. In terms of number of loans, our estimates show that about 44,000 more homeowners would have had access to credit during the critical time periods immediately following a natural disaster.

6 Discussion & Conclusions

We document a significantly higher denial rate of applications for SBA disaster loans in counties with a greater need for price discrimination: counties with a higher share of minorities, higher subprime share, and greater income inequality. This relationship persists after accounting for a benchmark private-market denial rate constructed from HMDA loans, which takes into account both raw credit quality and equilibrium credit rationing. Thus, compared with private markets, this direct government lending program denies credit to these populations at a significantly higher rate. Despite these borrowers often being the intended recipient of government assistance programs (and also a focus of government regulation in private-market lending), our results show that loans do not reach these borrowers at the same rate as borrowers who live in counties with less of a need for price discrimination.

We argue that the lack of risk-sensitive pricing is a key factor behind this finding. The setup of the SBA disaster loan program does not allow for borrowers to be charged an interest rate based on their credit risk, which is a stark departure from the risk-sensitive pricing seen in private lending markets. As a result, some creditworthy borrowers who are sufficiently good credit risks at a higher interest rate are instead denied credit altogether under this program. We provide further evidence of this channel by comparing SBA denial rates with the denial rates in another government loan program: home loans subsidized by the Federal Housing Authority (FHA). The FHA allows for risk-sensitive pricing. We find no relationship between need for price discrimination and loan denial rates in the FHA program, and FHA denial rates cannot explain the significant differences in denial rates in the SBA program.

Risk-insensitive pricing is a pervasive feature of government lending programs around the world, and it is often motivated by fairness and equality in access to credit. However, our results document important adverse consequences of loan programs with this feature. Thus, by failing to use a more-flexible, risk-sensitive pricing mechanism to help allocate credit, government lending programs may be unintentionally neglecting many of the creditworthy

borrowers that they are setting out to help.

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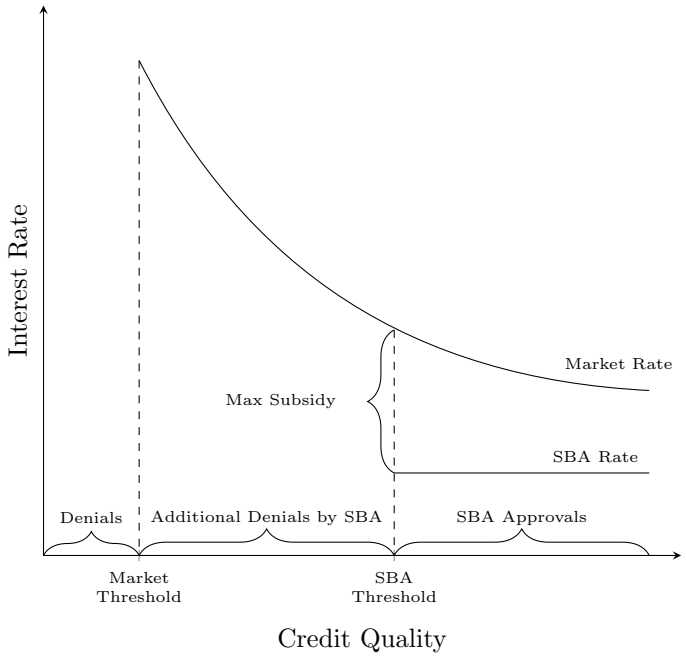

Figure 1: Credit Rationing
This figure illustrates the credit allocation decision with risk-insensitive and subsidized loan pricing compared to the credit allocation with risk-sensitive (market) pricing.

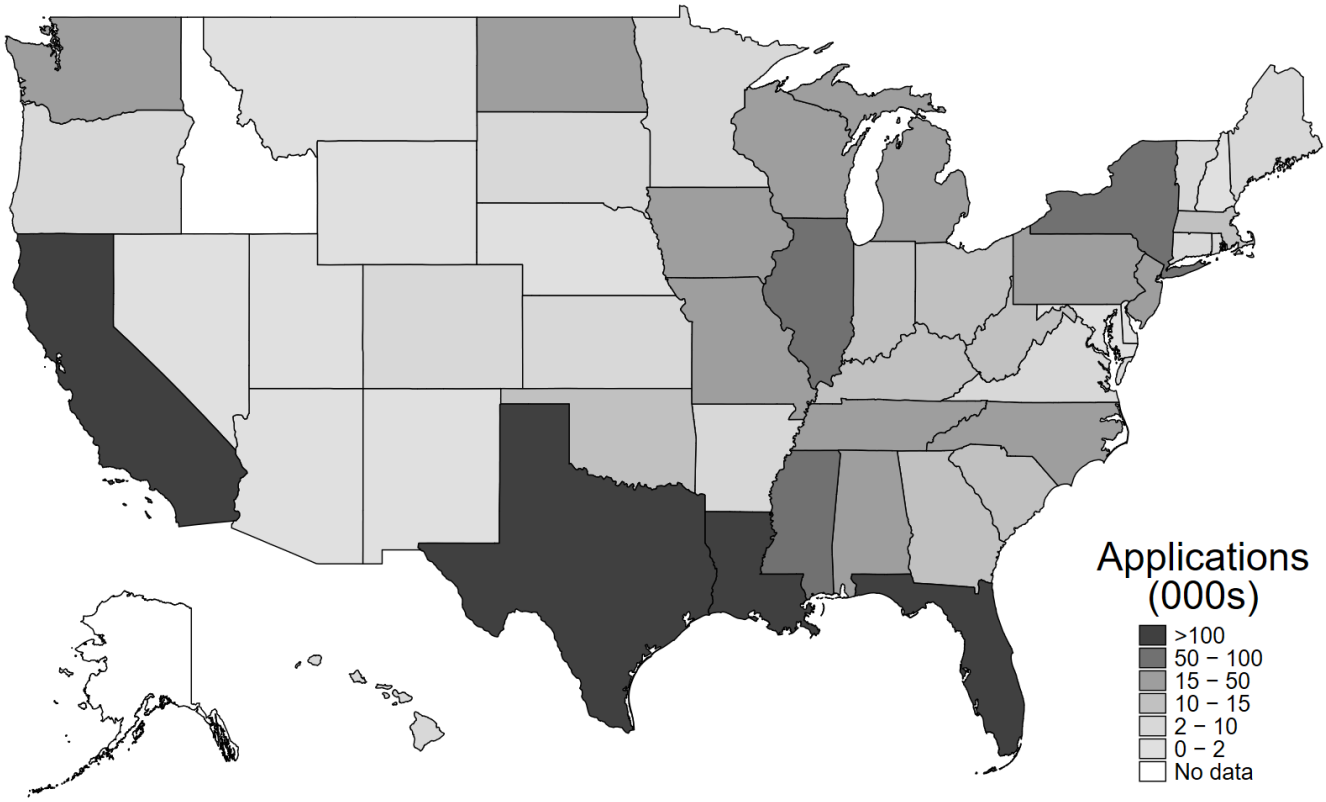

Figure 2: Geographical Distribution of Total Applications
This figure presents the number of disaster loan application during the sample period of 1991-2015 for each state.

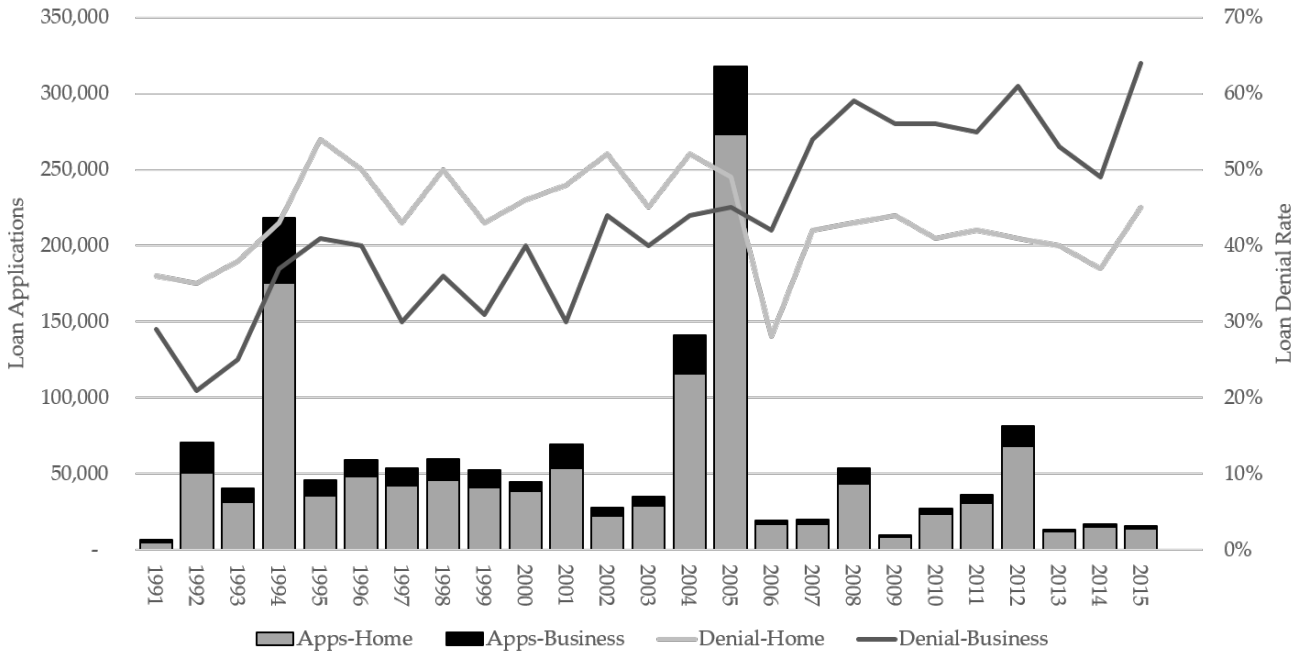

Figure 3: Applications and Denials Over Time
This figure presents the annual number of loan applications (left axis) and loan denial rates (right axis) for home and business loans for each year in the sample.

Table 1: Disaster Summary Statistics

This table presents loan application summary statistics by disaster and disaster type. Panel A presents the volume of applications and denial rates for the different types of disasters in the sample. Panel B presents statistics from the ten largest disasters (by loan application count) in the sample.

Panel A: Disaster Types

	applications	denial rate
Hurricane	571,357	48%
Severe Weather	432,938	44%
Earthquake	175,986	43%
Tropical Storm	55,784	49%
Fire	12,603	45%

Panel B: Ten Largest Disasters

Disaster	Year	applications	denial rate
Hurricane Katrina	2005	206,201	48%
Northridge Earthquake	1994	159,603	43%
Hurricane Sandy	2012	55,267	41%
Hurricane Andrew	1992	31,792	38%
Hurricane Ivan	2004	30,364	50%
Hurricane Rita	2005	33,107	56%
Tropical Storm Allison	2001	31,740	51%
Hurricane Floyd	1999	24,635	41%
Hurricane Wilma	2005	26,864	48%
Hurricane Frances	2004	23,645	56%

Table 2: Sample Summary Statistics

This table presents the sample summary statistics. *Subprime* is the share of the county population that is subprime (data starting from 1999), *Minority* is the share of the county population that is not white, *Gini* is the Gini index of the county as described in Section 4, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, and *HMDA-Denial* is the average county-level denial rate for applications for home refinancing loans from the Home Mortgage Disclosure Act 2007-2015 database, excluding years in which there was a disaster. *SBA Denial* for a given home or business disaster loan application is an indicator equal to one if the loan application was denied, and *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. For approved loans we report the loan *amount*, the *maturity* in months and whether or not the loan was charged-off (*Default*).

variable	mean	sd	min	p25	p50	p75	max	N
County Statistics:								
Subprime	0.35	0.07	0.08	0.30	0.37	0.41	0.62	811,133
Minority	0.39	0.22	0.00	0.19	0.37	0.63	0.98	1,207,081
Gini	0.45	0.04	0.32	0.43	0.46	0.47	0.60	1,207,081
Per capita income (000)	34.08	16.85	6.59	20.66	31.24	38.89	217.44	1,207,081
ln(Population)	13.01	1.83	9.12	11.78	13.03	14.50	16.01	1,207,081
HMDA denial	0.21	0.06	0.00	0.17	0.21	0.25	1.00	1,207,081
FHA Denial	0.12	0.09	0.00	0.71	0.11	0.14	1.00	1,196,00.
SBA Home Loans:								
SBA denial	0.46	0.50	0.00	0.00	0.00	1.00	1.00	1,207,081
Verified Loss (000)	50.77	72.52	0.70	9.35	22.44	54.82	384.33	1,207,081
Amount (000)	38.35	50.61	0.08	8.64	18.84	45.27	756.20	655,605
Maturity	214.84	128.55	1.00	96.00	192.00	360.00	963.00	727,993
Default	0.08	0.28	0.00	0.00	0.00	0.00	1.00	727,993

Table 3: SBA Loan Denial and Need for Price Discrimination: Subprime and Minority Share

This table presents OLS estimates from the regression of SBA home loan denial (*SBA Denial*) for a given home disaster loan application on the minority share of population in the county and various controls and fixed effects. *Minority* represents the nonwhite share of the county population, *Minority Xq* is the Xth quartile of the *Minority* with the first quartile (e.g., lowest minority share) as the omitted category, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. *HMDA-RecentND* is the denial rate for applications of home loan refinancing in the county in the most recent year in which there was no disaster. *Subprime* is the share of the population with FICO <660, and these data are only available from 1999 onwards (thus smaller sample sizes in the regressions). *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	Subprime			Minority			Both
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
zSubprime	0.038***	0.023***					0.006
	(<0.01)	(<0.01)					(0.37)
Subprime 2q			0.002				
			(0.81)				
Subprime 3q			0.013				
			(0.48)				
Subprime 4q			0.043**				
			(0.02)				
zMinority				0.046***	0.033***		0.029***
				(<0.01)	(<0.01)		(<0.01)
Minority 2q						0.021***	
						(0.01)	
Minority 3q						0.044***	
						(<0.01)	
Minority 4q						0.083***	
						(<0.01)	
zPerCapitaIncome		0.015**	0.006		0.003	0.003	0.010
		(0.05)	(0.34)		(0.64)	(0.66)	(0.14)
zln(Population)		0.016***	0.020***		0.001	0.004	-0.006
		(<0.01)	(<0.01)		(0.86)	(0.38)	(0.32)
zVerifiedLoss-H		-0.067***	-0.067***		-0.074***	-0.074***	-0.067***
		(<0.01)	(<0.01)		(<0.01)	(<0.01)	(<0.01)
HMDA-RecentND		0.410***	0.363***		0.264***	0.272***	0.273***
		(<0.01)	(<0.01)		(<0.01)	(<0.01)	(<0.01)
zSubprime×zMinority							0.007*
							(0.09)
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disaster-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	811133	811133	811133	1207081	1207081	1207081	811133
R^2	0.019	0.039	0.039	0.021	0.039	0.038	0.040

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: SBA versus HMDA: County-level Difference in Differences

For each county-year in the SBA dataset, we compute the home loan denial rate and append an additional observation to the dataset with the respective HMDA denial rate. This table presents OLS estimates from the regression of county-level loan denial rates (SBA or HMDA) for disaster-affected counties on the minority share of population in the county, whether the observation represent the SBA denial rate, and their interaction.

$$\textit{denial rate} = \alpha + \delta \mathbb{1}[SBA] + \psi \textit{Minority} + \theta(\mathbb{1}[SBA] \times \textit{Minority}) + \Gamma X + \epsilon$$

denial rate is the county denial rate for either SBA home loans or *HMDA-RecentND*, which is the denial rate for applications of home loan refinancing in the county in the most recent year in which there was no disaster. $\mathbb{1}[SBA]$ is an indicator equal to one if the observation represents the SBA denial rate and zero if the observation represents the HMDA denial rate. *Minority* represents the nonwhite share of the county population, *Minority Xq* is the Xth quartile of the *Minority* with the first quartile (e.g., lowest minority share) as the omitted category, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	(1)	(2)	(3)	(4)	(5)	(6)
zPerCapitaIncome	-0.028***	-0.028***	-0.028***	-0.031***	-0.031***	-0.031***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
zln(Population)	-0.013***	-0.013***	-0.013***	-0.009***	-0.009***	-0.009***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
zMinority	0.027***	0.027***	0.013***			
	(<0.01)	(<0.01)	(<0.01)			
$\mathbb{1}[SBA]$		0.209***	0.209***		0.209***	0.181***
		(<0.01)	(<0.01)		(<0.01)	(<0.01)
$\mathbb{1}[SBA]$×zMinority			0.027***			
			(<0.01)			
Minority 2q				-0.007	-0.007	-0.011**
				(0.16)	(0.17)	(0.02)
Minority 3q				0.009	0.009	-0.011*
				(0.19)	(0.19)	(0.09)
Minority 4q				0.045***	0.045***	0.012
				(<0.01)	(<0.01)	(0.12)
$\mathbb{1}[SBA]$×Minority 2q						0.007
						(0.42)
$\mathbb{1}[SBA]$×Minority 3q						0.040***
						(<0.01)
$\mathbb{1}[SBA]$×Minority 4q						0.065***
						(<0.01)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Disaster-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16935	16935	16935	16935	16935	16935
R^2	0.068	0.285	0.289	0.066	0.283	0.287

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: SBA versus FHA: County-level Difference in Differences

For each county-year in the SBA dataset, we compute the home loan denial rate and append an additional observation to the dataset with the respective FHA denial rate. This table presents OLS estimates from the regression of county-level loan denial rates (SBA or FHA) for disaster-affected counties on the minority share of population in the county, whether the observation represent the SBA denial rate, and their interaction.

$$\textit{denial rate} = \alpha + \delta \mathbb{1}[SBA] + \psi \textit{Minority} + \theta(\mathbb{1}[SBA] \times \textit{Minority}) + \Gamma X + \epsilon$$

denial rate is the county denial rate for either SBA home loans or the FHA denial rate, which is the denial rate for applications of FHA loans in the county in the most recent year in which there was no disaster. $\mathbb{1}[SBA]$ is an indicator equal to one if the observation represents the SBA denial rate and zero if the observation represents the FHA denial rate. *Minority* represents the nonwhite share of the county population, *Minority Xq* is the Xth quartile of the *Minority* with the first quartile (e.g., lowest minority share) as the omitted category, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	(1)	(2)	(3)	(4)	(5)	(6)
zPerCapitaIncome	-0.019***	-0.021***	-0.021***	-0.021***	-0.022***	-0.022***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
zln(Population)	-0.015***	-0.010***	-0.010***	-0.011***	-0.006**	-0.006**
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(0.03)	(0.03)
zMinority	0.020***	0.018***	-0.000			
	(<0.01)	(<0.01)	(0.99)			
$\mathbb{1}[SBA]$		0.277***	0.277***		0.277***	0.244***
		(<0.01)	(<0.01)		(<0.01)	(<0.01)
$\mathbb{1}[SBA]$×zMinority			0.035***			
			(<0.01)			
Minority 2q				-0.015**	-0.014**	-0.018**
				(0.01)	(0.02)	(0.03)
Minority 3q				-0.004	-0.007	-0.031***
				(0.59)	(0.37)	(<0.01)
Minority 4q				0.027***	0.022***	-0.019*
				(<0.01)	(<0.01)	(0.06)
$\mathbb{1}[SBA]$×Minority 2q						0.007
						(0.56)
$\mathbb{1}[SBA]$×Minority 3q						0.047***
						(<0.01)
$\mathbb{1}[SBA]$×Minority 4q						0.080***
						(<0.01)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Disaster-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16528	16528	16528	16528	16528	16528
R^2	0.044	0.324	0.328	0.044	0.323	0.327

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: SBA Home Loan Denial and Income Inequality: County Diff-in-Diff

This table presents OLS estimates from the regression of SBA home loan denial (*SBA Denial*) for a given home disaster loan application on the county income inequality as measured by the *Gini* index and various controls and fixed effects. *Gini* is an index that measures the income inequality in the county, *Gini Xq* is the Xth quartile of the *Gini* with the first quartile (e.g., lowest income inequality share) as the omitted category, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. *HMDA-RecentND* is the denial rate for applications of home loan refinancing in the county in the most recent year in which there was no disaster. *Subprime* is the share of the population with FICO <660, and these data are only available from 1999 onwards (thus smaller sample sizes in the regressions). *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	(1)	(2)	(3)	(4)
zPerCapitaIncome	-0.025***	-0.025***	-0.022***	-0.022***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)
zln(Population)	-0.005*	-0.005*	-0.010***	-0.010***
	(0.06)	(0.06)	(<0.01)	(<0.01)
$\mathbb{1}[SBA]$	0.277***	0.278***	0.277***	0.277***
	(<0.01)	(<0.01)	(<0.01)	(<0.01)
zGini	0.013***	-0.000	0.008***	0.003
	(<0.01)	(0.99)	(<0.01)	(0.34)
zMinority			0.014***	-0.002
			(<0.01)	(0.67)
$\mathbb{1}[SBA]\times$zGini		0.025***		0.011**
		(<0.01)		(0.02)
$\mathbb{1}[SBA]\times$zMinorityy				0.030***
				(<0.01)
State FE	Yes	Yes	Yes	Yes
Disaster-Year FE	Yes	Yes	Yes	Yes
Observations	16528	16528	16528	16528
R^2	0.323	0.325	0.324	0.329

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Ex-Post Loan Performance

This table presents OLS estimates from the regression of an indicator equal to one if the loan defaults (i.e., charged off) on measures of the need for price discrimination (NPD) and various controls and fixed effects. *NPD* is measured by *Minority* race share of the county population (columns 1 and 3), and county income inequality as measured by the *Gini* index (columns 2 and 5). Columns (1) and (2) are home loans and columns (3) and (4) are business loans. *NPD* represents the continuous version of each measure, with a higher measure representing a higher need for price discrimination. *ln(Amount)* is the log of the loan amount, *ln(Maturity)* is the log of the loan maturity in months, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	(1)
zMinority	0.008***
	(<0.01)
zln(Amount)	-0.036***
	(<0.01)
zln(Maturity)	0.033***
	(<0.01)
zPerCapitaIncome	-0.004***
	(<0.01)
zln(Population)	0.007***
	(<0.01)
State FE	Yes
Disaster-Year FE	Yes
Observations	727993
R^2	0.047

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Relative Changes in Subprime Share

This table presents OLS estimates from the regression of change in subprime share of the county population for each loan application from the year before the disaster until the year after the disaster ($Subprime_{t+1} - Subprime_{t-1}$), measured in percentage points, on the minority share of population in the county and various controls and fixed effects. *Minority* represents the nonwhite share of the county population, *Minority Xq* is the Xth quartile of the *Minority* with the first quartile (e.g., lowest minority share) as the omitted category, *PerCapitaIncome* and *ln(Population)* are the county-level per capita income and log of population at the time of the disaster, *VerifiedLoss* is the loss of the applicant as a result of the disaster as verified by SBA officials. *Subprime* is the share of the population with FICO <660, and these data are only available from 1999 onwards (thus smaller sample sizes in the regressions). *Disaster-Year FE* are fixed effects for each disaster type and year combination (e.g., hurricanes in 2004), and each regression includes state fixed effects. All continuous independent variables are standardized as indicated by "z" to have a mean of zero and unit variance. Standard errors are clustered by county.

	(1)	(2)
zMinority	-0.033	
	(0.93)	
Minority 2q		-0.556
		(0.31)
Minority 3q		-1.027
		(0.22)
Minority 4q		-0.488
		(0.68)
zPerCapitaIncome	-0.214	-0.202
	(0.56)	(0.58)
zln(Population)	-0.426	-0.238
	(0.10)	(0.31)
zVerifiedLoss	0.195*	0.155
	(0.10)	(0.11)
State FE	Yes	Yes
Disaster-Year FE	Yes	Yes
Observations	781319	781319
R^2	0.519	0.538

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Economic Significance

This table presents a back of the envelope calculation of the additional number of loans and dollar amount of loans that would have been approved if all counties were low minority share counties given the SBA's current pricing scheme.

	Minority 1q	Minority 2q	Minority 3q	Minority 4q	Total
Actual Loans:					
Loan Application	301,411	302,150	301,138	302,382	1,207,081
Average Loan Amount ($)	$43,276.99	$41,840.68	$30,860.16	$36,258.10	
Point Estimates	-	2.1%	4.4%	8.3%	
Counterfactual loans:					
Additional Approved	-	6,345	13,250	25,098	44,693
Additional Amount ($Mn)	-	$265.49	$408.90	$910.00	$1,584.38

A Appendix

Loan Name	Eligible Borrowers	Borrowing Limit	Interest Rate Cap	Term Cap
Personal Property	Homeowners Renters	\$40,000	4 or 8%*	30 years
Real Estate	Homeowners	\$200,000	4 or 8%*	30 years
Business physical disaster loans	Businesses (any size) and Most private nonprofit organizations	\$2M^{+}	4 or 8%*	30 years or 7* years
Economic injury disaster loans	Small business Small agricultural cooperative Most private nonprofit organizations	\$2M^{+}	4%	-

Table A.1: Loan Details

* 8% and 7 years if credit available elsewhere, $^{+}$ limit can be waived by SBA if the business is a major source of employment.

Date: 11/07/2017

U.S. Small Business Administration

U.S. SMALL BUSINESS ADMINISTRATION
FACT SHEET - DISASTER LOANS

TEXAS Declaration #15274 & #15275

(Disaster: TX-00487)

Incident: HURRICANE HARVEY

occurring: ***August 23 through September 15, 2017***

in the ***Texas*** *counties of:* ***Aransas, Austin, Bastrop, Bee, Brazoria, Caldwell, Calhoun, Chambers, Colorado, DeWitt, Fayette, Fort Bend, Galveston, Goliad, Gonzales, Grimes, Hardin, Harris, Jackson, Jasper, Jefferson, Karnes, Kleberg, Lavaca, Lee, Liberty, Matagorda, Montgomery, Newton, Nueces, Orange, Polk, Refugio, Sabine, San Jacinto, San Patricio, Tyler, Victoria, Walker, Waller & Wharton;***

for economic injury only in the contiguous ***Texas*** *counties of:* ***Angelina, Atascosa, Brazos, Brooks, Burleson, Guadalupe, Hays, Houston, Jim Wells, Kenedy, Live Oak, Madison, Milam, San Augustine, Shelby, Travis, Trinity, Washington, Williamson & Wilson;***

and for economic injury only in the contiguous ***Louisiana*** *parishes of:* ***Beauregard, Calcasieu, Cameron, Sabine & Vernon***

Application Filing Deadlines:

Physical Damage: ***November 30, 2017*** **Economic Injury:** ***May 25, 2018***

If you are located in a declared disaster area, you may be eligible for financial assistance from the U.S. Small Business Administration (SBA).

What Types of Disaster Loans are Available?

- Business Physical Disaster Loans – Loans to businesses to repair or replace disaster-damaged property owned by the business, including real estate, inventories, supplies, machinery and equipment. Businesses of any size are eligible. Private, non-profit organizations such as charities, churches, private universities, etc., are also eligible.
- Economic Injury Disaster Loans (EIDL) – Working capital loans to help small businesses, small agricultural cooperatives, small businesses engaged in aquaculture, and most private, non-profit organizations of all sizes meet their ordinary and necessary financial obligations that cannot be met as a direct result of the disaster. These loans are intended to assist through the disaster recovery period.
- Home Disaster Loans – Loans to homeowners or renters to repair or replace disaster-damaged real estate and personal property, including automobiles.

What are the Credit Requirements?

- Credit History – Applicants must have a credit history acceptable to SBA.
- Repayment – Applicants must show the ability to repay all loans.
- Collateral – Collateral is required for physical loss loans over $25,000 and all EIDL loans over $25,000. SBA takes real estate as collateral when it is available. SBA will not decline a loan for lack of collateral, but requires you to pledge what is available.

What are the Interest Rates?

By law, the interest rates depend on whether each applicant has Credit Available Elsewhere. An applicant does not have Credit Available Elsewhere when SBA determines the applicant does not have sufficient funds or other resources, or the ability to borrow from non-government sources, to provide for its own disaster recovery. An applicant, which SBA determines to have the ability to provide for his or her own recovery is deemed to have Credit Available Elsewhere. Interest rates are fixed for the term of the loan. The interest rates applicable for this disaster are:

	No Credit Available Elsewhere	Credit Available Elsewhere
Business Loans	3.305%	6.610%
Non-Profit Organization Loans	2.500%	2.500%
Economic Injury Loans		
Businesses and Small Agricultural Cooperatives	3.305%	N/A
Non-Profit Organizations	2.500%	N/A
Home Loans	1.750%	3.500%

Amendment #8

Figure A.1: Hurricane Harvey Fact Sheet