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INTEREST RATE AND COLLATERAL DIFFERENCES

IN LOANS TO BUSINESSES OWNED BY PEOPLE OF COLOR AND WOMEN: OPPORTUNITIES TO IMPROVE PROFITABILITY FOR BUSINESS BORROWERS AND LENDERS

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IN LOANS TO BUSINESSES OWNED BY PEOPLE OF COLOR AND WOMEN: OPPORTUNITIES TO IMPROVE PROFITABILITY FOR BUSINESS BORROWERS AND LENDERS

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EXECUTIVE SUMMARY

The U.S. small business sector is important in job creation and other elements of economic growth. This study examines the nature of the credit provided to support the growth of these firms. We examine differences in interest rates and collateral requirements for businesses owned by people of color compared to White-owned businesses and differences between businesses owned by men and those owned by women.

We have three goals for conducting this study:

- Provide business borrowers with information about where they would likely receive the best loan terms.
- Provide lenders with information that would enable them to more successfully compete for market share by providing more competitive loan terms.
- Provide regulators with information on the current credit environment for minority- and women-owned businesses.

Between January 2022 and June 2023, we collected data from 44 states on loans made to privately-owned businesses with 500 or fewer employees. This data set, collected through surveys, contained interest rate and collateral differences in loans to small businesses along racial, ethnic, and gender lines in the US; it was the first such survey since the Federal Reserve's Survey of Small Business Finances (SSBF) in 2003. This study provides a picture of small business financing in the early post-COVID period. We used the survey data to compare the credit terms of minority-owned firms to those of White-owned firms, and woman-owned firms to man-owned firms.

In comparing the terms of the loans, we considered a range of factors that might affect loan terms, such as the size of the business, credit rating, owner experience, industry, revenues, and more. These factors are important because they determine the risk for lenders when making a loan. Our statistical approach determined whether, after considering that range of factors, minority ownership or gender-based ownership affected the terms of the loan. Minority-owned or woman-owned status should not influence interest rates or collateral requirements if the financial risk factors have already been considered.

We found that, after controlling for firm risk factors:

- Our basic models indicate that after controlling for firm risk factors: Compared to White-owned firms, Asian American-owned firms paid 2.88 percentage points higher rates, Hispanic-owned firms paid 2.91 percentage points higher rates, and

Black-owned firms paid 3.09 percentage points higher rates.

- After adjusting our statistical analyses to reflect the national distribution of firms, we estimate that Asian-American-, Black-, and Hispanic-owned businesses collectively pay, on average, $8.0 billion more in annual interest than comparable White-owned firms.

- Women-owned firms paid 2.38 percentage points higher rates than man-owned firms.

- Lenders were more likely to require an outside co-signer on loans to Asian-American-, Black-, Hispanic-, and Native American-owned businesses than their White-owned counterparts. The survey data was not sufficient to estimate the economic impact. This is an important topic for future research.

We also examined the credit terms provided to these small firms across six types of lenders:

Large banks (deposits of at least $10 billion), small banks, community development financial institutions (CDFIs), credit unions, fintech lenders, and nonbank finance companies. While we earlier summarized the overall interest rate differential relative to White-owned firms for each minority group, the minority-owned groups' experiences differed across lenders. Consistent with the approach that controls for a broad range of factors that affect loan risk, we found that:

- Black-owned firms paid higher rates than their White-owned counterparts at credit unions, fintech lenders and nonbank finance companies. We did not find that race was statistically significant in bank and CDFI loans: the Black firm-White firm interest rate differences for these lenders were explained by factors such as credit score and size of firm, not race.

- Hispanic-owned firms paid higher interest rates than their White-owned counterparts at each of the six lender types.

- Asian-owned firms paid higher interest rates than their White-owned counterparts at large banks. There were too few cases in the sample to make inferences about the other lenders to Asian-owned firms.

- Woman-owned firms paid higher interest rates than their man-owned counterparts at credit unions, CDFIs, and fintech lenders. We did not find that gender affected the interest rate in bank and nonbank finance company loans; for these lenders, the interest rate differences between woman-owned firms and man-owned firms were explained by factors such as credit score and size of firm, not gender.

Disparities in borrowing experiences can have far-reaching implications beyond the economic sphere, contributing to broader inequalities and perpetuating historical patterns of discrimination and exclusion. If such disparities exist, addressing these disparities will require concerted efforts from policymakers, lenders, and other stakeholders to improve access to credit and reduce discrimination in lending.



I. INTRODUCTION

Borrowing difficulties can be one of the most important obstacles in operating and growing a business. The purpose of this study is to examine mispricing in small business loans regarding interest rate and collateral terms. Mispricing occurs when lenders adjust the terms for borrowers based on factors unrelated to their financial risk, such as the race or gender of the business owner, rather than basing decisions solely on economic indicators and creditworthiness. This study explores whether mispricing is evident across racial and gender groups on loans made to small firms.

The issue of discrimination in small business lending has long been a concern in the United States. This is the first data set containing interest rate and collateral differences in loans to small businesses along ethnic and gender lines in the US since the Federal Reserve's Survey of Small Business Finances (SSBF) in 2003. Research on the 2003 SSBF data indicated racial disparities: loan rejection rates and interest rates were inexplicably higher for some groups of minority borrowers (for example, see Asiedo et al., 2012). Our study collected and analyzed data on small business loans made between January 2022 and June 2023. This study provides a picture of small business financing in the early post-COVID period. We compared the terms of minority firms to White firms, and woman owned firms to man owned firms.

The information gathered in the survey includes loan terms (interest rate and collateral required), firm financial information, CEO attributes and lender type (bank, credit union, CDFI, fintech lender, and nonbank finance company).Data collected comprises over sixty characteristics of the firms and their owners including ethnicity/race of controlling ownership: White, Asian, Hispanic, Black, and Native (i.e., Native American and Alaskan Native), as well as gender of the majority ownership of the firm.

Regarding the results of our analyses, we find the interest rates paid by Asian-, Black-, and Hispanic-owned firms and woman-owned firms were higher than economically justified after considering creditworthiness indicators and other financial attributes of the firms. In contrast to comparable White-owned firms, Asian-owned firms paid 2.88 percentage points higher interest, Hispanic-owned firms paid 2.91 percentage points higher interest, and Black-owned firms paid 3.09 percentage points higher interest. Below we provide estimates of the dollar amount of mispricing across the minority firms.

Woman-owned firms paid 2.38 percentage points higher interest than man-owned firms.

Woman-owned firms paid 2.38 percentage points higher interest than man-owned firms. We also find that lenders were more likely to require an outside co-signer on loans to Asian-American-, Black-, Hispanic-, and Native American-owned businesses than to their White counterparts. However, the survey data was not sufficient to estimate the associated economic impact. This is an important topic for future research.

This study also examines lending practices across six types of lenders: large banks (with deposits greater than $10 billion), small banks, community development financial institutions (CDFIs), credit unions, fintech lenders, and nonbank finance companies. These lenders differ in regulatory structure, sources of funds, and lending specialization. By analyzing the differences in lending practices across these lenders, the study identifies variations in lending practices that may contribute to or soften disparities in lending outcomes for diverse firms.

While we earlier summarized the overall interest rates relative to White-owned firms for each of the groups, the minority-owned firms' experiences differed across the six types of lenders. Large commercial banks are the dominant business lenders in the U.S., so we conduct minority group vs. White-owned firm comparisons of interest rates to gauge differences (mispricing) between large banks and other lenders. In these exercises, mispricing is or is not evident when our models, which predict interest rates paid by firms, find that the firm's minority group indicator either has or does not have a statistically significant impact on its interest rate. These models also include relevant economic and creditworthiness indicators that lenders consider in making loans.

Considering large-bank lending to Hispanic-owned firms vs. White-owned firms, we find that Hispanic-owned firms paid higher interest rates to large banks than we can explain in our models. Also, the rate Hispanic-owned firms paid to large banks does not differ statistically from the rates Hispanic-owned firms paid to small banks, credit unions and nonbank finance companies; at the same time, the rates Hispanic-owned firms paid to CDFIs and fintech lenders are lower than those paid to large banks.

In the Black-owned firm vs. White-owned firm comparison, the rates paid by Black-owned firms to large banks are explained within our models, and rates paid to large banks do not differ statistically from the rates Black-owned firms paid to small banks and CDFIs. However, the rates paid by Black-owned firms to credit unions, fintech lenders and nonbank finance companies are higher than those our models can explain.

In the Asian-owned firm vs. White-owned firm comparison, we find that Asian-owned firms pay higher interest rates to large banks than we can explain in our models. Also, the rates paid to large banks do not differ statistically from the rates Asian-owned firms paid to each of the other types of lenders.

We also compared woman-owned firms to man-owned firms. Here, we find that relative to man-owned firms, the rates paid by woman-owned firms to large banks, small banks, and nonbank finance companies are explained by our models, while the rates paid to credit unions, CDFIs and fintech firms are higher than those predicted by our models.

Finally, we compared various forms of collateral requirements on credit provided to the firms.

> **We find that co-signatures from third parties are required more frequently for each minority group compared to White firms...**

We find that co-signatures from third parties are required more frequently for each minority group compared to White firms than is justified by our economic analyses. However, we do not find that collateral requirements are greater for woman-owned firms compared to man-owned firms. Our survey also asked the firm owners' opinions about their borrowing experience. Compared to White and man owners, minority and woman owners 1) were less satisfied with their loan terms, 2) more often felt that their loan terms were mispriced, and 3) more often felt that compared to similar firms, they had more difficulty in borrowing.

Disparities in lending practices can have far-reaching implications beyond the economic sphere, contributing to broader inequalities and perpetuating historical patterns of discrimination and exclusion. If such disparities exist, addressing these disparities will require concerted efforts from policymakers, lenders, and other stakeholders to improve access to credit and reduce discrimination in lending.

The data presented in this study originated from a national survey encompassing firms from 44 states across the U.S. These firms come from a large data set of either existing or prospective suppliers to the U.S. government. While the more populated states in our sample tend to have more firms, these 2,784 firms do not fully mirror the U.S. distribution of minority- and White-owned firms by number and industry. Accordingly, our analysis was twofold. First, we examined the original, unaltered firm data to maintain the statistical authenticity of the responses. Second, for the sake of methodological robustness, we included two separately weighted analyses of the relationships examined in the main analysis (additional robustness tests examined other aspects of the data). In both weighting analyses, weights were applied that mirrored the national distribution of White-owned and minority-owned firms across the various states and industries.

It is important to acknowledge, however, that the weighting process was constrained by the limitations of available data. The U.S. Census data, which is crucial for weighting, is regrettably incomplete in its state and industry-specific information, particularly for minority groups. Despite these constraints, a key finding of our study was the consistency in outcomes between the weighted and unweighted analyses. This consistency suggests that our core findings are resilient and remain unaffected by the chosen methodology of weighting. In this report we present the basic (unweighted) analyses in detail and discuss the equivalent results of the weighted analyses.

The remainder of this report is organized as follows. Part II: Background, presents the focus of this study in terms of the credit issues examined, and provides summary statistics on the firms that are analyzed in the study. Part III: Mispricing Analyses, introduces the statistical approach used in the study and reports the results on interest rate and collateral mispricing. Part IV: Conclusion, provides an overview of the results and estimates of the economic cost of the interest rate differentials found between minority- and White-owned small business borrowers.



II. BACKGROUND

FOCUS OF THE RESEARCH

Numerous studies have examined the differences in financing patterns between minority-owned firms and White-owned firms. No set of data has been available to examine mispricing in the terms of loans granted to small firms in the U.S. since 2003, which is the final year of the Federal Reserve's series of cross-sectional surveys: Survey of Small Business Finances (SSBF). The Federal Reserve's SSBF covered the years 1989, 1993, 1998 and 2003.

Researchers have used SSBF to explore: a) the number of businesses discouraged from applying for a loan due to fear of rejection; and b) the loan denial rates for businesses applying for credit, comparing minority-owned to White-owned firms and woman-owned firms to man-owned firms. Overall, these studies concluded that: a) compared to White business owners, a higher fraction of bankable minority business owners do not apply for loans because of fear of rejection; and b) for those minority businesses that do apply, higher fractions of bankable minority-owned businesses are rejected for financing than comparable White-owned businesses (Asiedu et al., 2012; Blanchard et al., 2008; Blanchflower et al., 2003; Bostic & Lamani, 1999; Cavalluzzo et al., 2002; Cavalluzzo & Cavalluzzo, 1998).

More recent research has had to rely on data sources that include less information on business loans than SSBF. The first, the Kauffman Firm Survey (KFS), contains data on the financing of new firms from 2004 through 2011. The second, the Federal Reserve, has completed annual Small Business Credit Surveys (SBCS) for each year 2019–2022. Bates and Robb (2015, 2016) and Fairlie et al. (2022), using the KFS results from 2008–2011, found that minority business owners were more likely to be discouraged from borrowing and more likely to be rejected for credit. Barkley and Schweitzer (2023) had similar findings using the SBCS. None of these data sets include information on the terms of loans granted to minority- and woman- owned businesses.

Since this study concerns loans granted to firms, it does not consider firms that needed credit but did not apply, nor firms that applied but were rejected for financing. A firm desiring debt financing is taking the first step in the sequence that ends in obtaining a loan.

However, not all firms that want debt financing take the second step and apply for a loan. The third step is the lender accepting the loan request and making the loan. However, the loan granted may differ from the loan requested. Thus, step four concerns whether the loan was fully or partially accepted. We collected data on both the loan requested and the final loan committed. We explored the loan terms conditional on the firm having received a loan with a focus on interest rates and collateral. This covers the outcomes in yellow below.



SURVEY SUMMARY STATISTICS

This section presents summary statistics on the responses of the surveyed firms. Supplier.IO is a private firm that provides diverse suppliers with connections to firms and organizations seeking to hire diverse suppliers, while concurrently providing these firms access to its list of diverse suppliers. It also assists firms in developing and growing their own programs for contracting with minority suppliers.

Supplier.IO provided us with a list of over 300,000 firms, to which we sent an internet survey. The survey collected firm/owner/lender information on non-government-guaranteed borrowing by small firms (< 500 employees) from January 2022 through May 2023. Duns credit score information was added as a variable for a subset of firms that completed the survey. To be eligible for the survey, a business must have been operating as a for-profit firm with employees at the time of the survey. Also, during the specified period, it must have borrowed through a line of credit or loan that was not government guaranteed. Following previous studies, firms in the finance industry were ineligible.

The summary statistics of the responding firms will be presented as follows: interest rate on financing received, other loan terms (including collateral), firm information, lender information, loan terms, and other survey information. The key outcomes of the loan process that we examine are the rate paid in borrowing and the collateral requirements associated with borrowing. We winsorized the reported interest rates at the bottom 1% and top 2% to reduce the distortive effect of outliers. Exhibit I shows that the average interest rate is higher for each of the minority groups than for the White-owned firms. Also, the woman-owned firms pay a higher average rate of interest than the man-owned firms.

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EXHIBIT I

SUMMARY STATISTICS ON LOAN RATE BY RACE AND GENDER

PANEL A: RACE	WHITE	HISPANIC	ASIAN	BLACK	NATIVE	TOTAL
Loan Rate (%)	6.74	8.74	9.16	8.60	7.33	7.86
N	992	649	320	434	389	2,784

PANEL B: GENDER	MAN OWNED		WOMAN OWNED	TOTAL
Loan Rate (%)	7.14		10.35	7.59
N	2,065		327	2,392

In Part III, we determine to what extent these rates embody mispricing of minority- and woman-owned firms, i.e., the extent to which the rates for minority- and women-owned firms are higher than they should be after risk factors are considered. The comparisons at the top of Exhibit II show the loan rate spread, which is the interest rate paid minus the prime rate at the time the loan was granted. The results of the loan spread mirror those of the interest rate. Exhibit II also contains various measures of collateral associated with the loans, as reported by the firms.

> **...White-owned firms committed the least collateral relative to the loan amount . . .**

It shows that White-owned firms committed the least collateral relative to the loan amount, were least often required to commit more collateral than the amount of the loan, and were least often required by the lender to have an external party sign for the loan. There are multiple reasons why these differences in interest rates and collateral might exist, including the industry, geographical location, and prior years' profits that are un-related to the race, ethnicity, and gender of the owner. Our analyses control for creditworthiness and other firm attributes to see if minority-owned and White-owned firms of like attributes were treated the same in defining the interest rate and collateral requirements.

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EXHIBIT II | OTHER LOAN OUTCOME VARIABLES

	RACE						GENDER	
	WHITE	HISPANIC	ASIAN	BLACK	NATIVE AMERICAN	TOTAL	MAN OWNED	WOMAN OWNED
MEAN VALUES								
Loan Spread (Loan Rate - Prime Rate)	1.73%	3.12%	3.87%	3.37%	2.09%	2.60%	1.99%	4.88%
Granted Amount/Requested Amount (fractions)	0.847	0.873	0.863	0.873	0.840	0.858	0.909	0.900
FRACTIONS YES:								
Required Collateral-Yes	0.737	0.741	0.784	0.719	0.679	0.732	0.728	0.676
Required More Collateral than Loan Amount	0.057	0.191	0.106	0.180	0.121	0.122	0.121	0.153
Required Blanket Lien	0.296	0.507	0.431	0.565	0.265	0.398	0.341	0.459
Required Business Assets as Collateral	0.735	0.490	0.734	0.712	0.440	0.633	0.653	0.563
Required Personal Assets as Collateral	0.536	0.589	0.581	0.567	0.450	0.546	0.527	0.492
Required both Business and Personal Assets as Collateral	0.528	0.367	0.550	0.560	0.270	0.462	0.467	0.401
Granted Less than Requested	0.586	0.621	0.622	0.449	0.650	0.586	0.611	0.541
Lender Required External Party to Sign	0.387	0.676	0.731	0.829	0.730	0.611	0.571	0.667
N	992	649	320	434	389	2,784	2,065	327

Exhibit III shows that firm characteristics vary across racial, ethnic and gender lines. White-owned firms report the lowest fraction of firms with losses in 2022. White-owned firms also report the highest fraction of firms with the same or higher revenue in 2022 vs. 2021 and the highest fraction of firms with the same or more employees in 2022 vs. 2021. White-owned firms also report the highest credit scores. On the other hand, White-owned firms report the lowest fraction of firms in good or better condition at yearend 2022. Black- and Hispanic-owned firms have the lowest credit score profile. The other traits are mixed, and no group stands out as better or worse overall in other firm measures

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EXHIBIT III

FIRM CHARACTERISTICS

	RACE						GENDER		
	WHITE	HISPANIC	ASIAN	BLACK	NATIVE AMERICAN	TOTAL	MAN OWNED	WOMAN OWNED	TOTAL
MEAN VALUES									
Business Age (years)	10.036	13.448	11.709	11.251	9.882	11.192	10.105	13.156	10.522
Most Responsible Owner's Experience (years)	8.823	9.442	10.131	11.501	10.064	9.709	9.252	11.115	9.507
Most Responsible Owner's Age (years)	42.392	43.846	48.184	41.180	41.460	43.078	42.118	48.110	42.937
Most Responsible Owner's Ownership	77.505%	42.542%	54.975%	53.901%	65.388%	61.392%	64.928%	57.043%	63.850%
Sales Value (in $10,000)	897.157	1308.918	906.117	748.324	1390.479	1039.904	1018.502	1060.830	1024.289
Asset Value (in $10,000)	1608.683	1619.476	799.648	1583.986	2079.251	1580.108	1594.398	1164.278	1535.598
FRACTIONS									
Firm Incurred Loss in 2021	0.085	0.180	0.147	0.237	0.111	0.142	0.109	0.217	0.124
Revenue stayed the same or grew from 2021 to 2022	0.762	0.613	0.688	0.629	0.674	0.686	0.719	0.694	0.715
# Employed stayed the same or grew from 2021 to 2022	0.783	0.613	0.597	0.664	0.681	0.689	0.715	0.648	0.706
Firm is in Good or Better Condition at yearend 2022	0.697	0.773	0.822	0.793	0.763	0.753	0.724	0.786	0.732
Limited Liability Company	0.435	0.670	0.756	0.624	0.519	0.568	0.523	0.740	0.553
Family Business	0.071	0.381	0.166	0.113	0.093	0.163	0.115	0.287	0.139
High Credit Score	0.766	0.407	0.463	0.320	0.496	0.540	0.585	0.437	0.564
Medium Credit Score	0.224	0.512	0.497	0.597	0.414	0.407	0.366	0.495	0.384
Low Credit Score	0.010	0.082	0.041	0.083	0.090	0.053	0.049	0.067	0.052
N	992	649	320	434	389	2,784	2,065	327	2,392

Regarding gender analysis, woman-owned firms exceeded man-owned firms in business age, owner's experience, and owner age.

> **Nonbank finance companies charged the lowest rate, followed by fintech lenders; CDFIs and large banks charged about equal rates, with small banks charging higher rates. Credit unions charged the highest average rates among the six lenders in our sample.**

A higher fraction of woman-owned firms suffered losses in 2021, and a higher fraction are family businesses. A lower fraction of woman-owned firms had a high credit score, and a higher fraction had a low credit scored compared to the man-owned firms.

The survey also collected information on the type of lender that provided the credit: large banks (deposits of at least $10 billion), small banks, CDFIs, credit unions, fintech lenders, and nonbank finance companies. The lenders and rates charged to each group of borrowers are shown in Exhibits IV-A and IV-B.
The lender utilization figures in Exhibit IV-A show that, overall, large banks were used more often than the other lender groups. However, only 13% of the White-owned firms used large banks, while at least 60% of each of the other four racial/ethnic groups borrowed from large banks. About nine out of ten Asian-owned firms and Native-owned firms in our sample borrowed from large banks.

Meanwhile, a higher fraction of White-owned firms borrowed from small banks, credit unions, CDFIs, and fintech lenders and non-bank finance companies than did any of the minority groups. In the case of gender, compared to man-owned firms, higher fractions of woman-owned firms borrowed from large banks and small banks, and lower fractions from the other lenders. Regarding the interest rate paid by the borrowing firms, nonbank finance companies charged the lowest rate, followed by fintech lenders; CDFIs and large banks charged about equal rates, with small banks charging higher rates. Credit unions charged the highest average rates among the six lenders in our sample.

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EXHIBIT IV-A

SUMMARY STATISTICS: LENDER CHARACTERISTICS BY RACE AND GENDER

	RACE						GENDER		
	WHITE	HISPANIC	ASIAN	BLACK	NATIVE AMERICAN	TOTAL	MAN OWNED	WOMAN OWNED	TOTAL
FRACTIONS									
Large bank	0.128	0.622	0.925	0.776	0.853	0.537	0.497	0.645	0.517
Small Bank	0.090	0.046	0.013	0.023	0.010	0.049	0.050	0.073	0.054
Credit Union	0.272	0.092	0.028	0.092	0.039	0.142	0.154	0.119	0.149
CDFI	0.223	0.128	0.019	0.046	0.039	0.124	0.133	0.073	0.125
Fintech Lender	0.193	0.082	0.016	0.041	0.044	0.102	0.114	0.064	0.107
Nonbank Finance Company	0.095	0.029	0.000	0.021	0.015	0.046	0.052	0.024	0.048
Total of fractions	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average Years Relationship with Borrower	3.057	5.284	4.672	4.980	4.868	4.315	3.912	4.693	4.019
Deposit Concentration Index in County	0.176	0.180	0.178	0.177	0.205	0.181	0.181	0.181	0.181
Number of Bank Branches in County	341.057	272.438	290.534	426.373	380.725	338.096	344.675	318.425	341.086
Standard Deviation	413.511	360.715	346.877	496.284	471.221	420.706	432.162	372.862	424.568
N	992	649	320	434	389	2,784	2,065	327	2,392

Regarding the borrower groups, Exhibit IV-B shows that White-owned firms are the only group that paid lower than average interest rates at each of the lenders. At the other end, Asian-owned firms are the only group that paid higher than average interest rates at each of the lenders that provided them credit. Asian-owned firms borrowed almost exclusively from large banks (92 percent).

Seventy-six percent of Hispanic-owned firms borrowed from large banks, small banks, or credit unions. For each of these sources, Hispanic firms paid higher than the average of all groups. For the other three sources, Hispanic-owned firm paid lower than the average rate of all groups. After Asian- and Hispanic-owned firms, Black-owned firms paid the highest average interest rate. The difference between the Hispanic- and Black-owned firms' borrowing rate is small. While Black-owned firms were charged a midrange average rate by large banks, they paid higher than average rates when borrowing from the other five lender types.

EXHIBIT IV-B

SUMMARY STATISTICS: LOAN RATE BY RACE/GENDER AND LENDER TYPE

	RACE						GENDER	
	WHITE	HISPANIC	ASIAN	BLACK	NATIVE AMERICAN	TOTAL	MAN OWNED	WOMAN OWNED
MEAN VALUES								
Large bank	6.90	8.84	8.93	7.26	6.97	7.92	7.37	8.61
N	127	404	296	337	332	1496	1026	211
Small Bank	5.89	12.15	11.25	11.46	21.50	8.28	7.15	13.16
N	89	30	4	10	4	137	104	24
Credit Union	7.12	11.04	12.50	11.70	11.65	8.48	7.60	13.27
N	270	60	9	40	15	394	318	39
CDFI	7.38	7.66	13.65	11.37	6.71	7.76	6.75	10.92
N	221	83	6	20	15	345	284	24
Fintech Lender	6.04	6.38	10.04	21.88	8.16	7.30	6.46	19.89
N	191	53	5	18	17	284	236	21
Nonbank Finance Company	6.13	5.33	.	9.17	6.45	6.24	6.16	6.24
N	94	19	0	9	6	128	107	8
TOTAL	6.74	8.74	9.16	8.60	7.33	7.86	7.14	10.35
N	992	649	320	434	389	2,784	2,065	327

With regard to the gender analysis, woman-owned firms paid higher rates to each type of lender than did man-owned firms, with an overall higher average borrowing rate than that paid by man-owned firms. The lender traits show that woman-owned firms borrowed from large banks and small banks more often than did man-owned firms and borrowed from the other lenders less often than man-owned firms.



III. MISPRICING ANALYSIS

APPROACH

The previous sections describe the summary findings, but they do not control for any risk factors among the borrowers. This "Mispricing Analysis" section reports the results of statistical tests to determine evidence of mispricing in borrowing terms for businesses owned by people of color and women, after controlling for financial attributes that are used to price credit. Ordinary least squares regressions are the standard approach to examine mispricing of loan terms. Financial theory suggests that the required return lenders demand from borrowers should be positively related to the loan's default risk.

Accordingly, we use the interest rate on the loan as the measure of return charged by the lender. An alternate measure is the interest rate on the loan less the prime rate at the time the loan was granted. This is the "loan spread". We report this in our analyses, and find the results using this measure are very similar to those using the interest rate. In this section, the standard regression framework was used to determine to what extent there is evidence of mispricing of loans to minority- and woman-owned firm borrowers.

The following basic model provides the framework for the multiple regressions that follow. R is the interest rate to be determined by a basic rate β_0, and there are N control variables that determine the shifts in R, based on the number of control variables. Thus, there are N control variables considered that affect the interest rate; the β_i (i = 1 ... N) represents the changes in the interest rate reflecting the value of the attributes affecting the rate; β_R measures the effect of race on the interest rate, while β_G is the effect of gender on the interest. Mispricing occurs when the coefficient of race and gender are statistically significant in a model that is considering effect of attributes measuring loan risk. This prediction is based on the information available to the lender concerning the creditworthiness of the applicant and the business activity, including the owner's credit and resources, the firm's credit and financial health, and the environment in which the firm and lender operate.

$$R = \beta_0 + \sum_{i=1}^{N} \beta_i X_i + \beta_R X_R + \beta_G X_G$$

When all the N attributes describing loan risk are included in the model, then β_R and β_G should be zero. We cannot prove, of course, that we have controlled for every credit variable that lenders consider in evaluating applications for business loans. However, the information gathered in the survey makes it possible to control for a very wide range of such variables, thereby greatly lowering the probability that our estimates are affected by omitted variable bias.

> **As a result, we believe that our results provide credible estimates of mispricing.**

As a result, we believe that our results provide credible estimates of mispricing. We assess mispricing by determining whether the interest rate on the credit received differs between the respective minority-owned firms and White-owned firms after controlling for the N variables that effect the interest rate. Included in the N variables are the other features of the loan, which include whether the interest rate is fixed or variable and whether collateral is required. These are determined at the same time as the interest rate and may, therefore, be endogenous. We will consider this as part of our analysis by studying the importance of this effect in our data. Exhibit V shows the control variables used in our analyses.

Our first step to gaining insight to potential factors contributing to differences in loan pricing across groups is to estimate linear regressions with loan rates as the dependent variable. In this way, we limit the sample to White-owned firms and each of the minority-owned firms, separately. For each of these regressions, we include an indicator variable for the relevant minority group, which then captures the loan rate difference between the two groups. We then examine changes in the estimated minority-White loan pricing difference (i.e., the estimated coefficient on the indicator variable of the minority group) as we sequentially added controls. The controls we used are in Exhibit V.

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EXHIBIT V | CONTROL VARIABLES

FIRM CHARACTERISTICS

- State of Firm's Headquarters
- Industry
- Business Age
- Most Responsible
- Owner's Experience
- Most Responsible
- Owner's Age
- Most Responsible Owner's Percentage Ownership
- Sales Level (categories)
- Assets Level (categories)
- Firm Suffered Loss in 2021
- Revenue stayed the same or grew from 2021 to 2022
- Employees stayed the same or grew from 2021 to 2022
- In Good or Very Good condition at yearend 2022
- Limited Liability Protection Firm
- Family Business
- Credit score
- Duns credit rating
- Woman-majority-owned in racial analysis
- Racial-majority-owned in gender analysis

LOAN CHARACTERISTICS

- Year and Month of Loan
- Loan vs. Line of Credit
- Purpose of Loan is debt consolidation
- Fixed Rate vs. Variable Rate Loan
- Term of the loan (in months)

LENDER CHARACTERISTICS

Lender type (category):

- Large Bank (Base category)
- Small Bank
- Credit Union
- CDFI
- Fintech Lender
- Nonbank Finance Company
- Years of relationship with firm
- Whether previously loaned to the firm
- Bank deposit concentration index in county
- Number of bank branches in county

We did the same exercise for man-owned firms and woman-owned firms, where we included owners of all minority groups and captured the loan rate difference between woman- and man-owned firms with an indicator for woman-owned.

INTEREST RATE RESULTS

Interest Results by Minority Group

Exhibit VI shows our analysis of interest rates on approved loans for firms in our sample. Groups are defined based upon controlling ownership. Racial/ethnic identity of a firm is defined by 50% or more controlling ownership, while all other racial/ethnic groups hold less than 50% combined ownership. Gender groups are defined by the gender holding 51% controlling ownership. We consider model 5 as the most important since it considers all the control variables. The interpretation is that, compared to White-owned firms and after controlling for equal creditworthiness and other firm attributes, the annual interest rate paid by Hispanic-owned firms was 2.91 percentage points higher than that paid by White-owned firms. The asterisks indicate the statistical significance of the finding. We consider a result statistically significant when it is at least significant at the .10 level. Statistically significant results are also found for Black-owned firms, Asian-owned firms and woman-owned firms in comparison to man-owned firms.

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EXHIBIT VI

REGRESSIONS CONTROLLING FOR DIFFERENT CHARACTERISTICS MINORITY VS. WHITE FIRMS AND MAN OWNED VS. WOMAN OWNED FIRMS

Dependent variable: Loan Rate	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
PANEL A					
Hispanic vs. White	2.0026**	2.3430**	2.6620**	2.8372***	2.9087***
	(0.9234)	(1.0678)	(0.9907)	(0.9854))	(0.9956)
N	1641	1641	1641	1641	1641
PANEL B					
Black vs. White	1.8639***	1.9852***	2.1188***	2.0053***	3.0893***
	(0.4687)	(0.5124)	(0.7415)	(0.6930)	(0.8492)
N	1426	1426	1426	1426	1426
PANEL C					
Asian vs. White	2.4219***	3.1231***	3.1949***	2.8458***	2.8815***
	(0.7679)	(0.9138)	(1.0042)	(0.9661)	(0.8325)
N	1312	1312	1312	1312	1312
PANEL D					
Native vs. White	0.5918	1.0220**	0.7642*	0.6510	1.1290
	(0.4708)	(0.4383)	(0.4459)	(0.4468)	(1.0911)
N	1381	1381	1381	1381	1381
PANEL E					
Women vs. Men	2.7441***	2.8236***	2.3213***	2.3606***	2.3798***
	(0.6482)	(0.6005))	(0.5003)	(0.4571)	(0.4519)
N	2392	2392	2392	2392	2392
CONTROL VARIABLES					
State and Time Fixed Effects		X	X	X	X
Firm Characteristics			X	X	X
Loan Characteristics				X	X
Lender Characteristics					X

STANDARD ERRORS IN PARANTHESES | STATISTICAL SIGNIFICANCE: *.10 **.05 ***.01

To assess the robustness of our analysis, we examined the results for firms where at least 51% of the ownership is by one racial/ethnic or gender group and no other single racial/ethnic or gender group owns more than 49.0%. These results appear in Exhibit VII.

EXHIBIT VII

ROBUSTNESS CHECK USING RACIAL/ ETHNIC FIRM 51% OWNERSHIP

Dependent variable: Loan Rate	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
PANEL A					
Hispanic vs. White	1.2543	1.8299	2.1934	2.1405	2.5805*
	(0.9904)	(1.1599)	(1.3299	(1.3711)	(1.4463)
N	1039	1039	1039	1039	1039
PANEL B					
Black vs. White	1.4694***	1.6144***	1.4089	1.2733	4.1872***
	(0.5414)	(0.5760)	(0.8524)	(0.7701)	(0.9947)
N	964	964	964	964	964
PANEL C					
Asian vs. White	2.2218***	2.8418***	2.5963**	2.4024**	3.5851***
	(0.8110)	(0.9677)	(1.1699)	(1.1840)	(0.8868)
N	945	945	945	945	945
PANEL D					
Native vs. White	0.1718	0.5207	0.2200	0.1383	2.6105*
	(0.4746)	(0.4568)	(0.4542)	(0.4585)	(1.3074)
N	976	976	976	976	976
CONTROL VARIABLES					
State and Time Fixed Effects		X	X	X	X
Firm Characteristics			X	X	X
Loan Characteristics				X	X
Lender Characteristics					X

STANDARD ERRORS IN PARANTHESES | STATISTICAL SIGNIFICANCE: *.10 **.05 ***.01

Using this check, we found that the statistical significance differences across groups do not change, while the percentage differentials are moderately different.

To confirm our results, we performed two separately weighted analyses of the relationships examined in the main analysis. In both weighting analyses, weights are applied to the winsorized data. The weights mirrored the national distribution of White-owned and minority-owned firms across the various states and industries. It is important to acknowledge, however, that the weighting process was constrained by the limitations of available data. The U.S. Census data, which is crucial for this analysis, is regrettably incomplete in its state and industry-specific information, particularly for minority groups. Despite these constraints, a key finding of our study was the consistency in outcomes between the weighted and unweighted analyses. This consistency suggests that our core findings are resilient and remain unaffected by the chosen methodology of weighting. We do not include the weighted analyses in this report, but they are available from the authors upon request.



In summary, our final mispricing differential for the minority-White interest rate for each minority group is the average of estimates from three models, all of which used the main data set (at least 50% ownership for that group with no other group holding more than 49%) with winsorized interest rate measures: the main model, the weighted-by-state model, and the weighted-by-state/industry model. The average of the mispricing differential across these three models is taken as the mispricing differential. Compared to White-owned firms, the results showed that Asian-owned firms paid 3.34 percentage points higher rates, Hispanic-owned firms paid 3.96 percentage points higher rates, Black-owned firms paid 2.82 percentage point higher rates. Woman-owned firms paid 2.29 percentage points higher rates than man-owned firms.

INTEREST RESULTS BY RACIAL/ETHNIC & GENDER GROUPS

The preceding analysis reports the **overall** mispricing interest rate differential for each of the minority groups relative to White-owned firms. However, the minority groups' experiences differed across lenders. Since minority-owned businesses most frequently borrowed from large banks, we used the interest rate differential with large banks as the baseline. We then looked to see if other lenders (i.e., small banks, FinTech, etc.) had a higher or lower interest rate differential between minority groups and White-owned firms than did large banks.

In Exhibit VIII, the "minority" line is the racial gap (difference between minority-owned firms and White-owned firms) in interest rate paid by that group at large banks. So, Hispanic-owned firms paid 3.57 percentage points higher interest rates than White-owned firms at large banks, and that difference is at the .01

level of statistical significance. Moving across the minority line, Asian-American-owned businesses paid 2.66 percentage points higher than White-owned firms at large banks and that difference is also statistically significant. There is no statistically significant difference in the interest rates that large banks charged Black- and Native American-owned businesses compared to White-owned firms, after considering creditworthiness and other attributes of the firms. The summary is that at large banks, Hispanic-owned firms and Asian-owned firms paid higher rates than those predicted in our model. For Black- and Native American-owned firms, mispricing by race was not indicated.

The terms noted by "#" are interaction terms that show the difference between that type of lender and large banks in the interest rate gap between minority- and White-owned firms. We add the interaction term to the Minority term to measure if the racial gap in interest rate (minority–White-owned firms) differs between that type of lender and large banks. Thus, Hispanic-owned firms paid higher rates (3.06 percentage points + 3.57 percentage points) than White-owned firms in small banks, meaning that the racial gap may be 3.07 percentage points larger in small banks than in large banks. However, the 3.06 percentage points are not statistically significant. So, we conclude that the difference at small banks is the same as large banks: 3.57 percentage points. Likewise, the additional .54 percentage points higher rates paid by Hispanic-owned firms over White-owned firms at credit unions compared to large banks are not statistically significant.

However, the CDFI interaction term is a statistically significant -2.91 percentage points, implying that at CDFIs, Hispanic-owned firms paid (3.57 percentage points – 2.91 percentage points =) .65 percentage points more than white-owned firms. The premium paid by Hispanic-owned firms over white-owned firms was lower at CDFIs. We conclude from additional tests that the.65 percentage points is not statistically significant, and thus Hispanic and White firms do not differ in interest rates paid at CDFIs.

For brevity and clarity, we will outline the remaining differences for the other minority groups and gender differences, without the specific numbers provided in Exhibit VIII. Black-owned firms paid the same interest rates as their White-owned counterparts at large banks, small banks and CDFIs, while paying higher interest rates than their White-owned counterparts at credit unions, fintech lenders and nonbank finance companies. Asian-owned firms paid higher interest rates than their White-owned counterparts at large banks. Because of the small sample sizes of Asian-owned firms borrowing from the other lenders, we will not make inferences about the results in those cases.

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EXHIBIT VIII

LENDER INTERACTION EFFECTS ADDED TO BASIC MODEL

DEPENDENT VARIABLE LOAN RATE	Hispanic vs. White	Black vs. White	Asian vs. White	Native vs. White	Woman vs. Man
Minority	3.5731***	0.5895	2.6551***	0.7244	1.4636**
	(1.2329)	(1.0616)	(0.8840)	(1.1117)	(0.6300)
Small Bank#Minority	3.0689	4.5001	1.4790	14.0013***	2.5252
	(2.3661)	(3.3365)	(2.6590)	(1.5123	(2.3767)
Credit Union#Minority	0.5382	3.1969*	0.3149	2.3315	2.0616
	(1.5683)	(1.6556)	(2.8489)	(3.5924)	(1.2665)
CDFI#Minority	-2.9093**	1.9211	2.3406	-1.0608	4.2779***
	(1.3765)	(1.5238)	(4.2601)	(2.9209)	(1.1080)
Fin Tech#Minority	-2.3932	12.7471***	0.1324	-0.7767	0.8794
	(1.9775)	(2.6414)	(1.7479)	(2.0745)	(2.2429)
Nonbank#Minority	-1.7110	2.6211**	0.0000	-0.3626	-0.6836
	(2.0830)	(1.0503)	(.)	(1.6183)	(1.2641)
Small Bank	-1.1966	-0.6502	-0.4056	-0.7949	-0.3424
	(1.0390)	(1.0416)	(1.0043	(1.0872)	(0.7339)
Credit Union	0.6901	0.3698	0.1200	0.7708	0.0786
	(1.3782)	(1.1166)	(1.2815)	(1.2329)	(0.6109)
CDFI	1.2188	0.3318	0.4417	0.8032	-1.0935
	(1.5536)	(1.2534)	(1.4485)	(1.3080)	(0.6981)
Fin Tech	-0.3280	-0.7206	-0.6710	-0.2777	-1.0722**
	(1.5190)	(1.2000)	(1.3808)	(1.2970)	(0.4718)
Nonbank	-0.2984	-0.6880	-0.6369	-0.3348	-1.3691**
	(1.6459)	(1.2758)	(1.5674)	(1.3959)	(0.6010)
Control Variables	ALL				
N	1,641	1,426	1,312	1,381	2,392

STANDARD ERRORS IN PARANTHESES | STATISTICAL SIGNIFICANCE: *.10 **.05 ***.01

Woman-owned firms paid the same rates as their comparable male-owned counterparts at large banks, small banks and nonbank finance companies, and higher interest rates than their male-owned counterparts at credit unions, CDFIs and fintech lenders. The five lines below the interaction term indicate the difference between the lender and large banks in the interest rate paid by White-owned firms. White-owned firms paid 1.197 percentage points less in small banks than large banks, but the difference is not statistically significant.

In summary, in the Hispanic-owned firm to White-owned firm comparison, the rates paid by Hispanic-owned firms to each of the lender types are higher than we can explain in our statistical models. In the Black-owned firm to White-owned firm comparison, the rates paid by Black-owned firms to large banks are explained within our models (no mispricing indicated), and rates paid to large banks do not differ statistically from the rates Black-owned firms paid to small banks and CDFIs. However, the rates paid by Black-owned firms to credit unions, fintech lenders and nonbank finance companies are higher than our models can explain. In the Asian-owned firm to White-owned firm comparison, we find that Asian-owned firms paid higher interest rates to large banks than we can explain in our models. The sample of Asian-owned borrowers at other lender types is too small to make inferences.

COLLATERAL

Thus far, this report has focused on mispricing in the context of interest rates. The other part of the credit agreement is the collateral requirement. Collateral can be examined in a binary approach: it can be observed in analyses of "yes" or "no" regarding various forms of collateral committed for the loan. These binary outcomes require a different type of statistical regression. This study used various "probit regressions" of collateral decisions on the credit received by the responding firms. We ran these probit regressions using all the control variables to determine if, after considering the control variables, the membership in a "minority" group-owned or woman-owned business had any impact on the collateral associated with the loan. The models determined the statistical significance of minority or woman-owned business was impacted by the yes/no outcome regarding that measure of collateral. The probits showed that for the minority-owned groups, the only consistent collateral term was that minority-owned groups had a higher probability of an external party being required to guarantee the loan (Exhibit IX).

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EXHIBIT IX

OTHER OUTCOME VARIABLE COMPARISONS: MINORITY VS. WHITE-OWNED FIRMS & WOMEN- VS. MAN-OWNED FIRMS

DEPENDENT VARIABLE	Hispanic vs. White	Black vs. White	Asian vs. White	Native vs. White	Woman vs. Man
A. OLS ANALYSES					
Loan Spread (Loan Rate - Prime Rate)	2.8895***	3.0732***	2.9018***	1.1799	2.1946***
	(0.9889)	(0.8539)	(0.8265)	(1.1032)	(0.4757)
Required Collateral Value Relative to Loan (Intervalled)	0.2898**	0.1488	0.2860	0.0967	-0.0749
	(0.1140)	(0.2016)	(0.2131)	(0.1785)	(0.1070)
Granted Amount / Requested Amount	0.1942	0.0180	0.0759	-0.0164	1.5984
	(0.1519)	(0.0232)	(0.0512)	(1.2461)	(1.4990)
B. PROBIT ANALYSES					
Required Collateral vs. Not	-0.0248	-0.0107	0.0311	-0.0136	-0.0105
	(0.0430)	(0.0652)	(0.0810)	(0.0493)	(0.0365)
Require More Collateral than Loan Amount	0.0753***	0.0504	0.0282	-0.0264	-0.0257
	(0.0276)	(0.0385)	(0.0471)	(0.0358)	(0.0172)
Required Blanket Lien	0.0109	0.1020*	-0.1180	-0.0953*	0.0818**
	(0.0453)	(0.0600)	(0.1016)	(0.0527)	(0.0301)
Required Business Assets as Collateral	-0.2607***	-0.0270	-0.0173	-0.2427***	-0.0350
	(0.0536)	(0.0722)	(0.0887)	(0.0445)	(0.0321)
Required Personal Assets as Collateral	0.0103	0.0145	0.0165	-0.0135	0.0363
	(0.0474)	(0.0814)	(0.0845)	(0.0500)	(0.0256)
Required both Business and Personal Assets as Collateral	-0.1814***	0.0002	-0.0046	-0.1756***	0.0051
	(0.0602)	(0.0836)	(0.0890)	(0.0437)	(0.0213)
Granted Less than Requested	0.0053	-0.1441***	-0.0528	-0.0545	-0.0856**
	(0.0440)	(0.0320)	(0.0847)	(0.0655)	(0.0263)
Lender Required External Party to Sign	0.1184**	0.2589***	0.2069***	0.2609***	0.0167
	(0.0510)	(0.0350)	(0.0413)	(0.0393)	(0.0280)
N	1,641	1,426	1,312	1,381	2,784
Control Variables	All	All	All	All	All

STANDARD ERRORS IN PARANTHESES | STATISTICAL SIGNIFICANCE: *.10 **.05 ***.01

In addition, for Hispanic-owned firms more often the value of the collateral is higher than the loan amount compared to white-owned firms. Regarding Black-owned firms, Exhibit II shows that 57% of Black-owned firms have blanket liens on their assets, which is the highest among all groups, while 30% of white-owned firms borrowed with blanket liens, the lowest of all groups. Exhibit IX shows that the black-white differences in blanket liens are statistically significant after considering all the controls. For Asian American-owned firms, only the external party signature requirement that is higher compared to white-owned firms after considering all the controls. All other differences are not statistically significant. Native American-owned firms are less likely to have cases of both business and personal collateral, than white-owned firms, after considering all controls. Woman owned firms were less often required to put up personal assets as collateral than man owned firms.

PRINCIPAL COMPONENT ANALYSIS

As mentioned above, loan terms are jointly determined and "packaged" together. For this reason, we seek to add robustness to our results above using Principal Component Analysis (PCA). PCA, originally introduced by Hotelling (1933), is a widely used technique for dimensionality reduction, with the different terms creating the dimensions in the PCA analysis. PCA synthesizes a series of correlated variables into one or more composite variables, referred to as principal components, which capture the most salient sources of variation in a dataset.

Loan interest rate and collateral requirements are important outcomes related to loan quality and they are often correlated with each other. For example, bundles of various collateral values and interest rates are frequently offered as part of a loan package, and their determination is simultaneous. Focusing solely on one outcome, however, would neglect the preferences of different racial groups in relation to the other outcome. To account for the simultaneity and correlation between these outcomes, we perform a PCA on all variables related to interest rate and collateral, encompassing a set of eight variables, including loan rate, loan spread, collateral requirement, collateral value, blanket lien requirement, business collateral requirement, personal collateral requirement, and both business and personal collateral requirements.

Using this analysis, we do not find that racial and ethnic minority groups had consistently greater collateral requirements than White-owned firms, and this finding is independent of the interest rate component.

> **Hispanic-, Black-, and Asian-owned firms have loans with higher interest rates than White-owned firms**

Hispanic-, Black-, and Asian-owned firms have loans with higher interest rates than White-owned firms. Additionally, woman-owned firms have loans with higher interest rates than man-owned firms. These results align with our previous findings. The appendix shows the statistical analyses related to PCA.



IV. CONCLUSION

FINDINGS

A major purpose of this study was to explore the economic impact of loan mispricing on diverse-owned companies in terms of interest rates and collateral required in obtaining credit.

> **We found that for Hispanic-, Asian- and Black-owned firms, the interest rate paid was higher than for comparable White-owned firms...**

We found that for Hispanic-, Asian- and Black-owned firms, the interest rate paid was higher than for comparable White-owned firms, after considering the controls for risk that determine the interest rate on loans, including the firm's industry, financial attributes, owner traits, credit history and type of loan. We conducted robustness tests to verify the strength of these results. Another component of the credit received by the firm is the collateral. We performed tests to determine if the collateral requirements were justified given the characteristics of the firm as enumerated above. We found that the only collateral requirement that is consistently mispriced is that third party co-signatories are demanded more frequently for minority-owned firms than is justified by our economic analysis. Unfortunately, the survey data did not have sufficient detail for us to pursue an estimate of the economic loss associated with the greater requirement for third party signatures across the minority firm borrowers. This is an important topic for future research. Also, previous studies have found that borrowers from minority-owned firms are rejected for loans at a higher rate than White-owned firms of the same creditworthiness. We did not look at loan rejections in this study, therefore, this is another important topic for future research. We need to understand the issues that minority-owned firms face in financing their survival and growth. We as a nation should identify and eliminate impediments to their growth that should not exist.

COST TO AFFECTED BUSINESSES

We were able to make estimates of the additional interest that the minority-owned firms paid for credit over and above the rates that comparable White-owned firms paid. We found that the interest rate differential due to

the race of the business owner totaled $8.1 billion annually (Exhibit X-A). The difference in the costs to each racial or ethnic group was a result of the number of businesses that secure loans annually, the average loan size of the group, and the mispricing differential estimated in this study.

As mentioned above, our final mispricing differential in minority-White interest rate for each minority group was the average of estimates from three models, all of which used the main data set (at least 50% ownership for that group, with no other group holding more than 49%): the basic model, the weighted-by-state model, and the weighted-by-state/industry model. Another approach would be to use the range of the three minority-White differentials to quantify the range of values. These results are presented in Exhibit X-B below.

EXHIBIT X-A

ADDITIONAL INTEREST PAID FROM MISPRICING

	A	B	C	D	E	F	G
				A*B*C			D*E*F
	2021	2022	2022	2022			
	Census ABS U.S. Total Employer Firms	Fed Res SBCS Fraction Applied For Credit	Fed Res SBCS Fraction Approved*	Number of Approved Loans	$ Estimated Average Loan Size**	Survey Estimated Mispriced Interest Rate Difference	$000 Total Annual Difference in Interest
WHITE	4,409,715	0.40	0.820	1,446,387	414,796		
HISPANIC	406,086	0.44	0.680	121,501	336,158	0.0334	1,363,765
ASIAN	637,539	0.48	0.690	211,153	776,816	0.0396	6,502,357
BLACK	149,326	0.40	0.500	29,865	276,518	0.0282	232,682
NATIVE	28,338	0.46	0.560	7,300	489,811	0.0000	0
							8,098,804

*PARTIALLY APPROVED PLUS FULLY APPROVED
**FISCAL YEAR 2023 AVERAGE SBA 7(A) LOAN FOR EACH RACIAL GROUP

The annual business survey (ABS) of the US Census Bureau provides the number of small businesses by race/ethnicity in column A. The latest figures refer to 2021. Column B is from the Small Business Credit Survey (SBCS) of the Federal Reserve for 2023. It indicates the fraction of each of the groups that applied for credit in 2022. It also shows, in Column C, the fractions approved for loans in each of the groups. Note that the fraction approved includes those credits that were fully approved and those that were partially approved. By multiplying through each of the foregoing columns, we obtain the estimated number of approved loans for each group, as shown in Column D. The average loan size is estimated based on the fiscal year 2023 average size of SBA 7(A) loans. These small business loans are often competitors with the conventional small business loans that we consider in this study. The average loan size for each group is in column E. Column F shows the interest rate differential we estimated in the study, and Column G reports the estimated annual total dollars paid by each of the minority groups through mispricing.

Exhibit X-A presents the average cost of the interest rate differential to different racial and ethnic groups. Yet, in conducting the data analysis, we used several analytical tools to test the robustness of the results. This led to developing a range possibilities for the interest rate differential and thus a range of potential impacts in excess interest payments paid by different racial and ethnic groups. These results are presented in Exhibit X-B below.

EXHIBIT X-B

LENDER INTERACTION EFFECTS ADDED TO BASIC MODEL

	A	B	C	D	E	F	G	H	I
				A*B*C				D*E*F	D*E*G
	2021	2022	2022	2022					
	Census ABS U.S. Total Employer Firms	Fed Res SBCS Fraction Applied For Credit	Fed Res SBCS Fraction Approved*	Number Approved Loans	$ Estimated Average Size of Loan**	Survey Estimates of Mispriced Interest Rate Difference %		$ Total Annual Difference in Interest (000)	
						LOW	HIGH	LOW	HIGH
WHITE	4,409,715	0.40	0.820	1,446,387	414,719				
HISPANIC	406,086	0.44	0.680	121,501	336,158	2.91	3.74	1,188,546	1,527,547
ASIAN	637,539	0.48	0.690	211,153	776,816	2.88	5.06	4,723,977	8,299,764
BLACK	149,326	0.40	0.500	29,865	276,518	2.06	3.31	237,838	417,868
NATIVE	28,338	0.46	0.560	7,300	489,811	0.00	0.00	0	0
							TOTAL	6,150,361	10,245,180

*PARTIALLY APPROVED PLUS FULLY APPROVED
**FISCAL YEAR 2023 AVERAGE SBA 7(A) LOAN FOR EACH RACIAL GROUP

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APPENDIX

USING PRINCIPAL COMPONENT ANALYSIS TO CONSIDER THE JOINT DETERMINATION OF LOAN TERMS

As mentioned earlier, loan terms are jointly determined and "packaged" together. For this reason, we seek to add robustness to our results above using Principal Component Analysis (PCA). PCA, originally introduced by Hotelling (1933), is a widely used technique for dimensionality reduction, with different terms creating the dimensions in the PCA analysis. PCA synthesizes a series of correlated variables into one or more composite variables, referred to as principal components, which capture the most salient sources of variation in a dataset. This method has found broad applications in constructing composite indices and summarizing complex data, including those related to economic development, quality of life, well-being (e.g., Dunteman, 1989; Ram, 1982; Slotted, 1991; Biswas & Caliendo, 2002; McGillivray, 2005; Haq & Zia, 2013).

The principal components are linear combinations of the original variables and are ranked according to the proportion of variance they account for. The first principal component explains the most substantial portion of the variance in the original variables, while the second captures the largest portion of the remaining variance, and so on. These components are orthogonal to each other and provide a more concise representation of the original variables.

Loan interest rate and collateral requirements are important outcomes related to loan quality and are often correlated with each other. For example, bundles of various collateral values and interest rates are frequently offered as part of a loan package, and their determination is simultaneous. Focusing solely on one outcome would neglect the preferences of different racial groups in relation to the other outcome. To account for the simultaneity and correlation between these outcomes, we perform a PCA on all variables related to interest rate and collateral, encompassing a set of eight variables, including loan rate, loan spread, collateral requirement, collateral value, blanket lien requirement, business collateral requirement, personal collateral requirement, and both business and personal collateral requirements.

In Panel A of Exhibit A-1, the principal components derived from the original variables are presented. Given that eight original variables are utilized, the PCA generates eight components. Following the Kaiser rule, only components with high eigenvalues (typically exceeding 1) are deemed significant and selected as principal components (PCs). In our case, the first two components meet this criterion. As indicated in the "proportion" column, the first component explains 46.28% of the variance in the eight variables, followed by the second component, which explains 24.78% of the variance. Together, these two components account for 71.06% of the variance.

Panel B of Exhibit A-2 shows the loadings on the principal components, which provides information on which original variables

contribute most to the first and second principal components. It is evident that the first component heavily loads on collateral-related variables, allowing us to define it as the collateral component of the loan quality. The second component exhibits significant loadings on loan rate-related variables; thus, we can define it as the loan rate component of loan quality. Due to the orthogonality of the PCs, the second PC (the loan rate component) is independent of the first PC (the collateral component). This feature allows us to examine the racial disparities in each component separately without concern for the correlation between the two. Consequently, we use these two principal components as dependent variables instead of the original variables to assess racial differences. Because the principal components represent composite indices of the original variables, our focus centers on the direction of the effect and its statistical significance in interpreting the results.

In Exhibit A-2, Panel A shows the results using the first principal component (the collateral component) as the dependent variable. There is no evidence that racial and ethnic minority groups have greater collateral requirements than majority White-owned firms, and this finding is independent of the interest rate component. However, majority woman-owned firms do exhibit higher collateral requirements. Panel B shows the results using the second principal components as the dependent variable, especially focusing on the loan rate component, which is independent of collateral. Firms owned by Hispanic, Black, and Asian owners have loans with higher interest rates than businesses owned by Whites. Additionally, woman-owned firms have loans with higher interest rates than man-owned firms. These results align with our previous findings.

GRAPH ON NEXT PAGE

EXHIBIT A–1

PRINCIPAL COMPONENT ANALYSIS: USE OF PCA TO SUMMARIZE LOAN QUALITY

PANEL B
Comp1 loads heavily on coll related variables

Comp2 loads heavily on loan rate

PANEL A
Proportion of variation in the data explained by each component

Kaiser Rule: eigenvalue>1
There is significant break between 2 and 3. keep 2.

PANEL A: COMPONENTS

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.7025	1.7200	0.4628	0.4628
Comp2	1.9826	1.0577	0.2478	0.7106
Comp3	0.9249	0.1560	0.1156	0.8262
Comp4	0.7688	0.4008	0.0961	0.9224
Comp5	0.3681	0.1511	0.0460	0.9684
Comp6	0.2170	0.1941	0.0271	0.9955
Comp7	0.0229	0.0097	0.0029	0.9983
Comp8	0.0132	.	0.0017	1.0000

PANEL B: LOADINGS ON THE PRINCIPAL COMPONENTS

Variable	Comp1	Comp2	Unexplained
Loan Rate	0.0669	0.7010	0.0091
Loan Spread	0.0689	0.6980	0.0164
Required Collateral vs. Not	0.4620	-0.0470	0.2055
Required Collateral Value relative to Loan (Intervalled)	0.3946	0.0022	0.4236
Required Blanket Lien	0.2901	0.0520	0.6831
Required Business Assets as Collateral	0.4165	-0.0927	0.3405
Required Personal Assets as Collateral	0.4333	-0.0417	0.3015
Required both Business and Personal Assets as Collateral	0.4199	-0.0776	0.3352

EXHIBIT A-2 REGRESSION MODELS USING PCA

	Hispanics vs. Whites	Blacks vs. Whites	Asians vs. Whites	Natives vs. Whites	Woman Owned vs. Man Owned
	Panel A: PC1 - Collateral Component				
Minority	-0.2397	0.1332	0.1013	-0.3886*	1.3313***
	(0.2075)	(0.3432)	(0.3933)	(0.2013)	(0.3003)
	Panel B: PC2 - Loan Rate Component				
Minority	0.7691***	0.5437***	0.6106***	0.3072	1.5253***
	(0.2395)	(0.1568)	(0.1643)	(0.1936)	(0.2780)
	1641	964	1312	1381	2392