

Supplemental Appendices

Are Loans to Minority Owned Firms Mispriced?

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Appendix A

Exhibit A-1 Summary Statistics of Control Variables

	White	Hispanic	Black	Asian	Native
Panel A: Firm Characteristics					
Industry					
Professional Services & Real Estate	0.188	0.177	0.205	0.181	0.147
Non-manufacture Production & Services	0.294	0.448	0.373	0.369	0.344
Business Support & Consumer Services	0.018	0.051	0.076	0.044	0.085
Retail	0.188	0.092	0.053	0.063	0.085
Healthcare & Education	0.058	0.051	0.081	0.050	0.123
Leisure & Hospitality	0.075	0.059	0.138	0.069	0.111
Manufacturing	0.179	0.122	0.074	0.225	0.105
Business Age (years)	10.036 (6.728)	13.448 (6.225)	11.251 (5.855)	11.709 (4.964)	9.882 (4.113)
Most Responsible Owner's Experience (years)	8.823 (5.727)	9.442 (4.821)	11.501 (5.072)	10.131 (5.306)	10.064 (4.345)
Most Responsible Owner's Age (years)	42.392 (7.224)	43.846 (9.930)	41.180 (8.218)	48.184 (9.915)	41.460 (7.398)
Most Responsible Owner's Ownership Percentage	77.505 (31.614)	42.542 (21.861)	53.901 (21.493)	54.975 (21.101)	65.388 (26.280)
Sales Value (in \$10,000)	897.157 (1271.8)	1308.918 (1922.4)	748.324 (1793.6)	906.117 (2372.8)	1390.479 (2217.1)
Asset Value (in \$10,000)	1608.683 (2072.7)	1619.476 (2092.9)	1583.986 (2811.0)	799.648 (1501.8)	2079.251 (2656.0)
Firm Incurred Loss in 2021	0.085	0.180	0.237	0.147	0.111
Revenue stayed the same or grew from 2021 to 2022	0.762	0.613	0.629	0.688	0.674
# Employed stayed the same or grew from 2021 to 2022	0.783	0.613	0.664	0.597	0.681
Firm is in Good or Better Condition at yearend 2022	0.697	0.773	0.793	0.822	0.763
Limited Liability Company	0.435	0.670	0.624	0.756	0.519
Family Business	0.071	0.381	0.113	0.166	0.093
Woman owned 51% or more of the firm	0.046	0.156	0.090	0.216	0.059
High Credit Score	0.766	0.407	0.320	0.463	0.496
Medium Credit Score	0.224	0.512	0.597	0.497	0.414
Low Credit Score	0.010	0.082	0.083	0.041	0.090
N	992	649	434	320	389

Exhibit A-1 Summary Statistics of Control Variables cont.

	White	Hispanic	Black	Asian	Native
Panel B: Loan Characteristics					
Loan vs. Line of Credit	0.917	0.826	0.823	0.800	0.830
New vs. Renewal	0.892	0.593	0.724	0.572	0.625
Purpose of Loan is Debt Consolidation	0.240	0.458	0.403	0.378	0.404
Loan is Fixed Rate	0.906	0.629	0.855	0.759	0.879
Term of the loan (months)	27.882 (16.816)	39.156 (33.797)	22.942 (15.415)	23.303 (11.963)	22.961 (12.430)
Panel C: Lender Characteristics					
Bank Type					
Large Bank	0.128	0.622	0.776	0.925	0.853
Small Bank	0.090	0.046	0.023	0.013	0.010
Credit Union	0.272	0.092	0.092	0.028	0.039
CDFI	0.223	0.128	0.046	0.019	0.039
Fintech Lender	0.193	0.082	0.041	0.016	0.044
Nonbank Finance Company	0.095	0.029	0.021	0.000	0.015
Length of Relationship with Borrower	3.057 (3.051)	5.284 (4.103)	4.980 (4.911)	4.672 (3.640)	4.868 (4.526)
Deposit Concentration Index in County	0.176 (0.101)	0.180 (0.107)	0.177 (0.119)	0.178 (0.099)	0.205 (0.139)
Number of Bank Branches in County	341.057 (413.511)	272.438 (360.715)	426.373 (496.284)	290.534 (346.877)	380.725 (471.221)
N	992	649	434	320	389

Exhibit A-2 Using Dun & Bradstreet credit score controls

Dep Var: Loan Rate	
Panel A	
Hispanics vs. Whites	8.4738***
	(1.4680)
Adjusted R ²	0.3210
N	420
Panel B	
Blacks vs. Whites	5.4778**
	(2.0598)
Adjusted R ²	0.2566
N	384
Panel C	
Asians vs. Whites	3.7748***
	(1.0069)
Adjusted R ²	0.2795
N	376
Panel D	
Natives vs. Whites	1.3870
	(1.0900)
Adjusted R ²	0.2942
N	393
Control Variables	
State and Time Fixed Effects	x
Firm Characteristics	x
Loan Characteristics	x
Lender Characteristics	x
D&B credit score	x

Exhibit A-3 Weighted Regressions Using Race-State Weights

Dep var	Hispanics vs. Whites	Blacks vs. Whites	Asians vs. Whites	Natives vs. Whites
Loan Rate	3.7351*** (1.2385)	3.3082*** (0.6926)	3.9554*** (0.9551)	1.3963 (0.9967)
Loan Spread (Loan Rate - Prime Rate)	3.7083*** (1.2287)	3.3057*** (0.6889)	3.9850*** (0.9594)	1.4255 (1.0062)
Required Collateral Value Relative to Loan (Intervalled)	0.1844 (0.1342)	0.1829 (0.1628)	0.4239** (0.2051)	0.2403 (0.1715)
Required Collateral vs. Not	-0.0502 (0.0476)	0.0113 (0.0639)	0.0994 (0.0746)	0.0280 (0.0532)
Required More Collateral than Loan Amount	0.0631** (0.0295)	0.0513* (0.0256)	0.0650 (0.0506)	0.0157 (0.0345)
Required Blanket Lien	-0.0342 (0.0505)	0.1129** (0.0477)	-0.0924 (0.0913)	-0.0571 (0.0550)
Required Business Assets as Collateral	-0.2759*** (0.0679)	-0.0091 (0.0695)	0.0602 (0.0805)	-0.2056*** (0.0453)
Required Personal Assets as Collateral	-0.0414 (0.0590)	0.0597 (0.0692)	0.0909 (0.0895)	0.0317 (0.0497)
Required both Business and Personal Assets as Collateral	-0.2024** (0.0777)	0.0381 (0.0669)	0.0786 (0.0933)	-0.1556*** (0.0425)
Lender Required External Party to Sign	0.1114*** (0.0411)	0.3084*** (0.0449)	0.1926*** (0.0534)	0.2331*** (0.0449)
N	1622	1404	1294	1360
Control Variables	All	All	All	All
Standard errors in parentheses. Statistical significance: *.10 ** .05 ***.01				

Exhibit A-4 Weighted Regressions Using Race-State-Industry Weights

Dep var	Hispanics vs. Whites	Blacks vs. Whites	Asians vs. Whites	Natives vs. Whites
Loan Rate	3.3733***	2.0552***	5.0559***	1.3299
	(0.9317)	(0.6055)	(1.3493)	(1.1203)
Loan Spread (Loan Rate - Prime Rate)	3.3252***	2.0654***	5.0960***	1.3689
	(0.9157)	(0.5957)	(1.3591)	(1.1335)
Required Collateral Value Relative to Loan (Intervalled)	0.1977	0.2020	0.5725**	0.0752
	(0.1896)	(0.1957)	(0.2322)	(0.1777)
Required Collateral vs. Not	-0.0329	0.0104	0.1294	0.0125
	(0.0670)	(0.0735)	(0.0842)	(0.0683)
Require More Collateral than Loan Amount	0.0452	0.0421	0.0771	-0.0451
	(0.0279)	(0.0292)	(0.0575)	(0.0304)
Required Blanket Lien	-0.0018	0.0338	-0.1027	-0.0804
	(0.0635)	(0.0512)	(0.1020)	(0.0609)
Required Business Assets as Collateral	-0.2248**	-0.0092	0.0961	-0.2357***
	(0.0858)	(0.0787)	(0.0884)	(0.0463)
Required Personal Assets as Collateral	-0.0386	0.0242	0.1257	-0.0109
	(0.0787)	(0.0871)	(0.0789)	(0.0595)
Required both Business and Personal Assets as Collateral	-0.1641	-0.0003	0.1193	-0.2134***
	(0.1001)	(0.0849)	(0.0805)	(0.0398)
Lender Required External Party to Sign	0.1523***	0.2703***	0.1563***	0.2693***
	(0.0333)	(0.0486)	(0.0487)	(0.0478)
N	1622	1404	1294	1360
Control Variables	All	All	All	All
Standard errors in parentheses. Statistical significance: *.10 ** .05 ***.01				

Appendix B

Using Principal Component Analysis to Consider the Joint Determination of Loan Terms

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, and the different terms create 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; Slottje, 1991; Biswas and Caliendo, 2002; McGillivray, 2005; Haq and 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 forth. 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 they 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 Table B1, 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 47.16% of the variance in the eight variables, followed by the second component, which explains 24.57% of the variance. Together, these two components account for 71.73% of the variance.

Panel B of Table B1 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 Table B2, Panel A shows the results using the first principal component (the collateral component) as the dependent variable. Except for guarantor required, minority groups do not have consistently greater collateral requirements than white owned firms, and this finding is independent of the interest rate component. Blanchard et al. 2008, using the 1998 SSBF do not find that their results of interest rate mispricing across races are affected by a correction for the endogeneity of a required outside guarantor. 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. Hispanic-, Black-, and Asian

American-owned firms have loans with higher interest rates than white owned firms. These results align with our findings.

Table B1 Principal Component Analysis: Use of PCA to Summarize Loan Quality

Panel A: Components				
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.7730	1.8076	0.4716	0.4716
Comp2	1.9654	1.0806	0.2457	0.7173
Comp3	0.8848	0.1341	0.1106	0.8279
Comp4	0.7508	0.3822	0.0938	0.9218
Comp5	0.3686	0.1566	0.0461	0.9678
Comp6	0.2120	0.1889	0.0265	0.9943
Comp7	0.0231	0.0007	0.0029	0.9972
Comp8	0.0223	.	0.0028	1.0000
Panel B: Loadings on the Principal Components				
Variable	Comp1	Comp2	Unexplained	
Loan Rate	0.0683	0.7026	0.0122	
Loan Spread	0.0693	0.7004	0.0177	
Required Collateral vs. Not	0.4598	-0.0413	0.1989	
Required Collateral Value relative to Loan (Intervalled)	0.3952	-0.0023	0.4108	
Required Blanket Lien	0.3009	0.0213	0.6575	
Required Business Assets as Collateral	0.4155	-0.0786	0.3364	
Required Personal Assets as Collateral	0.4309	-0.0467	0.2953	
Required both Business and Personal Assets as Collateral	0.4173	-0.0726	0.3327	

Panel B:

Comp1 loads heavily on collateral 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.

Table B2: Regression Models using PCA

	Hispanics vs. Whites	Blacks vs. Whites	Asians vs. Whites	Natives vs. Whites
Panel A: PC1-Collateral Component				
Minority	-0.2459 (0.2015)	0.1452 (0.3380)	0.0947 (0.3919)	-0.3899* (0.2031)
Panel B: PC2 - Loan Rate Component				
Minority	0.6631*** (0.2132)	0.6382*** (0.1973)	0.5846*** (0.1631)	0.2994 (0.2244)
	1641	964	1312	1381

Appendix B References

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