Analysis of Bank Risk Through Distance to Nearest Competitor: A Study of Racial Minority US Banks

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Abstract

Financial institutions, particularly banks, operate within a competitive market influenced by various competitors of differing sizes, structures, and market dominance. This study investigates how alterations in inter-bank distances, serving as an indicator of competition, impact the risk-taking behavior of racial minority banks, with a specific focus on African-American banks. The findings reveal that as the proximity of competitor banks increases, the propensity for risk-taking diminishes among minority banks. Essentially, banks tend to engage in riskier lending practices when faced with heightened competition due to closer physical proximity of their competitors. Furthermore, this study explores the intricate competitive landscape among other minority banks, shedding light on potential factors contributing to the observed decline in the number of African-American banks.

Contents

1 Introduction

In a competitive market, banks or lending institutions exhibit behaviors akin to other commercial firms. The distinction between commercial enterprises and banks lies in their functions and outputs. Banks establish market power ex ante based on their physical proximity to borrowing firms. Banks located in close proximity to borrowing firms enjoy significantly reduced transportation and monitoring costs. This advantage is noteworthy, leading to the observation that "if other banks are relatively far, close banks have considerable market power" (Degryse and Ongena, 2005; Petersen and Rajan, 1995)

This study analyzes the impact of geographical distance between two categories of banks in the USA, minority and non-minority banks, on the risk-taking behavior of minority banks, as measured by the Non-Performing Loan (NPL) ratio. The underlying assumption posits that non-minority banks excel in terms of capital, market power, and lending conditions. Minority ownership, in this context, encompasses five major ethnic groups: African American, Asian, Hispanic, Native American, and others. The Federal Deposit Insurance Corporation (FDIC) defines minority depository institutions as banks meeting specific criteria: either having at least 51 percent of the voting stock owned by minority individuals or a majority of the board of directors consisting of minority individuals, serving predominantly minority communities. The distinction between these two types of banks lies in their demographic composition, with minority banks typically serving specific ethnic or racial groups, while non-minority banks have a broader clientele base, contributing to potential variations in their risk- taking behaviors. This study therefore aims to provide an intersection between the literature of minority banking, distance lending and competition among different types of banking institutions.

Competition can extend beyond borrower-lending conditions by evaluating bank behavior within competitive environments, gauged through their risk profiles. The correlation between competition and risk profiles is akin to the analysis of firms, allowing for a comprehensive assessment across various bank types. Berger, Miller, et al., 2005 explore lending practice dynamics between large and small banks, shedding light on how bank competition intertwines with the utilization of both soft and hard information regarding borrowing firms. Degryse and Ongena, 2005 contribute to the literature on distance lending and competition, delving into spatial pricing and investigating whether transportation costs, arising from distances between borrowers and lending institutions, result in price discrimination. Additionally, the differentiation between banks isn't solely limited to small versus large banks but also encompasses banks with varying compositions and objectives, such as minority and non-minority banks. This study aims to unravel the dynamics of competition between such diverse bank categories.

We concentrate on banks owned by the African-American community within the sphere of racial minority banking. Historically, these banks were established to uplift the African-American community in the United States and diminish the racial wealth gap, ultimately aiming for the community's economic inclusion. However, contrasting views exist regarding the progress of African-American owned banks and their role in the community's advancement. For example, Baradaran, 2017 highlights that these banks had little to no effect on the eco-

nomic upliftment of this community. Much literature indicates that these banks often struggle to attract deposits, leading to many failures within a few years after their establishment.

It is intriguing to observe the progression or survival of these minority banks within a market dominated by other bank types, notably non-minority banks. This study assesses the physical proximity of a minority bank to its closest competitor, specifically a non-minority bank, and investigates the impact of this proximity on the risk-taking behavior of the minority bank. The underlying hypothesis suggests that if the physical distance to the nearest competitor increases, it may lead to a decrease in the risk profile of the minority bank in subsequent years, attributed to reduced competition.

1.1 Background of African-American Banks

The Federal Deposit Insurance Corporation (FDIC) defines minority depository institutions as banks in which at least 51 percent of the voting stock is owned by minority individuals, or the majority of the board of directors are minority individuals and the community that the institution serves is predominantly minority. Historically, minority depository institutions were formed to provide credit to groups of people who were typically denied credit (Gerena, 2007; Toussaint-Comeau and Newberger, 2017). After the Civil War, many African American banks were created to provide financial services to African Americans; for example, between 1888 and 1934, 134 black-owned banks were formed mostly in the southern states (Okonkwo, 2003). Most of them closed as a result of the Great Depression, and only nine black-owned banks were in business in the 1930s. Black-owned banks experienced a resurgence during the 1970s, with the civil rights movement encouraging blacks to empower themselves economically, along with some government interventions such as the Minority Bank Deposit Program (Gerena, 2007).

Numerous government policies and initiatives have been formulated to bolster minority-owned banks and their services within historically underserved communities. However, the actual impact of these interventions in fortifying these institutions remains ambiguous. The effectiveness of federal support toward these entities has yielded mixed views. Despite federal backing, several of these institutions have faced challenges in their progress, leading to closures or nearing the brink of bankruptcy.

1.2 African American Banks Over the Years

The distribution of these minority-owned banks is notably uneven across various regions, where certain states lack any branches of black-owned banks. This disparity accentuates the unequal access to financial services and underscores the concentrated presence of such institutions in specific geographic areas. Consequently, this unequal distribution poses challenges to ensuring widespread access to banking facilities within minority and underserved communities. Figure 1 illustrates a consistent decline in the percentage of American counties hosting a branch of a black-owned bank from 2001 to recent times. Across this period, the proportion ranges merely between 1.8% and 2.7% of counties housing these minority institutions. This trend highlights

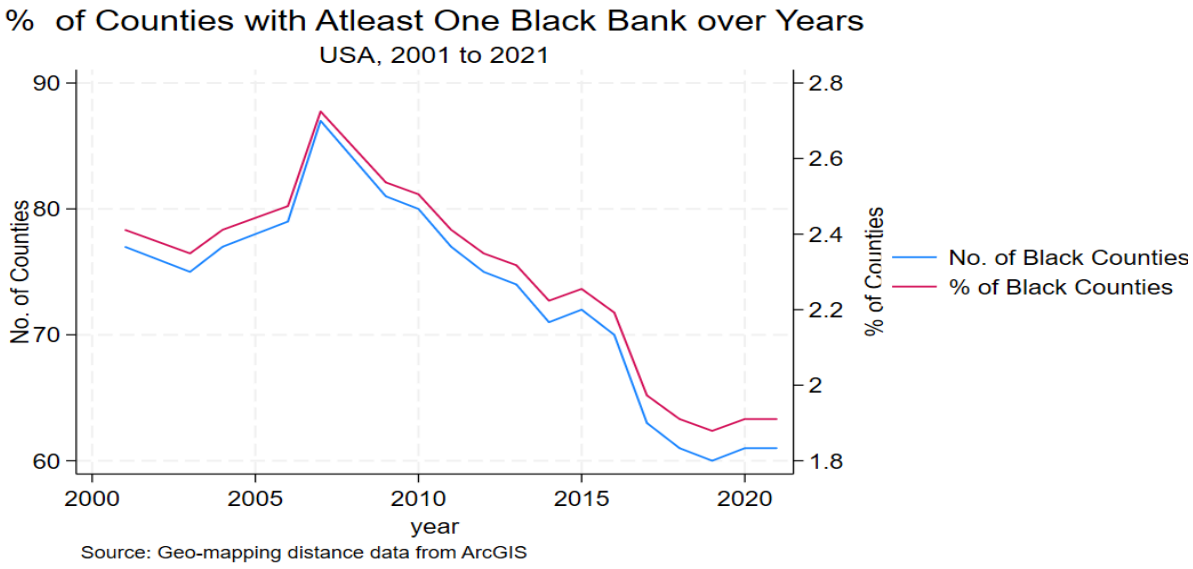

Figure 1: Percentage of American counties with atleast one black bank

the distinctive nature of these Minority Depository Institutions (MDIs) and underscores the unequal access to financial services within the communities they aim to serve.

The advantage of this study is that the element of competition is studied through spatial proximity or physical distance. Physical distance as a measure tends to be continuous and has lower correlation with unobservable characteristics, potentially reducing the risk of endogeneity between explanatory variables. Unlike social variables such as race or gender, which can be correlated with various other factors and may introduce bias due to unobserved variables or endogeneity issues, physical distance as a measure tends to be more straightforward and less influenced by subjective or unobservable factors.

Petersen and Rajan, 1995 documents dramatic increases in distances and substantially changing modes of communications between firms and lenders in the United States. Degryse and Ongena, 2005 complements their work by entering the distance between the firm and competing banks in the vicinity into the analysis of loan rate. This study is highly motivated by these notable works in the area of distance lending and banking. It tries to contribute to the literature of distance lending by using distance between the minority banks and the non-minority banks, into the analysis of competition. It also provides a wide picture of the evolution of these minority banks, in particular, the African-American banks and the reasons for their declining number.

The rest of the study is organized as follows: Section 2 shows the theoretical predictions and different scenarios the black banks experience. Section 3 describes the data and how various variables are created for the analysis. Section 4 discusses the empirical results of all the specifications and gives a robustness check to the study. Section 5 provides concluding statements.

2 Theoretical Predictions

A. What if the competitor comes closer? Various research studies highlight the relationship between competition and risk-taking in banks by using market power as a way to view competition (Berger, Klapper, and Turk-Ariss, 2009). According to the traditional 'Competition-fragility' view, increased competition among banks lowers market power and profit margins, thereby increasing risk-taking in banks.

Degryse and Ongena, 2005 conducted a study on the effects of geographical distance on lending conditions, wherein they also analyzed the proximity to competitor banks. They perceive competition as the spatial separation between two lending institutions. It states that Loan rates decrease with the distance between the firm and the lending bank and increase with the distance between the firm and competing banks. With these prior studies, one can establish a relation between competition and risk taking between banks.

In this study, our expectation is that a decrease in the distance to the nearest competitor —indicating closer proximity—in the year before the current year, will likely result in an escalation of the credit risk associated with a specific black bank. This decreased distance potentially limits the options available to the black bank when choosing borrowers, leading to a reduction in screening protocols and subsequently deteriorating the overall quality of credit. Consequently, a negative relationship is anticipated between a black bank's credit risk and its proximity to competitors, suggesting a negative coefficient indicating increased competition for a specific black bank.

B. What if the supply of black banks changes? The concept of competition and risk taking cannot be only limited to competition between minority and non-minority banks or in this case, black and non-black banks. The reason is that, black banks also face competition from other black banks. So, it is important to understand the relation between a particular black bank's credit risk and the competition it faces from other black banks.

One way to study this relationship is through supply of black banks. If the supply of black banks changes compared to the previous year, it should impact the risk taking ability of the existing black banks in the current year. In other words, if the number of black banks in the market increase in a preceding year, this should increase the competition for a particular black bank which is already there which leads to this bank taking more risk in the current year. Broecker, 1990 states that increased competition, measured as increased number of banks, has a negative effect on the average credit-worthiness of the banking system. Thus, there is a positive relationship between increased supply of black banks and the NPL-ratio of the existing black banks and one should expect a positive coefficient as there will be more competition and the credit-worthiness would decline.

Similarly, in the event of a decrease in supply of black banks in the market in a preceding year, it would likely reduce competition among the existing black banks. Consequently, this would grant greater market power to the existing black banks, enabling them to enhance their screening procedures and select more creditworthy borrowers, thereby leading to an im-

provement in creditworthiness and a decline in the NPL ratio in the current year. However, an opposing viewpoint suggests that, cateris paribus, as competition declines, banks earn more rent on their loan market by charging higher loan rates which implies higher bankruptcy risk for borrowers. Hence, increased risk-taking can also be due to market power concentration (Boyd and De Nicolo, 2005). Focusing solely on the decrease in the number of black banks for insights on competition might be misleading, given that the overall number of black banks is significantly lower compared to non-black banks for each year. The primary source of competition continues to come from the non-black banks, even if a negative coefficient for decreased supply of black banks is observed.

C. Is the effect of a change in supply of black banks on the Non-Performing Loan ratio larger when the main competitor comes closer? Consideration C investigates whether the impact of a change in the supply of black banks on the Non-Performing Loan (NPL) ratio is amplified when the primary competitor draws closer. This scenario delves into the intricate interplay between alterations in the black banks' supply and their spatial proximity to the main competitor, a non-black bank. Both variables exert individual and interactive influences on the risk profiles of existing black banks, as reflected in their NPL ratio.

Initially, examining the isolated effects of each event provides insights. An upsurge in the number of black banks in the preceding year heightens competitive pressures on existing black banks, compelling them to assume more risk to maintain market dominance. Consequently, this elevation leads to an increase in the NPL ratio in the current year. Conversely, a decrease in distance to the non-black bank escalates competition, intensifying risk-taking behavior among black banks, thus leading to an anticipated rise in the NPL ratio, indicating a less stable risk profile.

When considering both variables in conjunction, an intensified competition is expected to accelerate risk-taking behavior among existing black banks, especially if the supply of black banks increased in the preceding year and the primary competitor drew closer. This compounded effect is presumed to notably impact the NPL ratio of existing black banks.

However, when examining these variables in interaction, a nuanced dynamic emerges. As the main non-black bank, a primary competitor, comes closer, it amplifies direct competitive pressure on existing black banks, fostering increased risk behavior. Simultaneously, the rise in the number of black banks introduces a dual effect, heightening competition among black banks while also potentially mitigating risk by offering an alternative to the non-black bank. This interaction is anticipated to significantly influence the NPL ratio.

D. Is the effect of a decrease in supply of black banks on the Non-Performing Loan ratio larger or smaller when the main competitor comes closer? Consideration D aims to determine whether the impact of a decrease in the supply of black banks on the Non-Performing Loan (NPL) ratio is more significant or smaller when the primary competitor draws closer. This scenario assesses the interplay between changes in black bank supply, particularly a decrease, and their spatial proximity to the main competitor, a non-black bank, akin to consideration C.

A reduction in the supply of black banks prompts a shift in the competitive landscape. This event diminishes the number of players, potentially fostering a less aggressive competitive environment among the surviving black banks. This decrease in competition might encourage a more risk-averse approach, potentially resulting in a decline in the NPL ratio among the surviving banks in the current year.

However, isolating the impact of decreased black bank supply may not fully explain the variations in the NPL ratio of existing black banks, given the continued presence of the primary non-black bank competitor. When we consider both events—the decrease in black bank supply and the main competitor moving closer—the effect on the NPL ratio alters. As the proximity to the non-black bank decreases, intensifying competition for existing black banks, the impact of reduced black bank supply may have minimal effect on their credit risk. This is primarily due to the substantial dominance of non-black banks compared to black banks in the United States, as discussed in case B.

Hence, the effect of changes in black bank supply on the NPL ratio of existing black banks may be more substantial when the main competitor draws closer. However, this impact may be prominent only if the change in black bank supply is positive. Conversely, in other cases, the effect is expected to be lesser or negligible, akin to the outcomes detailed in case A when the primary competitor draws closer.

3 Data

3.1 Banks

The dataset consists of a total of 3368 observations, encompassing minority banks, specifically black banks, from the years 2001 to 2021 in the United States of America. These black banks are identified by their FDIC Certification ID, a unique number assigned by the Federal Deposit Insurance Corporation (FDIC) to every Minority Depository Institute (MDI). The data on minority banks, including the geographical locations of their branches, is sourced from the MDI program released by FDIC for the years 2001 to 2021. Table 1 provides information on the number of black banks and their respective branches in the dataset, along with statistics pertaining to counties.

Table 1: Black Bank and Black County Statistics

	Mean	Median	Minimum	Maximum	Standard Deviation
# Total Black Banks	164.57	166.00	134.00	198.00	19.17
# Total Black Bank Branches	1321.62	1387.00	796.00	1625.00	250.92
Total Number of Counties	3193.00	3193.00	3193.00	3193.00	0.00
# Counties with atleast 1 black bank	34.86	38.00	20.00	50.00	9.05
# Counties with 0 black bank	3158.14	3155.00	3143.00	3173.00	9.05

The table provides mean, the median(50th percentile),standard deviation, the minimum, and the maximumof number of black banks and counties with atleast one black bank used in the empirical analysis.

From Table 1, we can infer that the mean number of total black banks is 165, with a minimum of 134 and a maximum of 198 located across the entire USA within the considered time-frame. However, when examining the total number of banks, it becomes evident that only 12% of them are black-owned. Rows 4 and 5 of Table 1 provide information on the number of counties with at least one black bank. At most, there are 50 counties with at least one black bank out of a total of 3193 counties, which is roughly 1.5%. This indicates that black banks are distributed very unevenly among the states.

3.2 Distance to Nearest competitor

Distance to nearest competitor is a variable measuring competition coming from the non-black banks for the existing black banks and it is the main dependent variable of the study. The distance to the nearest non-black bank competitor is determined through the use of ArcGIS, a specialized geo-mapping software. This tool allows for precise mapping of bank branch locations, enabling accurate measurement of distances in kilometers. This distance metric is then aggregated at the bank level using the FDIC Certification ID. This aggregation is essential, as obtaining financial data at the branch level is notably challenging, ensuring a more streamlined dataset for empirical analysis.

Buch and DeLong, 2004 as well as Degryse and Ongena, 2005 have also considered the distance between banks as a determinant variable. However, they assess distance differently; Buch and DeLong, 2004 calculate it in terms of information cost, while Degryse and Ongena, 2005 measure it as the time taken to travel to a specific other bank. The natural logarithm is taken for this variable to align the scale of other variables and get better interpretative results. The log mean distance to nearest competitor bank is -0.72 which is equal to 0.486 kms. So, the average nearest competitor for a black bank is located at a distance of 0.486 kms, and aggregated at bank level.

3.3 Supply of Black Banks

The supply of black banks, in terms of number of black bank branches per county for each year, serves as variable measuring competition coming from other black banks for the existing black banks. For determining an increase or decrease in the supply of black banks, we create two proxies, namely entry and exit. The entry proxy takes the value of 1 if the number of black banks increase from the previous year and takes the value of 0 otherwise. Similarly, the exit proxy takes the value of 1 if the number of black banks decrease as compared to the previous year, and takes the value of 0 otherwise. As a result, an increase in the supply of black banks is indicated by the entry proxy, while a decrease in the supply of black banks is indicated by the exit proxy in the dataset. This branch level variable is then aggregating to the bank level. It plays a pivotal role in comprehending the competitive dynamics arising from other black banks.

A mean entry proxy value of 0.35 indicates that, on average, in approximately 35% of the observed cases, the supply of black bank increases in the market from the previous year. Similarly, a mean exit proxy value of 0.27 indicates that, on average 27% of the observed cases, the supply of black banks decreases in the market from the previous year. This indicates the activity in the black bank market for each year.

3.4 Other Variables

Other variables encompass control factors such as total assets, total deposits, total liabilities, scaled net interest income, return on capital, and privately issued collateralized mortgage obligations. With the exception of return on capital and privately issued collaterized mortgage obligation, all these variables are taken in log terms for analysis. This transformation helps ensure a more robust assessment of their impact.

In particular, controlling for liquidity is a crucial consideration in this analysis. This is achieved by incorporating total deposits and distinguishing interest income by net interest income. In addition, we account for mortgage lending by incorporating privately issued collateralized mortgage obligations into the study. This variable is binary in nature, indicating whether a bank engaged in mortgage lending. Specifically, a value of 1 is assigned if a bank had mortgage lending greater than 0, while a value of 0 is assigned otherwise. These measures provide valuable insights into the financial stability and liquidity position of the banks under examina-

tion. Table 2 offers a comprehensive overview of the summary statistics for all the variables employed in the empirical analysis. For detailed definitions and sources of these variables, please refer to Appendix Table A.

Table 2: **Descriptive statistics for the empirical analysis of bank competition, risk measures and other controls**

Variable	Observations	Mean	Median	Minimum	Maximum	Standard Deviation
Non Performing Loans (NPL) Ratio	3279.00	0.00	0.00	0.00	0.20	0.01
Log Nearest distance to competitor	3368.00	-0.72	-0.87	-8.06	8.21	1.64
Log Total Assets	3368.00	12.38	12.17	8.75	17.98	1.51
Log Total Deposits	3368.00	12.18	11.99	8.35	17.90	1.48
Log Total Liabilities	3368.00	12.26	12.06	8.71	17.92	1.52
Scaled Net Interest Income	3368.00	0.73	0.73	0.39	1.02	0.04
# Banks per County	3368.00	579.02	290.00	1.00	1811.00	633.51
# Black Bank branches per County	3368.00	65.79	12.00	1.00	418.00	99.40
# Non-Black Bank	3368.00	521.17	276.00	0.00	1636.00	559.08
Return On Capital	3368.00	0.03	0.06	-0.33	0.19	0.13
Collateralized Mortgage Obligation -Privately Issued (0/1)	3368.00	0.16	0.00	0.00	1.00	0.37
Entry of Black Banks	3368.00	0.35	0.00	0.00	1.00	0.48
Exit of Black Banks	3368.00	0.27	0.00	0.00	1.00	0.45
Entry of Non-Black Bank	3368.00	0.39	0.00	0.00	1.00	0.49
Exit of Non-Black Bank	3368.00	0.37	0.00	0.00	1.00	0.48
Observations	3368					

The table provides the number of observations, mean, the median(50th percentile),standard deviation, the minimum, and the maximum of all variables used in the empirical analysis. The detailed definitions of the variables and sources of each variable can be found in the Appendix A.

4 Empirical Results

4.1 Main Specification

This study investigates the factors influencing the credit risk of a minority bank through a regression analysis. In the primary specification, the Non-Performing Loan (NPL) ratio of the minority bank is regressed against a competition proxy, calculated as the distance to the nearest non-black bank competitor, along with various other control variables added simultaneously. This setup aims to discern the potential implications when the primary competitor approaches closer or goes farther. All the regressions employ ordinary least squares estimation. Both the competition proxy and control variables are drawn from the year preceding the current time period. This enables an evaluation of the impact of competition on bank risk in the present year. Consequently, the remaining variables are measured in period *t-1*, while the NPL ratio pertains to time period *t*.

Main Specification Equation:

$$y_{b,t} = \alpha_b + \delta_t + \beta Log(x_1)_{b,t-1} + Controls_{b,t-1} + \varepsilon_{b,t} \tag{1}$$

Where, $y_{b,t}$ represents the Non-Performing Loan (NPL) ratio of a minority bank in a specific year, while $Log(x_1)_{b,t-1}$ signifies the natural logarithm of the distance to the nearest non-black bank competitor from the preceding period *t-1*. The model also incorporates controls, including total assets, total deposits, total liabilities, and scaled net interest income, all in logarithmic form. Additionally, return on capital and privately collateralized mortgage obligation are included. The term α_b represents the bank-specific fixed effects, capturing inherent characteristics affecting the NPL ratio of different black banks and make them comparable. δ_t accounts for time fixed effects, reflecting broader economic conditions or trends as we capture a time-frame of 20 years which includes the Global Financial Crisis and the pandemic. Lastly, the data is clustered at bank-year level. In this study, clustering at the bank-year level is essential for capturing and understanding variations that may be specific to each bank in each year, providing a more nuanced and detailed examination of the relationships and dynamics under investigation. This approach enables the model to account for potential heterogeneity across different banks and over time, ensuring a more accurate and reliable analysis of the data.

The coefficient β of -0.0009, significant at the 5% level in Table 3, shows a notable relationship between the NPL-ratio and the competition proxy. Specifically, a unit increase (in logarithmic form) in the distance to the main competitor corresponds to a decrease of 0.0007 percentage points in the credit risk of the black bank on an aggregate level. The economic significance of -30.16% suggests that for every one standard deviation increase in the distance to the competitor, the Non-Performing Loan (NPL) ratio is expected to decrease by approximately 30.16% on average. It's important to note that economic significance provides a measure of the practical importance. So, a -30.16% economic significance suggests a substantial effect. It aligns with the theoretical prediction that the risk-taking behavior of the minority bank is influenced significantly when the competitor come closer or vice versa.

Table 3: **Regressing Non-Performing Loans ratio with Distance to the Nearest Competitor and Controls**

	(1)	(2)	(3)	(4)	(5)	(6)
L.Log Nearest distance to competitor	-0.0007**	-0.0008**	-0.0008**	-0.0007**	-0.0009**	-0.0009**
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
L.Log Total Assets	0.0011	-0.0066**	-0.0140*	-0.0130*	-0.0007	-0.0010
	[0.0007]	[0.0031]	[0.0080]	[0.0079]	[0.0069]	[0.0070]
L.Log Total Deposits		0.0078***	0.0066**	0.0072**	0.0027	0.0025
		[0.0030]	[0.0032]	[0.0030]	[0.0031]	[0.0030]
L.Log Total Liabilities			0.0084	0.0074	0.0012	0.0017
			[0.0081]	[0.0079]	[0.0069]	[0.0069]
L.Scaled Net Interest Income				-0.0270	0.0189	0.0190
				[0.0202]	[0.0173]	[0.0173]
L.Return On Capital					-0.0341***	-0.0341***
					[0.0050]	[0.0050]
L.Collateralized Mortgage Obligation- Privately Issued (0/1)						-0.0011
						[0.0009]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Economic Significance	-25.45%	-26.62%	-26.62%	-25.51%	-30.51%	-30.16%
Observations	2961	2961	2961	2961	2961	2961
Adjusted R2	0.2990	0.3008	0.3009	0.3013	0.3428	0.3429

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. Control variables include natural logarithm of Total Assets, Total Deposits, and Total Liabilities. Additional controls include Scaled Net Interest Income, Return on Capital, and Collateralized Mortgage Obligation Privately Issued., all aggregated at bank level. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Changes in Supply of Black Banks

In this specification, we explore the black banks competition market. Here, the Non-Performing Loan (NPL) ratio of a minority bank is regressed against a entry proxy, which is a binary indicator variable created from the number of bank branches per county and aggregated to bank level for each year. So, if the supply of black bank branches increased in a year as compared to the preceeding year, the indicator variable takes the value of 1, otherwise takes the value of 0. A few control variables are added to develop this regression. Both the entry proxy and the control variables are drawn from the year preceding the current time period *t-1*, while the NPL-ratio pertains to time period *t*.

Specification Equation:

$$y_{b,t} = \alpha_b + \delta_t + \beta(x_2)_{b,t-1} + Controls_{b,t-1} + \varepsilon_{b,t} \tag{2}$$

Where, $y_{b,t}$ represents the Non-Performing Loan (NPL) ratio of a minority bank in a specific year, while $(x_2)_{b,t-1}$ signifies the entry of a new black bank in the preceding period *t-1*. The model also incorporates controls, including total assets, total liabilities, and scaled net interest income, all in logarithmic form. The term α_b represents the bank-specific fixed effects, and δ_t accounts for time fixed effects. The data is clustered at bank-year level as before. In the same regression table, we change the independent variable from entry proxy to exit proxy. Contrary to entry, exit proxy takes the value of 1 if the supply of black bank branches decreased in a year as compared to the preceeding year, otherwise takes the value of 0. We have kept the control variables same as in the entry proxy and NPL-ratio estimation.

Table 4 presents the results for this estimation. Columns 1–3 has entry proxy as the independent variable, while columns 4–6 considers exit proxy as explanatory variable. Notably, there is a positive and statistically significant coefficient of 0.0012 for the entry proxy. This indicates a robust relationship between an increased supply of black banks and the credit risk of existing black banks. It suggests that for each one-unit increase in the supply of black banks, the NPL-ratio is anticipated to increase by 0.0012 units. This observation aligns with the anticipated outcome that a heightened supply of black banks intensifies the competition for existing black banks, thereby encouraging increased risk-taking behavior.

Conversely, we found a non-significant negative coefficient of -0.0004 for the exit proxy, indicating a minor decrease in the credit risk of existing black banks when the supply of black banks decreases by one unit in the preceding year. Although this aligns with expectations, the relationship lacks both statistical and practical significance.

Overall, while changes in the supply of black banks do influence the risk-taking behavior of existing black banks, the impact is notably clearer for an increased supply than for a decrease. The exit proxy alone cannot sufficiently explain variations in the credit risk of black banks, given the dominance of non-black banks as primary competitors. Therefore, while an increased supply heightens overall competition, a reduced supply doesn't yield a significant impact.

Table 4: **Analysis of Non-Performing Loans ratio and Changes in Supply of Black Banks**

	(1)	(2)	(3)	(4)	(5)
L.Entry of Black Banks	0.0012**	0.0012**	0.0012**		
	[0.0005]	[0.0005]	[0.0005]		
L.Log Total Assets	0.0007	-0.0127	-0.0117	0.0008	-0.0126
	[0.0007]	[0.0079]	[0.0077]	[0.0007]	[0.0079]
L.Log Total Liabilities		0.0130*	0.0126*		0.0130*
		[0.0077]	[0.0075]		[0.0077]
L.Scaled Net Interest Income			-0.0241		
			[0.0205]		
L.Exit of Black Banks				-0.0004	-0.0003
				[0.0006]	[0.0006]
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank-Year Cluster	Yes	Yes	Yes	Yes	Yes
Economic Significance	12.01%	11.80%	11.70%	-3.93%	-3.18%
Observations	2961	2961	2961	2961	2961
Adjusted R2	0.2984	0.2992	0.2995	0.2973	0.2981

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. Control variables include natural logarithm of Total Assets and Total Liabilities. Additional controls include Scaled Net Interest Income, all aggregated at bank level. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3 Combined Competition Effect

In Tables 3 and 4, we delved into competition dynamics from non-black banks in terms of physical proximity and from black banks regarding changes in their supply. Yet, focusing solely on the competition from black banks might yield limited insights, as observed with the exit proxy. Therefore, it's crucial to investigate whether alterations in black bank supply have a magnified or diminished impact when the primary competitor comes closer.

To examine this, we introduced interaction terms between the entry or exit proxies and the competition proxy, representing the proximity of the main competitor. The regression analysis assessed the NPL ratio of minority banks against these interaction terms and control variables, all sourced from the preceding year *t-1*, while the NPL ratio refers to the current time period *t*. The fixed effects and clustering remained consistent throughout the analysis.

When considering the interaction between the entry proxy and the competition proxy, the isolated effects of each variable remained consistent without significant changes. However, the resulting interaction effect displayed a non-significant negative coefficient of -0.0004. This suggests a limited impact, potentially due to existing black banks already contending with intense competition from non-black banks. Hence, the increased competition from additional black banks may not significantly alter their risk-taking behavior. In other words, the combined effect shows that the positive coefficient of standalone entry proxy is mitigated and almost halved when the main competitor goes further away.

Upon investigating the interaction between the exit proxy and the competition proxy, the individual effects of each variable stayed consistent with prior expectations. While the competition proxy maintained its significant influence, the effect of a decreased supply of black banks appeared negligible and statistically insignificant when examined in isolation, indicating an inability to explain variance on its own.

The emergence of a positive and statistically significant interaction effect at a 10% alpha level was an unexpected outcome, implying a synergistic impact when decreased proximity to non-black banks coincides with a simultaneous reduction in the supply of black banks. This unforeseen interplay highlights the intricate nature of factors influencing the risk profile of minority banks. One possible explanation for the positive coefficient could be the overall decrease in competition, which might bolster market power among existing black banks. As a result, these banks could potentially increase their lending rates, enhancing their rent on the loan market. This higher cost of borrowing could imply an escalated bankruptcy risk for bank borrowers, as suggested in the study by Boyd and De Nicolo, 2005. Furthermore, with reduced competition, these banks might relax their screening protocols, potentially leading to a deterioration in credit-worthiness assessment. Therefore, the combination of relaxed screening measures and increased market power could contribute to heightened risk-taking behaviors among these banks.

Moreover, detailed regression tables analyzing these interactions are included in the Appendix, providing comprehensive insights into model specifications and coefficients.

4.4 Robustness Checks

In this section of Robustness Checks, further investigation into the interpretation of the interaction results between the exit proxy and competition proxy is performed using a triple interaction. Here, a new proxy is introduced to represent the change in supply of non-black banks. This proxy indicates a decrease in the supply of non-black bank branches compared to the preceding year, denoted by a value of 1; otherwise, it takes a value of 0, signifying a decrease in the supply of non-black banks specifically.

Model 1 in Table 5 demonstrates the interaction between the exit proxy and the new exit proxy for non-black banks. A significant positive coefficient of 0.0012 at a 10% alpha level is observed. This finding suggests that a decrease in the supply of non-black banks in the previous year results in heightened risk-taking behavior among existing black banks in the current year. In essence, a reduction in the number of primary competitors leads to increased market power and potentially relaxed risk-mitigating measures, consequently elevating risk-taking among the existing black banks.

Moving to Model 2, the competition proxy is added to the interaction to ascertain whether the earlier interpretation regarding heightened risk-taking due to reduced competition or increased market power remains consistent. Even with the inclusion of this additional factor, a positive and statistically significant coefficient of 0.0015 at a 10% alpha level is observed. This outcome reaffirms the earlier assertion that decreased competition could potentially foster more relaxed risk mitigation and greater market power, ultimately resulting in increased risk-taking among the existing black banks.

In our second robustness check, we aim to extend the lag structure in the model presented in Table 3. This expansion allows us to increase the duration over which the impact of proximity to the nearest competitor persists and whether any significant changes or sign alterations occur in the coefficient. We maintain the same set of control variables as employed in Table 3. Upon examination in Table 6, it becomes evident that the coefficient representing the effect of competition remains negative and statistically significant up to $t+1$ year from the preceding year. However, in $t+2$ years, while the sign of the coefficient remains consistent, the results are no longer statistically significant. Additionally, by $t+3$ years, the effects seem to fade away, suggesting a diminishing influence of proximity to the nearest competitor on the outcomes being analyzed.

Table 5: **Analysis of Non-Performing Loans ratio and decreased Competition**

	(1)	(2)
1L.Exit of Black Banks	-0.0004	-0.0003
	[0.0006]	[0.0007]
1L.Exit of Non-Black Bank	0.0012*	0.0009
	[0.0007]	[0.0007]
1L.Exit of Black Banks × 1L.Exit of Non-Black Bank	0.0002	0.0016
	[0.0012]	[0.0013]
L.Log Nearest distance to competitor		-0.0008**
		[0.0003]
1L.Exit of Black Banks × L.Log Nearest distance to competitor		0.0002
		[0.0003]
1L.Exit of Non-Black Bank × L.Log Nearest distance to competitor		-0.0003
		[0.0005]
1L.Exit of Black Banks × 1L.Exit of Non-Black Bank × L.Log		0.0015*
Nearest distance to competitor		[0.0008]
Year FE	Yes	Yes
Bank FE	Yes	Yes
Bank-Year Cluster	Yes	Yes
Economic Significance	1.04%	18.13%
Observations	2961	2961
Adjusted R2	0.2979	0.3007

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. There are no control variables included in this table. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: **Analysis of Credit Risk with Increased Lags**

	(1)	(2)	(3)	(4)
L.Log Nearest distance to competitor	-0.0009**			
	[0.0003]			
L2.Log Nearest distance to competitor		-0.0007**		
		[0.0003]		
L3.Log Nearest distance to competitor			-0.0006	
			[0.0004]	
L4.Log Nearest distance to competitor				0.0000
				[0.0005]
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Bank-Year Cluster	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	2961	2718	2485	2244
Adjusted R2	0.3428	0.3294	0.3182	0.3170

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. Control variables are not included in this table. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level.

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

5 Conclusion

In this study, we delved into the impact of alterations in the physical distance between competitor banks on minority banks. Similar to any competitive market, the behavior of these banks mirrored that of firms, where the actions or changes in the competitive landscape significantly affected individual businesses. This empirical investigation presented compelling evidence demonstrating the causal relationship between a specific minority bank and its spatial proximity to non-minority competitor banks. Notably, it revealed that the risk-taking behavior of a minority bank tended to diminish as its main competitor moved farther away. The results obtained were robust, showcasing both statistical significance and economic relevance.

Our method delved further by examining the impact of fluctuations in the number of black banks, addressing the competitive landscape within this specific domain. The results revealed a distinct pattern: an escalation in the number of black banks exhibited a notable positive effect on the risk-taking tendencies of existing black banks. Conversely, a decrease in the count of black banks seemed to alleviate the intensity of risk-taking behavior. These findings, along with the analysis of distance variables, aligned closely with the "Competition Fragility" perspective, positing that intensified competition fostered a greater propensity for risk-taking. Additionally, these insights shed light on potential contributing factors to the decline observed in African-American banks.

However, the relationship between competition and risk is intricate, and a simplistic conclusion might not fully capture the scenario. While diminished competition seemed linked to reduced risk-taking, examining instances where competition decreased should, theoretically, have corresponded with improvements in the overall landscape of these black banks. This prompted further exploration of the variables to better understand these dynamics.

The "Competition Fragility" theory found support in the analysis of competition from black and non-black banks separately. Yet, a nuanced shift emerged when evaluating their combined impact through interaction. These results indicated that decreased overall competition prompted existing black banks to ease their risk-mitigation measures. Market power concentration seemed to weaken their creditworthiness, resulting in increased bad debts and adversely affecting the health of these banks. This aspect provided fresh insights into the complex nature and potential reasons behind the observed decline in black banks. The robustness checks further bolstered this argument, aligning with the "Competition Stability" view.

To conclude, minority banks, especially, African-American banks have come a long way from their inception and have survived till today. Their unique structure and tailored services for specific demographics set them apart, yet they navigate a competitive landscape dominated by powerful market players. As the banking sector undergoes technological transformations, the competition will undoubtedly intensify, presenting these banks with evolving challenges. While technological advancements may diminish the influence of physical distance, its relevance will persist in shaping competition. To thrive in this evolving landscape, these banks must innovate their risk mitigation strategies. Their ability to adapt to these complex and changing dynamics will be pivotal in securing their continued growth and relevance in the future.

References

Baradaran, Mehrsa (2017). *The color of money: Black banks and the racial wealth gap*. Harvard University Press.

Berger, Allen N, Leora F Klapper, and Rima Turk-Ariss (2009). "Bank competition and financial stability". In: *Journal of Financial Services Research* 35, pp. 99–118.

Berger, Allen N, Nathan H Miller, Mitchell A Petersen, Raghuram G Rajan, and Jeremy C Stein (2005). "Does function follow organizational form? Evidence from the lending practices of large and small banks". In: *Journal of Financial economics* 76.2, pp. 237–269.

Boyd, John H and Gianni De Nicolo (2005). "The theory of bank risk taking and competition revisited". In: *The Journal of finance* 60.3, pp. 1329–1343.

Broecker, Thorsten (1990). "Credit-worthiness tests and interbank competition". In: *Econometrica: Journal of the Econometric Society*, pp. 429–452.

Buch, Claudia M and Gayle DeLong (2004). "Cross-border bank mergers: What lures the rare animal?" In: *Journal of Banking & Finance* 28.9, pp. 2077–2102.

Degryse, Hans and Steven Ongena (2005). "Distance, lending relationships, and competition". In: *The Journal of Finance* 60.1, pp. 231–266.

Gerena, Charles (2007). "Opening the vault". In: *Federal Reserve Bank of Richmond Region Focus*.

Jiménez, Gabriel, Jose A Lopez, and Jesús Saurina (2013). "How does competition affect bank risk-taking?" In: *Journal of Financial stability* 9.2, pp. 185–195.

Kashian, Russell, Richard McGregory, and Robert Drago (2017). "Minority owned banks and efficiency revisited". In: *Journal of Productivity Analysis* 48, pp. 97–116.

Okonkwo, Valentine (2003). "Analysis of the portfolio behavior of black-owned commercial banks". In: *Journal of Academy of Business and Economics* 1.1.

Petersen, Mitchell A and Raghuram G Rajan (1995). "The effect of credit market competition on lending relationships". In: *The Quarterly Journal of Economics* 110.2, pp. 407–443.

Sarkar, Sanjukta and Rudra Sensarma (2016). "The relationship between competition and risk-taking behaviour of Indian banks". In: *Journal of Financial Economic Policy* 8.1, pp. 95–119.

Schaeck, Klaus, Martin Cihak, and Simon Wolfe (2009). "Are competitive banking systems more stable?" In: *Journal of Money, Credit and banking* 41.4, pp. 711–734.

Toussaint-Comeau, Maude and Robin Newberger (2017). "Minority-owned banks and their primary local market areas". In: *Economic Perspectives* 4.4, pp. 1–31.

A Variable names, definitions, and data sources for the empirical analysis

Variable Name	Definition	Source
Dependent Variable		
Non-Performing Loans Ratio	The value of a bank's Non-Performing Loans divided by its total loan portfolio	FDIC
Independent Variables		
Log Nearest Distance to Competitor	Natural logarithm of physical distance between a black bank branch and its nearest competitor non-black bank branch in kms and aggregated at bank level with the FDIC Certification ID	MDI-History and calculated by ArcGIS
Entry of Black Bank	= 1 if there is an increase in number of black banks in a particular year in a county from the previous year, = 0 otherwise	Manually calculated
Exit of Black Bank	= 1 if there is a decrease in number of black banks in a particular year in a county from the previous year, = 0 otherwise	Manually calculated
Exit of Non-Black Bank	= 1 if there is an decrease in number of non-black banks in a particular year in a county from the previous year, = 0 otherwise	Manually calculated
Control Variables		
Log Total Assets	A natural logarithm of total assets. Total assets are the operating expense of a bank as a share of all assets held	FDIC
Log Total Deposits	Natural Logarithm of total deposits. Total deposits includes a bank's saving deposit, demand deposit, time certificates of deposits, and long term negotiable certifocates of deposit	FDIC

Continued on next page

Table 7 – *Continued*

Variable Name	Definition	Source
Log Total Liabilities	Natural logarithm of total liabilities. Total Liabilities refers to the sum of all financial obligations and debts that a bank owes to external parties, including depositors, other financial institutions, and other creditors	FDIC
Net Interest Income	Difference between the interest earned on assets (such as loans and investment) and interest paid on liabilities (like deposits and borrowings)	FDIC
Scaled Net Interest Income	Scaled Net Interest Income is calculated by dividing natural logarithm of Net Interest Income with natural logarithm of Total assets	Manually calculated
Return on Capital	Expressed as a percentage and calculated by dividing Net Income (after taxed and preferred dividends) by total capital	Manually calculated
Collateralized Mortgage Obligation-Privalely Issued	Collaterallized Mortgage Obligation which is not issued by government agencies like Freddie Mac and Fannie Ma, but issued by private financial institutions or entities	FDIC
Other Variables		
# of banks per county	Number of bank branches per county in a particular year	FDIC and SOD
# of black banks per county	Number of black bank branches per county in a particular year	FDIC and SOD
# of non-black banks per county	Number of non-black bank branches per county in a particular year	FDIC and SOD
FDIC Certification ID	A unique identifier assigned to each depository institution by the Federal Depository Insurance Corporation (FDIC)	FDIC

B Regression Tables with Interaction

Table 8: **Analysis of Non-Performing Loans ratio and Increased Competition from Other Black Banks**

	(1)	(2)	(3)	(4)	(5)
L.Log Nearest distance to competitor	-0.0006*	-0.0007*	-0.0007**	-0.0007*	-0.0008**
	[0.0003]	[0.0003]	[0.0003]	[0.0004]	[0.0004]
1L.Entry of Black Banks	0.0009	0.0009	0.0009	0.0008	0.0005
	[0.0006]	[0.0006]	[0.0006]	[0.0006]	[0.0006]
1L.Entry of Black Banks × L.Log Nearest distance to competitor	-0.0004	-0.0004	-0.0004	-0.0004	-0.0002
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
L.Log Total Assets		0.0010	-0.0066**	-0.0064**	0.0002
		[0.0007]	[0.0031]	[0.0031]	[0.0033]
L.Log Total Deposits			0.0077**	0.0082***	0.0029
			[0.0030]	[0.0030]	[0.0030]
L.Scaled Net Interest Income				-0.0272	0.0191
				[0.0206]	[0.0175]
L.Return On Capital					-0.0338***
					[0.0051]
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank-Year Cluster	Yes	Yes	Yes	Yes	Yes
Economic Significance	-7.51%	-7.67%	-7.68%	-7.65%	-2.44%
Observations	2961	2961	2961	2961	2961
Adjusted R2	0.2998	0.3001	0.3019	0.3023	0.3430

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. Control variables include natural logarithm of Total Assets and Total Deposits. Additional controls include Scaled Net Interest Income, all aggregated at bank level. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: **Analysis of Non-Performing Loans ratio and Decreased Competition from Other Black Banks**

	(1)	(2)	(3)	(4)	(5)
L.Log Nearest distance to competitor	-0.0008***	-0.0009***	-0.0009***	-0.0009***	-0.0010***
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
1L.Exit of Black Banks	0.0000	0.0001	0.0000	0.0000	0.0003
	[0.0006]	[0.0006]	[0.0006]	[0.0006]	[0.0006]
1L.Exit of Black Banks × L.Log Nearest distance to competitor	0.0006*	0.0006*	0.0005*	0.0005*	0.0004
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
L.Log Total Assets		0.0011	-0.0063**	-0.0060*	0.0006
		[0.0007]	[0.0031]	[0.0032]	[0.0033]
L.Log Total Deposits			0.0074**	0.0079***	0.0026
			[0.0030]	[0.0030]	[0.0030]
L.Scaled Net Interest Income				-0.0293	0.0180
				[0.0207]	[0.0175]
L.Return On Capital					-0.0340***
					[0.0051]
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank-Year Cluster	Yes	Yes	Yes	Yes	Yes
Economic Significance	11.71%	11.83%	10.70%	10.97%	9.08%
Observations	2961	2961	2961	2961	2961
Adjusted R2	0.2991	0.2995	0.3011	0.3017	0.3431

The dependent variable is the credit risk of black banks measured by the Non-Performing Loans (NPL) ratio aggregated at black bank level for the years 2001 to 2021. All independent variables are defined in Appendix Table. All models are estimated with a linear regression (OLS) model. Control variables include natural logarithm of Total Assets and Total Deposits. Additional controls include Scaled Net Interest Income, all aggregated at bank level. The set of fixed effects and controls are indicated by (Yes/No). Estimated coefficients are reported in each row with standard errors below (in parentheses), are clustered at the bank-year level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Statement of Authorship:

"**I hereby confirm that the work presented has been performed and interpreted solely by myself except for where I explicitly identified the contrary. I assure that this work has not been presented in any other form for the fulfillment of any other degree or qualification. Ideas taken from other works in letter and in spirit are identified in every single case.**"

February 2nd, 2024

Krishna Akolkar — Date, Place