Three Essays on Banking, Digital Finance, and Financial Inclusion

by

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Abstract

The first essay examines how financial literacy affects household choice as being banked only, underbanked, or unbanked. Also, the relationship between financial literacy and household use and frequency of use of different alternative financial services is examined. The examination relies on a survey conducted by the FINRA National Investor Education Foundation's National Financial Capability Study and data from other sources. The results indicate that differences in financial literacy across households do matter for the type, use, and degree of use of banking and alternative financial firm services. Notably, the results also show that differences in financial literacy across households do matter for substituting credit cards and AFS use.

The decline in bank offices since 2009 raises concerns about reduced financial inclusion for local communities. However, banking technology, primarily transactional digital banking, provides an alternative to brick-and-mortar offices. The second chapter compares the rate of office growth between banks that invest heavily in financial technology and digital banking and those that do not. Using data on Federal Deposit Insurance Corporation (FDIC)-insured institutions from 2001 to 2019, I show that the increased use of technology has a negative impact on the growth rate of bank offices, especially after 2010. However, using the SimmonsLOCAL data from 2008 to 2019, I also find that office closures caused by the introduction of financial technology do not adversely affect local community access to banking services (i.e., financial inclusion) because people shift to online banking services.

Recent literature questions the relative advantage of community banks vs. non-community banks in small business funding. The third chapter re-examines the role of community banks in providing financing to small businesses using county-level data from 2003 to 2016. The empirical results indicate that community banks are still providing more small business funding than non-

community banks, especially after the Great Recession. This role is even more critical in those counties in non-metropolitan areas. The results show that in counties where community banks do not have branches, they provide fewer loans, suggesting they still rely on physical offices to maintain their relationship-banking advantage to make small business loans.

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List of Abbreviations

ACS	American Community Survey
AFS	Alternative financial services
BLS	Bureau of Labor Statistics
C&I	commercial and industrial
CAEL	Capital, Asset quality, Earnings, and Liquidity
CAMELS	Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity
CBP	County Business Pattern
CFA	Consumer Federation of America
CRA	Community Reinvestment Act
FDIC	Federal Deposit Insurance Corporation
FFIEC	Federal Financial Institutions Examination Council
FINRA	Financial Industry Regulatory Authority
FIPS	Federal Information Processing Standard
M&A	merger and acquisition
MSA	metropolitan and micropolitan statistical areas
NAICS	North American Industry Classification System
NCUA	National Credit Union Administration
NFCS	National Financial Capability Study
NPL	Non-Performing Loan
NSSBF	National Survey of Small Business Finances
OLS	Ordinary Least Squares
PSM	Propensity Score Matching

ROA	Return on Assets
SAIPE	Small Area Income and Poverty Estimates
SBA	Small Business Administration
SBL	small business loan
SDI	Statistics on Depository Institutions
SME	small business enterprise
SOD	FDIC Summary of Deposits

Chapter 1 How Differences in Financial Literacy Affect Household Choice and Use of Different Financial Institutions and Services

1.1. Introduction

Financial institutions play an essential role in the payment and credit systems for everyone at all income levels and in all parts of a country. In fulfilling this role, these institutions contribute to economic growth and development (Levine and Zervos, 1987; Levine, 2005). There are, however, different types of financial institutions providing a variety of financial services. Over time, moreover, the different types of institutions and variety of services have not only expanded but become more complex. This requires individuals to possess the ability to process financial and economic information to make informed decisions about their choices. In short, this needs people to be financially literate (Lusardi and Mitchell, 2014). Unfortunately, however, recent data indicate that only one in three adults are financially literate worldwide. Even in an advanced country like the U.S., only about 55 percent of adults are financially literate (Klapper and Lusardi, 2020).

Financial literacy affects many aspects of the behavior of individuals when making economic and financial decisions. For example, lower financial literacy contributes to a lower likelihood of participation in financial markets and investment in stocks. Also, it is associated with more mortgage delinquencies and defaults, a greater likelihood of over-indebtedness, and a lower likelihood of diversified savings. Furthermore, financial literacy is linked to financial fragility and the capacity to handle unexpected shocks.[1]

The focus of our paper is on how differences in financial literacy affect the household choice

[1] See Klapper and Lusardi (2020) and Lusardi and Mitchell (2014) for excellent discussions of these points and associated references as well as more detailed discussions of the measurement and importance of financial literacy.

and use of different financial institutions and services. Historically, the most common and widely used financial institutions have been banks, both for payment transactions and access to credit. Yet, not all individuals rely on banks to obtain credit or make payments for their purchases. Many individuals use alternative financial services (AFS) available from payday lenders, pawnshops, rent-to-own firms, auto title loan companies, and revenue anticipation loans. These services are typically more costly and less supportive of broader economic activity than the services offered by banks. AFS, moreover, are more heavily used by lower-income households (Toh and Tran, 2020) and quite frequently cluster in neighborhoods with a higher share of minorities (Apaam et al., 2018). This raises societal and policy concerns about ways to reduce the reliance on such services.

We, therefore, examine the relationship between financial literacy and these different types of firms and the various services they offer. The specific paper closest to ours is by Lusardi and de Bassa Scheresberg (2013), who find that less financially literate are more likely to use high-cost methods of borrowing like payday loans, pawnshops, auto title loans, refund anticipation loans, and rent-to-own shops. We rely upon more recent data to build upon and substantially extend their analysis and examine a broader range of relationships between financial literacy and financial firms and services[2]. As Lusardi and Mitchell (2014, p. 23) state, "[w]hile most attention has been devoted to the supply side, … it may also be important to look at the demand side and the financial literacy of borrowers." Therefore, the purpose of our study is to examine the financial literacy of households and their demand for financial services offered by financial firms.

Based on their use of financial services, households can be classified as banked only, underbanked, or unbanked. Banked only households currently have a bank account (i.e., checking and/or saving accounts) and have not used alternative financial services in the last five years.

[2] This paper also significantly expands upon and extends an earlier paper by Barth, et al. (forthcoming).

Underbanked households currently have a bank account but have also used AFS in the last five years. Such households, therefore, use a mix of financial services provided by different types of financial institutions.[3] At the other end of the spectrum are unbanked households. These households do not currently have a bank account. Instead, most, but not all of them, use AFS. The relatively few households that do not even use AFS rely on informal financial funding sources.

We use data from the household survey conducted by the FINRA National Investor Education Foundation's National Financial Capability Study (NFCS) in 2018. Unlike other related studies, we examine the impact of financial literacy on the likelihood of households being banked only, underbanked, and unbanked. Moreover, we examine the relationship between household use and frequency of use of different AFS, a relatively unexamined area of inquiry. We create two proxies for financial literacy: (1) a dummy variable with a value of one if a household correctly answers four or more out of six financial literacy questions, and a value of zero otherwise, and (2) an index based on a factor analysis of the number of questions answered correctly. In our regressions, we are careful to control for the presence of different types of financial firms and various socio-demographic variables that may also affect household choices. These controls enable us to isolate the relation of financial literacy to household choices.

The contribution made to the existing literature is as follows. First, we provide new results showing that greater financial literacy does increase the likelihood of households being banked only as compared to underbanked and unbanked. In short, households with a higher level of financial literacy are more likely to be banked and have access to cheaper financial services. This is consistent with the view that the better financial literacy skills people possess, the better is their ability to more effectively choose financial services that most efficiently accomplish their financial

[3] It should be noted that payday lenders require that their customers have a bank account.

goals. Second, unlike earlier studies, we examine the frequency (i.e., in terms of the number of times used) of AFS use by households and find that it is lower for those more financially literate. Third, focusing on the use of AFS as an outcome variable, our new results indicate that the likelihood of using AFS by a banked household reduces when the household is using credit card(s). a banked household is likely to use AFS even less when the household has a credit card(s) and is financially literate. However, when there is a carried-over balance, financial literacy does not generally matter for a household's likelihood of using AFS. Lastly, robustness tests confirm the basic results.

The remainder of the paper proceeds as follows. In the next section, a detailed discussion of the data used in our empirical analysis is provided. Section III contains the specification of the models and the results from them. Robustness tests are then provided in Section IV, with the conclusions in Section V.

1.2. Data and Sources

Data used in our analysis comes from household responses to a survey conducted by the FINRA National Investor Education Foundation's National Financial Capability Study (NFCS) in 2018. The households are located in counties throughout the United States. Information is available not only on individuals' financial literacy but also on the household use of various financial services, including those from banks, payday lenders, pawnshops, rent-to-own firms, auto-title-loan companies, and revenue anticipation loans. The same dataset includes demographic characteristics of the surveyed individuals and their households for the counties in which they are located. Additional information on the density of bank and credit union offices as well as the establishments of alternative financial services providers at the county level are available from the Federal Deposit Insurance Corporation (FDIC, 2018), National Credit Union Administration

(NCUA, 2018), and Bureau of Labor Statistics (BLS, 2018). State-level data on restrictions on payday lenders is available from the Consumer Federation of America (CFA, 2020), while state-level data on restrictions on auto title lenders is available from the CFA website (CFA, 2016). Lastly, county-level data on population, median household income, poverty rate, unemployment rate, the age distribution of the population, and the educational level of household respondents are available from the American Community Survey (ACS, 2018) in 2018. The data on individuals and households are available by zip codes, which enables us to match all the data at the county level using the Department of Housing and Urban Development's Zip Code Crosswalk Files.

In 2018, there were 120 million households, and the national-weighted data from the ACS indicate that 73 percent are banked only, 23 percent underbanked, and 5 percent unbanked. Figures 1.1, 1.2, and 1.3 provide information on the percentages of households that are banked only, underbanked, and unbanked, respectively, in various states. All data are weighted at the state level. As shown in Figure 1.1, the percentages of households that are banked only range from a low of 58 percent in Louisiana and Mississippi to a high of 82 percent in Hawaii. Turning to the underbanked households, Figure 1.2 shows the percentages range from a low of 16 percent in New Hampshire to a high of 35 percent in Louisiana. Lastly, Figure 1.3 shows that the percentages for unbanked households range from a low of 1 percent in Hawaii to a high of 12 percent in Oklahoma. Overall, more than half the households are banked only in every state throughout the country. The remaining households use either a combination of banks and alternative financial services providers or, to a substantially lesser degree, no financial services at all.

(Insert Figures 1.1 to 1.3 here)

In the FINRA Foundation NFCS 2018 survey, the answers to six financial literacy questions are the basis for measuring financial literacy. The number of correct answers to the

questions can range from zero to six. Respondents, however, may answer that they do not know or prefer not to provide an answer to each of the questions. Respondents who answer any of the questions with a "do not know" are assigned a score of zero for that question. The respondents who answer any of the six questions with a "prefer not to say" are excluded, which results in 1 percent of the individuals surveyed not entering our sample. Based on the number of correct answers to these questions, we create two key explanatory variables created to measure respondents' financial literacy. The first variable is a dummy variable (*financial literacy dummy*) that has a value of 1 if the respondent correctly answers four or more questions and 0 otherwise.[4] The second variable is based on combining information regarding the financial literacy of respondents using all six questions. This is done based on a factor analysis to create an index of financial literacy (*financial literacy index*). Specifically, for each question answered by a respondent, a dummy variable with a value of 1 is assigned to correct answers and zero otherwise. Factor analysis is performed on the six binary variables created using a principal factors method. The result is an index measuring the financial literacy of respondents.

The actual questions to the survey are listed in Appendix 1.1. The topics covered are (1) interest rates, (2) inflation, (3) bond prices, (4) mortgages, (5) risk, and (6) compound interest. Table 1.8 shows that the distribution of correct answers to the questions ranges from a low of 27 percent for the bond price question to a high of 76 percent for the mortgage question. In total, 43 percent of the respondents answered four or more questions correctly, 24 percent five or more questions, and only 8 percent answered all six questions correctly. The table also provides information on how many respondents answered with "Don't know." As may be seen, the banked

[4] In results not reported, we also use dummy variables based on 5 and 6 correct answers in all the regressions. However, since the results remain essentially the same as those based on 4 or more correct answers, they are not reported, but available upon request.

only households have the highest percentages of four or more correct answers at 53 percent, five or more correct answers at 31 percent, and all six correct answers at 11 percent as compared to the other two categories of households, with the percentages substantially lower in both cases.

(Insert Table 1.8 here)

There is other interesting information in Table 1.8. Married people, males, households with no dependent children, and more educated and older individuals, employed people, higher-income households, and white and Asian households have the highest percentages of correct answers, including four, five, or six answers. Figures 4.1 to 4.4 provide more detailed visualizations of the relationships between ethnicity, age, education, and income, and financial literacy as measured by the percentage of four or more correct answers. The differences between the low and high percentages for the different characteristics of the households are quite striking.

(Insert Figures 4.1 to 4.4 here)

Although our focus is on measuring financial literacy in terms of correct answers, it is useful to briefly say something about respondents in households that answer they "Don't know" to the various questions. The reason is that in many cases, the percentages of those responding this way are relatively high. Our approach is to estimate the following logistic regression:

(1.1) $$Don'tknow_{i,c} = \alpha + \sum_{k=1}^{n} \gamma_k \times HHControls_{i,c} + \sum_{j=1}^{m} \delta_j \times CountyControls_c + \varepsilon_{i,c},$$

where *Don't know*$_{i,c}$ is a dummy variable with the value of 1 if the respondent *i* in county *c* answers "I don't know" for each of the six financial literacy questions. As regards the various control variables in this equation, they are fully discussed in the next section. The results are presented in Table 1.9 and indicate that individuals with a high school and above, an income level of greater than $15,000, and older people are significantly more likely to not answer every question with a "Don't know." In contrast, females and Blacks are more likely to answer every question with a

"Don't know. " Once again, we include such answers in the measures of financial literacy used with a value of zero.

(Insert Table 1.9 here)

1.3. Empirical Model and Results

In this section, we estimate several models. First, we examine the relationship between financial literacy and whether households are: (1) *Banked only*, (2) *Underbanked*, and (3) *Unbanked.* Specifically, we estimate the following logistic regression model:

(1.2) $$Y_{i,c} = \alpha + \beta_1 \times Financial\ Literacy_{i,c} + \sum_{k=1}^{n} \gamma_k \times HHControls_{i,c} + \sum_{j=1}^{m} \delta_j \times CountyControls_c + \varepsilon_{i,c},$$

where $Y_{i,c}$ represents the three outcome variables described above *(Banked only vs. Underbanked, Banked only vs. Unbanked, and Underbanked vs. Unbanked*), each with a value of 1 or zero. $Financial\ Literacy_{i,c}$ is proxied by financial literacy dummy or financial literacy index as described in Section III. Since there are three outcome variables and two measures of financial literacy, six regressions are associated with equation (1.2). The subscript *i* refers to the individual respondent in households, while subscript *c* refers to a county, *n* to the number of household-level control variables, and *m* to the number of county-level control variables. The $\varepsilon_{i,c}$ is a random error term. The $HHControls_{i,c}$ refer to the characteristics of individuals in households responding to the FINRA Foundation NFCS survey, which include gender (*Female*), number of dependent children (*Dependent children*), marital status (*Married*), education attainment (*Education*), ethnicity (*Race*), age (*Age*), employment status (*Unemployed*) and household income level (*Income*). The $CountyControls_c$ refer to county-level control variables, such as banking density (*Bank density*) and AFS density (*AFS density*), payday and auto title lending state-level restriction dummy variables (*Payday restrictions dummy* and *Auto title restrictions dummy*), and local

economic and demographic characteristics (*Metropolitan, Median household income, Poverty rate, Unemployment rate, Not finish highschool rate, Population*).

Second, to assess the impact of financial literacy on the frequency of using each type of AFS and total AFS usage, we estimate Model (1.3), which is an ordered logit regression. The different dependent variables are the frequency of usage of *Auto title loans, Payday, Revenue anticipation, Pawnshop, Rent-to-own,* and *Total AFS*. This model has the same control variables as Model (1.2), but an Unbanked dummy variable, which has the value of 1 if the household is unbanked and 0 otherwise, is included. The model estimated is as follows:

(1.3) $AFS\_frequency_{i,c} = \alpha + \beta_1 \times Financial\ Literacy_{i,c} + \sum_{k=1}^{n} \gamma_k \times HHControls_{i,c} + \sum_{j=1}^{m} \delta_j \times CountyControls_c + \varepsilon_{i,c}$.

Third, we estimate Models (1.4a) and (1.4b), which are variations of Model (1.2). In particular, using a subsample of banked households, we estimate the same model as in equation (1.2) but allowing for the use of a credit card and a carried-over balance to affect the likelihood of using AFS in Model (1.4a) and Model (1.4b), respectively. The variables are entered separately in both equations and interacted with each of the two financial literacy measures. The models are as follows:

(4a) $AFS\_dummy_{i,c} = \alpha + \beta_1 \times Financial\ Literacy_{i,c} + \beta_2 \times Credit\ card\ dummy_{i,c} + \beta_3 \times Financial\ Literacy_{i,c} \times Credit\ card\ dummy_{i,c} + \sum_{k=1}^{n} \gamma_k \times HHControls_{i,c} + \sum_{j=1}^{m} \delta_j \times CountyControls_c + \varepsilon_{i,c}$

and

(4b) $AFS\_dummy_{i,c} = \alpha + \beta_1 \times Financial\ Literacy_{i,c} + \beta_2 \times Carry\ over\ balance_{i,c} + \beta_3 \times Financial\ Literacy_{i,c} \times Carry\ over\ balance_{i,c} + \sum_{k=1}^{n} \gamma_k \times HHControls_{i,c} + \sum_{j=1}^{m} \delta_j \times CountyControls_c + \varepsilon_{i,c}$.

Table 1.1 contains information on all the variables used in the empirical estimations. This includes summary information on the variables, the coding of the variables, and the variables' sources. As may be seen, there are more than 25,000 observations for the cross-sectional analysis. As already noted, 73 percent of households are banked only, 23 percent are underbanked, and almost 5 percent are unbanked. Also, 25 percent of households use AFS, with the frequency of use being highest for pawnshops and followed by payday loans. Moreover, 46 percent of the households are financially literate, meaning they answered four or more financial literacy questions correctly. The pairwise correlations for the same variables are presented in Table 1.10. The correlations are nearly always statistically significant and have the signs that one would generally expect.

(Insert Tables 1.1 and 1.10 here)

Turning to the empirical results, Table 1.2 contains those for the relationship between the two measures of financial literacy and the likelihood of being banked only vs. underbanked, banked only vs. unbanked, and underbanked vs. unbanked. There is a significantly positive relationship between financial literacy and the likelihood of being banked only. The relationship is significantly negative for being underbanked and unbanked. This means that financial literacy does matter, and significantly so for shifting households from an unbanked and underbanked status to a banked only status. Indeed, a household that becomes financially literate increases its likelihood of using only banking but not alternative financial services by 6 to 9 percentage points. Higher levels of both education and income are also associated with an increased likelihood of being banked only. The same is the case for female and married respondents. In contrast, Black and Hispanic respondents are associated with a reduced likelihood of being banked only.

Importantly, the inclusion of these control variables does not diminish the significance of either measure of financial literacy.

(Insert Table 1.2 here)

Furthermore, in Panels A, B, and C in Table 1.11, the information shows whether there are statistically significant differences between the explanatory variables used in Table 1.2 for banked only vs. underbanked households, banked only vs. unbanked, and underbanked vs. unbanked. The results indicate that there are significant differences in the means of the various explanatory variables in almost all cases. Also, the signs are generally consistent with prior expectations regarding financial literacy and other socio-demographic variables of those households with a greater extent to being banked.

(Insert Table 1.11 here)

Focusing more deeply on the use of AFS, Table 1.3 provides the results of the relationship between the use of AFS and financial literacy based on ordered logit regressions. It is found that the two measures of financial literacy are statistically and economically significant across the board as regards the five different types of AFS. This means the results for total AFS use are not being driven by one or a subset of the different types of services. Instead, each type contributes to the total effect. Interestingly, higher levels of income are associated with a greater frequency of use of auto title loans, payday loans, and revenue anticipation. The results are generally mixed for pawnshops and rent-to-own. Also, higher levels of education produce almost no significant results, except for significantly negative results for pawnshop loans and rent-to-own when included with the financial literacy dummy variable. Notably, the frequency of use of all five types of AFS is significantly and positively associated with only Black households. Once again, the inclusion of

these various control variables does not diminish the significance of the two measures of financial literacy.

(Insert Table 1.3 here)

To pursue further the use of AFS, we consider whether the use of a credit card or a carried over balance on a card is related to the use of AFS. The results are reported in Table 1.4, with both variables entered separately and interacted with the two financial literacy variables. In six of the eight regressions, the two financial literacy variables are negative and significant. This is not the case for the financial literacy dummy variable when the credit card dummy variable is included. However, the credit card variable itself and its interaction with both financial literacy variables enter the regression negatively and significantly, which indicates that more financially literate households are more likely to use credit cards than AFS. In terms of the carried-over balance variable, the results are essentially the opposite as those for the credit card variable: positive and significant coefficients for both the variable itself and when interacted with the two financial literacy variables, which indicates that the extent of financially literacy does not matter for households with a carried-over balance. The existence of a carried-over balance may indicate debt that is sufficient to lead to the use of AFS for additional funding by all households, whether financially literate or not.

(Insert Table 1.4 here)

1.4. Robustness Tests

As a check on the results previously presented, a robustness test is performed. In particular, using a propensity score matching methodology (PSM), we create two groups of households for

each of three dependent variables[5]. One group is for those households that are financially literate, based on the dummy measure, and those that are not. Table 1.5-1.7 contains the results of the test using PSM. The upper part of the table shows a significant difference between those that are financially literate and those that are not, based on PSM. More specifically, the mean value for those who are financially literate is greater than those who are not by nine percentage points in the case of banked-only households. This difference is statistically significant. In contrast, the mean values for those who are financially literate are lower than those who are not by seven and two percentage points in cases of underbanked and unbanked households, respectively. These differences are also statistically significant.

(Insert Tables 1.5 to 1.7 here)

Turning to the logit regression results in Table 1.5, we can see that the results in Table 1.2 are essentially confirmed. Once again, the financial literacy variable has a significantly positive association with banked-only households, whereas the relationship is significantly negative for underbanked and unbanked households. The results for all the other (control) variables are also quite similar to those reported in Table 1.2.[6] The marginal effects are included in the table, which indicates the magnitude of the economic effects. Overall, the basic results remain robust after performing this test.

Lastly, we treat "Don't know" answers as missing observations when constructing the *Financial literacy dummy* and *Financial literacy index* variables as an additional check on the robustness of the result. When we re-estimate the main regression models (i.e., Tables 1.2, 1.3, and 1.4 in Tables 1.12 to 1.14), the primary results essentially remain unchanged.

[5] We use the 1:1 nearest neighbor matching method in Table 1.5-1.7. However, the use of other matching methods produces similar results.
[6] The PSM method is also applied to the other tables and the results remain robust.

(Insert Tables 1.12 to 1.14 here)

1.5. Conclusions

Financial literacy is an important concept that has real-world impacts on people's lives, as discussed more fully in Lusardi and Mitchell (2014) and Klapper and Lusardi (2020). We contribute to the existing literature in the area by examining the relationship between financial literacy and the choice and use of different financial institutions and services by households. In contrast to earlier studies, we examine the impact of financial literacy on the likelihood of households being banked only, underbanked, and unbanked. We further explore the relationship between financial literacy and household frequency of use of different alternative financial services, a relatively unexamined study area. Our results indicate that financial literacy does affect the choice of financial firms and services by households. Financially more literate households are more likely to be banked and less likely to use alternative financial services, such as pawnshops or payday lenders. Also, the results indicate that more financially literate households rely on credit cards as a substitute for AFS. Our findings, therefore, confirm that financial literacy directly affects the type of financial institutions that households use as well as the frequency of use of different financial services. More generally, our results indicate that increasing financial literacy may improve households' financial well-being in these important respects, among others well documented in earlier literature.

Figure 1.1 Percent of Banked Only Households by State, 2018

Notes: All data are weighted at the state level. Source: Authors' calculations based on FINRA Foundation NFCS data.

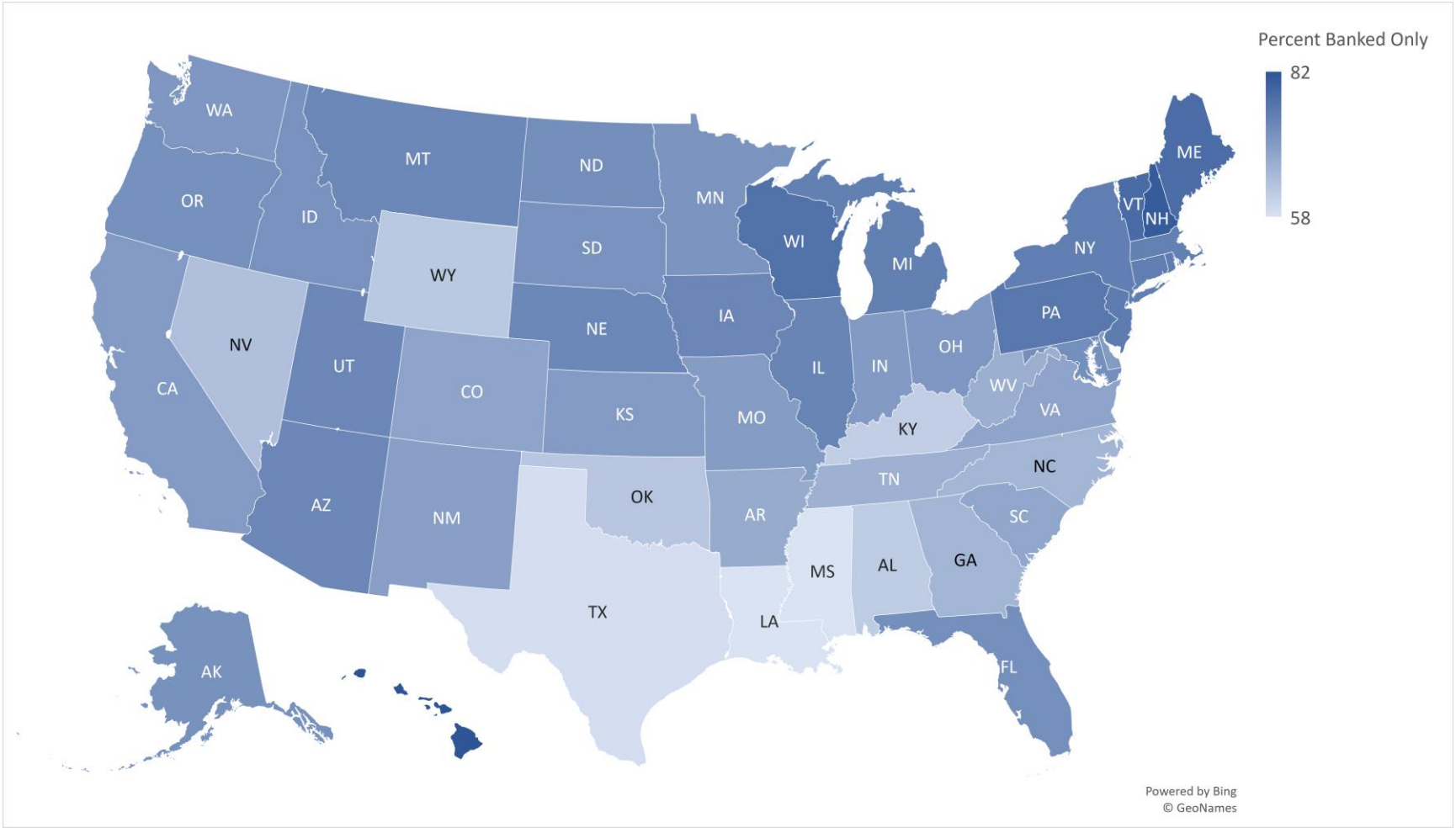


Figure 1.2 Percent of Underbanked Households by State, 2018

Notes: All data are weighted at the state level. Source: Authors' calculations based on FINRA Foundation NFCS data.

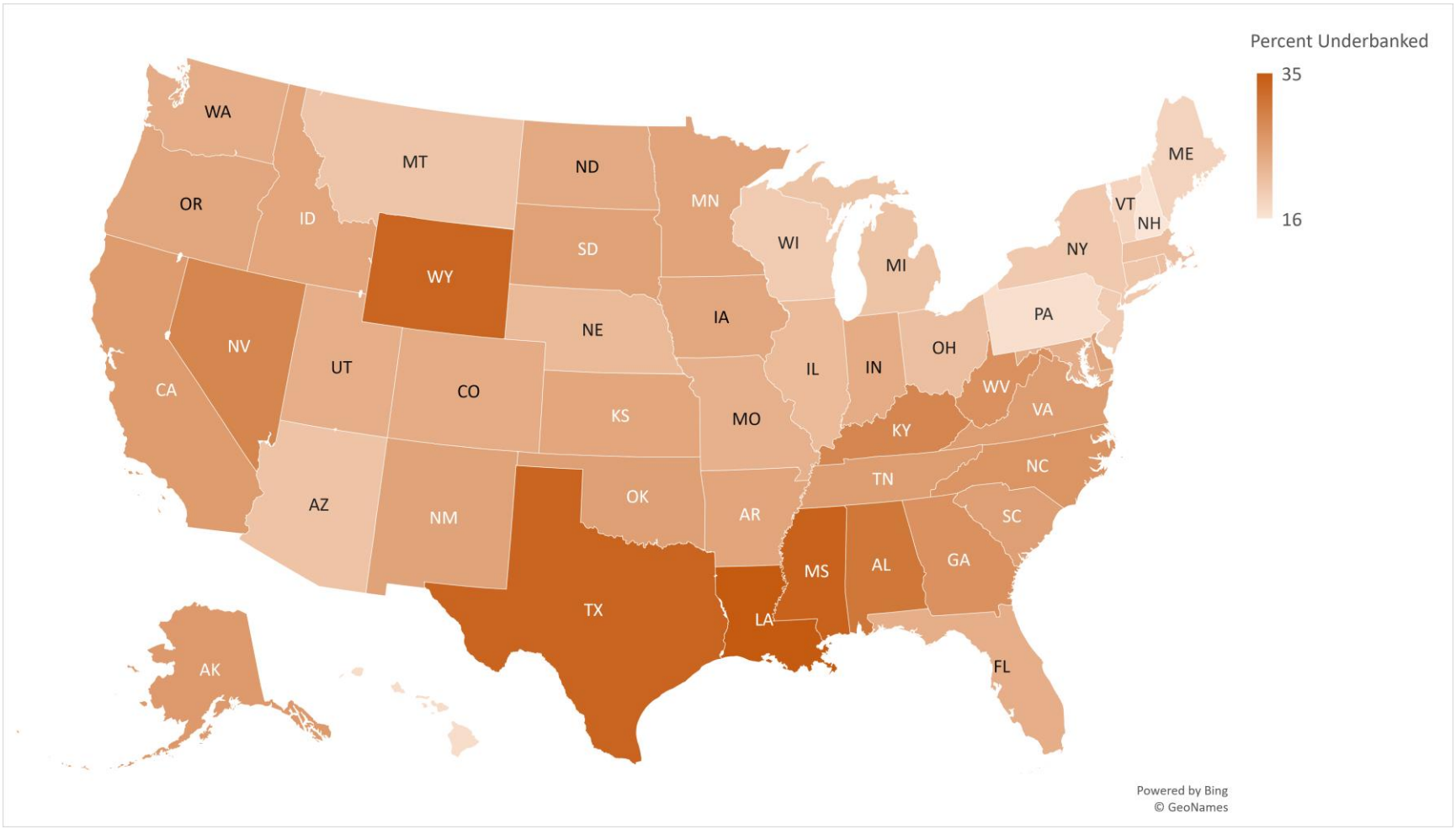


Figure 1.3 Percent of Unbanked Households by State, 2018
Notes: All data are weighted at the state level. Source: Authors' calculations based on FINRA Foundation NFCS data.

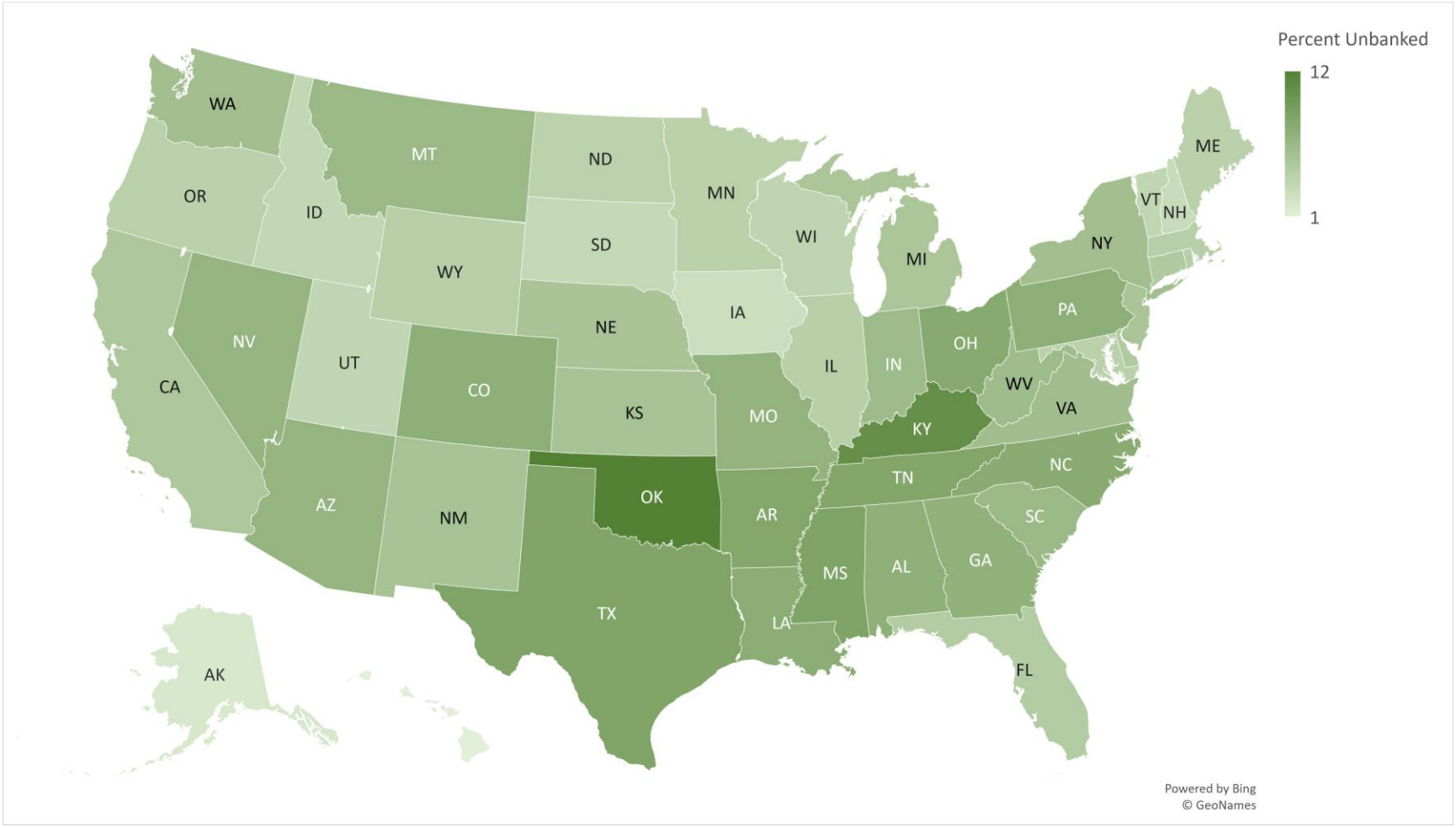


Figure 1.4 Ethnicity and Financial Literacy

Note: Source: Authors' calculations based on FINRA Foundation NFCS (2018) data.

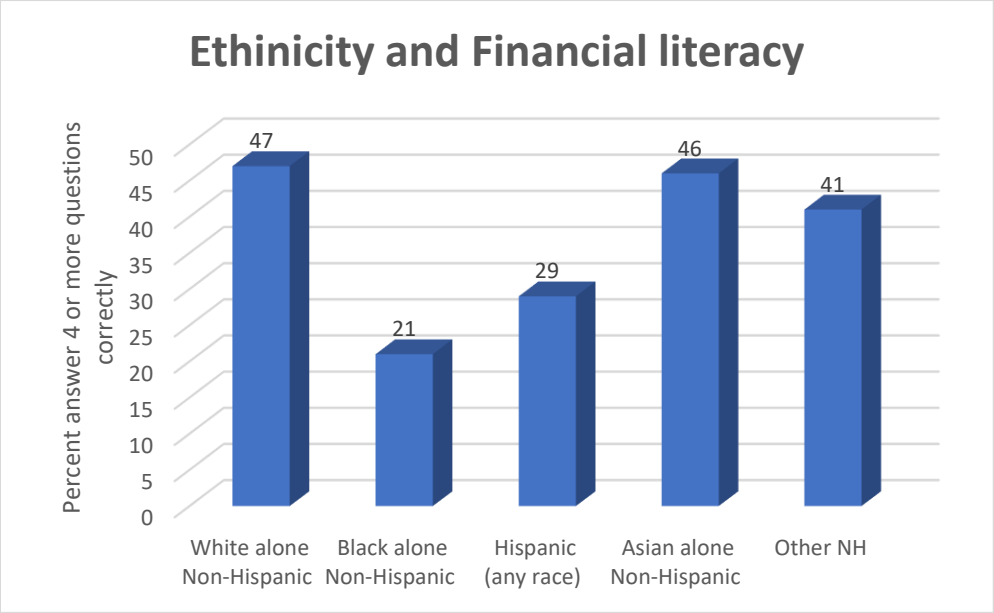


Figure 1.5 Age and Financial Literacy

Note: Source: Authors' calculations based on FINRA Foundation NFCS (2018) data.

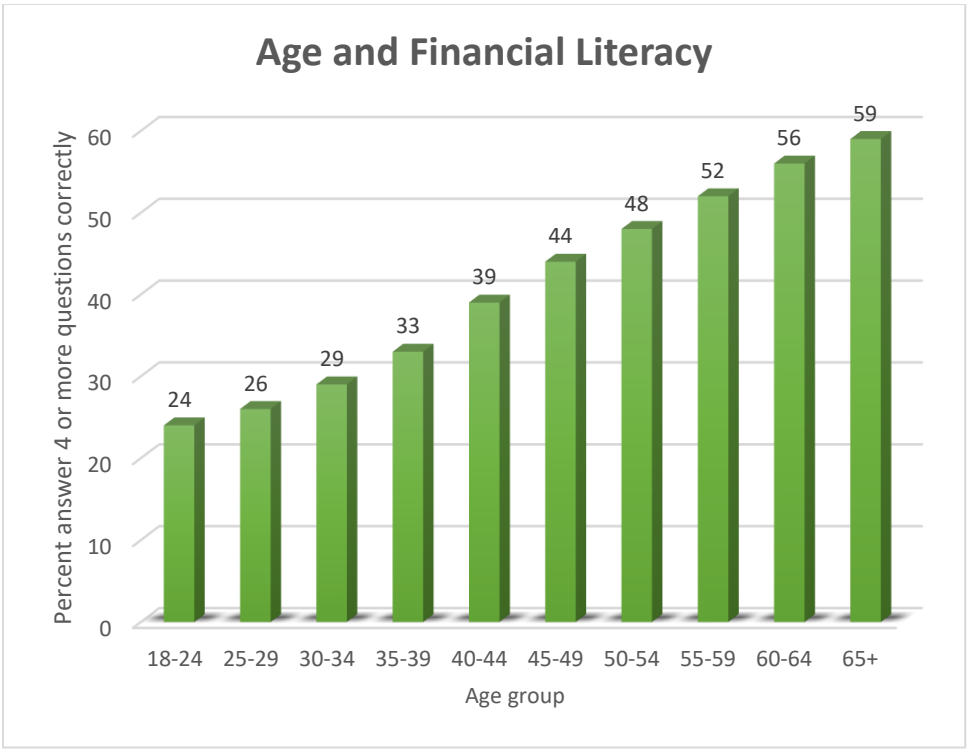


Figure 1.6 Education Level and Financial Literacy

Note: Source: Authors' calculations based on FINRA Foundation NFCS (2018) data.

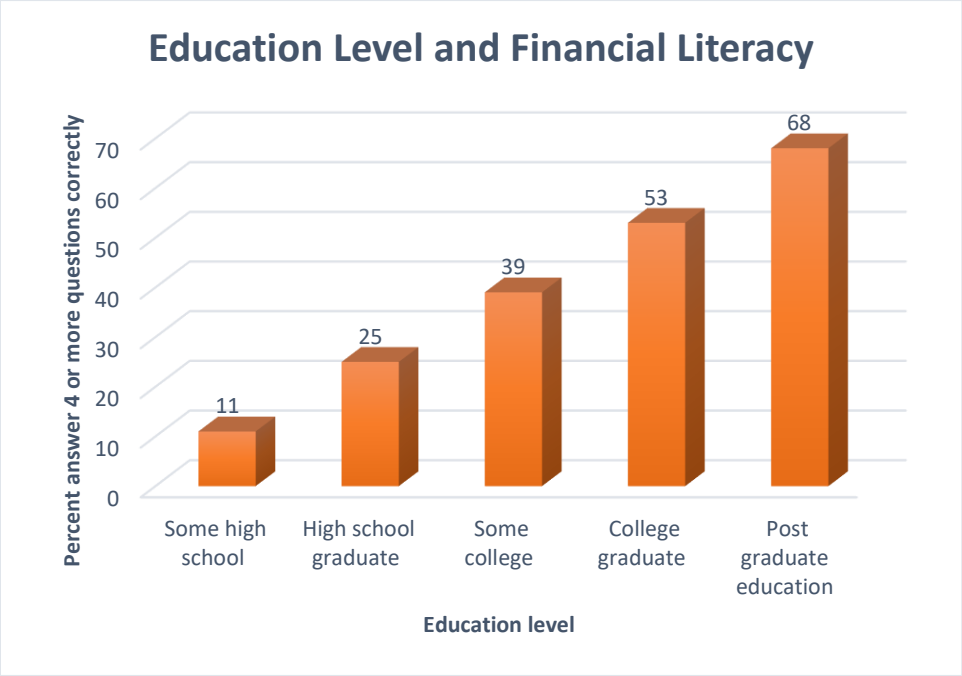


Figure 1.7 Income Level and Financial Literacy

Note: Source: Authors' calculations based on FINRA Foundation NFCS (2018) data.

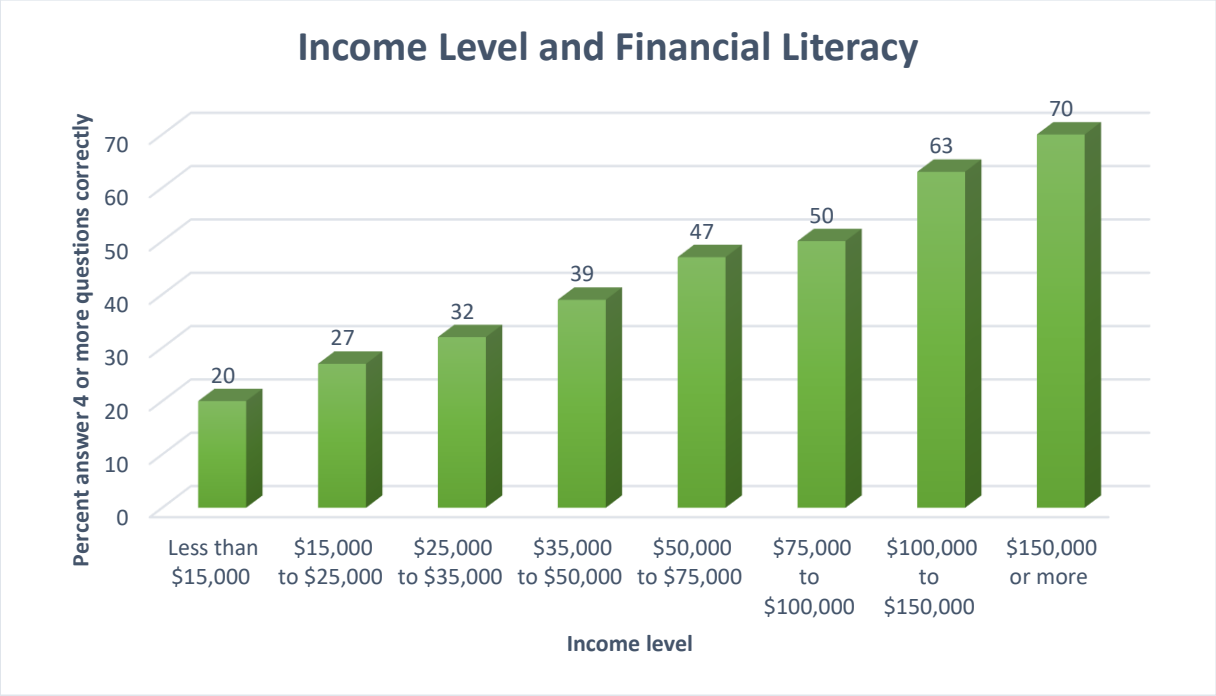


Table 1.1 Descriptive Statistics

Notes: The table provides summary statistics, coding, and data sources of all variables at the household and county level. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Variables	N	Mean	Standard Deviation	Min	Max	Coding	Source
Dependent variables							
Banked only	25,273	0.73	0.45	0	1	1 if banked, 0 otherwise	FINRA Foundation NFCS, 2018
Underbanked	25,273	0.23	0.42	0	1	1 if underbanked, 0 otherwise	FINRA Foundation NFCS, 2018
Unbanked	25,273	0.05	0.22	0	1	1 if unbanked, 0 otherwise	FINRA Foundation NFCS, 2018
AFS dummy	25,273	0.25	0.44	0	1	1 if used AFS in the last 5 years, 0 otherwise	FINRA Foundation NFCS, 2018
Auto title loan use	25,273	0.18	0.64	0	4	Auto title loan use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Payday loan use	25,273	0.28	0.88	0	4	Payday loan use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Revenue anticipation use	25,273	0.17	0.68	0	4	Revenue anticipation use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Pawnshop use	25,273	0.39	1.02	0	4	Pawnshop use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Rent-to-own use	25,273	0.20	0.71	0	4	Rent-to-own use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Total AFS use	25,273	0.72	1.39	0	4	Total AFS use in the last 5 years: 0: 0 time, 1: 1 time, 2: 2 times, 3: 3 times, or 4: 4 times and above	FINRA Foundation NFCS, 2018
Key variables							
Financial literacy dummy	24,768	0.46	0.50	0	1	1 if answered correctly 4 or more financial literacy questions, 0 otherwise	FINRA Foundation NFCS, 2018
Financial literacy index	24,768	0.04	0.78	-1.56	1.21	Index generated from factor analysis based on 6 financial literacy questions	FINRA Foundation NFCS, 2018
Individual/Households-level control variables							
Credit card dummy	25,040	0.82	0.38	0	1	1 if a credit card (s), 0 otherwise	FINRA Foundation NFCS, 2018
Carried over balance dunny	20,376	0.47	0.50	0	1	1 if carried over balance and charged interest on credit cards in the last 12 months, 0 otherwise	FINRA Foundation NFCS, 2018
Female	25,273	0.56	0.50	0	1	1 if female, 0 otherwise	FINRA Foundation NFCS, 2018
Dependent children	25,273	0.65	1.05	0	4	number of dependent children	FINRA Foundation NFCS, 2018
Married	25,273	0.54	0.50	0	1	1 if married, 0 otherwise	FINRA Foundation NFCS, 2018
Education	25,273	3.31	1.05	1	5	highest education attainment: 1: not complete high school, 2: high school graduate, 3: some college, 4: college graduate, and 5: post-graduate	FINRA Foundation NFCS, 2018
Race	25,273	1.51	1.02	1	5	1: White non-Hispanic, 2: Black non-Hispanic, 3: Hispanic, 4: Asian non-Hispanic, and 5: others	FINRA Foundation NFCS, 2018
White non Hispanic	25,273	0.80	0.40	0	1	1 if White non-Hispanic, 0 otherwise	FINRA Foundation NFCS, 2018
Black non Hispanic	25,273	0.10	0.30	0	1	1 if Black non-Hispanic, 0 otherwise	FINRA Foundation NFCS, 2018
Hispanic	25,273	0.08	0.28	0	1	1 if Hispanic, 0 otherwise	FINRA Foundation NFCS, 2018
Asian non Hispanic	25,273	0.04	0.20	0	1	1 if Asian non-Hispanic, 0 otherwise	FINRA Foundation NFCS, 2018

Variables	N	Mean	Standard Deviation	Min	Max	Coding	Source
Other races	25,273	0.03	0.16	0	1	1 if other races, 0 otherwise	FINRA Foundation NFCS, 2018
Age	25,273	48.36	16.72	18	100	Age from 18 to 101	FINRA Foundation NFCS, 2018
Unemployed	25,273	0.04	0.20	0	1	1 if unemployed, 0 otherwise	FINRA Foundation NFCS, 2018
Income level	25,273	4.54	2.06	1	8	income level: 1: <$15,000, 2: $15,000 to <$25,000, 3: $25,000 to <$35,000, 4: $35,000 to <$50,000, 5: $50,000 to <$75,000, 6: $75,000 to <$100,000, 7: $100,000 to <$150,000, and 8: >=$150,000	FINRA Foundation NFCS, 2018
County-level control variables							
Bank density	25,264	0.39	0.16	0.06	4.08	Number of bank and credit union branches per 1,000 population	FDIC, NCUA & ACS, 2018
AFS density	25,264	0.10	0.09	0	1.24	Number of AFS establishments per 1,000 population	BLS & ACS, 2018
Payday restrictions dummy	25,273	0.22	0.41	0	1	1 if the state has regulations that prohibit/restrict payday lending, 0 otherwise	paydayloaninfo.org, CFA, 2020
Auto title restriction dummy	25,273	0.57	0.49	0	1	1 if the state has regulations that prohibit/restrict auto title lending, 0 otherwise	CFA, 2016
Metropolitan	25,258	0.80	0.40	0	1	1: if county belongs to an MSA, 0 otherwise	FDIC, 2018
Median household income	25,266	11	0.24	9.96	11.82	Natural logarithm of 1 plus median household income	ACS, 2018
Poverty rate	25,266	0.14	0.05	.03	.48	Rate of households in poverty	ACS, 2018
Unemployment rate	25,266	0.06	0.02	0	0.29	Rate of over 16 years old civilization population unemployed	ACS, 2018
Not finish high school rate	25,273	0.10	0.04	0.01	0.42	Rate of over 25 years old population did not finish high school	ACS, 2018
Population	25,273	12.37	1.47	6.13	16.13	Natural logarithm of 1 plus population	ACS, 2018

Table 1.2 Financial Literacy and Likelihood of Banked Only, Underbanked, and Unbanked Households, 2018

Notes: The dependent variables have a value of 1 if a household is banked only and 0 if the household is underbanked in Columns (1) and (2). Similar values are assigned if a household is banked only or unbanked in Columns (3) and (4), and the same applies if a household is underbanked or unbanked in Columns (5) and (6). The key explanatory variables are the *Financial literacy dummy* in Columns (1), (3), and (5), and the *Financial literacy index* in Columns (2), (4), and (6). Panel A shows logit regression results, while Panel B shows the average marginal effects of both the *Financial literacy dummy* and the *Financial literacy index* on the dependent variables. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent variable	(1) Banked only vs. Underbanked	(2) Banked only vs. Underbanked	(3) Banked only vs. Unbanked	(4) Banked only vs. Unbanked	(5) Underbanked vs. Unbanked	(6) Underbanked vs. Unbanked
A: Logit regressions						
Financial literacy dummy	0.55***		0.83***		0.46***	
Financial literacy index		0.38***		0.55***		0.38***
Female	0.39***	0.40***	0.23***	0.26***	-0.10	-0.06
Dependent children	-0.33***	-0.33***	-0.43***	-0.44***	-0.04	-0.04
Married	0.09**	0.09**	0.46***	0.46***	0.48***	0.50***
Some high school						
High school graduate	0.51***	0.45***	1.09***	1.01***	0.54***	0.49***
Some college	0.47***	0.39***	1.45***	1.33***	0.92***	0.84***
College graduate	0.83***	0.75***	2.10***	1.97***	1.22***	1.13***
Postgraduate	0.84***	0.76***	2.28***	2.15***	1.37***	1.28***
White non-Hispanic						
Black non-Hispanic	-0.90***	-0.88***	-0.45***	-0.40***	0.19*	0.21**
Hispanic	-0.27***	-0.27***	-0.08	-0.06	0.09	0.09
Asian non-Hispanic	0.01	0.01	0.13	0.14	-0.04	-0.03
Other races	-0.25**	-0.25**	-0.36**	-0.36**	-0.11	-0.12
Age	0.03***	0.03***	0.02***	0.02***	0.00	0.00
Unemployed	-0.01	0.01	-0.79***	-0.78***	-0.72***	-0.72***
Income level <$15,000						
$15,000 to <$25,000	-0.44***	-0.46***	0.42***	0.40***	0.70***	0.68***
$25,000 to <$35,000	-0.33***	-0.37***	0.89***	0.85***	1.07***	1.02***
$35,000 to <$50,000	-0.13*	-0.17**	1.55***	1.50***	1.55***	1.51***
$50,000 to <$75,000	0.17**	0.12	1.86***	1.80***	1.55***	1.49***
$75,000 to <$100,000	0.1	0.05	2.55***	2.49***	2.40***	2.35***
$100,000 to <$150,000	0.49***	0.43***	2.32***	2.26***	1.75***	1.68***
>=$150,000	0.96***	0.90***	2.43***	2.34***	1.27***	1.20***
Observations	23,523	23,523	19,158	19,158	6,813	6,813
Pseudo R-squared	0.16	0.16	0.32	0.32	0.17	0.18
Chi squared	924.93	3,130.03	3,167.80	1,712.68	1,788.02	910.31
County-level controls	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES
B: Average marginal effects						
Financial literacy dummy	0.08***		0.04***		0.06***	
Financial literacy index		0.05***		0.02***		0.05***

Table 1.3 Ordered Logit Results: AFS Use Frequency and Financial Literacy, 2018

Notes: The dependent variables are the frequency (none, 1, 2, 3, or 4 or more times) of a household using different types of AFS in the last five years. We consider the frequency of using auto title loans (Columns (1) and (2)); payday loans (Columns (3) and (4)); revenue anticipation (Columns (5) and (6)); pawnshops (Columns (7) and (8)); rent-to-own services (Columns (9) and (10)); and any AFS (Columns (11) and (12)). The key explanatory variables are the *Financial literacy dummy* in Columns (1), (3), (5), (7), (9) and (11), and the *Financial literacy index* in Columns (2), (4), (6), (8), (10) and (12). Panel A shows logit regression results while Panel B shows the average marginal effects of both the *Financial literacy dummy* and the *Financial literacy index* on the dependent variables. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent variables	(1) **Auto title loans**	(2) **Auto title loans**	(3) **Payday**	(4) **Payday**	(5) **Revenue anticipation**	(6) **Revenue anticipation**	(7) **Pawnshop**	(8) **Pawnshop**	(9) **Rent-to-own**	(10) **Rent-to-own**	(11) **Total AFS uses**	(12) **Total AFS uses**
A: Logit regressions												
Financial literacy dummy	-0.96***		-0.79***		-1.14***		-0.66***		-1.01***		-0.61***	
Financial literacy index		-0.58***		-0.48***		-0.70***		-0.40***		-0.62***		-0.40***
Unbanked	0.31***	0.27***	0.32***	0.28***	0.50***	0.45***	0.92***	0.90***	0.53***	0.48***	0.77***	0.74***
Female	-0.80***	-0.82***	-0.60***	-0.61***	-1.05***	-1.08***	-0.55***	-0.56***	-0.72***	-0.74***	-0.44***	-0.45***
Dependent children	0.29***	0.30***	0.33***	0.34***	0.37***	0.38***	0.29***	0.29***	0.35***	0.36***	0.34***	0.34***
Married	0.06	0.05	-0.16***	-0.17***	0.09	0.08	-0.07	-0.08	0.03	0.02	-0.08**	-0.09**
Some high school												
High school graduate	0.14	0.21	0.01	0.07	-0.1	-0.02	-0.07	-0.01	-0.27**	-0.18	-0.17*	-0.12
Some college	0.24	0.34**	0.2	0.28**	-0.06	0.06	-0.01	0.06	-0.21	-0.09	-0.11	-0.04
College graduate	0.07	0.16	-0.14	-0.06	-0.31*	-0.19	-0.37***	-0.30***	-0.55***	-0.44***	-0.47***	-0.40***
Postgraduate	0.31*	0.39**	0.02	0.09	-0.09	0.00	-0.39***	-0.33***	-0.29*	-0.19	-0.47***	-0.41***
White non-Hispanic												
Black non-Hispanic	0.75***	0.73***	0.96***	0.94***	0.85***	0.83***	0.61***	0.60***	0.82***	0.80***	0.83***	0.81***
Hispanic	-0.11	-0.10	0.16**	0.17**	-0.04	-0.02	-0.03	-0.02	-0.05	-0.05	0.16***	0.16***
Asian non-Hispanic	0.11	0.11	0.02	0.02	0.55***	0.56***	-0.17*	-0.18*	0.00	0.00	0.01	0.01
Other races	-0.34**	-0.33**	0.07	0.08	-0.36**	-0.35**	0.36***	0.37***	-0.02	-0.02	0.26***	0.26***
Age	-0.04***	-0.04***	-0.03***	-0.03***	-0.06***	-0.06***	-0.04***	-0.03***	-0.04***	-0.04***	-0.03***	-0.03***
Unemployed	-0.49***	-0.52***	-0.33***	-0.34***	-0.53***	-0.55***	-0.05	-0.06	-0.61***	-0.63***	-0.17**	-0.19**
Income level <$15,000												
$15,000 to <$25,000	0.52***	0.56***	0.52***	0.55***	0.45***	0.50***	0.31***	0.33***	0.27***	0.32***	0.45***	0.48***
$25,000 to <$35,000	0.58***	0.64***	0.55***	0.60***	0.51***	0.59***	0.13*	0.17**	0.31***	0.38***	0.35***	0.39***
$35,000 to <$50,000	0.34***	0.39***	0.42***	0.46***	0.38***	0.45***	-0.03	0.00	0.12	0.18*	0.17**	0.20***
$50,000 to <$75,000	0.45***	0.53***	0.18*	0.25**	0.35***	0.45***	-0.32***	-0.28***	-0.01	0.08	-0.12*	-0.07
$75,000 to <$100,000	0.93***	1.02***	0.50***	0.57***	0.96***	1.07***	-0.14*	-0.09	0.48***	0.57***	0.01	0.07
$100,000 to <$150,000	0.58***	0.66***	0.03	0.1	0.56***	0.66***	-0.60***	-0.56***	0.08	0.17	-0.43***	-0.37***

Dependent variables	(1) Auto title loans	(2) Auto title loans	(3) Payday	(4) Payday	(5) Revenue anticipation	(6) Revenue anticipation	(7) Pawnshop	(8) Pawnshop	(9) Rent-to-own	(10) Rent-to-own	(11) Total AFS uses	(12) Total AFS uses
>=$150,000	0.02	0.11	-0.58***	-0.52***	0.01	0.11	-1.07***	-1.02***	-0.67***	-0.58***	-0.91***	-0.86***
Observations	24,747	24,747	24,747	24,747	24,747	24,747	24,747	24,747	24,747	24,747	24,747	24,747
Pseudo R-squared	0.11	0.11	0.11	0.11	0.17	0.17	0.12	0.12	0.13	0.13	0.12	0.12
Chi squared	4,268.95	1,488.83	1,542.47	2,634.45	2,682.77	2,332.41	2,367.88	3,625.43	3,729.70	2,503.81	2,519.22	4,292.73
County-level controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
B: Average marginal effects												
Financial literacy dummy												
	0.07***		0.07***		0.07***		0.07***		0.08***		0.09***	
	-0.03***		-0.02***		-0.02***		-0.02***		-0.03***		-0.02***	
	-0.02***		-0.02***		-0.02***		-0.02***		-0.02***		-0.01***	
	-0.01***		-0.01***		-0.01***		-0.01***		-0.01***		-0.01***	
	-0.01***		-0.02***		-0.02***		-0.03***		-0.02***		-0.06***	
Financial literacy index												
		0.04***		0.04***		0.04***		0.04***		0.05***		0.06***
		-0.02***		-0.01***		-0.01***		-0.01***		-0.02***		-0.01***
		-0.01***		-0.01***		-0.01***		-0.01***		-0.01***		-0.01***
		-0.01***		-0.01***		-0.01***		-0.01***		-0.01***		-0.01***
		-0.01***		-0.01***		-0.01***		-0.02***		-0.01***		-0.04***

Table 1.4 Logit Results: AFS Use, Credit Card Use and Financial Literacy of Banked Households, 2018

Notes: The dependent variables take on a value of 1 if a banked household has been using any AFS in the last five years, and 0 otherwise. The key explanatory variables are the *Financial literacy dummy* and the *Credit card dummy* in Column (1); and the *Financial literacy index* and the *Credit card dummy* in Column (2). The key explanatory variables are the *Financial literacy dummy* and the *Credit card dummy* and their interaction in Column (3); and the *Financial literacy index* and the *Credit card dummy* and their interaction in Column (4). The key explanatory variables are the *Financial literacy dummy* and the *Carried over balance* dummy in Column (5), and the *Financial literacy index* and the *Carried over balance* dummy in Column (6). The key explanatory variables are the *Financial literacy dummy* and the *Carried over balance* dummy variable and their interaction in Column (7), and the *Financial literacy index* and the *Carried over balance* dummy variable and their interaction in Column (8). Panel A shows logit regression results, while Panel B shows the average marginal effects of both the *Financial literacy dummy* (Columns (1) and (5)) and the *Financial literacy index* on the dependent variables (Columns (2) and (6)); the *Financial literacy dummy* and the *Financial literacy index* and their interaction with the *Credit card dummy* on the dependent variables (Columns (3) and (4)); the *Financial literacy dummy* and the *Financial literacy index* and their interaction with the *Carried over balance* dummy variable on the dependents variables (Columns (7) and (8)). All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**
A: Logit regressions								
Financial literacy dummy	-0.54***		0.12		-0.61***		-0.83***	
Financial literacy index		-0.37***		0.12**		-0.47***		-0.58***
Financial literacy dummy x Credit card dummy			-0.80***					
Financial literacy index x Credit card dummy				-0.62***				
Credit card dummy	-0.35***	-0.33***	-0.14**	-0.52***				
Financial literacy dummy x Carried over balance							0.35***	
Financial literacy index x Carried over balance								0.20***
Carried over balance					0.66***	0.67***	0.53***	0.69***
Female	-0.40***	-0.41***	-0.40***	-0.42***	-0.56***	-0.59***	-0.56***	-0.58***
Dependent children	0.33***	0.33***	0.33***	0.33***	0.27***	0.27***	0.26***	0.26***
Married	-0.08*	-0.08*	-0.08*	-0.07*	-0.09*	-0.09*	-0.09*	-0.09*
Some high school								
High school graduate	-0.48***	-0.43***	-0.50***	-0.47***	-0.57***	-0.49***	-0.57***	-0.49***
Some college	-0.45***	-0.37***	-0.48***	-0.43***	-0.59***	-0.49***	-0.59***	-0.49***
College graduate	-0.79***	-0.71***	-0.82***	-0.76***	-0.93***	-0.82***	-0.93***	-0.82***
Postgraduate	-0.79***	-0.72***	-0.81***	-0.75***	-0.90***	-0.79***	-0.89***	-0.79***
White non-Hispanic								

Dependent variables	(1) AFS dummy	(2) AFS dummy	(3) AFS dummy	(4) AFS dummy	(5) AFS dummy	(6) AFS dummy	(7) AFS dummy	(8) AFS dummy
Black non-Hispanic	0.90***	0.88***	0.90***	0.88***	1.04***	1.01***	1.04***	1.01***
Hispanic	0.27***	0.27***	0.27***	0.27***	0.29***	0.30***	0.29***	0.29***
Asian non-Hispanic	0.01	0.01	0.01	0.01	0.13	0.13	0.13	0.13
Other races	0.24**	0.24**	0.25**	0.25**	0.24*	0.24*	0.23*	0.23*
Age	-0.03***	-0.03***	-0.03***	-0.03***	-0.04***	-0.04***	-0.04***	-0.04***
Unemployed	-0.02	-0.04	-0.01	-0.01	-0.02	-0.03	-0.03	-0.04
Income level <$15,000								
$15,000 to <$25,000	0.48***	0.50***	0.48***	0.49***	0.39***	0.41***	0.39***	0.42***
$25,000 to <$35,000	0.41***	0.44***	0.40***	0.42***	0.23**	0.27***	0.23**	0.27***
$35,000 to <$50,000	0.24***	0.26***	0.23***	0.25***	0.09	0.13	0.09	0.13
$50,000 to <$75,000	-0.05	-0.01	-0.05	-0.02	-0.16*	-0.1	-0.16*	-0.1
$75,000 to <$100,000	0.03	0.07	0.03	0.07	-0.11	-0.05	-0.1	-0.05
$100,000 to <$150,000	-0.36***	-0.32***	-0.35***	-0.30***	-0.43***	-0.36***	-0.43***	-0.36***
>=$150,000	-0.84***	-0.79***	-0.82***	-0.76***	-0.80***	-0.73***	-0.79***	-0.71***
Observations	23,335	23,335	23,335	23,335	19,658	19,658	19,658	19,658
Pseudo R^2	0.16	0.16	0.17	0.17	0.19	0.20	0.19	0.20
Chi squared	2,911.27	3,112.23	3,150.27	3,162.37	3,277.87	2,876.02	2,935.50	2,788.09
County-level controls	YES	YES	YES	YES	YES	YES	YES	YES
Standard error clustered	YES	YES	YES	YES	YES	YES	YES	YES
B: Average marginal effects								
Financial literacy dummy	-0.08***		0.02		-0.08***		-0.11***	
Financial literacy index		-0.05***		0.02**		-0.06***		-0.08***
Financial literacy dummy x Credit card dummy			-0.12***					
Financial literacy index x Credit card dummy				-0.09***				
Financial literacy dummy x Carried over balance							0.05***	
Financial literacy index x Carried over balance								0.03***

Table 1.5 Financial Literacy and Likelihood of Banked Only, Underbanked, and Unbanked Households with PSM Matched Sample, 2018

The Impact of Financial Literacy on Banked Only, Underbanked and Unbanked: 1 Nearest Neighbor Matching PSM

Notes: The dependent variables have a value of 1 if a household is banked only and 0 if the household is underbanked in Row (1). Similar values are assigned if a household is banked only or unbanked not in Row (2) and the same applies if a household is underbanked or unbanked in Row (3). ATT Difference stands for the average treatment effect on the treated. N^{o} treated is the number of observations in the treatment group. N^{o} control is the number of observations in the control group. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent Variables	N^{o} treated	N^{o} control	ATT	Standard Error	t-statistic
Banked only vs. Underbanked (1)	12,230	11,104	0.08	0.01	8.47
Banked only vs. Unbanked (2)	9,669	9,190	0.02	0.01	4.24
Unbanked (3)	1,715	4,860	0.05	0.01	3.57

Notes: This table repeats Table 2 for the PSM 1 nearest neighbor matched sample. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

	Logit regressions			**Marginal effects**		
Dependent variables	(1) **Banked only vs. Underbanked**	(2) **Banked only vs. Unbanked**	(3) **Underbanked vs. Unbanked**	(4) **Banked only vs. Underbanked**	(5) **Banked only vs. Unbanked**	(6) **Underbanked vs. Unbanked**
Financial literacy dummy	0.45***	0.62***	0.43***	0.07***	0.03***	0.04***
Female	0.36***	0.17	-0.02	0.06***	0.01	-0.00
Dependent children	-0.35***	-0.48***	-0.14	-0.05***	-0.02***	-0.01
Married	0.02	0.23	0.52**	0.00	0.01	0.05**
Some high school						
High school graduate	0.67***	1.34***	1.09***	0.13***	0.12***	0.16***
Some college	0.79***	1.80***	1.13***	0.15***	0.15***	0.17***
College graduate	1.14***	2.43***	1.74***	0.20***	0.17***	0.23***
Postgraduate	0.98***	2.40***	2.10***	0.18***	0.17***	0.25***
White non-Hispanic						
Black non-Hispanic	-1.07***	-0.60*	0.15	-0.20***	-0.03*	0.02
Hispanic	-0.23*	-0.28	0.10	-0.04*	-0.01	0.01
Asian non-Hispanic	0.24	0.07	0.62	0.03*	0.00	0.06
Other races	-0.46**	0.19	0.63	-0.08**	0.01	0.06*
Age	0.04***	0.03***	-0.01	0.01***	0.00***	-0.00
Unemployed	-0.43**	-1.51***	-1.00***	-0.07**	-0.07***	-0.10***

	Logit regressions			Marginal effects		
Dependent variables	(1) **Banked only vs. Underbanked**	(2) **Banked only vs. Unbanked**	(3) **Underbanked vs. Unbanked**	(4) **Banked only vs. Underbanked**	(5) **Banked only vs. Unbanked**	(6) **Underbanked vs. Unbanked**
Income level <$15,000						
$15,000 to <$25,000	-0.73***	-0.14	0.32	-0.12***	-0.01	0.05
$25,000 to <$35,000	-0.55***	0.49	0.39	-0.09*	0.04	0.06
$35,000 to <$50,000	-0.28*	0.96***	1.38***	-0.04*	0.06***	0.16***
$50,000 to <$75,000	-0.01	1.85***	1.58***	-0.00	0.09	0.17***
$75,000 to <$100,000	0.01	2.26***	1.85***	0.00	0.09	0.19***
$100,000 to <$150,000	0.38**	1.96***	0.91*	0.05**	0.09	0.12**
>=$150,000	0.15	1.01*	1.36	0.02	0.06**	0.16**
Observations	23,334	18,859	6,575			
Pseudo R-squared	0.14	0.26	0.17			
Chi squared	685.63	529.76	209.43			
County-level controls	YES	YES	YES			
Standard errors clustered	YES	YES	YES			

Table 1.6 Ordered Logit Results: AFS Use Frequency and Financial Literacy with PSM Matched Sample, 2018

The Impact of Financial Literacy on frequency of AFS uses: 1 Nearest Neighbor Matching PSM

Notes: The dependent variables are the frequency (none, 1, 2, 3, or 4 or more times) of a household using different types of AFS in the last five years. We consider the frequency of using auto title loans (Row (1)); payday loans (Row (2)); revenue anticipation (Row (3)); pawnshops (Row (4)); rent-to-own services (Row (5)); and any AFS (Row (6)). ATT Difference stands for the average treatment effect on the treated. Nº treated is the number of observations in the treatment group. Nº control is the number of observations in the control group. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent Variables	Nº treated	Nº control	ATT	Standard Error	t-statistic
Auto title loans (1)	11,268	13,209	-0.15	0.02	-9.49
Payday (2)	11,268	13,209	-0.16	0.02	-7.66
Revenue anticipation (3)	11,268	13,209	-0.14	0.02	-8.61
Pawnshop (4)	11,268	13,209	-0.17	0.02	-7.68
Rent-to-own (5)	11,268	13,209	-0.15	0.02	-8.73
Total AFS uses (6)	11,268	13,209	-0.31	0.03	-9.86

Notes: This table repeats Table 4 for the PSM 1 nearest neighbor matched sample. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent variables	(1) Auto title loans	(2) Payday	(3) Revenue anticipation	(4) Pawnshop	(5) Rent-to-own	(6) Total AFS uses
A: Ordered logit regressions						
Financial literacy dummy	-0.86***	-0.64***	-1.06***	-0.54***	-0.84***	-0.58***
Unbanked	0.52*	0.25	0.61**	1.16***	0.75***	0.88***
Female	-0.57***	-0.41***	-0.79***	-0.46***	-0.57***	-0.30***
Dependent children	0.26***	0.34***	0.37***	0.28***	0.35***	0.33***
Married	0.12	-0.08	0.31**	0.17*	0.16	0.03
Some high school						
High school graduate	0.19	-0.14	0.22	-0.21	0.16	-0.19
Some college	-0.11	-0.25	-0.27	-0.41	-0.16	-0.43*
College graduate	-0.24	-0.58	-0.51	-0.71**	-0.34	-0.75***
Postgraduate	0.07	-0.25	0.04	-0.52	0.12	-0.70***
White non-Hispanic						
Black non-Hispanic	0.95***	1.04***	0.65***	0.57***	0.98***	1.01***
Hispanic	-0.28	0.07	-0.03	0.00	-0.24	0.14
Asian non-Hispanic	-0.11	0.12	0.33	-0.18	-0.14	-0.06
Other races	-0.75**	0.26	-0.22	0.38*	-0.11	0.36**
Age	-0.05***	-0.04***	-0.07***	-0.04***	-0.05***	-0.04***
Unemployed	-0.10	0.07	-0.44	-0.02	-0.30	-0.10
Income level <$15,000						
$15,000 to <$25,000	0.44	0.94***	0.94***	0.59***	0.46*	0.75***
$25,000 to <$35,000	0.24	0.69***	0.17	0.14	-0.01	0.36**
$35,000 to <$50,000	0.19	0.39*	0.09	-0.05	-0.21	0.11
$50,000 to <$75,000	0.11	0.34	0.24	-0.41**	-0.05	-0.09
$75,000 to <$100,000	0.44*	0.33	0.45	-0.46***	-0.18	-0.17
$100,000 to <$150,000	0.33	0.22	0.25	-0.69***	-0.2	-0.39**
>=$150,000	0.47	0.27	0.11	-0.30	-0.32	-0.10
Observations	24,477	24,477	24,477	24,477	24,477	24,477
Pseudo R-squared	0.10	0.09	0.16	0.11	0.11	0.10

Dependent variables	(1) Auto title loans	(2) Payday	(3) Revenue anticipation	(4) Pawnshop	(5) Rent-to-own	(6) Total AFS uses
A: Ordered logit regressions						
Chi squared	401.62	610.01	512.74	671.38	500.63	786.76
County-level controls	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES
B: Average marginal effects						
Financial literacy dummy						
	0.07***	0.06***	0.06***	0.06***	0.07***	0.09***
	-0.04***	-0.01***	-0.02***	-0.02***	-0.03***	-0.02***
	-0.02***	-0.01***	-0.01***	-0.01***	-0.02***	-0.01***
	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	-0.01***	-0.02***	-0.01***	-0.02***	-0.01***	-0.06***

Table 1.7 Logit Results: AFS Use, Credit Card Use and Financial Literacy of Banked Households with PSM Matched Sample, 2018

The Impact of Financial Literacy on the choice between Credit Cards and AFS: 1 Nearest Neighbor Matching PSM

Notes: The dependent variables have a value of 1 if a banked household used any types of AFS in the last five years and 0 if the household is otherwise in Row (1). ATT Difference stands for the average treatment effect on the treated. Nº treated is the number of observations in the treatment group. Nº control is the number of observations in the control group. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent Variables	Nº treated	Nº control	ATT	Standard Error	t-statistic
AFS dummy (1)	10,117	9,474	-0.09	0.01	-9.25

Notes: This table repeats Table 5 for the PSM 1 nearest neighbor matched sample. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

	(1)	(2)	(3)	(4)
Dependent variables	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**
A: Logit regressions				
Financial literacy dummy	-0.44***	0.10	-0.61***	-0.72***
Credit card dummy	-0.53***	-0.10		
Financial literacy dummy x Credit card dummy		-0.66***		
Carried over balance			0.84***	0.75***
Financial literacy dummy x Carried over balance				0.18
Female	-0.37***	-0.36***	-0.52***	-0.52***
Dependent children	0.35***	0.35***	0.24***	0.23***
Married	0	-0.01	-0.08	-0.07
Some high school				
High school graduate	-0.61**	-0.61**	-0.99***	-1.00***
Some college	-0.73***	-0.73***	-1.20***	-1.21***
College graduate	-1.06***	-1.06***	-1.49***	-1.50***
Postgraduate	-0.88***	-0.89***	-1.22***	-1.23***
White non-Hispanic				
Black non-Hispanic	1.05***	1.05***	0.99***	0.99***
Hispanic	0.24*	0.24*	0.2	0.2
Asian non-Hispanic	-0.19	-0.18	0.11	0.1
Other races	0.47**	0.48**	0.57**	0.58**
Age	-0.04***	-0.04***	-0.04***	-0.04***
Unemployed	0.37**	0.37**	-0.12	-0.13
Income level <$15,000				
$15,000 to <$25,000	0.81***	0.83***	0.41*	0.40*
$25,000 to <$35,000	0.68***	0.71***	0.13	0.12
$35,000 to <$50,000	0.44***	0.46***	0.02	0.01
$50,000 to <$75,000	0.19	0.22	-0.36*	-0.37*
$75,000 to <$100,000	0.19	0.2	-0.28	-0.28
$100,000 to <$150,000	-0.17	-0.17	-0.50**	-0.51**
>=$150,000	0.06	0.05	-0.54**	-0.55**
Observations	23,191	23,191	19,387	19,387
Pseudo R^2	0.14	0.14	0.16	0.16
Chi squared	692.71	684.88	687.30	684.05
County-level controls	YES	YES	YES	YES
Standard error clustered	YES	YES	YES	YES
B: Average marginal effects				
Financial literacy dummy	-0.07***	0.02	-0.08***	-0.10***
Financial literacy dummy x Credit card dummy		-0.10***		

Dependent variables	(1) AFS dummy	(2) AFS dummy	(3) AFS dummy	(4) AFS dummy
Financial literacy dummy x Carried overbalance				0.02

1.6. Appendices

Appendix 1.1 Financial Literacy Questions

1. Interest Rate. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?
a. More than $102
b. Exactly $102
c. Less than $102
d. Don't know
e. Prefer not to say

2. Inflation. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?
a. More than today
b. Exactly the same
c. Less than today
d. Don't know
e. Prefer not to say

3. Bond Price. If interest rates rise, what will typically happen to bond prices?
a. They will rise
b. They will fall
c. They will stay the same
d. There is no relationship between bond prices and the interest
e. Don't know
f. Prefer not to say

4. Mortgage. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.
a. True
b. False
c. Don't know
d. Prefer not to say

5. Risk. Buying a single company's stock usually provides a safer return than a stock mutual fund.
a. True
b. False
c. Don't know
d. Prefer not to say

6. Compound Interest. Suppose you owe $1,000 on a loan and the interest rate you are charged

is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?
a. Less than 2 years
b. At least 2 years but less than 5 years
c. At least 5 years but less than 10 years
d. At least 10 years
e. Don't know
f. Prefer not to say

Appendix 1.2 Households Responses to Different Financial Literacy Questions

Table 1.8 Distribution of Answers to Questions, 2018

Notes: This table presents the percent of all respondents with different demographic characteristics answering correctly, answering "Don't know" and answering "Prefer not to say" in the NFCS 2018 survey for each of the financial literacy questions (Columns (1) to (6)). The percent of respondents answering four or more questions correctly is presented in Column (7). The percent of respondents answering five or more questions correctly is presented in Column (8). The percent of respondents answering all six questions correctly is presented in Column (9). The respondents answering "prefer not to say" is not included because the percentages are always less than 2 percent for all questions. Source: Authors' calculations based on FINRA Foundation NFCS (2018) data.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Demographic	**Answer**	**Interest Rate**	**Inflation**	**Bond Price**	**Mortgage**	**Risk**	**Compound Interest**	**Four or More Correct Answers**	**Five or More Correct Answers**	**All Six Correct Answers**
All Respondents	Correct	74	58	27	76	46	31	43	24	8
	Incorrect	13	20	35	7	9	42	42	67	88
	Don't know	12	21	37	16	44	25	15	9	4
Financial Inclusion										
Banked only	Correct	81	67	30	83	53	33	53	31	11
	Incorrect	9	15	32	4	5	42	35	62	86
	Don't know	9	17	37	12	41	24	12	7	3
Underbanked	Correct	68	42	22	71	33	31	28	11	2
	Incorrect	18	36	46	12	22	45	58	81	94
	Don't know	13	21	32	17	45	23	14	8	4
Unbanked	Correct	51	31	16	45	22	18	14	4	1
	Incorrect	20	27	38	15	13	39	52	74	86
	Don't know	28	40	45	39	64	41	33	22	13
Gender										
Male	Correct	79	66	34	79	57	39	54	34	13
	Incorrect	11	20	38	7	11	43	36	60	84
	Don't know	9	13	27	13	31	17	9	6	3
Female	Correct	70	51	21	74	37	25	34	16	4
	Incorrect	14	22	33	7	8	41	46	73	91
	Don't know	15	26	45	18	54	32	19	11	5

Demographic	Answer	(1) Interest Rate	(2) Inflation	(3) Bond Price	(4) Mortgage	(5) Risk	(6) Compound Interest	(7) Four or More Correct Answers	(8) Five or More Correct Answers	(9) All Six Correct Answers
Dependent children										
No dependent children	Correct	76	63	29	77	49	31	47	27	9
	Incorrect	11	16	32	6	7	42	38	64	86
	Don't know	12	20	38	16	43	26	15	9	4
1 dependent child	Correct	70	49	23	74	40	31	36	18	5
	Incorrect	15	28	40	9	15	44	48	72	89
	Don't know	14	22	36	16	44	24	15	9	5
2 dependent children	Correct	72	50	26	76	42	31	38	19	6
	Incorrect	14	27	38	8	13	43	47	72	89
	Don't know	13	21	35	15	44	24	14	8	4
3 dependent children	Correct	71	44	21	74	38	32	33	17	5
	Incorrect	16	30	42	10	14	43	51	74	90
	Don't know	12	24	36	15	47	23	15	8	5
4 or more	Correct	68	43	22	73	35	31	31	14	4
	Incorrect	19	36	42	9	17	45	54	77	92
	Don't know	12	20	35	17	47	23	14	8	3
Married										
Married	Correct	78	63	30	82	52	33	50	29	10
	Incorrect	11	19	36	6	8	43	38	64	87
	Don't know	10	17	33	11	39	22	11	6	3
Not married	Correct	70	51	23	69	39	29	35	17	5
	Don't know	15	25	41	22	49	29	18	11	6
	Incorrect	14	23	35	8	11	41	46	71	88
Education										
Some high school	Correct	49	26	13	43	18	17	11	4	1
	Incorrect	16	28	34	14	13	34	48	67	82
	Don't know	33	44	52	42	67	47	40	29	16
High school graduate	Correct	63	45	18	65	31	20	25	10	2
	Incorrect	17	23	37	11	11	43	51	75	90
	Don't know	19	30	44	23	57	35	23	14	7
Some college	Correct	74	55	23	76	41	30	39	19	5

Demographic	Answer	(1) Interest Rate	(2) Inflation	(3) Bond Price	(4) Mortgage	(5) Risk	(6) Compound Interest	(7) Four or More Correct Answers	(8) Five or More Correct Answers	(9) All Six Correct Answers
	Incorrect	14	23	38	7	11	43	46	73	91
	Don't know	11	21	38	16	47	26	14	8	4
College graduate	Correct	80	65	32	82	54	36	53	31	11
	Incorrect	10	18	34	6	8	43	37	63	86
	Don't know	9	16	33	11	37	20	10	5	3
Postgraduate education	Correct	86	76	41	87	69	44	68	45	18
	Incorrect	7	13	32	5	6	41	25	51	80
	Don't know	6	10	26	7	24	14	6	3	2
Ethnicity										
White alone Non-Hispanic	Correct	77	62	28	80	49	32	47	27	9
	Incorrect	11	18	34	6	8	42	38	65	87
	Don't know	11	19	37	13	42	25	14	8	4
Black alone Non-Hispanic	Correct	61	35	19	59	28	27	21	7	2
	Incorrect	19	36	46	14	22	41	58	79	91
	Don't know	18	27	34	26	49	30	20	13	7
Hispanic (any race)	Correct	68	44	21	67	34	29	29	13	3
	Incorrect	15	29	39	10	13	43	54	76	91
	Don't know	16	26	39	22	52	27	17	10	6
Asian alone Non-Hispanic	Correct	76	56	33	71	52	35	46	28	11
	Incorrect	11	23	36	9	12	41	39	63	85
	Don't know	12	20	30	19	35	23	14	9	5
Other NH	Correct	78	58	24	73	44	29	41	20	6
	Incorrect	10	19	34	7	8	43	43	71	90
	Don't know	11	22	41	20	47	26	15	8	3
Age										
18-24	Correct	64	35	20	56	29	30	24	10	2
	Incorrect	17	32	38	13	16	36	53	76	90
	Don't know	18	32	41	30	54	32	22	13	7
25-29	Correct	65	35	19	63	31	33	26	12	3
	Incorrect	16	35	39	12	16	37	53	75	90

Demographic	Answer	(1) Interest Rate	(2) Inflation	(3) Bond Price	(4) Mortgage	(5) Risk	(6) Compound Interest	(7) Four or More Correct Answers	(8) Five or More Correct Answers	(9) All Six Correct Answers
	Don't know	18	29	41	24	52	29	20	12	7
30-34	Correct	68	39	18	71	33	32	29	13	3
	Incorrect	16	34	42	8	19	40	54	75	91
	Don't know	14	25	38	19	46	26	17	10	6
35-39	Correct	70	44	21	73	38	31	33	18	5
	Incorrect	15	30	38	8	14	41	49	72	89
	Don't know	14	24	40	18	47	26	17	10	5
40-44	Correct	75	51	22	76	44	30	39	21	6
	Incorrect	11	25	39	7	9	44	44	69	89
	Don't know	13	23	38	16	46	25	16	10	5
45-49	Correct	76	61	26	78	47	29	44	23	7
	Incorrect	11	18	36	7	8	44	41	68	89
	Don't know	11	19	37	14	44	25	14	8	4
50-54	Correct	76	65	26	79	50	30	48	25	8
	Incorrect	12	16	35	6	7	45	37	66	88
	Don't know	11	18	38	14	42	24	14	8	4
55-59	Correct	77	70	31	82	53	31	52	29	11
	Incorrect	12	12	32	6	5	45	35	64	86
	Don't know	10	17	36	11	41	23	12	7	3
60-64	Correct	80	73	34	85	56	31	56	33	12
	Incorrect	10	11	32	4	5	44	33	60	85
	Don't know	9	15	33	10	38	24	11	7	3
65+	Correct	83	78	38	85	59	32	59	36	14
	Incorrect	8	9	29	6	4	44	31	58	84
	Don't know	8	12	32	9	36	23	9	5	2
Employment										
Employed	Correct	75	58	27	77	47	31	44	24	8
	Incorrect	12	21	36	7	9	42	41	67	88
	Don't know	12	20	36	15	43	25	14	8	4
Unemployed	Correct	63	40	18	54	27	23	24	10	2

Demographic	Answer	(1) Interest Rate	(2) Inflation	(3) Bond Price	(4) Mortgage	(5) Risk	(6) Compound Interest	(7) Four or More Correct Answers	(8) Five or More Correct Answers	(9) All Six Correct Answers
	Incorrect	14	23	31	10	10	38	46	69	86
	Don't know	22	36	50	35	62	38	30	20	11
Income level										
Less than $15,000	Correct	58	37	15	50	25	21	20	8	2
	Incorrect	16	24	35	12	13	36	48	70	85
	Don't know	25	37	49	37	61	41	32	21	12
$15,000 to $25,000	Correct	65	47	18	64	30	24	27	10	3
	Incorrect	16	23	36	10	11	41	50	75	90
	Don't know	18	29	45	25	58	33	22	14	7
$25,000 to $35,000	Correct	70	50	21	70	36	26	32	14	4
	Incorrect	14	24	36	9	9	43	49	76	91
	Don't know	15	25	42	20	54	30	19	10	5
$35,000 to $50,000	Correct	74	56	24	76	41	28	39	18	5
	Incorrect	13	21	34	8	9	45	46	74	91
	Don't know	12	22	41	16	49	26	14	8	4
$50,000 to $75,000	Correct	78	62	28	81	49	32	47	25	8
	Incorrect	12	19	34	7	8	44	41	69	89
	Don't know	9	18	37	11	42	23	11	6	3
$75,000 to $100,000	Correct	79	62	32	84	52	34	50	30	10
	Incorrect	12	22	38	6	13	44	40	65	87
	Don't know	8	14	29	9	34	20	9	5	2
$100,000 to $150,000	Correct	84	72	38	88	64	41	63	41	14
	Incorrect	8	16	33	5	7	41	30	55	84
	Don't know	7	11	28	6	28	16	7	4	1
$150,000 or more	Correct	87	78	44	88	70	44	70	47	21
	Incorrect	7	11	32	6	7	40	24	48	76
	Don't know	5	9	22	5	22	14	5	4	2

Table 1.9 The likelihood of answering "Don't know."

Notes: The dependent variables have a value of 1 if a household answered "Don't know" and 0 otherwise for the Interest Rate question in Column (1), the Inflation question in Column (2), the Bond Price question in Column (3), the Mortgage question in Column (4), the Risk question in Column (5), and the Compound Interest question in Column (6). All regressions include demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, ACS, and BLS (2018) data.

	(1) **Interest Rate Question**	(2) **Inflation Question**	(3) **Bond Price Question**	(4) **Mortgage Question**	(5) **Risk Question**	(6) **Compound Interest Question**
Female	0.47***	0.79***	0.72***	0.30***	0.87***	0.71***
Dependent children	-0.03	-0.04**	-0.06***	-0.05***	0.00	-0.08***
Married	0.100**	0.01	-0.03	-0.15***	0.00	-0.02
Some high school						
High school graduate	-0.46***	-0.34***	-0.14*	-0.44***	-0.17*	-0.32***
Some college	-1.02***	-0.76***	-0.33***	-0.87***	-0.46***	-0.70***
College graduate	-1.15***	-0.97***	-0.46***	-1.05***	-0.74***	-0.93***
Postgraduate	-1.29***	-1.21***	-0.61***	-1.2***	-1.13***	-1.17***
White non-Hispanic						
Black non-Hispanic	0.32***	0.19***	-.28***	0.43***	0.03	0.12**
Hispanic	0.11	0.11*	-0.06	0.15**	0.17***	-0.01
Asian non-Hispanic	0.10	0.03	-0.26***	0.34***	-0.27***	0.04
Other races	-0.17	-0.03	0.02	0.17*	-0.01	-0.03
Age	-0.01***	-0.02***	-0.01***	-0.02***	-0.01***	0.00***
Unemployed	0.10	0.22***	0.27***	0.32***	0.28***	0.16**
Income level <$15,000						
$15,000 to <$25,000	-0.33***	-0.20***	-0.09*	-0.31***	-0.04	-0.24***
$25,000 to <$35,000	-0.46***	-0.32***	-0.19***	-0.5***	-0.14**	-0.30***
$35,000 to <$50,000	-0.61***	-0.42***	-0.18***	-0.74***	-0.28***	-0.44***
$50,000 to <$75,000	-0.87***	-0.60***	-0.29***	-1.01***	-0.46***	-0.50***
$75,000 to <$100,000	-0.94***	-0.74***	-0.54***	-1.21***	-0.69***	-0.58***
$100,000 to <$150,000	-1.01***	-0.90***	-0.51***	-1.5***	-0.84***	-0.70***
>=$150,000	-1.17***	-1.06***	-0.81***	-1.51***	-1.05***	-0.80***
Observations	27,060	27,060	27,060	27,060	27,060	27,060
Pseudo R^2	0.07	0.09	0.05	0.12	0.10	0.06
Chi squared	1,672.26	2,568.01	1,746.24	2,629.87	3,115.07	1,899.54
County-level controls	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES

Appendix 1.3 Pairwise Correlations

Table 1.10 Pairwise Correlations

Notes: The table contains pairwise correlations of all variables at household and county levels. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Variables	Banked only	Underbanked	Unbanked	AFS dummy	Auto title loan use	Payday loan use	Revenue anticipation use	Pawnshop use	Rent-to-own use	Total AFS use	Financial literacy dummy	Financial literacy index	Female	Dependent children	Married	Education
Banked only	1.00															
Underbanked	-0.88***	1.00														
Unbanked	-0.37***	-0.12***	1.00													
AFS dummy	-0.95***	0.92***	0.17***	1.00												
Auto title loan uses	-0.45***	0.46***	0.05***	0.48***	1.00											
Payday loan uses	-0.52***	0.53***	0.06***	0.55***	0.55***	1.00										
Revenue anticipation uses	-0.41***	0.41***	0.06***	0.43***	0.64***	0.51***	1.00									
Pawnshop uses	-0.62***	0.57***	0.19***	0.66***	0.46***	0.49***	0.45***	1.00								
Rent-to-own uses	-0.47***	0.45***	0.09***	0.49***	0.60***	0.54***	0.60***	0.50***	1.00							
Total AFS uses	-0.84***	0.80***	0.18***	0.88***	0.56***	0.70***	0.56***	0.79***	0.61***	1.00						
Financial literacy dummy	0.25***	-0.19***	-0.14***	-0.23***	-0.15***	-0.15***	-0.15***	-0.19***	-0.17***	-0.23***	1.00					
Financial literacy index	0.28***	-0.21***	-0.19***	-0.25***	-0.16***	-0.16***	-0.17***	-0.21***	-0.19***	-0.26***	0.83***	1.00				
Female	0.00	-0.01**	0.03***	0.00	-0.09***	-0.04***	-0.09***	-0.03***	-0.06***	-0.03***	-0.21***	-0.23***	1.00			
Dependent children	-0.20***	0.19***	0.05***	0.21***	0.16***	0.17***	0.17***	0.16***	0.18***	0.23***	-0.09***	-0.10***	0.05***	1.00		
Married	0.14***	-0.07***	-0.14***	-0.11***	-0.01*	-0.06***	-0.01**	-0.09***	-0.02***	-0.10***	0.16***	0.18***	-0.07***	0.20***	1.00	
Education	0.19***	-0.11***	-0.18***	-0.16***	-0.02***	-0.07***	-0.04***	-0.13***	-0.07***	-0.15***	0.30***	0.34***	-0.10***	-0.01*	0.10***	1.00
White non Hispanic	0.17***	-0.15***	-0.07***	-0.16***	-0.12***	-0.14***	-0.13***	-0.12***	-0.11***	-0.17***	0.15***	0.17***	0.00	-0.09***	0.14***	0.01*
Black non Hispanic	-0.19***	0.16***	0.08***	0.18***	0.15***	0.17***	0.15***	0.14***	0.15***	0.19***	-0.15***	-0.18***	0.00	0.07***	-0.15***	-0.05***
Hispanic	-0.08***	0.07***	0.03***	0.07***	0.00	0.03***	0.01*	0.03***	0.01	0.06***	-0.09***	-0.10***	0.03***	0.08***	-0.05***	-0.02***
Asian non Hispanic	0.02***	-0.01**	-0.02***	-0.02***	0.01	-0.01*	0.02***	-0.02***	-0.01*	-0.02**	0.03***	0.03***	0.00	0.01	0.00	0.09***
Other races	-0.03***	0.02***	0.02***	0.03***	-0.01**	0.01**	-0.01*	0.04***	0.00	0.03***	-0.01	-0.01	0.02**	0.02***	-0.03***	0.01
Age	0.30***	-0.26***	-0.12***	-0.29***	-0.20***	-0.18***	-0.21***	-0.24***	-0.20***	-0.29***	0.25***	0.30***	-0.05***	-0.29***	0.20***	0.06***
Unemployed	-0.10***	0.02***	0.17***	0.06***	-0.01**	0.01	-0.01	0.07***	0.00	0.05***	-0.09***	-0.12***	0.00	-0.03***	-0.13***	-0.12***
Income level	0.24***	-0.13***	-0.24***	-0.20***	0.01	-0.07***	0.00	-0.16***	-0.04***	-0.17***	0.30***	0.35***	-0.16***	0.10***	0.45***	0.38***
Bank density	0.02***	-0.02**	-0.01	-0.01**	-0.01**	-0.02***	-0.01*	-0.01	0.01	-0.02**	0.02***	0.03***	0.04***	0.01	0.03***	0.00
AFS density	-0.10***	0.08***	0.06***	0.09***	0.05***	0.09***	0.04***	0.08***	0.06***	0.09***	-0.05***	-0.06***	0.02***	0.04***	0.00	-0.08***
Payday restrictions dummy	0.02***	-0.02***	0.00	-0.02***	0.00	-0.05***	0.01*	-0.01**	0.02***	-0.02***	-0.01**	-0.02***	0.00	-0.03***	-0.03***	0.02***
Auto title restrictions dummy	0.04***	-0.03***	-0.01**	-0.04***	-0.03***	-0.05***	-0.01*	-0.02***	-0.01	-0.04***	0.03***	0.03***	0.00	-0.03***	-0.01	0.05***

Metropolitan	0.03***	-0.02***	-0.02***	-0.02***	0.00	-0.01*	0.00	-0.01**	-0.04***	-0.03***	0.03***	0.02***	-0.05***	-0.02***	-0.04***	0.07***
Median household income	0.12***	-0.08***	-0.09***	-0.11***	-0.04***	-0.06***	-0.04***	-0.09***	-0.08***	-0.11***	0.10***	0.11***	-0.04***	-0.03***	0.01*	0.17***
Poverty rate	-0.12***	0.09***	0.08***	0.11***	0.05***	0.07***	0.06***	0.09***	0.08***	0.11***	-0.10***	-0.11***	0.02**	0.02***	-0.07***	-0.09***
Unemployment rate	-0.08***	0.06***	0.06***	0.07***	0.05***	0.05***	0.05***	0.06***	0.06***	0.08***	-0.08***	-0.10***	0.00	0.01*	-0.06***	-0.07***
Not finish high school rate	-0.12***	0.09***	0.08***	0.11***	0.05***	0.06***	0.06***	0.08***	0.07***	0.10***	-0.10***	-0.12***	0.01	0.04***	-0.05***	-0.13***
Population	0.03***	-0.02***	-0.02**	-0.03***	-0.01	-0.01**	0.00	-0.02***	-0.04***	-0.03***	0.03***	0.02***	-0.07***	-0.04***	-0.07***	0.10***

Table 1.10 Pairwise correlations (cont.)

Variables	White non Hispanic	Black non Hispanic	Hispanic	Asian non Hispanic	Other races	Age	Unempl-oyed	Income level	Bank density	AFS density	Payday restriction dummy	Auto title restrictions dummy	Metropoli-tan	Median household income	Poverty rate	Unempl oyment rate	Not finish high school rate	Populat-ion
White non Hispanic	1.00																	
Black non Hispanic	-0.62***	1.00																
Hispanic	-0.32***	-0.06***	1.00															
Asian non Hispanic	-0.42***	-0.07***	-0.06***	1.00														
Other races	-0.14***	0.00	0.03***	-0.03***	1.00													
Age	0.21***	-0.14***	-0.16***	-0.08***	-0.02***	1.00												
Unemployed	-0.07***	0.07***	0.03***	-0.01	0.03***	-0.11***	1.00											
Income level	0.09***	-0.11***	-0.06***	0.05***	-0.04***	0.15***	-0.21***	1.00										
Bank density	0.15***	-0.06***	-0.13***	-0.08***	0.00	0.03***	-0.02***	-0.01**	1.00									
AFS density	-0.06***	0.11***	0.00	-0.06***	0.02***	-0.02***	0.01	-0.08***	0.04***	1.00								
Payday restrictions dummy	-0.06***	0.09***	0.00	-0.01	-0.03***	-0.01	0.01	0.02***	-0.04***	-0.24***	1.00							
Auto title restrictions dummy	0.07***	-0.08***	-0.08***	0.05***	0.02***	0.01	-0.01	0.05***	0.11***	-0.40***	0.28***	1.00						
Metropolitan	-0.11***	0.07***	0.08***	0.06***	-0.02***	-0.02***	0.00	0.09***	-0.41***	-0.13***	0.06***	-0.04***	1.00					
Median household income	-0.03***	-0.05***	0.01	0.15***	-0.01*	0.00	-0.03***	0.22***	-0.15***	-0.41***	0.08***	0.19***	0.40***	1.00				
Poverty rate	-0.11***	0.14***	0.06***	-0.07***	0.02***	-0.05***	0.04***	-0.17***	-0.05***	0.39***	0.05***	-0.15***	-0.20***	-0.81***	1.00			
Unemployment rate	-0.16***	0.18***	0.06***	-0.02***	0.02***	-0.03***	0.05***	-0.10***	-0.31***	0.21***	0.11***	-0.09***	-0.01	-0.44***	0.66***	1.00		
Not finish high school rate	-0.15***	0.11***	0.15***	-0.03***	0.00	-0.04***	0.05***	-0.13***	-0.21***	0.36***	0.08***	-0.24***	-0.14***	-0.56***	0.65***	0.54***	1.00	
Population	-0.21***	0.09***	0.15***	0.14***	-0.03***	-0.04***	0.02***	0.10***	-0.54***	-0.14***	0.09***	-0.07***	0.66***	0.44***	-0.13***	0.08***	-0.02***	1.00

Appendix 1.4 Difference Among Banked Only, Underbanked, and Unbanked Households

Table 1.11 Test for Differences in Means

Notes: Panel A presents tests for the difference in means of different socio-demographic characteristics between banked only and underbanked households. Panel B presents tests for the difference in means of different socio-demographic characteristics between banked only and unbanked households. Panel C presents tests for the difference in means of socio-demographic characteristics between underbanked and unbanked households. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Panel A: Banked only vs. Underbanked							
	Banked only Observation No.	**Underbanked Observation No.**	**Banked only**	**Underbanked**	**Difference**	**t-value**	**p-value**
Financial literacy dummy	17,949	5,593	0.54	0.29	0.25	33.45	0.00
Financial literacy index	17,949	5,593	0.18	-0.26	0.44	37.90	0.00
Female	18,324	5,691	0.56	0.55	0.01	1.45	0.14
Dependent children	18,324	5,691	0.52	1.01	-0.49	-31.95	0.00
Married	18,324	5,691	0.58	0.47	0.11	14.50	0.00
Some high school	18,324	5,691	0.01	0.03	-0.02	-11.65	0.00
High school graduate	18,324	5,691	0.22	0.28	-0.06	-8.85	0.00
Some college	18,324	5,691	0.25	0.33	-0.08	-12.60	0.00
College graduate	18,324	5,691	0.36	0.28	0.08	11.55	0.00
Postgraduate	18,324	5,691	0.16	0.08	0.08	15.35	0.00
White non-Hispanic	18,324	5,691	0.84	0.69	0.15	25.50	0.00
Black non-Hispanic	18,324	5,691	0.07	0.19	-0.13	-28.55	0.00
Hispanic	18,324	5,691	0.07	0.12	-0.05	-11.85	0.00
Asian non-Hispanic	18,324	5,691	0.04	0.04	0.01	2.70	0.01
Other races	18,324	5,691	0.03	0.04	-0.01	-3.60	0.00
Age	18,324	5,691	51.47	40.36	11.12	45.65	0.00
Unemployed	18,324	5,691	0.03	0.05	-0.02	-7.45	0.00
Income level <$15,000	18,324	5,691	0.08	0.12	-0.04	-9.15	0.00
$15,000 to <$25,000	18,324	5,691	0.08	0.14	-0.06	-13.70	0.00
$25,000 to <$35,000	18,324	5,691	0.09	0.14	-0.05	-10.30	0.00
$35,000 to <$50,000	18,324	5,691	0.14	0.17	-0.03	-6.05	0.00
$50,000 to <$75,000	18,324	5,691	0.21	0.18	0.03	5.20	0.00
$75,000 to <$100,000	18,324	5,691	0.15	0.14	0.01	2.05	0.04
$100,000 to <$150,000	18,324	5,691	0.15	0.08	0.07	14.35	0.00
>=$150,000	18,324	5,691	0.09	0.03	0.06	15.90	0.00
Panel B: Banked only vs. Unbanked							
	Banked only Observation No.	**Unbanked Observation No.**	**Banked only**	**Unbanked**	**Difference**	**t-value**	**p-value**
Financial literacy dummy	17,949	1,226	0.54	0.15	0.39	26.70	0.00
Financial literacy index	17,949	1,226	0.18	-0.60	0.78	34.70	0.00
Female	18,324	1,258	0.56	0.63	-0.07	-4.85	0.00
Dependent children	18,324	1,258	0.52	0.87	-0.35	-12.50	0.00
Married	18,324	1,258	0.58	0.24	0.34	24.00	0.00
Some high school	18,324	1,258	0.01	0.14	-0.12	-31.75	0.00
High school graduate	18,324	1,258	0.22	0.43	-0.21	-17.30	0.00
Some college	18,324	1,258	0.25	0.28	-0.03	-2.60	0.01
College graduate	18,324	1,258	0.36	0.13	0.23	16.70	0.00
Postgraduate	18,324	1,258	0.16	0.02	0.14	13.40	0.00
White non-Hispanic	18,324	1,258	0.84	0.68	0.16	14.85	0.00

Black non-Hispanic	18,324	1,258	0.07	0.20	-0.14	-18.05	0.00
Hispanic	18,324	1,258	0.07	0.12	-0.05	-6.95	0.00
Asian non-Hispanic	18,324	1,258	0.04	0.02	0.02	3.35	0.00
Other races	18,324	1,258	0.03	0.05	-0.02	-4.15	0.00
Age	18,324	1,258	51.47	39.30	12.18	25.50	0.00
Unemployed	18,324	1,258	0.03	0.20	-0.16	-28.85	0.00
Income level <$15,000	18,324	1,258	0.08	0.44	-0.36	-43.10	0.00
$15,000 to <$25,000	18,324	1,258	0.08	0.21	-0.13	-15.65	0.00
$25,000 to <$35,000	18,324	1,258	0.09	0.13	-0.04	-4.35	0.00
$35,000 to <$50,000	18,324	1,258	0.14	0.09	0.05	5.40	0.00
$50,000 to <$75,000	18,324	1,258	0.21	0.08	0.13	11.45	0.00
$75,000 to <$100,000	18,324	1,258	0.15	0.02	0.13	12.60	0.00
$100,000 to <$150,000	18,324	1,258	0.15	0.02	0.13	12.90	0.00
>=$150,000	18,324	1,258	0.09	0.01	0.08	9.80	0.00
Panel C: Underbanked vs. Unbanked							
	Underbanked Observation No.	**Unbanked Observation No.**	**Underbanked**	**Unbanked**	**Difference**	**t-value**	**p-value**
Financial literacy dummy	5,593	1,226	0.29	0.15	0.14	9.95	0.00
Financial literacy index	5,593	1,226	-0.26	-0.60	0.34	15.35	0.00
Female	5,691	1,258	0.55	0.63	-0.08	-5.25	0.00
Dependent children	5,691	1,258	1.01	0.87	0.14	3.70	0.00
Married	5,691	1,258	0.47	0.24	0.23	15.35	0.00
Some high school	5,691	1,258	0.03	0.14	-0.10	-14.90	0.00
High school graduate	5,691	1,258	0.28	0.43	-0.15	-10.90	0.00
Some college	5,691	1,258	0.33	0.28	0.05	3.50	0.00
College graduate	5,691	1,258	0.28	0.13	0.15	11.00	0.00
Postgraduate	5,691	1,258	0.08	0.02	0.06	7.40	0.00
White non-Hispanic	5,691	1,258	0.69	0.68	0.01	0.70	0.49
Black non-Hispanic	5,691	1,258	0.19	0.20	-0.01	-1.00	0.33
Hispanic	5,691	1,258	0.12	0.12	-0.00	-0.35	0.73
Asian non-Hispanic	5,691	1,258	0.04	0.02	0.01	2.05	0.04
Other races	5,691	1,258	0.04	0.05	-0.01	-1.80	0.07
Age	5,691	1,258	40.36	39.30	1.06	2.40	0.02
Unemployed	5,691	1,258	0.05	0.20	-0.14	-17.50	0.00
Income level <$15,000	5,691	1,258	0.12	0.44	-0.32	-28.85	0.00
$15,000 to <$25,000	5,691	1,258	0.14	0.21	-0.07	-6.10	0.00
$25,000 to <$35,000	5,691	1,258	0.14	0.13	0.01	0.95	0.33
$35,000 to <$50,000	5,691	1,258	0.17	0.09	0.09	7.70	0.00
$50,000 to <$75,000	5,691	1,258	0.18	0.08	0.10	8.95	0.00
$75,000 to <$100,000	5,691	1,258	0.14	0.02	0.12	11.70	0.00
$100,000 to <$150,000	5,691	1,258	0.08	0.02	0.06	7.30	0.00
>=$150,000	5,691	1,258	0.03	0.01	0.02	3.50	0.00

Appendix 1.5 Treating "Don't Know" Answer as Missing Observations

Table 1.12 Financial Literacy and Likelihood of Banked Only, Underbanked, and Unbanked Households - "Don't know" answers treated as missing observations, 2018

Notes: The dependent variables have a value of 1 if a household is banked only and 0 if the household is underbanked in Columns (1) and (2). Similar values are assigned if a household is banked only or unbanked in Columns (3) and (4), and the same applies if a household is underbanked or unbanked in Columns (5) and (6). The key explanatory variables are the *Financial literacy dummy* in Columns (1), (3), and (5), and the *Financial literacy index* in Columns (2), (4), and (6). Panel A shows logit regression results, while Panel B shows the average marginal effects of both the *Financial literacy dummy* and the *Financial literacy index* on the dependent variables. "Don't know" answers are counted as missing observations when constructing *Financial literacy dummy* and *Financial literacy index* variables. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent variable	(1) **Banked only vs. Underbanked**	(2) **Banked only vs. Underbanked**	(3) **Banked only vs. Unbanked**	(4) **Banked only vs. Unbanked**	(5) **Underbanked vs. Unbanked**	(6) **Underbanked vs. Unbanked**
A: Logit regressions						
Financial literacy dummy	1.30***		1.35***		0.42***	
Financial literacy index		1.05***		1.02***		0.12
Female	0.33***	0.37***	0.02	0.12	-0.35**	-0.33*
Dependent children	-0.30***	-0.29***	-0.34***	-0.33***	0.07	0.06
Married	0.05	0.08	0.34*	0.38*	0.44**	0.45**
Some high school						
High school graduate	0.52	0.4	1.20***	1.09**	0.66**	0.68**
Some college	0.57*	0.41	1.45***	1.30***	0.85***	0.89***
College graduate	0.89***	0.66**	1.93***	1.73***	1.09***	1.15***
Postgraduate	0.93***	0.72**	2.14***	1.91***	1.11**	1.17***
White non-Hispanic						
Black non-Hispanic	-0.95***	-0.77***	-0.48**	-0.34	0.28	0.26
Hispanic	-0.30***	-0.28**	0.13	0.24	0.46*	0.44*
Asian non-Hispanic	-0.07	-0.06	-0.05	0.01	-0.08	-0.08
Other races	-0.2	-0.22	-0.64*	-0.54	-0.52*	-0.53*
Age	0.04***	0.04***	0.03***	0.02***	-0.01	-0.01
Unemployed	0.16	0.16	-0.97***	-0.95***	-1.00***	-0.97***
Income level <$15,000						
$15,000 to <$25,000	-0.56***	-0.48***	0.05	0.10	0.47**	0.49**
$25,000 to <$35,000	-0.45***	-0.43**	0.45*	0.49*	0.85***	0.86***
$35,000 to <$50,000	-0.23	-0.22	1.54***	1.58***	1.71***	1.72***
$50,000 to <$75,000	0.11	0.1	1.61***	1.63***	1.39***	1.42***
$75,000 to <$100,000	0	0.06	2.17***	2.19***	2.29***	2.30***
$100,000 to <$150,000	0.42***	0.39**	2.16***	2.18***	1.78***	1.79***
>=$150,000	0.98***	0.92***	2.09***	2.06***	0.95**	0.97**
Observations	9,302	9,302	7,425	7,425	2,379	2,379
Pseudo R-squared	0.28	0.30	0.36	0.37	0.18	0.17
Chi squared	247.94	1,795.32	2,011.66	720.6	758.45	253.13
County-level controls	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES
B: Average marginal effects						

Financial literacy dummy	0.16***		0.03***		0.03***			
Financial literacy index		0.12***		0.02***		0.01		

Table 1.13 Ordered Logit Results: AFS Use Frequency and Financial Literacy- "Don't know" answers treated as missing observations, 2018

Notes: The dependent variables are the frequency (none, 1, 2, 3, or 4 or more times) of a household using different types of AFS in the last 5 years. We consider the frequency of using auto title loans (Columns (1) and (2)); payday loans (Columns (3) and (4)); revenue anticipation (Columns (5) and (6)); pawnshops (Columns (7) and (8)); rent-to-own services (Columns (9) and (10)); and any AFS (Columns (11) and (12)). The key explanatory variables are the *Financial literacy dummy* in Columns (1), (3), (5), (7), (9) and (11), and the *Financial literacy index* in Columns (2), (4), (6), (8), (10) and (12). Panel A shows logit regression results while Panel B shows the average marginal effects of both the *Financial literacy dummy* and the *Financial literacy index* on the dependent variables. "Don't know" answers are counted as missing observations when constructing *Financial literacy dummy* and *Financial literacy index* variables. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

Dependent variables	(1) Auto title loans	(2) Auto title loans	(3) Payday	(4) Payday	(5) Revenue anticipation	(6) Revenue anticipation	(7) Pawnshop	(8) Pawnshop	(9) Rent-to-own	(10) Rent-to-own	(11) Total AFS uses	(12) Total AFS uses
A: Logit regressions												
Financial literacy dummy	-1.85***		-1.55***		-2.12***		-1.37***		-1.90***		-1.39***	
Financial literacy index		-1.35***		-1.16***		-1.52***		-1.01***		-1.40***		-1.13***
Unbanked	-0.01	0.00	0.28	0.29	0.12	0.16	0.69***	0.68***	0.27	0.27	0.66***	0.60***
Female	-0.61***	-0.64***	-0.55***	-0.58***	-0.97***	-1.03***	-0.49***	-0.52***	-0.67***	-0.71***	-0.41***	-0.47***
Dependent children	0.24***	0.22***	0.32***	0.30***	0.34***	0.33***	0.25***	0.24***	0.31***	0.30***	0.31***	0.30***
Married	0	-0.03	-0.15*	-0.17**	0.08	0.05	-0.09	-0.12	0.00	-0.04	-0.07	-0.09
Some high school												
High school graduate	0.12	0.18	0.16	0.21	-0.27	-0.34	-0.26	-0.18	0.01	0.08	-0.12	-0.06
Some college	0.28	0.42	0.40	0.53*	-0.09	-0.06	-0.28	-0.15	0.15	0.31	-0.12	0.00
College graduate	-0.02	0.17	0.00	0.16	-0.49	-0.44	-0.51*	-0.34	-0.19	0.02	-0.46	-0.28
Postgraduate	0.18	0.34	0.08	0.22	-0.24	-0.23	-0.56*	-0.42	0.02	0.18	-0.49*	-0.32
White non-Hispanic												
Black non-Hispanic	0.81***	0.68***	0.98***	0.83***	0.84***	0.69***	0.73***	0.60***	0.80***	0.65***	0.94***	0.76***
Hispanic	-0.14	-0.15	0.17	0.19	-0.05	-0.05	0.05	0.06	-0.11	-0.11	0.17	0.13
Asian non-Hispanic	0.19	0.17	0.06	0.04	0.65***	0.67***	-0.20	-0.24*	0.08	0.05	0.08	0.08
Other races	-0.83***	-0.77**	-0.19	-0.11	-0.61*	-0.53	0.15	0.21	-0.25	-0.15	0.08	0.12
Age	-0.05***	-0.04***	-0.04***	-0.03***	-0.07***	-0.06***	-0.05***	-0.04***	-0.05***	-0.04***	-0.04***	-0.04***
Unemployed	-0.52*	-0.51*	-0.30	-0.30	-0.38	-0.34	-0.06	-0.08	-0.75***	-0.75***	-0.20	-0.22
Income level <$15,000												
$15,000 to <$25,000	0.24	0.18	0.36**	0.30*	0.34*	0.31	0.32*	0.26	0.09	0.06	0.51***	0.44***
$25,000 to <$35,000	0.45**	0.46**	0.50***	0.50***	0.55**	0.55**	0.22	0.22	0.25	0.22	0.46***	0.48***
$35,000 to <$50,000	0.30	0.33*	0.34**	0.36**	0.49**	0.56***	0.02	0.03	0.05	0.08	0.27*	0.28*
$50,000 to <$75,000	0.42**	0.46**	0.13	0.15	0.49***	0.55***	-0.15	-0.14	0.04	0.07	-0.02	0.01
$75,000 to <$100,000	0.89***	0.84***	0.53***	0.46***	1.03***	0.95***	0.04	-0.04	0.56***	0.50***	0.2	0.16

Dependent variables	(1) Auto title loans	(2) Auto title loans	(3) Payday	(4) Payday	(5) Revenue anticipation	(6) Revenue anticipation	(7) Pawnshop	(8) Pawnshop	(9) Rent-to-own	(10) Rent-to-own	(11) Total AFS uses	(12) Total AFS uses
$100,000 to <$150,000	0.48**	0.53***	0.14	0.18	0.63***	0.66***	-0.42***	-0.40**	0.14	0.18	-0.30**	-0.26*
>=$150,000	-0.01	0.13	-0.77***	-0.65***	0.09	0.24	-1.11***	-1.03***	-0.60**	-0.46*	-0.90***	-0.81***
Observations	9,553	9,553	9,553	9,553	9,553	9,553	9,553	9,553	9,553	9,553	9,553	9,553
Pseudo R-squared	0.23	0.26	0.21	0.24	0.30	0.33	0.20	0.22	0.25	0.28	0.21	0.23
Chi squared	2,779.42	1,725.38	2,148.62	1,977.77	2,193.58	1,770.87	2,083.85	2,097.85	2,238.17	1,878.95	2,147.98	2,465.36
County-level controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Standard errors clustered	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
B: Average marginal effects												
Financial literacy dummy												
	0.14***		0.13***		0.13***		0.13***		0.13***		0.17***	
	-0.04***		-0.03***		-0.03***		-0.03***		-0.04***		-0.02***	
	-0.03***		-0.03***		-0.03***		-0.02***		-0.03***		-0.02***	
	-0.03***		-0.03***		-0.03***		-0.03***		-0.03***		-0.01***	
	-0.03***		-0.05***		-0.05***		-0.05***		-0.04***		-0.12***	
Financial literacy index												
		0.10***		0.09***		0.08***		0.09***		0.09***		0.13***
		-0.03***		-0.02***		-0.02***		-0.02***		-0.02***		-0.02***
		-0.02***		-0.02***		-0.02***		-0.02***		-0.02***		-0.01***
		-0.02***		-0.02***		-0.02***		-0.02***		-0.02***		-0.01***
		-0.02***		-0.03***		-0.03***		-0.04***		-0.03***		-0.09***

Table 1.14 Logit Results: AFS Use, Credit Card Use and Financial Literacy of Banked Households - "Don't know" answers treated as missing observations, 2018

Notes: The dependent variables take on a value of 1 if a banked household has been using any AFS in the last 5 years, and 0 otherwise. The key explanatory variables are the *Financial literacy dummy* and the *Credit card dummy* in Column (1); and the *Financial literacy index* and the *Credit card dummy* in Column (2). The key explanatory variables are the *Financial literacy dummy* and the *Credit card dummy* and their interaction in Column (3); and the *Financial literacy index* and the *Credit card dummy* and their interaction in Column (4). The key explanatory variables are the *Financial literacy dummy* and the *Carried over balance* dummy in Column (5), and the *Financial literacy index* and the *Carried over balance* dummy in Column (6). The key explanatory variables are the *Financial literacy dummy* and the *Carried over balance* dummy variable and their interaction in Column (7), and the *Financial literacy index* and the *Carried over balance* dummy variable and their interaction in Column (8). Panel A shows logit regression results, while Panel B shows the average marginal effects of both the *Financial literacy dummy* (Columns (1) and (5)) and the *Financial literacy index* on the dependent variables (Columns (2) and (6)); the *Financial literacy dummy* and the *Financial literacy index* and their interaction with the *Credit card dummy* on the dependent variables (Columns (3) and (4)); the *Financial literacy dummy* and the *Financial literacy index* and their interaction with the *Carried over balance* dummy variable on the dependents variables (Columns (7) and (8)). "Don't know" answers are counted as missing observations when constructing *Financial literacy dummy* and *Financial literacy index* variables. All regressions include banking, AFS, AFS regulation, and demographic county-level control variables. Robust standard errors are clustered at the county level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Source: Authors' calculations based on FINRA Foundation NFCS, FDIC, NCUA, ACS, BLS, and CFA (2018) data.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**	**AFS dummy**
A: Logit regressions								
Financial literacy dummy	-1.30***		-0.42**		-1.38***		-1.55***	
Financial literacy index		-1.06***		-0.29***		-1.13***		-1.19***
Financial literacy dummy x Credit card dummy			-1.02***					
Financial literacy index x Credit card dummy				-0.88***				
Credit card dummy	-0.45***	-0.51***	0.19	-0.69***				
Financial literacy dummy x Carried over balance							0.28**	
Financial literacy index x Carried over balance								0.11
Carried over balance					0.78***	0.77***	0.60***	0.79***
Female	-0.34***	-0.38***	-0.33***	-0.37***	-0.42***	-0.47***	-0.42***	-0.47***
Dependent children	0.30***	0.29***	0.30***	0.28***	0.24***	0.22***	0.24***	0.22***
Married	-0.03	-0.06	-0.03	-0.05	-0.02	-0.05	-0.02	-0.05
Some high school								
High school graduate	-0.52	-0.4	-0.54*	-0.47	-0.3	-0.26	-0.32	-0.26
Some college	-0.59*	-0.43	-0.62*	-0.51	-0.4	-0.3	-0.42	-0.31

Dependent variables	(1) AFS dummy	(2) AFS dummy	(3) AFS dummy	(4) AFS dummy	(5) AFS dummy	(6) AFS dummy	(7) AFS dummy	(8) AFS dummy
College graduate	-0.89***	-0.66*	-0.92***	-0.74**	-0.65*	-0.49	-0.67*	-0.49
Postgraduate	-0.92***	-0.71**	-0.95***	-0.78**	-0.63*	-0.49	-0.65*	-0.49
White non-Hispanic								
Black non-Hispanic	0.94***	0.76***	0.94***	0.75***	0.98***	0.78***	0.99***	0.79***
Hispanic	0.30***	0.28**	0.31***	0.30***	0.20*	0.19	0.21*	0.19
Asian non-Hispanic	0.1	0.09	0.1	0.09	0.17	0.16	0.18	0.16
Other races	0.19	0.22	0.2	0.24	0.16	0.22	0.15	0.22
Age	-0.04***	-0.04***	-0.04***	-0.03***	-0.05***	-0.04***	-0.05***	-0.04***
Unemployed	-0.2	-0.2	-0.19	-0.17	-0.48*	-0.48*	-0.49*	-0.47*
Income level <$15,000								
$15,000 to <$25,000	0.62***	0.55***	0.58***	0.51***	0.33	0.26	0.33	0.26
$25,000 to <$35,000	0.54***	0.54***	0.49***	0.46***	0.19	0.17	0.18	0.16
$35,000 to <$50,000	0.35**	0.36**	0.32**	0.30*	-0.03	-0.04	-0.03	-0.04
$50,000 to <$75,000	0.03	0.07	-0.01	0.02	-0.29*	-0.26	-0.31*	-0.27
$75,000 to <$100,000	0.15	0.12	0.11	0.06	-0.21	-0.25	-0.21	-0.25
$100,000 to <$150,000	-0.27*	-0.23	-0.30*	-0.27*	-0.55***	-0.51***	-0.55***	-0.51***
>=$150,000	-0.83***	-0.75***	-0.86***	-0.77***	-1.03***	-0.95***	-1.03***	-0.94***
Observations	9,259	9,259	9,259	9,259	8,477	8,477	8,477	8,477
Pseudo R^2	0.28	0.31	0.28	0.31	0.31	0.34	0.31	0.34
Chi squared	1,988.14	1,787.56	1,987.09	1,869.62	2,102.23	1,793.29	1,976.24	1,789.18
County-level controls	YES	YES	YES	YES	YES	YES	YES	YES
Standard error clustered	YES	YES	YES	YES	YES	YES	YES	YES
B: Average marginal effects								
Financial literacy dummy	-0.16***		-0.05**		-0.15***		-0.17***	
Financial literacy index		-0.12***		-0.03***		-0.12***		-0.12***
Financial literacy dummy x Credit card dummy			-0.12***					
Financial literacy index x Credit card dummy				-0.10***				
Financial literacy dummy x Carried over balance							0.03**	
Financial literacy index x Carried over balance								0.01

Chapter 2 Brick-And-Mortar or Digital? The Impact of Technology on Bank Branching and Financial Inclusion

2.1. Introduction

Since their peak number (99,550) in 2009, more than 13,000 bank offices have closed, a decline of 13 percent, raising concerns that fewer branch offices will result in "banking deserts" and erode financial inclusion for low-income and minority communities (Morgan, Pinkovskiy, and Yang, 2016). Without access to formal financial services, people may turn to informal, alternative financial service providers such as high-interest payday lenders, pawnshops, and check-cashing companies. These alternative financial services are considered to be costlier and may hurt the economic wellbeing of households.

Branching is the method by which banks have traditionally entered new markets and competed with one another. If customers solely rely on bank offices to make banking transactions, it is reasonable to worry about the lack of financial inclusion in banks close to their offices. However, banking technology, especially digital banking—which makes all bank functions, including autopay, peer-to-peer payments, account and loan management, etc., available online is a rising alternative to brick-and-mortar branches. As more and more customers shift to online banking, traditional branch banking could be less critical than before. This paper looks at the impact of banking technology on the growth rate of bank offices and asks whether the replacement of bank offices by digital banking is actually harmful to financial inclusion.

The first question that this paper seeks to answer is whether the investment into banking technology to facilitate digital banking has a negative impact on the growth rate of the bank's office number. Pressure from either (or both) the supply or demand side can prompt a bank to close

branches. On the supply side, a bank whose expenses include costly properties and fixed assets, e.g., rent, taxes, maintenance costs, and utilities, may be motivated to close its branches (Hinton, Thieme, and Woodhead, 2017). Banks may also shed branches due to industry consolidations that cause markets to overlap (Hinton, Thieme, and Woodhead, 2017; Nguyen, 2019). Note, however, that while Figure 2.1 shows a sharp decline in the number of FDIC-insured institutions from 2001 to 2019, there is only a general downward trend in the branch numbers since 2010. In the decades before the financial crisis, branch numbers steadily rose (Stackhouse, 2018), in large part because of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. This Act allowed banks that operated in multiple states to consolidate their separate state charters and convert existing banks into branches.

(Insert Figure 2.1 here)

On the demand side, branch closures or debranching can stem from weakening local demand attributable to population decline and/or migration (Hinton, Thieme, and Woodhead, 2017). According to Morgan, Pinkovskiy, and Yang (2016), who focus on the consequences rather than the source of debranching, other causes may include deteriorating local economic conditions following the 2008 financial crisis and increased online banking.

Since the first bank websites launched in the U.S. in 1995 (Barth and Brumbaugh Jr., 1995), digital banking has developed dramatically, reshaping the industry (DeYoung Lang, and Nolle, 2007; Hernández-Murillo, Llobet, and Fuentes, 2010). The adoption of financial technology (fintech) has allowed banks to invest in digital banking services; as of 2019, more than 90 percent of all FDIC-insured depository institutions had transactional websites. Banks can even apply credit scoring tools that use big data in digital retail lending (Frame, Wall, and White, 2018). The shift of customer preference toward digital banking services reduces the need for traditional interactions

between banks and customers (Demos, 2019; FDIC, 2017; Stackhouse, 2018). This paper aims at providing empirical evidence to support the idea that investing in digital banking is a reason for bank office closure, which is under-investigated in the literature.

Frame, Wall, and White (2018) provide a literature review of some of the major technology-driven financial innovations of recent decades. However, the effects of digital banking on the industry have attracted less scholarship. Using a structural equation model, Acharya, Kagan, and Lingham (2008) construct a performance measure for a sample of more than 600 community banks and find that when community banks adopt online banking, their financial performance improves. DeYoung, Lang, and Nolle (2007) look at changes in different financial indicators of community banks from 1999 to 2001 and conclude that adding a transactional website increases profitability. Hernando and Nieto (2007), and Ciciretti, Hasan, and Zazzara (2009) give international evidence of online banking's positive impact on Spain and Italy's bank performance. In a different focus, Sullivan and Wang (2013) find that online banking adoption positively correlates with the average bank size at the state level. In a recent study, Feng and Wu (2019) examine the impact of technology investment on bank productivity and employment. They find that lagged technology spending of banks contributes to the net output, and the contribution of technology to bank productivity was more potent after the financial crisis of 2007-2009. In addition, their study also indicates that the use of technology increases the employment of banks. This paper takes an empirical approach to examine a different aspect: the correlation between bank office growth rates and online and mobile banking by proposing the first Hypothesis:

(H2.1) A bank that invests heavily in digital banking has a lower office growth rate than other banks.

After the enactment of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, banks had reason to restructure offices so as to reduce costs and enhance risk management. Therefore, it is reasonable to infer that banks that make significant fintech investments to facilitate digital banking will lower their office growth rates. To estimate the impact of this shift in High-Tech/Digital Bank branching behavior, I propose the second Hypothesis:

(H2.2) The difference between the office growth rates of High-Tech/Digital Banks and other banks is even more significant for the years after 2010.

The literature on financial inclusion documents a positive relationship between bank branches' existence and the supply of local banking services, i.e., financial inclusion. Célerier and Matray (2019) use the deregulation of U.S. interstate branching between 1994 and 2005 to demonstrate that the exogenous expansion of bank branches increased low-income financial inclusion over the period. Nguyen (2019) estimates the impacts of branch closures following mergers and acquisitions of big banks from 1999 to 2012 and finds that M&A-induced branch closures led to a decline in local small-business lending. It is reasonable to conclude that without advances in fintech, branch closures would have led to inadequate financial inclusion in communities with lost bank offices (Friedline, 2018). However, as fintech reduces the adverse effects of geographic distance between banks and clients, the impacts of closures attributable to the transition to online banking may be less deleterious than closures caused by other reasons. To the knowledge of the author, there is still a lack of empirical evidence on the positive impact of banking technology on financial inclusion. This study aimed to fill this gap by offering the third Hypothesis:

(H2.3) Bank offices' closures induced by banking technology have less negative impact on local retail bank services than closures caused by other reasons.

In this study, two proxies for high-tech banks are used. The first, High-Tech Bank, refers to a bank that invests heavily in banking technologies, like telecommunication and data processing services, that facilitate digital banking services. The second, Digital Bank, refers to a High-Tech Bank that explicitly provides a website that offers transactional experience online. With these proxies, I can investigate how office growth rates differ between High-Tech Banks/Digital Banks and other banks, which I call basic banks. (These are banks with a lower investment in technologies or do not have a website that facilitates online banking services.) Using bank-level panel data from 2001 to 2019, I find supporting evidence for Hypothesis 2.1 (H2.1). On average, the rate of office growth per year of a High-Tech Bank is 1.3 percentage points lower than that of a basic bank. This effect gains greater significance in the years after 2010, which supports Hypothesis 2.2 (H2.2). For instance, the difference in office growth rate between a Digital Bank and a basic bank is 2.4 percentage points greater per year than in the pre-2010 years.

To compare the impacts on county-level financial inclusion when a High-Tech/Digital Bank closes offices versus the impacts when a basic bank closes offices, I select all counties that experienced a net decline in the number of bank offices from 2008 to 2019 and which did not regain offices in the following four-year period. I also compare the percentage of the county population's use of retail banking services like checking accounts and credit cards for the four years before closure with the percentage in the four years post-closure. In counties where technology adoption caused office closures, the negative impacts on local financial inclusion were less than in counties where offices closed for other reasons, supporting Hypothesis 2.3 (H2.3). I also find evidence of greater use of online banking in counties where an office closed because the bank had adopted financial technologies. This suggests that people shift to online banking after

bank offices are closed. This finding is supported by Choi and Loh (2019), who show that after banks reduce the number of ATM locations, customers increase their use of digital banking.

The paper contributes to the literature with additional evidence of the impact of high technology and digital banking on debranching. It also adds evidence that an office closure does not necessarily reduce local financial inclusion if the cause of the closure was a bank's adoption of online and digital banking services and the shift of its customers away from traditional branch banking.

The remainder of the paper proceeds as follows. In the next section, an explanation of data and variables is provided. This is followed by Section 2.3, with a detailed discussion of the models used and the results of the empirical analysis. Robustness tests are then provided in Section 2.4, with the conclusions and future research in Section 2.5.

2.2. Data & Variables

The bank-level data are panel data of FDIC-insured depository institutions for 2001–2019. Two proxies were created to identify whether a bank invests in high technology to facilitate its digital banking services. These are High-Tech Bank and Digital Bank, mainly based on technology expenses. Technology expenses are the sum of two items in the "Reports of Condition and Income" (Call Reports) obtained from the Federal Financial Institutions Examination Council: (1) data processing expenses, (2) telecommunications expenses[7]. Technology expenses show how much a bank invests in technologies that facilitate remote banking activities, e.g., online and mobile banking. Thus, the first proxy, High-Tech Bank, includes any bank that for each year 2001–2019 shows a ratio of technology expenses-to-total assets above the median, while a bank with a below-median spending ratio is a basic bank. The second proxy, Digital Bank, is a bank that have a ratio

[7] This data is available on Call Reports from 2001.

of technology expenses-to-total assets above the median and includes a transactional website. Since 2003, banks have reported whether they offer online transactional services (FDIC, 2020) in their Call Reports. Therefore, a Digital Bank is a High-Tech Bank with a transactional website, and other banks are basic banks. On average, a Hi-Tech Bank or a Digital Bank has fewer offices and fewer employees per bank than other banks (Table 2.1).

(Insert Table 2.1 here)

To test Hypothesis 2.1 (H2.1) and Hypothesis 2.2 (H2.2), I use two dependent variables. The first one is the one-year growth rate in total bank branches, defined by formula (2.1).

$$(2.1) \quad 1\_year\_office\_growth_{b,t} = \frac{(Number\ of\ Offices_{b,t} - Number\ of\ Offices_{b,t-1})}{Number\ of\ Offices_{b,t-1}}$$

One could argue that the change in the number of bank offices attributable to technology adoption might have some delay effects. Therefore, the second dependent variable is used, which measures the two-year growth rate in the total number of a bank's branches, defined by:

$$(2.2) \quad 2\_year\_office\_growth_{b,t} = \frac{(Number\ of\ Offices_{b,t} - Number\ of\ Offices_{b,t-2})}{Number\ of\ Offices_{b,t-2}}$$

I compile bank-level financial variables from the FDIC's Statistics on Depository Institutions (SDI) as control variables. These variables provide information about the bank's financial characteristics, including equity, nonperforming loans, returns, liquid assets, core deposits, total loans. All are scaled by Total Assets. The size of the bank is also controlled for by using the logarithm of 1 plus Total Assets. Such non-financial characteristics of the bank are also used as a community bank dummy and the De novo bank dummy. Especially, variables that could affect a bank's decision to close some branches, as indicated in the literature, are also included. Among them are the number of domestic bank branches, the dummies variables showing whether the bank experience merger and acquisition (M&A) in the current year or one year ago, and the total premises-to-Total Assets ratio. The insured depository institution M&A data come from the

FDIC's "Reports of Structure Changes." See Table 2.2 for the list of all bank-level variables, their definitions, and data sources.

(Insert Table 2.2 here)

In the regression to test the third Hypothesis (H2.3), the county-level panel data for 2007–2019 are collected from different sources. The dependent variables indicating financial inclusion are percentages of each county's population that use banking services, like checking accounts, credit cards, and online banking services. The data is obtained from the SimmonsLOCAL consumer survey for 2008–2019. The data of depository institutions' offices per county comes from the FDIC Summary of Deposits (SOD). To control for banks' competitors in the area (the supply side), I collect the data on the numbers of a county's alternative financial services and credit union establishments from the Bureau of Labor Statistics (BLS). The alternative financial services (AFSs) are those establishments that have the NAICS industry code of 522291 (consumer lending), 522390 (Other credit intermediation activities), 522298 (All other non-depository credit intermediation). The county-level demographic variables for the years 2009–2018 are obtained from the American Community Survey (ACS). For the years 2007 and 2008, county-level demographic data are interpolated from the 2000 Census and ACS 2009. These county-level demographic variables include those that indicate population, percentage of the population with low educational attainment, poverty, unemployment, minority population, elders (see Table 2.2 for the list of all variables, their definitions, and data sources). Also, two dummy variables indicate whether any bank in the county experienced an M&A this year or last year (data obtained from the FDIC's "Reports of Structure Changes").

2.3. Models and Empirical Results

(H2.1) A bank that invests heavily in digital banking has a lower office growth rate.

To estimate the relationship between being a High-Tech Bank or Digital Bank and the rate of branch growth, I use two fixed-effect models:

(2.3) $1\_year\_office\_growth_{b,t} = \alpha + \beta_1 Banktype_{b,t-1} + \sum_{i=1}^{k} \gamma_i Bank\_controls_{b,t-1} + \delta_t + \theta_b + \varepsilon_{b,t}$

(2.3) $2\_year\_office\_growth_{b,t} = \alpha + \beta_1 Banktype_{b,t-2} + \sum_{i=1}^{k} \gamma_i Bank\_controls_{b,t-2} + \delta_t + \theta_b + \varepsilon_{b,t}$

The critical variables in Model (2.3) are the dummy variables $Banktype_{b,t-1}$, which shows a value of 1 if, in year *t-1*, bank *b* is a High-Tech/Digital Bank; and has a value of 0 otherwise. $Bank\_controls_{b,t-1}$ show the one-year lagged bank controls variables; δ_t presents the time fixed effects, and θ_b shows the bank fixed effects.

Model (2.4) is similar to Model (2.3) except for the dependent variable. Here the two-year branch growth rate per bank is used. All *Banktype* and *Bank_controls* variables in Model (2.4) are lagged by two years.

Table 2.3 presents the regression results for Model (2.3) in Columns (1) and (2), and for Model (2.4) in Columns (3) and (4). Columns (1) and (3) show the same results, i.e., that a High-Tech Bank has significantly lower one- and two-year rates of office growth. On average, a High-Tech Bank shows a one-year office growth rate that is 1.3 percentage points lower and a two-year growth rate that is 2.5 percentage points lower than a basic bank. Being a Digital Bank indicates similar results. Columns (2) and (4) of Table 2.3 show that a Digital Bank has a one-year growth rate that is 1 percentage point lower and a two-year growth rate that is 2.5 percentage points lower than a basic bank.

(Insert Table 2.3 here)

To test the second Hypothesis (H2.2), I use the following Model (2.5) and Model (2.6).

(2.5) $1\_year\_office\_growth_{b,t} = \alpha + \beta_1 Banktype_{b,t-1} + \beta_2 Post_{t-1} +$

$\beta_3 Banktype_{b,t-1} \times Post_t + \sum_{i=1}^{k} \gamma_i Bank\_controls_{b,t-1} + \delta_t + \theta_b + \varepsilon_{b,t}$

(2.6) $2\_year\_office\_growth_{b,t} = \alpha + \beta_1 Banktype_{b,t-2} + \beta_2 Post_{t-2} +$

$\beta_3 Banktype_{b,t-2} \times Post_{t-2} + \sum_{i=1}^{k} \gamma_i Bank\_controls_{b,t-2} + \delta_t + \theta_b + \varepsilon_{b,t}$

Model (2.5) repeats Model (2.3) but adds two variables. The first is $Post_{t-1,}$ which is a dummy with a value of 1 if the year *t-1* is after 2010 and 0 otherwise. The variable of interest is the second added variable. It is the interaction between $Post_{t-1}$ and $Banktype_{b,t-1}$ dummy.

Model (2.6) is similar to Model (2.5), but the dependent variable is the two-year office growth rate. The variable of interest is the interaction between $Post_{t-2}$ and $Banktype_{b,t-2}$ dummy.

(Insert Table 2.4 here)

In Table 2.4, Columns (1) and (2) present the regression results for Model (2.5). Columns (3) and (4) show the results for Model (2.6). Overall, the findings indicate that after 2010, the difference between the office growth rate for a High-Tech Bank or a Digital Bank and a basic bank is even more pronounced. For example, the coefficient for the interaction between Digital Bank dummy and Post shows that the difference between a Digital Bank's and a basic bank's one-year office growth after 2010 is 2.4 percent greater than that of a year before 2010. Also, the difference between a Digital Bank's and a basic bank's two-year office growth after 2010 is and 4.1 percent greater than that of a year before 2010. Figure 2.2 and Figure 2.3 plot yearly coefficients on the interaction between High-Tech Bank dummy or Digital Bank dummy and year dummy before and after 2010. These figures present sustainable trends of a significant negative difference in the rates of office growth between a High-Tech/Digital Bank and a Non-High-Tech/Non-Digital Bank for the years after 2010.

(Insert Figure 2.2 and 2.3 here)

To test Hypothesis 2.3 (H2.3): whether the office closures induced by High-Tech/Digital Banks has less negative impact on local communities' access to banking services than that of other banks, Model (2.7) presents a formula to compare the impacts of closure events, i.e., office closures due to advances in technology versus closures due to other reasons on the percentage of county population using various kinds of banking services.

(2.7) $$Bank\_service_{c,t} = \alpha + \beta_1 AfterClosure_{c,t} + \beta_2 Closurereason_c \times AfterClosure_{c,t} + \sum_{i=1}^{k} \gamma_i County\_controls_{c,t-1} + \delta_t + \theta_c + \varepsilon_{c,t}$$

In Model (2.7), dependent $Bank\_service_{c,t}$ variables show the percentage of county *c*'s population that use online banking, checking accounts, or credit cards. Again, a decline in the total number of bank branches in a year *t* for a county *c* is called a closure event. I remove closure events followed by an increase in the number of offices within four years to only focus on the impact of the decline in counties' bank office numbers on financial inclusion. Then I include county-level data for both the four years preceding and four years following the event closure in the sample regressions. $Closurereason_c$ is a dummy variable with the value of 1 if county *c*'s closure event is mainly due to the reduction in the number of High-Tech/Digital Bank offices, and 0 otherwise. $AfterClosure_{c,t}$ will have a value of 1 if the year is the year since the closure event, and 0 for the years before the closure event in county *c*. The variable of interest is the interaction between $Closurereason_c$ and $Postclosure_{c,t}$.

Table 2.5 shows the results of Model (2.7) with the High-Tech and other banks. Table 2.6 indicates the results for Digital and other banks. Tables 2.5 and 2.6 present positive impacts on the percentage of county population using various banking services after the technology-caused bank office closures. For instance, after the closure event, a county will experience a decline in banking

service usage. However, Columns (1), (2), and (3) of Table 2.5 show that if the office closure event is mainly from a High-Tech Bank, after the closure event, the county will experience a less negative impact on banking services usage (i.e., on financial inclusion). In particular, the High-Tech Bank closure event has a 0.6 percentage point change in the population's rate using checking accounts and a 0.4 percentage point change in the use of credit cards. After a High-Tech Bank causes an office closure event, people tend to use more online banking (0.8 percentage points) than for a closure caused by a basic bank, which indicates that the closure events induced by Hitech banks will force the customers to switch to online banking activities as a substitute for traditional transactions made by brick-and-mortal bank offices. Table 2.6 gives the same results for closures by Digital Banks versus other banks.

(Insert Tables 2.5 and 2.6 here)

2.4. Robustness Check

As with High-Tech Banks and other banks, I distinguish between Digital and other banks using the ratio of total technology expenses to total assets. However, there is a concern that the definition of a Digital bank may be sensitive to the threshold of the median value of the total technology expenses to total assets ratio. In this case, I change the threshold to define a Digital Bank as a bank whose total technology expenses to total assets ratio falls in the upper tercile and which has a website that facilitates online banking services. The results remain robust (see Table 2.7).

(Insert Table 2.7 here)

Also, as the dependent variables of Tables 2.5 and 2.6 are the percentage of the county population percentage using various banking services, they contain values bounded between 0 and 1. In this case, there is a concern that it is more appropriate to use the fractional logit model instead

of OLS fix-effect models as the fractional model typically deals with dependent variables that take on all possible values in the unit interval. Therefore, I perform a robustness check by replacing OLS fixed-effect regressions in Model (2.7) with fractional logistics regressions; the results presented in Tables 2.8 and 2.9 remain robust.

(Insert Tables 2.8 and 2.9 here)

2.5. Conclusions & Future Research

This study provides evidence that the introduction of financial technologies and digital (transactional) banking negatively correlates with bank offices' growth rates. The impacts have increased substantially in the decade following the Dodd-Frank Act. This study also adds to the financial inclusion literature by providing evidence of the effect of technology-caused office closures on local banking services. A county that experiences a reduction in bank offices because a bank adopted online and digital technologies does not show reductions in financial inclusion, as represented by the county population's use of retail banking services.

This paper also opens potential development directions for future research. With the outbreak of the Covid-19 Pandemic, banks have to temporally close their branches due to the mandatory lockdown in some states in 2020. Therefore, it is predicted that there will be a stronger transition from traditional brick-and-mortal banking toward digital banking. It would be interesting to see how these changes due to an exogenous caused by a disease can affect bank office closures and local financial inclusion.

Figure 2.1 Number of FDIC-insured institutions and branches, 2001–2019

Note: Author's calculations based on FDIC data.

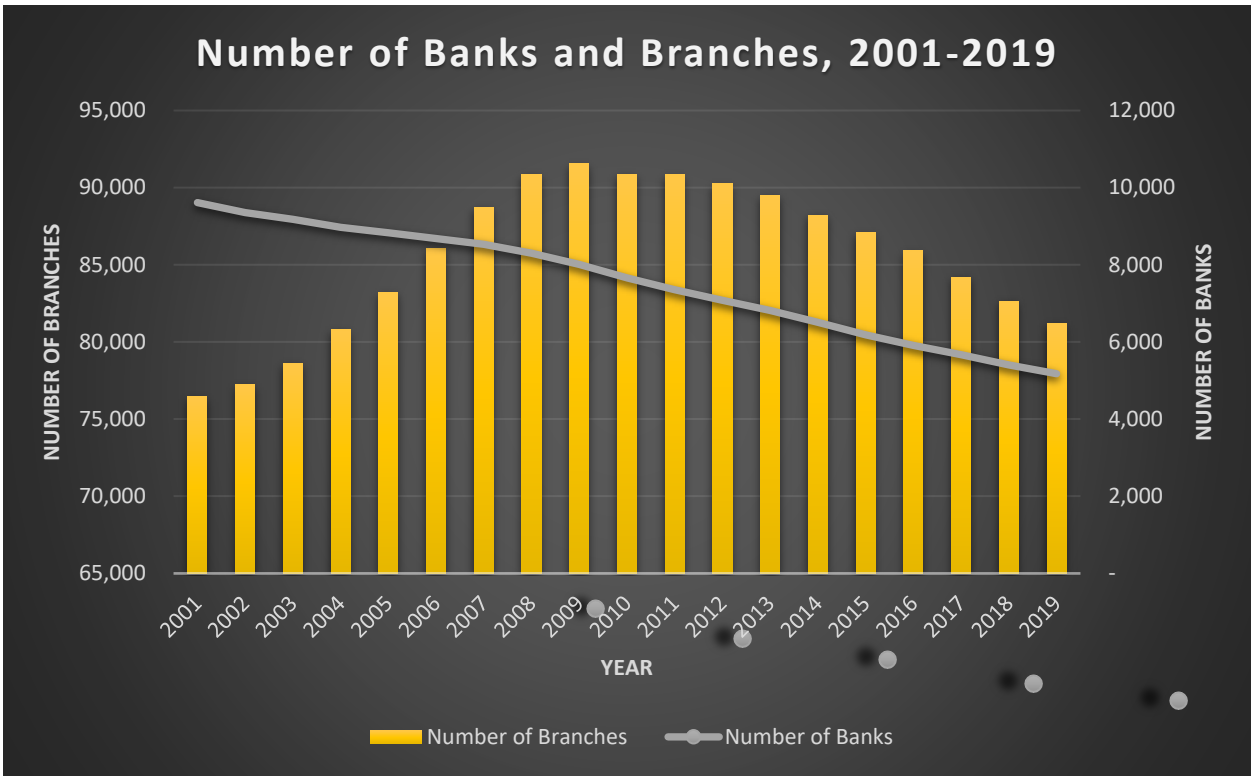
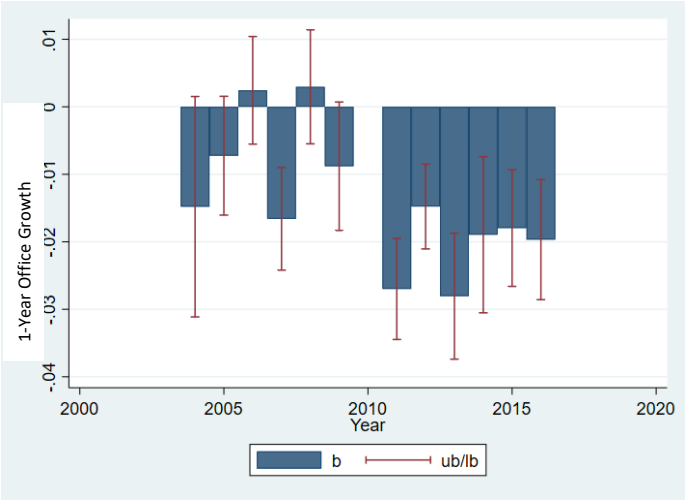


Figure 2.2 Rates of Office Growth: High-Tech Banks vs. Other Banks

Source: Author's calculations based on FDIC and Federal Financial Institutions Examination Council's (FFIEC) data.
Note: This figure plots the relationship between High-Tech Bank dummy and 1- and 2-year office growth rates. The bars show yearly coefficients on the interactions between High-Tech Bank dummy and years before and after 2010 from the regression that includes all bank control variables. Year fixed effects and bank fixed effects are included. The red bars show 95% confidence intervals. Robust standard errors are clustered at the bank and year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.



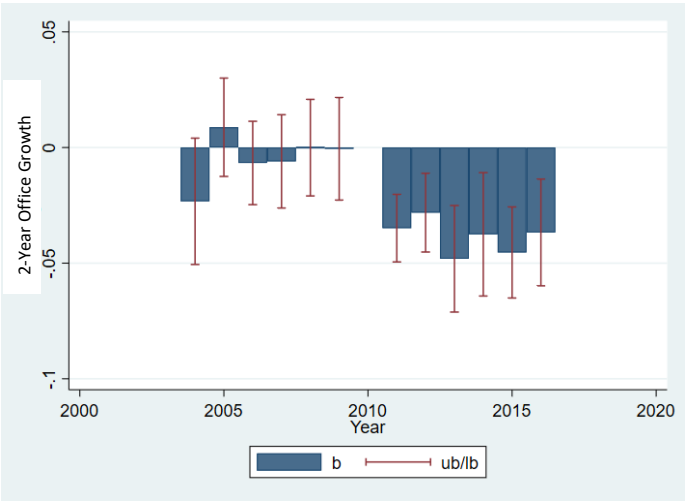


Figure 2.3 Rates of Office Growth: Digital Banks vs. Other Banks

Source: Author's calculations based on FDIC and FFIEC data.
Note: This figure plots the relationship between the Digital Bank dummy and 1- and 2-year office growth rates. The bars show yearly coefficients on the interactions between the Digital Bank dummy and years before and after 2010 from the regression that includes all bank control variables. Year fixed effects and bank fixed effects are included. The red bars show 95% confidence intervals. Robust standard errors are clustered at the bank and year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

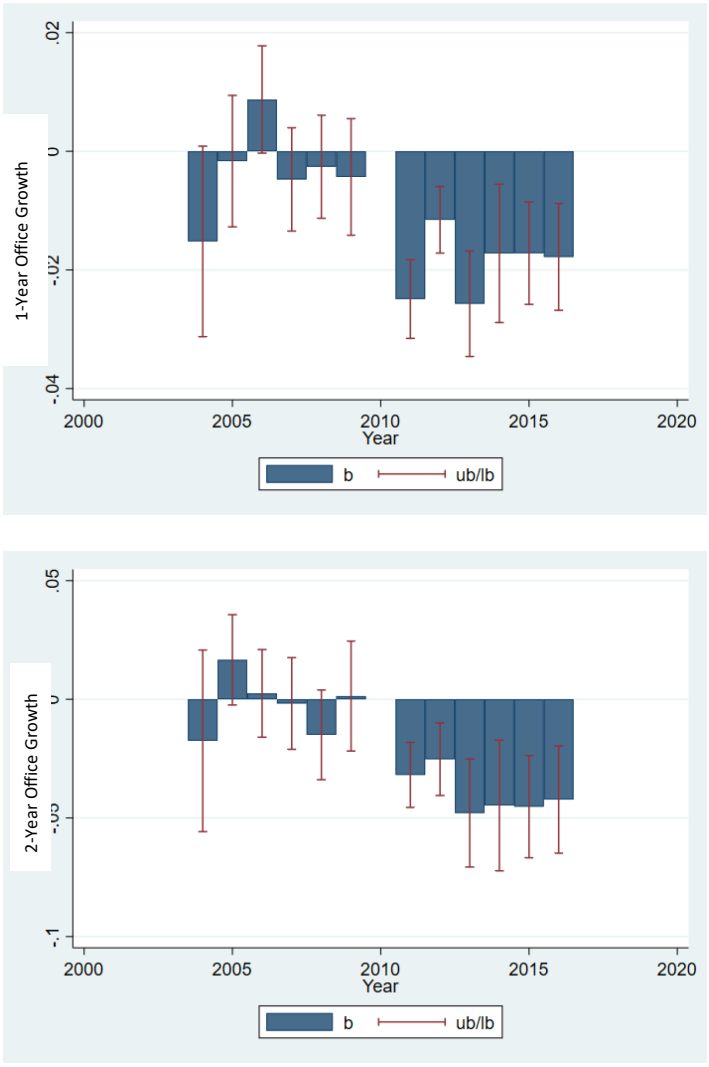


Table 2.1 Hi-Tech Banks, Digital Banks vs. Other Banks

Source: Author's calculations based on FDIC, FFIEC data.
Note: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Non-Hi-Tech Banks	Hi-Tech Banks	Difference	Non-Digital Banks	Digital Banks	Difference
No. of offices per bank	14.7	9.8	4.9***	13.5	11.9	1.6**
No. of employees per bank	336.2	213.3	122.9***	303.9	260.5	43.4*
Average No. of banks	3,688	3,477		4,171	2,828	

Table 2.2 Descriptive Statistics (Summary of Bank- and County-Level Variables, Coding, and Sources)

Source: Author's calculations, FDIC, FFIEC, BLS, ACS, and SimmonsLOCAL data.

Variables	N	Mean	Standard Deviation	Min	Max	Coding	Source
Bank-level data							
1_year office growth	125,463	.051	.354	-1	54	The 1-year growth rate of offices per bank	FDIC
2_year office growth	115,366	.105	.572	-1	60	The 2-year growth rate offices per bank	FDIC
High-Tech	136,141	.485	.5	0	1	1 if the bank is a High-Tech Bank, 0 otherwise	FFIEC
Digital	118,973	.404	.491	0	1	1 if the bank is a Digital Bank, 0 otherwise	FFIEC
Post	136,141	.416	.493	0	1	1 if the year is after 2010, 0 otherwise	Author's calculation
Community bank	136,141	.911	.285	0	1	1 if the bank is a community bank, 0 otherwise	FDIC
Assets	136,141	11.993	1.394	4.522	21.58	1 plus logarithm of total assets	FDIC
Equity to TAs	136,141	.116	.072	-3.634	1	Total equity-to-total assets	FDIC
Nonperforming loans	136,141	1.348	2.274	0	48.891	Nonperforming loans-to-total assets	FDIC
ROA	136,141	.004	.016	-.598	2.006	Return on assets	FDIC
Liquid assets to TAs	136,141	.305	.168	0	1.599	Liquid assets-to-total assets; liquid assets include cash and balances due from depository institutions plus federal funds purchased and securities purchased under reverse repurchase agreements plus securities held to maturity plus securities available for sale.	FDIC
Core deposits to TAs	136,141	.716	.134	-.148	1.06	Core deposits-to-total assets	FDIC
Commitment rate	136,141	.093	.083	0	.999	Business loan commitments-to-total credit commitment	FDIC
Total loans to TAs	136,141	.634	.168	0	1.17	Total loans-to-total assets	FDIC
Total premises to TAs	136,141	.018	.014	0	.455	Total premises-to-total assets (Total premises: Bank premises, furniture and fixtures, equipment, and other assets representing bank premises (including capitalized leases) owned by the institution.	FDIC
De novo	136,141	.050	.218	0	1	1 if the bank joins the industry for fewer than 5 years, 0 otherwise	FDIC
Number of offices	136,141	12.343	121.481	0	6626	Number of domestic offices	FDIC
M&A	136,141	.031	.174	0	1	1 if the bank has been through an M&A this year, 0 otherwise	FDIC
Lag M&A	125,629	.031	.173	0	1	1 if the bank has been through an M&A last year, 0 otherwise	FDIC
County-level data							
Closedby High-Tech	5,056	.434	.496	0	1	1 if High-Tech Banks chiefly causes the county office closure event, 0 otherwise	Author's calculation, FDIC
Closedby Digital	5,056	.423	.494	0	1	1 if the county office closure event is chiefly caused by Digital Banks, 0 otherwise	Author's calculation, FDIC
Postclosure	5,056	.471	.499	0	1	Years after the closure event	Author's calculation, FDIC
Online banking	4,618	.358	.077	.071	.658	Percentage of population using online banking	SimmonsLOCAL

Variables	N	Mean	Standard Deviation	Min	Max	Coding	Source
Checking accounts	4,618	.314	.063	0	.806	Percentage of county population using checking accounts	SimmonsLOCAL
Credit card	4,618	.616	.084	.28	.927	Percentage of population using credit cards	SimmonsLOCAL
Population	5,051	9.727	.828	6.412	14.784	1 plus logarithm of county population	ACS
Low education	5,051	.178	.082	.007	.551	Rate of the population over age 25 that did not finish high school	ACS
Poverty	5,051	.179	.091	.024	.62	Rate of households in poverty	ACS
Unemployment	5,051	.079	.043	0	.337	Rate of unemployed population over age 16	ACS
Minority	5,051	.148	.16	0	.868	Rate of minority population	ACS
Elder	5,051	.17	.041	.069	.379	Rate of population over age 60	ACS
AFSs	5,056	5.306	10.836	0	239	Number of alternative financial services establishments	BLS
Credit unions	5,056	1.13	1.682	0	18	Number of credit unions	BLS
Bank offices	5,056	9.362	14.477	1	382	Number of bank offices	BLS
M&A	5,056	.537	.499	0	1	1 if any bank in county experienced a M&A this year, 0 otherwise	FDIC
M&A1	5,055	.544	.498	0	1	1 if any bank in county experienced a M&A last year, 0 otherwise	FDIC

Table 2.3 High-Tech/Digital Banks and Rates of Office Growth

Source: Author's calculations based on FDIC, FFIEC data.
Note: The dependent variables are 1-year rates of office growth per bank in Columns (1) and (2) and 2-year rates of office growth per bank in Columns (3) and (4). The key explanatory variables are the High-Tech Bank dummy in Columns (1) and (3) and the Digital Bank dummy in Columns (2) and (4). Standard errors are in parentheses. Robust standard errors are clustered at the bank and year levels. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	(1) **1-Year Office Growth**	(2) **1-Year Office Growth**	(3) **2-Year Office Growth**	(4) **2-Year Office Growth**
High-Tech	-.013***		-.025***	
	(.004)		(.007)	
Digital		-.01**		-.025***
		(.003)		(.008)
Community bank	-.042**	-.034	-.043	-.021
	(.018)	(.021)	(.057)	(.065)
Assets	-.186***	-.205***	-.442***	-.486***
	(.04)	(.044)	(.089)	(.097)
Equity to TAs	-.198	-.255	-.768**	-.902**
	(.132)	(.146)	(.294)	(.33)
Nonperforming loans	-.009***	-.009***	-.018***	-.019***
	(.001)	(.001)	(.003)	(.003)
ROA	.701**	.814**	1.287**	1.658**
	(.259)	(.294)	(.599)	(.704)
Liquid assets to TAs	-.007	-.008	.018	.02
	(.04)	(.044)	(.092)	(.101)
Core deposits to TAs	-.227***	-.233***	-.435***	-.455***
	(.029)	(.032)	(.065)	(.071)
Commitment rate	.162*	.19*	.306	.364
	(.089)	(.096)	(.214)	(.231)
Total loans to TAs	.098	.11	.244	.258
	(.068)	(.076)	(.155)	(.176)
Total premises to TAs	-1.498***	-1.776***	-4.409***	-4.694***
	(.381)	(.354)	(.732)	(.803)
Denovo	-.011	-.012	-.027	-.025
	(.012)	(.015)	(.033)	(.04)
Number of offices	0*	0**	-.001**	-.001**
	(0)	(0)	(0)	(0)
M&A	-.045***	-.045***	-.077***	-.076***
	(.008)	(.009)	(.014)	(.015)
Lag M&A	-.029***	-.027***	-.053***	-.047***
	(.007)	(.007)	(.013)	(.013)
Observations	115,008	106,898	105,191	97,451
Adjusted R-squared	0.042	0.045	0.153	0.157
Bank fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Standard error clustered	YES	YES	YES	YES

Table 2.4 High-Tech/Digital banks and Rates of Office Growth After 2010

Source: Author's calculations based on FDIC and FFIEC data.
Note: The dependent variables are 1-year rates of office growth per bank in Columns (1) and (2) and 2-year rates of office growth per bank in Columns (3) and (4). The key explanatory variables are the interaction between High-Tech Bank dummy and Post dummy in Columns (1) and (3), and the interaction between Digital Bank dummy and Post dummy in Columns (2) and (4). Standard errors are in parentheses. Robust standard errors are clustered at the bank and year levels. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	(1) **1-Year Office Growth**	(2) **1-Year Office Growth**	(3) **2-Years Office Growth**	(4) **2-Years Office Growth**
High-Tech	-.006		-.007	
	(.004)		(.008)	
Digital		.007		.012
		(.005)		(.008)
Post	.065***	.072***	.149***	.161***
	(.016)	(.017)	(.039)	(.042)
High-Tech x Post	-.014***		-.027***	
	(.004)		(.009)	
Digital x Post		-.024***		-.041***
		(.004)		(.009)
Community bank	-.038*	-.031	-.033	-.011
	(.018)	(.021)	(.057)	(.066)
Assets	-.15***	-.169***	-.353***	-.398***
	(.032)	(.035)	(.071)	(.074)
Equity to TAs	-.039	-.085	-.384	-.493*
	(.128)	(.14)	(.252)	(.275)
Nonperforming loans	-.008***	-.008***	-.015***	-.015***
	(.002)	(.002)	(.004)	(.004)
ROA	.51**	.618**	.721	1.036
	(.232)	(.278)	(.616)	(.752)
Liquid assets to TAs	.012	.011	.062	.07
	(.048)	(.052)	(.108)	(.117)
Core deposits to TAs	-.18***	-.173***	-.324***	-.312***
	(.042)	(.044)	(.096)	(.101)
Commitment rate	.187**	.183**	.362*	.34
	(.069)	(.076)	(.182)	(.197)
Total loans to TAs	.129	.148*	.311*	.339*
	(.076)	(.082)	(.169)	(.192)
Total premises to TAs	-1.433***	-1.765***	-4.262***	-4.682***
	(.373)	(.339)	(.71)	(.785)
Denovo	-.009	-.01	-.019	-.017
	(.011)	(.014)	(.031)	(.038)
Number of offices	0*	0**	-.001**	-.001**
	(0)	(0)	(0)	(0)
M&A	-.054***	-.053***	-.096***	-.094***
	(.009)	(.01)	(.018)	(.019)
Lag M&A	-.036***	-.033***	-.071***	-.063***
	(.008)	(.007)	(.016)	(.016)
Observations	115,008	106,898	105,191	97,451
Adjusted R-squared	0.039	0.042	0.147	0.151
Bank fixed effects	YES	YES	YES	YES
Year fixed effects	NO	NO	NO	NO
Standard error clustered	YES	YES	YES	YES

Table 2.5 Financial Inclusion and Office Closure: High-Tech Banks

Source: Author's calculations based on FDIC, FFIEC, BLS, ACS, and SimmonsLOCAL data.
Note: The dependent variables are the percentage of the county population using online banking (1), checking accounts (2), and credit cards (3). Key explanatory variables are the interaction between Closedby_High-Tech Bank dummy and After Closure dummy. Standard errors are in parentheses. Robust standard errors are clustered at the state x year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	(1) **Online_banking**	(2) **Checking**	(3) **Credit_cards**
Closedby_Hightech x After Closure	.008***	.006**	.004**
	(.002)	(.002)	(.002)
After Closure	-.004**	-.003	-.003*
	(.002)	(.002)	(.002)
Population	.037	-.081	-.036
	(.039)	(.051)	(.033)
Low education	-.01	.04	-.035
	(.05)	(.054)	(.054)
Poverty	-.005	-.028	-.028
	(.042)	(.037)	(.039)
Unemployment	.084*	-.031	.001
	(.049)	(.055)	(.049)
Minority	.021	.056	.099*
	(.056)	(.036)	(.052)
Elder	-.038	-.091	-.135
	(.124)	(.177)	(.119)
Nonbank services	0	0	0
	(0)	(0)	(0)
Credit unions	.002	.002	0
	(.002)	(.002)	(.002)
Bank offices	.001**	.001	.001
	(.001)	(.001)	(.001)
M&A	-.001	0	0
	(.002)	(.002)	(.002)
M&A1	-.001	0	-.003*
	(.002)	(.002)	(.001)
Observations	4,609	4,609	4,609
R-squared	0.800	0.687	0.839
County Fixed Effects	YES	YES	YES
Year Fix Effects	YES	YES	YES
Standard error clustered	YES	YES	YES

Table 2.6 Financial Inclusion and Office Closure: Digital Banks

Source: Author's calculations based on FDIC, FFIEC, BLS, ACS, and SimmonsLOCAL data.
Note: The dependent variables are the percentage of the county population using online banking (1), checking accounts (2), and credit cards (3). Key explanatory variables are the interaction between Closedby_Digital Bank dummy and After Closure dummy. Standard errors are in parentheses. Robust standard errors are clustered at the state x year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	(1) **Online_banking**	(2) **Checking**	(3) **Credit_cards**
Closedby_Digital x After Closure	.008***	.007***	.004*
	(.002)	(.002)	(.002)
After Closure	-.004**	-.003*	-.003*
	(.002)	(.002)	(.002)
Population	.036	-.082	-.037
	(.039)	(.051)	(.033)
Low education	-.009	.04	-.035
	(.05)	(.054)	(.054)
Poverty	-.003	-.027	-.028
	(.042)	(.038)	(.039)
Unemployment	.083*	-.032	.001
	(.049)	(.055)	(.049)
Minority	.021	.056	.099*
	(.056)	(.036)	(.052)
Elder	-.039	-.092	-.134
	(.124)	(.177)	(.119)
Nonbank services	0	0	0
	(0)	(0)	(0)
Credit unions	.002	.002	0
	(.002)	(.002)	(.002)
Bank offices	.001**	.001	.001
	(.001)	(.001)	(.001)
M&A	-.001	0	0
	(.002)	(.002)	(.002)
M&A1	-.001	0	-.003*
	(.002)	(.002)	(.001)
Observations	4,609	4,609	4,609
R-squared	0.800	0.687	0.839
County Fixed Effects	YES	YES	YES
Year Fix Effects	YES	YES	YES
Standard error clustered	YES	YES	YES

2.6. Appendices

Table 2.7 Digital Banks and Rates of Office Growth: New Threshold for Digital Banks

Source: Author's calculations based on FDIC and FFIEC data.
Note: The dependent variables are 1-year rates of branch growth per bank in Columns (1) and (2) and 2-year rates of office growth per bank in Columns (3) and (4). Key explanatory variables are the Digital_tercile dummy in Columns (1) and (3) and the interaction between Digital_tercile dummy and Post dummy in Columns (1) and (3), and the interaction between Digital_tercile dummy and Post dummy in Columns (2) and (4). Standard errors are in parentheses. Robust standard errors are clustered at the bank and year levels. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	(1) **1-Year Office Growth**	(2) **1-Year Office Growth**	(3) **2-Years Office Growth**	(4) **2-Years Office Growth**
Digital_tercile	-.016***	0	-.033***	.002
	(.005)	(.007)	(.009)	(.01)
Post		.068***		.156***
		(.017)		(.042)
Digital_tercile x Post		-.018***		-.039***
		(.006)		(.011)
Community bank	-.035	-.031	-.021	-.011
	(.021)	(.021)	(.065)	(.066)
Assets	-.205***	-.169***	-.487***	-.399***
	(.044)	(.035)	(.097)	(.074)
Equity to TAs	-.253	-.083	-.899**	-.492*
	(.146)	(.14)	(.329)	(.276)
Nonperforming loans	-.009***	-.008***	-.019***	-.015***
	(.001)	(.002)	(.003)	(.004)
ROA	.811**	.603**	1.65**	1.012
	(.294)	(.277)	(.704)	(.75)
Liquid assets to TA.s	-.008	.011	.02	.07
	(.044)	(.053)	(.101)	(.117)
Core deposits to TAs	-.232***	-.172***	-.454***	-.312***
	(.032)	(.045)	(.07)	(.102)
Commitment rate	.19*	.185**	.362	.341
	(.096)	(.075)	(.231)	(.197)
Total loans to TAs	.111	.149*	.259	.341*
	(.076)	(.082)	(.176)	(.192)
Total premises to TAs	-1.756***	-1.749***	-4.661***	-4.65***
	(.349)	(.333)	(.794)	(.777)
Denovo	-.012	-.008	-.025	-.016
	(.015)	(.014)	(.04)	(.039)
Number of offices	0**	0**	-.001**	-.001**
	(0)	(0)	(0)	(0)
M&A	-.045***	-.053***	-.076***	-.094***
	(.009)	(.01)	(.015)	(.019)
Lag M&A	-.027***	-.034***	-.047***	-.063***
	(.007)	(.007)	(.013)	(.016)
Observations	106,898	106,898	97,451	97,451
Adjusted R-squared	0.045	0.042	0.157	0.151
Bank Fixed Effects	YES	YES	YES	YES
Year Fix Effects	YES	NO	YES	NO
Standard error clustered	YES	YES	YES	YES

Table 2.8 Financial Inclusion and Office Closure: High-Tech Banks Using Fractional Logit Regressions

Source: Author's calculations based on FDIC, FFIEC, BLS, ACS, and SimmonsLOCAL data.
Note: The table shows the fractional logit regression results (Panel A) and the average marginal effect (Panel B). The dependent variables are the percentage of county population using online banking (1), checking accounts (2), and credit cards (3). Key explanatory variables are the interaction between Closedby High-Tech Bank dummy and After Closure dummy. Standard errors are in parentheses. Robust standard errors are clustered at the county and year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Panel A. Fractional logit regressions			**Panel B. Average Marginal Effect**		
	(1)	(2)	(3)	(4)	(5)	(6)
	Online_banking	**Checking**	**Credit_cards**	**Online_banking**	**Checking**	**Credit_cards**
Closedby_Hightech x After Closure	0.034***	0.032***	0.017*	0.007***	0.006***	0.004**
After Closure	-0.018**	-0.014*	-0.013*	-0.004**	-0.003*	-0.003**
Population	0.099	-0.403*	-0.163	0.023	-0.085*	-0.037
Low education	-0.233	0.098	-0.154	-0.053	0.020	-0.036
Poverty	0.012	-0.102	-0.113	0.001	-0.023	-0.026
Unemployment	0.413**	-0.131	0.012	0.094**	-0.027	0.003
Minority	0.101	0.259	0.410**	0.023	0.055	0.094**
Elder	-0.283	-0.503	-0.615	-0.063	-0.106	-0.143
Nonbank services	0.002	-0.001	0.002	0.000	-0.000	0.000
Credit unions	0.008	0.010	0.001	0.002	0.002	0.000
Bank offices	0.004	0.003	0.004	0.001	0.001	0.001
M&A	-0.005	-0.002	-0.002	-0.001	-0.000	-0.000
M&A1	-0.005	0.000	-0.011**	-0.001	0.000	-0.003**
Observations	4,617	4,617	4,617			
Pseudo R-squared	0.016	0.010	0.019			
County Fixed Effects	YES	YES	YES			
Year Fix Effects	YES	YES	YES			
Standard error clustered	YES	YES	YES			

Table 2.9 Financial Inclusion and Office Closure: Digital Banks Using Fractional Logit Regressions

Source: Author's calculations based on FDIC, FFIEC, BLS, ACS, and SimmonsLOCAL data.
Note: The table shows the fractional logit regression (Panel A) and the average marginal effect (Panel B). The dependent variables are the percentage of county population using online banking (1), checking accounts (2), and credit cards (3). Key explanatory variables are the interaction between Closedby Digital Bank dummy and After Closure dummy. Standard errors are in parentheses. Robust standard errors are clustered at the county and year level. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Panel A. Fractional logit regressions			**Panel B. Average Marginal Effect**		
	(1)	(2)	(3)	(4)	(5)	(6)
	Online_banking	**Checking**	**Credit_cards**	**Online_banking**	**Checking**	**Credit_cards**
Closedby_Digital x After Closure	0.032***	0.029***	0.019**	0.008***	0.007***	0.004*
After Closure	-0.017**	-0.013**	-0.015**	-0.004**	-0.003*	-0.003*
Population	0.104	-0.398**	-0.160	0.022	-0.086*	-0.037
Low education	-0.235	0.096	-0.155	-0.052	0.021	-0.036
Poverty	0.007	-0.109	-0.114	0.003	-0.022	-0.026
Unemployment	0.417**	-0.127	0.011	0.093**	-0.028	0.003
Minority	0.100	0.258	0.409**	0.023	0.055	0.095**
Elder	-0.281	-0.500	-0.618	-0.064	-0.107	-0.142
Nonbank services	0.002	-0.001	0.002	0.000	-0.000	0.000
Credit unions	0.008	0.010	0.001	0.002	0.002	0.000
Bank offices	0.004	0.003	0.004	0.001	0.001	0.001
M&A	-0.005	-0.002	-0.002	-0.001	-0.000	-0.000
M&A1	-0.005	0.000	-0.011**	-0.001	0.000	-0.003**
Observations	4,617	4,617	4,617			
Pseudo R-squared	0.016	0.010	0.019			
County Fixed Effects	YES	YES	YES			
Year Fix Effects	YES	YES	YES			
Standard error clustered	YES	YES	YES			

Chapter 3 Community Banks Vs. Non-Community Banks: Contribution to Local Small Business Funding

3.1. Introduction

There is no doubt about the vital role played by small businesses in the U.S. economy. According to the Small Business Administration (SBA, 2017), small businesses account for 99.7% of employer firms, employing 47.8% of private-sector employees. Due to the size and opaqueness of small business enterprises, they tend to depend heavily on bank credit for their external funding. Traditionally, community banks provide banking services in their local communities (FDIC, 2012) and generally possess an advantage in providing small business funding compared to non-community banks. The conventional paradigm is that such banks can use "soft" information gathered through direct contact, enabling lending officers to become better informed about small businesses and their suppliers, customers, or neighboring businesses to make their lending decisions (Berger and Udell, 2006). In contrast, bigger banks, operating in multi-markets and therefore are nonlocal institutions, tend to use "hard" information in making lending decisions, thereby underserving small businesses.

Many studies dating from the 1990s support this conventional paradigm. These studies include ones by Petersen and Rajan (1994); Stein (2002); Berger and Udell (2002); Berger et al. (2005); DeYoung, Hunter and Udell (2004); Berger and Roman (2018); Strahan (2017); Berger Bouwman and Kim (2017); and Cole (2018). However, the conventional paradigm has received skepticism following banking deregulation and the change in lending technology over time. Non-community banks can take advantage of transactional lending techniques, like credit scoring, that enable them to serve small businesses better (Berger and Udell, 2006; Berger and Black, 2011;

Berger, Goulding, and Rice, 2014; DeYoung et al., 2011). Therefore, whether or not community banks play a more important role in small business funding than non-community banks is still an open question in the existing literature.

The primary purpose of this paper is to reexamine the competitive advantages of community banks in providing funding for small businesses at the county level throughout the country. Our examination relies heavily on the Community Reinvestment Act (CRA) small business lending dataset from the Federal Financial Institution Examination Council (FFIEC), allowing one to examine small business funding by each bank at the county level. This enables one to address the difference in market targeting between community banks and non-community banks, not only before and after the Great Recession but also between metropolitan and non-metropolitan areas. In addition, by examining small business lending at the bank-county level, we control for demographic characteristics of each county where banks provide small business loans, especially controlling for the number of small business establishments in each county where banks operate.

Notably, we deviate from the previous literature on community banks that usually uses asset size as the threshold for identifying a community bank. Yet, according to the FDIC (2012, p.1-2), "…the problem with using a fixed size limit to define community banks is that the attributes associated with community banking are only loosely correlated with size." As a result, in the case of small business funding, using only asset size as the threshold to identify community banks deemphasizes how community banks utilize their strength regarding "relationship banking." In addition, by using size to categorize community banks, researchers may include those small banks with business specialties that do not support lending to local customers. At the same time, using size may omit some bigger banks that focus on local markets. For this reason, this study uses the

FDIC's definition of a community bank to identify and examine the impact of a local-oriented bank on small business funding (FDIC, 2012).

The first empirical result shows that from 2003 to 2016, community banks are still more critical than non-community banks insofar as they rely heavily on relationship banking in providing funds for small businesses. However, from 2003 to 2007, the year before the Great Recession, our results indicate that community banks provided no more small business loans in each county than non-community banks. There is one possible explanation: the allowance of more banking across state lines due to a deregulation trend that started in the 1990s gave non-community banks some advantage in the small business funding market. After the Great Recession (2008-2009), our results indicate that community banks contributed more to small business funding. This result can be explained by the change in focus of non-communities banks in small business lending and the withdrawal of such banks in the non-metropolitan market. In recent research, Chen, Hanson and Stein (2017), focusing on small business loans of the four biggest banks, find that small business lending declined sharply relative to other banks after the Great Recession. The authors argue that the big banks were facing high charge-off rates on their business portfolios during the crisis, and small business lending was viewed as a non-core operation, so they shifted away from this market. Other evidence indicates a consolidation in the number of branches of non-community banks, especially in non-metropolitan areas. In a study of banking office structure by the FDIC from 2012 to 2017, non-community banks reduced their offices in all regions. Still, the highest percentage decline was concentrated in non-metropolitan areas (FDIC, 2017). This trend contributed to the decrease in small business lending of non-community banks, thereby creating opportunities for community banks to become more important in these markets.

Also, our second empirical result reveals that in non-metropolitan areas, community banks are a more important source of small business funding than in metropolitan areas compared to non-community banks.

Studies show that the importance of small business relationships has diminished over time (Durguner, 2012), and many banks have changed a relationship banking model to a transactional model (Berger, Cowan, and Frame, 2011; Van Ewijk and Arnold, 2014). Therefore, the study also examines whether relationship banking is still an important lending technique used by community banks in creating a competitive advantage. Our regressions provide evidence that in areas where community banks do not have offices, they offer fewer small business loans than non-community banks. The result suggests that community banks still need to have offices in the local area and take advantage of their relationship banking better serve small businesses.

3.2. Literature Review

Given the importance of small businesses in a local community and the modest amount of bank funding provided by such enterprises, the question of whether community banks have a more competitive advantage than non-community banks in lending to small businesses is still debatable.

Some studies support the "conventional paradigm," which states that large banks tend to serve more transparent firms based on "hard" information, including quantitative data from financial statements and credit scoring. In addition, smaller banks are better at building relationship lending with smaller opaque businesses using "soft" information. Soft information is obtained through direct contact between lending officers and the small businesses over time or knowledge from past communications with their suppliers, customers, or neighboring businesses (Berger and Udell, 2006). Berger, Goulding, and Rice (2014) mention that the conventional paradigm relating

to the difficulty of large banks in dealing with soft information could apply to distinctions between non-local and multimarket banks.

In support of the conventional paradigm, Stein (2002) develops a theoretical model to show that those decentralized institutions (like community banks) with a less complex hierarchical structure can do a better job in providing capital to projects (like lending to small businesses) where the information is "soft" and not easily transmitted through sophisticated operational structures (like non-community banks).

Several empirical studies support the conventional wisdom regarding small business lending. Using the survey data from the Federal Reserve Board's National Survey of Small Business Finances (NSSBF), Petersen and Rajan (1994) provide the first empirical evidence supporting the benefit of close relationships between banks and small businesses. Using the same source of data, Berger and Udell (2002), and Berger et al. (2005) find that larger banks are more reliant upon hard information from financial statements to make decisions to extend or deny credit to small businesses. In contrast, the smaller banks rely more on soft qualitative information based upon loan officers' personal interactions.

Recently, the conventional paradigm received more support from empirical studies using other sources of small business survey datasets. For example, Berger, Hanson and Stein (2017) claim that small businesses in those areas with more small banks confront fewer financial constraints. Using bank-level data and examining the impact of a recent crisis on small business lending, Cole (2018) documents that the declines in small business lending were significantly less at small banks than large banks during the post-crisis period. Mkhaiber and Werner (2018), focusing on the propensity of a bank to lend to small businesses, measured as the relative share of small business loans to total business loans of a bank. They find a negative relationship between

bank size and the propensity rates, and the relationship is even more robust during the crisis. This implies that smaller banks tend to devote a larger share of total business loans to small businesses.

Nevertheless, there are also studies questioning the conventional paradigm. These studies argue that the innovation in lending technology and deregulation enable large banks, which use hard information, to serve smaller and opaque firms. Berger and Udell (2006) argue that the "hard" and "soft" information categorization is too simple. The transactional lending technology offered by a large bank is not only a financial statement-based technology. Other techniques like small business credit scoring, asset-based lending, factoring, fixed-asset lending, and leasing technologies can help large banks to target opaque small business customers better.

Utilizing cross-sectional survey data, Berger and Black (2011) find a non-linear relationship between the comparative advantage of large banks in hard information technology with the firm size. They suggest that small banks have an advantage in relationship lending. Still, this advantage is most substantial for big firms, not small firms. Berger, Cowan, and Frame (2011) verify a widespread use of credit scoring techniques in small business lending by community banks, proving that community banks also use hard information to make SME funding decisions. Using survey data in 2003, Durguner (2012) documents that the relationship-based loans in lending to small businesses have declined over time. DeYoung et al. (2011) find that the distance between small businesses and their bank lenders has increased. They suggest that if technological advance causes and increases the distance between lender-borrower, then the local credit market should be more competitive, and larger banks may overcome the relationship banking advantage of small local banks in SME lending. Although questioning the role of soft information used by community banks and hard information used by non-community banks, these empirical studies do not examine the relative use of these lending techniques between community banks and non-community banks. Only recent research of Berger, Goulding, and Rice (2014) directly address this problem, using

the survey of SMEs in 2003, and find small businesses are not more likely to choose community banks as their main banks.

Studies show mixed results of the relative competitiveness of community banks and non-community banks in small business lending. DeYoung, Hunter, and Udell (2004) argue that there is a comparative advantage of community banks in relationship lending to small businesses. However, the regulatory and technological change has put community banks in a tough competitive environment. On the other hand, Van Ewijk and Arnold (2014) find that relationship banks still enjoy higher interest margins. Still, many banks have moved from a relationship-oriented to a transaction-oriented model from 1992 to 2007.

Many stated studies based on small business survey data address questions such as whether small businesses have the community bank or non-community bank as their primary funding provider. However, some do not provide a direct comparison between the community and non-community banks' small business lending performance. Our approach to whether community banks have an advantage in competing in the small business loans market is unique. More specifically, we examine whether at the county level, on average, community banks provide more small business loans in terms of both number and dollar amount than non-community banks. Only a few studies compare community and non-community small business loan performance (e.g., Cole (2018) or Mkhaiber and Werner (2018)). However, they only make a comparison at the bank headquarters data level. Not only do they exclude branch-level data, but they also do not control for local demographic and economic factors that may affect the number of small business loans that a bank can provide in each county. Using the number of small business loans that each bank originates in each county, we can control for bank characteristics variables and control for the demographic characteristics in each county in which the bank provides small business loans.

3.3. Data

List of banks, branches, and financial data

The list of banks and their financial data is obtained from the FDIC website for Statistics on Depository Institutions (SDI). In this paper, the terms bank and FDIC insured institutions are used interchangeably. Year-end financial and banks list data available from 1992 until 2016 are used. A list of bank branches from the FDIC's Summary of Deposits (SOD) is also used. The dataset provides each office's address with the deposits that each branch mobilized as of June every year from 1994 to 2016.

Small Business Loans

The CRA (1977) encourages depository institutions to help meet the needs of the communities in which they operate. Under the CRA, banks have periodic CRA examinations and are given CRA Ratings. In addition, banks with assets threshold[8] are required to disclose annual data on loans originated to small businesses at the tract-code level and aggregated at the county level. A bank obligated to the disclosure requirement must report their number and amount of loans originated to firms with less than $1 million in gross revenue. The data is publicly available on the website of the FFIEC and available from the year 1996 to 2016.

There is another source of data for banks' small business loans. The FFIEC's Consolidated Reports of Condition and Income (the Call Reports) also public quarterly at the bank-level data of the number of loans and dollar amount outstanding of commercial real estate and commercial & industrial loans with original loan amounts of less than $100,000, more than $100,000 to $250,000 and more than $250,000 to $1 million.

[8] Before 2005, all banks that have total assets of $250,000 belonging to a bank holding company must report under CRA. From 2005, all banks that have total assets of above $1,000,000 have to report under CRA.

We rely on the CRA data for the number and dollar amount of small business loans for this research. The first reason for this choice is CRA data are based on the borrower's location, not on the establishment of a bank. The second reason is that data from the Call Reports are at the bank level and are categorized by the size of loans and may not represent whether the loans are provided to small businesses. Even though the small business loan data from CRA do not cover all FDIC-insured institutions, according to Greenstone et al. (2014), CRA-eligible banks account for 86% of total lending for small businesses. In addition, when using CRA data, the asset size gap between the community and non-community banks is narrower than when all banks are included. Therefore, the empirical results are better explained by other reasons than an asset size difference between a control and treatment group of banks. Moreover, we control for asset size in the regressions to limit any possible impact of asset size on small business lending.

MSA Identification

To identify counties belonging to metropolitan or non-metropolitan areas, we utilize the metropolitan and micropolitan statistical areas (the MSA delineation files) of the Census Bureau that are available for Census 2000, Census 2010, and Census 2015. This MSA identification data are available for the years 2003 to 2016, which is the sample period.

Demographic Data

To generate demographic control variables, we use some demographic datasets at the county level from different sources. The number of small business establishments is available from the County Business Pattern (CBP) dataset of the Census Bureau. The CBP provides the number of establishments of businesses with different employment sizes at the county level during the week of March 12 every year from 1986 to 2016. Following the SBA definition, we define any establishment with less than 500 employees as a small business. The county annual population estimates from 2000-2009 are extracted from County Intercensal Tables: 2000-2010 of Census

Bureau. From 2010 to 2016, we use the Population and Housing Unit Estimates dataset to obtain the county annual population estimates. The poverty rate and median household income data are available from the Small Area Income and Poverty Estimates (SAIPE) Program from 1989 to 2016. And finally, the unemployment rate is obtained from the Census of Labor Statistics from 1990 through 2016.

Each dataset provides the county and state FIPS code for each county that allows me to merge all the available data to generate panel data at the county level from 2003 to 2016. The final sample includes 1,176,724 observations. The cross-sectional data is at the bank-county level, which consists of 2,345 banks and 3,146 counties. Table 3.1 presents summary statistics for the sample variables. For the whole sample, the mean of the logarithm of the dollar amount of small business loans that a bank provides in each county is 3.579, and the mean of the logarithm of the number of small business loans that a bank offers in each county is 1.452. Except for a Denovo dummy, all other variables have statistically significant differences in means between community banks and non-community banks. However, this is not surprising given a large number of observations. Overall, non-community banks, on average, have more assets, a higher capital ratio, a higher non-performing loan rate, higher profitability, a higher rate of commitment, a higher business loans-to-total assets ratio, a lower small dollar amount, and a lower liquid assets-to-total assets ratio.

3.4. Hypotheses and Empirical Models

We estimate pooled OLS and fixed effects (county- and year-fixed effects) regression models to test our hypotheses, with the error terms clustered by county and year. Two dependent variables (denoted as $SBL_{b,c,t}$) are used in all the regressions for hypothesis testing. The dependent variables are either the natural logarithm of the number or the dollar amount of loans that each

bank provides in each county to the firms with gross annual revenue of less than $1 million each year plus 1. Since the interested variable is a dummy variable for whether a bank is a community or non-community bank, we cannot use bank fixed effects for all models. The reason is that the interested variable may be perfectly collinear with the fixed effect dummy variable.

Based on the above arguments, we propose three hypotheses and relative models related to the research questions.

H3.1: At the county level, community banks still provide more small business loans in terms of both number and amount than non-community banks.

As community banks still have an advantage in providing relationship banking to small businesses, on average, they can offer more small business loans in each county than non-community banks. Community banks might have experienced stronger competition from non-community banks due to the deregulation trend in branching, starting from the early 1990s and the development of new lending technologies before the Great Recession. After the Great Recession, however, community banks became more competitive again due to the change in branching structure and the shift in small business lending strategies of non-community banks.

To test this hypothesis, we then use the following model.

(3.1) $$SBL_{b,c,t} = \alpha_{b,c,t} + \beta_1 CBdummy_{b,t} + \sum_{i=1}^{k} \gamma_i BankControls_{b,t} + \sum_{j=1}^{n} \delta_j DemographicControls_{c,t} + \varepsilon_{b,c,t}$$

The key variable for the first model is a dummy variable $CBdummy_{b,t,}$ which equals one if the bank is a community bank and 0 otherwise. The expected value of β_1 is positive if H3.1 holds. We also separate the whole sample into three sub-periods, the years before the Great Recession, 2003-2007; the Great Recession period, 2008-2009; and the period after the Great Recession for the years from 2010 to 2016. We also estimate the model to test whether a community bank

provides more small business funding in each county. The expectation is β_1 is not significant before the Great Recession but is positively significant afterward.

H3.2: In non-metropolitan areas, community banks are a more important source of small business funding than in metropolitan areas.

Information on small business loans that each bank lends at the county level allows ú to examine differences between community banks and non-community banks in metropolitan and non-metropolitan areas. This is important because recently, especially after the Great Recession, there is a consolidation trend among banks, and the tendency of community bank consolidation is relatively high. If community banks still play an essential role in small business funding, the disappearance of community banks in non-advantage areas, like non-metropolitan areas, would harm small businesses in those areas that need them the most.

(3.2) $$SBL_{b,c,t} = \alpha_{b,c,t} + \beta_1 CBdummy_{b,t} + \beta_2 Non\_metropolitan\_dummy_{c,t} + \beta_3 CBdummy_{b,t} \times Non\_metropolitan\_dummy_{c,t} + \sum_{i=1}^{k} \gamma_i BankControls_{b,t} + \sum_{j=1}^{n} \delta_j DemographicControls_{c,t} + \varepsilon_{b,c,t}$$

In the regression for Hypothesis 3.2, we use the $Non\_metropolitan\_dummy_{c,t}$ equals 1 if the county is not located in a metropolitan area and equals 0 if the county is located in a metropolitan area in that year. The coefficient of interest is β_3, which is the coefficient of the interaction between the community bank dummy and the non-metropolitan dummy. If H3.2 is supported, then β_3 should be significantly positive.

H3.3: In areas where community banks do not have branches, they perform worse than non-community banks in small business funding.

This paper also considers whether community banks still rely on relationship banking to make small business loans. This hypothesis tests whether community banks have an advantage in providing small business funding in counties where they do not have branches. If the relationship

is negative, this is consistent with the view that community banks do not have an advantage in non-branch counties. Stated another way, it is consistent with the belief that they still need to have offices in the local community to take advantage of relationship banking.

(3.3) $$SBL_{b,c,t} = \alpha_{b,c,t} + \beta_1 CBdummy_{b,t} + \beta_2 Nonbranch\_dummy_{b,c,t} + \beta_3 CBdummy_{b,t} \times Nonbranch\_dummy_{b,c,t} + \sum_{i=1}^{k} \gamma_i BankControls_{b,t} + \sum_{j=1}^{n} \delta_j DemographicControls_{c,t} + \varepsilon_{b,c,t}$$

In Hypothesis 3.3, we identify those counties in the CRA sample that a particular bank does not have a branch in that county. The $Nonbranch\_dummy_{b,c,t}$ is the dummy with the value of 1 if the bank does not have any branch in that county and 0 otherwise. If H3.3 is true, then $\beta 3$, the interaction coefficient between community bank dummy and non-branch areas is expected to be negatively significant.

In all of our models, the bank control variables ($BankControls_{b,t}$) include bank-level control variables, which measure different characteristics of the bank. This paper follows Peek and Rosengren (1998), Berger and Udell (2004), and Cole (2018) to create financial health variables that proxy for the CAEL components of the CAMELS supervisory rating system: Capital, Asset quality, Earnings, and Liquidity. Capital is total equity capital to total assets; Asset quality is nonperforming loans (NPLs) to total assets; Earnings is measured by return to assets (ROA), and Liquidity is liquid assets total assets. Liquid assets include cash and balances due from depository institutions plus Federal Funds purchased, and securities purchased under reverse repurchase agreements plus securities held to maturity plus securities available for sale. In addition, according to Cornett et al. (2011), loan originations are affected by liquidity shocks that banks experience. Therefore, two variables representing possible liquidity risks are included, core deposit to total assets and the Commitment rate, which is the ratio of business loan commitments to total credit commitments. Here, total credit commitments are the sum of total assets and total loan

commitments. Cornett et al. (2011) and Cole (2018) also control for bank size, measured by the logarithm of total assets plus 1. Bigger banks have an advantage in funding loans under challenging times. We also follow Cole (2018) in controlling for De Novo banks, those banks joining the industry for fewer than five years. He argued that loan growth is expected to be much more rapid at such banks because of the abundance of cash in their early years. The total business loans, measured as the sum of total commercial real estate lending and total commercial and industrial (C&I) lending of the bank, also relate directly to small business lending. Therefore, we control for the total business loans outstanding-to-total assets ratio.

As for demographic control variables at the county level, we control for the logarithm of population plus 1, the logarithm of household median income plus 1, the poverty rate, and the unemployment rate. Counties with a greater population or higher household median income and a lower poverty rate are expected to be more developed areas. As a result, these factors may enhance the chance that more small businesses will prosper, and the demand and the density for bank operations will be higher. We also control for the number of small business establishments as a demand size control for the number of small business loans. We calculate the logarithm of the number of business establishments plus 1 (*Ln number of SB establishments*).

3.5. Empirical Results

Tables 3.2 presents overall small business lending results at the bank-county level for the entire period 2003-2016, including the banking and demographic factors and the key explanatory community bank dummy variable. Table 3.2 reports the results for the test of Hypothesis 3.1. Column (1) in the first column of the table shows the OLS results incorporate the key variable, bank controls, and demographic control variables with the number of SBL as the dependent variable. Column (2) includes all variables and year-fixed effects. Column (3) provides county

fixed effects, and Column (4) consists of both county and year fixed effects. Columns (5) to Column (8) repeat each column from Columns (1) to (4) with the dollar amount of SBL as a dependent variable. Columns (1) to (8) in this table show similar results in that community banks significantly provide, on average, a higher number and dollar amount of small business loan originations in a county. The coefficient of the community bank dummy in Column (4) suggests that community banks, on average, will make 30 percentage points more small business loans in each county than that of non-community banks. Among control variables, the number of small businesses in a county is positively correlated with the log number of small business loan originations. This finding indicates that the number of small business firms variable is an endogenous variable that could be omitted if we only use bank control variables. It is also interesting to note that the size of the bank is positively correlated with the number of small business loans provided in each county. This is reasonable because the more assets a bank has, the more resources available to provide small business loans. Controlling for bank asset size also underlines the impact of the community bank dummy variable. The model also indicates that the higher the total business loans-to-total assets ratio, the higher the number of small business loans that each bank originates in each county. Controlling for bank and demographic characteristics, Column (8) of Table 3.2 suggests that a community bank will make 73.8 percentage points higher in the dollar amount of small business loan originations than a non-community bank.

(Insert Table 3.2 here)

To test hypothesis 3.1, in Table 3.3, we repeat Column (4) and Column (8) of Table 3.2, respectively. However, we separate the research periods into three sub-periods, those years before, during, and after the Great Recession. The results show that the community bank dummy variable does not statistically significantly correlate to both dependent variables before the Great Recession. This supports the argument that, in these years, community banks did not significantly provide

more loans than non-community banks. As mentioned before, one possible explanation is that, due to deregulation and advancement in lending technologies, the extension of non-community banks into small business funding markets weakened the competitiveness of community banks.

Meanwhile, after the Great Recession, the coefficient of the community bank dummy is strongly positively significant, suggesting a revoke of community banks' role in small business funding. This result is supported by Chen, Hanson, and Stein (2017)'s study, in which they show a decrease in small business lending among the biggest banks after the Great Recession. The reduction in small business lending activities of non-community banks enhances the relative advantage of community banks in this market.

(Insert Table 3.3 here)

To test hypothesis 3.2, in Table 3.4, we repeat Columns (1) to (8) of Table 3.2, respectively. However, we add a non-metropolitan dummy and interact with the community bank dummy and non-metropolitan dummy. Table 3.4 indicates that, compared to non-community banks, community banks originate more small business loans, both in number and total dollar amount in non-metropolitan counties. Column (3) and Column (7) in Table 3.4 show that, on average, community banks provide 73 percentage points more loans and 85 percentage points more total dollar amounts of loans than non-community banks in non-metropolitan areas respectively. The regression results of Table 3.4 suggest that community banks play an even more critical role in providing small business loans in non-metropolitan areas than non-community banks do. There is one possible way to explain these results. Non-community banks may not focus on non-metropolitan areas, where the market was potentially showing non-profitability. This is supported by the fact that the number of non-community bank branches is smaller than that of community banks in non-metropolitan areas. The situation is the opposite in metropolitan areas where non-community banks dominate in the number of branches. Suppose the conventional paradigm holds,

with the advantage of relationship lending and more physical offices in non-metropolitan counties, community banks will have the higher competitiveness than non-community banks in these counties.

(Insert Table 3.4 here)

One thing to be noted here is that the non-metropolitan dummy is a county fixed variable. Therefore, the results explained in Column (4) and Column (8) of Table 3.4, which take into account the year and county fixed effects, show the impact on those counties that have changed metropolitan status through time. The results still support hypothesis 3.2 in these cases.

To find further evidence for the conventional paradigm, Table 3.5 repeats Table 3.2 except for two additional variables, the non-branch dummy and the interaction between the community bank dummy and the non-branch dummy. The coefficient of the interaction value between community bank dummy and non-branch dummy provides that in the county that the bank does not have any branch; community banks perform worse than non-community banks in terms of small business loan originations. For example, Column (4) of Table 3.5 illustrates that a community bank originated significantly 48 percentage point fewer small business loans than a non-community bank in the county that the bank does not have the branch. This result supports the argument that community banks cannot provide small business loans better than non-community banks in those counties with no branch. It suggests that the physical appearance of an office in the county increases the ability that community banks can utilize the relationship banking. In other words, community banks still rely on relationship banking as their competitive advantage.

(Insert Table 3.5 here)

Overall, regression results suggest that community banks provide more small business loans than non-community banks at the county level regarding dollar amount and number of loans after the Great Recession. The results also assert that community banks provide more loans to

small businesses than non-community banks in non-metropolitan areas. And in counties that they do not have branches, where they seem to have less advantage in relationship banking, community banks provide fewer small business loans than non-community banks.

3.6. Robustness Tests

Table 3.6 repeats Columns (4) and (8) in Table 3.4. However, we separate the sample into three periods, before, during, and after the Great Recession. The interaction between the community bank dummy and the non-metropolitan shows significant positive results in all sub-periods. This strongly supports Hypothesis 3.2. The positive significant coefficients present that in any period, community banks provide more loans in both number and dollar amount than non-community banks in non-metropolitan areas.

(Insert Table 3.6 here)

In 2005, there was a change in the size threshold for those banks that need to report their small business loans in CRA. The threshold was raised to $1 billion in asset size. To eliminate the possible impact of this regulatory change, in an unreported test, we only use those years after 2004 and rerun all the tests. The results, which are available upon request, are still robust to this change.

In addition, in an unreported test, we change the dependent variables to the number and dollar amount of originations for those loans with original loan amount less than $1 million and redo all the tests. The results remain robust.

3.7. Conclusions

In conclusion, this paper contributes to the existing literature by providing evidence indicating community banks perform better than non-community banks after the Great Recession in funding small businesses at the county level. In contrast to earlier studies using asset size threshold to identify whether a bank is a community bank or not, we use a more reasonable

definition of a community bank provided by the regulatory authority. The findings indicate, when controlling for a bank's asset size and other bank and demographic factors, there is strong evidence that community banks significantly and positively increase small business loans in counties, particularly in micropolitan or rural areas and after the Great Recession. The results emphasize the importance of community banks in small business funding in more disadvantaged areas, where small businesses would experience difficulty obtaining funding sources from non-community banks.

In addition, the paper indicates that the conventional paradigm may not hold due to deregulation and lending technology innovations in the period before the Great Recession. However, the branch consolidation trend among non-community banks, which shows a switch in market orientation after the Great Recession, has enabled community banks, with their advantage of relationship banking, to return to their essential role in providing funding for small businesses.

The paper also contributes evidence that community banks still take advantage of relationship banking in funding small businesses in counties where they have branches, but do not significantly provide more loans than non-community banks in those counties where there are no branches.

Table 3.1 Summary Statistics

This table shows the summary statistics for the bank and demographic characteristics of counties in which community banks and non-community banks in CRA sample provide small business loans. Panel A provide summary statistics for the bank characteristics variables at the bank level for community banks and non-community banks in CRA sample. Panel B shows the demographics of counties where banks report origination of small business loans. Column 2 and 3 presents the number and the mean value of the whole sample; column 4 and 5 presents those of community banks; and column 6 and 7 shows those of non-community banks. Column 8 shows the different between the mean of community bank and non-community bank samples and the last column presents the t-statistics of the difference. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	Total		Community Banks		Non-Community Banks		Difference	t-stats
	Observations	Mean	Observations	Mean	Observations	Mean		
Panel A: Bank characteristics								
Ln dollar amount of SBL	1,176,724	3.58	182,810	4.45	993,914	3.42	-1.027***	-136.87
Ln number of SBL	1,176,724	1.45	182,810	1.29	993,914	1.48	0.195***	48.64
Ln assets	1,176,724	16.68	182,810	14.01	993,914	17.17	3.162***	637.66
Equity/TA	1,176,689	0.13	182,810	0.10	993,879	0.14	0.0378***	198.96
Non-performing loans/TA	1,176,689	0.02	182,810	0.02	993,879	0.02	0.00378***	74.79
ROA	1,176,689	0.02	182,810	0.01	993,879	0.02	0.00944***	166.18
Liquid assets/TA	1,176,724	0.25	182,810	0.28	993,914	0.25	-0.0374***	-92.3
Core deposit/TA	1,176,716	0.51	182,810	0.69	993,906	0.48	-0.206***	-332.98
Commitment rate	1,176,724	0.39	182,810	0.13	993,914	0.43	0.307***	447.93
Denovo dummy	1,176,724	0.01	182,810	0.01	993,914	0.01	-0.00031	-1.67
Business loan/TA	1,176,724	0.70	182,810	0.69	993,914	0.71	0.0196***	49.82
Panel B: Demographic characteristics								
Ln population	1,176,665	11.09	182,805	11.69	993,860	10.98	-0.702***	-172.11
Unemployment rate	1,176,076	6.43	182,714	6.21	993,362	6.47	0.253***	38.51
Ln median household income	1,176,639	10.72	182,804	10.77	993,835	10.71	-0.0602***	-88.56
Poverty rate	1,176,640	14.80	182,804	13.65	993,836	15.01	1.351***	90.49
Ln number of SB establishments	1,176,639	7.31	182,805	7.95	993,834	7.20	-0.750***	-177.64

Table 3.2 Small Business Loan Originations by Community Banks and Non-Community Banks in Counties

This table presents results from regressions of natural logarithm of number and natural logarithm of dollar amount of small business loan originations of each bank in each county from 2003 to 2016 on community bank dummy variable, bank control variables and demographic control variables. Columns 1 to 4 show the results for logarithm of number of small business loans originations, columns 5 to 8 show the results for logarithm of dollar amount of small business loans originations. Columns 1 and 5 shows the OLS regressions results on community bank dummy. Columns 2 and 6 present the year fixed effect regression. Columns 3 and 7 present the county fixed effects regression. Columns 4 and 8 show the county and year fixed effects regression. All regressions are controlled with bank control and demographic variables and clustered at county and year level. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	Ln of number of small business loan originations				**Ln dollar amount of small business loan originations**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CBDummy	0.285**	0.291**	0.294**	0.300**	0.708**	0.726**	0.719**	0.738**
Ln assets	0.166***	0.182***	0.177***	0.182***	0.200***	0.231***	0.240***	0.241***
Equity/TA	-0.362	-0.304	-0.310	-0.296	-1.227	-1.068	-1.053	-1.018
Non-performing loans/TA	2.220	2.582	2.468	2.480	5.530	6.034	6.105	5.820
ROA	1.408	1.697	1.302	1.695	-2.497	-2.707	-1.956	-1.877
Liquid assets/TA	0.833*	0.863*	0.849*	0.863*	1.478	1.521*	1.552*	1.558*
Core deposit/TA	0.767**	0.904**	0.851**	0.903**	1.625**	1.840**	1.978**	1.975**
Commitment rate	1.059***	1.016***	1.068***	1.039***	-0.632*	-0.630**	-0.738**	-0.699**
Denovo dummy	-0.058	-0.122	-0.064	-0.098	0.027	-0.009	-0.133	-0.095
Business loan/TA	1.057**	1.142**	1.094**	1.127**	2.602***	2.711***	2.821***	2.791***
Ln population	0.201***	0.120***	-1.298**	0.114	0.376***	-3.313***	0.188***	0.085
Unemployment rate	-0.034**	0.003	-0.055***	0.007**	-0.067*	-0.118**	0.015***	0.008
Ln median household income	-1.041***	-0.133**	-1.865***	0.065	-2.158***	-4.199***	0.115	0.206
Poverty rate	-0.039***	-0.011***	-0.024*	0.000	-0.082***	-0.048*	-0.012***	0.001
Ln number of SB establishments	0.092**	0.120***	1.334***	0.216***	0.142*	3.196***	0.197***	0.487***
County FE	No	No	Yes	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	No	Yes	Yes
Observations	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917
Adjusted R-squared	0.104	0.121	0.123	0.132	0.127	0.151	0.156	0.163

Table 3.3 Small Business Loan Originations by Community Banks and Non-Community Banks in Counties in Different Periods

This table presents results from regressions of natural logarithm of number of small business loan originations (column 1,2 and 3) and of natural logarithm of dollar amount of small business loan origination at each bank in each county (column 4,5 and 6) on community bank dummy variable, bank control variables and demographic control variables. Columns 1 and 4 show the results for the period before the Great Recession, columns 2 and 5 show the results for the Great Recession period and columns 3 and 6 present the estimates for the period after the Great Recession. We estimate all regressions using county and year fix effects and clustering at county and year level. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	2003-2007	**2008-2009**	**2010-2016**	**2003-2007**	**2008-2009**	**2010-2016**
	Ln number of SBLs			**Ln dollar amount of SBLs**		
CBDummy	0.046	0.387*	0.470***	0.030	1.006	1.140***
Ln assets	0.074	0.208*	0.271***	0.047	0.305*	0.349**
Equity/TA	-0.689	0.638	-3.513*	-1.920*	-4.338	-3.052
Non-performing loans/TA	-9.497*	3.176	3.112	-16.159*	4.024	9.325**
ROA	-1.294	-1.404	9.688	-4.875	-7.050	9.142
Liquid assets/TA	-0.598*	2.005	2.511***	-1.269*	2.693	4.313***
Core deposit/TA	0.086	1.303	0.996**	-0.064	1.613	2.872***
Commitment rate	1.346**	0.762	0.530	-0.851	-0.941	-0.703
Denovo dummy	-0.145	-0.385	0.191	-0.386	-1.203	0.763**
Business loan/TA	1.181*	1.177	2.663***	2.685**	2.828	4.555***
Ln population	0.204	0.409	-0.022	-0.448	1.664	0.253
Unemployment rate	-0.002	0.004	0.001	-0.014	0.019	0.008
Ln median household income	-0.005	-0.033	-0.068	-0.112	-0.133	-0.016
Poverty rate	-0.002	0.004	-0.000	0.005	0.007	0.001
Ln number of SB establishments	0.082	-0.035	0.123	0.082	0.046	0.330*
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	442,273	159,972	573,672	442,273	159,972	573,672
Adjusted R-squared	0.114	0.135	0.176	0.135	0.180	0.191

Table 3.4 Small Business Loan Originations by Community Banks and Non-Community Banks in Counties of Metropolitan and Non-Metropolitan Areas

This table presents the results of the specification of equation (3.2) of Section 3.4, estimating the effect of being a community bank on number and dollar amount of small business loan originations in difference metropolitan areas from 2003 to 2016. The dependent variable is natural logarithm of number of small business loan originations by a bank in each county in columns 1 to 4 and is natural logarithm of dollar amount of small business loan originations by a bank in each county in columns 5 to 8. Column 1 and 5 shows the OLS regressions results on community bank dummy, non-metropolitan dummy, and the interaction between these two dummy variables. Columns 2 and 6 present the year fixed effect regression. Columns 3 and 7 present the county fixed effects regression. Columns 4 and 8 show the county and year fixed effects regression. All regressions are controlled with bank control and demographic variables and clustered at county and year level. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln of number of small business loan originations				**Ln dollar amount of small business loan originations**			
CBdummy	0.027	0.031	0.045	0.049	0.412*	0.417*	0.437*	0.443*
Non_metropolitan_dummy	-0.191***	-0.162***	-0.111***	-0.098***	-0.312***	-0.233***	-0.158**	-0.116***
CBdummy x Non_metropolitan_dummy	0.762***	0.768***	0.729***	0.737***	0.878***	0.892***	0.846***	0.864***
Ln assets	0.169***	0.185***	0.180***	0.185***	0.204***	0.243***	0.235***	0.245***
Equity/TA	-0.354	-0.299	-0.299	-0.288	-1.216	-1.046	-1.056	-1.008
Non-performing loans/TA	2.247	2.634	2.549	2.552	5.525	6.157	6.129	5.904
ROA	1.461	1.753	1.336	1.758	-2.430	-1.887	-2.669	-1.804
Liquid assets/TA	0.832*	0.862*	0.849*	0.863*	1.476	1.550*	1.521*	1.558*
Core deposit/TA	0.768**	0.902**	0.850**	0.902**	1.627**	1.976**	1.839**	1.974**
Commitment rate	1.102***	1.059***	1.106***	1.076***	-0.581*	-0.687**	-0.585*	-0.654**
Denovo dummy	-0.063	-0.125	-0.070	-0.105	0.022	-0.138	-0.017	-0.102
Business loan/TA	1.068**	1.152**	1.105**	1.138**	2.616***	2.832***	2.724***	2.804***
Ln population	0.154***	0.086***	-1.365***	0.063	0.278***	0.128***	-3.392***	0.025
Unemployment rate	-0.033**	0.004	-0.055***	0.007**	-0.065*	0.017***	-0.118**	0.008
Ln median household income	-1.052***	-0.135**	-1.815***	0.079	-2.208***	0.086	-4.141***	0.222
Poverty rate	-0.037***	-0.010***	-0.022*	0.001	-0.080***	-0.010**	-0.046*	0.002
Ln number of SB establishments	0.129***	0.148***	1.327***	0.203***	0.211**	0.244***	3.187***	0.472***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln of number of small business loan originations				**Ln dollar amount of small business loan originations**			
County FE	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917
Adjusted R-squared	0.112	0.128	0.130	0.138	0.130	0.159	0.153	0.165

Table 3.5 Small Business Loan Originations by Community Banks and Non-Community Banks in Counties at Non-Branch Counties

This table presents the results of the specification of equation (3.3) of Section 3.4, estimating the effect of being a community bank on number of small business loan originations in counties that banks have and do not have branches from 2003 to 2016 The dependent variable is natural logarithm of number of small business loan originations by a bank in each county in columns 1 to 4 and is natural logarithm of dollar amount of small business loan originations by a bank in each county in columns 5 to 8. Columns 1 and 5 shows the OLS regressions results on community bank dummy, non-branch dummy, and the interaction between these two dummy variables. Columns 2 and 6 present the year fixed effect regression. Columns 3 and 7 present the county fixed effects regression. Columns 4 and 8 show the county and year fixed effects regression. All regressions are controlled with bank control and demographic variables and clustered at county and year level. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln of number of small business loan originations				**Ln dollar amount of small business loan originations**			
CBdummy	0.634***	0.672***	0.665***	0.682***	0.857***	0.953***	0.945***	0.982***
Nonbranch_dummy	-2.073***	-2.043***	-2.055***	-2.044***	-3.891***	-3.812***	-3.848***	-3.820***
CBdummy x Nonbranch_dummy	-0.441***	-0.482***	-0.471***	-0.484***	-0.197*	-0.302**	-0.289**	-0.320**
Ln assets	0.130***	0.143***	0.140***	0.144***	0.132*	0.168**	0.161**	0.170**
Equity/TA	-0.765*	-0.729*	-0.708*	-0.710*	-1.981**	-1.842**	-1.811**	-1.789**
Non-performing loans/TA	1.072	1.579	1.392	1.513	3.435	4.283	4.077	4.066
ROA	1.010	1.296	0.940	1.306	-3.268	-2.725	-3.410	-2.629
Liquid assets/TA	0.761	0.790*	0.779*	0.793*	1.338	1.411*	1.385	1.421*
Core deposit/TA	0.493*	0.603**	0.566*	0.606**	1.111*	1.418**	1.307**	1.420**
Commitment rate	1.641***	1.593***	1.643***	1.613***	0.460	0.339	0.448	0.376
Denovo dummy	-0.216**	-0.267**	-0.215**	-0.243**	-0.266	-0.401	-0.290	-0.363
Business loan/TA	1.099**	1.170**	1.135**	1.164**	2.667***	2.859***	2.775***	2.846***
Ln population	0.205***	0.130***	-1.317***	-0.125	0.381***	0.204***	-3.342***	-0.360*
Unemployment rate	-0.038***	-0.003	-0.058***	0.005	-0.076**	0.005	-0.122***	0.004
Ln median household income	-0.895***	-0.139**	-1.457***	0.154*	-1.878***	0.103	-3.429***	0.369**
Poverty rate	-0.032***	-0.009***	-0.021*	-0.000	-0.069***	-0.009**	-0.042*	0.000
Ln number of SB establishments	0.040	0.071***	1.152***	0.214***	0.047	0.109***	2.855***	0.485***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln of number of small business loan originations				**Ln dollar amount of small business loan originations**			
County FE	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917	1,175,917
Adjusted R-squared	0.319	0.332	0.332	0.339	0.326	0.348	0.343	0.353

Table 3.6 Small Business Loan Originations by Community Banks and Non-Community Banks in Counties of Metropolitan and Non-Metropolitan Areas in Different Periods

This table presents the results of the specification of equation (3.2) of Section 3.4, estimating the effect of being a community bank on number of small business loan originations in difference metropolitan areas in different periods. The dependent variables are natural logarithm of number of small business loan originations (columns 1,2 and 3) and natural logarithm of dollar amount of small business loan origination at each bank in each county (columns 4,5 and 6). Columns 1 and 4 show the results for the period before the Great Recession, columns 2 and 5 show the results for the Great Recession period and columns 3 and 6 present the estimates for the period after the Great Recession. All regressions use community bank dummy, non-metropolitan dummy, the interaction between these two variables controlled by bank and demographic variables we estimate all regressions using county and year fix effects and clustering at county and year level. *, ** and *** denote significance at 10%, 5%, and 1%, respectively.

	Ln number of SBLs			**Ln dollar amount of SBLs**		
	(1)	(2)	(3)	(4)	(5)	(6)
	2003-2007	**2008-2009**	**2010-2016**	**2003-2007**	**2008-2009**	**2010-2016**
CBdummy	-0.224	0.113	0.208*	-0.265	0.665	0.827**
Non_metropolitan_dummy	-0.183**	-0.148	-0.157***	-0.235**	-0.239	-0.231***
CBdummy x Non_metropolitan_dummy	0.797***	0.793*	0.762***	0.862***	0.977*	0.905***
Ln assets	0.081	0.210*	0.273***	0.054	0.305*	0.350**
Equity/TA	-0.675	0.595	-3.541*	-1.920*	-4.444	-3.099
Non-performing loans/TA	-9.467**	3.192	3.300	-16.130*	4.109	9.707**
ROA	-1.265	-1.288	9.661	-4.984	-6.897	9.051
Liquid assets/TA	-0.571*	1.990	2.469***	-1.237*	2.649	4.251***
Core deposit/TA	0.101	1.303	0.981**	-0.048	1.605	2.864***
Commitment rate	1.406**	0.792	0.524	-0.791	-0.914	-0.706
Denovo dummy	-0.190	-0.377	0.176	-0.457	-1.192	0.750**
Business loan/TA	1.208*	1.205	2.668***	2.740**	2.863	4.556***
Ln population	0.106*	0.096	0.080**	0.156*	0.134	0.115**
Unemployment rate	0.009	0.001	0.002	0.028**	0.014	0.013**
Ln median household income	-0.176*	-0.170	-0.092*	0.087	0.043	0.099
Poverty rate	-0.011**	-0.012	-0.007**	-0.011*	-0.013	-0.008*
Ln number of SB establishments	0.128**	0.160	0.152***	0.201**	0.257	0.261***
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	442,273	159,972	573,672	442,273	159,972	573,672
Adjusted R-squared	0.110	0.139	0.176	0.130	0.181	0.188

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