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The Effect of Credit Scoring on Small-Business Lending

This paper examines the effect of credit scoring on small-business lending for a sample of large U.S. banking organizations. We find that credit scoring is associated with an 8.4 percent increase in the portfolio share of small-business loans, or \$4 billion per institution. However, we fail to uncover any specific attributes of bank small-business credit-scoring programs that lead to this increased lending. Overall, we conclude that credit scoring lowers information costs between borrowers and lenders, thereby reducing the value of traditional, local bank lending relationships.

THE U.S. COMMERCIAL BANKING SECTOR has experienced tremendous consolidation this decade—due to the removal of geographic and product market entry barriers, advances in electronic technology, and financial innovation. Proponents of bank mergers and acquisitions often cite the consumer benefits derived from increased bank efficiency, competition, and geographic diversification. However, some policymakers have expressed concern that the emerging institutions may significantly reduce the availability of credit to small firms, which account for roughly half of U.S. private-sector employment and gross domestic product.¹ This conjecture is based primarily on the fact that bank call report data indicate that small banks hold a greater percentage of their assets in small-business loans than do large

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1. Small businesses, as defined by the Small Business Administration (SBA), are those enterprises employing fewer than five hundred employees, or 99 percent of the twenty-three million nonfarm U.S. firms (Small Business Administration, 1997).

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banks (Berger, Kashyap, and Scalise 1995).² The explanations offered for this disparity are grounded in the economics of information.

To date, theories concerning small-business credit markets have emphasized the existence of significant information asymmetries between borrowers and lenders (Nakamura 1993). It is also believed that such market imperfections can result in credit rationing by lenders, particularly when loans are unsecured (Stiglitz and Weiss 1981). To mitigate such problems, borrowers and lenders have historically used long-term relationships, or close and continuous interactions that generate useful information about the borrowers financial state (Frame 1995). Moreover, small businesses are thought to be dependent on local banks for such relationship-based borrowing. Empirical evidence confirms both the value of lending relationships (Peterson and Rajan 1994; Berger and Udell 1995; Cole 1998) as well as the use of local commercial banks for small-business credits (Elliehausen and Wolken 1990).

Studies concerning the effect of banking industry consolidation on small-business lending are generally motivated by (1) the stylized fact that small banks are relatively more active in this market; and (2) the theoretical emphasis on small-business credit market imperfections. Berger and Udell (1996) synthesize two theories positing that the provision of banking services to small businesses decreases with bank size and organizational complexity. The first is that the small-business lending is fundamentally different from large firm lending in that the former credits are more information intensive and relationship driven. The second, based on the work of Williamson (1967), emphasizes managerial diseconomies of scale with the provision of multiple activities in large, complex organizations.³ The authors' empirical tests indicate that large banks tend to charge relatively lower loan rates to and less often require collateral of small-business borrowers. However, they find that large banks reduce their volume of relatively costly relationship loans via price or quantity rationing. Related work by Cole, Goldberg, and White (1998) indicates that large banks typically employ standard financial statement criteria in the loan decision process, while small banks focus more on their impression of borrower character.

While it appears that large and small banks approach lending to small businesses differently, the empirical evidence regarding the effect of bank merger and acquisition activity is mixed. Two early studies indicate that small-business borrowers may be adversely affected by consolidation (Keeton 1995 and Peek and Rosengren 1995). More recent evidence, however, suggests that there is little cause for policymakers' credit access concerns (Strahan and Weston 1996, 1998; Jayaratne and Wolken 1999; Cole and Walraven 1998; and Peek and Rosengren 1998). One potential explanation for these conflicting results is that large banks' approach to small-business lending has changed. In recent years, many large banks have adopted automated underwriting

2. However, such static analysis does not capture market responses by other market participants (Berger, Saunders, Scalise, and Udell 1998) or potential entrants (Goldberg and White 1998).

3. For example, the trend toward large banking organizations with expanded product lines and increased geographic dispersion may complicate the managerial structure of the banking organization. This can result in increased layers of management (vertical complexity) and an increased number of parallel functions (horizontal complexity).

systems based upon credit scoring. This approach allows banks to make small, unsecured business loans that were previously relationship oriented or cost prohibitive.

Credit scoring is the process of assigning a single quantitative measure, or score, to a potential borrower representing an estimate of the borrower's future loan performance (Feldman 1997). While credit scores have been used for some time in the underwriting of consumer loans, this technology has only recently been applied to commercial credits. Specifically, credit analysts have determined that the personal credit history of small-business owners is highly predictive of the loan repayment prospects of the business, especially for loans under \$100,000.⁴ Thus, personal information is obtained from a credit bureau and then augmented with basic business-specific data to predict repayment.

For a given institution, the effect of credit scoring is dependent on how the underwriter incorporates the measure into the loan review process. For example, the lender may use credit scores to either automatically approve or reject loan applications or simply as a supplement to its traditional underwriting techniques. Also, whether a bank has purchased a credit-scoring model or has developed its own may have implications. Specifically, purchased software is more likely to be viewed by lenders as a "black box"—indicating their apprehension about the model's predictive ability.⁵

According to Feldman (1997), credit scoring will alter small-business lending in three areas: (1) the interaction between borrowers and lenders; (2) loan pricing; and (3) credit availability. First, credit scoring allows lenders to underwrite and monitor loans without actually meeting the borrower. This development is in stark contrast to the perceived importance of a local bank-borrower relationship. In fact, because of scoring systems, borrowers can obtain unsecured credit from distant lenders through direct marketing channels. Second, the price of small-business loans should decline—especially for high-credit-quality borrowers who will no longer have to bear the cost of extensive underwriting. Also, increased competition—resulting from small businesses having access to more lenders—should further lower borrowing costs. Third, credit scoring should increase credit availability for small businesses. Better information about the repayment prospects of a small-business applicant makes it more likely that a lender will price the loan based on expected risk, rather than denying the loan out of fear of charging too little. Moreover, the widespread use of credit scoring will increase prospects for asset securitization by encouraging consistent underwriting standards.

In this paper, we empirically examine the effect of the automated scoring of small-business credit applications on large banking organizations' propensity to engage in small-business lending. To this end, we present new survey data concerning the use of credit-scoring technology by a sample of large U.S. banking organizations. Theoretically, credit scoring should result in greater competition among lenders for small-

4. Mester (1997) cites the use of such personal information as the applicant's monthly income, outstanding debt, financial assets, employment tenure, home ownership, and previous loan defaults or delinquencies.

5. This is at least likely in the short run, or until the institution builds a history (or comfort level) with the technology.

business loans as traditional underwriting impediments (for example, significant information asymmetries) erode and underwriting costs decline. Moreover, this technology should significantly enhance lenders' ability to evaluate and price small-business credit risks and reduce their need to ration credit. In short, banks and nonbank financial institutions may now compete over a wider (that is, nonlocal) geographic area for small-business customers; thereby reducing the value of lending relationships.

The remainder of the paper is organized as follows. Section 1 describes the data. Section 2 outlines the hypothesis tests and presents our results. Section 3 concludes.

1. DATA

The primary data employed in this paper were collected through a phone survey of the two hundred largest U.S. banking organizations (as measured by total domestic banking assets) as of June 30, 1997.⁶ Combined, these institutions accounted for 71.3 percent of U.S. domestic banking assets and 53.2 percent of all small loans to businesses outstanding. Two additional criteria limited our sample. First, banking organizations not principally engaged in small-business lending—defined as those institutions having less than 0.50 percent of their total banking assets in small-business loans (as of June 30, 1997)—were not included in the survey. Second, credit card banks were also excluded. Ultimately, the lead banks of 190 of the two hundred largest U.S. banking organizations were surveyed. Of these, we received 99 responses.

In order to test for potential nonresponse error, we used a simple *t*-test comparing the average institution size (as measured by total banking assets) between respondents and nonrespondents. We examine institution size because of its relationship to our two dependent variables of interest—the ratio of small-business loans to total banking assets and whether an institution credit scores small-business loans. We find strong evidence of nonresponse bias in our survey responses.⁷ (In fact, because of the significant variation in banking organization size, 184 responses (97 percent) would have been required for 95 percent confidence that the sample was representative of the population.) Therefore, our results represent the effect of credit scoring on small-business lending only for the responding institutions and cannot be generalized to the population of the two hundred largest U.S. banking organizations.

As of January 31, 1998, 63 percent of our sample institutions used credit scoring for small-business lending.⁸ The other survey questions were designed not only to

6. This survey, conducted in January 1998 by the Federal Reserve Bank of Atlanta, represents the only available data on banks' use of credit scoring for small business lending. Moreover, this paper is the first to use the data.

7. The average size of respondents was \$27 billion (standard deviation \$43 billion), while the average size of non-respondents was \$6 billion (standard deviation \$1 billion).

8. Thirty-seven survey respondents did not use credit scoring. However, eleven of these institutions intended to implement such a program before June 1999. Commonly cited reasons for not currently using credit scoring included (1) a lack of confidence in the scores; (2) low loan volume; (3) customer resistance; and (4) that these loans don't lend themselves to scoring.

gauge the pervasiveness of credit scoring in the underwriting of small-business loans, but also to uncover variation in credit scoring practices across institutions. We were particularly interested in the following information: (1) the classification of loan sizes scored; (2) whether credit scoring is used for the automatic approval or rejection of small-business loan applications; (3) whether the results were used to set loan terms (that is, risk-based pricing); (4) whether the bank developed their own model or used one purchased from an outside vendor; and (5) how long the bank had been using credit scoring for underwriting small-business credits. Table 1 presents our survey results with respect to these questions. Based on the Call Report breakdown for small-business loans, 100 percent of the scoring banks used the information for loans under \$100,000 and 74 percent used it for all loans under \$250,000. However, only 21 percent of the banks scored larger loans. Credit scoring was used for the automatic approval or rejection of loans by 42 percent of institutions and affected loan terms at 32 percent of the banks. Surprisingly, only 13 percent of banks developed their own credit-scoring model. Lastly, scoring banks had been using these models for twenty-four months on average.

2. HYPOTHESIS TESTING

In this paper, we are interested in exploring two questions. First, does the use of credit scoring by large banking organizations influence the level of small-business lending? Second, are there particular characteristics of the credit-scoring programs that predict their effectiveness in enhancing credit availability?

Using data from the June 30, 1997, Call Report, we specify a cross-sectional relationship between the ratio of small-business loans and total domestic banking assets (*SBLRATIO*) for large banking organizations and their reported use of credit-scoring technology. First, given the survey results regarding the typical loan sizes scored (Table 1) and the Call Report data, we define small-business lending as "small loans to businesses outstanding with original amounts below \$100,000." Second, we de-

TABLE 1
SURVEY RESULTS FOR BANKS USING CREDIT SCORING (Data as of January 31, 1998)

	Number	Percent of Scoring Banks
Loan Sizes Scored:		
Under \$100,000	62	100.0
\$100,000–\$250,000	46	74.2
\$250,000–\$1,000,000	13	21.0
Automatic Approval / Rejection	26	41.9
Setting Loan Terms	20	32.3
Use Proprietary Models	8	12.9
Average Number of Months	24	—

note a dummy variable (*SCORING*) that takes a value of one for the fifty-one institutions that were using this automated underwriting technique as of January 1997.⁹

The decision to use credit scoring may be driven, in part, by the fact that an institution simply maintains a relatively high concentration of small-business loans. Thus, the use of credit scoring is potentially *endogenous* with respect to any institutional focus on small-business lending at large banking organizations. In order to account for this fact, we specify the following two-equation simultaneous equations model:

$$\begin{aligned} SBLRATIO_i = & b_0 + b_1SCORING_i + b_2LNASSETS_i + b_3EQUITYRATIO_i \\ & + b_4CORATIO_i + b_5LOANRATIO_i + b_6BANKS_i \\ & + b_7BRANCHES_i + b_8MERGEDASSETS_i + \varepsilon_{i1} \end{aligned} \quad (1)$$

$$\begin{aligned} SCORING_i = & c_0 + c_1SBLRATIO_i + c_2LNASSETS_i + c_3LNSBL \\ & + c_4CORATIO_i + c_5BANKS_i + c_6BRANCHES_i \\ & + c_7MERGEDASSETS_i + \varepsilon_{i2} \end{aligned} \quad (2)$$

where $I = 1, \dots, n$ sample banks ($N = 99$).

Besides credit scoring, several variables that may lead to variation in the percent share of small-business loans held by large banking organizations. First, we include the natural logarithm of total domestic banking assets (*LNASSETS*) to account for the fact that larger banking organizations tend to have a smaller portfolio share of small-business loans. Second, we control for banking risks by including total equity capital as a percentage of total domestic banking assets (*EQUITYRATIO*) and net commercial loan charge-offs as a percent of total commercial and industrial loans (*CORATIO*). Third, we control for the banking organization's overall focus on lending by including total loans as a percent of total domestic banking assets (*LOANRATIO*). Fourth, we account for banking company organizational structure by including both the number of subsidiary banks (*BANKS*) and number of branches (*BRANCHES*). The former is included to capture the tendency for more decentralized banking organizations to be more active small-business lenders because of their more effective use of traditional relationships. The latter, by contrast, captures a more centralized decision-making corporate structure. Lastly, we control for recent merger activity by including total domestic banking assets acquired in the previous two years as a percent of total domestic banking assets (*MERGEDASSETS*).

9. Recall that sixty-two banking organizations reported using credit scoring at year-end 1998. However, eleven of these institutions implemented their programs during 1997. These firms were considered "nonscorers" for our purposes.

In equation (2), we specify variation in the use of credit scoring as a function of a bank's institutional focus on small-business lending and certain other exogenous variables. We include the natural logarithm of the level of small-business lending (*LNSBL*) to control for portfolio size effects—that is, the larger the small-business loan portfolio, the more apt an institution is to use credit scoring. Equation (2) also includes *LNASSETS* to account for the possibility that larger banking organizations are simply more likely to use credit-scoring technology simply because of their institutional sophistication. *CORATIO* is included to control for problems in the commercial loan portfolio. Of course, credit scoring could have caused such problems or be seen as remedy to existing problems. The organizational structure variables, *BANKS* and *BRANCHES*, are also incorporated. We expect that decentralized decision-making structures associated with *BANKS* is negatively related to the use of credit scoring because of the aforementioned focus on relationship lending. The number of branches, on the other hand, should be positively related to the use of credit scoring. We also include *MERGEDASSET* in the second equation to account for recent growth that may precipitate a move toward automated underwriting. Table 2 provides sample statistics for the exogenous variables included in equations (1) and (2).

Following Maddala (1983), we use a two-step instrumental variables procedure to estimate the structural model defined by equations (1) and (2). This approach adjusts for the potential endogeneity between a banking organization's share of small-business loans and its use of credit scoring. Specifically, we first estimate the *reduced forms* of equations (1) and (2) using ordinary least squares and probit, respectively. Next, fitted values are created for the *SBLRATIO* and *SCORING* series. Lastly, these fitted values are placed into the structural equations and reestimated. Reduced-form parameter estimates are provided in Table 3, while those for the structural model appear in Table 4. *T*-statistics are based on White's (1980) corrected standard errors.

Due to the ad hoc nature of our identifying restrictions, we first present the results of the reduced-form estimation. Table 3 documents that a banking organization's focus on small-business lending is negatively related to size and positively related to the dollar volume of small-business loans in the portfolio. In fact, these scale effects dominate to the extent that all other variables are statistically and economically in-

TABLE 2
SUMMARY STATISTICS

Variable	Mean	Minimum	Maximum
<i>LNASSETS</i>	9.36	7.24	12.34
<i>EQUITYRATIO</i>	8.69	6.43	19.04
<i>CORATIO</i>	0.25	-1.13	5.26
<i>LOANRATIO</i>	64.91	33.74	81.71
<i>BANKS</i>	6.98	1.00	38.00
<i>BRANCHES</i>	430.25	12.00	3,236.00
<i>MERGEDASSETS</i>	13.11	0.00	122.76
<i>LNSBL</i>	5.07	1.66	8.55

TABLE 3

REDUCED-FORM ESTIMATES FOR THE SIMULTANEOUS EQUATIONS MODEL

Variable	<i>SBLRATIO</i>	Variable	<i>SCORING</i>
Constant	8.8067** (13.4716)	Constant	-1.3571 (-0.5591)
<i>LNASSETS</i>	-1.5008** (-9.8670)	<i>LNASSETS</i>	0.1110 (0.3695)
<i>LNSBL</i>	1.3780** (6.8867)	<i>LNSBL</i>	0.1634 (0.6785)
<i>EQUITYRATIO</i>	-0.0109 (-0.4482)	<i>EQUITYRATIO</i>	-0.1418 (-1.6213)
<i>CORATIO</i>	-0.0566 (-0.9250)	<i>CORATIO</i>	-0.1623 (-0.5747)
<i>LOANRATIO</i>	0.0002 (0.0292)	<i>LOANRATIO</i>	0.0065 (0.3546)
<i>BANKS</i>	-0.0049 (-0.6817)	<i>BANKS</i>	-0.0520** (-2.3653)
<i>BRANCHES</i>	0.0003 (1.5980)	<i>BRANCHES</i>	0.0024* (1.8525)
<i>MERGEDASSETS</i>	-0.0011 (-0.4212)	<i>MERGEDASSETS</i>	-0.0037 (-0.3616)
Observations	99	Observations	99
R-Squared	0.9360	R-Squared	N.A.

NOTES: *T*-Statistics in parentheses. * Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level.

TABLE 4

STRUCTURAL ESTIMATES FOR THE SIMULTANEOUS EQUATIONS MODEL

Variable	<i>SBLRATIO</i>	Variable	<i>SCORING</i>
Constant	20.2537** (9.2698)	Constant	0.7537 (0.1960)
<i>SCORING</i>	8.4352** (6.8867)	<i>SBLRATIO</i>	-0.2639 (-0.6859)
<i>LNASSETS</i>	-2.4370** (-8.6080)	<i>LNASSETS</i>	-0.3211 (-0.5293)
<i>EQUITYRATIO</i>	-0.0313 (-1.2018)	<i>LNSBL</i>	0.4544 (0.8737)
<i>CORATIO</i>	1.1399** (4.4972)	<i>CORATIO</i>	-0.1463 (-0.5154)
<i>LOANRATIO</i>	-0.0550** (-5.5791)	<i>BANKS</i>	-0.0520** (-2.4163)
<i>BANKS</i>	0.0267** (4.4972)	<i>BRANCHES</i>	0.0028** (2.1995)
<i>BRANCHES</i>	0.4392** (6.8829)	<i>MERGEDASSETS</i>	-0.0047 (-0.4888)
<i>MERGEDASSETS</i>	1.3680** (6.9150)	Observations	99
Observations	99	R-Squared	N.A.
R-Squared	0.9360		

NOTES: *T*-Statistics in parentheses. * Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level.

significant. With respect to the probability of using credit scoring, we find that it is negatively related to the number of subsidiary banks and positively related to the number of branches. These results are consistent with our predictions.

The results presented in Table 4 for the structural model provide evidence that credit scoring increases credit availability for small businesses. In particular, after controlling for several institution-specific variables, we find that the use of credit scoring has a positive and statistically significant effect on our sample banks' portfolio share of small-business loans (with original amounts below \$100,000) outstanding. The parameter estimate indicates that, on average over our sample, credit scoring increases this portfolio share by 8.4 percent. Furthermore, given that the average size of the scoring banks in our sample was \$42 billion, this translates to increases in small-business lending of about \$4 billion per institution. This finding indicates that advances in information technology have benefitted even the smallest credit markets.

In the same regression, we also find a negative and statistically significant relationship between both banking organization size and loan-to-asset ratio and the portfolio share of small-business loans. The former result is well documented and the latter result may stem from the fact that small-business loans are less liquid and, as a result, banking organizations with larger concentrations of these assets hold fewer loans (in aggregate) out of liquidity concerns.¹⁰

We also find positive and statistically significant relationships between the share of small-business loans and the number of branches, the number of subsidiary banks, the percentage of recently acquired assets, and the percentage of net commercial loan charge-offs. Our findings for the organizational complexity variables (*BRANCHES* and *BANKS*) are generally consistent with our expectations. The number of branches may be important (especially after accounting for bank size and the number of subsidiary banks) because it accounts for relatively greater customer contact. While branch networks are associated with more centralized decision making, they are also associated with the use of credit scoring (see below), which in turn leads to more small-business lending. Decentralized decision making through a number of subsidiary banks also tends to increase small-business lending via the maintenance of traditional banking relationships. The percent of recently acquired assets may be positively related to the share of small-business loans because large banking organizations take over smaller institutions that tend to have a larger portfolio share. Furthermore, many large banking organizations have made commitments to small-business lending markets (often through negotiation with community activists) as a condition of their merger programs. The positive relationship with commercial loan charge-off rates probably stems from the higher risk associated with these credits.

The estimates for the model predicting the use of credit scoring [equation (2)] are also interesting. First, we find that neither the portfolio share of small-business loans nor the level of these loans (in natural logarithms) explains the propensity of our

10. That is, these institutions tend to hold relatively more cash and investment securities for liquidity.

sample banking organizations to use credit scoring. We do, however, find that our sample organizations having a greater number of subsidiary banks are less likely to use credit scoring, while those with larger branch networks are more likely to use it. The former result is consistent with a more decentralized decision-making structure that is more focused on the maintenance of traditional banking relationships. In this case, the benefits of such relationships must outweigh the increased costs associated with manual underwriting. Larger branch networks are probably associated with the use of credit scoring because they allow the branch to make the lending decision itself based on the banking organizations' objective criteria and overall risk preferences (rather than those of the individual bank managers). Such a structure is perhaps better positioned to take advantage of cost reductions associated with automated underwriting because such institutions are generally less relationship-oriented lenders to begin with.

Lastly, focusing exclusively on those fifty-one institutions using credit scoring as of January 1997, we attempt to isolate characteristics of their programs that may enhance their propensity to lend to small businesses. Based on the survey results, we explore several distinct possibilities using dummy variables. First, the automatic approval or rejection of applications (*AUTO*) could imply greater small-business lending due to reduced underwriting costs. Second, using credit scoring to set loan terms (*TERMS*) may be important in that it allows institutions to better price risk. Third, whether a bank developed their own model (*INTERNAL*) or used one purchased from an outside vendor could be important in that internal modeling implies a certain comfort level with the technology. Fourth, the length of time an institution has used credit scoring (*MONTHS*) again focuses on the familiarity of the institution with the scoring system.¹¹ In testing these four hypotheses, we once again included *LNASSETS*, *EQUITYRATIO*, *CORATIO*, *LOANRATIO*, *BANKS*, *BRANCHES*, and *MERGEDASSETS*. The results of this regression—reported in Table 5—fail to point to any of the characteristics of the credit-scoring program as important in explaining variation in the portfolio share of small-business lending by credit scorers. We would note, however, that the small number of degrees of freedom in this regression constrains our inferences.

3. CONCLUSIONS

As consolidation has swept the financial services sector this decade, policymakers have repeatedly expressed concern about its effect on credit availability for small businesses. Traditional theories of small-business credit markets have emphasized the existence of significant information asymmetries between borrowers and lenders, which may lead to credit rationing. In fact, empirical evidence has demonstrated the value of relationships with local commercial banks toward mitigating such market

11. We also substituted the squared number of months and separated institutions by those having scored for certain lengths of time. Such transformations had little impact on our results.

TABLE 5

CROSS-SECTIONAL REGRESSION RELATING CREDIT-SCORING BANKING ORGANIZATIONS' SMALL-BUSINESS LENDING RATIO TO CHARACTERISTICS OF THE CREDIT-SCORING PROGRAM

Variable	SBLRATIO
Constant	3.3040** (1.9994)
LNASSETS	-0.4584** (-2.2446)
EQUITYRATIO	-0.0011 (-0.0152)
CORATIO	0.6295 (1.6057)
LOANRATIO	0.0305 (1.3857)
BANKS	0.0218* (1.8124)
BRANCHES	0.0006 (1.0474)
MERGEDASSETS	-0.0130 (-1.1811)
AUTO	0.4516 (1.2538)
INTERNAL	-0.4029 (-0.8067)
TERMS	0.1112 (0.3359)
MONTHS	0.0072 (0.6317)
Observations	51
R-Squared	0.7334

NOTES: T-Statistics in parentheses. * Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level.

imperfections. Moreover, such findings are the cornerstone of public policy with respect to bank antitrust review and federal small-business loan guarantee programs.

Recently, banks have begun applying automated underwriting techniques (that is, credit scoring) to small-business loans. This paper presented survey data from ninety-nine of the two hundred largest U.S. commercial banking organizations documenting this trend and describing the various ways in which credit scoring is used. Using an instrumental variables approach, we find a positive and statistically significant relationship between the portfolio share of our sample banks' small-business loans and the use of credit-scoring models. Moreover, this finding is robust to variation in banking organization size, risk, organizational complexity, portfolio quality, and recent merger activity. In fact, after controlling for these factors, we find that (on average) credit scoring increased the portfolio share of small-business loans by 8.4 percent for our sample banking organizations, or about \$4 billion per institution. However, examining the subsample of credit-scoring institutions, we fail to uncover any specific characteristics of their programs that lead to this increased lending activity. For our sample, we also find that the number of subsidiary banks, the number of bank branches, and a larger proportion of recently acquired assets are all positively related to small-business loan portfolio share. In addition, the probability of a banking organization scoring its small-business loan portfolio is positively related to

the number of bank branches and negatively related to the number of subsidiary banks. These findings directly point to advances in information technology reducing information costs and asymmetries between borrowers and lenders. This development, in turn, may serve to reduce the value of traditional, local lending relationships.

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