

# **The Surprising Use of Credit Scoring in Small Business Lending by Community Banks and the Attendant Effects on Credit Availability and Risk**

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\* The views expressed do not necessarily reflect those of the Federal Reserve Board, the Federal Reserve Bank of Atlanta, or their staffs.

# Introduction

Commercial bank lending to small businesses has received a great deal of research attention over the past two decades.

The primary issue is “credit availability” -- small firms have historically faced difficulties funding creditworthy projects.

Small businesses tend to be informationally opaque – no certified financial statements or publicly traded securities.

To address the problem of informational opacity, banks use a number of lending technologies (e.g., Berger & Udell 2006).

Small business credit scoring is a lending technology that has recently received some research attention.

# Credit Scoring Small Business Loan Applications

Credit scoring involves the statistical evaluation of a loan applicant's financial information to predict their future credit performance.

Consumer credit scoring (CCS) has been widely used for many years in retail lending – e.g., credit cards and auto loans.

In this study, we also learn that many small banks also use CCS for evaluating small business applications.

Typically think of small business credit scoring (SBCS) methods being employed for these applications.

- SBCS combines financial information for the business owner with that for the firm.
- Very large banks began using SBCS in the mid-1990s, but only for smaller commercial credits (< \$250,000).

# Literature: Small Business Credit Scoring

Empirical studies have found that SBCS is associated with greater small business credit availability, broadly defined (e.g., Berger & Frame, 2007).

- 1.) Increases in the quantity of lending;
- 2.) More lending to riskier borrowers;
- 3.) Lending in low-income as well as high-income areas; and
- 4.) Lending over greater distances.

However, this literature is limited by the fact that all of the studies are based on a single (1998 Atlanta Fed) survey.

- 1.) Subject to same sample selection issues;
- 2.) Focus only on very largest banking organizations; and
- 3.) Study only mid-1990s when the technology was new.

# This Paper

- 1.) Presents new survey data relating to commercial banks' use of credit scoring models for small business applications.
  - Focused primarily on community banks.
  - Information about the use of both CCS and SBCS.
  
- 2.) Studies the empirical relationship between credit scoring and both the quantity and quality of small business lending by community banks.
  - Focus on community banks allows us to conduct first analysis of the quality of small business credits.

## Survey Data (1)

Data from a new survey conducted in 2005 on behalf of the U.S. Small Business Administration by Analytic Focus LLC.

Nationally representative stratified random sample of banking industry.

- Stratification based on total assets and small business lending intensity (C&I and CRE).

1,500 banks received surveys; 330 banks responded; and 299 respondents were community banks (<\$1 billion in GTA).

See Cowan & Cowan (2006) for a comprehensive overview of the survey methodology and results.

## Survey Data (2)

Credit scores are surprisingly widely used by community banks when underwriting small business loans.

-- 47% report using for some loan applications.

Community banks rely more heavily on CCS than SBCS.

Several community banks report using CCS prior to the adoption of SBCS by many of the largest banks in the mid-1990s.

Consistent with past research, credit scores are most often used for the smallest credits – e.g., <\$50,000.

Community banks tend to use credit scores as additional information for another lending technology, rather than for automatic approval/rejection.

## Data Sample

Start with 299 “community bank” respondents with total assets < \$1 billion as of June 2004.

- Drop thrifts, cooperative banks, and bank-year observations where C&I loans = 0.
- Final sample of 277 institutions.

Quantity analysis covers 1993 to 2005; reflecting introduction of information about “small loans to businesses” in the Call Report. ( $N=3,089$ )

Quality analysis covers 2001 to 2005; reflecting introduction of information about nonperforming C&I loans in the Call Report. ( $N=1,292$ )

# Empirical Analysis (1)

$$Y_{it} = \alpha + \beta_1 * SCOREVARS_{it} + \beta_2 * BANKVARS_{it-1} + \gamma_t + \varepsilon_{it}$$

## Dependent variables

$Y_1$  = Natural log of the dollar amount of C&I loans with original amounts of \$100,000 or less (*lnQLOANS* ≤ 100K);

$Y_2$  = Ratio of nonperforming C&I loans (past due 90 days or more or nonaccrual) to total C&I loans (*C&I NPLRATIO*).

## Credit scoring variables

*SCORE* = Bank *i* reported using credit scores during period *t*.

*YEARS SINCE* = Number of years that bank *i* has been using credit scores as of time *t*;

*AUTOACCEPT* = Bank *i* reported using credit scores to automatically approve/reject loan applications;

*BUSINESS SCORE* = Bank *i* reported using business credit scores.

## Empirical Analysis (2)

$$Y_{it} = \alpha + \beta_1 * SCOREVARS_{it} + \beta_2 * BANKVARS_{it-1} + \gamma_t + \varepsilon_{it}$$

### Bank variables

*LogGTA* = Natural logarithm of gross total assets for bank *i* six months earlier (previous December);

*LogAGE* = natural logarithm of the age (in years) of bank *i* six months earlier (previous December).

*EQUITYRATIO* = ratio of total equity to total assets for bank *i* six months earlier (previous December).

*ONLY ≤ 100K* = Bank *i* reported that substantially all of their C&I loan portfolio had original amounts of \$100,000 or less.

-- For these observations,  $Y_1 = \log$  of total C&I loans.

## Empirical Analysis (3)

$$Y_{it} = \alpha + \beta_1 * SCOREVARS_{it} + \beta_2 * BANKVARS_{it-1} + \gamma_t + \varepsilon_{it}$$

The terms  $\gamma_t$  and  $\varepsilon_{it}$  represent time fixed effects (i.e., annual dummies) and a random disturbance, respectively.

One specification also includes bank fixed effects.

Excluding fixed effects has the benefit of increased test power.  $\beta_1$  reflects both differences across banks (scoring/nonscoring) and differences within banks (before/after scoring adoption).

Including fixed effects has the benefit of eliminating otherwise unobserved (and systematic) differences between scorers and non-scorers.

## Sample Statistics

<u>Dependent Variables</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>NOBS</u>
QLOANS≤100K (\$000)	5,439	6,119	3,089
C&I NPLRATIO	0.0161	0.0390	1,292
<u>Independent Variables</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>NOBS</u>
SCORE	0.2279	0.4195	3,089
YEARS SINCE	1.1392	2.5633	3,089
AUTOACCEPT	0.0447	0.2066	3,089
BUSINESS SCORE	0.0188	0.1358	3,089
GTA (\$000)	134,814	146,386	3,089
AGE	65.56	39.89	3,089
EQUITYRATIO	0.1060	0.0561	3,089
ONLY≤100K	0.2648	0.4413	3,089

# Credit Scoring & the Quantity of Lending

$$Y = \ln QLOANS_{\leq 100K}$$

	(1)	(2)	(3)	(4)	(5)
SCORE	0.091*	-0.044	-0.028	-0.012	0.053
YEARS SINCE	---	0.028*	0.028*	0.028*	0.012*
AUTOACCEPT	---	---	-0.088	-0.087	-0.199*
BUSINESS SCORE	---	---	---	-0.153	-0.130
LogGTA	0.862*	0.861*	0.861*	0.862*	0.500*
LogAGE	-0.089*	-0.095*	-0.095*	-0.095*	-0.098*
EQUITYRATIO	-1.153*	-1.109*	-1.103*	-1.094*	-1.881*
ONLY $\leq$ 100K	0.599*	0.589*	0.588*	0.587*	0.630*
Constant	-1.341*	-1.306*	-1.303*	-1.308*	---
Time Effects	Yes	Yes	Yes	Yes	Yes
Bank Effects	No	No	No	No	Yes
R-Squared	0.506	0.507	0.507	0.508	0.848

# Credit Scoring & the Quantity of Lending

$$Y = \ln QLOANS_{\leq 100K}$$

Column (1): Credit scoring is associated with a more than 9% increase in the quantity of small loans.

-- Mean ( $QLOANS_{\leq 100K}$ ) = \$5.4M; increase by \$0.5M

Columns (2-4): The increase in lending is driven by learning to use the technology over time.

-- Estimated increase of 2.8% each year after adoption.

Columns (4-5): Inclusion of fixed effects alters magnitudes, but not main inferences.

-- Learning remains important, but less so;

-- "Auto decision banks" appear to lend less.

# Credit Scoring & the Quality of Lending

$$Y = C\&I\ NPLRATIO$$

	(1)	(2)	(3)	(4)	(5)
SCORE	0.003	-0.007	-0.006	-0.005	0.001
YEARS SINCE	---	0.002*	0.002*	0.002*	0.001
AUTOACCEPT	---	---	-0.008	-0.008	-0.008
BUSINESS SCORE	---	---	---	-0.003	-0.015*
LogGTA	-0.004*	-0.004*	-0.004*	-0.004*	-0.003*
LogAGE	0.003*	0.003*	0.002*	0.002*	0.003
EQUITYRATIO	-0.017	-0.014	-0.013	-0.013	-0.009
Constant	0.054*	0.056*	0.058*	0.057*	---
Time Effects	Yes	Yes	Yes	Yes	Yes
Bank Effects	No	No	No	No	Yes
R-Squared	0.019	0.025	0.027	0.027	0.248

# Credit Scoring & the Quality of Lending

## $Y = C\&I\ NPLRATIO$

The data suggest a weak relationship between credit scoring and loan quality.

Column (1): SCORE is small and statistically insignificant.

Columns (2-4): YEARS SINCE is positive; suggesting a modest deterioration in loan quality over time.

-- However, the estimate is quite small; and even then would appear to take about four years to manifest itself.

Column (5): Bank fixed effects improve  $R^2$  appreciably. The use of business scores are found to improve loan quality.

## Summary & Preliminary Conclusions

The use of credit scoring by community banks is associated with increases in commercial “micro lending”.

- These increases manifest themselves over time.

Credit scoring is not strongly associated with a change in the quality of community banks’ C&I loan portfolios.

- Some improvement for banks using business scores?

Overall, credit scoring appears to allow community banks to increase business lending w/out a decrease in the quality of the loan portfolio.

- Some evidence that community banks using business scores pare marginal credits.

## Forthcoming Extensions

- 1.) Include (deposit-weighted) bank-year market control variables relating to: MSA/Rural, market concentration, and large bank market shares.
- 2.) Include (deposit-weighted) market control variables for local economic activity (e.g., income and employment).
- 3.) Sub-sample regressions sorting banks by total assets or their focus on very small C&I loans – e.g.,  $\leq \$100,000$ .
- 4.) Scale dollar quantity variable by total assets to mitigate possible size bias.
- 5.) Include “vendor fixed effects”.
- 6.) Include banks not reporting adoption dates and imputing YEARS SINCE.
- 7.) More rigorous examination of the “exogeneity” of credit scoring adoption.
- 8.) Others?