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FINANCIAL PERFORMANCE OF SMALL BUSINESS LOANS: INDIRECT EVIDENCE

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ABSTRACT: Using nationwide U.S. bank-level data from 2003-2007, this paper explores multiple dimensions of the financial performance of small business loans by means of statistical decompositions. I find systematic contrasts across small commercial loans of different sizes, which suggest dynamic changes for growing business borrowers as well as diverse challenges and opportunities for banks. The findings overall suggest that small business lending is neither riskier nor less profitable than larger commercial loans, with higher yields offsetting higher marginal costs, and better portfolio diversification offsetting higher chargeoff rates on the smallest commercial loans.

Keywords: small business loans; financial performance; profits; costs; volatility

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1. Introduction

The pivotal role of banks in the aggregate supply of credit, along with a significant role of small businesses in the economy, together imply a special importance for the causes and consequences of bank lending to small businesses. The importance of this segment of the market is recognized, for instance, in the regulatory requirement that banks must report the number and dollar amount of all business loans in original balances up to $ 1million, along with other details of their balance sheets and income statements (Wolken, 1998). Its importance has also attracted many studies in recent years, as discussed below.

However, one of the main questions we would like to answer – how do the costs, risks, and returns of small business loans compare with those of larger commercial loans – cannot be addressed directly using available data.[1] The regulatory Call Reports do not include information relating to the revenues, delinquencies, chargeoffs, or cost structure of small business loans, but merely their outstanding balances and numbers of accounts. This paper applies indirect statistical methods to infer the answers for a nationwide sample of U.S. commercial banks over the years 2003-2007, selected as the most recent available five-year period (which also has the advantage of avoiding atypical disruptions in 2001 due to recession, corporate accounting scandals, and terrorist attacks; as well as avoiding the major regulatory change of Gramm-Leach-Bliley near the end of 1999).

[1] A few studies such as Berlin and Mester (1998) use pricing data from the Federal Reserve System's Quarterly Survey of the Terms of Bank Lending, resulting in small samples (126 banks, or on the order of 1 percent of the industry total, in their study) that may not be representative of the banking industry as a whole. A key advantage of the method used in this paper is its ability to provide industry-wide estimates.

Conflicting theoretical considerations render the performance comparison a primarily empirical question. The financial performance characteristics will in general reflect a combination of exogenous differences between large and small business borrowers, exogenous technical factors such as economies of scale due to fixed costs of credit analysis and loan processing, and endogenous responses by banks in terms of pricing and credit standards. Even the exogenous variations may be unclear a priori; while some studies have regarded small firms as more informationally opaque than larger firms (DeYoung et al., 2008), the very smallest firms may be sufficiently simple as to render them more informationally transparent.

Previous research has explored factors empirically associated with various levels of lending to small businesses, as well as noting theoretical aspects of small business lending that might contribute distinct risks and costs as compared with other business loans. In assessing aggregate economic welfare or optimal public policy, it is relevant to consider not only the volume of lending but also its cost to the borrowers and its financial impact on the lenders. On the one hand, regulatory pressure might succeed in prompting a larger volume of such loans than unconstrained lenders would supply. But, on the other hand, if the data were to indicate that such loans exhibited systematically higher cost and risk, then the social desirability of such policies would need to be re-assessed in light of those tradeoffs.[2]

I estimate statistical decompositions for 16 measures of loan performance: gross yield, risk-adjusted yield, interest rate spread, risk-adjusted spread, nonperforming loan ratio, net chargeoff (loan loss) ratio, marginal cost, marginal net return (profitability), the

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[2] Some observers have similarly argued that the Community Reinvestment Act, by requiring banks to provide lending services in low-income areas within their communities, contributed to the large increase in subprime mortgages that imploded in 2007 (Wesbury, 2008).

standard deviation (volatility) over time of the first six of these measures, the contribution to the bank's Z-score, and the Lerner index of market power. The details of the decomposition are tailored to each performance measure based on applicable theory.

The results indicate several significant differences between small business loans and large commercial loans, as well as some significant differences among various size categories of small business loans. On average, small business loans earn higher yields and exhibit higher and somewhat more volatile delinquency rates and spreads over funding costs. The smallest commercial loans are associated with less volatile bank assets and lower bankwide risk (higher Z scores). No significant differences were found for the volatility over time of risk-adjusted yields or spreads, nor for the volatility of net chargeoff rates. The former result suggests that banks may tend to reprice small business loans at similar frequencies and by similar amounts as large commercial loans, while the latter finding suggests that credit risk may be similarly stable and (since banks adopt credit standards that are intended to control net chargeoff rates) predictable as compared with larger commercial loans. Small business loans have higher costs per dollar lent than do larger commercial loans, indicating a form of economies of scale. Profitability appears higher for the smallest commercial loans than for larger categories, despite higher marginal costs. Finally, small business lending appears more competitive than larger commercial loans. The findings overall suggest that small business lending is neither riskier nor less profitable than larger commercial loans, despite contrasting individual components.

The remainder of this paper is organized as follows. The next section reviews some of the more important studies related to our topic. Section 3 describes the model and hypotheses, section 4 presents the empirical results, and section 5 concludes.

2. Related Studies

Interest in financing small business is prompted in part by the historical pattern that most new jobs are created by small businesses (Davis and Haltiwanger, 1992; Davis et al., 1996; Hart and Oulton, 1996; Robbins et al., 2000). This motivation is strengthened by recent evidence that local economies with small businesses tend to grow faster, both in per capita income and in total employment (Shaffer, 2002, 2006a, b). Some studies have also found evidence that small firms typically innovate faster, induce faster diffusion of new technology either directly or through Schumpeterian competition, and stimulate faster productivity growth (see van Praag and Versloot, 2007, for an excellent recent survey). For such reasons, it is important to understand the factors that support or hinder the development of small businesses.

In recognition of the importance of the topic, bank lending to small business has been extensively addressed in a separate and voluminous literature. A comprehensive review of that literature is well beyond the scope of this paper, so only the most important or relevant studies will be mentioned here. One branch of research has addressed the benefits of ongoing lending relationships to small business borrowers (Petersen and Rajan, 1994, 1995), finding that such relationships enhance the availability of credit, especially when credit markets are unconcentrated. Berger and Udell (2002) demonstrate how relationship lending may mitigate problems of asymmetric information, especially in small banks, though Berger et al. (2007) find evidence that larger banks are not measurably disadvantaged in that regard.

Another line of research has explored the impact of bank size and consolidation on small business loans; Strahan and Weston (1998) report that the proportion of small business loans depends nonmonotonically on bank size, is enhanced by mergers between small banks, and is unaffected by other types of bank mergers or acquisitions. Similarly benign conclusions regarding the effect of bank mergers on small business lending are drawn by Peek and Rosengren (1998), Berger et al. (2001), and others, though some analysis suggests that certain details of bank size and structure do affect the proportion or growth of lending to small firms (Craig and Hardee, 2001; Avery and Samolyk, 2004).

Jayaratne and Wolken (1999) find evidence that small firms are not typically credit-constrained in areas with fewer small banks, and Petersen and Rajan (2000) uncover evidence that small businesses are now less locally limited in their available sources of credit than in earlier years. On the other hand, DeYoung et al. (2008) find that default probabilities on SBA-guaranteed loans are an increasing function of the distance between lender and borrower, as well as higher when credit scoring was used. Hunter (1984) similarly finds that SBA-guaranteed loans exhibit higher default rates when banks or borrowers exercise less care with regard to risk, and that the level of care is negatively related to the SBA guarantee level on the insured loans.

Due to a paucity of relevant data, very few studies have attempted to characterize the profitability or risk profile of small business lending overall, especially using nationwide data.[3] Kolari et al. (1996) is a rare exception, using 1994-95 data to assess banks' ROA as a function of their level of small business lending and other variables.

[3] Churchill and Lewis (1985) analyze the profitability and credit risk of small business lending at a single bank during 1981-1983, an atypical period that includes exceptionally high interest rates, high inflation, and a severe recession. Kimball (1997) compares performance ratios of 14 banks specializing in small business loans in 1995-96 versus a matched-pair peer sample. Berlin and Mester (1998) examine rate-smoothing in small business loans and explore the effect of the estimated smoothing on costs and profits in a sample of 126 banks. As discussed below, our sample contains around 2,500 banks over a five-year period and is therefore much more representative of the U.S. banking industry overall.

One limitation of their study is that they aggregate all business loans smaller than $250,000 and ignore those between $250,000 and $1 million in original balance; here, by contrast, I provide separate estimates on the performance characteristics of all four size categories of commercial loans. Theoretical considerations suggest the possibility of important differences across the size categories, a pattern confirmed by the empirical analysis as discussed below.

In a more recent study, Kolari et al. (2006) explore the profitability and risk of small business lending in a nationwide sample. They find that small business lending is typically associated with neutral or positive effects on ROA and ROE, and lower risk of bank failure. Again, that study aggregates all business loans smaller than $250,000 and omits those larger than $250,000. Neither of these latter studies explored the broader range of performance measures analyzed below.

3. Model and Hypotheses

The basic idea behind the approach here is the use of statistical decomposition of aggregated data on loan performance into systematic associations with more disaggregated loan categories. The details of the empirical model vary across the 16 measures of loan performance, based on applicable theory for each measure.

Yield, Spread, and Risk

For the first six performance measures, I estimate a simple linear decomposition to retrieve sample average associations of small business loans with each measure. These measures include the gross revenue per dollar of lending (i.e., the average interest rate or yield), the risk-adjusted yield (net of the rate of loan losses due to default), the interest rate spread (gross yield minus average cost of funding), the risk-adjusted spread (net of loan losses and funding costs), the nonperforming loan ratio (delinquency rate), and the net chargeoff ratio.

The empirical method may be expressed as follows. For a given amount of lending X_i of loan type i, and a given outcome Y_i generated by that lending, suppose the true model is strict proportionality with additive noise:

$$(1) \qquad Y_i = b_i X_i + \varepsilon_i$$

where b_i is the interest rate on loan type i and ε_i is a stochastic error term with mean zero. Here, Y_i will correspond in turn to gross revenue, gross revenue minus net chargeoffs, total nonperforming loans of type i, or net chargeoffs on loans of type i. (The spread will be discussed separately below.) The categories i will include small business loans in each of three size categories, and other (larger) business loans. We wish to estimate b_i but lack data on the disaggregated values of Y_i, precluding the direct estimation of equation (1).

Now consider the aggregate outcome $Y \equiv \sum Y_i$. The true model for Y is then:

$$(2) \qquad Y = \sum b_i X_i + \varepsilon$$

where $\varepsilon \equiv \sum \varepsilon_i$ is again a stochastic error term with mean zero. Ordinary least squares estimation of equation (2) will provide unbiased minimum-variance estimators of each b_i, given the available data on Y and X_i. Because b_i corresponds to $\partial Y / \partial X_i$, the regression coefficient will provide an unbiased estimate of the marginal revenue per dollar of loan type i where Y is gross revenue; marginal nonperforming loans per dollar of loans where Y is total nonperforming loans; and marginal net chargeoffs per dollar of loans where Y is total chargeoffs.

Because of the wide range of values of X_i and Y across banks in the sample, heteroscedasticity is likely in the error term. In addition, larger banks typically have larger values of each X_i than do smaller banks, inducing multicollinearity across the X_is. Both of these problems are mitigated by scaling all variables for each bank by the value of that bank's total commercial loans, $X \equiv \sum X_i$. Thus, I estimate the following equation by OLS for these three performance measures:

$$(3) \qquad Y/X = \sum b_i X_i/X + \varepsilon$$

where ε is now the stochastic error term corresponding to the weighted regression. I further mitigate any effects of multicollinearity by using heteroscedastic-consistent standard errors to calculate t-statistics on the regression coefficients (White, 1980).

Note that all variables in this specification are unit-free (dollars / dollars) and therefore need no adjustment for inflation. Note too that the dependent variable, as scaled by total commercial loans, now corresponds in turn to the gross yield, risk-adjusted yield, nonperforming loan ratio, or net chargeoff ratio. By defining the dependent variable as the difference between the gross yield on commercial loans and the average cost of funding per dollar of funding, we obtain the interest rate spread between funding and the associated lending; the relevance of this measure depends on the natural assumption that deposits are fungible across lending and investment in different categories.

Because the denominator X is the sum of small business loans and larger commercial loans, I estimate equation (3) for X_i representing small business loans in each of three size categories (omitting the fourth category of large commercial loans), plus with an intercept term (not shown above) to capture the average value of the dependent variable for large commercial loans. The alternative would be to include large commercial loans as a distinct category i while suppressing the intercept.[4] The main advantages of the former approach are a standard interpretation of R-squared and convenient hypothesis testing, as the t-statistic on each category of small business loans tests the significance of the *difference* between that category's outcomes and those of large commercial loans. Because intertemporal variations in performance are also of some interest, I further include a trend term in these regressions. In alternative versions of equation (3), I additionally include the natural logarithm of bank assets.[5]

Although our research objective is purely descriptive, some theoretical considerations may be suggested to predict or interpret the results. If, as some studies have suggested, small business borrowers are more informationally opaque than larger borrowers, we should expect to see higher gross yields and spreads, risk-adjusted yields and spreads, delinquency rates, and chargeoff rates on small business loans compared to larger commercial loans. If the observed pricing is not commensurate with the observed risk, such a mismatch could be evidence of informational opacity or, depending on the direction of mismatch, of monopoly power. Mismatches between pricing and ex post risk would in general tend to provide a financial incentive for banks to avoid underpriced products and expand into

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[4] One cannot include all four categories plus an intercept, as the intercept equals the sum of the four ratios, causing the X'X matrix to be singular.

[5] A few studies have included measures of credit risk such as the net chargeoff ratio as independent variables in similar regressions, but these are influenced by each bank's choice of credit standards and so are endogenous. Hence, we treat such variables as performance measures rather than regressors.

any overpriced products. Moreover, some research has suggested that the yields on commercial loans can predict both future loan performance and subsequent regulatory examination ratings (Morgan and Ashcraft, 2003).

The approach represented in equation (3) is related to the "statistical cost accounting" (SCA) method that has long been used to study the financial behavior of bank portfolios, as in Hester and Zoellner (1966), Hester and Pierce (1975), Maisel and Jacobsen (1978), Kwast and Rose (1982), McKenzie et al. (1992), Vasiliou (1996), and Asiri (2007). The original application of SCA was by Meyer and Kraft (1961) to develop cost estimates in the transportation industry, based on methods presented in Johnston (1960). The selection of regressors in such models should depend on the research question, the nature of the dependent variable, and applicable theory, although traditional SCA studies have tended to use a uniform set of regressors in all cases. The selection of regressors for equation (3) has been justified by the discussion and derivation following equations (1) and (2), and we turn next to a more extensive discussion of the appropriate regressors for the cost model.

Costs

Because banking cost data are not reported by individual product lines – in contrast to data on revenues, delinquencies, and chargeoffs – the cost regressions must use a bankwide model. The theory of cost functions has advanced significantly beyond that embodied in Johnston (1960) and Meyer and Kraft (1961), and I incorporate those theoretical advances in the empirical cost model. The relevant advances are threefold, including two improvements to the specification of generic cost functions and a third that is specific to banking.

First, it is now well known that a properly specified cost function contains output quantities and input prices as independent variables (see for example Kreps, 1990, Chapter 7; Berger and Mester, 1997). Second, it is well known that a properly specified cost function must be homogeneous of degree 1 in input prices (Kreps, 1990, page 251).[6] Finally, a consistent taxonomy of inputs and outputs for banks has long been controversial, especially regarding whether deposits are inputs or outputs, and nearly all of the systematic exploration of that issue has occurred since the 1970s. Perhaps the most widely accepted, empirically grounded, and conceptually valid taxonomy is the so-called intermediation model, as developed in Sealey and Lindley (1977) and applied in Berger and Mester (1997, 2003), Angelini and Cetorelli (2003), Fernández de Guevara et al. (2005), and many other studies.[7]

Traditional SCA formulations are not consistent with any of these advances. According to the intermediation model, banks employ labor and fixed assets to transform deposits and other liabilities into loans and other earning assets, so that deposits are inputs (along with labor and fixed assets) while loans and investment securities are outputs.[8] Thus, the cost function should include as regressors the volume of loans and other earning assets, along with the prices of labor, deposits, and fixed assets (physical capital); see for example Berger and Mester (1997, 2003), Angelini and Cetorelli (2003), and Fernández de Guevara et al. (2005). Traditional SCA studies, by contrast, have attempted to estimate marginal costs in regressions

[6] Intuitively, the idea is that, if all input prices double while quantities remain unchanged, total costs must double.
[7] Earlier versions of this model were developed by Klein (1971) and Monti (1972); see Dermine (1986) and Freixas and Rochet (1997) for further references and discussion.
[8] Some have argued that the deployment of labor and fixed assets to process deposits confers an aspect of outputs on deposits, but this argument is specious: manufacturing firms, for example, must likewise allocate warehouse space and staff to maintain their inventories of raw materials used in the production process, but that does not make the raw materials part of the factory's output.

that include the quantities of all assets and liabilities, and omitting any prices, as regressors. While the fitted coefficients of those models have indeed exhibited superficial plausibility, we now know that such models are severely misspecified as cost functions.

Moreover, a simple linear cost function cannot satisfy the required property of linear homogeneity in input prices. Previous SCA studies have argued that the linear form is indeed correct (see for example Hester and Pierce, 1975; Rose and Wolken, 1986), which is true for the non-cost performance measures discussed in relation to equation (3) above. However, linear homogeneity can only be satisfied by log-linear specifications (Cobb-Douglas) or their generalizations such as the translog or flexible Fourier forms that embed the log-linear form as a special case.

Therefore, in the cost estimates, I apply the same logic of statistical decomposition, as discussed above, within functional forms and model specifications appropriate to cost functions. Here I estimate two forms to explore robustness of the estimated marginal costs of small business loans. I begin with the log-linear form derived from the Cobb-Douglas function, and then fit the popular and more general translog form as in Angelini and Cetorelli (2003), Fernández de Guevara et al. (2005), and others. The respective regression equations are:

$$(4) \qquad \ln TC = \alpha + \sum \beta_i \ln X_i + \sum \gamma_j \ln w_j + \varepsilon$$

for the Cobb-Douglas cost function and:

$$(5) \qquad \ln TC = \alpha + \sum \beta_i \ln X_i + \sum\sum \delta_{ij} \ln X_i \ln X_j + \sum \gamma_j \ln w_j + \sum\sum \rho_{ij} \ln wi \ln wj + \sum\sum \eta_{ij} \ln wi \ln Xj + \varepsilon$$

for the translog cost function. I impose the standard restrictions of symmetry and factor price homogeneity: $\Sigma\ \gamma_j = 1$ in both specifications and, in the translog, $\delta_{ij} = \delta_{ji}$, $\rho_{ij} = \rho_{ji}$, $\Sigma_i\ \eta_{ij} = 0$ for all j, and $\Sigma\ \rho_{ij} = 0$ for all j. I also include a trend term to control for cost-reducing technological change as in Hunter and Timme (1984) and others.[9]

In these regressions, output quantities X_i are measured as the dollar volume of small business loans, other commercial loans, non-commercial loans, investment securities, and non-interest income (a proxy for off-balance-sheet activities, as in Hunter and Timme, 1995, and other studies).[10] As in Angelini and Cetorelli (2003) and Fernández de Guevara et al. (2005), I measure input prices w_i as the average wage rate, defined as the ratio of wage expenses to number of employees; the average interest rate paid on deposits and other funds, defined as the ratio of interest expenses to total deposits and other borrowing; and the average price of physical capital, defined as the ratio of expenses on fixed assets to total fixed assets. In alternate specifications, as a check of robustness, I specify the price of funding as the average interest rate paid on all liabilities, as in Berger and Mester (2003). These measures follow the widely accepted intermediation model of a bank, as discussed above and supported by empirical evidence suggesting that aggregate deposits behave primarily as inputs (Gilligan and Smirlock, 1984; Hughes and Mester, 1993).

In equations (4) and (5), the functional form forces the estimated marginal

[9] Share equations implied by Shephard's lemma were not fitted, following Berger and Mester's (1997, 2003) objection that Shephard's lemma imposes the undesirable assumption of perfect allocative efficiency. As reported below, the absolute t-statistics on the key regressors were sufficiently high to suggest that additional estimating efficiency was not needed.

[10] Activities that generate fee income for banks include investment banking, mutual funds, loan origination and servicing, securitization, asset sales, trading activities, and other financial services distinct from traditional deposit-taking and lending activities (DeYoung and Roland, 2001; Stiroh, 2006).

cost of X_i to vary systematically by loan volume. In particular, the elasticity of cost with respect to X_i is $\partial \ln TC / \partial \ln X_i = \beta_i$ for equation (4) and $\beta_i + \sum_j \delta_{ij} \ln X_j + \sum_j \eta_{ij} \ln w_j$ for equation (5). Since the marginal cost of X_i equals the cost elasticity times TC / X_i, equation (4) implies an estimated marginal cost equal to $\beta_i\ TC / X_i$ while equation (5) implies a related but more complex expression.

Note that we can exponentiate both sides of equation (4) to obtain $TC = \Pi X_i^{\beta i} \Pi w_j^{\gamma j}$, ignoring the mean-zero error term. The special case where $\sum \beta_i = 1$ thus corresponds to constant returns to scale, though without any fixed costs. In equation (5), constant returns to scale is likewise equivalent to the condition $\sum \beta_i = 1$ combined with the condition that $\delta_{ij} = 0$ for all i and j.

Many recent studies have estimated an even more general cost function, the flexible Fourier form, which embeds the translog as a special case. I do not do so here for three reasons. First, our research objective is to obtain precise estimates of the marginal cost of small business loans, and the additional severe multicollinearity generated by the multiplicity of related terms in the flexible Fourier form would undermine that objective. Second, the inclusion of four size categories of commercial loans results in seven separate outputs in our specification, making the number of estimated coefficients excessively large in the flexible Fourier function. Third, as reported below, the adjusted R-squared is 0.980 for the Cobb-Douglas function and 0.984 for the translog function, indicating that these forms are flexible enough to fit the data quite well. Indeed, the miniscule gain from the additional 45 parameters in the translog form versus the Cobb-Douglas form indicates that very little benefit is obtained in our sample from enhanced flexibility.

Profits

Similar theoretical and practical advances have occurred since 1960 regarding the profit function. The profit function from neoclassical production theory uses prices of inputs and outputs as regressors, and is homogeneous of degree 1 in those prices (Kreps, 1990, Chapter 7). However, the assumptions underlying this standard theory include technological convexity conditions sufficient to generate a U-shaped average cost curve with a unique efficient firm size, a condition that is evidently violated in the banking industry.[11] A recent innovation to account for these considerations is the alternative profit function of Berger and Mester (1997, 2003), which includes output quantities and input prices as regressors; this function often fits banking data much better than the neoclassical profit function, and provides more plausible estimates. I use that form here, with one modification: Berger and Mester (1997, 2003) impose linear homogeneity on the input prices in the alternative profit function, mirroring the same condition in the cost function, but without theoretical justification. Direct consideration of this issue fails to suggest any reason why the alternative profit function should be homogeneous in input prices, and so I relax that constraint in the model.[12]

Using the same specification of inputs and outputs as in the cost function

[11] Banks in the U.S. have exhibited long-term viability at scales ranging from less than $10 million in assets to roughly $1 trillion in assets, a size range of 100,000:1. The market test of competitive survivability thus suggests that the average cost curve for banks must be substantially flat over this enormous range.

[12] Linear homogeneity in input prices implies that, if input prices double while quantities remain unchanged, net profits will double. This outcome would require that output prices double as well, which is both an empirical question not tested in the alternative profit function, and implausible a priori as a consistent pattern. Appeal to oligopoly theory cannot justify the assumption either: if banks have any market power on the output side, the equilibrium rate of pass-through of input price changes is less than 100 percent; but if banks are perfectly competitive, the long-run pass-through of input price changes would typically occur only with a lag and hence would not show up fully in cross-sectional samples. For these reasons, imposing linear homogeneity in the alternative profit function is likely a misspecification.

above, I estimate the alternative profit function given by:

(8) $$\pi = \alpha + \sum \beta_i \ln X_i + \sum \gamma_j \ln w_j + \varepsilon$$

in the loglinear case, and:

(9) $$\pi = \alpha + \sum \beta_i \ln X_i + \quad + \sum \gamma_j \ln w_j + \quad + \varepsilon$$

in the translog case. Here π denotes each bank's net profit, and the right-hand variables are as in equations (4) and (5).

It is useful to note that the specifications described in equations (3) through (9) provide another minor improvement over previous SCA banking studies, in the use of multiple levels of aggregation as appropriate to the outcomes measured and the data available. Some key performance variables, such as costs and profits, are reported only on a bankwide level rather than for each category of loans, necessitating an application of SCA across the bank's full set of outputs. But other performance variables – including interest and fee income on loans, chargeoffs, and delinquencies – are reported separately for each category of loans, permitting us to apply SCA to commercial loans alone when studying those variables. This finer level of decomposition avoids an extra layer of noise in the data that is intrinsic to bankwide figures, potentially yielding more precise estimates of the marginal revenue and credit risk associated with small business loans.

Volatility

In addition to financial performance measured as marginal or average cost, revenue, or chargeoffs, the volatility of several performance indicators is also of independent interest. The relevant question here is whether small business loans tend to fluctuate over time more than large business loans in terms of their relative balances, yields, chargeoff rates, and other outcomes in response to exogenous shocks to risk, demand, costs, or other factors. If so, then such volatility would confer an additional dimension of financial risk to banks, beyond those measured as mean outcomes in the previous discussion.

To explore this possibility, I adapt equation (3) above to additional dependent variables defined as the standard deviation over time of each bank's yield, delinquency rate, net chargeoff rate, risk-adjusted yield, spread, and risk-adjusted spread on commercial loans. I also perform univariate analysis on the coefficient of variation over time of each bank's relative balance in commercial loans of varying sizes, as well as a multivariate analysis of how commercial loans of varying sizes are related to each bank's overall asset volatility over time. For these calculations, unlike those above, we require a balanced panel of banks to construct the standard deviations, and the analysis is performed on the resulting cross section.

Although the sign of each coefficient is ultimately an empirical question, a few theoretical considerations can be mentioned. On the one hand, a given pool of funds can be invested in a larger number of smaller loans, providing potential diversification benefits to the extent that defaults are not perfectly correlated across loans; this consideration suggests that chargeoff rates may be less volatile on pools of smaller loans than for an equal dollar volume of larger loans. On the other hand, small business borrowers may tend to be more locally limited and less diversified than larger business borrowers, inducing a higher correlation of defaults across small business loans than across larger business loans.

Their lower degree of diversification also implies that profits, liquidity, and credit risk should be more volatile for small business borrowers than for larger business borrowers. Such volatility might show up as higher volatility of relative loan balances, if banks respond to some extent by credit rationing. It might also show up as a higher volatility of gross yield or spread on small business loans versus larger business loans, though not necessarily as higher volatility of risk-adjusted yields or spreads.

Another consideration is that banks are likely to have more monopoly power over small business borrowers than over larger business borrowers, and may therefore be able to pass through shocks to funding costs and other adverse events at different rates. This reasoning suggests that spreads might be less volatile for small business loans than for larger business loans.

Finally, our most comprehensive bankwide risk measure is the Z-score, corresponding to the number of standard deviations of recent profitability by which a bank would have to suffer losses before it became technically insolvent (Hannan and Hanweck, 1988; Nash and Sinkey, 1997).[13] It is measured as a ratio in which the numerator is the difference between the average pre-tax return on assets (ROA) minus the average equity/asset ratio; and the denominator is the standard deviation of pre-tax ROA (ibid.).[14] Some previous studies have pointed out that Chebyshev's inequality provides an upper bound on the one-period probability that a bank will experience book value insolvency for arbitrary serially independent distributions of earnings (Hannan and Hanweck, 1988; Kolari et al., 2006), while others have noted that specific distributions of

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[13] Hannan and Hanweck (1988) do not use the name "Z-score" as do later studies such as Nash and Sinkey (1997).

[14] Kolari et al. (2006) use an equivalent ratio that omits assets, defined as (1 + ROE) divided by the standard deviation of ROE.

earnings (such as normal) permit a more precise calculation of the probability of insolvency (Nash and Sinkey, 1997; Kimball, 1997). However, the validity of such calculations requires profits to be serially independent (Kimball, 1997), which is unrealistic. It also requires the equity/asset ratio to be nonstochastic, which is violated by the bank's accounting identities when earnings are stochastic. Therefore, while acknowledging the monotonic linkage between the Z-score and the risk of insolvency, I do not attempt to quantify that risk in terms of actual probabilities.

Lerner Index

An important final dimension of financial performance explored here is a measure of market power in small business lending, using the well-known Lerner index or percentage markup over marginal cost (Angelini and Cetorelli, 2003; Fernández de Guevara et al., 2005). Defined as 1 minus the ratio of marginal cost to unit price of output, the Lerner index theoretically ranges from zero for perfect competition to 1 for zero marginal cost and positive output price. Unexpected losses, strategic loss-leader pricing, or a transitional period of disequilibrium involving price wars or excess entry might temporarily drive price below marginal cost, generating a negative value of the Lerner index.

Because small businesses tend to be more locally limited in their available sources of credit, we might expect banks to exercise more market power in such markets than among large commercial loans where borrowers face broader alternatives. An important policy question is thus whether monopoly power constrains the quantity of credit available to small businesses.

Although Lerner indices have been calculated for banks overall (Angelini and

Cetorelli, 2003; Fernández de Guevara et al., 2005), no previous study has estimated Lerner indices for small business loans. Here I apply a standard method of constructing the Lerner index from estimated values of the gross yield (average revenue per dollar of lending) and marginal cost. I apply this technique separately to each size category of small business loans.

4. Sample and Results

The sample is drawn from all U.S. banks over the years 2003-2007, using financial data from the Call Report as available online from the Federal Reserve Bank of Chicago (www.chicagofed.org). I restrict the sample to commercial banks less than 10 years old, based on empirical findings that newer banks are significantly abnormal in their financial performance (DeYoung and Hasan, 1998; Shaffer, 1998).[15] I also omit banks with missing values of the relevant variables, or obviously spurious values such as negative gross assets. Finally, I omit banks that report zero amounts of all small business loans or zero amounts of larger commercial loans.[16] The final sample is an unbalanced panel containing from 12,291 to 12,660 observations, depending on the model, or an average of around 2,500 banks each year.[17] Table 1 lists summary statistics for the variables.

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[15] Goldberg and White (1998) also find that new banks lend disproportionately to small businesses, compared to older banks.

[16] The latter criterion was adopted to prevent bias due to either unobserved, exogenous market characteristics (in cases where banks face no large commercial lending opportunities) or extreme specialization (since banks that choose to forego all opportunities for large commercial lending may also differ in other, unobserved aspects that could impact their financial performance in ways unrelated to small business lending). We estimated additional regressions including those banks in the sample (approximately 200 overall), not reported in the tables, but the results were essentially unchanged.

[17] As noted above, our volatility analysis requires cross-sectional analysis on data assembled from a balanced panel, which contained 1,826 banks. There is an evident tradeoff between more years and more banks when assembling a balanced panel; entry of new banks and exit by mergers and acquisitions substantially changes the identity of banks nationwide from year to year.

In these files, commercial loans are reported in four size categories: total commercial loans, commercial loans less than $250,000 initial balance, those between $250,000 and $500,000, and those between $500,000 and $1 million. The latter three categories are reported only in the June 30 Call Report, while all other variables are reported quarterly. The performance variables encompass both stocks (the volume of nonperforming loans) and flows (gross revenues, net chargeoffs, expenses, and profits). For the stock variables, I use June 30 figures to match the loan balance data. Since a bank's loan volume and pricing can fluctuate over time, I measure performance flow variables and other flow variables in the shortest available window corresponding to the reported loan volumes, namely the second quarter of each year. Because the Call Reports list flow items on a year-to-date basis, I subtracted the first-quarter totals from each second-quarter figure to obtain the corresponding value for the second quarter alone.

Although Kolari et al. (1996, 2006) aggregated together the two smallest size categories of commercial loans and omitted the next larger category, there are several reasons to expect systematic differences in the risk, cost, and profitability across all size categories. For example, the very smallest businesses may be sufficiently simple as to be more informationally transparent than somewhat larger borrowers; fixed costs associated with credit analysis and loan processing provide some degree of economies of scale in lending as a function of loan size; very small loans permit broader diversification within a portfolio of a given size, compared with the lumpiness of investment in larger loans. These offsetting factors render the sign of any differences an empirical question, which we explore below.

It is important to note that any systematic differences in risk and performance across size categories of small business loans would have dynamic implications as growing firms migrate from one size category to another in their borrowing over time, creating different challenges and opportunities for their banks. Practitioners have been aware of this need for banks to adapt to growing commercial borrowers, or for growing businesses to transfer their borrowing relationship at some stage from a smaller bank to a larger bank, but this process has not been actively studied in the research literature.

Yield, Spread, and Risk

Table 2 reports regression estimates for equation (3) with an intercept and trend term, related to gross yield, spread, nonperforming loans, net chargeoffs per dollar of small business lending, various measures of financial volatility, and the Lerner index of market power.[18] In addition to the basic equation, I estimated an alternate version controlling for the log of bank assets.[19] Table 3 reports the corresponding values of each performance variable implied by the regressions for the various performance measures. This section discusses the measures related to yield, spread, and credit risk; subsequent sections discuss the results for volatility and market power.

Small business loans in the two smallest size categories exhibit significantly higher gross yields, delinquency rates, and yield spreads than larger commercial loans,

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[18] Given the very large number of banks in the unbalanced panel, it was impractical to consider incorporating bank fixed effects. Moreover, because many banks were omitted from the sample due to missing or zero values of key variables, the sample – though extensive – does not contain the entire population of interest, in which case random effects estimation is preferred to fixed effects (Mishkin, 1990).

[19] We did not control for the delinquency rate or the net chargeoff rate, as in some studies, because those ratios are influenced by each bank's choice of credit standards and hence are endogenous, yielding biased estimates if included as regressors. Estimates from the augmented specifications controlling for bank size are not reported in the table but are discussed in the text and available from the author.

whether controlling for the asset size of the bank or not.[20] A negative coefficient on bank size in each case (not reported in the tables) indicates that larger banks earn systematically lower interest rates and narrower spreads than smaller banks on commercial loans overall, while maintaining lower delinquency rates.

Risk-adjusted yields and risk-adjusted spreads (net of chargeoffs) are likewise significantly higher for the two smallest size categories of commercial loans. Controlling for bank size mitigates the significance for the smallest loans, but the p-value for risk-adjusted yield still remains marginally significant ($p = 0.104$). Across all commercial loans, larger banks earn smaller risk-adjusted yields and risk-adjusted spreads than smaller banks, perhaps in part because they are able to maintain better-diversified asset portfolios and can thus afford to charge smaller risk premia, or possibly because smaller banks have an informational advantage in evaluating the credit risk of smaller commercial borrowers (a hypothesis advanced in the literature on relationship lending).

The higher delinquency rate on small business loans is reflected in higher net chargeoff rates only for the smallest commercial loans, which exhibit more than three times the net chargeoff rate as the largest commercial loans on average. For the middle size category, one interpretation of this pattern is that small business borrowers may in effect use bank credit as a mechanism for smoothing their cash flows without necessarily conferring higher credit risk. Another possible interpretation is that banks may provide more latitude to medium-small business borrowers in the timing of their payments, perhaps because their small size makes it easier for banks to monitor the borrowers' true credit risk, or because the small loan size makes it less cost-effective for banks to enforce

[20] When observing the values of these estimates, keep in mind that the yields, costs, and chargeoffs reflect only the second quarter of each year, rather than an annualized figure.

repayment schedules as strictly. The absence of a significant difference in net chargeoff rates between medium-small business loans and larger commercial loans stands in contrast to previous findings for SBA-guaranteed loans (Hunter, 1984; DeYoung et al., 2008), suggesting that many banks tend to rely on an SBA guarantee for loans that are riskier than average within the corresponding size category. Across all commercial loans, larger banks experience significantly higher net chargeoff rates than smaller banks.

The trend term indicates a significantly increasing gross and risk-adjusted yield, along with gross and risk-adjusted spreads, over the years of the sample. The nonperforming loan ratio declines significantly across the sample period.

Cost

Table 4 reports coefficient estimates for the Cobb-Douglas cost function.[21] Both the Cobb-Douglas and translog forms fit the data quite well, with adjusted R-squared values of 0.980 for the Cobb-Douglas and 0.984 for the translog. Likelihood ratio tests strongly reject the hypothesis that the coefficients are identical across all size categories of commercial loans.[22] Hence, the marginal cost of commercial lending is significantly different for small business loans than for other commercial loans.

The negative trend term is consistent with a pattern of cost-saving innovation over time. Trend interactions in the augmented Cobb-Douglas specification (not reported in the table) indicate no significant trends in the marginal cost of commercial loans in any size category. Size interactions, by contrast, indicate that larger banks face higher

[21] For those variables that exhibited zero values in some observations, a small constant was added to each observation before taking logs, as in Berger and Mester (1997, 2003) and other studies. Translog regression estimates, discussed here but not reported in the table for brevity, are available from the author.
[22] For the Cobb-Douglas specification, the test statistic is 97.06, which exceeds the 0.9999 critical value of 21. For the translog specification, the test statistic is 609.14, which exceeds the 0.9999 critical value of 63.28.

marginal costs of the smallest business loans (possibly due to informational disadvantages relative to smaller banks in this category of lending) but lower marginal costs of commercial loans larger than $250,000 (a type of economies of scale). The alternative measure of the price of funding yielded very similar results (not reported in the table).

The regression coefficients in equations (4) and (5) permit a direct calculation of the cost elasticity, ∂ log (TC) / ∂ log (quantity), for each output. We can apply the definition of elasticity, ∂ log (TC) / ∂ log (x) = (x / TC) ∂ TC / ∂ x, to transform this expression into an estimate of the marginal cost per dollar lent, MC = ∂ TC / ∂ x = (TC / x) ∂ log (TC) / ∂ log (x). Because TC / x varies by bank, and in the translog form ∂ log (TC) / ∂ log (x) also varies by bank, I report the marginal cost estimates evaluated at sample mean values of the relevant variables.[23]

These marginal costs are shown at the bottom of Table 3 for the Cobb-Douglas and translog cost functions. Both functional forms yield very similar estimates of marginal cost for the smallest commercial loans, with increasing disparity for the larger size categories. The translog form predicts negative marginal costs for the largest commercial loans – not only at the average bank size but for all bank sizes represented in the sample – an implausible finding that is likely an artifact of the extreme multicollinearity always present in translog regressions by construction.[24] Consistent with this concern, the standard errors of coefficient estimates on the individual terms in the log of commercial loan volume were an average of 16 times higher in the translog

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[23] Separate estimates of marginal cost could thus be computed for each bank in our sample. However, this step is impractical with around 2,500 banks in each year of our sample.

[24] A correlation matrix of the data used to estimate equation (5), available from the author, showed 149 correlation coefficients larger than 0.9 in absolute value, and another 263 between 0.8 and 0.9.

regression than in the Cobb-Douglas regression. That is, these estimates, which are key to inferring marginal costs, are 16 times more precise in the Cobb-Douglas regression than in the translog, and it is well known that the chief effect of multicollinearity is to inflate the standard errors of regression coefficients. Therefore, I conclude that the simpler Cobb-Douglas form provides more reliable estimates of marginal cost.

At any rate, it is evident that the marginal costs are quite different for the different size categories of commercial loans. In general, smaller commercial loans have higher marginal costs per dollar lent than larger ones, and commercial loans smaller than $100,000 have at least twice as high a marginal cost as commercial loans larger than $250,000. This result is consistent with the existence of some fixed costs of lending in terms of credit analysis and loan administration, and constitutes a potential deterrent to small business lending.

Profitability

Table 4 reports estimated coefficients for the alternative profit function shown in equation (8).[25] As indicated in Table 3, these estimates imply that – at the sample mean values of the variables – the marginal profitability per dollar of lending is positive for the smallest category of commercial loans (those with initial balances below $100,000), insignificantly negative for the next larger category, and significantly negative for the two largest categories, though with a magnitude very near zero for the largest commercial loans. A likelihood ratio test strongly rejects the hypothesis that the coefficients are

[25] For those variables with some zero or negative values, a constant was added to each observation to ensure positive values before taking logs, as in Berger and Mester (1997, 2003) and other studies. The much more extensive list of estimated regression coefficients for equation (9) is available from the author, though not reported in the table for brevity. Both sets of estimates are discussed in the text.

identical across all size categories of commercial loans.[26] Hence, the marginal profitability of commercial lending is significantly different for small business borrowers than for other borrowers.

While negative marginal profitability does not necessarily imply negative total profits, it is nevertheless an implausible result over a five-year period and may suggest a conceptual or empirical weakness in the alternative profit function. Indeed, the fit of the profit function to the data was relatively poor, with an adjusted R-squared of 0.213 for equation (8).

The trend term was not significant in the loglinear specifications but was marginally negative in the more flexible translog regression, consistent with a trend of increasing competition over time. Trend interactions in the loglinear form indicated a pattern of improving profitability over time of commercial loans larger than $250,000. Despite their higher marginal cost of small business lending as reported above, larger banks exhibited significantly higher marginal profitability of small business loans smaller than $100,000. And despite their cost advantage shown in Table 3, larger banks exhibited lower profitability of commercial loans larger than $250,000. A possible explanation of this latter pattern could be that smaller banks on average operate in smaller, less competitive markets, permitting both higher prices to be charged for larger commercial loans and a higher degree of cost inefficiency (perhaps even some expense behavior) for such banks. The alternate measure of the price of funding yielded very similar results, not reported in the table.

Compared to the cost estimates, the translog version of the profit function (equation (9)) exhibited an even sharper deterioration in precision compared to the

[26] For the loglinear specification, the test statistic is 106.2, which exceeds the 0.9999 critical value of 21.

loglinear function. The standard error of the regression coefficients on the terms expressing the natural logarithm of commercial loan volume averaged *31 times higher* in the translog specification than in the loglinear specification. Given this extreme contrast, I focus on the loglinear estimates as being much more reliable than the translog, and do not report translog marginal profitability estimates in Table 3.

Volatility

As shown in Table 3, small business loans of all three size categories are associated with more volatile delinquency rates, though only the middle size category remains significant when controlling for bank size. Small business loans between $250,000 and $1 million are associated with more volatile gross yields and spreads, though these differences again vanish when controlling for bank size. Small business loans are not significantly associated with different levels of volatility of risk-adjusted yields, risk-adjusted spreads, or net chargeoff rates. Compared with smaller banks, larger banks exhibit less volatile yields (gross and risk-adjusted), spreads (gross and risk-adjusted), delinquency rates, and net chargeoff rates of commercial loans than smaller banks, consistent with their ability to diversify more broadly.

Overall, these findings suggest that the financial performance of small business loans is not generally either more volatile or less volatile than that of larger commercial loans, but that volatility is primarily related to a bank's degree of diversification within its portfolio. The similarity across loan sizes of the volatility of yields and risk-adjusted yields suggests that banks may tend to reprice small business loans at similar frequencies and by similar amounts as large commercial loans. The similarity of the volatility of net chargeoff rates suggests that credit risk may be similarly stable and (since banks adopt credit standards that are intended to control net chargeoff rates) predictable across sizes of commercial loans.

On the other hand, the coefficient of variation of total bank assets is negatively associated with the share of commercial loans in each small size category, and the significance of that association remains for the smallest category (though not for the other two categories of small business loans) after controlling for bank size (not shown in the tables). Contrary to the diversification hypothesis, larger banks experience relatively greater volatility of the volume of total assets, perhaps reflecting flexible responses to perceived business opportunities. Hence, the apparent link between asset volatility and the share of small business loans in the larger two categories may be partly an artifact of the well-known tendency of smaller banks to invest larger shares of their commercial loan portfolios in small business loans.

Turning to the univariate analysis of coefficients of variation, not reported in the table, I find that the respective portfolio balances are relatively more volatile for small business loans between $250,000 and $1 million, somewhat less so for business loans between $100,000 and $250,000, still less for loans between $100,000 and $250,000, and slightly lower yet for all commercial loans. The coefficient of variation for the largest category of small business loans is 77 percent higher than across all commercial loans. However, these differences are not statistically significant. Further study of these patterns could explore the extent to which the observed variability is endogenous (representing strategic choices by the banks) or exogenous (driven perhaps by fluctuating demand among small business borrowers).

Finally, the Z-score is positively associated with small loans less than $100,000 (implying lower risk of bank insolvency) and negatively associated with small business loans between $100,000 and $1 million (implying higher risk), whether or not controlling for bank size.[27] Additional regressions not shown in the table indicate that the Z-score does not vary systematically as a function of bank size. These findings refine and extend those of Kolari et al. (2006), who reported evidence that commercial loans smaller than $250,000 were associated with lower risk of bank failure in an earlier sample. The more disaggregated pattern found here is consistent with the notion that banks can use their smallest business loans to diversify their total portfolio risk, even though the net chargeoff rate on such loans in isolation may be higher than on larger commercial loans, yet that benefit does not carry over to somewhat larger categories of commercial loans.

Lerner Index

The Lerner index, or relative markup of price over marginal cost, is one measure of the degree of market power exercised by lenders, as discussed above (Angelini and Cetorelli, 2003; Fernández de Guevara et al., 2005). Positive values of the Lerner index are associated with imperfect competition, with larger values indicating higher degrees of monopoly power. The estimate of the Lerner index L is 1 – MC / Y where the marginal cost MC is obtained from the regression estimates of equations (4) and (5), and the gross yield Y is obtained from regression estimates of equation (3).[28]

Note that the units in this calculation are consistent, despite the use of deflated values in equations (4) and (5) but nominal values in equation (3). In the expression for

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[27] The average value of the Z-score in our sample is large because we are using quarterly earnings rather than annual earnings, so the associated interpretation is the risk of book insolvency during a single quarter rather than over a full year.

[28] An alternate approach sometimes used in the literature, measuring L as the marginal profit divided by price, has the drawback that the marginal profit should equal zero in any form of profit-maximizing equilibrium, for any degree of market power. We therefore do not apply that technique here.

marginal cost, the ratio TC / x is the same whether nominal or deflated. Denoting the GDP deflator as g, we can express $\partial \log (TC/g) / \partial \log (x)$ as $\partial [\log (TC) – \log (g)] / \partial \log (x) = \partial \log (TC) / \partial \log (x) - \partial \log (g) / \partial \log (x) = \partial \log (TC) / \partial \log (x)$ since $\partial \log (g) / \partial \log (x) = 0$. Therefore, the estimates of MC are the same whether equations (4) and (5) are estimated with nominal or deflated values.

Estimated values of the Lerner index are reported in Table 3. Because the additional yield earned on small business loans does not fully offset their higher marginal costs, the Lerner index is smaller for small business loans under both measures of marginal cost. The negative estimates for the smallest category of these loans indicate that the estimated yields fail to cover the associated marginal costs, a disequilibrium situation that might reflect a variety of factors including unexpected costs or loss-leader pricing to small borrowers that may later grow into larger borrowers. At any rate, the empirical evidence suggests that pricing is more competitive for small business loans than for large commercial loans, despite the perception that larger borrowers may typically have broader alternative sources of funds. It is possible that regulatory incentives, such as the Community Reinvestment Act, may help explain this outcome. This pattern may also reflect the recent finding that small business borrowers are less locally limited in their sources of credit than in earlier times (Petersen and Rajan, 2000).

5. Summary and Conclusion

This paper has developed applications of statistical techniques to provide indirect evidence of multiple aspects of the financial performance of small business loans, using a nationwide sample of U.S. commercial banks over a recent five-year period. The empirical method is related to, but improves on, the Statistical Cost Accounting approach used in prior literature; the chief improvements include a more theoretically defensible selection of variables and functional forms. Further, the analysis encompasses a richer set of performance measures than previous studies, as well as a broader industry-wide set of banks than most prior studies. The findings indicate systematic patterns that distinguish the performance of small business loans from that of larger commercial loans, with implications for the incentives faced by banks in lending to various categories of borrowers.

Yields, marginal costs, and profitability appear higher for smaller commercial loans than for the largest. Delinquency rates and spreads over funding costs appear higher and more volatile for the smallest commercial loans as well. However, despite exhibiting higher net chargeoff rates, the very smallest commercial loans are also associated with less volatile bankwide asset volumes and lower bankwide risk overall. Estimates of the Lerner index indicate that small business lending is more competitive on average than large business lending. No significant differences were found for the volatility of risk-adjusted yields or spreads, nor for the volatility of net chargeoff rates.

Within small business loans, some contrasts were found across size categories. These differences may reflect multiple factors such as economies of scale due to fixed costs of lending; diseconomies of diversification; and varying degrees of informational transparency across small businesses of different sizes and complexity. Such differences further suggest the possibility, long recognized by practitioners, that growing businesses evolve different types of credit needs over time, creating challenges for their banks to adapt to evolving needs in terms of loan size and terms, credit screening, and monitoring. These dynamics warrant further research, both to understand these patterns more precisely, and perhaps to identify regulatory policies that might facilitate the necessary transitions.

Overall, the findings suggest that the combination of market competition and current regulatory scrutiny has enabled the pricing and provision of small business credit to accommodate intrinsic variations in costs and risk. No systematic evidence was found to indicate that small business lending may be less profitable than larger commercial loans, nor that banks have been unable to manage the risk associated with smaller borrowers that some observers have deemed less informationally transparent.

Table 1: Variables and Sample Statistics

Variable	Mean	Standard Deviation
Yield	0.01962	0.009055
Risk-Adjusted Yield	0.01840	0.01755
Delinquency Rate	0.02889	0.04766
Net Chargeoff Rate	0.001217	0.01487
Spread	0.01452	0.008957
Risk-Adjusted Spread	0.01330	0.01751
Std. Dev. of Yield	0.004322	0.005168
Std. Dev. of Risk-Adjusted Yield	0.006312	0.01142
Std. Dev. of Delinquency Rate	0.002308	0.03049
Std. Dev. of Net Chargeoff Ratio	0.003107	0.01055
Std. Dev. of Spread	0.003589	0.005260
Std. Dev. of Risk-Adjusted Spread	0.005741	0.01153
Coeff. of Var. of Assets	0.1268	0.1003
Z-score	178.873	159.045
Total Costs	3.0980	1.2941
Net Income	8.0161	0.06631
Business Loans <$100k	3.5927	1.2269
Business Loans $100-250k	3.3076	1.2792
Business Loans $0.25-1MM	3.7770	1/5660
Business Loans > $1MM	2.1926	3.6639
Securities	5.7673	1.5250
Other Loans	7.0669	1.3183
Non-Interest Income	1.2329	1.6113
Wage Rate	-2.1980	0.2470
Deposit Interest Rate	-5.3422	0.4522
Price of Fixed Assets	-2.7606	0.6821

Note: All income and expense figures are for the second quarter of each year. Figures for quantities of loans, securities, non-interest income, total cost, and net income, as well as for prices of inputs (labor, deposits, and fixed assets), are shown for the natural logarithms of the deflated values, as used in the regressions.

Table 2: Regression Estimates from Equation (3)

OLS Estimates with Intercept and Trend

Variable	Intercept	Commercial Loans <$100k	Commercial Loans $100k-$250k	Commercial Loans $250k-$1 million	Trend
Yield	0.01263 (44.47)*	0.004572 (7.35)*	0.006101 (5.70)*	0.000727 (1.29)	0.001448 (28.69)*
Risk-Adjusted Yield	0.01145 (28.26)*	0.002708 (2.89)*	0.005757 (4.19)*	0.001189 (1.28)	0.001550 (19.13)*
Delinquency Rate	0.02140 (10.57)*	0.01716 (5.04)*	0.02314 (3.72)*	0.005514 (1.38)	-0.001666 (-6.20)*
Net Chargeoff Ratio	0.001182 (4.24)*	0.001865 (2.66)*	0.000344 (0.40)	-0.000462 (-0.64)	-0.000102 (-1.58)
Spread	0.01046 (36.30)*	0.004274 (6.78)*	0.006036 (5.61)*	0.000541 (0.95)	0.000466 (9.13)*
Risk-Adjusted Spread	0.009282 (22.64)*	0.002409 (2.55)**	0.005692 (4.12)*	0.001003 (1.07)	0.000568 (6.96)*
Std. Dev. of Yield	0.003400 (7.02)*	0.000856 (0.81)	0.001292 (0.75)	0.002172 (1.79)[a]	--
Std. Dev. of Risk-Adjusted Yield	0.005510 (4.28)*	0.000359 (0.26)	0.002439 (0.89)	0.000750 (0.28)	--
Std. Dev. of Delinquency Rate	0.002925 (1.18)	0.00919 (1.65)[a]	0.04321 (3.28)*	0.02688 (3.64)*	--
Std. Dev. of Net Chargeoff Ratio	0.002870 (2.38)**	0.000908 (0.90)	0.001235 (0.56)	-0.000811 (-0.33)	--
Std. Dev. of Spread	0.001924 (3.88)*	0.001157 (1.08)	0.002626 (1.48)	0.002711 (2.20)**	--
Std. Dev. of Risk-Adjusted Spread	0.004203 (3.23)*	0.001329 (0.95)	0.003789 (1.35)	0.001366 (0.51)	--
Coeff. of Var. of Assets	0.2018 (18.59)*	-0.1374 (-7.77)*	-0.0770 (-2.73)*	-0.06253 (-3.41)*	--
Z-score	192.424 (11.11)*	80.453 (3.14)*	-106.373 (-2.21)**	-59.118 (-1.91)[a]	--

Note: Robust t-statistics in parentheses, based on White (heteroscedasticity-consistent) standard errors, significant at the *0.01, **0.05, or [a]0.10 level (one-tail test).

Table 3: Estimated Performance Measures for Commercial Loans

Based on Regression Estimates from Equations (3), (4), and (5)

Variable	Commercial Loans <$100k	Commercial Loans $100k-$250k	Commercial Loans $250k-$1 million	Commercial Loans > $1 million
Yield	0.024446	0.025975	0.020601	0.019874
Risk-Adjusted Yield	0.021908	0.024957	0.020389	0.019200
Delinquency Rate	0.030228	0.036204	0.018583	0.013070
Net Chargeoff Ratio	0.002538	0.001018	0.0002119	0.0006739
Spread	0.017069	0.018832	0.013337	0.012796
Risk-Adjusted Spread	0.014531	0.017814	0.013125	0.012122
Marginal Cost:				
via equation (4)	0.027789	0.019818	0.009976	0.000766
via equation (5)	0.027627	0.015046	0.0021417	-0.0068864
Marginal Profit via equation (6)	0.002037	-0.0004227	-0.0005435	$-5.572\text{x}10^{-5}$
Lerner Index:				
via equation (4)	-0.13675	0.23704	0.51574	0.96143
via equation (5)	-0.13012	0.42075	0.89604	1.34650
Std. Dev. of Yield	0.004256	0.004692	0.005572	0.003400
Std. Dev. of Risk-Adjusted Yield	0.005459	0.007539	0.005850	0.005510
Std. Dev. of Delinquency Rate	0.01212	0.04614	0.02980	0.002925
Std. Dev. of Net Chargeoff Ratio	0.003778	0.004105	0.002059	0.002870
Std. Dev. of Spread	0.003081	0.004550	0.004635	0.001924
Std. Dev. of Risk-Adjusted Spread	0.005532	0.007992	0.005569	0.004203
Coeff. of Var. of Assets	0.0644	0.1248	0.1393	0.2018
Z-Score	272.877	86.051	133.306	192.424

Note: Figures are computed for the year 2007 except for volatility items, which are computed across the full sample period 2002-2007. Rates are calculated on a quarterly basis.

Table 4: Cost and Profit Characteristics of Small Business Loans

OLS Estimates of Equations (4) and (8) with Trend

Linear Homogeneity Imposed on Equation (4)

	Cost Function		**Profit Function**	
Variable	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Intercept	1.866	35.76*	7.850	292.38*
Business Loans <$100k	0.02623	6.13*	6.914×10^{-3}	3.57*
Business Loans $100-250k	0.01316	2.76*	-1.006×10^{-3}	-1.01
Business Loans $0.25-1MM	0.01491	4.73*	-2.899×10^{-3}	-4.71*
Business Loans > $1MM	5.732×10^{-3}	5.92*	-1.465×10^{-3}	-7.42*
Securities	0.1022	31.12*	3.493×10^{-3}	5.73*
Other Loans	0.5215	102.58*	0.01778	10.64*
Non-interest Income	0.2410	48.01*	2.271×10^{-2}	1.39
Wages	0.5294	41.11*	-2.657×10^{-3}	-0.64
Deposit Rate	0.4137	39.90*	-3.516×10^{-3}	-2.01**
Price of Fixed Assets	--	--	6.401×10^{-3}	7.97*
Trend	-5.174×10^{-3}	-2.36**	5.135×10^{-4}	1.19

Note: t-statistics are robust, based on White (heteroscedasticity-consistent) standard errors: significant at the *0.01 or **0.05 level (one-tail test). Price of fixed assets is used as a normalizing variable to impose linear homogeneity on the cost function and so does not appear with a separately estimated coefficient in that specification, as is standard in the literature and explained in the text.

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