PROFITABILITY AND RISK OF U.S. AGRICULTURAL BANKS

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Abstract

Study of profitability and risk of agricultural banks is very important in assessing the ability to adequately finance agricultural production and rural development. A recursive system of profitability and risk equations is estimated to compare the performance of agricultural with nonagricultural banks and to identify factors which affect performance. A linear regression model which measures risk-adjusted profitability confirms the results from the recursive system. Results show that agricultural banks perform better than nonagricultural counterparts on average even after controlling for risks and other factors. Further, off-balance-sheet business is found to be negatively related to the risk-adjusted profitability of agricultural banks.

Key Words: Agricultural Banks, profitability, risk, noninterest income

Introduction

Commercial banks and the farm credit system have been the main financing sources for farmers in the United States. USDA data (1999 & 2001) show that agricultural banks are playing a more important role relative to the farm credit system in financing American agriculture, especially for young and small farmers, compared with the farm credit system. Commercial banks have increased their share of agricultural loans from 25% in 1985 to about 40% in 2000, about one third higher than that of farm credit system. Agricultural banks as a type, those banks with the proportion of agricultural loans higher than the unweighted average among all commercial banks (USDA 1999 & 2001; Kliesen and Gilbert 1996; Barry and Escalante 1998), are the main source of agricultural loans. Efficient operation and risk management of agricultural banks are of great importance for the agricultural sector as a whole. At the same time, safe and profitable operation of agricultural banks contributes to the safety of the whole banking system.

Bank merger waves in the past decades have raised concerns as to whether agricultural banks can maintain a competitive position in agricultural loans or whether the bigger banks, after merger, will be willing to provide substantial agricultural loans (Dolan and Collender 1996). Such concerns are grounded in the following claims about agricultural banks. First, due to asset specialization in the agricultural sector which is prone to widespread risks arising from weather, disease, insects, and the export market, agricultural banks are more risky than nonagricultural banks. Second, compared with small nonagricultural banks and medium-size nonagricultural banks, agricultural banks are characterized by smaller percentages of cash, more securities holdings, higher equity ratios, and lower levels of assets (Kliesen and Gilbert 1996). Compared with larger banks, small banks are much more likely to rely on deposits to fund loans and much less likely to use nonlocal, nondeposit funds. Economic theory and empirical evidence suggest

that the ability of small banks to raise deposits may constrain lending activity. As a result, agricultural banks are presumed to be at a disadvantage compared with nonagricultural banks, making agricultural banks unattractive in bank mergers. In order to make agricultural banks viable and continue to effectively and efficiently finance agriculture, one view has been to extend federal assistance to them. The federal Gramm-Leach-Bliley (GLB) Act of 1999, which broadened community and agricultural bank access to funds from the Federal Home Loan Bank (FHLB), is a reflection of such concern (Dolan and Collender 2001).

Using a large sample of U.S. commercial banks for a period of 16 years, we investigate bank risks reflected in the variation in bank performance over time and compare the profitability and risk of agricultural and nonagricultural banks while controlling for financial and geographical characteristics of individual banks. Our results are contrary to the above presumptions: agricultural banks, as a group, generally perform better than nonagricultural counterparts with respect to profitability and risk. We also find that the new trend in the banking business, a shift toward noninterest income, only diminishes bank profitability and increases bank risk, which is true for agricultural and nonagricultural banks alike. The paper is organized as follows. The first part reviews studies focusing on agricultural banks and bank profitability and risk in general. In the second part, we describe the variables to be included in the models. The third part presents econometric models and estimated results. Finally conclusions are drawn emphasizing major findings.

Previous Study

In a portfolio model of a banking firm, bank managers make the dual choice of asset composition and financial structure subject to capitalization and asset quality restrictions

(internally feasible and externally conforming to regulation). Consequently, both the expected rate of profit and risk are simultaneously determined. Empirical modeling of bank performance should address profitability and risk at the same time. Controlling for risk of banking firms has become a norm in bank performance study. Clark (1986) developed a simultaneous system of four structural equations which treats single bank profit, risk level, asset composition, and liability composition as endogenous variables and controls for differences in market and regulatory structure. In a more recent study, Rivard and Thomas (1997) investigated the effect of interstate banking on large bank holding company profitability and risk using a recursive system of profit and risk equations and found that large bank holding companies operating subsidiary banks in other states experienced higher rates of return on assets and lower levels of volatility risk and bank failure risk.

In contrast to the voluminous literature on risk and performance studies of banks in general, there are just a handful of studies focusing on performance of agricultural banks. Kliesen and Gilbert (1996) examined the distinguishing characteristics of agricultural banks and then described the financial performance measures in comparison with other banks. Their descriptive statistics showed that agricultural banks outperformed non-agricultural banks in recent years. But in order to reduce the vulnerability of the banking industry to a downturn in the agricultural sector, they suggested that bank supervisors require the banks with relatively high ratios of their assets invested in agricultural loans to maintain relatively high capital ratios.

By looking into the structural changes and trends of agricultural banking for the period from 1991 to 1997, Barry and Escalante (1998) found that the shares of agricultural debts held by agricultural banks within and across regions have been sustained. They argued that agricultural lending will remain a profitable target for well-capitalized, highly competitive, and

effectively managed community banks that have strong customer relationships and the ability to effectively employ various services from larger bank and non-bank institutions as banking structures and financial services continue to evolve.

Using data for a longer time horizon and explicitly accounting for risk and other characteristics of agricultural banks in bank performance models, this paper provides a more general and objective view of agricultural banks. At the same time, we are able to investigate the effect of various bank characteristics, including assets and liabilities compositions, and off-balance-sheet business, on the agricultural bank performance.

Data and Variables

The Report of Condition and Income (the call-report) is the data source for this study. It contains balance sheet, income statement, and risk-based capital data on all insured national and state nonmember commercial banks and state-chartered savings banks regulated by the Federal Reserve System, Federal Deposit Insurance Corporation, and the Comptroller of the Currency. Data from 1985 to 2000 are collected and averaged to measure bank conditions and variations in basic performance measures. Only those banks existing for all 16 years, 8734 commercial banks in total, are in our sample.

Following Rivard and Thomas (1997), profitability is measured as the commercial bank's average accounting return on assets (ROA) because ROA better measures profitability than ROE in that ROA is not distorted by high equity multipliers, and ROA represents a better measure of the ability of the firm to generate returns on its portfolio of assets. The type of risk analyzed in this paper is insolvency risk, which is present because a bank may be unable to meet obligations to depositors and other creditors. The insolvency risk index is a ratio in which the numerator is a

measure of volatility of realized earnings and the denominator is a sum of the expected earnings plus a relative measure of the owner's equity. Specifically, it is calculated as the standard deviation of ROA divided by the sum of average ROA and the average equity assets ratio. It is a better measure of bank risk than the volatility risk (standard deviation of ROA) because it accounts for the fact that banks with the same volatility risk may have higher expected ROA and equity-to-asset ratios, and hence less likely to be at high risk. In addition, we also used the risk-adjusted profitability, the so-called "Sharpe ratio", as a measure of bank performance in our models to see whether our results are consistent. The risk-adjusted profitability is calculated as the ROA divided by standard deviation of ROA.

Descriptive statistics show that the average percentage of agricultural loans to total loans (together with real estate loan, industrial and commercial loans, and loans to individuals) is about 15.92% during the 16 years from 1985 to 2000. Defined as those banks with the proportion of agricultural loans higher than the unweighted average among all commercial banks, nearly half (4195 out of 8734) of all commercial banks can be defined as agricultural banks. As shown in Table 1, agricultural banks are characterized by much smaller size, higher reliance on deposits for funding, higher percentage of equity capital and liquid assets, lower ratios of non-interest income, and higher ratios of non-performing loans. This is the case because such bank are more specialized in one particular asset, agricultural loans, which are more prone to some natural risks like weather or disease and export market.

Bank size is the first factor we consider in bank performance study since larger banks have more opportunities in diversifying assets to spread risks and may also experience various economies of size in technology adoption and networking effects. We measured bank size as the natural logarithm of total assets since the scale of banks measured in assets is highly skewed with

many more banks having assets below the average level. Capital-to-asset ratio is another important variable affecting bank risk. By intuition, highly-capitalized banks provide a cushion of equity to protect creditors from adverse earnings, and thus less risky than banks with lower capital-to-asset ratios. On the other hand, having a high capital-to-asset ratio reduces banks' opportunity to extend loans to borrowers, thus lower profitability levels.

We use the loan-to-asset ratio and the deposit-to-asset ratio as measures of bank asset and liability compositions. A bank holding a large share of assets in loans is generally expected to have a higher, but more volatile, rate of return on assets than a similar bank holding a larger percentage of liquid assets. Thus we expect the sign of the effect of loan-to-asset ratio on both bank profitability and risk to be positive, but the sign of its effect on the risk-adjusted profitability is indeterminate. There are two main sources of external funds which banks can utilize for loans, deposits from individuals and firms and funds purchased from the money market. Because of limitation in size and market scope, agricultural banks are much more likely to rely on deposits to fund loans and much less likely to use nonlocal, nondeposit funds. As shown in Table 1, agricultural banks have a higher deposit-to-asset ratio on average. The effect of deposit-to-asset ratio on bank profitability is arguable. The classic design rule for a bank is a deposit-to-asset target ratio of 0.8:1 to fund lending operations and generate service charge revenue with minimal exposure to market risk. If a bank is highly capable of mobilizing funds, it can rely more on purchased funds and still maintain high profitability. As a stable source of funding, a higher percentage of deposits is usually related to lower risk levels. However, high fluctuation of the deposit levels will surely result in higher risk.

The U.S. banking industry is steadily increasing its reliance on nontraditional business activities that generate fee income, trading revenue, and other types of noninterest income.

Stiroh (2002) studied the impact of increasing non-interest income on the mean and variation of bank profits and revenues using the accounting data for U.S. commercial banks. His study showed that risk-adjusted returns are strongly, negatively associated with the share of income derived from non-interest sources for average U.S. commercial banks. Percentage of non-interest income in this paper is calculated as the ratio of non-interest income to net operating income which equals interest income minus interest expense. For all banks, the percentage of non-interest income was 14.59% in 1985 and increased to 15.38% in 2000. Non-interest income accounted for 13.04% of total income in 2000, up from 11.26% in 1985 for agricultural banks. For nonagricultural banks, the percentage of non-interest income increased from 16.30% to 16.51% for the same time period. Thus, the increase in non-interest income is relatively greater for agricultural banks even though with lower ratios of non-interest income on average.

The ratio of non-performing loans measures the quality of the main assets of commercial banks. It is always true that this ratio is negatively related to profitability and positively related to bank risk. The last group of variables that we consider for our models is the ratios of various loans to the total loans. By examining the effect of these ratios to bank profitability and risk, we can ascertain to some extent the types of loan portfolio that contribute favorably to bank performance.

Econometric Models and Results

Following Rivard and Thomas (1997), a triangular specification of the profitability and risk equations captures the relationship of profitability and risk levels by allowing risk to contribute to the determination of profitability, while risk itself is determined by other bank

condition variables. Variable definitions are provided in Table 1. The model is presented as follows:

$$ROA_i = \alpha_0 + \alpha_1 INSOLV_i + \alpha_2 LOG(SIZE)_i + \alpha_3 CAR_i + \alpha_4 LNASR_i + \alpha_5 DEPOR_i + \alpha_6 NINSTINC_i + \alpha_7 NPERFLNR_i + \alpha_8 AGBANK_i + \varepsilon_1 \quad (1)$$

$$INSOLV_i = \alpha_0 + \alpha_2 LOG(SIZE)_i + \alpha_3 CAR_i + \alpha_4 LNASR_i + \alpha_5 DEPOR_i + \alpha_6 DEPOSITSD_i + \alpha_7 NINSTINC_i + \alpha_8 NPERFLNR_i + \alpha_9 AGBANK_i + \varepsilon_2 . \quad (2)$$

In this specification, if ε_1 and ε_2 are correlated, $INSOLV$ is endogenous. A two-step endogeneity test of $INSOLV$ follows: Assume $\varepsilon_1 = \theta^* \varepsilon_2 + u$. Thus, we can take the residuals $\hat{\varepsilon}_2$ from (2) and plug it into (1) in place of ε_1. The test of endogeneity is equivalent to test for significance of $\hat{\theta}$ with respect to 0. The T-test for $\hat{\theta}$ shows that it is not significant from 0 even at the 10% significance level, suggesting $INSOLV$ can be regarded as exogenous in explaining ROA. Similarly, we can test the endogeneity of ROA for equation (2) that includes ROA as an explanatory variable and test the significance of residuals from equation (1) without $INSOLV$. Using the same T-test, the null hypothesis that ROA is exogeneous is soundly rejected. Since the endogeneity test confirms that $Cov(\varepsilon_1, \varepsilon_2) = 0$ in the above triangular specification, the recursive system of equations can be consistently estimated with OLS (Wooldridge, 2002).

To check the robustness of the results from the recursive system, a linear regression model which measures risk-adjusted profitability with other variables is also employed:

$$PROFRISK_i = \alpha_0 + \alpha_2 LOG(SIZE)_i + \alpha_3 CAR_i + \alpha_4 LNASR_i + \alpha_5 DEPOR_i + \alpha_6 DEPOSITSD_i + \alpha_7 NINSTINC_i + \alpha_8 NPERFLNR_i + \alpha_9 AGBANK_i . \quad (3)$$

In equation (3), $PROFRISK_i$ is defined as $ROA / ROASD_i$ and $AGBANK_i$ is a dummy variable representing agricultural banks. In addition, we use ratios of various loans to the total loans in place of the dummy variable for agricultural banks to learn what types of loan portfolios contribute favorably to bank performance, as shown in the following equation:

$$PROFRISK_i = \alpha_0 + \alpha_2 LOG(SIZE)_i + \alpha_3 CAR_i + \alpha_4 LNASR_i + \alpha_5 DEPOR_i + \alpha_6 DEPOSITSD_i + \alpha_7 NINSTINC_i + \alpha_8 NPERFLNR_i + \alpha_9 RER_i + \alpha_{10} CIR_i + \alpha_{11} INDR_i . \quad (4)$$

The model (4) is also run estimated with data only for agricultural banks so as to check whether the variables have different effects for agricultural banks. Results show that the coefficients have the same signs and are only slightly different in magnitude for agricultural banks compared those for all banks.

The estimation results of the model (1)-(4) are reported in Table 2. The coefficient of the variable of primary concern in the recursive system of equations, the dummy variable for agricultural banks, suggests that agricultural banks enjoy better performance with high profitability and lower insolvency risk than non-agricultural banks on average over the 16-year period from 1985 to 2000. The robustness of this result is confirmed by the result from equation (3), agricultural banks having higher risk-adjusted profitability. As to loan types, we found that agricultural loans (the left-out baseline category) are related with the better performance. Loans to individuals are not significantly different from agricultural loans regarding contribution to bank performance. The real estate loans are related to the lower bank performance, followed by industrial and commercial loans. Considering that real estate loans encompass almost half of the total loans of commercial banks, a shift of loans from real estate to agriculture or individuals may help to improve bank performance.

Noninterest income from off-balance-sheet business was found to be negatively related to profitability and positively related to insolvency risk for agricultural banks as well as all banks. This result echoes the finding of Stiroh (2002). The reason for the negative contribution of off-balance-sheet business, as Stiroh shows, is that noninterest income growth is much more volatile

than net interest income growth and the covariance between the two has risen as the line between interest and noninterest activities becomes increasingly blurred.

Model results also indicate that the increase in bank size can also contribute favorably to bank performance, which supports the hypotheses of risk spreading and economies of size. This result is common for many bank profitability and efficiency studies (Berger and Humphrey 1991; Rivard and Thomas 1997). As expected, the capital-to-asset ratio is negatively related to insolvency risk. The positive relationship between capital-to-asset ratio and ROA may be the result of a more risky and profit-enhancing business operation backed by sound adequacy of capital.

A high loan-to-asset ratio will result in relatively high insolvency risk, which confirms our intuition because a high loan-to-asset ratio is accompanied by a relatively low liquidity level. And high loan-to-asset ratio does not necessarily lead to high profitability level, as shown by the insignificant relationship with ROA. The coefficient for the deposit-asset ratio should be interpreted with caution. In our results, the deposit-asset ratio is found to be positively related to risk and negatively related to ROA, which is at odds with Rivard and Thomas (1997) who found a positive relationship between the deposit-to-asset ratio and ROA and an insignificant relationship between the deposit-to-asset ratio and risk for bank-holding companies. The contradiction can perhaps be reconciled in that the deposit-to-asset of the commercial banks may reflect the ability to mobilize funds by affiliating with bank holding companies or utilizing other external funds. With a high capability to source external funds, commercial banks can maintain a relatively low deposit-to-asset ratio while still achieving good performance. Of course, if deposits are highly volatile, banks will suffer from this unstable source of financing, thus take higher risks. The non-performing loan ratio, as expected, is the most important source of bank

risk and is a severe drag on the bank profitability. Even though agricultural banks have a higher non-performing loan ratio on average, they are not at a higher insolvency risk than nonagricultural banks.

Conclusion

Using data on commercial banks for a period of 16 years from 1985 to 2000, this paper analyzed the performance of agricultural banks in comparison with nonagricultural banks by modeling the average profitability and insolvency risk embodied in the variation of profitability. Our results are consistent across various models, all suggesting that agricultural banks have enjoyed better performance over the years than nonagricultural banks, higher return on assets, lower insolvency risk, and higher risk-adjusted profitability.

The off-balance-sheet business, which seems to be a trend in the banking industry, decreases profitability and increases insolvency risk of agricultural banks as well as all banks in general. Reliance on off-balance-sheet business to improve bank performance does not appear to be feasible. The trend of increasing off-balance-sheet business in commercially banks may simply reflect the commercial banks' efforts to take more financial management business from customers in order to secure a stable source of customers and compete for loyal customers.

Maintaining the traditional role of agricultural lending seems to be a prudent strategy for agricultural bank to improve performance. The underlying source of better performance is sound assets and higher interest margins earned from the assets – agricultural loans. The data in our study shows that the average interest margin (average interest rate for loans minus average interest rate for deposits) for agricultural banks is 11.31%, higher than that for nonagricultural banks, 10.93%. Even though agricultural banks are smaller in size, which may limit the ability to

spread risk geographically or through assets diversification, they can still achieve good performance by focusing on their market niche in the agricultural sector and benefiting from strong customer relationships in the local communities. Thus, the usual concern that agricultural banks will lose their competitive edge in bank merger waves is not supported by our empirical evidence and some policies which are intended to support agricultural banks are not economically justified. In fact, Craig and Thomson (2003) show that the federal Gramm-Leach-Bliley (GLB) Act of 1999, which broadened rural bank access to funds from the Federal Home Loan Bank (FHLB), will not increase the amount of small-business loans made by rural banks. Instead, it could lead to increased risk-taking by rural financial institutions and hence, increase the loss exposure to the Federal Deposit Insurance Corporation.

This paper investigated differences in profitability and risk between agricultural and nonagricultural banks and identified factors which affect bank performance using financial data for commercial banks. Further study may involve investigation of the effect of clientele or farm-level data, such as land values, income, and employment on agricultural bank profitability and risk, which may provide information on the impact of economic conditions on the agricultural bank performance. In addition, the findings of this study are based on data for commercial banks from 1985 to 2000 when there was no fundamental downturn in the business. If there is sharp deterioration in the agricultural sector, the conclusion that agricultural banks perform better than nonagricultural banks may not hold.

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Table 1: Descriptive Statistics of the Selected Variables:

Variables	Definition	MEAN (S. E.)	
		Ag. Banks n = 4195	Non-Ag. Banks n = 4539
ROA	Return on assets (net income/total assets)	0.0087 (0.0030)	0.0084 (0.0031)
ROASD	Standard deviation of ROA over the whole period	0.0094 (0.0082)	0.0101 (0.0076)
INSOLV	Insolvency risk (ROASD/(ROA+CAR))	0.0932 (0.0839)	0.1037 (0.0934)
PROFRISK	Risk adjusted profitability	1.3797 (0.8555)	1.2559 (0.8337)
LOGSIZE	Ln (Assets)	9.5280 (0.9103)	9.7870 (0.9220)
CAR	Capital-to-asset ratio	0.0947 (0.0093)	0.0927 (0.0099)
LNASR	Loan-to-asset ratio	0.5527 (0.0346)	0.5659 (0.0360)
DEPOR	Deposit-to- asset ratio	0.8699 (0.0172)	0.8674 (0.0198)
DEPORSD	Standard deviation of DEPOR over the whole period	0.0617 (0.0370)	0.0688 (0.0429)
NINSTINC	Ratio of non-interest income to total operating income	0.1503 (0.0249)	0.1590 (0.0281)
NPERFLNR	Ratio of non-performing loans to total loans	0.0175 (0.0059)	0.0172 (0.0058)
RER	Ratio of Real estate loans	0.4320 (0.0444)	0.4942 (0.0476)
CIR	Ratio of commercial and industrial loans	0.1740 (0.0296)	0.1839 (0.0317)
INDR	Ratio of loans to individuals	0.1749 (0.0317)	0.1855 (0.0348)
AGR	Ratio of agricultural loans	0.2031 (0.0352)	0.1186 (0.0284)
AGBANK	Dummy variable, 1 for agricultural banks, 0 otherwise		

Table 2: OLS Estimation of Profitability, Risk and Risk-adjusted Profitability Equations:

Explanatory Variables	Eq. 1 ROA	Eq. 2 INSOLV	Eq. 3 PROFRISK	Eq. 4 PROFRISK
Constant	0.0153 (0.0019)	-1.3903 (0.0987)	14.3932 (0.9266)	15.3895 (0.9261)
INSOLV	-0.0189 (0.0003)			
LOGSIZE	0.0001 (0.0000)	-0.0039 (0.0010)	0.0453 (0.0098)	0.0488 (0.0098)
CAR	0.0187 (0.0031)	-0.6004 (0.1113)	-4.1295 (1.0454)	-4.2961 (1.0413)
LNASR	-0.0004* (0.0007)	0.0769 (0.0251)	-1.5313 (0.2358)	-1.4795 (-0.2386)
DEPOR	-0.0075 (0.0017)	1.5768 (0.0986)	-12.1362 (0.9261)	-12.2609 (0.9242)
DEPORSD		0.8602 (0.0403)	-6.7536 (0.3783)	-6.9586 (0.3805)
NINSTINC	0.0061 (0.0010)	0.2359 (0.0341)	-2.5043 (0.3205)	-2.2900 (0.3242)
NPERFLNR	-0.1108 (0.0045)	4.6492 (0.1486)	-54.6688 (1.3951)	-53.5446 (1.3985)
AGBANK	0.0002 (0.0001)	-0.0062 (0.0018)	0.0986 (0.0166)	
RER				-0.7579 (0.1648)
CIR				-3.0227 (0.2864)
INDR				-0.1881* (0.2644)
Adjusted R^2	0.4468	0.1991	0.2197	0.2313

Note: (1) All coefficients are significant at the 5% level except those marked with an asterisk.
(2) Standard errors are in parentheses.