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A TOBIT ANALYSIS OF DETERMINANTS OF GEOGRAPHIC DIFFERENTIALS IN THE COMMERCIAL BANK CLOSING RATE IN THE UNITED STATES

by
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I. *Introduction*

Not since the Great Depression have the regulatory authorities in the United States closed as many banks as they did during the 1980s and early 1990s. For the period from 1943 through 1981, comparatively few banks were closed because of insolvency. Indeed, over this lengthy period, there were only two years (1975 and 1976) in which the number of closed federally insured banks exceeded ten. However, this situation changed dramatically beginning with the year 1982. During this year, 42 banks were closed, followed by 48 closings in 1983 and then 79 closings in 1984. The number of closed banks increased fairly sharply thereafter, surpassing 100 closings per year until 1993.

One discernable pattern that emerges from an examination of the bank closing data is the substantial geographic variation in the distribution of bank closings. Specifically, the bank closing rate by state, especially during the turbulent 1980s, differs widely among the various states. For instance, at the extrema, for the 1982 through 1990 period (when the number of bank closings had especially intensified), there were eight states that experienced zero closings, whereas there were ten states in which the *percentages* of banks that were closed reached double digits.

Given this widely divergent geographic pattern in the bank closing rate, it is important to determine whether regional factors played a role. It is well known that banks may engage in excessively risky activities when they have access to federally insured deposits. But what is less understood is the reason some banks may engage in such behaviour, while other banks may

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not. The fact that closing rates differ so widely among states enables one to go beyond bank specific variables to examine the role of regional economic factors. This type of analysis also enables one to assess whether some states experience bank closings because of their regulatory environment or were simply fortunate enough to have avoided an adverse economic shock. With this in mind, this study analyzes bank failure rates by state for the period 1982 through 1990.

II. *Framework*

Studies of closing or failure rates among the different types of financial institutions in the United States have been conducted by a number of scholars (for example: Amos, 1992; Barth, 1991; Barth, Brumbaugh, and Litan, 1992; Barth and Brumbaugh, 1992; Brumbaugh, 1988; Carron, 1982; Cebula, 1993; Jaffee, 1989; Kane, 1985; and Kaufman, 1989). These various studies have focused mainly on the problems of savings and loans (S&Ls), although an analysis of banks has certainly not been totally ignored (see, especially, Amos, 1992; Barth, Brumbaugh, and Litan, 1992; and selected essays in Barth and Brumbaugh, 1992).

Based largely on Amos (1992), Barth, Brumbaugh, and Litan (1992), Barth and Brumbaugh (1992), Bradley and Jansesn (1986), and Kaufman (1989), this study focuses on three categories of factors that have been identified as influencing bank closing rates:

1. financial market factors: the cost of deposits (*ACBCD*) and net charge-offs as a percentage of outstanding loans (*CHARGEOFF*);
2. other economic factors: unemployment rates (*UN*), the average growth rate of state product over time (*AGSP*), the inflation rate of housing (*HINFL*), and the average percentage of state product derived from oil and natural gas extraction (*OILNG*);
3. state regulations on bank branching: such as whether unit banking is the regulation in a state (*UNIT*).

It is argued that, *ceteris paribus*, the higher the cost of deposits over time (*ACBCD*), the lower is the bank profit rate (Bradley and Jansen, 1986) and hence the greater the likelihood that over time the bank will fail (see also Barth, Brumbaugh, and Litan, 1992). Further, the larger the percentage of its outstanding loans that a bank charges off (*CHARGEOFF*), the greater the likelihood of losses and, over time, the greater the likelihood of the bank's being closed (see, for example, Barth, Brumbaugh, and Litan, 1992).

The higher the unemployment rate in a state (*UN*), the greater the probability of loan defaults (Kaufman, 1989) and hence of bank closings.

Alternatively, states with more rapidly *growing* levels of Gross State Product (*AGSP*) are more likely to be environments with fewer loan defaults and hence fewer bank closings. Presumably, a more rapid inflation rate of housing prices (*HINFL*) would reflect a more vibrant housing market and potentially therefore a more vital economic environment. Such an environment would be more likely to be associated with fewer bank failures. The oil/energy situation during the 1980s may also have been an important factor in affecting the performance of banks. Prices on crude petroleum, for example, dropped significantly from 1980-1985 and were halved from 1985-86. This contributed to economic stress in those areas of the nation (largely the Southwest but elsewhere as well) where employment was very dependent on oil (and natural gas) extraction. It follows that the higher the percentage of state product derived from oil and natural gas extraction (*OILNG*), the greater the probability of loan defaults at banks and hence of bank failures (Barth, 1991, makes a similar argument regarding S&L closings).

Finally, Amos (1992, p. 812) argues that bank closings may be significantly determined by ".... differences in state branch banking regulations". Following Amos (1992), a binary [0,1] dummy variable is included to indicate the degree of branch banking permitted: *UNIT*, for states permitting only unit banking. As argued in Amos (1992), the restrictive variable, *UNIT*, should be associated with more bank closings because of the limitations it places on the ability of banks to diversify geographically.

III. *Empirical Model*

In this study, the determinants of geographic bank closing rate differentials over the 1982-90 time period are empirically investigated. Given the nature of the available data, the 50 states serve as the measure of the geographic unit. However, the results are materially the same if Alaska, with its 50 percent bank closure rate over the 1982-90 period, is dropped from the model. Of the 50 observations on the dependent variable in this study, eight have a value of zero. Thus, 16 percent of the observations on the dependent variable in this analysis are zeros. This situation corresponds to a standard "censored" regression model. Consequently, the model is estimated using the TOBIT estimation technique, which is perhaps the oldest and best known econometric technique used for estimating relationships involving censored data. As Maddala (1991, p. 794) observes, "... the TOBIT model is a censored regression model where observations on the de-

pendent variable ... are censored ...". The use of ordinary least squares techniques is not appropriate when observations on the dependent variable are zeros.

Based upon the analysis in the preceding section of this study, the following equation is estimated:

$$(1)\quad CBFR_j = a + b\,ACBCD_j + c\,HINFL_j + d\,OILNG_j + e\,CHARGEOFF_j + f\,UN_j + g\,AGSP_j + h\,UNIT_j + u$$

where:

$CBFR_j$ = the percentage of commercial banks in state j that were closed during the period 1982-1990;
a = constant term;
$ACBCD_j$ = the average cost of deposits for commercial banks in state j, 1982-89, as a percent per annum;
$HINFL_j$ = the inflation rate of single family dwellings, in state j, 1979-1989, expressed as a percent;
$OILNG_j$ = the average percentage, 1979-88, of state j's gross state product that derived from oil and natural gas extraction;
$CHARGEOFF_j$ = the average, 1985-89, at commercial banks in state j, of net charge-offs as a percentage of outstanding loans;
UN_j = the average unemployment rate in state j, 1980-87, as a percent;
$AGSP_j$ = the average annual percentage rate of growth of state product in state j, 1979-88;
$UNIT_j$ = a binary (dummy) variable indicating whether unit bank regulations prevail in state j; $UNIT_j = 1$ in those states having unit banking regulations and $UNIT_j = 0$ otherwise;
u = stochastic error term.

The time period studied runs from 1982 through 1990. This represents the time period during which the number of bank closings rose dramatically, surpassing any prior equivalent experience in the post-World War II period, and during which the bank insurance fund reported insolvency.

The dependent variable, $CBFR_j$, represents the proportion of the total number of commercial banks in state j that were closed over the 1982-90 period. These data were obtained from the *FDIC Annual Reports*, 1982-1990. The average cost of deposits, $ACBCD_j$, was obtained from the Federal Reserve Bank of Atlanta Research Department. The data for computing

HINFL were obtained from various issues of the *Statistical Abstract of the United States*. The data for computing the variables *OILNGj* and *AGSPj* were obtained from the Bureau of Economic Analysis. The data for the variable *CHARGEOFF* were computed using data from various issues of the *Sheshunoff Bank Quarterly*. Finally, the unemployment rate, *UNj*, was obtained from various issues of the *Statistical Abstract of the United States*.

Based on the arguments in the preceding section of this study, the following signs on the coefficients are expected:

$$b > 0,\ c < 0,\ d > 0,\ e > 0,\ f > 0,\ g < 0,\ h > 0 \qquad (2)$$

In equation (3), the empirical results of the TOBIT estimation of equation (1) are reported:

$$\begin{aligned} NCBFRj = {} & 7.45 + 2.41\ ACBCDj - 0.03\ HINFLj + 0.521\ OILNGj \\ & (-1.31)\ (+2.01) \qquad (-2.66) \qquad (+5.20) \\ & + 0.86\ CHARGEOFFj + 1.16\ UNj + 0.22\ AGSPj + 2.71\ UNITj \\ & (+2.31) \qquad (+1.26) \quad (+1.52) \quad (+2.12) \\ & 11r = 13.99\ (p\text{value} = 0.00014) \end{aligned} \qquad (3)$$

where terms in parentheses are *t*-values and $11r$ is the log likelihood ratio.

In equation (3), five of the seven estimated coefficients are statistically significant at least at the five percent level and have the expected signs. Only two coefficients are not statistically significant at the ten percent level.

The estimated coefficient on variable *ACBCDj* is positive and significant at the five percent level, implying that the bank closing rate in a state is an increasing function of the cost of deposits in that state (see Barth, Brumbaugh, and Litan, 1992, as well as Bradley and Jansen, 1986). The coefficient on variable *HINFLj* is negative and significant at the one percent level, implying that the bank closing rate is a decreasing function of the housing inflation rate. The estimated coefficient on variable *OILNGj* is positive and significant at the one percent level; this finding implies that the bank closing rate is an increasing function of the percent of a state's product that derives from oil and natural gas extraction. Next, the coefficient on variable *CHARGEOFF* is positive and significant at the five percent level, which implies that the bank closing rate is an increasing function of the ratio of net charge-offs to loans (Barth, Brumbaugh, and Litan, 1992). Finally, the dummy variable for unit banking is positive and statistically significant at the four percent level; thus, it appears, as argued in Amos (1992), that restrictive unit banking regulations may lead to an increased bank closing rate. By contrast, neither the average growth rate in state product nor the

unemployment rate appear to have exerted a significant impact on bank closing rates.

IV. *Conclusions*

This study empirically examines the determinants of the geographic (interstate) differentials in bank closing rates over the period 1982 through 1990. Based upon earlier studies, several causal factors were employed in this analysis. The TOBIT estimation technique was adopted because eight (out of 50) of the observations on the dependent variable are zeros. The findings indicate that the cost of deposits, the housing inflation rate, the percent of gross state product derived from oil and natural gas extraction, the ratio of net charge-offs to outstanding loans, and unit banking regulations all significantly influence interstate differentials in bank closing rates. This means that regional economic factors do indeed affect bank performance. Regulatory authorities should therefore focus not only on bank specific variables when assessing the likelihood of bank failures, but also on the broader economic environment in which banks operate. They should also consider the potentially adverse effects that limitations on geographic diversification can have on bank performance.

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LE DETERMINANTI DEI DIFFERENZIALI GEOGRAFICI SUL TASSO DI CHIUSURA DELLE BANCHE COMMERCIALI NEGLI STATI UNITI

Con una tecnica di stima Tobit questo studio esamina empiricamente le determinanti dei differenziali sul tasso di chiusura delle banche in 50 stati degli Stati Uniti nel periodo 1982-1990. Risulta che il costo dei depositi, il tasso di inflazione del mercato degli alloggi, la percentuale del prodotto lordo degli stati derivato dalla estrazione di petrolio e gas naturali, il tasso delle commissioni sui prestiti, e i regolamenti bancari restrittivi, tutti questi elementi contribuiscono ai differenziali dei tassi di chiusura bancari fra gli stati.