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Consolidation in US Banking: Which Banks Engage in Mergers?

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ABSTRACT

The number of U.S. commercial banks has declined by some 40 percent since 1984, primarily through mergers of solvent institutions. The relaxation of legal impediments to branching has enabled this consolidation, but specific characteristics of banks that engage in mergers reflect the regulatory process and market structure, as well as the bank's own condition. This paper seeks to quantify the regulatory, market, and financial characteristics that affect the probability of a bank engaging in mergers and the volume of banks it absorbs over time. We examine separately consolidation within holding companies and mergers of independent banks.

JEL classification numbers: C1, G2, L1, L8.

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1. INTRODUCTION

From a postwar peak of 14,483 banks at the end of 1984, the number of U.S. commercial banks had fallen to just 8,563 by the end of 1999. Although 1,312 bank failures contributed to this decline, unassisted bank mergers accounted for the elimination of 7,268 banks.[1] Historically, legal barriers limited the extent that banks could operate branch offices, and the rapid consolidation of the U.S. banking industry has coincided with the relaxation of such barriers (Rhoades, 2000). Still, many banks continue to operate independently and have not absorbed other banks, and at the end of 1999, the United States still had 2,733 unit banks, *i.e.,* commercial banks with no branch offices.

Several studies have investigated bank mergers by examining the effects of mergers on efficiency, productivity, *etc.,* or identified reasons for specific mergers from case studies (*e.g.,* Calomiris and Karceski, 1998).[2] Little attention, however, has been paid to the effects of regulator supervision, market structure, or changes in regulation on the probability or number of mergers a bank engages in. The goal of this paper is to provide quantitative evidence on the impacts of branching laws, market structure, and supervisory evaluations of both bank safety and soundness and community reinvestment activity on the volume of mergers a bank will undertake in a given period. In doing so, we control for various financial characteristics of the bank, as well as for the number of potential merger targets available to the bank. Our study thus provides evidence on the extent that regulatory factors, such as satisfactory performance with regard to community reinvestment, truly constrain a bank's ability to absorb other banks. To our knowledge, no prior study has produced quantitative evidence on the extent to which supervisory evaluations affect merger activity.

Industry consolidation has often involved the acquisition of one holding company

[1]The issuance of new bank charters, and other charter additions and deletions account for the remaining change in the number of banks over these years (*FDIC Historical Statistics on Banking,* www.fdic.gov/hsob).

[2]Some mergers appear motivated by the desire of owners to increase value by expanding market power or improving efficiency; others seem more beneficial to bank managers than to bank shareholders. See Berger *et al.* (1999), Berger (1998), and Pilloff and Santomero (1998) for recent surveys and evidence on the motives and effects of bank mergers and acquisitions.

by another, with acquired banks operated as independent subsidiaries within the holding company. As barriers to branching have fallen, many holding companies have consolidated their operations by merging subsidiary banks. In addition, numerous mergers among banks that are not members of multi-bank holding companies have taken place. Still, many banks have not merged, either within or across holding companies.

With the increased tendency of industry consolidation to involve mergers of banks, not just acquisitions of bank holding companies, we focus here on identifying characteristics of absorbing banks. We recognize that mergers involving members of multi-bank holding companies (MBHCs) are determined by holding company management, and so we examine MBHC members separately from other banks. MBHC banks can merge with other banks in the same MBHC or absorb banks outside the MBHC, while independent banks necessarily can absorb only banks outside their organizations. The motives for consolidating banks within holding companies might differ from those affecting the merger of unaffiliated banks. In addition, regulators likely scrutinize outside mergers more closely than they do holding company consolidations. Hence, we distinguish between the absorption of banks within the same MBHC and absorptions of banks outside the MBHC. By distinguishing empirically between the two types of merger, we can identify whether the profile of banks that absorb banks outside their holding company differs from those involved merely in holding company consolidations.

In focusing on individual banks as opposed to holding companies, we are following the approach taken by O'Keefe (1996) and Wheelock and Wilson (2000). For a sample of 890 bank mergers during 1984–95, O'Keefe (1996) estimates a series of cross-sectional logit models to predict banks that are likely to merge with other banks. He found that size, liquidity, loan concentration and management quality most consistently predict such banks. Not surprisingly, O'Keefe found that the probability of engaging in mergers increases with bank size. O'Keefe also found that the probability increases with bank liquidity and management quality, as reflected in examiner ratings of bank management. The probability of engaging in mergers decreases with loan portfolio concentration. Wheelock and Wilson (2000) examine the probability that a bank will disappear either by being absorbed or by failing. That study finds, for example, that banks with low capital ratios are more likely to be absorbed, as are cost-efficient banks, all else equal. In focusing on banks that engage in mergers, rather than targets, our study provides a complement to Wheelock and Wilson (2000). In estimating explicitly the impacts of changing branching laws and supervisory ratings on merger volume, the study also complements and extends O'Keefe (1996).

Banks sometimes engage in more than one merger during a quarter (our sample includes a bank that absorbed 30 banks in one quarter). Hence, we model the intensity of merger activity, rather than simply the probability that a bank will engage in any mergers. Specifically, we model two aspects of merger intensity—the number banks and the amount of deposits absorbed in a quarter. Our models allow us to identify whether a particular variable affects the *number* of banks absorbed differently than the amount of deposits absorbed.

The next section defines our statistical models, for both MBHC and non-MBHC banks. Section 3 defines covariates and discusses data. Estimation results are presented in section 4, and conclusions are given in section 5.

2. THE STATISTICAL MODEL

We describe our model of the expected number of banks absorbed by merger first, followed by our model of the expected volume of deposits absorbed. The basic Poisson model is often used to model count data, such as the number of banks absorbed in a given period of time. We employ a two-part hurdle model, however, to avoid the mean-variance restriction of the basic Poisson model. We give details of our hurdle model below since it is non-standard.

Let $y_{it} \in \mathbb{I}_+$ denote the number of banks absorbed by bank i in period t, where $\mathbb{I}_+$ denotes the set of nonnegative integers ($\mathbb{I}_{++}$ will be used to denote the set of strictly positive integers). For banks that are members of an MBHC, we distinguish between mergers of banks within a single holding company (type-1 mergers) and of banks owned by different holding companies (type-2 mergers).[3] Let $y_{1it} \in \mathbb{I}_{+}$ equal the number of type-1 mergers undertaken by bank i during period t, and let $y_{2it} \in \mathbb{I}_{+}$ equal the number of type-2 mergers undertaken by bank i during period t. Then $y_{it} = y_{1it} + y_{2it}$.

Count-data model for non-MBHC banks:

For banks affiliated either with no holding company or with a single-bank holding company, $y_{1it} = 0$ and hence $y_{it} = y_{2it}$. For these banks, we represent the data-generating process by writing the probability of y_{it} mergers by the ith bank in period t as

$$\Pr(y_{it}) = \begin{cases} \Pr(y_{it} \mid y_{it} > 0) \times \Pr(y_{it} > 0) & \forall\, y_{it} \in \mathbb{I}_{++}; \\ 1 - \Pr(y_{it} > 0) & \text{for } y_{it} = 0. \end{cases} \tag{2.1}$$

We specify the probability of the conditioning event as a probit probability, *i.e.,*

$$\Pr(y_{it} > 0) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha}), \tag{2.2}$$

where $\Phi(\cdot)$ denotes the standard Gaussian distribution function, $\boldsymbol{X}_{it}$ is a vector of covariates and $\boldsymbol{\alpha}$ is a corresponding vector of parameters to be estimated. We specify the conditional probability as truncated Poisson:

$$\Pr(y_{it} \mid y_{it} > 0) = \begin{cases} \lambda^{y_{it}} \left[y_{it}! \left(e^{\lambda} - 1\right)\right]^{-1} & \forall\, y_{it} \in \mathbb{I}_{++}; \\ 0 & \text{otherwise,} \end{cases} \tag{2.3}$$

with $\lambda = \exp(\boldsymbol{X}_{it}\boldsymbol{\beta})$ to ensure $\lambda > 0$.

The parameter vectors $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ may be estimated by maximizing the likelihood function

$$\mathrm{LF} = \prod_{i,t|y_{it}=0} [1 - \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})] \prod_{i,t|y_{it}>0} \lambda^{y_{it}} \left[y_{it}! \left(e^{\lambda} - 1\right)\right]^{-1} \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha}). \tag{2.4}$$

[3] Thus, type-2 mergers can be of either banks that are not subsidiaries of any holding company, or of banks that are subsidiaries of different holding companies.

The corresponding log-likelihood is additively separable in $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$, and thus can be easily maximized by maximizing the two parts independently. Although we have defined only one covariate vector, $\boldsymbol{X}_{it}$, zero restrictions on selected elements of the parameter vectors $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ may be employed; we use a common covariate vector to simplify notation here and below. Note that the number of unique covariates may be less than the number of elements of $\boldsymbol{X}_{it}$ if the elements of $\boldsymbol{X}_{it}$ include interactions among the covariates or their squares.

Our specification resembles the Poisson hurdle model of Mullahy (1986), with the exception that we specify the probability of the conditioning event differently. Our model allows for over-dispersion as well as under-dispersion in the data, and hence avoids the problematic mean-variance restriction of the standard Poisson distribution.[4]

Derivation of Elasticities:

We derive elasticity measures for continuous variables and analogous measures for discrete variables to estimate the economic impacts of different variables on the number of banks absorbed during a period. Simple algebra reveals that for the model defined by (2.1)–(2.3),

$$E(y_{it} \mid \boldsymbol{X}_{it}) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha}) \left(e^{\lambda} - 1\right)^{-1} \lambda e^{\lambda}. \tag{2.5}$$

Let x_{it} denote a unique covariate (as opposed to a particular element of $\boldsymbol{X}_{it}$) for bank i at time t; we write $\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\partial x_{it}}$ and $\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\beta})}{\partial x_{it}}$ rather than merely α_j and β_j to reflect the possibility that x_{it} may appear in more than one element of $\boldsymbol{X}_{it}$ due to interaction and nonlinear

[4]Mullahy's (1986) Poisson hurdle model specifies $Pr(y_{it} > 0) = 1 - e^{e^{-\boldsymbol{X}_{it}\boldsymbol{\delta}}}$ (based on the Gompertz distribution) instead of the probit probability we use in (2.2). Although our hurdle model does not nest the standard Poisson model, Mullahy's (1986) Poisson hurdle model does when the two parts contain the same covariates. We estimated Mullahy's model as well the basic Poisson model for non-MBHC banks and for MBHC banks using the covariates that appear in both parts of our specification. Using likelihood-ratio tests, we are able to reject the basic Poisson specification in favor of the Poisson-hurdle specifications in both cases at any reasonable level of significance. The Gompertz model becomes unstable when we add additional covariates, and moreover is less familiar to readers; consequently, having overwhelmingly rejected the mean-variance restriction contained in the basic Poisson model, we use the probit specification in (2.2).

terms. Then the elasticity of expected mergers, $E(y_{it} \mid \boldsymbol{X}_{it})$, with respect to a unique continuous covariate x_{it} in $\boldsymbol{X}_{it}$ is

$$\eta_{it} = x_{it} \left[\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})} + \frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\beta})}{\partial x_{it}} \left(1 - \frac{\lambda}{e^{\lambda} - 1} \right) \right], \tag{2.6}$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ denote the standard Gaussian density and distribution functions, respectively.

In the case of a discrete-valued covariate, the elasticity in (2.6) is not defined. For a binary variable $d_{it} \in \{0, 1\}$, we compute

$$\Delta_{it} = \left[E(y_{it} \mid \boldsymbol{X}_{it}, d_{it} = 1) - E(y_{it} \mid \boldsymbol{X}_{it}, d_{it} = 0) \right] / E(y_{it} \mid \boldsymbol{X}_{it}, d_{it} = 0), \tag{2.7}$$

where the conditioning on the right-hand side means that all unique covariates except d_{it} are set to their observed values for bank i at time t, while d_{it} equals either 0 or 1 as noted. For $\Delta_{it} > 0$ and other things constant, a change in d_{it} from 0 to 1 causes a $\Delta_{it} \times 100$-percent increase in the expected number of mergers; if $\Delta_{it} < 0$, changing d_{it} from 0 to 1 decreases the expected number of mergers by $\Delta_{it} \times 100$-percent. In the case of lagged count variables, we similarly define δ_{it} as the proportionate increase in expected number of mergers resulting from an increment of 1 in the lagged count.

We replace ordered categorical variables taking values 1, 2, ..., K (for K categories) with $K-1$ binary dummy variables $d_{it2},\ d_{it3},\ \ldots,\ d_{itK}$, all equal to zero if the categorical variable equals 1. If the categorical variable equals 2, $d_{it2} = 1$ and the remaining $K - 2$ dummy variables equal 0; if the categorical variable equals 3, then $d_{it3} = 1$ and the other $K - 2$ dummy variables equal 0; *etc.* We use the $K - 1$ dummy variables rather than the original ordered, categorical variable to allow for nonlinear effects with respect to the K categories. We define differences based on changes from category l to category $l + 1$. If all of the $K - 1$ binary dummies equal zero for a particular observation, we compute

$$\Delta_{it2} = \left[E(y_{it} \mid \boldsymbol{X}_{it}, d_{it2} = 1) - E(y_{it} \mid \boldsymbol{X}_{it}, d_{it2} = 0) \right] / E(y_{it} \mid \boldsymbol{X}_{it}, d_{it2} = 0) \tag{2.8}$$

to measure the effect of moving from category 1 to category 2. Similarly, if the last, $(K-1)$th binary dummy equals 1, we compute

$$\Delta_{itK} = \frac{E(y_{it} \mid \boldsymbol{X}_{it}, d_{itK}=1, d_{it(K-1)}=0) - E(y_{it} \mid \boldsymbol{X}_{it}, d_{itK}=0, d_{it(K-1)}=1)}{E(y_{it} \mid \boldsymbol{X}_{it}, d_{it(K-2)}=1, d_{itK}=0)} \tag{2.9}$$

to measure the effect of moving from category $(K-1)$ to category K. Finally, if one of the intermediate binary dummies $d_{it\ell}$, $\ell \in \{3, \ldots, K-1\}$, is equal to 1, we compute

$$\Delta_{it\ell} = \frac{E(y_{it} \mid \boldsymbol{X}_{it}, d_{it(\ell-1)}=0, d_{it\ell}=1) - E(y_{it} \mid \boldsymbol{X}_{it}, d_{it(\ell-1)}=1, d_{it\ell}=0)}{E(y_{it} \mid \boldsymbol{X}_{it}, d_{it(\ell-1)}=1, d_{it\ell}=0)} \tag{2.10}$$

to measure the effect of moving from the category where $d_{it(\ell-1)}=1$ to the category where $d_{it\ell}=1$, as well as

$$\Delta_{it(\ell+1)} = \frac{E(y_{it} \mid \boldsymbol{X}_{it}, d_{it\ell}=0, d_{it(\ell+1)}=1) - E(y_{it} \mid \boldsymbol{X}_{it}, d_{it\ell}=1, d_{it(\ell+1)}=0)}{E(y_{it} \mid \boldsymbol{X}_{it}, d_{it\ell}=1, d_{it(\ell+1)}=0)} \tag{2.11}$$

to measure the effect of moving from the category where $d_{it\ell}=0$ to the category where $d_{it(\ell+1)}=1$, and report the average of $\Delta_{it\ell}$ and $\Delta_{it(\ell+1)}$.

The elasticity in (2.6), as well as the differences in (2.7)–(2.11), show that the effect of a particular covariate on the expected number of mergers depends on the signs of elements of both $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$. Conceivably, a given covariate might have opposing effects in the two parts of the model. For example, an increase in a certain covariate might reduce the probability of a bank engaging in mergers, but given that a bank *does* engage in mergers, an increase in this same covariate might increase the expected number of mergers. The variable's effect on unconditional expected mergers given by (2.5), however, will depend on the net of these two effects. Hurdle models such as the one represented here allow for possibly different processes determining (i) whether there are any mergers, and (ii) the number of mergers when at least one occurs.

Count-data model for MBHC banks:

A bank belonging to an MBHC may absorb banks from within its own holding company or from outside the holding company. The factors affecting the number of each type of merger are potentially different. For MBHC banks, we augment the data-generating process for non-MBHC banks in (2.1) by specifying the joint probability of mergers of either type:

$$\Pr(y_{1it}, y_{2it}) = \begin{cases} \Pr(y_{1it}, y_{2it} \mid y_{it}) \times \Pr(y_{it} \mid y_{it} > 0) \times \Pr(y_{it} > 0) \\ 1 - \Pr(y_{it} > 0). \end{cases} \tag{2.12}$$

We specify $\Pr(y_{1it}, y_{2it} \mid y_{it})$ as binomial with Gaussian probabilities:

$$\Pr(y_{1it}, y_{2it} \mid y_{it}) = \frac{y_{it}!}{y_{1it}! y_{2it}!} \Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})^{y_{1it}} \left[1 - \Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})\right]^{y_{2it}} \;\forall\, y_{it} \in \mathbb{I}_{++}. \tag{2.13}$$

We specify the probability of the conditioning event in (2.13) as before; *i.e.,* we specify $\Pr(y_{it} \mid y_{it} > 0)$ as truncated Poisson as in (2.3), and $\Pr(y_{it} > 0)$ as a probit probability as in (2.2).

The parameter vectors $\boldsymbol{\alpha}$, $\boldsymbol{\beta}$, and $\boldsymbol{\gamma}$ can be estimated by maximizing the likelihood function

$$\begin{aligned} \mathrm{LF} = &\prod_{i,t} \frac{y_{it}!}{y_{1it}! y_{2it}!} \Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})^{y_{1it}} \left[1 - \phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})\right]^{y_{2it}} \\ &\times \prod_{i,t \mid y_{it}=0} \left[1 - \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})\right] \prod_{i,t \mid y_{it}>0} \lambda^{y_{it}} \left[y_{it}! \left(e^{\lambda} - 1\right)\right]^{-1} \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha}) \end{aligned} \tag{2.14}$$

with respect to $\boldsymbol{\alpha}$, $\boldsymbol{\beta}$, and $\boldsymbol{\gamma}$. As with (2.4), the log-likelihood corresponding to (2.14) is additively separable, simplifying the estimation.

Straightforward algebra reveals that the expected number of type-1 (inside) mergers for bank i in period t is

$$E\left(y_{1it} \mid \boldsymbol{X}_{it}\right) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})\Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})\lambda e^{\lambda}\left(e^{\lambda} - 1\right)^{-1}, \tag{2.15}$$

while the expected number of type-2 (outside) mergers is

$$E\left(y_{2it} \mid \boldsymbol{X}_{it}\right) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})\left[1 - \Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})\right]\lambda e^{\lambda}\left(e^{\lambda} - 1\right)^{-1}. \tag{2.16}$$

The corresponding elasticities, with respect to a particular covariate x_{it}, are

$$\eta_{1it} \equiv \frac{\partial E\left(y_{1it} \mid \boldsymbol{X}_{it}\right)}{\partial x_{it}} \frac{x_{it}}{E\left(y_{1it} \mid \boldsymbol{X}_{it}\right)} = \eta_{it} + x_{it}\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})} \tag{2.17}$$

and

$$\eta_{2it} \equiv \frac{\partial E\left(y_{2it} \mid \boldsymbol{X}_{it}\right)}{\partial x_{it}} \frac{x_{it}}{E\left(y_{2it} \mid \boldsymbol{X}_{it}\right)} = \eta_{it} - x_{it} \frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{[1-\Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})]}. \tag{2.18}$$

Signs of the elasticities in (2.17)–(2.18) depend on signs of elements of $\boldsymbol{\alpha}$, $\boldsymbol{\beta}$ (through η_{it}, defined in (2.6)), and $\boldsymbol{\gamma}$. Covariates in the probit and truncated Poisson parts of the model affect total mergers of either type, and thus capture effects analogous to income effects in ordinary demand models. The binomial component of the model captures any complementarity or substitution with respect to the two types of mergers that banks might engage in. Since there are only two types, for a given number of mergers, an increase (decrease) in the probability of a type-1 merger necessarily means that the probability of a type-2 merger decreases (increases), where both probabilities are conditioned on a merger being made. Therefore, any changes in covariate x_{it} for which estimates of $\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})}$ or $\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})}{[1-\Phi(\boldsymbol{X}_{it}\boldsymbol{\gamma})]}$ in (2.17) or (2.18) are significantly different from zero is interpreted as leading to substitution between the two merger types. On the other hand, if estimates of these terms are statistically insignificant, changes in the covariate x_{it} do not significantly affect the relative odds of either type of merger, suggesting that changes in x_{it} have complementary effects on the two types of mergers. If estimates η_{it} in (2.17)–(2.18) are also insignificant, the covariate x_{it} has no significant effect on either elasticity—*i.e.,* it does not change the relative odds of either type of merger, nor does it significantly affect the expected number of total mergers of either type.

As before, the elasticities in (2.17)–(2.18) are not defined if x_{it} is discrete. For discrete variables, either binary or ordered-categorical, we compute differences analogous to (2.7)–(2.11) to examine changes in expected number of mergers with respect to changes in the discrete variables.

Continuous model for non-MBHC banks:

In addition to modeling the number of mergers in a given quarter, we also model deposits absorbed by merger. Let $D_{it} \in \mathbb{R}_+$ denote the amount of deposits absorbed by bank i in period t. For banks that are not members of MBHCs, the probability of a bank absorbing nonzero deposits in a given period, $\Pr(D_{it} > 0)$, equals the probability of the bank engaging in one or more mergers, and is given by the probit model in (2.2). For i, t such that $D_{it} > 0$, we specify the fixed-effects model

$$D_{it} = \exp(\theta_{0i} + \boldsymbol{X}_{it}\boldsymbol{\theta} + \varepsilon_{it}), \tag{2.19}$$

where $\varepsilon_{it} \sim N(0, \sigma^2)$. Then

$$E(D_{it}) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha}) \exp\left(\theta_{0i} + \boldsymbol{X}_{it}\boldsymbol{\theta} + 0.5\sigma^2\right), \tag{2.20}$$

where $\Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})$ is the probability of the conditioning event $D_{it} > 0$ in (2.19); the $\Phi(\boldsymbol{X}_{it})$ used here is the same as in (2.2). The elasticity of deposits for observation i, t with respect to continuous covariate x_{it} is then

$$\eta_{Dit} = x_{it}\left[\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\partial x_{it}} \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})} + \frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\theta})}{\partial x_{it}}\right]. \tag{2.21}$$

For discrete covariates, we can compute differences analogous to those used in the count models by replacing y_{it} with D_{it} in (2.7)–(2.11).[5]

Continuous model for MBHC banks:

As before, for members of MBHCs, we distinguish between deposits absorbed from within the bank's own holding company (type-1) and deposits absorbed from outside the holding company (type-2). Let $D_{1it} \in \mathbb{R}_+$ equal type-1 deposits absorbed, and let $D_{2it} \in \mathbb{R}_+$ equal type-2 deposits absorbed by bank i in period t. Then $D_{1it} + D_{2it} = D_{it}$ (for banks that are not members of MBHCs, $D_{1it} = 0$ and $D_{2it} = D_{it}$). For MBHC banks, we have $D_{1it} = R_i D_{it}$ and $D_{2it} = (1 - R_i)D_{it}$, so that $R_i = D_{1it}/D_{it}$ for $D_{it} > 0$. In

[5]Our two-part model for deposits is a variation of Cragg's (1971) generalization of the standard tobit model. Here, we regress *log* deposits on explanatory variables due to the substantial skewness in deposits, thus avoiding the tobit model's normality assumption, which would clearly be inappropriate for our data. Moreover, the standard tobit model restricts the process that determines whether observations are censored to be the same as the process governing responses in the uncensored observations; our two-part model avoids this restriction and thus is more flexible.

principal, $R_i \in [0,1]$. In our sample, however, we observe only 15 out of a total of 1,538 bank-quarters in which an MBHC bank engages in both type-1 and type-2 mergers. Hence, for modeling purposes, we delete the 15 observations where $R_i \in (0,1)$ and treat R_i as binary by defining

$$\Pr(R_i = 1) = \Phi(\boldsymbol{X}_i \boldsymbol{\tau}). \tag{2.22}$$

Then the parameter vector $\boldsymbol{\tau}$ (which will contain some zero restrictions) can be estimated by a probit procedure.

Since $D_1 = RD$, we have $E(D_1 \mid D) = \Pr(R=1)D$, and therefore

$$\begin{aligned} E(D_1) &= E_D\left[E(D_1 \mid D)\right] \\ &= \Pr(R=1)\int_0^\infty D_i f(D \mid D > 0) \times \Pr(D > 0)\, dD \\ &= \Pr(R=1)E(D). \end{aligned} \tag{2.23}$$

To obtain the elasticity of type-1 deposits with respect to a particular covariate, note

$$\begin{aligned} \eta_{D_1 it} \equiv& \frac{\partial E(D_{1it})}{\partial x_{it}} \times \frac{x_{it}}{E(D_{1it})} \\ =& \left[\frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\tau})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\tau})}\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\tau})}{\partial x_{it}} + \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\alpha})}\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\alpha})}{\partial x_{it}} + \frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\theta})}{\partial x_{it}}\right] x_{it} \\ =& \eta_{Dit} + \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\tau})}{\Phi(\boldsymbol{X}_{it}\boldsymbol{\tau})}\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\tau})}{\partial x_{it}} x_{it}, \end{aligned} \tag{2.24}$$

where η_{Dit} is given in (2.21). Similar reasoning leads to $E(D_2) = \left[1 - \Pr(R=1)\right]E(D))$ and

$$\eta_{D_2 it} \equiv \frac{\partial E(D_{2it})}{\partial x_{it}} \times \frac{x_{it}}{E(D_{2it})} = \eta_{Dit} - \frac{\phi(\boldsymbol{X}_{it}\boldsymbol{\tau})}{[1 - \Phi(\boldsymbol{X}_{it}\boldsymbol{\tau})]}\frac{\partial(\boldsymbol{X}_{it}\boldsymbol{\tau})}{\partial x_{it}} x_{it}. \tag{2.25}$$

From the expressions in (2.24)–(2.25), it is clear that $\Pr(R_i = 1) = \Phi(\boldsymbol{X}_{it}\boldsymbol{\tau})$ captures substitution effects between the two types of deposits that can be absorbed. A positive element in $\boldsymbol{\tau}$ indicates that an increase in the corresponding element of $\boldsymbol{X}_{it}$ causes banks to substitute away from type-2 deposits toward type-1 deposits. The same variable, however, may have an effect (through $\boldsymbol{X\alpha}$ and $\boldsymbol{X\theta}$) on the overall quantity of deposits absorbed; if the overall quantity of deposits absorbed increases, this will tend to increase both type-1 and type-2 deposits absorbed, although perhaps in different proportions if the relevant element in $\boldsymbol{\tau}$ is non-zero. Hence the model is capable of distinguishing overall (*i.e.,* "income") effects as well as substitution effects in the absorption of deposits by MBHC banks. The elasticities $\eta_{D_1 it}$, $\eta_{D_2 it}$ can be estimated by replacing parameters in (2.24)–(2.25) with corresponding estimates.

3. DATA AND SPECIFICATION OF COVARIATES

Commercial bank mergers reflect decisions of bank owners and regulators given financial, legal and other environmental constraints. Here, we specify variables aimed at identifying the characteristics that influence the probability that a bank will engage in mergers and if so, how many banks (or deposits) it will absorb during a given period. We include variables that reflect the financial characteristics of banks, as well as the market and regulatory environments in which they operate. The statistical models described in the previous section represent reduced forms intended to reflect the interaction of financial, environmental, and regulatory factors on the probability of engaging in mergers and the number of banks (or amount of deposits) absorbed via merger.

Regulatory Process:

Table 1 lists and defines the variables we use in our empirical analysis. All bank mergers must be approved by one or more regulatory agencies. When the result of a merger will be a national bank, the Comptroller of the Currency (OCC) must approve the merger; when the result will be a state chartered, Federal Reserve member bank, the Fed must approve the merger; and when the result will be a state, non-member bank, the FDIC and state authorities must both approve the merger (the Federal Reserve must approve all bank holding company acquisitions). A bank applying to absorb another bank is evaluated on its own management and financial condition, as well as the capital and likely earnings prospects of the merged institution. Regulators also consider each institution's Community Reinvestment Act (CRA) performance, and may deny applications from banks that have unsatisfactory records of performance. Finally, regulators and the Department of Justice evaluate mergers on the basis of their likely effects on market competition and may deny mergers that substantially reduce competition.[6]

To capture the influence of regulator evaluations of bank safety and soundness and CRA compliance on mergers, we include both CAMEL composite examination ratings and CRA ratings. CAMEL ratings are assigned on a scale from 1 (strongest) to 5 (weakest), whereas CRA ratings are assigned on a scale from 1 (outstanding) to 4 (substantial non-compliance). We allow for the possibility that the association between the probability of engaging in mergers and examination ratings is nonlinear by including separate dummy variables for each rating value (CAMEL2–CAMEL5 and CRA2–CRA4, treating CAMEL1 and CRA1 as reference categories). Banks with a CAMEL rating of 3, 4, or 5 are considered by regulators to have moderate to serious deficiencies and, hence, are unlikely to be permitted to absorb other banks (O'Keefe 1996). Similarly, banks with a CRA rating of 3 or 4 are considered not to have satisfactory performance, which would make any application for merger less likely to be approved. We expect that the probability of engaging in mergers generally declines with higher (worse) examiner ratings, especially for banks rated CAMEL 3, 4 or 5 in comparison with CAMEL 1 or 2, or rated CRA 3 or 4 in comparison with CRA 1 or 2.

Examinations of national banks are conducted by the OCC; examinations of state chartered members of the Federal Reserve System (FRS) are conducted by the FRS; examinations of other state chartered banks are conducted by the Federal Deposit Insurance Corporation (FDIC). State banking authorities also conduct examinations of state chartered banks. We include agency dummy variables (OCC, FRS, and STATE) to control for possible systematic differences in examination procedures by agency, or other differences in the regulation or characteristics of banks with different charter types.[7]

[6]For additional detail, see "FDIC Statement of Policy on Bank Merger Transactions," FDIC Statements of Policy (www.fdic.gov/regulations/laws/rules/5000-1200.html).

[7]FDIC examinations are the reference group. See Wheelock and Wilson (1999) for additional

Market Characteristics:

We also include a set of variables to capture various market characteristics that might affect the probability of engaging in mergers. The ability to absorb other banks and operate them as branches is affected by branch banking laws. With few exceptions, branching was not permitted across state lines before 1997. Hence, over most of the period covered by our study, state branching laws determined the extent to which banks could operate branches. State branching laws were generally liberalized during the 1980s and 1990s. We include dummy variables (UNIT and LTD) reflecting the extent to which states restricted branching. States that permitted no branching, or only very limited branching are considered to be "unit" banking states; states that permitted more liberal branching, such as within contiguous counties, are considered to be "limited" branching states. Several states permitted state-wide branching via merger with an existing bank, but otherwise restricted branching. Since our objective is to capture the constraints on mergers, we treat such states as permitting state-wide branching.[8] In addition to controlling for state branching laws, we test whether changes in branching restrictions affect the probability of merger in the short run by including a dummy variable, BRCHNG, that equals 1 in the four quarters following a change in state branching law.

In addition to obvious size differences, urban banks may face different circumstances than their non-urban counterparts. In particular, as financial intermediaries, banks in urban areas may play an important role in urban agglomeration economies. These same agglomeration economies may affect the extent to which banks absorb other banks, although the direction of the effect is an empirical question. Hence, we include the dummy variable URBAN to reflect urban versus non-urban location.

We expect also that the probability of a bank engaging in mergers is affected by its market opportunities. Branching restrictions define the geographic region over which

information about supervisory examinations of commercial banks.

[8]State-wide branching is the reference group. Branching dummies are determined separately for each bank and quarter in the sample.

a bank can branch, but market concentration and the number of potential targets in the market might also affect a bank's ability to absorb other banks or bank offices. Bank regulators are more likely to reject proposed mergers that would result in high market concentration. Hence, we expect that the more concentrated the market in which a bank is located, as measured by the Herfindahl-Hirschman Index (HHI), the less likely it will absorb other banks. Of course, if one were studying specific mergers, it would be important to control for the concentration of the target bank's market. In profiling absorbing banks, we include the HHI of the potential absorber's home market as a control, on the expectation that home market concentration would affect the cost or ability of a bank to absorb banks either inside or outside its home market.

We define STARG1, LTARG1, STARG2, and LTARG2 to reflect the number of targets (either type-1 or type-2) that a bank could absorb in its state or local market. Similarly, we define STARG1_D, LTARG1_D, STARG2_D, and LTARG2_D to reflect the amount of deposits held by potential targets that could be absorbed in either the state or local market.[9] In our empirical analysis, we include the number of potential targets state-wide (STARG1, STARG2, STARG1_D, and STARG2_D) for banks located in states that permit state-wide branching, but only the number of potential targets in the local market (LTARG1, LTARG2, LTARG1_D, and LTARG2_D) for banks located in states that limit branching. We expect that the number of mergers (and amount of deposits a bank absorbs) will increase with an increase in potential targets, all else equal.

Lagged Dependent Variables

Banks may face significant transactions costs when they engage in mergers, particularly when they do not involve a merger of banks within the same MBHC. Experience with previous mergers may reduce some of these costs, making subsequent mergers more

[9] Note that STARG1, LTARG1, STARG1_D, and LTARG1_D are necessarily zero for banks that are not members of an MBHC. For banks located in a metropolitan statistical area (MSA), local market is defined to include all counties within the MSA. For banks located outside an MSA, local market is defined as the county in which the bank resides.

likely. On the other hand, to the extent that a merger is time-consuming or costly, recent mergers might reduce the willingness of an absorbing bank to engage in additional mergers in the near future.

These effects suggest time-dependence in the processes determining the number of banks and amount of deposits absorbed. To deal with this potential econometric problem, and to examine the net of these various effects, we include lagged counts (YT1_4, YT2_4, YT1_P4, and YT2_P4) and lagged values of deposits absorbed (DT1_4, DT2_4, DT1_P4, and DT2_P4) in our models.[10]

Financial Characteristics:

In their examination of the characteristics of targets of bank mergers during the 1980s and early 1990s, Wheelock and Wilson (2000) include several financial ratios designed to mirror various aspects of bank condition that bank regulators evaluate in their examinations of bank safety and soundness: capital adequacy, asset quality, management, earnings, and liquidity (CAMEL).[11] We include the same financial ratios (namely, C, A1–A6, EXP, E, and L) here. In addition, we include dummy variables (MGMT2–MGMT5) reflecting the management component rating of the most recent bank examination; these variables provide a direct measure of management quality, and may provide a more complete assessment of management quality than does a simple expense ratio (EXP).

We also include several other characteristics, namely CORE, SIZE, AGROW, LOGAGE, and BHCBIG (see Table 1). We expect that larger banks, as well as banks that have grown rapidly, are more likely to engage in mergers. The lead banks in MBHCs (BHCBIG) also may be more likely to absorb other banks, particularly banks within the same holding company. Young, recently-established banks may or may not be more likely to engage in mergers.

[10]In the case of our count models, this approach also avoids imposing restrictions seen in many dynamic count-data models that have been proposed in the literature; see Cameron and Trivedi (1998, chapter 7) for discussion.

[11]Since 1997, supervisors have also evaluated banks on their sensitivity to market risk.

Summary Statistics

Our sample is based on the population of unassisted bank mergers occurring between 1987:Q2 and 1999:Q1, inclusive. Some observations were lost because of missing data on one or more independent variables in the models, as discussed below. Over this period, we observe 924 mergers by 829 non-MBHC banks, and 2,363 mergers by 1,539 MBHC banks. MBHC banks absorbed 629 banks within the same holding company (*i.e.*, type-1 mergers), and 1734 unrelated banks (type-2 mergers). Summary statistics for our dependent variables are presented in Tables 2–3 for observations with nonzero counts. Among these observations, the number of banks absorbed per quarter (y) ranges from 1 to 5 for non-MBHC banks, and from 1 to 30 for MBHC banks. Table 2 also reports the mean, median and range of the amount of deposits absorbed in a quarter by banks that engaged in any mergers. The maximum amount absorbed in any one quarter was $24.7 billion (in 1992 prices).[12] Table 3 gives frequencies for the count variables; note that for MBHC banks, type-1 or type-2 mergers (y_1 or y_2), but not both, may be zero in a given quarter when total mergers (y) are greater than zero.

Table 4 presents summary statistics for the independent variables defined in Table 1. Separate statistics are presented for non-MBHC banks and for banks that are members of an MBHC. For each type of bank, we present separate statistics for banks that engage in mergers and those that do not, where a bank is defined as engaging in mergers in a given quarter if it completes one or more mergers in that quarter.

Because of the regulatory hurdles involved in the approval process, a bank merger can take some time to complete, even apart from the time it takes for a bank to evaluate potential merger options.[13] Based on discussions with Federal Reserve officials involved

[12]Table 2 indicates that the median number of type-1 mergers and median type-1 deposits absorbed by MBHC banks are zero. Recall that MBHC banks may make either type-1 or type-2 mergers; among all bank-quarters where MBHC banks engaged in one or more mergers, more than half involve zero type-1 mergers, resulting in the zero medians shown in Table 2.

[13]Typically, once the regulator receives an application for merger, the approval process is not lengthy, though the size of the banks involved, and other factors can affect the time bank regulators and the Justice Department require to evaluate an application. The evaluation of a potential merger and the

in the approval process, when estimating our models we assume that mergers completed during one quarter reflect financial and market conditions four quarters previously.[14] For example, in estimating the probability of completing a merger in 1999:Q1, we use observations on the independent variables for 1997:Q4. We obtained financial statement information from quarterly Reports of Income and Condition (*i.e.,* call reports), and supervisory examination ratings for safety and soundness and for compliance with the Community Reinvestment Act from an internal Federal Reserve System database (NIC). Bank examinations occur at irregular intervals, but most banks were examined at 12-18 month intervals during our sample period. We assume that ratings from an examination remain in effect until the closing date of a subsequent exam. Missing call report or examination data caused the deletion of some banks and mergers, but our remaining sample includes 3287 mergers and 369,983 bank-quarters; *i.e.,* we observe an average of 7708 banks per quarter over the 48 quarters between March 31, 1986 and December 31, 1997.[15]

Table 4 reveals noticeable differences in the characteristics of banks that engage in mergers and those that do not. Banks that engage in mergers are more likely to be national banks (OCC). In addition, they are more likely to have CAMEL ratings of 1 or 2, and a CRA rating of 1. Absorbing also are more likely to be located in states that permit state-wide branching (as indicated by smaller mean values for LTD and UNIT), to be headquartered in urban markets, and to be located in less concentrated markets (HHI). Banks that engage in mergers are also much more likely to have engaged in mergers during

preparation of an application can, however, be time consuming for the bidder in a bank merger.

[14]Preliminary analysis indicated that using a lag a short as six months or as long as two years had little or no impact on the results.

[15]Missing examination ratings, especially before 1991, are responsible for many missing observations. The Federal Reserve System historical database on examinations is known to be incomplete because exam records were not reported uniformly by the different banking agencies before 1991. In particular, national banks are under-represented in the early years of our sample. We re-estimated our models using weighted maximum likelihood in the probits, with weights determined by proportions of national banks, state banks that are members of the Federal Reserve System, and state banks that are not members of the Federal Reserve System. Coefficient estimates and elasticity estimates for these models, available from the authors, are for the most part not qualitatively different from those derived from the unweighted estimation.

the previous eight quarters.

In comparing financial characteristics of banks that engage in mergers and those that do not, we find that absorbers tend to be larger banks (SIZE) with a recent history of rapid growth (AGROW). Absorbers also tend to have lower average capital ratios (C) than non-absorbers, and have higher ratios of total loans to assets (A1). For non-MBHC banks, we find that banks that engage in mergers are more likely to have CAMEL management component ratings of 1 or 2 than other banks, suggesting that management quality (as reflected in supervisor ratings) has a positive impact on the probability of engaging in mergers. On the other hand, higher expense ratios (EXP) seem to reduce the probability of engaging in mergers, so the relationship between management quality and merger activity is somewhat unclear.[16]

4. ESTIMATION RESULTS

Although comparison of sample means reveals a number of differences in the characteristics of banks that engage in mergers and those that do not, the means do not reveal the contribution of particular variables to the probability that a bank will engage in mergers or to the number of mergers a bank will undertake. Hence, we turn to results obtained from estimation of our models.

Tables 5-8 present parameter estimates for each component of our models. By examining the parameter estimates for each component separately, one can identify the determinants of, say, the *probability* that a bank will engage in any mergers separately from those affecting the *number* of mergers a bank will engage in, given that it undertakes at least one merger. In addition to parameter estimates, each table reports p-values for hypothesis tests of the statistical significance of individual coefficients, as well as of tests of the equality of coefficients across the separate model components. Whereas each independent variable

[16] In this discussion we highlight differences between banks that engage in mergers and banks that do not that appear especially noteworthy. The differences in mean values for most of the variables are statistically significant, owing to the large number of observations in our sample. Many of these differences, however, are economically small.

appears in the probit part of the models, some variables are not included in the truncated Poisson (or truncated regression) or binomial parts. We do not include CAMEL or CRA ratings in the latter components of the model under the assumption that while satisfactory exam ratings will affect the regulator's decision to permit a bank to engage in mergers, they will not affect the number of mergers (or deposits absorbed), given that the bank is permitted to undertake at least one merger.[17] Likelihood ratio tests of the joint significance of coefficients in the individual parts of each model presented in Tables 5–8 reject the null hypothesis that all coefficients are zero at any reasonable level of significance.

Regulatory Variables:

Our estimates indicate that CAMEL ratings have a significant and nonlinear effect on the probability that a bank will engage in mergers. For non-MBHC banks, we find that relative to a 1 rating, a 2-rating will significantly increase the probability of engaging in mergers. For both non-MBHC and MBHC banks, a 3- or 4-rating will significantly reduce the probability of the bank engaging in mergers. Clearly, regulators are much less likely to permit banks with such low ratings to undertake mergers.

For non-MBHC banks, we also find that the probability of engaging in mergers is significantly reduced by a reduction in a bank's CRA rating. For MBHC banks, however, CRA ratings appear not to affect the probability of engaging in mergers at the margin. This does not necessarily indicate that regulators fail to consider CRA ratings in evaluating proposed mergers, however, as very few mergers involve 3- or 4-rated banks. Moreover, for MBHC banks, we find that a CRA-rating of 3 significantly reduces the expected amount of deposits a bank will absorb as a result of mergers (see Table 8, truncated regression component).

[17] We attempted to test this assumption by including the ratings variables in all components of the models, but were unable to obtain estimates for the more general specification because of a failure of the models to converge during estimation. Other variables that appear only in the probit part of the model were omitted from the other components for the same reason. Lack of convergence was especially acute for non-MBHC banks, where few banks engaged in multiple mergers in any one quarter.

Market Variables:

For non-MBHC banks, we find that being located in a unit banking state has a significantly negative impact on the probability of being engaged in mergers. We find no impact of branching restrictions on the probability of mergers for non-MBHC banks, however. We also detect no significant marginal impact of recent branching deregulation (BRCHNG) on the probability of engaging in mergers for either non-MBHC or MBHC banks. Although consolidation coincided with deregulation, it appears that removal of branching restrictions did not have a strong independent impact on mergers within the first four quarters following deregulation.

Branching laws and deregulation may affect mergers through their interaction with the number of potential target banks available under a given regime, and our models include such interactions. Specifically, for a bank located in a state that permits state-wide branching, we identify the potential target banks as all other banks located in that state. For MBHC banks, we identify separately the numbers of banks affiliated with the same holding company (type-1 banks) and all other banks (type-2 banks). Similarly, for a bank located in a state that limits branching, we identify the number of each type of bank located within the given bank's market area.

For non-MBHC banks located in states that permit state-wide branching, the probability of engaging in mergers is related positively to the number of potential targets (STARG2). Moreover, we find that for such banks, the expected volume of deposits absorbed is greater, the more deposits are available (see Table 7, truncated regression component). We find a similar effect for non-MBHC banks located in states that limited branching.

For MBHC banks located in states that permit state-wide branching, we find a positive impact on the *probability* of engaging in mergers from an increase in the number of potential type-2 targets. However, we find the opposite effect for MBHC banks located in states that limit branching. Given that an MBHC bank located in a limited branching state engages in at least one merger, we find that the expected *number* of mergers rises with an increase in the available number of either type-1 or type-2 target banks. For both MBHC and non-MBHC banks, we find a similar impact of the potential volume of deposits a bank might absorb on the expected volume it will absorb via merger.

We find that other market characteristics also significantly affect the probability of engaging in mergers, as well as the volume of mergers. Being located in an urban market significantly increases both the probability of engaging in mergers and the volume of deposits that MBHC banks absorb via merger. For non-MBHC banks, an urban location does not increase the probability of merger at the margin, but for non-MBHC banks that undertake any mergers, an urban location appears to increase the expected number of mergers (see Table 5, truncated Poisson component).

Market concentration, as reflected in the HHI of a bank's home market, appears to have a negative influence on the probability of engaging in mergers for both MBHC and non-MBHC banks. For MBHC banks that undertake mergers, the negative sign on HHI in the binomial parts of the count and continuous models (Tables 6 and 8) indicates that these banks are more likely to engage in type-1 mergers than type-2 mergers as market concentration increases.

Taken as a whole, our findings with respect to the impact of various market characteristics on the probability of engaging in mergers, as well as on the volume of mergers a bank will engage in, generally conform with expectations. The major exception is our finding that at the margin, relaxation of state branching restrictions appears not to significantly affect the probability of engaging in mergers. Although the removal of branching restrictions made many mergers possible, especially among banks affiliated with the same holding company, other bank and market characteristics apparently are more important for distinguishing those banks that engage in mergers from those that do not. For example, market concentration appears to have a negative impact on mergers, while the number of available targets (or volume of target deposits) generally has a positive impact.

Other Bank Characteristics:

In addition to market characteristics and examiner evaluations, several other characteristics help establish a profile of banks that engage in mergers. For example, for both non-MBHC and MBHC banks, we estimate a statistically significant effect of management quality, as measured by examiner ratings, on the probability of engaging in mergers. Relative to banks with a top CAMEL management rating, banks rated 2 or 3 are significantly less likely to engage in mergers. This result suggests that regulators are especially concerned about the quality of a bank's management in deciding whether to approve mergers or, alternatively, that banks with high quality management are simply more aggressive in engaging in mergers.

Not surprisingly, we find that the probability of engaging in mergers increases with bank size and, for MBHC banks, whether a bank is the lead bank in its holding company. In recent years, many mergers have involved the conversion of independently operated banks within holding companies into branches of lead holding company banks.

We also find that the probability of mergers in one quarter is positively associated with mergers made during recent quarters. The coefficient estimates for the number of mergers carried out during the previous four or eight quarters are all positive and highly statistically significant in the probit part of the models. We find less consistent impacts of past mergers in the truncated Poisson and truncated regression parts of the models. This indicates that while banks that engaged in mergers in the recent past are significantly more likely to engage in mergers in a given quarter, a history of recent mergers has no clear impact on the *number* of mergers or volume of deposits absorbed in a quarter in which the bank engages in mergers.

Finally, the coefficients on several balance sheet variables are statistically significant, especially in the probit part of the models. For non-MBHC banks, the coefficients on various measures of asset quality are significant. For example, we find that the probability of engaging in mergers increases with higher ratios of commercial loans to total loans

(A3), and with two indicators of problem loans: the ratio of other real estate owned to total assets (A4) and the ratio of uncollected income to total assets (A5). For MBHC banks, the coefficients on A3 and A4 are also statistically significant, as are the coefficients on total loans to assets (A1) and, in one model, real estate loans to assets (A2). Although these results suggest that risky asset portfolios have a positive impact on the probability of a bank engaging in mergers, we also find that merger probability is positively affected by the ratio of core deposits to total liabilities (CORE). Hence, at the margin, while the probability of engaging in mergers is positively related to asset risk, it is also positively related to conservative funding.

Estimates of Economic Impact:

Although many of the model coefficients reported in Tables 5-8 are statistically significant, not all reflect large-sized effects on the number of mergers or the volume of deposits a bank will absorb as a result of mergers. Table 9 reports mean elasticity estimates to provide an indication of the relative importance of the independent variables.[18] For independent variables with continuous values, the elasticity estimates indicate the marginal contribution of a 1 percent increase in the value of the independent variable on the expected number of banks (or amount of deposits) absorbed in a quarter. For independent variables that assume discrete values, which are identified by italics, "elasticity" estimates are average percent changes, as defined in (2.7)-(2.11). For example, the elasticity reported for the variable CAMEL2 is the estimated percentage change (divided by 100) in the expected number of mergers (or amount of deposits absorbed) associated with a change in the composite CAMEL rating from 1 to 2. The elasticity reported for CAMEL3 is the estimated impact of a change in rating from 1 to 3, etc. Elasticity measures for CRA ratings are interpreted similarly. The elasticity estimate for the dummy variable LTD reflects the impact of a change from state-wide branching to limited branching; the elasticity esti-

[18]Elasticity estimates were computed for each observation, then averaged to obtain the mean estimates shown in Table 9.

mate for UNIT reflects the impact of a change from state-wide branching to unit banking. Finally the elasticity measures for FRS, OCC, and STATE measure the impact of going from FDIC-examined to Federal Reserve examined, OCC examined, and state examined, respectively.

As with the coefficient estimates reported in Tables 5-8, we present separate elasticity estimates for banks that are not members of MBHCs and for MBHC banks. For the latter, we report separate elasticity estimates for the absorption of affiliated banks, i.e., type-1 mergers, and non-affiliated banks, i.e., type-2 mergers. For MBHC banks, elasticity estimates will be identical across type-1 and type-2 mergers for explanatory variables that affect only the decision to engage in any mergers, regardless of type. For example, we assume that the marginal impact of CAMEL composite ratings and CRA ratings on mergers will be the same for both types of merger. A bank with unsatisfactory ratings generally is not permitted to absorb other banks, even banks within its own holding company. Similarly, we assume that supervisory ratings affect only the probability of engaging in mergers but, if a merger is made, affect neither the number of mergers nor amount deposits absorbed in a given quarter.[19]

We turn first to the explanatory variables that reflect the impact of the regulatory process on mergers. We find evidence that the merger approval process, as reflected in supervisory ratings of bank safety and soundness and community reinvestment, is an important constraint on bank mergers. We find that banks with a CAMEL rating of 2 are more likely to engage in mergers than those rated 1, suggesting that top-rated banks are more conservatively managed and, hence, less likely to engage in mergers. For example, the expected number of mergers by non-MBHC banks with a rating of 2 is almost 41 percent *greater* than that of top-rated banks. Banks viewed by regulators as having serious deficiencies, however, appear to be constrained in their ability to merge. 3, 4, or 5-rated

[19]Note that for variables affecting only the probability of engaging in any mergers, the elasticity estimates for the expected number of mergers and the amount of deposits absorbed will be identical (see (2.17)–(2.18) and (2.24)–(2.25)).

banks generally will make substantially fewer mergers than will a bank with a CAMEL rating of 1 or 2, all else equal. The expected number of mergers by non-MBHC banks with a rating of 3 is 29 percent *less* than the expected number of mergers by top-rated banks, and the expected number of mergers by 4-rated banks is 57 percent less than that of top-rated banks. Hence a downgrade from a 2 rating to a 3 rating lowers the expected number of mergers by roughly $29 + 41 = 70$ percent, and a downgrade from a 3 rating to a 4 rating lowers the expected number of mergers by roughly $57 - 29 = 28$ percent.

The Community Reinvestment Act has been the subject of considerable scrutiny in Congress and among interest groups, with some groups claiming that regulators are not sufficiently tough on poorly performing banks. We find evidence, however, that a low CRA rating limits a bank's ability to undertake mergers. The estimated effect is especially large for non-MBHC banks. For such banks, we find that a downgrade from a 1 rating to a 2 rating, for example, lowers the expected number of mergers by 23 percent. As noted in the discussion above, CRA ratings appear to have little impact at the margin on mergers by MBHC banks. However, 99 percent of all mergers in our data were by banks with CRA ratings of 1 or 2, so there is little variability in the underlying data to obtain reliable estimates of the marginal effect of a lower rating.

Turning to market characteristics, we find that expected mergers are lower, the more concentrated the market in which a bank is headquartered. Banks located in highly concentrated markets are limited in their ability to engage in mergers with other banks in their home market, whereas mergers in other markets might be more costly. For non-MBHC banks, for example, we estimate that a 1 percent increase in HHI reduces expected mergers by 0.37 percent, and expected deposits absorbed by 0.18 percent. For MBHC banks, we estimate that a 1 percent increase in HHI reduces expected type-1 mergers by 0.69 percent and expected type-2 mergers by 0.13 percent, but has no impact on expected deposits absorbed. Nevertheless, taken as a whole our results are consistent with a desire by regulators to preserve competitive banking markets.

The consolidation of the U.S. banking industry has coincided with an easing of branch banking restrictions at both the state and national levels. Although the coefficients on *BRCHNG* are not statistically significant in the models reported in Tables 5-8, in some cases the estimated elasticities are large. For example, we estimate that for non-MBHC banks, a relaxation of a state's branching restrictions will increase the expected number of mergers a bank will engage in by 23 percent. For MBHC banks, we estimate a 24 percent increase in type-1 mergers, but that type-2 mergers will be unaffected.[20]

An urban location is another market variable that has a large effect on the expected number of mergers and expected deposits absorbed. For example, for non-MBHC banks, the elasticity estimate indicates that being in an urban market increases expected mergers by 263 percent, and expected deposits absorbed by 67 percent. The availability of potential targets, however, appears to have only a small impact on expected mergers, even though the coefficients on several of these variables are statistically significant.

Turning to internal bank characteristics, we find that expected mergers are clearly affected by a bank's size, the quality of its management, as reflected in supervisory ratings, and its use of core deposits as a funding source. We find that banks with a top CAMEL management rating have a higher probability of engaging in mergers, and that a rating-downgrade has a substantial negative impact on the estimated number of mergers a bank will engage in during a given quarter. For example, for non-MBHC banks, we estimate that a downgrade from a 1 rating to a 2 rating results in an estimated 31 percent decline in the expected number of mergers. For MBHC banks, the estimated impact is 26 percent. Recall that expected mergers *increase* with a downgrade of the *composite* CAMEL rating from 1 to 2. Our results suggest, therefore, that banks that merge aggressively tend to be well managed, but somewhat riskier overall, than other banks.[21]

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[20]Note that to interpret the impact of adoption of a specific type of branching law on expected mergers one would have to take account of the interactions of UNIT and LTD with the targets variables.

[21]The positive elasticity estimate for MGMT4 is probably spurious since virtually no bank with a management rating lower than 3 engaged in mergers.

Another variable that we find to have a robust relationship with merger activity is CORE, the ratio of a bank's core deposits to its total liabilities. In our sample, for both non-MBHC and MBHC banks, the unconditional mean CORE of banks that engage in mergers is smaller than that of other banks (see Table 4). Nevertheless, controlling for other factors in our model, we find a positive association between CORE and the estimated number of mergers a bank will engage in during a given quarter. The estimated effect is especially large for non-MBHC banks.

As expected, the number of mergers a bank engaged in during the recent past appears to have a large impact on the expected number of mergers a bank will undertake in a given quarter. The elasticity estimates for lagged deposits absorbed, however, are small.

Finally, turning to bank asset quality measures, the elasticity estimates show little consistent influence across bank or merger types. We do find, however, that an increase in a bank's commercial loan to total asset ratio (A3) tends to increase expected mergers and deposits absorbed. For example, for MBHC banks, a one percent increase in A3 increases the expected number of type-1 (type-2) mergers by 0.35 percent (0.23 percent). For non-MBHC banks, we also find positive and rather large effects from the ratios of other real estate owned to total assets (A4) and uncollected income to total assets (A5).

Taken as a whole, the elasticity estimates indicate large effects on expected mergers of bank size, an urban location, market concentration, examination ratings, and management quality. We find some rather large differences in the effects of individual variables on the expected number of mergers by MBHC and non-MBHC banks, however, and for banks that are members of an MBHC, we also note some differences between expected mergers with banks that are affiliated with the same holding company and outside mergers.

5. CONCLUSION

The U.S. banking industry has undergone rapid consolidation during the past 20 years as legal impediments to mergers, such as branching restrictions, have been relaxed.

The present paper uses bank-level data to identify characteristics influencing the number and size of mergers a bank will engage in during a fixed interval of time. By using bank-level data, we are able to identify constraints on consolidation within holding companies, as well as identify characteristics, including regulatory constraints, that affect mergers with banks outside the holding company. In addition, our sample includes banks that either are not affiliated with a holding company or are members of a one-bank holding company. Our sample includes all U.S. commercial banks (with usable data) involved in over 3000 mergers during 1987:Q2–1999:Q1, and hence is much larger than most prior studies of bank merger activity.

The few previous econometric studies of the characteristics of banks that either engage in mergers or are merger targets, such as O'Keefe (1996) and Wheelock and Wilson (2000), use discrete-choice or hazard models to investigate the probability of, say, engaging in mergers. Here, by contrast, we investigate the determinants of the expected *number* of mergers and the expected *volume of deposits* a bank will absorb via merger within a fixed interval of time. Some banks are involved in numerous mergers, while others merge just once. Our models enable us to identify not only the characteristics affecting the probability of engaging in any mergers, but also those influencing the number of mergers a bank will undertake and the amount of deposits it will absorb.

We find that the regulatory approval process serves as a real constraint on bank merger activity. All mergers, including holding company consolidations, require approval by one or more bank regulators as well as by the Justice Department. Regulators consider such factors as the bidder's financial strength and its record of community reinvestment. Regulators also consider the potential impact of a merger on market competition. Accordingly, we find that supervisory evaluations of bank performance, as reflected in CAMEL and CRA ratings, significantly affect expected mergers. For example, a downgrade from a satisfactory CAMEL rating of 2 to an unsatisfactory rating of 3 or 4 substantially reduces the expected number of mergers a bank will engage in, holding other factors constant. We also find that in general, the expected number of mergers falls with an increase in the concentration of the market in which a bank is headquartered. This result is consistent with a desire by regulators to maintain competitive banking markets. Finally, we find that a bank's merger activity is strongly affected by whether it is located in an urban market. All else equal, being in an urban market greatly increases the expected number of mergers a bank will engage in over time.

Among the internal bank characteristics that consistently relate to merger activity is the quality of a bank's management, as reflected in the CAMEL-component rating for management. We find that, all else equal, the expected number of mergers is largest for banks with top-rated management, and that expected mergers fall with a rating downgrade. This could reflect special emphasis by regulators on the quality of a bank's management in the approval process. Alternatively, a high management rating could reflect management skilled in expanding bank activities through mergers. Not surprisingly, we also find that a bank's size, and whether or not it is the lead bank in a holding company, strongly influence the expected number of mergers the bank will engage in. And, finally, we find that an increase in core deposits, and increases in some indicators of asset risk, raise the expected number of mergers.

Qualitatively, our findings with respect to the impact of regulation, supervision and market characteristics on bank merger activity largely confirm our prior expectations. In addition, our model estimates provide new information about how large the impacts of such factors are on mergers, and thereby contribute to establishing a profile of banks that engage in mergers.

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TABLE 1—Variable Definitions

Name	Definition
Regulatory Process:	
FRS	equals 1 if exam is conducted by the FRS; 0 otherwise.
OCC	equals 1 if exam is conducted by the OCC; 0 otherwise.
STATE	equals 1 if exam is conducted by state banking authorities; 0 otherwise.
CAMEL2	equals 1 if CAMEL rating is 2; 0 otherwise.
CAMEL3	equals 1 if CAMEL rating is 3; 0 otherwise.
CAMEL4	equals 1 if CAMEL rating is 4; 0 otherwise.
CAMEL5	equals 1 if CAMEL rating is 5; 0 otherwise.
CRA2	equals 1 if CRA rating is 2; 0 otherwise.
CRA3	equals 1 if CRA rating is 3; 0 otherwise.
CRA4	equals 1 if CRA rating is 4; 0 otherwise.
Market Characteristics:	
UNIT	equals 1 in states that permitted no, or highly restricted branching; 0 otherwise.
LTD	equals 1 in states that permitted limited branching; 0 otherwise.
BRCHNG	equals 1 in each of four quarters following a change in state branching law; 0 otherwise.
URBAN	equals 1 if bank is located in a metropolitan statistical area (MSA); 0 otherwise.
HHI	Herfindahl-Hirschman index, based on local market concentration.
LTARG1	number of other affiliated banks operating in local market.
STARG2	number of other unaffiliated banks operating in state.
LTARG2	number of other unaffiliated banks operating in local market.
STARG1_D	total deposits of other affiliated banks operating in state.
LTARG1_D	total deposits of other affiliated banks operating in local market.
STARG2_D	total deposits of other unaffiliated banks operating in state.
LTARG2_D	total deposits of other unaffiliated banks operating in local market.
Capital adequacy:	
C	total equity/total assets.

TABLE 1 (continued)

Name	Definition
Asset quality:	
A1	total loans/total assets.
A2	real estate loans/total loans.
A3	commercial and industrial loans/total loans.
A4	other real estate owned/total assets.
A5	income earned, but not collected on loans/total assets.
A6	nonperforming loans/total assets.
Management:	
EXP	noninterest expense/total assets.
MGMT2	equals 1 if management component rating from most recent examination was 2; 0 otherwise.
MGMT3	equals 1 if management component rating from most recent examination was 3; 0 otherwise.
MGMT4	equals 1 if management component rating from most recent examination was 4; 0 otherwise.
MGMT5	equals 1 if management component rating from most recent examination was 5; 0 otherwise.
Earnings:	
E	net after-tax income/total assets.
Liquidity:	
L	(federal funds purchased − fed funds sold)/total assets.
Other Financial Characterisitcs:	
CORE	core deposits/total liabilities.
SIZE	log of total assets.
AGROW	percent change in total assets during previous four quarters.
LOGAGE	log of bank's age in years.
BHCBIG	1 if bank is lead bank in MBHC; 0 otherwise.
Lagged Dependent Variables:	
YTj_4	number of type-j acquisitions in the four quarters prior to current quarter; j=1 (within) or 2 (outside).
YTj_P4	number of type-j acquisitions 5–8 quarters prior to current quarter; j=1 (within) or 2 (outside).
DTj_4	total type-j deposits acquired in the four quarters prior to current quarter; j=1 (within) or 2 (outside).
DTj_P4	total type-j deposits acquired 5–8 quarters prior to current quarter; j=1 (within) or 2 (outside).

NOTES: A6 includes past due, nonaccrual loans, lease financing receivables, and securities, less any guaranteed portion. Coefficients on CAMELx, CRAx, and MGMTx rating dummies reflect the estimated impact of a specific rating relative to a rating of 1.

TABLE 2—Summary Statistics for Dependent Variables Among Observations with Nonzero Total Counts (deposits measured in thousands of 1992 dollars)

	Mean	Median	Std. Dev.	Min.	Max.
Non-MBHC Banks:					
y	1.1146	1	0.4792	1	5
D	69,729	30,918	160,037	9.83	3,550,072
MBHC Banks:					
y	1.5354	1	1.7292	1	30
y_1	0.4087	0	1.2497	0	30
y_2	1.1267	1	1.5163	0	26
D	245,452	64,644	910,231	0.62	24,749,483
D_1	66,316	0	366,462	0.00	8,126,173
D_2	179,137	39,940	842,782	0.00	24,749,483

TABLE 3—Frequencies for Count Variables Among Observations with Nonzero Counts

	Non-MBHC	MBHC Banks		
	y	y	y_1	y_2
0	—	—	1148	376
1	769	1194	302	912
2	39	178	43	136
3	11	88	23	59
4	6	25	6	20
5	4	22	5	17
6	0	7	3	4
7	0	5	3	2
8	0	2	1	0
9	0	4	0	4
≥ 10	0	14	5	9

TABLE 4—Summary Statistics for Explanatory Variables

	Non-MBHC Banks				MBHC Banks			
	Mergers=0 258,839 obs.		Mergers>0 829 obs.		Mergers=0 108,776 obs.		Mergers>0 1,539 obs.	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Regulatory Process:								
FRS	0.0808	0.2726	0.0796	0.2709	0.0960	0.2945	0.1222	0.3276
OCC	0.1868	0.3897	0.2823	0.4504	0.2397	0.4269	0.3457	0.4757
STATE	0.3357	0.4722	0.2786	0.4486	0.3079	0.4616	0.2326	0.4226
CAMEL2	0.5441	0.4981	0.6333	0.4822	0.5594	0.4965	0.5724	0.4949
CAMEL3	0.1116	0.3148	0.0808	0.2727	0.0740	0.2618	0.0663	0.2488
CAMEL4	0.0467	0.2109	0.0157	0.1243	0.0205	0.1418	0.0162	0.1265
CAMEL5	0.0106	0.1026	0.0012	0.0347	0.0037	0.0608	0.0006	0.0255
CRA2	0.8388	0.3677	0.7853	0.4109	0.7733	0.4187	0.7128	0.4526
CRA3	0.0386	0.1926	0.0193	0.1377	0.0216	0.1454	0.0201	0.1405
CRA4	0.0031	0.0560	0.0012	0.0347	0.0016	0.0394	0.0013	0.0360
Market Characterisitcs:								
UNIT	0.0258	0.1587	0.0084	0.0916	0.0413	0.1989	0.0286	0.1667
LTD	0.2009	0.4007	0.1303	0.3368	0.2553	0.4361	0.2034	0.4026
BRCHNG	0.0766	0.2660	0.0555	0.2291	0.0902	0.2864	0.0851	0.2792
URBAN	0.3967	0.4892	0.5489	0.4979	0.4759	0.4994	0.6849	0.4647
HHI	3.298E3	2.221E3	3.155E3	2.120E3	3.002E3	2.146E3	2.774E3	2.019E3
STARG1	—	—	—	—	5.7029	7.8914	5.4113	7.8072
LTARG1	—	—	—	—	0.8872	2.4644	0.8402	1.9151
STARG2	455.5629	318.1537	453.4041	304.7576	466.9907	336.6170	455.2982	339.6411
LTARG2	23.1537	48.8795	26.5802	47.0194	34.2287	72.4613	38.5510	67.9659
STARG1_D	—	—	—	—	3.803E9	6.275E11	1.394E05	3.890E4
LTARG1_D	—	—	—	—	2815.0801	1.442E4	1679.3600	7439.5898
STARG2_D	3.509E11	6.013E12	1.364E12	1.178E13	8.362E10	2.941E12	2.727E12	5.347E12
LTARG2_D	3.235E10	1.830E12	1.269E11	3.655E12	8.610E9	9.473E11	1.147E06	2.254E5
Capital Adequacy:								
C	0.0977	0.0362	0.0902	0.0261	0.0866	0.0294	0.0815	0.0206

TABLE 4 (continued)

	Non-MBHC Banks				MBHC Banks			
	Mergers=0 258,839 obs.		Mergers>0 829 obs.		Mergers=0 108,776 obs.		Mergers>0 1,539 obs.	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Asset Quality:								
A1	0.5374	0.1471	0.5650	0.1283	0.5833	0.1438	0.6033	0.1282
A2	0.4979	0.1924	0.5214	0.1757	0.5169	0.1791	0.5187	0.1665
A3	0.1755	0.1192	0.2012	0.1182	0.1814	0.1158	0.2043	0.1090
A4	0.0050	0.0114	0.0048	0.0084	0.0034	0.0085	0.0035	0.0077
A5	0.0072	0.0048	0.0065	0.0051	0.0064	0.0041	0.0056	0.0034
A6	0.0027	0.0083	0.0029	0.0063	0.0033	0.0081	0.0042	0.0074
Management:								
EXP	0.0347	0.0180	0.0364	0.0159	0.0335	0.0180	0.0344	0.0125
MGMT2	0.5905	0.4918	0.6318	0.4808	0.6065	0.4885	0.5861	0.4927
MGMT3	0.1772	0.3818	0.1194	0.3245	0.0959	0.2944	0.0825	0.2752
MGMT4	0.0446	0.2065	0.0157	0.1243	0.0152	0.1222	0.0130	0.1133
MGMT5	0.0094	0.0966	0.0012	0.0347	0.0027	0.0522	0.0006	0.0255
Earnings:								
E	0.0092	0.0152	0.0118	0.0094	0.0104	0.0141	0.0107	0.0109
Liquidity:								
L	−0.0427	0.0613	−0.0240	0.0631	−0.0203	0.0823	0.0025	0.0762
Other Financial Characteristics:								
CORE	0.7614	0.0988	0.7579	0.0890	0.7487	0.1070	0.7314	0.1042
SIZE	6.1339	0.9967	7.1883	1.3617	6.7592	1.2810	7.8628	1.4597
AGROW	5.4693	22.3361	13.1331	35.8369	7.8594	51.8771	30.2332	393.9282
LOGAGE	3.7767	1.0103	3.7140	1.0290	3.8698	0.9287	3.9455	0.9146
BHCBIG	—	—	—	—	0.3254	0.4685	0.6212	0.4853
Lagged Dependent Variables:								
YT1_4	—	—	—	—	$1.471E-4$	0.0288	0.1598	1.4900
YT1_P4	—	—	—	—	$2.758E-5$	0.0068	0.0955	0.5650
YT2_4	$3.863E-6$	0.0020	0.1942	0.8953	$2.114E-4$	0.0503	0.3853	1.4551
YT2_P4	$1.932E-5$	0.0071	0.2292	0.8315	$6.435E-5$	0.0184	0.2287	0.8600
DT1_4	—	—	—	—	0.5658	112.7529	359.6888	4217.6499
DT1_P4	—	—	—	—	0.0607	15.8401	143.3987	1243.9700
DT2_4	0.0076	3.8815	196.8418	1246.2600	0.5392	121.0258	813.9125	7327.8901
DT2_P4	0.0321	11.5394	215.5994	1334.7000	0.1191	38.6343	300.5900	1882.0699

TABLE 5—Parameter Estimates, Count Model for Non-MBHC Banks

	Probit α	Truncated Poisson θ	p − values $H_0:$ $\alpha = 0$	$H_0:$ $\theta = 0$	$H_0:$ $\alpha = \theta = 0$
CONSTANT	−4.299	−18.86	—	—	—
Regulatory Process:					
FRS	−0.07555	2.344	0.1634	0.04171	0.04762
OCC	0.03384	1.018	0.326	0.197	0.2686
STATE	−0.01722	0.4089	0.5963	0.6092	0.7626
CAMEL2	0.1146	—	0.009977	—	—
CAMEL3	0.002356	—	1.000	—	—
CAMEL4	−0.2615	—	0.06669	—	—
CAMEL5	−0.5618	—	0.0544	—	—
CRA2	−0.0871	—	0.01389	—	—
CRA3	−0.2269	—	0.008999	—	—
CRA4	−0.2597	—	0.3754	—	—
Market Characteristics:					
UNIT	−0.253	—	0.0553	—	—
LTD	−0.0187	—	0.7042	—	—
BRCHNG	−0.04558	0.7866	0.4132	0.6246	0.6347
URBAN	−0.07223	2.764	0.05101	0.01257	0.006617
HHI	$-1.69E-5$	−0.0002269	0.0154	0.1273	0.01661
STARG1†	—	—	—	—	—
LTARG1‡	—	—	—	—	—
STARG2†	0.0002088	−0.004404	0.0002583	0.001018	$5.711E-6$
LTARG2‡	$3.759E-5$	−0.006281	0.9342	0.4027	0.7022
Capital Adequacy:					
C	−0.7761	10.95	0.137	0.5452	0.2756
Asset Quality:					
A1	−0.09095	2.981	0.4429	0.4341	0.5486
A2	−0.02158	−3.618	0.8259	0.1438	0.3353
A3	0.3154	−1.43	0.01898	0.7047	0.05939
A4	2.358	32.03	0.1366	0.3348	0.2074
A5	15.12	171.7	$2.951E-5$	0.2361	$8.058E-5$
A6	−0.1949	−19.71	0.9349	0.7306	0.9393
Management:					
EXP	1.249	−13.4	0.0596	0.8332	0.1659
MGMT2	−0.1258	—	0.006236	—	—
MGMT3	−0.21	—	0.001735	—	—
MGMT4	−0.1293	—	0.3212	—	—
MGMT5	−0.2698	—	0.3848	—	—

TABLE 5 (continued)

	Probit	Truncated Poisson	p − values		
			$H_0:$	$H_0:$	$H_0:$
	α	θ	$\alpha = 0$	$\theta = 0$	$\alpha = \theta = 0$
Earnings:					
E	2.602	-13.44	0.03433	0.5294	0.08743
Liquidity:					
L	0.4176	-4.746	0.0919	0.3739	0.1627
Other Financial Characteristics:					
CORE	0.799	7.447	$7.56E-8$	0.1348	$1.72E-7$
SIZE	0.2517	0.4854	$2.011E-59$	0.1364	$1.356E-58$
AGROW	-0.001725	0.01075	0.01405	0.3188	0.0298
LOGAGE	-0.04533	0.8192	0.005987	0.1273	0.007156
BHCBIG	—	—	—	—	—
Lagged Dependent Variables:					
YT1_4	—	—	—	—	—
YT1_P4	—	—	—	—	—
YT2_4	3.511	-0.08799	$3.008E-105$	0.5939	$7.14E-104$
YT2_P4	2.726	-0.1137	$2.099E-130$	0.7879	$6.176E-129$
Time Dummies:					
YEAR87	-0.1903	—	0.09427	—	—
YEAR88	-0.2797	—	0.01078	—	—
YEAR89	-0.2669	—	0.01154	—	—
YEAR90	-0.2846	—	0.007185	—	—
YEAR91	-0.1837	—	0.07636	—	—
YEAR92	-0.2087	—	0.04652	—	—
YEAR93	-0.1688	—	0.1057	—	—
YEAR94	-0.1787	—	0.08865	—	—
YEAR95	-0.2555	—	0.01709	—	—
YEAR96	-0.2385	—	0.0266	—	—
YEAR97	-0.2355	—	0.03033	—	—

NOTES: Scientific notation is used to display small quantiies; *e.g.,* $9.125E-6$ denotes 9.125×10^{-6}. In addition, (†) denotes interaction with (1−UNIT−LTD), while (‡) denotes interactions with (UNIT+LTD); *e.g.,* STARG2† denotes STARG2 $\times$ (1 − UNIT − LTD), and LTARG2‡ denotes LTARG2$\times$(UNIT+LTD).

TABLE 6—Parameter Estimates, Count Model for MBHC Banks

	Probit	Truncated Poisson	Binomial	p − values				
	α	θ	τ	$H_0:$ $\alpha=0$	$H_0:$ $\theta=0$	$H_0:$ $\tau=0$	$H_0:$ $\theta=\tau=0$	$H_0:$ $\alpha=\theta=\tau=0$
CONSTANT	−3.338	−0.6094	−3.731	—	—	—	—	—
Regulatory Process:								
FRS	0.03935	−0.2864	0.1018	0.3413	0.1092	0.3952	0.1931	0.2412
OCC	0.07506	−0.0007447	0.123	0.01665	1.000	0.1618	0.3759	0.05287
STATE	0.02333	0.1353	0.1142	0.4571	0.332	0.2242	0.2984	0.3961
CAMEL2	0.03445	—	—	0.368	—	—	—	—
CAMEL3	−0.04947	—	—	0.5037	—	—	—	—
CAMEL4	−0.2532	—	—	0.07154	—	—	—	—
CAMEL5	−0.8816	—	—	0.01054	—	—	—	—
CRA2	−0.01918	—	—	0.4678	—	—	—	—
CRA3	0.01431	—	—	0.8807	—	—	—	—
CRA4	0.006543	—	—	0.9779	—	—	—	—
Market Characteristics:								
UNIT	0.1452	0.5563	—	0.07516	0.06815	—	—	—
LTD	0.05826	0.1121	—	0.1645	0.5137	—	—	—
BRCHNG	0.02237	−0.1312	0.1136	0.5929	0.6041	0.4333	0.6432	0.7606
URBAN	0.06964	0.1076	0.01823	0.0338	0.471	0.8436	0.7563	0.1672
HHI	$-6.861E-6$	$6.08E-5$	−0.0001014	0.2972	0.01964	$6.663E-8$	$3.06E-8$	$8.703E-8$
STARG1†	0.0003016	0.03639	0.03295	1.000	$1.585E-7$	$2.542E-10$	$2.221E-15$	$1.491E-14$
LTARG1‡	0.0002906	0.04556	−0.06043	0.8965	0.02147	0.03236	0.0072	0.01958
STARG2†	$9.861E-5$	−0.0004666	−0.0002319	0.09479	0.051	0.08514	0.03384	0.02267
LTARG2‡	−0.000741	0.001848	−0.001076	0.007637	0.03697	0.1711	0.04449	0.003953
Capital Adequacy:								
C	−1.575	−3.937	1.136	0.005697	0.2172	0.53	0.3834	0.02269
Asset Quality:								
A1	0.1549	−0.3991	−0.02039	0.09338	0.3046	0.9432	0.5889	0.2754
A2	0.1626	−0.4125	0.00524	0.05024	0.2623	0.9831	0.5333	0.1653
A3	0.4645	0.8725	0.3757	$7.091E-5$	0.1248	0.3159	0.1863	0.0002548
A4	4.803	−41.13	−33.03	0.003698	$1.733E-6$	$2.832E-5$	$1.689E-9$	$1.422E-10$
A5	−1.696	44.4	−20.43	0.676	0.004374	0.07975	0.003713	0.009901
A6	−0.2903	29.88	9.17	0.8811	$5.978E-7$	0.06557	$7.122E-7$	$3.093E-6$
Management:								
EXP	−1.29	13.58	9.927	0.1436	$3.416E-5$	0.0002149	$1.983E-7$	$3.211E-7$
MGMT2	−0.1161	—	—	0.002179	—	—	—	—
MGMT3	−0.1163	—	—	0.06974	—	—	—	—
MGMT4	0.01197	—	—	0.9529	—	—	—	—
MGMT5	−0.3312	—	—	0.3703	—	—	—	—

TABLE 6 (continued)

	Probit α	Truncated Poisson θ	Binomial τ	p − values H_0: $\alpha=0$	H_0: $\theta=0$	H_0: $\tau=0$	H_0: $\theta=\tau=0$	H_0: $\alpha=\theta=\tau=0$
Earnings:								
E	−1.337	5.004	6.968	0.2201	0.4824	0.156	0.2857	0.2605
Liquidity:								
L	0.2335	0.5992	−0.9492	0.1793	0.3977	0.06701	0.1307	0.1179
Other Financial Characteristics:								
CORE	0.2397	−0.7807	−0.04261	0.05023	0.1292	0.9071	0.3142	0.1046
SIZE	0.1031	0.06089	−0.007106	$3.78E-17$	0.2262	0.8375	0.4708	$1.31E-15$
AGROW	0.0001086	0.000791	$-3.232E-6$	0.09567	0.01675	0.9822	0.0572	0.03675
LOGAGE	0.005667	−0.03877	0.2513	0.6614	0.5523	$2.028E-9$	$1.311E-8$	$5.895E-8$
BHCBIG	0.2924	0.06326	−0.02898	$1.012E-27$	0.5897	0.7141	0.8086	$9.926E-26$
Lagged Dependent Variables:								
YT1_4	0.7636	−0.001728	−0.009642	$1.552E-15$	0.9078	0.5034	0.7941	$8.107E-14$
YT1_P4	2.694	−0.2551	0.1649	$3.223E-66$	0.001895	0.003451	0.0001116	$1.102E-67$
YT2_4	0.8701	−0.09168	−0.3149	$1.261E-143$	$9.46E-6$	$1.385E-15$	$7.74E-19$	$6.768E-159$
YT2_P4	1.845	−0.03364	−0.1623	$5.632E-154$	0.4374	0.0001958	0.0007196	$2.869E-154$
Time Dummies:								
YEAR87	−0.1217	—	−0.6452	0.1616	—	0.1075	—	—
YEAR88	−0.2089	1.33	−0.1472	0.01797	0.001875	0.6611	0.007226	0.001463
YEAR89	−0.1743	0.7037	−0.1876	0.03966	0.09128	0.5482	0.2007	0.059
YEAR90	−0.1315	0.6577	−0.1471	0.1163	0.05544	0.6187	0.1411	0.09442
YEAR91	−0.1417	1.406	0.0759	0.1017	$2.796E-5$	0.794	0.0001492	0.0001471
YEAR92	−0.1513	1.1	0.2707	0.08482	0.003658	0.3498	0.009464	0.006451
YEAR93	−0.06052	1.436	0.647	0.4859	$5.743E-5$	0.01878	$1.933E-5$	$5.946E-5$
YEAR94	−0.08368	1.649	0.5303	0.3473	$3.906E-6$	0.05842	$3.933E-6$	$1.063E-5$
YEAR95	−0.1633	1.971	0.7935	0.06829	$5.301E-9$	0.004094	$6.47E-10$	$6.761E-10$
YEAR96	−0.1798	1.439	0.8146	0.0468	$9.952E-5$	0.003807	$7.813E-6$	$4.688E-6$
YEAR97	−0.1349	1.123	1.235	0.1278	0.004411	$6.1E-6$	$6.276E-7$	$9.004E-7$

NOTES: Scientific notation is used to display small quantiies; *e.g.,* $9.125E-6$ denotes 9.125×10^{-6}. In addition, (†) denotes interaction with (1−UNIT−LTD), while (‡) denotes interactions with (UNIT+LTD); *e.g.,* STARG1†denotes STARG1×(1−UNIT−LTD), and LTARG1‡denotes LTARG1×(UNIT+LTD).

TABLE 7—Parameter Estimates, Continuous Model for Non-MBHC Banks

	Probit	Truncated Regression	p − values		
	α	θ	H_0 : $\alpha = 0$	H_0 : $\theta = 0$	H_0 : $\alpha = \theta = 0$
CONSTANT	-4.326	—	—	—	—
Regulatory Process:					
FRS	-0.09125	0.1773	0.08122	1.000	0.2187
OCC	0.04803	0.4582	0.157	0.4907	0.2897
STATE	-0.01071	-0.04285	0.7347	0.4907	0.7446
CAMEL2	0.1145	-0.1529	0.008769	0.5566	0.02712
CAMEL3	0.01329	-0.1366	0.8696	0.5566	0.83
CAMEL4	-0.2644	-0.5019	0.0563	0.7717	0.1551
CAMEL5	-0.5863	-0.952	0.042	0.7717	0.1213
CRA2	-0.08443	0.2339	0.01412	0.06112	0.008522
CRA3	-0.2382	0.4863	0.004918	0.06112	0.003319
CRA4	-0.2866	0.6407	0.322	0.2876	0.348
Market Characteristics:					
UNIT	-0.3147	-0.5811	0.01011	0.2876	0.0208
LTD	-0.0975	0.0006519	0.01843	0.2815	0.03483
BRCHNG	-0.01173	-0.1857	0.8279	0.2815	0.5468
URBAN	-0.07906	0.7531	0.0282	0.2109	0.04116
HHI	$-2.59E-5$	$2.544E-5$	0.00011	0.2109	0.0002585
STARG1_D†	—	—	—	—	—
LTARG1_D‡	—	—	—	—	—
STARG2_D†	$-1.621E-16$	$2.235E-15$	1.000	0.01987	0.06912
LTARG2_D‡	$-3.102E-8$	$3.921E-7$	0.843	0.01987	0.06514
Capital Adequacy:					
C	-1.088	-2.345	0.03017	0.04626	0.01309
Asset Quality:					
A1	-0.1728	0.01813	0.1332	0.04626	0.04444
A2	-0.0715	0.535	0.4538	0.4303	0.5535
A3	0.2804	0.4122	0.03144	0.4303	0.07242
A4	3.108	10.72	0.04248	0.2609	0.06788
A5	14.41	-4.537	$4.253E-5$	0.2609	0.0001222
A6	-0.2516	13.18	0.9202	0.4738	0.7698
Management:					
EXP	1.472	3.072	0.01491	0.4738	0.03994
MGMT2	-0.1081	0.04124	0.01753	0.3508	0.03852
MGMT3	-0.1814	-0.1229	0.005651	0.3508	0.01406
MGMT4	-0.1349	0.4405	0.2907	0.128	0.1797
MGMT5	-0.2647	-0.3604	0.3912	0.128	0.2175

TABLE 7 (continued)

	Probit α	Truncated Regression θ	p − values H_0 : $\alpha = 0$	H_0 : $\theta = 0$	H_0 : $\alpha = \theta = 0$
Earnings:					
E	2.866	0.3199	0.01549	0.1017	0.01399
Liquidity:					
L	0.4026	−0.01475	0.09146	0.1017	0.06305
Other Financial Characteristics:					
CORE	0.9662	0.6916	$1.106E-11$	0.19	$4.073E-11$
SIZE	0.2609	0.3771	$1.336E-68$	0.19	$1.246E-67$
AGROW	0.0002799	0.0008067	0.587	0.3811	0.5879
LOGAGE	−0.04488	−0.07386	0.00445	0.3811	0.01193
BHCBIG	—	—	—	—	—
Lagged Dependent Variables:					
DT1_4	—	—	—	—	—
DT1_P4	—	—	—	—	—
DT2_4	0.002996	$-5.86E-6$	$2.748E-72$	0.1349	$2.032E-71$
DT2_P4	0.001448	$1.56E-5$	$4.441E-40$	0.1349	$2.425E-39$
Time Dummies:					
YEAR87	−0.1639	−0.0476	0.139	0.5521	0.2804
YEAR88	−0.2779	−0.2394	0.01067	0.5521	0.03218
YEAR89	−0.2579	−0.5398	0.01285	0.003135	0.0005766
YEAR90	−0.2788	−0.501	0.007271	0.003135	0.0003471
YEAR91	−0.1692	−0.313	0.095	0.1421	0.08446
YEAR92	−0.171	−0.3051	0.09295	0.1421	0.083
YEAR93	−0.1102	−0.1898	0.2729	0.05496	0.08693
YEAR94	−0.1311	−0.2284	0.1971	0.05496	0.069
YEAR95	−0.1922	0.1113	0.06368	0.7297	0.1688
YEAR96	−0.1906	0.2113	0.06729	0.7297	0.1766
YEAR97	−0.1862	0.0336	0.07669	0.07323	0.04194

NOTES: Scientific notation is used to display small quantiies; *e.g.,* $9.125E-6$ denotes 9.125×10^{-6}. In addition, (†) denotes interaction with (1−UNIT−LTD), while (‡) denotes interactions with (UNIT+LTD); *e.g.,* STARG2_D†denotes STARG2_D $\times$ (1−UNIT−LTD), and LTARG2_D‡denotes LTARG2_D $\times$ (UNIT+LTD).

TABLE 8—Parameter Estimates, Continuous Model for MBHC Banks

	Probit α	Truncated Regression θ	Binomial τ	p − values $H_0: \alpha = 0$	$H_0: \theta = 0$	$H_0: \tau = 0$	$H_0: \theta = \tau = 0$	$H_0: \alpha = \theta = \tau = 0$
CONSTANT	−3.37	—	−2.684	—	—	—	—	—
Regulatory Process:								
FRS	0.05706	0.008548	0.04918	0.1432	0.9287	0.7277	0.9374	0.5178
OCC	0.06359	0.09944	0.1573	0.03336	0.2006	0.1286	0.1389	0.03715
STATE	0.01584	0.1811	0.2154	0.5992	0.02869	0.048	0.01293	0.02966
CAMEL2	0.03301	0.2074	—	0.3683	0.0354	—	—	—
CAMEL3	−0.08507	0.2074	—	0.2341	0.2991	—	—	—
CAMEL4	−0.3001	0.03585	—	0.02797	0.9287	—	—	—
CAMEL5	−0.9257	−0.6896	—	0.00607	0.6228	—	—	—
CRA2	−0.0195	−0.01699	—	0.4592	0.8034	—	—	—
CRA3	−0.006367	−0.4621	—	0.9357	0.02839	—	—	—
CRA4	−0.03201	0.04304	—	0.9081	0.9496	—	—	—
Market Characteristics:								
UNIT	0.08323	−0.3012	—	0.2567	0.1483	—	—	—
LTD	0.03701	0.08811	—	0.2616	0.3504	—	—	—
BRCHNG	0.05304	0.02105	0.08521	0.2079	0.8495	0.5849	0.846	0.5891
URBAN	0.0722	0.168	0.04557	0.0217	0.06049	0.6848	0.1581	0.02985
HHI	$-1.3E-5$	−0.0006965	$-5.171E-5$	0.04177	0.4447	0.02201	0.05423	0.01879
STARG1_D†	$-1.547E-14$	$3.647E-6$	$4.546E-7$	0.8431	0.0001071	0.6949	0.0005101	0.001653
LTARG1_D‡	$-2.702E-6$	$8.748E-6$	$-1.842E-5$	0.1228	0.1359	0.2913	0.1885	0.1261
STARG2_D†	$4.091E-16$	$1.245E-15$	$-5.742E-15$	0.8919	0.8302	0.3926	0.6781	0.8506
LTARG2_D‡	$-2.823E-7$	$3.624E-7$	$-1.634E-7$	0.001237	0.2247	0.645	0.4304	0.006981
Capital Adequacy:								
C	−1.794	1.844	0.395	0.000893	0.2344	0.8503	0.4844	0.005888
Asset Quality:								
A1	0.08673	0.7722	0.3984	0.3541	0.003882	0.259	0.008181	0.01496
A2	0.1744	−0.03907	−0.2687	0.03147	0.8625	0.3719	0.6613	0.1414
A3	0.4987	0.5789	−0.2456	$1.044E-5$	0.06962	0.5841	0.166	$3.998E-5$
A4	4.634	9.516	−27.57	0.004395	0.07473	0.00271	0.002278	0.0001484
A5	−0.04884	−11.57	−46.59	1.000	0.2951	0.00221	0.005348	0.01504
A6	−0.4471	9.478	0.5972	0.7982	0.06085	0.9372	0.172	0.3098
Management:								
EXP	−0.8849	1.517	1.443	0.2712	0.6047	0.7249	0.8221	0.6589
MGMT2	−0.1194	−0.1279	—	0.001117	0.2006	—	—	—
MGMT3	−0.1041	−0.2009	—	0.09728	0.2415	—	—	—
MGMT4	0.02578	−0.08511	—	0.8517	0.8266	—	—	—
MGMT5	−0.3272	−2.21	—	0.3754	0.0295	—	—	—

TABLE 8 (continued)

	Probit	Truncated Regression	Binomial	p − values				
	α	θ	τ	H_0 : $\alpha = 0$	H_0 : $\theta = 0$	H_0 : $\tau = 0$	H_0 : $\theta = \tau = 0$	H_0 : $\alpha = \theta = \tau = 0$
Earnings:								
E	−1.004	−2.105	3.373	0.3356	0.5704	0.575	0.7275	0.6676
Liquidity:								
L	0.1823	−0.2061	−0.01013	0.2424	0.6596	0.9887	0.9075	0.6684
Other Financial Characteristics:								
CORE	0.3218	−0.1285	0.3163	0.005843	0.6929	0.4731	0.7151	0.04077
SIZE	0.1207	0.4901	−0.005998	$2.319E-25$	$3.74E-48$	0.8933	$6.804E-47$	$2.977E-69$
AGROW	0.0001269	$-9.584E-5$	$2.108E-5$	0.06272	0.7269	0.8744	0.9291	0.3067
LOGAGE	−0.002525	0.02864	0.1817	0.8646	0.423	0.0002456	0.0008729	0.002751
BHCBIG	0.3053	−0.382	−0.2329	$1.066E-37$	$5.149E-8$	0.01269	$1.624E-8$	$3.181E-43$
Lagged Dependent Variables:								
DT1_4	$3.257E-5$	$1.447E-5$	$2.792E-5$	0.0377	0.02128	0.03077	0.00684	0.002538
DT1_P4	0.001214	$3.495E-5$	0.0001057	$9.044E-39$	0.1232	0.01592	0.01668	$2.649E-38$
DT2_4	0.0002802	$-7.849E-7$	−0.0002397	$5.858E-72$	0.8537	$1.314E-10$	$1.065E-9$	$2.145E-78$
DT2_P4	0.0009244	$-6.506E-6$	−0.0001237	$1.195E-92$	0.6783	0.003836	0.01404	$7.098E-92$
Time Dummies:								
YEAR87	−0.118	0.4552	−0.6322	0.1734	0.04732	0.1346	0.04566	0.04546
YEAR88	−0.1926	0.2401	−0.1368	0.02624	0.3237	0.7034	0.5715	0.1088
YEAR89	−0.1537	0.0327	−0.2417	0.06569	0.8821	0.4672	0.7593	0.2682
YEAR90	−0.1174	0.1745	−0.06722	0.154	0.4266	0.8316	0.7128	0.4387
YEAR91	−0.1151	0.0958	0.04933	0.1713	0.6663	0.8744	0.8999	0.5555
YEAR92	−0.1092	0.4558	0.1484	0.1996	0.0467	0.633	0.1234	0.1202
YEAR93	−0.0172	0.2185	0.5306	0.8355	0.3313	0.07375	0.1261	0.2422
YEAR94	−0.01958	0.3783	0.2982	0.815	0.09762	0.3218	0.1552	0.2862
YEAR95	−0.1044	0.6175	0.5868	0.2254	0.007162	0.05098	0.004004	0.005825
YEAR96	−0.1185	0.5843	0.6823	0.1722	0.01145	0.02383	0.003181	0.00391
YEAR97	−0.08427	0.207	1.16	0.3346	0.3765	$8.407E-5$	0.0002965	0.0006497

NOTES: Scientific notation is used to display small quantiies; *e.g.,* $9.125E-6$ denotes 9.125×10^{-6}. In addition, (†) denotes interaction with (1−UNIT−LTD), while (‡) denotes interactions with (UNIT+LTD); *e.g.,* STARG1_D†denotes STARG1_D×(1−UNIT−LTD), and LTARG1_D‡denotes LTARG1_D×(UNIT+LTD).

TABLE 9—Mean Elasticity Estimates

	Count Model			**Continuous Model**		
	Non-MBHC	MBHC		Non-MBHC	MBHC	
	$\widehat{\eta}, \widehat{\Delta}$	$\widehat{\eta}_1, \widehat{\Delta}_1$	$\widehat{\eta}_2, \widehat{\Delta}_2$	$\widehat{\eta}_D, \widehat{\Delta}_D$	$\widehat{\eta}_{D1}, \widehat{\Delta}_{D1}$	$\widehat{\eta}_{D2}, \widehat{\Delta}_{D2}$
Regulatory Process:						
FRS	2.35	0.2473	0.01867	−0.09854	0.2722	0.1567
OCC	0.6387	0.4998	0.1787	0.8259	0.6786	0.2458
STATE	0.08391	0.3416	0.07132	−0.07262	0.7661	0.176
CAMEL2	0.4088	0.094	0.094	0.2108	0.3409	0.3409
CAMEL3	−0.2869	−0.198	−0.198	−0.2509	−0.2678	−0.2678
CAMEL4	−0.571	−0.4182	−0.4182	−0.7157	−0.5262	−0.5262
CAMEL5	−0.6428	−0.8385	−0.8385	−0.7906	−0.9219	−0.9219
CRA2	−0.2276	−0.04868	−0.04868	−0.0175	−0.06539	−0.06539
CRA3	−0.3504	0.0916	0.0916	−0.2013	−0.3368	−0.3368
CRA4	−0.1009	−0.01994	−0.01994	−0.004085	0.549	0.549
Market Characteristics:						
UNIT	−0.5263	0.4345	0.4345	−0.7204	−0.2348	−0.2348
LTD	0.7654	0.1947	0.1947	−0.2361	0.6181	0.3948
BRCHNG	0.2253	0.2445	−0.0006506	−0.1984	0.3374	0.1413
URBAN	2.631	0.2693	0.2251	0.6717	0.5342	0.4087
HHI	−0.3703	−0.6852	−0.1302	−0.1758	0.000	0.000
STARG1†	—	0.06723	0.001077	—	—	—
LTARG1‡	—	−0.0868	0.02768	—	—	—
STARG2†	−0.0005256	−0.0002448	0.0002071	—	—	—
LTARG2‡	−0.003381	−0.003262	−0.001176	—	—	—
STARG1_D†	—	—	—	—	0.05271	0.0427
LTARG1_D‡	—	—	—	—	−0.05836	0.003412
STARG2_D†	—	—	—	0.000628	−0.0009166	0.0002301
LTARG2_D‡	—	—	—	0.00397	−0.02698	−0.01399
Capital Adequacy:						
C	0.1266	−0.1697	−0.3359	−0.5527	−0.1951	−0.2588
Asset Quality:						
A1	0.4048	0.211	0.2313	−0.2695	0.9486	0.5131
A2	−0.5711	0.2239	0.2193	0.1593	−0.004216	0.2552
A3	0.07945	0.3499	0.2344	0.2194	0.2656	0.35
A4	0.1069	−0.2335	0.0204	0.1005	−0.1293	0.08831
A5	0.837	−0.2928	−0.0628	0.2817	−0.5704	0.003317
A6	−0.02702	0.06205	0.008723	0.03403	0.03101	0.02698
Management:						
EXP	−0.01904	0.5347	−0.02579	0.2614	0.05093	−0.04052
MGMT2	−0.3078	−0.2585	−0.2585	−0.242	−0.3527	−0.3527
MGMT3	−0.2248	−0.0005936	−0.0005936	−0.3205	−0.03238	−0.03238
MGMT4	0.2875	0.396	0.396	1.033	0.5754	0.5754
MGMT5	−0.3757	−0.6172	−0.6172	−0.7108	−0.9558	−0.9558

TABLE 9 (continued)

	Count Model			**Continuous Model**		
	Non-MBHC	MBHC		Non-MBHC	MBHC	
	$\widehat{\eta}, \widehat{\Delta}$	$\widehat{\eta}_1, \widehat{\Delta}_1$	$\widehat{\eta}_2, \widehat{\Delta}_2$	$\widehat{\eta}_D, \widehat{\Delta}_D$	$\widehat{\eta}_{D1}, \widehat{\Delta}_{D1}$	$\widehat{\eta}_{D2}, \widehat{\Delta}_{D2}$
Earnings:						
E	0.03383	0.09551	−0.01934	0.07922	0.001515	−0.0609
Liquidity:						
L	0.0152	0.01995	−0.0107	−0.05319	−0.006113	−0.006514
Other Financial Characteristics:						
CORE	3.747	0.4067	0.4611	2.747	0.9049	0.4622
SIZE	0.9165	0.2548	0.267	1.165	0.7947	0.8059
AGROW	−0.006582	0.002039	0.002085	0.008821	0.001914	0.00159
LOGAGE	0.1328	0.5033	0.07484	−0.2095	0.3087	−0.03143
BHCBIG	—	1.048	1.167	—	0.02888	0.5927
Lagged Dependent Variables:						
YT1_4	—	4.674	4.782	—	—	—
YT1_P4	—	82.73	59.9	—	—	—
YT2_4	370.6	2.922	6.42	—	—	—
YT2_P4	191.3	22.51	31.49	—	—	—
DT1_4	—	—	—	—	0.0006711	0.0001195
DT1_P4	—	—	—	—	0.0008955	0.000501
DT2_4	—	—	—	0.0002305	−0.04613	0.03784
DT2_P4	—	—	—	0.0003517	−0.0005354	0.001137

NOTES: Scientific notation is used to display large quanties; *e.g.,* $4.72E15$ denotes 4.72×10^{15}. In addition, (†) denotes interaction with (1−UNIT−LTD), while (‡) denotes interactions with (UNIT+LTD); *e.g.,* STARG2†denotes STARG2 × (1−UNIT−LTD), and LTARG2‡denotes LTARG2 × (UNIT+LTD). Names of discrete variables, for which differences Δ are estimated rather than elasticities η, are shown in italics.