Investment Strategies and Market Structure: An Empirical Analysis of Bank Branching Decisions

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February 2007

ABSTRACT: This paper analyzes the relationship between the competitive environment faced by depository institutions and the decisions these institutions make regarding the size of their branch networks. Specifically, we consider branches as a sunk investment that potentially increases utility for consumers and examine how local competition and product differentiation affect firms' decisions regarding whether to make such investments. We account for endogenous market structure using an equilibrium structural model, which corrects for bias caused by correlation in the unobservables associated with market structure and branching activity. We estimate the model using data from 1,882 concentrated rural markets. Our results demonstrate the importance of accounting for market structure and product differentiation, and are consistent with a potential entry-deterring effect of bank branch investments.

JEL classification: L11, L13, G21, G28
Keywords: Investments, competition, market structure, banking industry

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* The views expressed in this paper are those of the authors and do not necessarily reflect the view of the Board of Governors or its staff.

We thank Dean Amel, Leemore Dafny, Shane Greenstein, Tim Hannan, Robin Prager, and participants at the 2005 Econometric Society World Congress, the 2004 IOS conference, the Southern Economics Association conference, and seminars at Arizona, Indiana, Harvard/MIT, Toronto, Stanford, Columbia, Dartmouth (Tuck), the Department of Justice, the Federal Reserve Bank of Kansas City and the Federal Reserve Board for helpful comments. All errors are the responsibility of the authors.

I. Introduction

Defying predictions from the late 1990s that advances in information technology might render bank branches obsolete, financial institutions have been aggressively extending their local retail presence over the past several years. A variety of explanations for this "return to retail" have been put forward; this paper explores the potential competitive effects of bank branch expansion.[1] Industry analysts report that investing in branch networks has increasingly been utilized as a strategy to steal market share from competitors, targeting consumers who value more convenient access to branches. Because investments in branches may also be substantial and largely sunk, institutions may be able to use these investments to deter entry or facilitate the exit of competitors. Our empirical analysis, therefore, investigates the relationship between market structure – the operating banks in a market – and the number of branches operated by the market's participants.

Since geographic markets for retail banking are inherently local, our data contains a large cross-section of market observations. The dataset includes 1,882 non-MSA markets, and we analyze the branching activity of 4,891 financial institutions that operate in these markets. We also distinguish among firms that operate in many markets ("multimarket banks"), just one market ("single-market banks") and thrift institutions ("thrifts").[2] These distinctions allow us to assess the competitive consequences of recent

[1] See Clark et al. (2006) for a comprehensive survey of the "return to retail" including various explanations for, and implications of, this trend.

[2] The banks that we classify as "single-market" in our dataset would also qualify as "community banks" under almost all of the definitions that have been used in the community banking literature. Thrift institutions refer to savings banks and savings and loans. These institutions operate under different charters, statutory requirements and regulatory agencies than commercial banks.

deregulation that has facilitated the spread of institutions across multiple markets, and the role of branch expansion strategies in this competition.

Our empirical analysis exploits recent developments in the industrial organization literature to address the econometric endogeneity of market structure in the relationship between branching and competition. As a consequence, the results demonstrate interesting and subtle connections among branching, competition and product differentiation. Most substantially, where institutions (of any type) compete in markets where operating a multimarket bank is particularly attractive, their branch networks are *larger*. Correcting for market structure endogeneity turns out to be crucial; it allows us to uncover a strong negative correlation between unobservables associated with branching and multimarket bank presence. This finding is consistent with deterrence effects of branching – in markets that appear attractive for multimarket banks but into which multimarket banks have not entered, the institutions that do operate have more branches than would otherwise be expected.

The remainder of the paper is organized as follows. Section II provides background: first a brief review of the industrial organization literature on investments and market structure and then a discussion of the rural bank branching application. We describe the estimation strategy in Section III and the data we use for the study in Section IV. Section V presents the empirical results and Section VI concludes.

II. Background

This paper uses data on branching activity in retail banking to empirically investigate the relationship between market structure and the investment strategies of competing firms. Assuming endogenous investments in branches, an individual firm would compare the costs associated with opening additional branches with the additional revenue that could be generated from the investment. This tradeoff could potentially be complicated depending on the amount of market competition faced by firms. In particular, investments in branch networks could increase market concentration if entry is more difficult or exit more likely where operating firms have made such investments. While a substantial industrial organization theory literature analyzes these issues, few empirical studies (in any industry) have been able to tackle it directly.[3]

In this paper, we explore the relationship between branch networks and competition in a cross-section of rural banking markets, distinguishing among single-market (or community) banks, thrift institutions, and multimarket banks. Certain features of this application make for an especially useful setting to analyze potential interactions between investment and market structure. First, there is evidence to suggest that a bank's investments in branches are largely sunk. Specific construction requirements often make commercial space designed for bank branches inappropriate for alternative retail uses.[4] Analysts have suggested that larger branch networks may also serve an advertising function, as branches are thought to represent the "face" of the bank to customers. Many authors (Judd, 1985; Sutton, 1991, et al.) have noted that the commitment associated with sunk investments makes them more credible in influencing competition.

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[3] Tirole's (1988) textbook presents the relevant theory literature; empirical studies include Lieberman (1987), Vogt (1999), Ellison & Ellison (2000), Dafny (2005) and Hamilton & McManus (2005). Ishii (2005) analyzes the ATM deployment decision of operating financial institutions, but does not explore the margin of operating versus not operating. This margin will play an important role in our empirical work.

[4] Steve Reider (cited in Muto, 2005), president of the market-research firm Bancography, states, "There's not a lot of demand for retailers for a space where a good chunk of it is taken up by a cast-iron and concrete vault." Reider goes on to say that "some banks are reluctant to retrofit a former bank location to fit their own design criteria, which can be as expensive as building another bank from scratch."

In addition, practitioners and analysts in the banking industry consider retail branches to be a crucial determinant of a firm's demand. Former Federal Reserve Governor Mark Olson noted that, "Branch offices and networks continue to be critical factors to customers as they choose their financial services providers…Surveys conducted by the Federal Reserve Board indicate that the single most-important factor influencing a customer's choice of banks is the location of the institution's branches."[5] Of course, there are other product characteristics that are likely to be important to consumers. Some consumers may value more personalized service, accessibility of an institution's executives, or longer hours of operation. In fact, we will be able to investigate whether there are different branching strategies for different types of financial institutions and if these strategies depend on the type of competitors a firm faces.

The potential connection between branching and competition was not empirically relevant until relatively recently, as regulation severely limited the potential entry and branching strategies of financial institutions. As late as 1970, only a handful of U.S. states allowed banks to have more than one branch, and several states restricted branching activity through the early 1990s. In addition, banks were typically not permitted to cross state lines until the late 1980s.[6] In this context, there has been vigorous debate in industry and policy circles over whether smaller "single-market"

[5] Speech delivered to the Fortieth Annual Conference on Bank Structure and Competition in Chicago, IL on May 6, 2004. The surveys to which Governor Olson refers are the 2001 Survey of Consumer Finances and the 1998 Survey of Small Business Finances. Studies like Berger, Leusner and Mingo (1997) support the role of branches in consumer demand. They find about twice as many branches as would minimize costs, but suggest that having extra branches may nonetheless be profit maximizing, "since additional offices provide convenience for the bank's customers that may be recaptured by the bank on the revenue side."

[6] A series of papers has examined the consequences of regulatory changes on dynamic efficiency (Jayaratne and Strahan, 1998), entry (Amel and Liang, 1992), merger and acquisition activity (Berger et al., 2004) and entrepreneurship (Kerr and Nanda, 2006).

banks and thrift institutions would represent an important potential source of competition as multimarket banks are permitted to expand their operations.[7] While pointing out that branching is generally related to better financial performance, the FDIC notes that "these relationships are especially evident among community banks, which are less profitable on average than larger institutions."[8]

Our study is close in spirit to Dick's (forthcoming) analysis of large (MSA) banking markets. She relates various measures of quality — including the density of a bank's branch network — to market size, and finds that quality tends to be greater in larger MSAs. Dick's findings suggest that banks use sunk investments in quality, e.g., branch networks, to raise the costs of potential entrants and thereby affect market concentration. Our findings are complementary to Dick's, as we analyze rural markets. Furthermore, because we restrict attention to these smaller markets, we are able to formally combine an analysis of branching activity with a model of endogenous market structure, and thereby provide a more explicit link between local branch network size and the actual competitiveness of markets (controlling for market size).

[7] For example, Hannan and Prager (2004) find that the share of deposits held by multimarket banks is negatively related to deposit rates offered by single-market banks. Cohen (2004) rejects the hypothesis that banks and thrifts operate in independent product markets. Berger et al. (forthcoming) focus on how efficiency improvements affected the competition between single-market and multimarket banks.

[8] The FDIC report goes on to say that "these results suggest that maintaining a branch network may be one way in which smaller institutions can close the profitability gap with their larger rivals." This notion may have deep roots in historical bank performance, as Carlson and Mitchener's (2007) study of branching and Depression-era bank performance suggests. See also Hirtle (2005), which focuses on the returns to the overall branch network of banks (across multiple local geographic markets), for more evidence on the pressure (particularly on multimarket banks) to increase their branching activity.

III. Empirically Analyzing Branching and Market Structure

A goal of our paper is to understand the relationship between bank branching decisions and market structure. Other researchers (at least as far back as White, 1976) have investigated this issue by running a straightforward regression of the form:

$$B_{j,m} = Z_{j,m}\gamma + h(\phi;\vec{N}_m) + \mu_{j,m} \qquad (1)$$

where $B_{j,m}$ is the number of branches that institution j has in market m, $Z_{j,m}$ is a vector of control variables that may vary by firm and/or market, the vector $\vec{N}_m$ is a measure of market structure in market m, and $\mu_{j,m}$ represents the unobservable factors that influence observed branching decisions.

Estimating a regression equation such as (1) assumes that the observed market structure, $\vec{N}_m$, is exogenous. It is reasonable, however, to expect that unobservable factors that affect the returns to operating additional branches within a market may also affect that banking market's overall concentration, or market structure. That is, we would expect there to be some correlation between $\mu_{j,m}$ and $\vec{N}_m$. Without addressing such correlation, estimates of the γ and ϕ parameters would be biased.

To address this endogeneity problem, we employ a two-step estimation procedure that has been adapted to industrial organization applications by Mazzeo (2002a), Watson (2005) and Manuszak and Moul (2006).[9] The first step is a model that predicts observed market structure, $\vec{N}_m$. As highlighted in the previous sections, our analysis will distinguish between different types of institutions: multimarket banks, single-market banks and thrifts. Therefore, our market structure measure $\vec{N}_m$ will incorporate the

[9] These IO applications mirror the approach commonly employed in labor econometrics – see Heckman and MaCurdy (1986) for a discussion and several empirical applications.

number and institution type of all the operating firms in the market. We will explicitly model the determination of $\vec{N}_m$, and then use the parameter estimates from this model to calculate a series of correction terms that are proportional to the correlation between $\mu_{j,m}$ and $\vec{N}_m$. Once computed, we insert these correction terms into (1) to offset any correlation between $\mu_{j,m}$ and $\vec{N}_m$ and thereby obtain unbiased estimates of γ and ϕ.[10]

The market structure model follows the approach of the empirical entry literature developed by Bresnahan and Reiss (1991) and Berry (1992). Specifically, as in Cohen and Mazzeo (2007), market structure is represented by an ordered triple (M, S, T) that represents the number of multimarket banks (M), single-market banks (S), and thrifts (T) that are operating. Within each institution type, firms are assumed to be homogeneous and make decisions on whether to operate based on a latent payoff function of the form:

$$\pi_{I,m} = X_{I,m}\beta_I + g(\theta_I; \vec{N}_m) + \varepsilon_{I,m} \qquad (2)$$

There is a separate payoff function for each institution type, *I*, consisting of market characteristics, $X_{I,m}$; the effect of competitors captured by $\vec{N}_m$; and unobserved factors for each type, $\varepsilon_{I,m}$. It is the potential correlation between the $\varepsilon_{I,m}$'s and $\mu_{j,m}$ that is the source of the endogeneity bias in equation (1). Note that the parameters β_I and θ_I are permitted to vary by type – for example, the effects of multimarket competitors may be different for thrifts, single-market banks and other multimarket banks.

Translating the latent payoff functions into observed market outcomes requires specifying an equilibrium decision process for market participants. We assume a Stackelberg game in which the (homogeneous) firms of each type make irrevocable

[10] The idea is the same as the Heckman "two-step" estimator.

decisions about whether to operate in sequence. As they make these decisions, the firms anticipate that potential competitors will subsequently make entry decisions once the earlier movers have committed to their choice. This characterization yields a Nash equilibrium in which: (1) all operating firms have positive payoffs (Panel A, below); (2) no firm of (any type) would have positive payoffs if it were to enter (Panel B, below); and, (3) payoffs are higher for each firm in the current configuration than for a hypothetical firm of either other type in an alternative configuration that differed by that one firm's institution type (Panel C, below). As such, an observed market structure $\vec{N}$ = (M, S, T) implies the following set of 12 inequality restrictions on equation (2) will hold:

Panel A

$\pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M,S,T)) + \varepsilon_M > 0$
$\pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M,S,T)) + \varepsilon_S > 0$
$\pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M,S,T)) + \varepsilon_T > 0$

Panel B

$\pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M+1,S,T)) + \varepsilon_M < 0$
$\pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M,S+1,T)) + \varepsilon_S < 0$
$\pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M,S,T+1)) + \varepsilon_T < 0$

Panel C

$\pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M,S,T)) + \varepsilon_M > \pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M-1,S+1,T)) + \varepsilon_S$
$\pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M,S,T)) + \varepsilon_M > \pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M-1,S,T+1)) + \varepsilon_T$
$\pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M,S,T)) + \varepsilon_S > \pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M+1,S-1,T)) + \varepsilon_M$
$\pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M,S,T)) + \varepsilon_S > \pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M,S-1,T+1)) + \varepsilon_T$
$\pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M,S,T)) + \varepsilon_T > \pi_M = X_M \beta_M + g(\theta_M; \vec{N} = (M+1,S,T-1)) + \varepsilon_M$
$\pi_T = X_T \beta_T + g(\theta_T; \vec{N} = (M,S,T)) + \varepsilon_T > \pi_S = X_S \beta_S + g(\theta_S; \vec{N} = (M,S+1,T-1)) + \varepsilon_S$

Under the assumption that an additional market participant always decreases payoffs and that the decrease is larger if the market participant is of the same product type, a unique equilibrium exists.[11] Therefore, 12 inequalities corresponding to a particular ordered triple market structure outcome (M, S, T) are satisfied for every possible realization of ($\varepsilon_{M,}$ $\varepsilon_{S,}$ ε_T) based on the data for the market in question and values for the profit function parameters. A predicted probability for each of the possible outcomes is calculated by integrating $f(\varepsilon_{M,}\ \varepsilon_{S,}\ \varepsilon_T)$, which we specify as independent standard trivariate normal, over the regions of the $\{\varepsilon_{M,}\ \varepsilon_{S,}\ \varepsilon_T\}$ corresponding to that outcome. Maximum likelihood selects the profit function parameters that maximize the probability of the observed market configurations across the dataset. The likelihood function is:

$$L = \prod_{m=1}^{M} \text{Prob}\left[(M,S,T)_m^O\right] \tag{3}$$

where $(M,S,T)_m^O$ is the observed configuration of firms in market *m*.

Having estimated the profit function parameters, we can turn to the calculation of the terms we will use to correct equation (1). Consider, for example, a market where $\vec{N}$ = (1,1,1). In this case, we can specify the troublesome correlation as follows:

$$E\left[\mu_{j,m}\middle|(\varepsilon_M,\varepsilon_S,\varepsilon_T)_m : \vec{N}_m = (1,1,1)\right] =$$

$$\rho_M E\left[\varepsilon_M \middle| \vec{N}_m = (1,1,1)\right] + \rho_S E\left[\varepsilon_S \middle| \vec{N}_m = (1,1,1)\right] + \rho_T E\left[\varepsilon_T \middle| \vec{N}_m = (1,1,1)\right] \tag{4}$$

[11] Mazzeo (2002b) contains proofs of existence and uniqueness of the equilibrium, as well as a discussion of the structural derivation of the underlying payoff functions.

Using the estimated parameters from (3), we can back out estimates of the three expectation terms in equation (4). These are then inserted as data (for each market) into (1):

$$B_{j,m} = Z_m \gamma + h(\phi; \vec{N}_m) +$$

$$\rho_M \hat{E}\left[\varepsilon_M \middle| \vec{N}_m = (1,1,1)\right] + \rho_S \hat{E}\left[\varepsilon_S \middle| \vec{N}_m = (1,1,1)\right] + \rho_T \hat{E}\left[\varepsilon_T \middle| \vec{N}_m = (1,1,1)\right] + \zeta_{j,m} \qquad (5)$$

and the ρ_I become additional parameters to be estimated. This procedure ensures that $\zeta_{j,m}$ in equation (5) now has mean zero. As a result, the regression isolates the relationship between branching and competition from unobserved factors that may influence both the underlying profitability of the operating firms and common unobservables in the returns to branching. In addition, we will recover estimates of the ρ_I's which will have an economic interpretation as discussed in section 5.

The logic behind our parameter identification is illustrated in Figure 1 (simplified by abstracting from institution types). To start, the γ parameter is determined by comparing markets represented by points A and B, for which N and $\hat{\varepsilon}$ are the same, but Z varies. Points C and D are used to identify the ϕ and ρ parameters. Assuming that the diagonal line in the figure represents the true γ, the value of $\hat{\varepsilon}$ at point C will determine the estimate of ρ. The benefit of the correction procedure is that with the influence of $\rho\hat{\varepsilon}$ accounted for in the regression, the estimate for ϕ can appropriately come from the difference between points D and E. Figure 2 shows how bias results in the uncorrected regression — here γ is biased upward and ϕ is determined by the vertical distance between C and D.[12] While this example shows ϕ being biased downward without the

[12] To simplify the exposition, we omit point B from Figure 2. This slightly changes the magnitude, but not the direction of the bias, in the ϕ and γ coefficients.

correction, this is not generically the case. The direction of the bias depends on the sign of ρ, which is an empirical question for each application.

Employing a structural approach for addressing market structure endogeneity is particularly useful in cases where the potential correlation is between competitive outcomes and market structure. More traditional instrumental variable methods are hampered by the difficulty of finding appropriate instruments in this context (see Manuszak and Moul (2006) for a detailed discussion of this point and the pitfalls of incorporating *ad hoc* exclusion restrictions). While the resulting econometric identification relies on functional form, our particular application differs from more traditional selection models in which some may argue that the underlying distributional assumptions are arbitrary. In our context, a well-specified game that determines the equilibrium configuration of firms introduces a fundamental non-linearity into the market structure equation (through the 12 threshold inequalities introduced above). The behavioral assumptions underlying the game combine the discrete decisions of potential firms and the strategic interaction among them to yield the threshold conditions associated with a particular configuration of operating institutions. Thus, the market structure equation is inherently non-linear — no comparable linear market structure model could be constructed in this case.[13]

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[13] That is, under our behavioral assumptions a system of linear equations would not be capable of identifying the underlying structural parameters of the profit function that determines the equilibrium configuration of firms. As such, X and Z are the same for the two steps in our analysis. While not required for identification, the market structure model may contain instruments that are not included in the second-stage regression. The following section provides additional details about our empirical specification.

IV. Data

We use data on institutions and their branch networks from 1,882 non-MSA labor market areas (LMAs) as of June 30, 2004. To represent individual observations, geographic markets must be defined in such a way that (1) all the firms in the geographic area compete with each other and (2) consumers do not typically use firms outside their own geographic area. To accomplish (1), we focus on less populated geographic markets, which are unlikely to contain distinct submarkets. We therefore eliminated all urbanized areas (MSAs) and rural areas with relatively high population (LMAs with over 115,000 residents). The Bureau of Labor Statistics defines LMAs as integrated economic areas, combining contiguous counties into a single LMA if at least 15 percent of the workers from one county commute for work to the other. Using LMAs (as opposed to counties) gives us more confidence that two neighboring markets are indeed competitively distinct.[14]

To construct the dependent variable for each step of the model – the number of institutions of each of the three types within each LMA, and the number of branches belonging to each of those institutions – we use data from several sources. The FDIC Summary of Deposits contains location information on all banks and their branches. We classified each bank and branch within its LMA market: to be classified as a single-market bank, an institution must have a bank charter and receive at least 80 percent of its deposits from branches in that market; otherwise, the bank was classified as a

[14] In addition, these markets have far fewer competitors, making the endogenous market structure model more tractable. Importantly, many of the mergers that raise competitive concerns with regulators do so because of their effect on the market structure of these smaller markets.

multimarket bank.[15] Analogous information about operating thrifts was obtained from the Office of Thrift Supervision's Branch Office Survey. Table 1 shows the distribution of firm configurations among the LMA markets in our dataset. Each panel of the table represents a particular number of thrifts in the market, with the rows and columns of each panel referring to single-market banks and multimarket banks, respectively. The numbers in the table represent the number of markets in which the operating firms follow the given configurations – for example, there are 64 markets that include one multimarket bank, one single-market bank and zero thrifts.[16] Table 2 summarizes the branching data for the institution/market combinations in the dataset. Note that in approximately 55 percent of the cases a firm operates only one branch (this includes all the active firms in approximately 19 percent of our markets). About ten percent of the firms have more than three branches in a particular market. Differences in branching across different market configurations will be exploited in the empirical analysis.

The control variables are summarized in Table 3. These variables represent market characteristics that may contribute to the profitability of financial institutions as well as exogenous factors that may influence the decision of banks to open additional branches in a particular LMA. These variables include: (1) population; (2) the number of

[15] This definition is consistent with previous papers that distinguish "single-market" banks. Note that a bank with 90 percent of its deposits in market A and 10 percent in market B would, according to this definition, be classified as a single-market bank in market A and a multimarket bank in market B. This reflects the view that the decision to operate in market B would be significantly more affected by the role of the branch in B in the bank's overall network, as opposed to in market A where the presence of any branches in market B would be less important.

[16] In our estimation of the endogenous market structure model we have collapsed the distribution of markets from above for each of the three categories – that is, all markets with three or more thrifts are treated as if they have at least three, all markets with four or more single-market banks are treated as if they have at least four, and all markets with six or more multimarket banks are treated as if they have at least six. This reduces the complexity of the estimation without appreciably influencing the results (see Cohen and Mazzeo 2007).

non-farm establishments; (3) the number of farms; (4) per capita income; (5) a dummy variable for LMAs in the five states that still had some restrictions on branching activity as of 2004; and (6) a dummy variable indicating whether the LMA borders an MSA. The sources for these variables are the Census Bureau, the Agricultural Census, and the Bureau of Economic Analysis.[17]

V. Results

This section presents and discusses the estimated parameters that measure the relationship between competition and branching activity in our sample of rural banking markets. We begin with a brief overview of the results from the market structure model. Then, we proceed to the branching regressions, whose parameter estimates demonstrate the more nuanced competitive effects on branching. These results highlight the importance of addressing market structure endogeneity in the analysis of branching and distinguishing the competitive effects of the defined institution types.

V.A Market Structure Model

We begin with a brief review of the results from the market structure model, which estimates the latent payoff function parameters in equation (2). Note that we specify separate effects for each type of depository institution in each market (multimarket banks, single-market banks and thrifts), since our likelihood is based on the observed triples (M,S,T) of extant firms across the markets in our dataset. The $g(\theta_I;\vec{N}_m)$ term from equation (2) includes individual competitive effect dummy

[17] The continuous explanatory variables (population, establishments, farms and per capita income) are scaled to facilitate estimation in the results that follow. The value for each variable will equal that market's observation divided by the sample mean for that variable across the 1,882 markets in the dataset.

variables whose parameters represent the incremental effects of additional competitors; Table 4 lists the effects estimated. Critically, separate parameters are estimated for the effect of each of the three types of competitors on multimarket banks, single-market banks and thrifts.

Table 4 displays the competitive effects in the top panel and the control variables below. These estimates indicate the relative effect on the returns to operating each type of financial institution under different market conditions and with various sets of competitors. For the competitive effects, the key result is the large difference between the impact of same-type and different-type institutions. For example, the effect of the first multimarket competitor on multimarket banks (-1.111) is more than three times the effect of the first single market competitor, while the effect of the first thrift is negligible (-0.020).[18] The incremental effects of additional competing firms are smaller than for the first competitor; for example, the effect of the second multimarket competitor on multimarkets is roughly four-fifths the effect of the first (–1.111 vs. –0.895).

The control-variable parameters indicate the demographic conditions under which an operating institution of each type will be more or less attractive. For example, the number of establishments has a positive and significant impact on all three types, but the relative magnitude of the coefficients reveals that multimarket banks benefit from local commercial activity the most. Multimarket banks are also most affected, positively, by proximity to urbanized areas. Single-market banks (but not thrifts) tend to operate more in markets with substantial agricultural activity. Branching restrictions have a significant adverse effect on multimarkets (larger than the effect of having a second single-market

[18] The comparisons are similar for the profits of single-market banks (–0.916 vs. –0.278 and 0) and thrifts (–1.178 vs. –0.050 and –0.003).

bank competitor), but a significant positive effect on single-market banks. This suggests that the option to branch is a particularly important consideration for multimarket banks, which we will revisit in our discussion of branching strategies of the different types of institutions. Finally, combining the control variables and the relative value of the three sets of intercept terms indicates that, all else equal, multimarket banks would earn the highest baseline profits ($C_M = 2.94$ vs. $C_S = 1.01$ vs. $C_T = -.45$).[19]

V.B Branching Regressions

Most importantly, the estimates presented in Table 4 allow us to calculate the corresponding error-term predictions for each market that are used to estimate equation (5). Table 5 displays the results from the second step branching regressions, run separately for institutions of each of the three types in the three vertical panels of the Table. In each panel, an observation is an institution (of that type)/LMA combination, and the dependent variable is the number of branches the institution operates in that LMA. There are two columns of results in each panel, a base case corresponding to equation (1) in which no endogeneity corrections are made and a version in which the estimated error terms from the market structure model are included as regressors, as in equation (5). We have chosen a Tobit specification for estimating these equations; this treatment of the dependent variable acknowledges potential differences between institutions with a single branch (a prerequisite for operating in the market) and those

[19] These profits reflect the payoffs to firms of each type located in markets with a value of one for the explanatory variables, assuming that each type firm is a monopolist operating in a market that borders an MSA, has branching restrictions, and where the control variables are at the sample mean. Positive payoffs correspond to a prediction of entry (operation) in a market; thrifts appear as the effects of the explanatory variables become more strongly positive (to offset the negative baseline profits).

with more than one branch (though the results are qualitatively similar if we treat the dependent variable as linear).[20]

The estimated parameters representing the impact of competitors on branching activity are listed in the top three rows of Table 5. We have specified the competitive effects to be linear by product type; therefore, we have nine (pairs) of estimated parameters corresponding to the effect of additional competitors of each type on the number of branches operated by multimarket banks, single-market banks and thrifts, respectively.[21] The top row of Table 5, describing the impact of multimarket competitors, is of particular interest. Critically, the endogeneity correction matters here substantially – the estimates are negative and significant in the unadjusted results, but positive and significant in the right-hand column of each pair. Correspondingly, the estimated coefficients on the terms representing the correlations between the branching and the multimarket profit function errors are negative and significantly different from zero (in the next set of rows in the table). It appears that there is a strong enough negative correlation between the unobservables associated with multimarket bank presence and with branching to significantly bias the uncorrected results. Competition from single-market banks and thrifts, however, is associated with fewer branches per firm. Note that these results contrast with the market structure model estimates, in which the important distinction was between undifferentiated and differentiated competitors. Here, the particular product type of the competitor is the key distinguishing factor in the effect of competitors on branching – multimarket competition induces a different

[20] The number of observations, including the number of observations for which the dependent variable is exactly one, are noted at the bottom of Table 5.

[21] We report the linear specification of the competitive effects for clarity. An alternative specification with incremental competitive effects (as in the market structure model) produced similar results.

strategic response (from all types) as compared with single-market bank and thrift competitors.

We interpret the adjusted regressions to strongly suggest that the *market conditions that are conducive to operating multimarket banks induce institutions (of all types) to expand their branch networks*, while this competitive response is not optimal where single-market banks or thrifts are more likely to operate. Just as competition with operating multimarket banks induces additional branching, incumbent firms may also be able to discourage potential multimarket bank entrants from joining particular local markets by increasing the size of their own branch networks. We cannot infer this behavior directly, but our results are nonetheless consistent with a scenario in which incumbent firms that anticipate further entry by multimarket banks (in markets with characteristics that would make multimarket banks particularly profitable) add additional branches, and multimarket banks correspondingly choose not to enter.[22] In that case, we would observe the incumbent firms offering more branches than expected and markets containing fewer multimarket banks than expected, which is consistent with the estimated negative correlation between the branching unobservable and the multimarket bank presence unobservable.

In this case, a simple regression of branches on market structure would indicate that institutions operate more branches in more concentrated markets (i.e., negative parameter estimates), to the extent that markets in which additional branching and a lack

[22] This may reflect the differentiated strategies of these types of institutions – single-market banks and thrifts focus on providing more personalized service, while multimarket banks have broader branch networks by nature. By expanding their branch networks, incumbent single-market banks may be effectively co-opting the favored strategy of multimarket banks where conditions for their entry appear attractive.

of multimarket banks are prevalent. The uncorrected results would therefore obscure the fact that while multimarket banks' underlying behavior is to compete in branches, this behavior induces other types to do so as well. Once we account for endogenous market structure, this is revealed. In fact, the competitive implications of branching are so strong that it appears to successfully pre-empt the entry of multimarket banks.[23] Crucially, these branching strategies appear to depend critically on the identity of (potential) competitors – only the multimarket banks are associated with more branching activity by operating institutions.[24]

The remainder of Table 5 presents the estimated control variable parameters regarding the baseline propensity of financial institutions to establish additional branches in a market. While the estimated effects of the control variables generally have the expected signs, the magnitudes are reasonably small. The exception is the population variable, which is positive and significant for all institution types in both the unadjusted and the adjusted regression. For example, the adjusted regression parameter values indicate that a 10,000 person increase in market population is associated with approximately one quarter of an additional branch per operating single-market bank.[25] Interestingly, higher income residents do not correlate with more branching activity, even though income predicts entry of each type of firm. The branching restriction dummy

[23] To be clear, while we can address market structure endogeneity, our methodology cannot allow us to distinguish the preemption hypothesis from others that could potentially explain the estimated correlation. We intend to pursue this in future work.

[24] Of course, competition from single-market banks and thrifts may induce additional investments as well – just along different dimensions. Unfortunately, there is no data (such as access to bank executives or familiarity of bank employees with regular customers) that would enable us to address this possibility.

[25] Given the scaling relative to the sample mean used in the estimation and the data from Table 3, a population change of 10,000 is about 41% of the sample mean (24,315). Multiplying 0.41 by the parameter estimate 0.564 yields a value of 0.23 for the increase in single-market bank branches.

estimate is unexpectedly positive for multimarket banks, but the increase in the coefficient in the adjusted regression (and the results from the market structure model) may indicate that entry of multimarket banks is being deterred by these regulatory rules.

Taken together, the results from Table 5 suggest important strategic interactions between branching investments, competition and product differentiation. The comparison between the first and second columns in each pair of results demonstrates the importance of accounting for market structure endogeneity in this context. Advice from industry analysts and regulatory agencies based on the correlation between branches and profitability that fails to consider the potential effects of branching on market structure may result in ineffective investments by community banks and thrifts (i.e., in markets where multimarket banks already operate). In particular, the profound difference between multimarket bank competition and other financial institutions is highlighted by these results. Policy makers may be interested in this market-level consequence of multimarket bank competition. Along with the efficiency benefits other studies have documented, our results suggest that when multimarket banks are present, consumers are provided with more branch locations than would be expected in a similar economic environment or if the market consisted of only single-market banks and thrifts. Given the impact of the market structure endogeneity correction, the mere threat of entry by multimarket firms may be sufficient to induce this response.

VI. Conclusion

This paper adds to the relatively small empirical literature that explores the connection between the investment strategies of firms and the amount of competition they face, by examining the decision of financial institutions regarding the extent of their local branching networks. We acknowledge the importance of product heterogeneity in this industry by distinguishing between multimarket banks, single-market banks and thrift competitors in the analysis. By doing so, we uncover interesting insights about investment strategies in the presence of heterogeneous competitors. While competition from traditional single-market banks and thrifts is associated with smaller branching networks, all types of institutions tend to have more branches when they face (or could potentially face) multimarket banks as their competitors. These insights are lost if the analyst (1) ignores product differentiation among these three types of firms and (2) fails to account for the endogeneity of competitors' presence when analyzing branching decisions. The empirical results also provide a powerful demonstration for why (2) is particularly important in an application like this where market structure could affect investment and vice versa – failing to account for the endogeneity of market structure would have obscured the key result relating multimarket bank competition and branch network expansion. This sort of analysis will be crucial as empirical industrial organization researchers continue to explore applications in which investment strategies and market structure are interrelated.

The empirical analysis undertaken in this paper makes inferences based on differences among a cross-section of banking markets, all of which are observed at a single moment in time. While this identification strategy is informative, it does not fully incorporate the dynamic process in which markets become more concentrated over time as firms enter and exit the market and make investments in additional branches. An important extension to this analysis would incorporate data on the timing of firm entry, as well as the opening of additional branches within markets where institutions are already operating. Such an extension could potentially verify that incumbents use branching to pre-empt the entry of multimarket banks, as suggested by our results. Finally, it is important to note that while we have demonstrated correlations between investment in branches and market competition, the effects on consumer welfare are ambiguous. Consumers may face lower or higher deposit and loan rates depending on competition, which will trade off against the effects of different type of institutions having more (or fewer) branches.

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Figure 1:

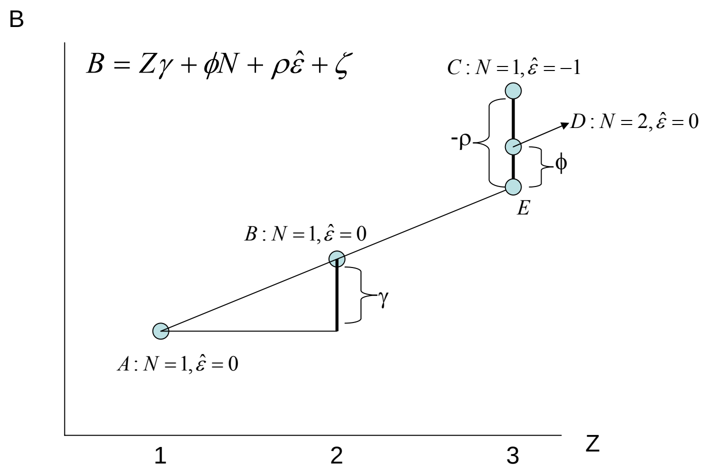

Figure 2:

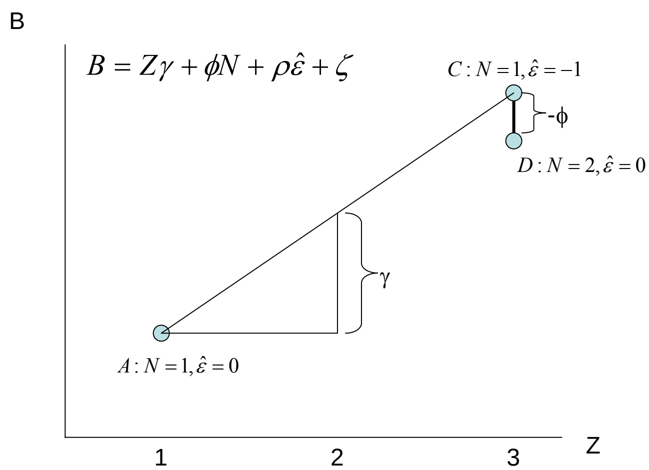

Table 1: Market Configurations

Thrifts=0

Single-market \ Multimarket	0	1	2	3	4	5	6+	*Total*
0	14	86	116	106	92	58	86	*558*
1	19	64	92	66	62	38	48	*389*
2	12	31	30	27	33	20	24	*177*
3	7	5	11	23	7	8	14	*75*
4+	2	5	13	13	9	7	27	*76*
Total	*54*	*191*	*262*	*235*	*203*	*131*	*199*	*1275*

Thrifts=1

Single-market \ Multimarket	0	1	2	3	4	5	6+	*Total*
0	0	6	14	32	26	25	51	*154*
1	3	12	16	18	20	12	46	*127*
2	4	4	9	11	13	12	28	*81*
3	0	2	9	4	7	11	13	*46*
4+	1	3	1	7	9	16	16	*53*
Total	*8*	*27*	*49*	*72*	*75*	*76*	*154*	*461*

Thrifts=2

Single-market \ Multimarket	0	1	2	3	4	5	6+	*Total*
0	0	1	1	6	3	6	19	*36*
1	2	0	2	5	9	4	13	*35*
2	1	0	1	2	3	1	6	*14*
3	0	2	1	1	2	2	5	*13*
4+	0	0	1	1	1	3	11	*17*
Total	*3*	*3*	*6*	*15*	*18*	*16*	*54*	*115*

Thrifts=3+

Single-market \ Multimarket	0	1	2	3	4	5	6+	*Total*
0	0	0	0	1	1	0	4	*6*
1	0	0	0	0	0	0	4	*4*
2	0	0	2	1	0	0	2	*5*
3	0	0	0	0	1	1	6	*8*
4+	0	0	1	0	1	0	6	*8*
Total	*0*	*0*	*3*	*2*	*3*	*1*	*22*	*31*

Table 2: Distribution of branches per market, by type

# of Branches	Type			
	M	S	T	All
1	53%	55%	68%	55%
2	25%	25%	21%	25%
3	11%	11%	7%	11%
4	5%	5%	2%	5%
5	3%	2%	1%	2%
6+	3%	2%	1%	2%

Table 3: Summary Statistics for Explanatory Variables

	Mean	Med	Std Dev	Min	Max
Population	24315	17119	21892	51	114424
Establishments	567	389	556	1	5305
Farms	683	565	526	1	8249
Per Capita Income (in 000s)	24599	24102	4796	11362	89471
Branching Restrictions	0.19	0	0.39	0	1
Border Market	0.56	1	0.50	0	1

N=1882 markets

Table 4: Parameter Estimates from Endogenous Market Structure Model

(Asymptotic t statistics in parentheses)

	Multimarket Bank Profits		Single-market Bank Profits		Thrift Profits	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
First MM competitor	-1.111	(-16.65)	-0.278	(-1.59)	-0.050	(-0.27)
Second MM competitor	-0.895	(-21.16)	--	--	--	--
Additional MM competitors	-0.747	(-39.72)	-0.098	(-3.04)	-2.E-08	(-0.00)
First SM competitor	-0.304	(-3.64)	-0.916	(-29.07)	-0.003	(-0.03)
Second SM competitor	--	--	-0.624	(-19.48)	--	--
Additional SM competitors	-0.126	(-3.30)	-0.504	(-14.27)	-1.E-09	(-0.00)
First Thrift Competitor	-0.020	(-0.31)	-2.E-06	(-0.00)	-1.178	(-24.65)
Second Thrift Competitor	--	--	--	--	-0.920	(-11.58)
Additional Thrift Competitors	-3.E-01	(-3.32)	-5.E-08	(-0.00)	--	--
Population	0.226	(2.79)	-0.211	(-2.79)	0.126	(1.71)
Establishments	1.2675	(17.27)	0.308	(4.17)	0.350	(5.77)
Farms	0.663	(14.84)	0.765	(18.71)	0.181	(3.55)
Per capita income	0.410	(3.40)	0.787	(5.39)	0.768	(4.21)
Border Market	0.097	(1.77)	-0.130	(-2.37)	-0.022	(-0.34)
Branching Restrictions	-0.492	(-6.98)	0.204	(2.60)	-0.010	(-0.11)
Intercept	0.765	(5.31)	-0.718	(-3.16)	-1.841	(-7.34)

N=1882

Log Likelihood = -6749.8

Note: Population, establishments, farms and percapita income are expressed as percentages of sample mean

Table 5: Tobit Estimates from Branching Model

(Asymptotic t statistics in parentheses)

	Multimarket Bank Branches				Single-market Bank Branches				Thrift Branches			
	Unadjusted		Adjusted		Unadjusted		Adjusted		Unadjusted		Adjusted	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
MM competitors	-0.110	(-3.93)	0.334	(6.12)	-0.080	(-2.18)	0.191	(2.36)	0.169	(2.25)	0.515	(3.73)
SM competitors	-0.225	(-8.48)	-0.202	(-1.62)	-0.331	(-7.14)	-0.317	(-1.94)	-0.136	(-1.95)	0.131	(0.33)
Thrift competitors	-0.095	(-2.15)	-0.318	(-1.17)	-0.109	(-1.60)	-0.655	(-1.58)	-0.148	(-1.13)	-9.149	(-2.73)
MM market presence unobservable			-0.724	(-10.46)			-0.413	(-4.22)			-0.478	(-2.94)
SM market presence unobservable			0.033	(0.22)			-0.009	(-0.04)			-0.295	(-0.60)
Thrift market presence unobservable			0.207	(0.93)			0.484	(1.43)			9.130	(2.71)
Population	0.884	(12.12)	0.643	(7.52)	0.673	(4.77)	0.567	(3.64)	0.656	(3.35)	1.624	(3.60)
Establishments	0.145	(2.35)	0.053	(0.51)	0.193	(1.64)	0.227	(1.28)	-0.060	(-0.36)	2.574	(2.46)
Farms	0.098	(2.19)	-0.117	(-1.09)	-0.014	(-0.23)	-0.133	(-0.88)	-0.027	(-0.22)	1.091	(1.78)
Per capita income	-0.035	(-0.16)	-0.294	(-1.12)	-0.183	(-0.55)	-0.164	(-0.39)	-0.478	(-0.80)	5.514	(2.30)
Border Market	-0.101	(-1.45)	-0.191	(-2.72)	-0.023	(-0.22)	-0.108	(-1.00)	-0.466	(-2.35)	-0.617	(-2.92)
Branching Restrictions	0.102	(1.03)	0.335	(3.23)	-0.060	(-0.46)	0.079	(0.54)	-0.557	(-2.04)	-0.512	(-1.83)
Intercept	0.073	(0.33)	-0.208	(-0.86)	0.898	(2.56)	0.363	(0.76)	-0.434	(-0.67)	-21.474	(-2.81)
Variance of branching error	2.346	(74.80)	2.323	(74.94)	2.064	(41.00)	2.050	(41.05)	1.928	(19.26)	1.907	(19.28)
Psuedo R-squared	0.0464		0.0526		0.0397		0.0440		0.0526		0.0609	
Observations	7371				2329				793			
Observations with 1 branch	3923				1060				542			

Note: Population, establishments, farms and percapita income are expressed as percentages of sample mean