THE JOURNAL OF FINANCE • VOL. LXII, NO. 1 • FEBRUARY 2007

Learning by Observing: Information Spillovers in the Execution and Valuation of Commercial Bank M&As

GAYLE DELONG and ROBERT DEYOUNG*

ABSTRACT

We offer a new explanation for why academic studies typically fail to find value creation in bank mergers. Our conjectures are predicated on the idea that, until recently, large bank acquisitions were a new phenomenon, with no best practices history to inform bank managers or market investors. We hypothesize that merging banks, and investors pricing bank mergers, learn by observing information that spills over from previous bank mergers. We find evidence consistent with these conjectures for 216 M&As of large, publicly traded U.S. commercial banks between 1987 and 1999. Our findings are consistent with semistrong stock market efficiency.

You can observe a lot just by watching.
—Lawrence Peter (Yogi) Berra

UNDER THE SEMISTRONG EFFICIENT MARKETS HYPOTHESIS, stock prices react positively (negatively) to public events and announcements that informed market participants expect will increase (decrease) long-run firm value. However, realized long-run outcomes need not be consistent with short-run market reactions. One reason is that, after the event, the public information set about the firm—including information idiosyncratic to the firm, its competitors, its customers, its production technology, or its regulation—may change unexpectedly in a way that exacerbates, mutes, or reverses the impact of the short-run event on long-run firm value. Another reason is that the event that is being priced in the short-run may itself be poorly understood by market participants. Indeed, if the information necessary to correctly value the event is not in the public information set—say, because the event is a new kind of phenomenon—then even in the absence of post-event informational surprises, the initial reaction of a semistrong efficient market may be an inefficient long-run predictor of firm value.

*Delong is from the Zicklin School of Business at Baruch College/CUNY. DeYoung is from the Federal Deposit Insurance Corporation. A substantial portion of this research was performed when DeYoung was at the Federal Reserve Bank of Chicago. The views expressed in this paper are those of the authors and do not necessarily reflect the views of either the Federal Deposit Insurance Corporation or the Federal Reserve Bank of Chicago. The authors thank Yakov Amihud, Allen Berger, Rob Bliss, Eli Brewer, Kenneth Daniels, Paul Halpern, Beverly Hirtle, Wenying Jiangli, Morris Knapp, David Marshall, Hamid Mehran, Art Murton, Don Morgan, Rich Rosen, Wei-Ling Song, Robert Stambaugh, Kevin Stiroh, Dan Sullivan, Greg Udell, and Haluk Unal and two anonymous reviewers for their helpful comments, and Susan Yuska for her assistance with the data.

Mergers and acquisitions (M&As) of large banking companies over the past two decades have been difficult to value, as well as difficult to execute, for both of the above reasons. First, the banking industry experienced a series of substantial and unpredictable strategic shocks during the 1980s and 1990s. Examples include the rapid commoditization of consumer credit markets (home mortgages, credit card loans, auto financing), the disappointing performance of a thought-to-be-promising business model (Internet banking), a large merger that required the Congress to repeal the Glass–Steagall restrictions on banking and finance earlier than expected (CitiCorp-Travelors), and slower-than-expected geographic integration (there is still no banking company with full service branches in all 50 states). It is reasonable to expect, however, that the frequency and magnitude of these types of informational shocks will diminish over time as the industry approaches a structural, technological, and regulatory equilibrium, thus stabilizing the informational environment in which bank mergers are valued and executed.

Second, because decades of strict regulation had prevented commercial banks from operating across either state lines or product market boundaries (e.g., insurance, brokerage, securities underwriting), M&As involving large, publicly traded banking companies were a relatively new phenomenon in the 1980s and into the 1990s. There was little reliable information available to the market, or even to the merging banks themselves, regarding which types of mergers would create the most value or which banking companies would be good at planning and executing mergers—in other words, there were no established best practices for merging two large banking companies. As more commercial bank mergers occurred over time, however, one might expect that such information and best practices would have emerged, and that this information would eventually have spilled over from one bank to other banks, and from these banks to investors. Stated differently, it is reasonable to expect that banks learn how to better plan and execute mergers by observing previous bank mergers, and it is similarly reasonable to expect that investors learn how to better value bank mergers as they observe and evaluate more of them. It is this potential for "information spillover" and "learning-by-observing" that is the focus of this study.

An intensive process of mergers and acquisitions has transformed U.S. commercial banking from an industry best characterized by thousands of small, traditional, privately held firms shielded from geographic and product market competition, to an industry now characterized by increasingly large and technologically progressive banks in vigorous competition to sell a wide range of financial services. This massive industry consolidation was expected to enhance efficiency by eliminating banks that were operating below efficient scale, exposing local banks to competition from other markets, and reallocating assets away from inefficient bank managers. However, academic studies find little systematic evidence that the stock market expects bank mergers to create value, that bank mergers improve financial performance in the long run, or that the market can predict postmerger financial performance. Some plausible explanations for these findings include, for example, managerial hubris and other

principal-agent problems, an ongoing industry disequilibrium that makes executing and evaluating bank mergers difficult, and accounting conventions idiosyncratic to the banking industry that cloud performance measurement.

We offer a new explanation for these empirical findings. We argue that mergers of large, publicly traded commercial banks in the 1980s and 1990s were difficult to plan, execute, and value because these mergers were in many ways a new phenomenon. When regulatory restrictions on interstate banking and nonbanking financial activities were rolled back in the 1980s and 1990s, M&As became a vehicle for commercial banks to expand into new geographic markets and new financial products such as brokerage, insurance, and investment banking. However, these acquiring banks had no best-practices guidelines for planning and executing these increasingly large and complex acquisitions, and capital markets had no experience evaluating these new kinds of deals. Under such circumstances, it is not surprising that many and perhaps most commercial bank M&As would perform poorly, nor is it surprising that investors would have difficulty pricing bank M&As.

We argue further that such circumstances eventually must change due, in large part, to information spillover. That is, we hypothesize that commercial banks learn how to better plan and execute M&As not only by participating in repeated acquisitions themselves, but also by observing the previous mistakes and successes of other acquiring banks. Note the important distinction between "learning-by-doing" and "learning-by-observing." The former is fueled by information generated inside the firm, while the latter, which is the focus of this study, is fueled by information generated outside the firm that spills over into the public sphere. Similarly, we hypothesize that investors learn how to better evaluate bank mergers by observing the successes and deficiencies of previous bank acquisitions.

If these information spillover hypotheses are correct, then we should observe that the typical commercial bank merger of the mid- to late 1990s created more value than did the typical commercial bank merger of the 1980s, because bank managers would have benefited from observing a larger number of previous commercial bank M&As in the newly deregulated and technologically advanced banking environment. We should also observe that the stock market more accurately predicted the long-run performance of commercial bank M&As announced during the 1990s than those announced during the 1980s. Note that these patterns would be consistent with the extant literature that the financial performance of the *average* bank merger announced during the 1980s and 1990s has been poor, and that *on average* the ability of the stock market to predict post-bank-merger performance during the 1980s and 1990s has been poor.

We present four formal hypotheses. Two are about value creation by bank M&As and how this value creation relates to information spillover from previous bank M&As, and two are about stock market valuations of bank M&As and how these valuations relate to information spillover from previous bank M&As. We test our four hypotheses using data from 216 M&As between publicly traded commercial banking companies in the United States between 1987 and 1999.

These empirical tests are based mainly on the inter-relationships among three M&A-related variables, namely, the abnormal stock market returns for the combined banks upon merger announcement, the long-run change in the financial performance of the combined banks, and the volume of other (unrelated) bank M&As in the years prior to the merger announcement.

We find strong and persistent evidence consistent with the notion that managers of merging banks learn by observing previous bank mergers, and persistent albeit somewhat weaker evidence that market investors learn by observing previous bank mergers. Our results suggest that the value to bank managers and market investors of the information present in previous mergers decays relatively quickly—sometimes after just a single year—consistent with the rapid pace of change in bank regulations, banking technologies, industry structure, and merger profiles in the United States during our sample period. These findings help explain why many academic studies reject the notion that bank M&As have created value. More broadly, our findings imply that the stock market is a poor evaluator of phenomena that are incompletely understood by market participants. Note that if this "incomplete understanding" is characterized as a deficiency in the stock of public information (which seems reasonable), then the inability of investors to accurately price commercial bank M&As observed in previous studies becomes quite consistent with the theory of semistrong market efficiency.

I. Experience Effects

Asher (1956), Arrow (1962), Alchian (1963), Hartley and Corcoran (1978), and others develop the concept of experience effects to explain efficiency differences between British and U.S. airframe manufacturers after World War II. The concept is typically expressed as follows: Holding production technology and firm size constant, as a firm accumulates experience using the technology, unit costs fall. Experience is usually measured by accumulated production volume over time starting from the initial unit produced, and experience effects are often characterized as "learning curves." Ghemawat (1985) collects information on 97 such learning curves from firms in various industries. For over 80% of the firms in his sample, a doubling of experience (that is, a 100% increase in accumulated production between time s and time t, $s < t$) is associated with a 10–25% decline in unit costs.

While it seems intuitive that more experience improves outcomes, in some cases experience can actually impede understanding, progress, and profits. Merlo and Schotter (2003) construct an experiment to test whether subjects learn better by doing or by observing, and find that "observers" outperform "doers" in determining the unique Nash equilibrium in a multiround tournament. Doers focus on each round individually, and receive either positive or negative reinforcement for the actions they take, while observers have the luxury of considering potential payoffs from hypothetical decisions. Jovanovic and Nyarko (1996) model the influence of learning-by-doing on technological choice. Agents who invest their human capital to learn a technology tend to be reluctant to

switch technologies, even when new technologies promise greater output. In the realm of finance Gervais and Odean (2001) model how traders and investors overemphasize their successes and thereby become overconfident, which can lead in turn to lower profits from future transactions. Griliches (1979) argues that measures of learning that are based on accumulated experience over time can overstate a firm's knowledge, because knowledge gained in the past depreciates over time.

In addition to the knowledge they accumulate from their own activities, Griliches (1979) points out that firms also accumulate knowledge via information spillover from the activities of competitors, suppliers, customers, universities, and government. In this study we characterize the experience gained from spillover as "learning-by-observing," to distinguish this external experience channel from "learning-by-doing," in which the creation and exploitation of new information is internal to the firm. For example, because investors are external to the firms they value, the stock market cannot learn by doing, but can learn by observing private information that spills over into the public sphere. Pastor and Veronesi (2003) model the market's valuation process in the presence of learning about firm profitability. Starting with the straightforward theoretical result that market-to-book ratios are positively related to earnings uncertainty, they hypothesize that market-to-book ratios should decline over firms' lifetimes as information about the firms' potential earnings streams becomes more certain. They find empirical support for these predictions, especially for young firms and for firms that do not pay dividends.

There are numerous channels through which useful information can spill over from one firm or industry to another firm or industry. For instance, consulting firms can be great clearinghouses for knowledge. Indeed, Ofek and Sarvary (2001) show that consulting firms leverage their knowledge from previous projects when they embark on new projects. Investment banks are probably a less important source for the spillover of unbiased, value-relevant information, as Rau (2000) finds that investment bankers are more interested in closing the deal than in creating mergers that perform well. A less formal channel is "the industry buzz" that travels through trade publications (e.g., the *American Banker*), industry networks, and professional/social circles. Information can also spill over via labor mobility, and in the longer term via regulatory filings. In the semiconductor industry, for example, there is evidence linking technology spillover to engineers changing employers (Irwin and Klenow (1994)) and also to patent filings (Almeida and Kogut (1999)).

In the banking industry, the location of regional and headquarters offices in close proximity to each other within large cities is likely to increase the frequency and speed of information spillover among banks, clients, and personnel through both formal and informal channels.[1] Moreover, the recent consolidation of the U.S. banking industry has likely intensified these information

[1] The idea that a dense economic landscape makes knowledge more likely to spill over between firms in the same industry dates to Alfred Marshall (1890). Carlino (2001) provides an overview of how urban characteristics impact knowledge spillovers, product innovation, and local economic growth.

flows as managers move from bank to bank as a result of merger-induced reassignments, buyouts, or overhead reductions. If anything, information spillover in the banking industry may be of higher quality than in other industries: Extensive quarterly regulatory filings provide an especially detailed source of financial and operating information and may make it relatively easier for industry analysts to validate qualitative information (i.e., the buzz) about commercial banking companies.

To date, there has been little systematic investigation of experience effects at financial institutions. Remolona and Wulfekuhler (1992) argue that finance companies that entered niche markets (such as leasing) earlier than their commercial bank competitors benefited from "dynamic scale economies in information because of their early entry and accumulated experience." However, the authors do not estimate the impact of this accumulated experience on costs or productivity (i.e., a learning curve). DeYoung (2005) argues that newly chartered Internet banks may face two learning curves, one learning curve related to the general banking experience accumulated as the new bank matures, and another technology-specific learning curve related to the experience accumulated as the bank implements a new (Internet) business model. He finds strong evidence of the former but little evidence of the latter.

There is mixed evidence regarding experience effects at acquiring banks. DeYoung (1997) finds that mergers in which the acquiring bank has recent experience with acquisitions are more likely to generate postmerger cost efficiency gains. Zhang (1997) finds that abnormal returns tend to increase with experience for banks that make Federal Deposit Insurance Corporation–assisted acquisitions of insolvent banks, but not for banks that make nonassisted acquisitions. Leshchinkskii and Zollo (2004) find that acquisition experience is positively correlated to postmerger financial performance, but only for acquiring firms that carefully codify their experiences in manuals and systems. In contrast to these studies, Beitel, Schiereck, and Wahrenburg (2004) find lower market returns upon the announcement of bank acquisitions in which the bidders were experienced acquirers.

II. Bank M&A Performance

One of the puzzles in the empirical finance literature in recent years is the lack of systematic evidence that bank M&As enhance firm value. For example, in their review of the literature on bank mergers and cost efficiency, Berger, Demsetz, and Strahan (1999, p. 162) conclude that these studies "show very little or no cost X-efficiency improvement . . . on the order of 5% or less." These findings are surprising because the geographic-expansion M&As of the 1980s and 1990s were widely expected to generate scale economies and remove poorly run target banks from the industry. Some researchers offer plausible explanations for these unexpected results. Demsetz and Strahan (1997) and Hughes et al. (1999) offer evidence that merger-induced cost reductions did occur but were offset by the increased costs associated with changes in postmerger risk profiles and business strategies. Kwan and Wilcox (1999) argue that cost

savings were hidden by accounting conventions. Akhavein, Berger, and Humphrey (1997) find evidence that some bank mergers focused on revenue gains rather than cost reductions. Finally, Bliss and Rosen (2001) argue that some bank mergers were driven by managerial hubris rather than efficiency motives.

James and Wier (1987), Cornett and De (1991), Houston and Ryngaert (1994), Becher (2000), DeLong (2001), Houston, James, and Ryngaert (2001), Rosen (2006), and others study the initial market reaction to the announcement of bank mergers. Collectively, these studies document the following stylized facts: Abnormal returns to target firms are large and positive, abnormal returns to acquiring banks are marginally negative, and combined abnormal returns are insignificant. A handful of other studies find mixed evidence when testing whether abnormal market returns are good predictors of postmerger financial performance. For example, Cornett and Tehranian (1992) find a positive correlation between the initial market reaction to bank mergers and the long-run financial performance of the merged firms, but Pilloff (1996) and Hart and Ipilado (2002) find no such evidence.[2] Other studies (e.g., DeLong (2003b)) test whether strategic bank mergers—that is, combinations of two banks with similar geographic footprints or similar activity mixes—perform better than average in the long run, but find little evidence.

Some observers argue that the planning, implementation, and evaluation of bank mergers during the 1980s and 1990s was unusually difficult because the banking industry was in disequilibrium during this time period. Flannery (1999) cautions that rapid and repeated changes in regulatory and technological environments make it difficult for the market to gauge the value-creating effects of bank mergers. At the extreme, Pilloff and Santomero (1998) argue that in such an environment every bank merger must be viewed as an idiosyncratic case. This is consistent with Halpern (1983) who, in an early study of value creation by M&As, suggests that it is difficult to make generalizations about mergers. Although this view implies that there has been little useful information spillover for bank mergers, opportunities for learning by observing should be increasing as the industry disequilibrium dissipates and regularities concerning successful bank mergers emerge.

III. Hypotheses

We hypothesize that commercial banks have learned, by observing recent bank mergers, how to better plan and execute mergers in an evolving, post-deregulation banking environment. This broad hypothesis is consistent with an academic literature that finds lackluster financial performance *on average* for bank M&As over the past two decades. It posits that bank mergers an-

[2] This mixed evidence for bank mergers parallels the evidence for mergers in general. For example, Healy, Palepu, and Ruback (1992) find statistically significant gains in postmerger operating performance, while Agrawal, Jaffe, and Mandelker (1992) find statistically significant stock market losses over a 5-year postmerger period.

nounced following periods of relatively light bank M&A activity are less likely to create value, while bank mergers announced following periods of relatively heavy bank M&A activity are more likely to create value. We also hypothesize that the stock market has learned, also by observing recent bank mergers, how to better identify value-enhancing bank mergers. This broad hypothesis is consistent with extant evidence that investors have been unable to accurately value bank M&As over the past two decades *on average*. It posits that market valuations should be especially poor for bank mergers announced following periods of relatively light bank M&A activity, and should be relatively more accurate for bank mergers announced following periods of relatively heavy bank M&A activity.

We formalize these two broad hypotheses into four explicit, empirically testable hypotheses. The first of these we refer to as the "efficient mergers" hypothesis:

Hypothesis 1: Bank mergers improve the long-run financial performance of the combined banks.

As discussed above, this hypothesis does not receive systematic support in the existing bank merger literature. We test H1 here to see if we can replicate the general findings of the previous literature using our merger data set, and to establish a benchmark against which we can evaluate the hypothesis tests that follow. The second hypothesis is an intertemporal variant of H1, which we refer to as the "bank learning-by-observing" hypothesis.

Hypothesis 2: Bank mergers are more likely to improve the long-run performance of the combined banks if a substantial number of other banks have merged in the recent past.

Implicit in H2 is the proposition that bank managers learn by observing the experiences of recent bank mergers via information spillover, and this information makes them more likely to repeat the successes, and less likely to repeat the mistakes, of those mergers.

Even if the average bank merger does not create value in the long run, an efficient stock market should be able to identify which bank mergers will perform relatively well or relatively poorly. The third hypothesis concerns the ability of the stock market to correctly value bank mergers, and we refer to it as the "efficient markets" hypothesis.

Hypothesis 3: The stock market is able to identify value-enhancing mergers upon their announcement.

As discussed above, there is little empirical support for this hypothesis in the extant bank merger literature. We test H3 here to see whether we can replicate the general findings of the previous literature using our merger data set, and to establish a benchmark for evaluating our final hypothesis test, which we refer to as the "market learning-by-observing" hypothesis.

Hypothesis 4: The stock market will be better able to identify value-

enhancing bank mergers if a substantial number of other banks have merged in the recent past.

Implicit in H4 is the proposition that investors learn by observing the post-merger successes and failures of recent bank mergers, resulting in merger valuations that are more likely to reflect the long-run financial performance of the combined banks. Also implicit in H4 is the presumption that the stock market is semistrong efficient—that is, the spillover of private information from previous mergers adds to the stock of public information, and thereby facilitates more correct valuations of current mergers.

IV. Bank Merger Data Set

We test these four hypotheses for 216 mergers and acquisitions of publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. Although thousands of U.S. commercial banks merged or were acquired during the 1980s and 1990s, only a small percentage of those mergers combined two publicly traded banking companies. We construct an initial data set of 616 mergers that were announced and completed between publicly traded banking companies between 1987 and 1999 using data from the Thomson Financial Securities Data (formally Securities Data Company, or SDC) database.[3] From this initial sample, we excluded 206 mergers because stock return data for either the acquiring firm (11 mergers) and/or the target firm (195 mergers) were not available in the Center for Research in Stock Prices (CRSP) database, and we excluded 65 additional mergers because stock return data were available but were incomplete for either the acquirer (14 mergers) or the target (51 mergers). An additional 129 mergers are excluded from our sample for a variety of (sometimes multiple) reasons: The acquiring or target firm was not a commercial bank or bank holding company (35 mergers), we do not observe one full calendar year of premerger accounting data for both merger partners (23 mergers), we do not observe three full calendar years of postmerger accounting data for the merged bank (67 mergers) often because an acquirer became a target itself (33 mergers), or the target firm was a failing bank (3 mergers).

Table I displays some descriptive information for our merger data set. Accounting data for acquiring banks and target banks come from the Y-9C Reports that bank holding companies submit to the Federal Reserve, or from the Call Reports that banks submit to the Federal Deposit Insurance Corporation for the handful of banking companies in our sample that are not organized as holding companies. The number of mergers per year, the size of the acquiring bank, and the size of the target bank all exhibit increasing trends over time. These data reflect the evolving industry conditions during our sample period, in particular, an industry-wide focus on recapitalization rather than growth during the poor banking environment early in the sample period, and the fruits of

[3] Although this database includes mergers announced and completed as far back as 1979, in the years prior to 1987 only a small number of bank mergers met our sample selection criteria.

Table I
Descriptive Statistics for U.S. Bank M&As, 1987–1999

This table reports data for 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. We report asset amounts in 2002 dollars. A merger has geographic focus if the merging banks' geographic markets overlap more than the sample median. A merger has activity focus if the correlation between the merging banks' stock returns exceeds the sample median. Percentage of sample or subsamples appears in parentheses. The sources for the table are Thomson Securities Data, Federal Reserve Y-9 Reports, and Federal Deposit Insurance Corporation Reports of Condition and Income (Call Reports).

Year	Number of Mergers Announced	Mean Assets of Acquirer ($ billions)	Mean Assets of Target ($ billions)	Number of Geographic Focus Mergers	Number of Activity Focus Mergers
Panel A: All Mergers					
1987–1999	216	$28.5	$7.4	108 (50.0%)	108 (50.0%)
Panel B: By Year of Merger Announcement					
1987	13	$22.7	$4.7	2 (15%)	6 (46%)
1988	8	$17.2	$6.1	4 (50%)	7 (88%)
1989	12	$14.8	$2.2	7 (58%)	2 (17%)
1990	4	$6.3	$1.3	1 (25%)	2 (50%)
1991	21	$41.0	$10.5	11 (52%)	15 (71%)
1992	18	$28.4	$4.0	8 (44%)	11 (61%)
1993	20	$24.9	$2.8	10 (50%)	10 (50%)
1994	14	$37.9	$2.9	10 (71%)	4 (29%)
1995	20	$43.4	$14.7	11 (55%)	11 (55%)
1996	19	$11.7	$1.0	12 (63%)	6 (32%)
1997	29	$34.7	$6.9	14 (48%)	11 (38%)
1998	24	$27.7	$18.3	12 (50%)	14 (58%)
1999	14	$25.3	$7.9	6 (43%)	8 (57%)

industry deregulation that permitted banking companies to grow in size and geographic scope later in the sample period. There are no discernable trends in the percentage of mergers with strategic geographic focus (proxied by the degree to which the deposit markets of the acquiring and target banks substantially overlap) or strategic activity focus (proxied by the degree to which the stock returns of the acquiring and target banks are positively correlated).

V. Measuring Stock Market Valuation

We use an event study methodology to measure the initial stock market reaction to each of the 216 merger announcements. We use ordinary least squares (OLS) regression techniques to estimate the following daily market model:

$$R_{i,t} = \alpha_i + \beta_i * R_{m,t} + \varepsilon_{i,t}, \tag{1}$$

where $R_{m,t}$ is the daily return on the Datastream Index for U.S. Banks, $i =$ (1,216) indexes the mergers, and $t = (-300, -50)$ indexes days prior to the

merger announcement. The dependent variable $R_{i,t}$ is either the daily market return on the acquiring bank ($R^A{}_{i,t}$), the daily market return on the target bank ($R^T_{i,t}$), or the daily return on the combined market values of the acquiring and target banks ($R^P_{i,t}$), all of which we calculate using CRSP data. We calculate the combined return $R^P_{i,t}$ as follows:

$$R^P_{i,t} = \ln\left[\left(MV^A_{i,t} + MV^T_{i,t}\right)/\left(MV^A_{i,t-1} + MV^T_{i,t-1}\right)\right], \tag{2}$$

where $R^P_{i,t}$ is the day t market return on a portfolio consisting of the acquiring and target banks, ln is the natural log operator, and $MV^A_{i,t}$ and $MV^T_{i,t}$ are the market values of the acquiring and target banks, respectively, on day t. As DeLong (2001) demonstrates, constructing pro forma combined returns in this fashion is more accurate than the typical procedure that uses asset-weighted or equity-weighted averages of the acquirer and target returns (e.g., Houston and Ryngaert (1994)). We construct the cumulative abnormal returns (*CAR*s) around the event date by summing the estimated daily abnormal returns from 10 days before the merger announcement to 1 day after the announcement, that is,

$$CAR_i = \sum_{t=-10}^{+1} \left[R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i * R_{m,t})\right]. \tag{3}$$

We also estimated the acquirer, target, and combined *CAR*s using three alternative event windows (-5 days to $+5$ days, -10 days to $+10$ days, and –10 days to $+5$ days).

Table II displays summary statistics for acquirer, target, and combined *CAR*s. Consistent with the large extant body of merger literature, these merger announcements on average simply redistributed wealth in the short run from acquirer shareholders (statistically significant *CAR*s ranging from –2.39% to –3.16%) to target shareholders (statistically significant *CAR*s ranging from 13.92% to 16.43%) with no creation of new shareholder wealth (statistically nonsignificant combined *CAR*s). Because the results are robust across the four different event window definitions, we use the –10 day to $+1$ day *CAR* values throughout the remainder of this study.

Table III reports chronological subsample averages for acquirer, target, and combined *CAR*s for the first 108 mergers (column b) and the second 108 mergers (column c) in our data. The differences across these columns are not statistically significant, which suggests that bank mergers remained purely redistributional over time, creating no value on average. We test this more formally by regressing combined *CAR*s on an intercept and a linear time variable. The slope coefficient for this estimated regression line, displayed as the solid line in Figure 1 for combined *CAR*, is statistically no different from zero. (We obtain but do not display similar results for acquirer and target *CAR*s.) Overall, the market reaction to bank M&As became neither more favorable nor less favorable over the course of our 1987–1999 sample period.

Table II

CARs upon Merger Announcements, Various Event Windows

This table reports cumulative abnormal returns (*CAR*s) to stockholders upon merger announcement. We report the means with standard deviations in parentheses. The sample consists of 216 M&As between 1987 and 1999.

	Mean *CAR*s for		
Event Window	Combined Banks	Acquiring Banks	Target Banks
−10 days to +1 day	0.30%	−2.39%***	16.43%***
	(5.21)	(5.11)	(16.20)
−10 days to +5 days	−0.39%	−3.16%***	15.05%***
	(5.92)	(6.03)	(24.44)
−10 days to +10 days	−0.26%	−3.09%***	14.96%***
	(6.92)	(7.36)	(24.57)
−5 days to +5 days	−0.47%	−3.15%***	13.92%***
	(5.24)	(5.65)	(22.89)

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table III

CARs upon Merger Announcements, Split Sample

This table reports subsample averages for cumulative abnormal returns (*CAR*s) to stockholders upon merger announcement. We report the means with standard deviations in parentheses. The sample consists of 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. *CAR*s are expressed in percentages and are measured over the −10 to +1 day event window.

	Full Sample (a)	First Half of Sample (b)	Second Half of Sample (c)	Difference (c) – (b) (d)
Combined *CAR*	0.30	0.22	0.39	0.17
	(5.21)	(5.23)	(5.22)	(5.22)
Acquirer *CAR*	−2.39***	−2.04%***	−2.73***	−0.69
	(5.11)	(4.71)	(5.47)	(5.11)
Target *CAR*	16.43***	14.89%***	17.98***	3.09
	(16.20)	(16.17)	(16.15)	(16.16)
N	216	108	108	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VI. Measuring Postmerger Financial Performance

We measure the long-run change in financial performance, Δ*postmerger performance*, for the merging banks along seven dimensions of performance: ROA (return-on-assets), ROE (return-on-equity), interest margin (net interest income-to-assets), cost efficiency (noninterest expense-to-operating income), loans-to-assets, core deposits-to-assets, and noninterest income ratio (noninterest income-to-operating income). As we describe below, Δ*postmerger performance* is based on industry-adjusted data, and measures the premerger (1 year

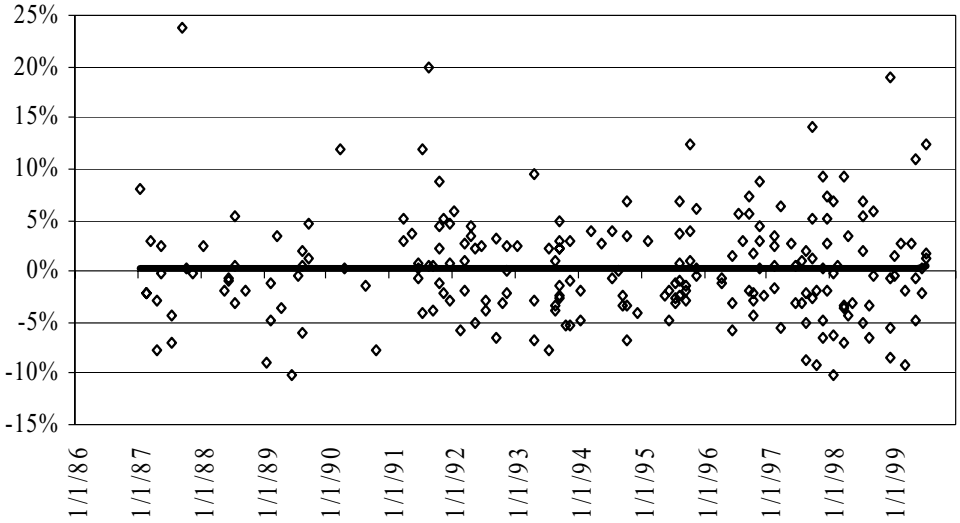

Figure 1. Change in Combined Cumulative Abnormal Return. Data for 216 U.S. banking M&As announced and completed between 1987 and 1999. Linear trend time calculated using ordinary least squares.

prior) to postmerger (3 years after) change in the financial ratios of the merging banks after first normalizing those financial ratios to average industry-wide levels in those years. This approach largely inoculates Δ*postmerger performance* from intertemporal changes in recorded financial performance that were caused by industry-wide phenomena or economy-wide phenomena that systematically affected the banking industry.

There are three compelling reasons to measure long-run post-merger performance based on accounting ratios rather than market returns. First, accounting ratios capture *actual* financial performance over a period of time, while market returns are forward-looking measures of expected earnings. Second, accounting ratios allow us to analyze important components of financial performance (e.g., cost efficiency or core deposit funding) in addition to overall financial performance (e.g., ROA and ROE). Third, given that one of our goals is to test conjectures about the stock market's ability to predict future financial performance (H3 and H4), using short-run market returns (*CAR*s, which measure investor expectations based on current information) to predict long-run buy-and-hold returns (*BAHR*s, which compare investor expectations based on different information sets at two different points in time) would simply come up short.

We follow a four-step process to calculate Δ*postmerger performance*. First, we observe the financial statements of the acquiring and target banks at the end of the calendar year preceding the merger announcement date, we combine these statements to create pro forma financial statements for a hypothetical combined bank, and we calculate hypothetical premerger financial ratios for the pro forma combined bank. Second, we calculate postmerger financial ratios

for the actual combined banks using financial statements three full calendar years after the merger announcement date. Berger et al. (1998) argue persuasively that it takes 3 years for merged banks to achieve the bulk of the merger-induced changes in financial and operational performance. Third, we normalize both the premerger and postmerger financial ratios by subtracting off the same-year, industry-average financial ratios.[4] Fourth, we take the difference between the normalized premerger financial ratios and the normalized postmerger financial ratios. Table IV displays sample and subsample averages for Δ*postmerger performance* for the seven different performance dimensions.

Column (a) in Table IV provides our basic test of H1 (efficient mergers). Consistent with the previous literature on bank merger performance, overall postmerger financial performance as measured by ROA and ROE does not improve on average, and ROA actually declines by a small but statistically significant amount. Postmerger noninterest income ratio also declines on average, although this is not necessarily an indication of poor financial performance: DeYoung and Rice (2004) conclude that well-managed banks focus more closely on traditional intermediation-based activities such as lending and expand more slowly into noninterest activities than do their less well-managed peers. Neither cost efficiency nor the interest margin improve postmerger; the former result is interesting given that cutting duplicative and wasteful overhead costs was the primary stated motive for many of these bank mergers. There is a substantial increase (equal to about 5% of assets) in loans-to-assets. While this increase may or may not indicate improved asset allocation (i.e., loans-to-assets can be *too* high, depending on the risk-return profile of the marginal loan and the cost and stability of loan funding), it is consistent with Akhavein et al.'s (1997) conclusion that revenue efficiency increased with bank megamergers during the 1990s chiefly due to postmerger shifts in acquired banks' assets from securities to loans. We also find a substantial improvement (equal to about $2\frac{1}{2}$% of assets) in core deposits-to-assets. Core deposits (defined here as deposits in transactions accounts and nonbrokered time deposits less than $100,000) represent a relatively inexpensive and stable funding source, and are held by customers likely to purchase additional products from the bank. This is somewhat of a surprise, given the well-documented depositor run-offs following the First Union-CoreStates merger, the Bank of America-Security Pacific merger, and other large bank mergers during the 1990s (Bush (2004)).

Columns (b) and (c) in Table IV display the subsample averages for the first-half and second-half mergers. These data suggest that, as time passed during the sample period, banks became better at achieving postmerger financial performance gains. Postmerger performance is statistically better in the second half of the sample in terms of ROA, ROE, cost efficiency, and core deposits-to-assets. As we discuss above, the statistically negative change in noninterest income ratio over time may also indicate improving merger performance over time. Although these findings are consistent with the learning-based

[4] The industry averages are asset weighted and hence dominated by the performance of large banks, which is appropriate for our sample of mostly large merging banks.

Table IV
Change in Long-Term Performance, Averages

This table reports changes in long-run financial performance ratios (Δ*postmerger performance*) for merged banks. The cells contain means with standard deviations in parentheses. The sample consists of 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. Δ*postmerger performance* is the difference between the performance of a hypothetical combination of the acquirer and target 1 year before the merger announcement and the actual performance of the bank 3 years after the merger is consummated, where both pre- and postmerger performance are adjusted for industry-level performance. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income.

	Full Sample (a)	First Half of Sample (b)	Second Half of Sample (c)	Difference (c) – (b) (d)
Δ*ROA*	−0.05*	−0.17***	0.06	0.23***
	(0.45)	(0.50)	(0.37)	(0.44)
Δ*ROE*	−0.62	−2.08***	0.84*	2.92***
	(6.19)	(7.43)	(4.77)	(6.24)
Δ*Interest margin*	0.03	0.06	−0.01	−0.07
	(0.44)	(0.44)	(0.43)	(0.44)
Δ*Cost efficiency*	−0.47	1.37*	−2.32***	−3.69***
	(7.82)	(8.57)	(6.52)	(7.61)
Δ*Loans-to-assets*	5.25***	4.58***	5.92***	1.34
	(7.46)	(7.07)	(7.82)	(7.45)
Δ*Core deposits-to-assets*	2.64***	0.26	5.02***	4.76***
	(7.32)	(7.19)	(6.68)	(6.94)
Δ*Noninterest income ratio*	−0.12***	0.08**	−0.32***	−0.40***
	(0.50)	(0.44)	(0.48)	(0.46)
N	216	108	108	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

explanation of merger performance posited in H2 (bank learning by observing), these are uncontrolled tests and thus cannot rule out other explanations.

VII. Regression Frameworks

We test the remainder of our hypotheses using multivariate regression techniques. Equation (4) provides our test of H2 (bank learning by observing):

$$\Delta\ postmerger\ performance_i = \mathrm{a} + \mathrm{b} \cdot LBYO_i + \mathrm{c} \cdot time_i + \mathrm{d} \cdot LBYO_i \cdot time_i + \mathrm{f} \cdot controls_i + e_i, \quad (4)$$

where the dependent variable Δ*postmerger performance* is the change in industry-adjusted accounting performance (e.g., ROA, ROE, cost efficiency) for merger i during the 3 years following the merger, as described above. The

residual term e captures the unexplained variance in Δ*postmerger performance*, and is assumed to be randomly distributed around zero for merger i and unrelated to the other terms on the right-hand side. We describe the variables in the *controls* vector in detail below. The two main variables on the right-hand side are *LBYO* and *time*.

The variable *LBYO* is our proxy for learning by observing, or more exactly, for observable information spillover from previous bank mergers from which bank managers and bank investors can potentially learn. As we discuss more fully below, *LBYO* can be thought of as an information state variable. We calculate *LBYO* in a number of different ways. Our base definition, *LBYO(3)*, is equal to the cumulative number of mergers involving either traded or nontraded commercial banking companies in the United States during the 1,095 days (3 years) prior to the merger in question. This definition presumes that it takes 3 years for bank managers and investors to fully validate the information that spills over from previous bank mergers. While our choice of 3 years is consistent with the conventions used in many of the bank merger studies we discuss above (e.g., Berger et al. (1998)), it remains an arbitrary choice, so we augment our base *LBYO(3)* definition with two alternative definitions. First, we recalculate *LBYO* using premerger learning-by-observing windows as short as 1 year and as long as 7 years, resulting in the following set of alternative measures: *LBYO(1)*, *LBYO(2)*, *LBYO(4)*, *LBYO(5)*, *LBYO(6)*, and *LBYO(7)*. Second, we construct a weighted version of *LBYO* that includes the number of bank mergers observed in each of the previous 7 years, with the more recent years receiving heavier weights based on a logistic distribution. The resulting variable, *weighted˙LBYO*, accounts for the possibility that older information degrades, either because it becomes less relevant to current circumstances or because it is forgotten. Figure 2 plots *LBYO(1)*, *LBYO(3)*, and *weighted˙LBYO* against time for each of the 216 M&As in our data set. As the figure illustrates, the information state represented by these variables does not increase monotonically during our sample period, but rather has several high and low points.

The variable *time* measures elapsed calendar time in years starting at the beginning of our sample period (*time* = 1 for mergers announced in 1987, *time* = 2 for mergers announced in 1988, etc.). We include *time* to separate general effects associated with the passage of time (e.g., regulatory change, technological progress) from the information spillover and learning effects more specific to bank mergers (*LBYO*). As Table IV shows, our measures of Δ*postmerger performance* exhibit increases and decreases over time; by including *time* we hope to neutralize these general intertemporal effects. Because these effects are unlikely to be linear, we also estimate four alternative sets of regressions in which *time* is replaced by technology trend variables—*cell phones* per capita, *computers* per capita, *ATM transactions* per capita, and *cashless transactions* per capita—all of which increase nonlinearly over time and hence may prove to be more flexible proxies for general time effects. Moreover, because these technology variables reflect changes in the speed at which information travels, the efficiency with which information can be processed, and the manner in which banks produce financial services, they are likely to be related to the changing

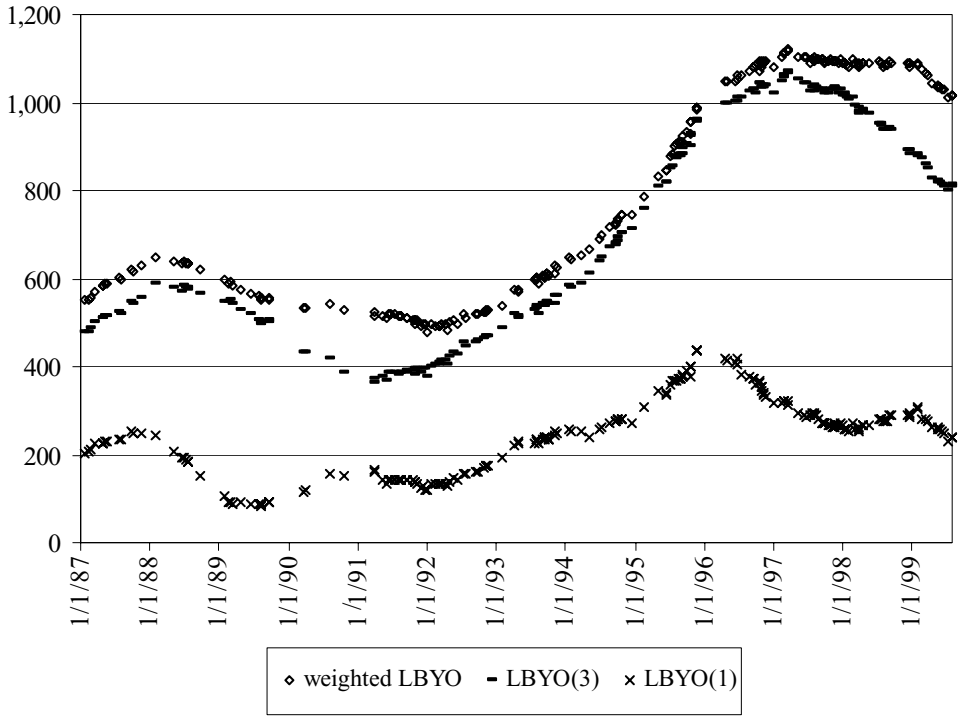

Figure 2. Learning-by-Observing Variable Plotted against Time. *LBYO(1)* is the number of bank mergers that occurred in the year preceding a merger; *LBYO(3)* is the number of bank mergers that occurred in the 3 years preceding a merger; *Weighted LBYO* is the number of bank mergers that occurred in the 3 years preceding a merger with more weight placed on the more recent mergers based on a logistic distribution.

capabilities of bank managers and investors to plan, implement, and evaluate M&As.[5]

H2 (bank learning by observing) predicts a positive relationship between *LBYO* and Δ*postmerger performance*, that is, a merger will tend to perform better as information spillover from recent mergers increases. We include the interaction term *LBYO* * *time* to account for the possibility that learning from information spillover may accelerate over time, or that the benefits from information spillover may diminish over time. Thus, any combination of $b > 0$

[5] We construct the technology trend variables based on annual OECD (Organization for Economic Cooperation and Development) data for the United States during the merger announcement year. We do not include any Internet-related time series, because the Internet was not widely accessible until relatively late in our 1987–1999 sample period. For example, the first commercial online Internet service (Delphi) was not introduced until 1992 and the first graphical web browser (Mosiac) was not introduced until 1993 (Howe (2004)). Banks did not offer Internet services until 1995, when Wells Fargo first offered online account access to their customers and Security First Network Bank became the first Internet-only bank (DeYoung (2005)).

and any sign for d in equation (4) would be consistent with bank learning-by-observing effects.

Equation (5) provides our tests of H3 (efficient markets) and H4 (market learning by observing):

$$CAR_i = \mathrm{a} + \mathrm{b} \cdot \Delta postmerger\ performance_i + \mathrm{c} \cdot LBYO_i + \mathrm{d} \cdot \Delta postmerger\ performance_i \cdot LBYO_i + \mathrm{f} \cdot controls_i + e_i, \quad (5)$$

where the dependent variable *CAR* is the cumulative abnormal return for the combined banks around the merger announcement date, as we describe above. Although the dependent variable *CAR* predates the independent variable Δ*postmerger performance*, this specification is a natural way to test our hypotheses about merger pricing and information spillover. In a full information (strong efficient markets) world, investors know upon announcement how a merger will impact the financial performance of the merging firms (i.e., ΔROA, ΔROE, Δinterest margin, Δcost efficiency, Δloans-to-assets, Δcore deposits-to-assets, and Δnoninterest income ratio) and price the merger accordingly. Thus, causation will run from Δ*postmerger performance* to *CAR*, where our measures of Δ*postmerger performance* are noisy proxies for actual investor knowledge upon merger announcement. These measures are noisy proxies because we only get to observe them after 3 years, by which time unpredictable events may have enhanced or worsened actual merger performance. In a partial information (semistrong efficient markets) world, this causation will be somewhat weaker because, in addition to being noisy, the ex post realizations of Δ*postmerger performance* also reflect merger-specific information that investors did not know at the time of the merger. Thus, we are testing whether the strength of the causation running from Δ*postmerger performance* to *CAR* is at least partially explained by changes in the information state variable *LBYO*.

H3 (efficient markets) predicts a positive relationship between *CAR* and Δ*postmerger performance* with no role for the information-state variable *LBYO*. If the stock market is efficient *and* investors are fully informed about the phenomenon they are pricing (strong efficient markets), then investors will be able to accurately price a new merger regardless of the amount of information that spills over from other recent mergers. Thus, we would expect $b > 0$, $c = 0$, and $d = 0$ in equation (5). The volume of and/or experiences conveyed from other recent mergers have no impact on investors' information state under this hypothesis.

H4 (market learning by observing) predicts that the relationship between *CAR* and Δ*postmerger performance* will grow increasingly positive with increases in the information state variable *LBYO*. If the stock market is efficient *but* investors lack full information about the phenomenon they are pricing (semistrong efficient markets), then investors will be better able to price a new merger when relevant information does spill over from other recent mergers. Thus, we would expect $d > 0$ as investor valuations more closely reflect actual merger value in high-information states. The implications of this hypothesis for coefficients b and c are less direct. Because risk-averse investors should be

willing, ceteris paribus, to pay higher prices in high-information states (due to reduced uncertainty), we may observe a positive relationship between *CAR* and *LBYO* even in the absence of improved postmerger performance ($c \geq 0$). The expected sign for coefficient b is ambiguous. If investor information is only somewhat incomplete, then we may still observe a positive relationship between *CAR* and Δ*postmerger performance* even in the absence of information spillover ($b \geq 0$). However, if investor information is substantially incomplete and there is a substantial amount of uncertainty—a distinct possibility for combinations of unrelated firms in a newly deregulated industry environment—then investors might interpret increased profitability as a signal of increased risk, resulting in a negative relationship between *CAR* and Δ*postmerger performance* ($b < 0$). Thus, any combination of $c \geq 0$, $d > 0$, and any sign for b would be consistent with the market learning by observing hypothesis.

A. Control Variables

We include a vector of controls on the right-hand side of equations (4) and (5) to help explain the variation in the dependent variables that is not related to our main hypothesis tests. Our control variables include the following:

- *Target equity-to-assets*. Postmerger financial performance may be hampered when the target bank has depleted levels of capital. Because the condition of the banking industry improved over time during our sample period, we also include *target equity-to-assets* interacted with *time*.
- *Activity focus*. Postmerger performance may be stronger when the premerger business strategies of the target and acquiring banks are similar (DeLong (2003b), Altunbas and Ibánez (2004)); *Activity focus* is a dummy variable equal to 1 if the correlation between the premerger stock returns of the target and acquiring banks is above the sample median (Mørck, Shleifer, and Vishny (1990)).
- *Geographic focus*. Postmerger performance may be stronger when the target and acquiring banks have overlapping premerger footprints; *Geographic focus* is a dummy variable equal to 1 if the degree to which the target and acquiring banks' deposits overlapped was above the sample median.
- *Learning-by-doing (LBYD).* We include this variable to separate the potential effects of passive learning by observing from the potential effects of active, internal learning by doing; *LBYD* is the number of other bank acquisitions made by the acquirer during the previous 1,095 days.
- *Postmerger growth*. Postmerger gains may be weaker for acquiring banks that are experiencing rapid growth, because managing growth can divert attention from integrating the target bank into its new organization; *Postmerger growth* is the percentage growth rate of postmerger bank assets divided by the percentage growth rate of total industry assets during the 3 years following the merger.
- *Log acquirer assets*. Postmerger performance may be weaker at large acquiring banks that have already achieved scale-based improvements in

costs and diversification prior to the acquisition; *Log acquirer assets* is the natural log of the acquiring bank's total assets prior to the merger.

- *Equal size*. Postmerger performance may be weaker in so-called "mergers of equals" in which control of the postmerger bank is in question; *Equal size* is an index that ranges from near 0 for mergers between disparate-sized banks to 1 for mergers between equal-sized banks.[6]
- *Megamerger*. Postmerger performance may differ for so-called "megamergers" between two already large banks; *Megamerger* is a dummy variable equal to 1 if both the target and acquiring banks have more than $1 billion in assets (Akhavein et al. (1997)).
- *CEO tenure* and *CEO stock*. Postmerger gains may be weaker when acquiring bank managers are entrenched (Bliss and Rosen (2001)); *CEO tenure* is the number of years the acquiring bank's CEO has held that position, and *CEO stock* is the percentage of acquiring bank shares held by the CEO.[7]
- *Percent stock*. Postmerger performance may differ if the acquirer uses stock versus cash to pay for the target (Myers and Majluf (1984), Eckbo, Giammarino, and Heinkel (1990)); *Percent stock* is the percentage of the payment the acquirer makes in stock.
- *Pooling*. Postmerger performance as indicated by accounting ratios may differ if the acquirer uses the pooling method versus the purchase method to incorporate the target into its books (see DeLong (2003a)); *Pooling* is a dummy variable equal to 1 for mergers that use the pooling method.
- *Hostile*. Postmerger performance may differ for so-called "hostile takeover" mergers (Jensen and Ruback (1983)); *Hostile* is a dummy variable equal to 1 for unfriendly takeovers.[8]
- *Hot market*. Postmerger performance may be related to so-called "hot markets," periods of time when investors respond especially positively to merger announcements (Rosen (2006)); *Hot market* is equal to the average *CAR* for the previous five mergers in our data.
- *State M&As* and ΔHHI. Postmerger performance may be related to the regulatory and competitive environments that the merging banks face. The *State M&As* variable is the percentage of all banks that were acquired in the target bank's home state during the year of the merger, and is included to capture (inversely) state-level regulatory barriers to entry and expansion by merger. The ΔHHI variable is the change in the Herfindahl index (weighted by the deposit shares of the acquiring and target banks) caused by the merger, and is included to capture the increase in potential market power due to the merger.
- *GDP growth*. Postmerger performance may be related to the phases of the business cycle; *GDP growth* is the percent change in U.S. gross domestic product during the merger announcement year.

[6] *Equal size* = 1 – [ABS(acquirer assets – target assets)/MAX(acquirer assets, target assets)].

[7] We thank Hamid Mehran for access to these data.

[8] Hostile takeovers are rare in the banking industry. Indeed, only 3 of the 216 M&As in our data were hostile.

Table V provides summary statistics for all the dependent and independent variables that we use in our regression tests.

VIII. Results for Bank Learning-by-Observing

Table VI displays the results from OLS estimation of equation (4). Additional results are available in the working paper version of this study (DeLong and DeYoung (2004)). The estimated coefficients on *LBYO(3)* and *LBYO(3)* * *time* provide the tests of H2 (bank learning by observing).

We find evidence consistent with bank learning by observing in four of the seven regressions. The coefficient on *LBYO(3)* is statistically positive and the coefficient on *LBYO(3)* * *time* is statistically negative in the ΔROA, ΔROE, and Δinterest margin regressions. These coefficients are also statistically significant in the Δefficiency ratio regressions, albeit with the opposite signs as expected. The implied improvements in financial performance tend to be economically significant as well. A 10% increase in *LBYO(3)* evaluated at the sample means generates an estimated 0.0004 increase in ΔROA; using the average premerger acquiring bank ROA of 0.0108 as a benchmark, this corresponds to a substantial 3.7% improvement in postmerger profitability.[9] Similarly, a 10% increase in *LBYO(3)* is associated with a 2.3% increase in ROE, a 1.3% increase in interest margin, and a 1.5% improvement in efficiency ratio. Thus, our findings imply nontrivial information spillover-related improvements in postmerger bank performance.

The estimated coefficients on *LBYO(3)* are approximately 9–11 times the size of the estimated coefficients on *LBYO(3)* * *time*, which indicates robust bank learning by observing early in the sample period that gradually diminished over time. The bottom panel of Table VI shows the estimated derivatives of Δ*postmerger performance* with respect to *LBYO(3)*, evaluated for each value of *time* (1 through 13). The derivatives for ΔROA, ΔROE, Δinterest margin, and δefficiency ratio remain statistically different from zero for *time* ≤6, implying that on average the existence of bank learning-by-observing in these performance dimensions had run its course by the mid-1990s. The Δnoninterest income derivatives are an exception to this pattern, and do not become statistically negative until *time* ≥10. This time lag implies that bank learning-by-observing regarding noninterest-based activities occurred late in the sample period, with a negative sign that is consistent with recent findings that risk-adjusted returns from nontraditional fee-based activities (e.g., investment

[9] We calculate the percentage change in *ROA* associated with a 10% increase in *LBYO(3)* as follows:

$$\%\Delta ROA = (0.02843 - 0.00290 * 7.8935) * (0.7263 * 0.10)/(0.0108) = 3.70\%,$$

where 0.02843 and 0.00290 are the coefficient estimates for *LBYO(3)* and *LBYO(3)* * *time* from equation (4), 7.8935 and 0.7263 are the mean values of *time* and *LBYO(3)* from Table 5, and 0.0108 is the premerger (1 year prior) value of *ROA* for the average acquiring bank in our sample. We calculate the percentage changes in the other performance measures in a similar fashion.

Table V

Summary Statistics for Regression Variables

The sample consists of 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. Δ*postmerger performance* is the difference between the performance of a hypothetical combination of the acquirer and target 1 year before the merger announcement and the actual performance of the bank 3 years after the merger is consummated, where both pre- and postmerger performance are adjusted for industry-level performance. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *CAR* is the cumulative abnormal return for combined partners upon the announcement of a merger. *LBYO(x)* is the number of bank mergers that occur in the *x* years that predate the merger announcement. *Weighted LBYO* puts a heavier weight on the number of mergers in years directly preceding the announcement based on a logistic distribution. *Time* measures elapsed calendar time in years starting at the beginning of our sample period (*time* = 1 for mergers announced in 1987, *time* = 2 for mergers announced in 1988, etc.). *Cell phones* per capita, *computers* per capita, *ATM transactions* per capita, and *cashless transactions* per capita are based on aggregate annual data for the U.S. *GDP growth* is the percentage change in U.S. gross domestic product during the year in which the merger was announced. *Learning by doing* is the number of other bank acquisitions made during the previous 1,095 days (3 years) by the acquiring bank. *Target equity-to-assets* is a book value ratio for the acquired bank prior to the merger. *Activity focus* is a dummy variable equal to 1 for mergers in which the correlation of the premerger stock returns for the acquiring and target banks was above the sample median. *Geographic focus* is a dummy variable equal to 1 for mergers in which the overlap between the deposit markets of the acquiring and target banks was above the sample median. *Log acquirer assets* is the natural log of the acquiring bank's total assets prior to the merger. *Equal size* is an index that ranges from near 0 for mergers between disparate-sized banks to 1 for mergers between equal-sized banks. *Megamerger* is a dummy variable equal to 1 for mergers in which both the target and acquiring banks have more than $1 billion in assets. *CEO tenure* is the number of years the CEO of the acquiring bank has held that position. *CEO stock* is the percentage of acquiring bank shares held by the CEO. *Postmerger growth* is the percentage growth rate of postmerger bank assets divided by the percentage growth rate of total industry assets over the 3 years following the merger. *State M&As* is the percentage of all banks that were acquired in the target bank's home state during the year of the merger. Δ*HHI* is the change in the Herfindahl index (weighted by the deposit shares of the acquiring and target banks) caused by the merger. *Hot market* is equal to the average *CAR* for the previous five mergers in our data. *Percent stock* is the percentage of payment the acquirer makes in stock. *Pooling* is a dummy variable equal to 1 for mergers that use the pooling method. *Hostile* is a dummy variable equal to 1 for unfriendly takeovers. All dollar-denominated variables are expressed in 2002 dollars. The sources for this table are Federal Reserve Y-9 Reports, Federal Deposit Insurance Corporation Reports of Condition and Income (Call Reports), CRSP database, Thomson Financial Securities Data, the World Bank, and the authors' calculations.

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
		Panel A: ΔPostmerger Performance			
Δ*ROA*	−0.0006	0.0046	−0.0192	0.0158	0.00006
Δ*ROE*	−0.0062	0.0640	−0.2118	0.2650	0.0037
Δ*Interest margin*	0.0003	0.0044	−0.0119	0.0134	−0.0002
Δ*Cost efficiency*	−0.0047	0.0782	−0.2855	0.3298	−0.0085
Δ*Loans-to-assets*	0.0525	0.0746	−0.1476	0.3178	0.0556
Δ*Core deposits-to-assets*	0.0264	0.0732	−0.2187	0.2002	0.0280
Δ*Noninterest income ratio*	−0.0012	0.0050	−0.0153	0.0205	−0.0012

(*continued*)

Table V—*Continued*

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Panel B: Market Reaction					
CAR	0.0030	0.0521	−0.1019	0.2379	−0.0027
Panel C: Information Spillover					
LBYO(1) in thousands	0.2464	0.0852	0.0540	0.4370	0.2570
LBYO(2)	0.4927	0.1621	0.2060	0.7670	0.5170
LBYO(3)	0.7263	0.2465	0.3630	1.0710	0.7030
LBYO(4)	0.9398	0.3146	0.4900	1.3320	0.8430
LBYO(5)	1.1334	0.3483	0.6960	1.6130	0.9990
LBYO(6)	1.3051	0.3631	0.8670	1.8690	1.0980
LBYO(7)	1.4502	0.3737	0.8660	2.0660	1.2320
Weighted LBYO	0.8082	0.2479	0.4776	1.1199	0.7439
Panel D: Time and Technological Change					
Time	7.8935	3.5164	1.0000	13.0000	8.0000
Cell phones per capita	0.1231	0.0972	0.0050	0.3151	0.0926
Computers per capita	0.3208	0.1027	0.1544	0.5163	0.2973
ATM transactions per capita (in thousands)	0.0325	0.0084	0.0161	0.0414	0.0318
Cashless transactions per capita (in thousands)	0.3057	0.0358	0.2420	0.3632	0.2999
Panel E: Control Variables					
GDP growth	3.2704	1.3327	−0.2000	4.5000	3.6000
Learning-by-doing (LBYD)	3.9352	4.3504	0.0000	26.0000	3.0000
Target equity-to-assets	0.0804	0.0211	0.0235	0.1756	0.0769
Activity focus	0.4954	0.5011	0.0000	1.0000	0.0000
Geographic focus	0.5000	0.5012	0.0000	1.0000	0.5000
Log acquirer assets	$16.3733	$1.3838	$13.1001	$19.3936	$16.5518
Equal size	0.7776	0.2470	0.0166	0.9959	0.8587
Megamerger	0.5370	0.4998	0.0000	1.0000	1.0000
CEO tenure	7.1481	5.2789	0.0000	29.0000	6.0000
CEO stock	0.4788	1.3159	0.0100	12.2500	0.1600
Postmerger growth	0.0488	0.1062	−0.3000	0.3000	0.0419
State M&As	0.0545	0.0440	0.0000	0.2131	0.0428
ΔHHI	−0.0013	0.0133	−0.0525	0.0757	−0.0006
Hot market	0.0022	0.0188	−0.0401	0.0602	0.0018
Percent stock	0.8668	0.3114	0.0000	1.0000	1.0000
Pooling	0.5321	0.5001	0.0000	1.0000	1.0000
Hostile	0.0139	0.1173	0.0000	1.0000	0.0000

banking, securities brokerage, insurance) may be less favorable than commercial banks initially expected (DeYoung and Rice (2004)).

We perform additional estimations of equation (4) using alternative definitions for the *time* and *LBYO* variables. We replace the linear *time* variable with the nonlinear technology time trend variables described above, namely, *cell phones* per capita, *computers* per capita, *ATM transactions* per capita, and *cashless transactions* per capita. Table AI displays partial results from these

Table VI

Cross-sectional Analyses of Changes in Performance

This table reports the ordinary least squares regression results for equation (4). The sample consists of 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. In each regression, the dependent variable is Δ*postmerger performance*, the difference between the performance of a hypothetical combination of the acquirer and target 1 year before the merger announcement and the actual performance of the bank 3 years after the merger is consummated, where both pre- and postmerger performance are adjusted for industry-level performance. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *LBYO(x)* is the number of bank mergers that occur in the x years that predate the merger announcement. *Time* measures elapsed calendar time in years starting at the beginning of our sample period (*time* = 1 for mergers announced in 1987, *time* = 2 for mergers announced in 1988, etc.). *GDP growth* is the percentage change in U.S. gross domestic product during the year in which the merger was announced. *Target equity-to-assets* is a book value ratio for the acquired bank prior to the merger. *Activity focus* is a dummy variable equal to 1 for mergers in which the correlation of the premerger stock returns for the acquiring and target banks was above the sample median. *Geographic focus* is a dummy variable equal to 1 for mergers in which the overlap between the deposit markets of the acquiring and target banks was above the sample median. *Learning by doing* is the number of other bank acquisitions made during the previous 1,095 days (3 years) by the acquiring bank. *Postmerger growth* is the percentage growth rate of postmerger bank assets divided by the percentage growth rate of total industry assets over the 3 years following the merger. *Log acquirer assets* is the natural log of the acquiring bank's total assets prior to the merger. *Equal size* is an index that ranges from near 0 for mergers between disparate-sized banks to 1 for mergers between equal-sized banks. *Megamerger* is a dummy variable equal to 1 for mergers in which both the target and acquiring banks have more than $1 billion in assets. *CEO tenure* is the number of years the CEO of the acquiring bank has held that position. *CEO stock* is the percentage of acquiring bank shares held by the CEO. *Percent stock* is the percentage of payment the acquirer makes in stock. *Pooling* is a dummy variable equal to 1 for mergers that use the pooling method. *Hostile* is a dummy variable equal to 1 for unfriendly takeovers. *Hot market* is equal to the average *CAR* for the previous five mergers in our data. *State M&As* is the percentage of all banks that were acquired in the target bank's home state during the year of the merger. Δ*HHI* is the change in the Herfindahl index (weighted by the deposit shares of the acquiring and target banks) caused by the merger. All dollar-denominated variables are expressed in 2002 dollars. The sources for this table are Federal Reserve Y-9 Reports, Federal Deposit Insurance Corporation Reports of Condition and Income (Call Reports), CRSP database, Thomson Financial Securities Data, and the authors' calculations. All dollar-denominated variables are expressed in 2002 dollars. Heteroskedastic-adjusted standard errors appear in parentheses.

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
			Panel A: OLS Results				
Constant	−0.0055	−0.0158	−0.0019	0.0309	0.2563**	−0.1089	−0.0139**
	(0.0061)	(0.0865)	(0.0059)	(0.1090)	(0.1059)	(0.1038)	(0.0066)
LBYO(3)	0.0284***	0.3282***	0.0233***	−0.4598***	0.1242	0.1727	0.0023
	(0.0068)	(0.0974)	(0.0067)	(0.1155)	(0.1352)	(0.1110)	(0.0081)
Time	0.0012**	0.0156*	0.0018***	−0.0188**	0.0072	0.0128	0.0012*
	(0.0005)	(0.0082)	(0.0005)	(0.0092)	(0.0102)	(0.0088)	(0.0006)
LBYO(3) ∗ *time*	−0.0029***	−0.0362***	−0.0021***	0.0417***	−0.0097	−0.0070	−0.0017*
	(0.0007)	(0.0106)	(0.0007)	(0.0128)	(0.0143)	(0.0115)	(0.0009)
GDP growth	−0.0002	−0.0003	−0.0009***	0.0024	−0.0061	−0.0084*	0.0005
	(0.0003)	(0.0042)	(0.0003)	(0.0053)	(0.0052)	(0.0051)	(0.0003)
Target equity-to-assets	−0.1217***	−1.6123***	0.0559*	1.1816**	−0.1738	0.5885	−0.0050
	(0.0326)	(0.4646)	(0.0318)	(0.5855)	(0.5687)	(0.5573)	(0.0355)
Target equity-to-assets ∗ *time*	0.0121***	0.1673***	−0.0080**	−0.1053	−0.0110	−0.0772	0.0034
	(0.0038)	(0.0548)	(0.0038)	(0.0691)	(0.0671)	(0.0658)	(0.0042)
Activity focus	−0.0003	−0.0057	0.0006	−0.0067	−0.0182	−0.0083	−0.0005
	(0.0007)	(0.0098)	(0.0007)	(0.0123)	(0.0120)	(0.0117)	(0.0008)

(*continued*)

Table VI—*Continued*

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
Panel A: OLS Results							
Geographic focus	−0.0011*	−0.0115	−0.0015***	0.0048	−0.0173*	−0.0070	−0.0014**
	(0.0006)	(0.0086)	(0.0006)	(0.0108)	(0.0105)	(0.0103)	(0.0007)
Learning by doing (LBYD)	−0.0000	−0.00091	0.0000	0.0007	0.0033***	−0.0005	−0.0000
	(0.0000)	(0.0010)	(0.0001)	(0.0013)	(0.0012)	(0.0012)	(0.0001)
Postmerger growth	−0.0093***	−0.1030***	−0.0168***	0.0871*	−0.1085**	−0.0560	−0.0058*
	(0.0028)	(0.0405)	(0.0028)	(0.0511)	(0.0496)	(0.0486)	(0.0031)
Log acquirer assets	−0.0003	−0.0058	−0.0007***	0.0093*	−0.0166***	−0.0010	0.0006*
	(0.0003)	(0.0039)	(0.0003)	(0.0049)	(0.0048)	(0.0047)	(0.0003)
Equal size	0.0010	−0.0043	0.0018	−0.0025	0.0210	0.0072	0.0013
	(0.0015)	(0.0207)	(0.0014)	(0.0261)	(0.0253)	(0.0248)	(0.0016)
Megamerger	0.0018**	0.0223**	0.0006	−0.0320**	0.0201	0.0045	0.00044
	(0.0008)	(0.0114)	(0.0008)	(0.0144)	(0.0140)	(0.0137)	(0.0009)
CEO tenure	0.0001	0.00057	0.0000	0.0002	0.0006	0.0023**	0.0000
	(0.0001)	(0.0008)	(0.0001)	(0.0010)	(0.0009)	(0.0009)	(0.0001)
CEO stock	0.0001	0.0002	0.0006***	0.0012	0.0146***	0.0060	−0.0004
	(0.0002)	(0.0033)	(0.0002)	(0.0042)	(0.0041)	(0.0040)	(0.0003)
Percent stock	−0.0008	−0.0116	−0.0010	0.0334*	−0.0047	−0.0107	0.0005
	(0.0011)	(0.0150)	(0.0010)	(0.0189)	(0.0184)	(0.0180)	(0.0012)
Pooling	0.0006	0.0058	0.0002	−0.0243*	−0.0018	0.0085	0.0002
	(0.0007)	(0.0104)	(0.0007)	(0.0131)	(0.0128)	(0.0125)	(0.0008)
Hostile	0.0003	−0.0572	0.0002	−0.0541	−0.0549	−0.0216	0.0016
	(0.0025)	(0.0359)	(0.0025)	(0.0452)	(0.0439)	(0.0430)	(0.0027)
Hot market	−0.0180	−0.3141	−0.0205	−0.1197	−0.1434	−0.0981	−0.0125
	(0.0164)	(0.2343)	(0.0160)	(0.2952)	(0.2868)	(0.2810)	(0.0179)
State M&As	0.0096	0.1596*	−0.0019	−0.1753	0.0142	−0.1546	−0.0093
	(0.0069)	(0.0977)	(0.0067)	(0.1231)	(0.1196)	(0.1172)	(0.0075)
ΔHHI	−0.0574***	−0.8639***	−0.0070	0.8395**	−0.2186	−0.4072	−0.0518**
	(0.0223)	(0.3182)	(0.0218)	(0.4010)	(0.3895)	(0.3817)	(0.0243)
Adjusted R^2	0.2418	0.2198	0.2176	0.1695	0.1405	0.1424	0.2532
Panel B: ∂ΔPerformance/∂*LBYO*, Evaluated at Various Values of the Time Variable							
Time = 1	0.0255***	0.2920***	0.0212***	−0.4181***	0.1145	0.1657	0.0006
Time = 2	0.0226***	0.2558***	0.0191***	−0.3764***	0.1048	0.1587	−0.0011
Time = 3	0.0197***	0.2196**	0.0170***	−0.3347***	0.0951	0.1517	−0.0028
Time = 4	0.0168***	0.1834*	0.0149**	−0.2930***	0.0854	0.1447	−0.0045
Time = 5	0.0139**	0.1472	0.0128**	−0.2513**	0.0757	0.1377	−0.0062
Time = 6	0.0110	0.1110	0.0107	−0.2096*	0.0660	0.1307	−0.0079
Time = 7	0.0081	0.0748	0.0086	−0.1679	0.0563	0.1237	−0.0096
Time = 8	0.0052	0.0386	0.0065	−0.1262	0.0466	0.1167	−0.0113
Time = 9	0.0023	0.0024	0.0044	−0.0845	0.0369	0.1097	−0.0130
Time = 10	−0.0006	−0.0338	0.0023	−0.0428	0.0272	0.1027	−0.0147*
Time = 11	−0.0035	−0.0700	0.0002	−0.0011	0.0175	0.0957	−0.0164**
Time = 12	−0.0064	−0.1062	−0.0019	0.0406	0.0078	0.0887	−0.0181**
Time = 13	−0.0093	−0.1424	−0.0040	0.0823	−0.0019	0.0817	−0.0198**

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

regressions. The estimates are robust to the base case from Table VI and continue to offer strong support for H2 in the ΔROA, ΔROE, Δinterest margin, and Δefficiency ratio regressions. We also replace the information state variable *LBYO(3)* with the several alternatives described above. Table AII displays partial results from these regressions, and these estimates also indicate robust support for the results in Table VI. The value of observed information degrades most quickly in the Δloans-to-assets regressions, which provide support for H2

only when the information set is limited to mergers occurring within the past year (*LBYO(1)*). In contrast, information has quite long-lasting value in the ΔROA, ΔROE, and Δefficiency ratio regressions, in which information sets as short as 1 year (*LBYO(1)*) and as long as 6 years (*LBYO(6)*) provide support for H2.

Returning to the Table VI regressions, a number of the control variables have statistically significant and economically sensible coefficients. M&As in which the combined banks share the same geographic market (*geographic focus*, Δ*HHI*), acquiring banks that make additional acquisitions in the years following the merger (*postmerger growth*), and M&As in which the acquiring bank is large (*log acquirer assets*) all tend to realize smaller postmerger improvements in financial performance. In contrast, M&As in which both banks are relatively large (*megamergers*) tend to realize larger postmerger improvements. Acquiring banks led by CEOs with large ownership stakes (*CEO stock*) tend to achieve postmerger progress in intermediation activities (Δloans-to-assets, Δinterest margin), while acquiring banks led by CEOs with long job tenure (*CEO tenure*) are better able to hold on to core depositor relationships postmerger. The estimated derivatives with respect to *target equity-to-assets* (evaluated at the mean value of *time*) imply that postmerger performance improvements are more likely when the acquired bank has been poorly run or suffered from bad luck in the recent past. M&As announced during economic expansions (*GDP growth*) are less likely to improve postmerger interest margins and more likely to lose core depositors. These results are consistent with procyclical narrowing of interest margins due to increases in short-term rates, increases in deposit demand, and increased inter-bank competition for lending opportunities.

It is worth emphasizing that the coefficient on *LBYD*, the learning-by-doing variable, is statistically significant only in the Δloans-to-assets regressions. So, while the data strongly support the possibility that banks benefit by observing other previous mergers, we find relatively little evidence to suggest that banks learn from their own previous mergers. This counterintuitive finding most likely reflects the fact that the banks in the best position to learn by doing are also the banks that perform a lot of mergers. These banks have noisy financial statements because they are perpetually digesting other banks, making it difficult to measure improved financial performance for any single merger in our empirical framework.

IX. Results for Market Learning by Observing

Table VII displays the results from OLS estimation of equation (5). Additional results are available in the working paper version of this study (DeLong and DeYoung (2004)). The estimated derivative with respect to Δ*postmerger performance* (displayed near the bottom of the table along with its *p*-value) provides a test of H3 (efficient markets) and the estimated coefficient on the interaction term *LBYO(3)* $*$ Δ*postmerger performance* provides the test of H4 (market learning by observing).

Table VII

Cross-sectional Analysis of *CAR*s upon Announcement

This table reports the ordinary least squares regression results for equation (5). The sample consists of 216 M&As between publicly traded U.S. commercial banking companies that were announced and completed between 1987 and 1999. The dependent variable is *CAR*, cumulative abnormal returns upon announcement of a merger. The definition for the Δ*postmerger performance* variable changes across columns. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *LBYO(x)* is the number of bank mergers that occur in the x years that predate the merger announcement. *GDP growth* is the percentage change in U.S. gross domestic product during the year in which the merger was announced. *Target equity-to-assets* is a book value ratio for the acquired bank prior to the merger. *Time* measures elapsed calendar time in years starting at the beginning of our sample period (*time* = 1 for mergers announced in 1987, *time* = 2 for mergers announced in 1988, etc.). *Activity focus* is a dummy variable equal to 1 for mergers in which the correlation of the premerger stock returns for the acquiring and target banks was above the sample median. *Geographic focus* is a dummy variable equal to 1 for mergers in which the overlap between the deposit markets of the acquiring and target banks was above the sample median. *Learning by doing* is the number of other bank acquisitions made during the previous 1,095 days (3 years) by the acquiring bank. *Postmerger growth* is the percentage growth rate of postmerger bank assets divided by the percentage growth rate of total industry assets over the 3 years following the merger. *Log acquirer assets* is the natural log of the acquiring bank's total assets prior to the merger. *Equal size* is an index that ranges from near 0 for mergers between disparate-sized banks to 1 for mergers between equal-sized banks. *Megamerger* is a dummy variable equal to 1 for mergers in which both the target and acquiring banks have more than $1 billion in assets. *CEO tenure* is the number of years the CEO of the acquiring bank has held that position. *CEO stock* is the percentage of acquiring bank shares held by the CEO. *Percent stock* is the percentage of payment the acquirer makes in stock. *Pooling* is a dummy variable equal to 1 for mergers that use the pooling method. *Hostile* is a dummy variable equal to 1 for unfriendly takeovers. *Hot market* is equal to the average *CAR* for the previous five mergers in our data. *State M&As* is the percentage of all banks that were acquired in the target bank's home state during the year of the merger. Δ*HHI* is the change in the Herfindahl index (weighted by the deposit shares of the acquiring and target banks) caused by the merger. All dollar-denominated variables are expressed in 2002 dollars. The sources for this table are Federal Reserve Y-9 Reports, Federal Deposit Insurance Corporation Reports of Condition and Income (Call Reports), CRSP database, Thomson Financial Securities Data, and the authors' calculations. All dollar-denominated variables are expressed in 2002 dollars. Heteroskedastic-adjusted standard errors appear in parentheses.

Δ Postmerger Performance Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
			Panel A: OLS Results				
Constant	0.1317**	0.1332**	0.1309**	0.1415**	0.1468**	0.1437**	0.1290**
	(0.0612)	(0.0612)	(0.0620)	(0.0619)	(0.0645)	(0.0615)	(0.0624)
Δ*Postmerger performance*	−4.3783**	−0.3114**	−1.9086	0.1685	−0.2159	−0.0641	1.5106
	(2.145)	(0.1469)	(2.4820)	(0.1268)	(0.1689)	(0.1115)	(2.4635)
LBYO(3)	0.0306	0.0303	0.0242	0.0309	0.01858	0.0069	0.0253
	(0.0253)	(0.0255)	(0.0258)	(0.0247)	(0.0280)	(0.0270)	(0.0274)
LBYO(3) ∗ Δ*performance*	6.0208**	0.3671*	3.4106	−0.1598	0.2586	0.2361	−2.0366
	(2.9800)	(0.2112)	(3.0096)	(0.1742)	(0.2099)	(0.1524)	(3.2540)
GDP growth	−0.0107***	−0.0109***	−0.0111***	−0.0114***	−0.0119***	−0.0108***	−0.0116***
	(0.0029)	(0.0028)	(0.0030)	(0.0029)	(0.0030)	(0.003)	(0.0030)
Target equity-to-assets	−0.2378	−0.2541	−0.1316	−0.1914	−0.1040	−0.1304	−0.1084
	(0.2567)	(0.2579)	(0.2513)	(0.2484)	(0.2445)	(0.2422)	(0.2497)
Target equity-to-assets ∗ *time*	0.0126	0.0151	0.01024	0.0108	0.00721	0.0092	0.0080
	(0.0227)	(0.0230)	(0.0222)	(0.0219)	(0.0220)	(0.0213)	(0.0224)
Activity focus	0.0069	0.0061	0.00801	0.0081	0.0077	0.0104	0.0075
	(0.0080)	(0.0081)	(0.0080)	(0.0078)	(0.0081)	(0.0081)	(0.0079)
Geographic focus	−0.0037	−0.0044	−0.0036	−0.0042	−0.0038	−0.0022	−0.0041
	(0.0067)	(0.0066)	(0.0067)	(0.0067)	(0.0067)	(0.0067)	(0.0068)
Learning by doing (LBYD)	−0.0003	−0.0004	−0.0002	−0.0003	−0.0000	−0.0002	−0.0003
	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)

(*continued*)

Table VII—*Continued*

ΔPostmerger Performance Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
			Panel A: OLS Results				
Postmerger growth	−0.0341	−0.0396	−0.0258	−0.0381	−0.0387	−0.0227	−0.0317
	(0.0358)	(0.0349)	(0.0386)	(0.0365)	(0.0352)	(0.0353)	(0.0356)
Log acquirer assets	−0.0029	−0.0030	−0.0028	−0.0036	−0.0035	−0.0033	−0.0028
	(0.0034)	(0.0034)	(0.0035)	(0.0035)	(0.0035)	(0.0035)	(0.0035)
Equal size	−0.0468**	−0.0473**	−0.0482**	−0.0464**	−0.0457**	−0.0465**	−0.0474**
	(0.0221)	(0.0221)	(0.0223)	(0.0223)	(0.0214)	(0.0217)	(0.0223)
Megamerger	−0.0120	−0.0109	−0.0131	−0.0104	−0.0116	−0.0136	−0.0126
	(0.0095)	(0.0094)	(0.0095)	(0.0096)	(0.0094)	(0.0096)	(0.0094)
CEO tenure	0.0005	0.0005	0.00039	0.0005	0.0005	0.0002	0.0004
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
CEO stock	0.0005	0.0007	−0.0005	0.0007	−0.0001	−0.0004	0.0004
	(0.0024)	(0.0023)	(0.0024)	(0.0023)	(0.0024)	(0.0021)	(0.0023)
Percent stock	−0.0182	−0.0180	−0.0169	−0.0186	−0.0167	−0.0157	−0.0161
	(0.0129)	(0.0129)	(0.0128)	(0.0130)	(0.0123)	(0.0126)	(0.0130)
Pooling	0.0015	0.0015	0.00281	0.0029	0.0016	0.0005	0.0022
	(0.0092)	(0.0092)	(0.0092)	(0.0092)	(0.0093)	(0.0090)	(0.0092)
Hostile	0.1016**	0.0991**	0.0997**	0.1070**	0.0976*	0.1043**	0.1027**
	(0.0445)	(0.0447)	(0.0464)	(0.0436)	(0.0495)	(0.0478)	(0.0449)
Hot market	−0.4861***	−0.5061***	−0.4870***	−0.4763***	−0.4779***	−0.4887***	−0.4816***
	(0.1823)	(0.1819)	(0.1805)	(0.1821)	(0.1825)	(0.1819)	(0.1794)
State M&As	−0.0701	−0.0635	−0.0697	−0.0609	−0.0684	−0.0615	−0.0730
	(0.0698)	(0.0686)	(0.0675)	(0.0691)	(0.0674)	(0.0668)	(0.0681)
ΔHHI	0.2873	0.2233	0.2731	0.2476	0.2795	0.3123	0.2417
	(0.3273)	(0.3148)	(0.3212)	(0.3142)	(0.3113)	(0.3048)	(0.3217)
Adjusted R^2	0.1455	0.1484	0.1373	0.1412	0.1395	0.1538	0.1325
			Panel B: $\partial CAR/\partial \Delta$Performance				
For *LBYO(3)* = median	−0.1457	−0.0534	0.4891	0.0562	−0.0341	0.1019	0.0789
For *LBYO(3)* = 75$^{\text{th}}$ %	1.5792	0.0518	1.4662	0.0104	0.0400	0.1695**	−0.5046
For *LBYO(3)* = 90$^{\text{th}}$ %	1.8411	0.0678	1.6146	0.0034	0.0512	0.1798**	−0.5932

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

We find little evidence consistent with H3. The estimated derivative $\partial CAR/\partial \Delta$*postmerger performance* is statistically significant only when postmerger performance is measured by Δcore deposits-to-assets. Evidently, market investors are able to distinguish ex ante between bank mergers that have favorable versus unfavorable impacts on core deposit funding, but are not able on average to assess the impact of bank mergers on other dimensions of financial performance. The fact that this derivative test yields statistically nonsignificant results in the first two columns, where Δ*postmerger performance* is defined by the broad profitability measures ΔROA and ΔROE, suggests that on average market investors were not able to efficiently price bank mergers during our 1987 to 1999 sample period.

In contrast, we find relatively broad evidence consistent with H4 that market investors learn by observing. The positive coefficients on the interaction terms in the first two columns indicate that the correlations between *CAR* and Δ*ROA* and between *CAR* and Δ*ROE* are more positive for mergers that occur during high-information states. For example, in the average information state indicated by the median value of *LBYO(3)* = 0.7030, a one standard deviation increase in Δ*ROA* is associated with a trivial change in *CAR* of −0.0007 (only

about 7/100ths of a percentage point),[10] whereas in the relatively high information state indicated by the 75th percentile value of *LBYO(3)* = 0.9895, a one standard deviation increase in ΔROA is associated with an economically meaningful increase in *CAR* of +0.0072 (about 7/10ths of a percentage point). We obtain similar results using the regression results in the second column of the table: In the relatively high 75th percentile information state, a one standard deviation increase in ΔROE is associated with an economically meaningful increase in *CAR* of +0.0033 (about 3/10ths of a percentage point). The interaction term *LBYO(3)* $*$ Δ*postmerger performance* is not statistically significant in the remaining five columns of the table; thus, not surprisingly, on average our results indicate that an informed market prices mergers according to their impact on overall profitability (ΔROA, ΔROE) rather than their impact on the various components of profitability, some of which may be important in some mergers but relatively unimportant in other mergers.

A handful of the control variables bear statistically significant coefficients in these regressions. All else equal, market investors pay less for mergers of equals, a rational response given the anecdotal evidence that these mergers undergo difficult postmerger transitions. Ironically, investors pay less during "hot markets." This likely indicates that bank merger pricing occurs in waves, so that mergers occurring near the end of, or just after, a so-called hot market period (by our definition) have lower than average prices. Consistent with the equation (4) results, investors pay less during economic expansions. Finally, investors pay more for hostile takeovers, although this result should be discounted given the small number (three) of hostile takeovers in our data.

For robustness, we re-estimated the equation (5) tests using the alternative *LBYO(1)*, *LBYO(2)*, *LBYO(3)*, and *weighted LBYO* definitions for the information-state variable *LBYO*. Table AIII displays partial results from these regressions, which are consistent with H4 (market learning by observing) for the broad ΔROA and ΔROE performance measures, and are weakly consistent with this hypothesis for the Δefficiency ratio performance measure. These regressions also suggest that more recent mergers contain relatively more valuable information for investors: The coefficient magnitudes for the interaction variables *LBYO* $*$ Δ*postmerger performance* decline systematically as we include older information in the information state variable.[11]

[10] We calculate the percentage change in *CAR* associated with a one standard deviation increase in ΔROA in the median information state as follows:

$$\%\Delta CAR = (-4.3783 + 6.0207 * 0.7030) * (0.0046) = -0.0007,$$

where −4.3783 and 6.0207 are the coefficient estimates for ΔROA and *LYBO(3)* $*$ ΔROA from equation (5), 0.7030 is the median value of *LBYO(3)* from Table 5, and 0.0046 is the standard deviation of ΔROA from Table 5. We calculate the percentage changes at the 75th percentile information state in a similar fashion.

[11] We also estimate equation (5) using the following alternative specifications, none of which alter our main results (results not shown): adding the time trend variable to the right-hand side of the equation, adding any of our four technological change variables to the right-hand side of the equation, and replacing the continuous *LBYO* variables with dummy variables equal to 1 if the merger occurred during an "above-median" information state.

X. Conclusions

In this study we examine the long-run financial performance of 216 M&As of publicly traded U.S. banking companies announced and completed between 1987 and 1999, as well as the ability of the stock market to predict this long-run performance. On average, these data are broadly consistent with the previous literature on bank merger and stock market performance: The typical bank merger did not improve postmerger financial performance, and investors were unable to accurately predict the future performance of the typical bank merger. However, when we analyze these data in a statistical framework that allows for the possibility that banks and investors can learn from observing the best and worst practices of previous bank M&As, we find evidence of improved postmerger financial performance as well as evidence of more accurate stock market predictions of this performance.

Our framework is based on two broad conjectures about information, merger execution, and merger valuation. We hypothesize that bank managers can learn by observing information that spills over from recent bank mergers, where we distinguish this passive learning from the more traditional notion of active learning by doing. Although we find no systematic evidence of the latter, we do find persistent evidence consistent with the possibility that merging banks learn by observing. More precisely, we find that improvements in postmerger financial performance are positively associated with the quantity of observable bank mergers announced and in-process during the previous several years.

Similarly, we hypothesize that investors become better able to accurately value bank mergers by observing the financial performance of previous bank mergers. Indeed, we find evidence consistent with the conjecture that the stock market learns by observing. More precisely, we find that the correlation between short-run market reactions and long-run postmerger financial performance is positively associated with the quantity of observable bank mergers during the previous several years. These results are statistically strong for broad measures of postmerger financial performance such as ROA and ROE, and are statistically nonsignificant for more narrow measures of postmerger financial performance such as noninterest income, loan-to-asset ratios, and interest rate margins. This is a sensible result consistent with investors that price bottom line impacts rather than individual operational improvements at the postmerger bank.

Both of these broad conjectures are predicated on the fact that the large and often complex commercial bank mergers of the late 1980s and the 1990s were a relatively new phenomenon. To make these mergers productive, managers and consultants had to first develop a set of best merger practices, which could only be based on the accumulation of information spillovers from previous bank mergers. Lacking a track record of previous bank merger performance, investors could only base their evaluations on the accumulated observable information about what kind of bank mergers tended to do well or do poorly. Importantly, while it takes time for banks to develop best merger practices and for investors to develop a deep information set about bank mergers, our statistical results are not merely proxies for the passage of time, as our results obtain

in regression tests that control for time and relevant measures of technological advance, business cycles, and other time-related arguments. Moreover, our strongest results occur in the first year after previous mergers are observed, which suggests that (a) best practices for bank M&As is a moving target that evolved with changes in technology, competitive strategy, and market conditions during the 1980s and 1990s, and (b) knowledge spillover intensifies with "event density" in a fashion similar to the informational benefits generated by "geographic density" documented in the urban economics literature (see footnote 1).

Our findings help explain why extant academic studies reject the notion that bank mergers create value. Furthermore, our findings suggest that the stock market may be a poor evaluator of new phenomena that are poorly or incompletely understood by market participants, and we note that this "failing" of the market is consistent with a semistrong theory of market efficiency. Nevertheless, we urge the reader to interpret these findings with some caution. While our tests indicate that the data are consistent with our hypotheses about experience effects and information spillover, we emphasize that our main test variable is only a proxy for these phenomena. We do not directly observe the transformation of accumulated experience and/or information spillover into applied knowledge. In addition, our hypotheses are not derived from a formal underlying theory of learning in the banking industry.

Appendix

Table AI

Selected OLS regression results from alternative specifications of equation (4) in which the *time* trend variable is replaced with the technology trend variables such as *cell phones per capita*, *computers per capita*, *ATM transactions per capita*, and *cashless transactions per capita*. The sample consists of 216 M&As between 1987 and 1999. In each regression, the dependent variable is Δ*postmerger performance*, the difference between the performance of a hypothetical combination of the acquirer and target 1 year before the merger announcement and the actual performance of the bank 3 years after the merger is consummated, where both pre- and postmerger performance are adjusted for industry-level performance. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *LBYO(x)* is the number of bank mergers that occur in the *x* years that predate the merger announcement. *Cell phones* per capita, *computers* per capita, *ATM transactions* per capita, and *cashless transactions* per capita are based on aggregate annual data for the United States. All dollar-denominated variables are expressed in 2002 dollars. Heteroskedastic-adjusted standard errors appear in parentheses.

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
Panel A: Time Trend Replaced with Cell Phones per Capita							
LBYO(3)	0.01191***	0.11191**	0.01322***	−0.20111***	0.07043	0.11488*	−0.00519
	(0.00308)	(0.04555)	(0.00336)	(0.05727)	(0.07342)	(0.06340)	(0.00412)
cellphones_pc	0.03353	0.27566	0.02629	−0.19270	0.08319	−0.40142	0.04673*
	(0.02717)	(0.37680)	(0.02585)	(0.46620)	(0.49101)	(0.42850)	(0.02702)
LBYO(3) ∗	−0.07769***	−0.84599**	−0.05908**	0.85574*	−0.22160	0.22503	−0.06424*
cellphones_pc	(0.02536)	(0.36547)	(0.02670)	(0.47473)	(0.56628)	(0.45733)	(0.03342)

(*continued*)

Table AI—*Continued*

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
Panel B: Time Trend Replaced with Computers per Capita							
LBYO(3)	0.02175***	0.23480**	0.02863***	−0.35414***	0.11045	0.20149	0.00534
	(0.00759)	(0.11502)	(0.00760)	(0.13183)	(0.16075)	(0.13799)	(0.00931)
computers_pc	0.01280	0.11724	0.04358**	−0.13756	0.07377	0.14589	0.04030*
	(0.02524)	(0.37043)	(0.02124)	(0.41948)	(0.42949)	(0.38985)	(0.02304)
LBYO(3) ∗	−0.06015**	−0.71508*	−0.07160***	0.82421**	−0.21182	−0.23183	−0.05581*
computers_pc	(0.02433)	(0.36624)	(0.02359)	(0.41936)	(0.48903)	(0.40815)	(0.02926)
Panel C: Time Trend Replaced with ATM Transactions per Capita							
LBYO(3)	0.04084***	0.45063***	0.01996	−0.57484***	0.14294	0.01661	0.02248
	(0.01212)	(0.17496)	(0.01288)	(0.22390)	(0.26784)	(0.21550)	(0.01586)
ATMtrans	0.57299***	7.19838**	0.71918***	−8.90339**	3.23072	4.59913	0.55083**
	(0.22354)	(3.39000)	(0.22477)	(3.83567)	(4.54691)	(3.74923)	(0.27475)
LBYO(3) ∗	−1.02760***	−12.1106***	−0.53154	13.52462**	−3.20166	1.02867	−0.92837***
ATMtrans_pc	(0.31299)	(4.50184)	(0.33826)	(5.68475)	(6.88744)	(5.49052)	(0.42183)
Panel D: Time Trend Replaced with Cashless Transactions per Capita							
LBYO(3)	0.07715***	0.90715***	0.07675***	−1.14544***	0.33541	0.40478	0.04408
	(0.02063)	(0.30979)	(0.02154)	(0.36491)	(0.44380)	(0.36275)	(0.02822)
cashless	0.07734	0.83816	0.17196***	−1.14135	0.64934	1.06337	0.13264*
	(0.06380)	(0.96932)	(0.05612)	(1.13571)	(1.17353)	(1.05466)	(0.06910)
LBYO(3) ∗	−0.23594***	−2.84398***	−0.22999***	3.34047***	−0.94708	−0.92624	−0.18238*
cashless_pc	(0.06709)	(1.00894)	(0.06965)	(1.19213)	(1.42071)	(1.15629)	(0.09173)

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table AII

Selected OLS regression results from alternative specifications of equation (4) in which the information state variable *LBYO(3)* is replaced with alternative definitions of the information state. The sample consists of 216 M&As between 1987 and 1999. In each regression, the dependent variable is Δ*postmerger performance*, the difference between the performance of a hypothetical combination of the acquirer and target 1 year before the merger announcement and the actual performance of the bank 3 years after the merger is consummated, where both pre- and postmerger performance are adjusted for industry-level performance. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *Weighted LBYO* puts a heavier weight on the number of mergers in years directly preceding the announcement based on a logistic distribution. *LBYO(x)* is the number of bank mergers that occur in the *x* years that predate the merger announcement. All dollar-denominated variables are expressed in 2002 dollars. Heteroskedastic-adjusted standard errors appear in parentheses.

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
Panel A: *LBYO(3)* Replaced with Weighted *LBYO*							
weighted *LBYO*	0.02849***	0.29580***	0.02744***	−0.53033***	0.17849	0.31557***	−0.01167
	(0.00737)	(0.10185)	(0.00668)	(0.11651)	(0.13060)	(0.11867)	(0.00805)
weighted *LBYO* ∗	−0.00310***	−0.03586***	−0.00275***	0.05222***	−0.01630	−0.02429**	−0.00046
time	(0.00074)	(0.01042)	(0.00069)	(0.01205)	(0.01318)	(0.01157)	(0.00086)
Panel B: *LBYO(3)* Replaced with *LBYO(1)*							
LBYO(1)	0.05579***	0.62069***	0.02337*	−0.79957***	0.50696**	0.19599	0.03743**
	(0.01346)	(0.19115)	(0.01329)	(0.29923)	(0.23053)	(0.25821)	(0.01642)
LBYO(1) ∗ time	−0.00553***	−0.06557***	−0.00094	0.0735**	−0.05913**	−0.01124	−0.0067***
	(0.00166)	(0.02311)	(0.00178)	(0.03638)	(0.02902)	(0.03205)	(0.00210)

(*continued*)

Table AII—*Continued*

Dependent Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
			Panel C: *LBYO(3)* Replaced with *LBYO(2)*				
LBYO(2)	0.03505***	0.4132***	0.01410	−0.52488***	0.19091	0.1437	0.01936*
	(0.00916)	(0.13365)	(0.00919)	(0.17491)	(0.18592)	(0.15816)	(0.01185)
LBYO(2) ∗ time	−0.00357	−0.0462***	−0.00062	0.04894**	−0.01857	−0.00134	−0.0038***
	(0.00107)***	(0.01542)	(0.00111)	(0.02053)	(0.02140)	(0.01820)	(0.00143)
			Panel D: *LBYO(3)* Replaced with *LBYO(4)*				
LBYO(4)	0.02342***	0.24309***	0.02251***	−0.42640***	0.15399	0.23325**	−0.01032
	(0.00567)	(0.07758)	(0.00518)	(0.09279)	(0.10310)	(0.09735)	(0.00654)
LBYO(4) ∗ time	−0.00258***	−0.02945***	−0.00233***	0.04281***	−0.01418	−0.01870**	−0.00020
	(0.00056)	(0.00781)	(0.00053)	(0.00951)	(0.01052)	(0.00955)	(0.00069)
			Panel E: *LBYO(3)* Replaced with *LBYO(5)*				
LBYO(5)	0.01855***	0.15940**	0.02073***	−0.37536***	0.14157	0.29357***	−0.01789***
	(0.00597)	(0.08205)	(0.00526)	(0.09326)	(0.09854)	(0.09537)	(0.00635)
LBYO(5) ∗ time	−0.00211***	−0.02145***	−0.00221***	0.03858***	−0.01319	−0.02563***	0.00076
	(0.00055)	(0.00751)	(0.00049)	(0.00858)	(0.00930)	(0.00873)	(0.00062)
			Panel F: *LBYO(3)* Replaced with *LBYO(6)*				
LBYO(6)	0.00968	0.06600	0.01478**	−0.31966***	0.10312	0.29726***	−0.02660***
	(0.00684)	(0.09273)	(0.00612)	(0.10261)	(0.10033)	(0.09802)	(0.00592)
LBYO(6) ∗ time	−0.00128**	−0.01237	−0.00164***	0.03185***	−0.00979	−0.02518***	0.00143***
	(0.00060)	(0.00808)	(0.00052)	(0.00847)	(0.00827)	(0.00805)	(0.00047)
			Panel G: *LBYO(3)* Replaced with *LBYO(7)*				
LBYO(7)	−0.00325	−0.05619	0.00358	−0.14226	0.03673	0.23578**	−0.02698***
	(0.00726)	(0.10068)	(0.00654)	(0.11857)	(0.09642)	(0.10422)	(0.00592)
LBYO(7) ∗ time	−0.00037	−0.00412	−0.00079*	0.01793**	−0.00465	−0.01855***	0.00119***
	(0.00056)	(0.00775)	(0.00048)	(0.00830)	(0.00666)	(0.00727)	(0.00038)

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table AIII

Selected OLS regression results from alternative specifications of equation (5) in which the information state variable *LBYO(3)* is replaced with alternative definitions of the information state. The sample consists of 216 M&As between 1987 and 1999. The dependent variable is *CAR*, cumulative abnormal returns upon announcement of a merger. The definition for the Δ*postmerger performance* variable changes across columns. Δ*ROA* is the change in the ratio of book assets to net income; Δ*ROE* is the change in the ratio of book equity to net income; Δ*interest margin* is the change in the ratio of net interest income to book assets; Δ*cost efficiency* is the change in the ratio of noninterest expense to operating income; Δ*loans-to-assets* is the change in the ratio of loans to book assets; Δ*core deposits-to-assets* is the change in the ratio of transactions deposits plus small time deposits to book assets; and Δ*noninterest income ratio* is the change in the ratio of noninterest income to operating income. *Weighted LBYO* puts a heavier weight on the number of mergers in years directly preceding the announcement based on a logistic distribution. *LBYO(x)* is the number of bank mergers that occur in the *x* years that predate the merger announcement. All dollar-denominated variables are expressed in 2002 dollars. Heteroskedastic-adjusted standard errors appear in parentheses.

ΔPostmerger Performance Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
			Panel A: *LBYO(3)* Replaced with *LBYO(1)*				
ΔPostmerger performance	−4.93889**	−0.40088***	−2.22855	0.19878*	−0.10399	−0.01823	1.40613
	(1.99423)	(0.15214)	(2.38312)	(0.11632)	(0.16142)	(0.09978)	(2.47251)

(*continued*)

Table AIII—*Continued*

ΔPostmerger Performance Variable	ΔROA	ΔROE	ΔInterest Margin	ΔEfficiency Ratio	ΔLoans-to-Assets	ΔCore Deposits-to-Assets	ΔNoninterest Income Ratio
LBYO	0.06763	0.07110	0.02407	0.05870	0.03611	0.01884	0.03308
	(0.04955)	(0.04875)	(0.05085)	(0.04918)	(0.05611)	(0.05158)	(0.05295)
LBYO ∗	19.39409***	1.43390**	11.13943	−0.61279	0.30089	0.51576	−5.89529
Δperformance	(7.72297)	(0.62926)	(8.01328)	(0.47467)	(0.55089)	(0.38771)	(8.67702)
Panel B: *LBYO(3)* Replaced with *LBYO(2)*							
ΔPostmerger	−5.00903***	−0.37283***	−1.67775	0.24236**	−0.22624	−0.03320	2.28604
performance	(2.02171)	(0.14404)	(2.58069)	(0.12051)	(0.17885)	(0.10438)	(2.46041)
LBYO	0.05551*	0.05657*	0.03928	0.05061*	0.03109	0.02493	0.03772
	(0.03085)	(0.03103)	(0.03229)	(0.03011)	(0.03626)	(0.03375)	(0.03439)
LBYO ∗	9.84350***	0.66106**	4.25685	−0.38962*	0.39483	0.27235	−4.38615
Δperformance	(4.04819)	(0.30105)	(4.48075)	(0.24088)	(0.31945)	(0.20066)	(4.51200)
Panel C: *LBYO(3)* Replaced with weighted *LBYO*							
Δpost-merger	−4.13028*	−0.32307**	−2.20281	0.12349	−0.22329	−0.07288	2.03168
performance	(2.31445)	(0.15838)	(2.74502)	(0.13824)	(0.18084)	(0.12865)	(2.70371)
LBYO	0.04077	0.03858	0.03806	0.04225	0.03207	0.02210	0.04033
	(0.02895)	(0.02913)	(0.02927)	(0.02793)	(0.03126)	(0.03041)	(0.03091)
LBYO ∗	5.13042*	0.34831*	3.51097	−0.08888	0.24474	0.21894	−2.35741
Δperformance	(2.83487)	(0.20119)	(3.16066)	(0.17204)	(0.20744)	(0.16184)	(3.34033)

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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