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Looking Back with Interest (Rates): Merger Retrospectives in the U.S. Banking Industry

By

Joshua Lee Palmer

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Economics

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Joseph Farrell, Chair
Professor Sofia Berto Villas-Boas
Professor David Ahn

Spring 2011

Abstract

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Professor Joseph Farrell, Chair

In the following three essays I use quantitative evidence to address the effectiveness of horizontal merger policy in the United States in protecting the competitive balance of markets. Since the enactment of the Sherman Antitrust Act in 1890, the Federal Government has attempted to protect the public from increased prices, reduced innovation, and other adverse effects that may occur when firms are able to exercise market power. Horizontal mergers, in which firms that were previously direct competitors combine to operate as a single entity, are of particular concern to the Antitrust Authorities (mainly the Department of Justice and the Federal Trade Commission) as these mergers necessarily remove a competitor from the market. Surprisingly, there are relatively few empirical studies that investigate whether the Antitrust Authorities are able to accurately identify the potentially anticompetitive mergers, or whether once identified, the proposed remedies are appropriate to alleviate concerns over gains in market power. I provide empirical work on these two issues.

In the first essay, I consider the question of how the antitrust agencies identify potentially troublesome mergers based on pre-merger information. I use pre-merger data from the commercial banking industry to implement a model proposed in the literature to be an improvement over the current merger application screening tool. I find that relative to the current screen the proposed model reduced the number of mergers flagged as being competitively troublesome. This result is important given the time and resource constraints that antitrust agencies face when evaluating merger applications. To test whether the proposed model was not too lax, I combine pre- and post-merger data and implement a difference-in-differences method to estimate the actual merger affects. I then check to see whether mergers estimated to have resulted in price effects were identified by the proposed model and find that all of the mergers estimated to have resulted in statistically significant price increases were flagged by the proposed model.

In my second essay, I turn to the question of whether branch divestitures are sufficient market power remedies in bank mergers. In particular, I combine data on pre- and post-merger market conditions with data on the Federal Reserve Board's (FRB) stated post-merger expectations to investigate how well divestiture remedies alleviate market power concerns. I identify mergers that involved the divestitures of bank branches in at least one of the banking markets in which

the merging banks competed prior to the merger. I then divide the sample of merger markets into two subsamples, one in which divestitures occurred and one in which no divestitures occurred and compare the interest rates banks paid depositors in divestiture markets to the rates paid to depositors in non-divestiture markets. I find that in the second year after the merger the interest rate spread between divestiture and non-divestiture markets was over 135 percent larger on deposit accounts than the pre-merger spread and remained almost 40% higher in the third year following the merger. As a result, depositors in divestiture markets were relatively worse off than depositors in non-divestiture markets following the merger. This evidence suggests that the divestitures may not have been sufficient market power remedies.

In the final chapter I address a troubling aspect of antitrust policy. Namely, despite its long history and recognized importance, a deficiency of the empirical evidence required to accurately assess the effectiveness of antitrust policy has persisted. I identify publicly available data sets on pre- and post-merger market data, as well as publicly available data on specific post-merger market predictions made by the Federal Reserve Board at the time of the merger application review that can be collected to address this deficiency. I then check to see how the FRB's pro forma estimates of the post-merger market shares underlying their review process compare to the post-merger market shares observed in the data. I find that pro forma market shares consistently overestimate the post-merger market share of the surviving bank, a finding that is troublesome to the extent that it reflects a restriction in output by the merged bank. I conclude that the findings reaffirm the warnings from a number of economists that assumptions underlying merger policy need to be analyzed and argue that the availability of data useful for such analyses should be viewed by the profession and policy makers as rendering the deficiency of empirical evidence on antitrust policy as irresponsible and unacceptable.

To my family, for all of their encouragement, support, and inspiration over the years;
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Chapter 1

Merger Simulation with PCAIDS: A More Informative Screen?

1.1 Introduction

The Department of Justice (DOJ) and the Federal Trade Commission (FTC) attempt to prohibit mergers that are likely to lessen competition.¹ From 1991 through 2004, over 37,000 merger or acquisition notifications were filed (Ashenfelter and Hosken, 2008), representing trillions of dollars in assets annually.² Subsequent to receiving a notification of the intent to merge, the government generally has just 30 days to determine whether to allow the merger to proceed, whether to challenge the merger, or whether to issue a second request for additional information.³ To facilitate this task, the agencies typically employ a screen based on whether the post-merger market share concentration and the merger induced-change in market share reach certain thresholds. For example, in the banking industry the agencies determine whether a proposed merger would result in the Herfindahl-Hirschman Index (HHI) measure of market concentration to be at or above 1800 following the merger, and whether the local market would experience an increase in HHI of at least 200 due to the merger.^{4,5} Although factors other than the HHI are taken into consideration, the likelihood that the agencies request additional information from the merging parties is directly related to the post-merger HHI and change in HHI (Horizontal Merger Guidelines, 2010). The underlying logic of the current policy is based on the structure-conduct-performance (SCP) paradigm that attributes firm conduct to the market

¹ While the DOJ and the FTC are the primary antitrust agencies, the set of agencies responsible for any particular merger depends in part on the industry in which the merger will occur. For example, the Federal Reserve Board, the Office of the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Office of the Thrift Supervision are all involved in enforcing the antitrust laws in the U.S. banking industry. Hereafter, the terms Agency or Agencies are inclusive of the appropriate set of regulators for any particular merger.

² The FTC is required to report annually to Congress on the operation of the HSR. All Annual Reports to Congress are available at <http://www.ftc.gov/bc/anncompreports.shtm>.

³ If during the initial period either the DOJ or FTC determine that additional information beyond that in the notification filing is required, then the Agency is granted an additional 30 days from the time the requested information is received.

⁴ For a statement of the thresholds in the banking industry see <http://www.justice.gov/atr/public/guidelines/>. Although DOJ and FTC issued a revised version of the Horizontal Merger Guidelines in 2010, the Bank Merger Competitive Guidelines remain unchanged, <http://www.justice.gov/opa/pr/2010/August/10-at-938.html>.

⁵ The HHI is calculated by summing the square of the market share of each firm in the industry. Formally, $HHI = \sum_{i=1}^I (ms_i)^2$, where ms_i is the share of Firm i and there are I total firms in the market. For a merger involving two firms, the change in market share due to the merger is twice the product of the merging firms' pre-merger market share.

structure in place. In particular, firms in more highly concentrated markets are presumed to wield relatively larger amounts of market power. Use of the SCP paradigm in merger policy has long been criticized due to its weak link to economic theory, particularly in industries comprised of differentiated products. Schmalensee (1982), Werden and Froeb (1994), and Farrell and Shapiro (2010) are but a few of the works offering such a criticism. Cetorelli (1999) discusses empirical evidence showing mixed results of the HHI screen in the banking industry, including findings that the relationship between the HHI and degree of market power may not be monotonic.

One alternative to the SCP approach that is more tightly linked to economic theory and that has received an increasing amount of attention is merger simulation. Described in more detail below, merger simulation models go beyond simple measures of market shares to predict the competitive effects of a merger by incorporating a presumed demand system, supply (cost) function, and the form of competitive interaction prevalent in the market at issue. While models that are more tightly linked to economic theory are intuitively attractive, the increased sophistication often makes them impractical to use as a screening tool for agencies tasked with reviewing a large number of merger applications under time constraints. However, Epstein and Rubinfeld (2001) introduce a simplified merger simulation model and argue that it may serve as a valuable screening device for enforcement agencies. Specifically, the authors present the Proportionality-Calibrated Almost Ideal Demand System (PCAIDS), which simplifies the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980) by making the assumption that lost sales due to a price increase are diverted to other firms in proportion to each firm's market share.⁶ Epstein and Rubinfeld (2001) show that this simplification allows for post-merger predictions using only estimates on pre-merger market shares, the own-price elasticity of any single firm in the market, and the industry price elasticity of demand.

In this paper, I combine pre- and post-merger data from the U.S. commercial banking industry to test the competitive effects predictions of a simulation based screen vis-a-vis the current HHI screen. Specifically, I use pre-merger data and implement merger simulations based on the PCAIDS model to obtain post-merger price predictions for a sample of consummated bank mergers.⁷ I also take advantage of pre- and post-merger data to estimate the price effects of these bank mergers using a difference-in-differences approach. Finally, I compare which of the mergers would have been flagged based on the current HHI screen and which would have been flagged using a screen based on the simulated predictions. I use the PCAIDS model as the basis for the simulations because it arguably has a number of advantages over other simplified simulation models.⁸ For instance, although both the PCAIDS and the logit model rely on the restrictive assumption of “Irrelevance of Independent Alternatives” (IIA) in the pre-merger period, post-merger this restriction is relaxed in the PCAIDS model. Further, Saha and Simon (2000) find empirical evidence using scanner data that the AIDS model fits demand data better than does the logit model. Hausman and Leonard (1997) provide additional arguments for the AIDS model over the logit model. I use the commercial banking industry because the large

⁶ This assumption is analogous to the Independence of Irrelevant Alternatives (IIA) assumption in the discrete choice literature.

⁷ As described in more detail below, the price at issue in this paper is the deposit interest rate. Note that this means that price increases in this context are analogous to deposit rate decreases.

⁸ Werden, Froeb, and Tardiff (1996), for example, describe a simplified merger simulation based on the logit model.

number of merger applications filed in the banking industry implies large benefits from an improved screening method. For instance, during Fiscal Year 1995 alone, the Department of Justice received almost 1,900 bank merger applications.⁹ In Fiscal Year 1998, this number was even higher at 1,923 applications.¹⁰ Moreover, regulatory data submission requirements in the banking industry provide for the necessary pre- and post-merger data. Despite the popularity the merger simulation method has enjoyed, Werden, Froeb, and Scheffman (2004) discuss a number of limitations of the simulation program that help explain the apparently limited impact the method has had on policy decisions.¹¹ For one, the authors note that simulation models do not have a well-established record of providing a high degree of accuracy in predicting merger outcomes and therefore do not provide the courts with a reliable method. Similarly, Walker (2005) argues that although merger simulation models may provide an important tool for policy, they do not provide a substitute for a full-competitive effects analysis. Consequently, I focus on the ability of the PCAIDS based simulation model to provide a more informative screen relative to the current HHI screen rather than the ability of the model to accurately produce post-merger price levels for use in a full-competitive effects analysis. An improved application screening diagnostic is important for at least two reasons. First, to the extent that the screen is more discriminate, fewer of the agencies' scarce resources would be expended reviewing applications. As a result, more time could be spent on the full competitive effects analysis, which would presumably improve the quality of decisions.

Using data on all consummated bank mergers in the U.S. from 1994-2007, I select a sample of mergers that *a priori* appear to be the best candidates for a simulation based screen.¹² If the method does not provide a useful screen for the selected mergers, it is unlikely to provide a useful screen for more complicated mergers. Before specifying my selection criteria, I define the merger period. As Ashenfelter et al (2009) point out, the appropriately defined period is sufficiently long to capture the changes in prices resulting from the merger, but short enough to avoid the effects of non-merger related changes in the market. Consistent with findings in the empirical banking literature that the deposit rates of banks involved in a merger may be affected as much as a year before the merger (Prager and Hannan, 1998), I define the merger period to include the year prior to the quarter of the merger, and the year after the quarter of the merger. Although there is work suggesting post-merger price changes may continue beyond the first year (Focarelli and Panetta, 2003), I focus on the short term price effects. Extending the merger period both increases the likelihood that other important changes occur in the market that may contaminate the observed price changes, as well as reduces further the merger sample. I now specify how I select the mergers to be analyzed. First, the merging banks must not have been in any other merger over the merger period. Additionally, there must have been no entry or exit in the market during the merger period. The first criterion prevents having to disentangle the effect of multiple mergers on a bank's price change. Although the PCAIDS model can be adjusted to accommodate entry, the second criterion keeps the focus on the screening efficacy of the least

⁹ Constance K. Robinson, Director of Operations, Antitrust Division of the Department of Justice, Speech before the 31st Annual Banking Law Institute, May 30, 1996.

¹⁰ Robert Kramer, Chief of Litigation Section II, Antitrust Division of the Department of Justice, Speech before the American Bar Association, April 14, 1999.

¹¹ Budzinski and Ruhmer (2008) provide a summary of the use of merger simulation in competition policy.

¹² Merger data come from the Federal Reserve System's National Information Center (NIC) Transformation Table obtained via a Freedom of Information Act (FOIA) request. All data are described in more detail in Section 5.

complicated version of the model and is also in line with the standard assumption of merger simulation models of no entry or exit. Moreover, to the extent that entry barriers are low so that entry is likely, the concern over unilateral effects due to the merger would also be low. Finally, because the market-level data is filed annually as of the end of the second quarter, I select mergers that occur in the second quarter of a given year so that the beginning of the merger period and the end of the merger period correspond to quarters in which banks file these reports.¹³ This leaves me with observations on 10 mergers, a sample size that compares favorably with similar studies. Peters (2006), for example, uses pre- and post-merger data from five mergers in the airline industry to test simulated predictions. Similarly, Weinberg and Hosken (2008) investigate simulated outcomes of two mergers, and Ashenfelter and Hosken (2008) use the outcomes of five mergers in their evaluation of the effectiveness of U.S. horizontal merger policy.

The PCAIDS model requires three pieces of information to implement: pre-merger market shares, an estimate of any single firm's own-price elasticity, and an estimate of the industry price elasticity. I follow common practice in the empirical banking literature and calculate pre-merger market shares as a bank's share of deposits in the local market as reported in the Summary of Deposit Report (SOD) that each bank files with the Federal Deposit Insurance Corporation (FDIC).¹⁴ Structural demand models are often estimated to obtain measures of demand elasticity and a number of authors have estimated the own-price elasticity banks face in regard to the deposit rate, largely based on the discrete choice demand model suggested by Dick (2002, 2008). Although all required data to replicate such estimations would be available to regulators, a screen that required estimating a demand model for each merger application would not be practical. However, as Werden et al (1996) assert, even simulations based on rough estimates but more rigorous theory offer significant improvements over traditional analysis. A rich empirical literature in the banking industry provides such estimates. In particular, Adams et al (2007) estimate the own-price elasticity separately for banks operating in an MSA and banks operating in non-MSA counties and I use these as inputs in the simulation model.¹⁵ More specifically, because reversing the effects of an anticompetitive merger is likely to be costly or impossible post-merger, as an estimate of the own-price elasticity of the acquiring bank, I reduce the estimated mean elasticity reported in Adams et al (2007) by one standard deviation so that a screen based on the simulation results is conservative in that it is biased toward a false positive and away from a false negative.¹⁶ With estimates of firm market shares and the own-price elasticity of the acquiring firm, the final input needed is an estimate of the industry price elasticity. Again, because any adverse effects of a consummated merger are likely to be difficult or impossible to remedy, I follow Epstein and Rubinfeld (2001), and Weinberg and Hosken

¹³ The average number of mergers by quarter is relatively consistent, with 25% of the mergers occurring in the first quarter, 23% in the second quarter, 25% in the third quarter and 27% in the fourth quarter.

¹⁴ See, for example, Prager and Hannan (1998), Ishii (2004), Dick (2008) and Miller (2008).

¹⁵ Clearly not every industry will have a rich enough empirical literature so that relevant elasticity estimates are available to the Agency. However, alternative estimates are likely to be available. Epstein and Rubinfeld (2001), for example, use the negative of the ratio of sales to gross profit to estimate the firm's price elasticity.

¹⁶ A "false positive" under this screen would occur if the screen flagged a proposed merger that is not likely to harm competition. Similarly, a "false negative" would occur if the screen failed to flag a proposed merger which would be likely to harm competition. Given the Agencies' directive of preventing mergers likely to lessen competition, false negatives are more serious flaws of any merger application screen than are false positives.

(2008), and take the industry elasticity to have a magnitude of one as this is conservative in regards to merger policy as it will over predict the price effects of mergers relative to higher (in magnitude) estimates of industry elasticity. With the above estimates of pre-merger market shares, own-price and industry elasticities, I am able to obtain post-merger price predictions from the PCAIDS merger simulation model for each of the 10 mergers in the sample. I then define a simulation based screen whereby a merger is flagged for further review if the simulation model predicts that market deposit rates will decrease by at least five percent.¹⁷

An estimate of the merger effect is needed to compare the current and proposed application screens. Although data on pre- and post-merger deposit rates are available, banks may adjust the interest rate paid on deposits for a variety of reasons that are not related to a merger. Unfortunately, the only data available for banks affected by a merger reflect the impact of both merger and non-merger related factors. Therefore, in order to isolate the merger effect, it is necessary to remove the non-merger related changes from the observed deposit rate changes. One method for obtaining an estimate of the non-merger related portion of the observed change in deposit rates is to construct a set of control banks that have not been exposed to any mergers.¹⁸ Under the assumption that the non-merger factors have the same effect on the control banks as the banks that are affected by the merger, the change in the deposit rates of the control banks can be used as a proxy for the non-merger related portion of the change in the deposit rates of the affected banks.¹⁹ The merger effect can then be estimated as the difference between the change in the affected banks' deposit rates and the change in the control banks' deposit rates. This approach is typically referred to as the difference-in-differences approach and is commonly used to estimate the price effects of mergers.²⁰ I combine the data from the NIC transformation table, the Call Reports, and the Summary of Deposits to construct a database of pre- and post-merger data on bank deposit rates, deposit shares and merger participation status to estimate a difference-in-differences model as follows. Banks that participate in a merger or that have a presence in the market in which the merger occurred are categorized as “affected” banks. I assign a bank to the control group if it does not have a presence in a market in which a merger has occurred and if it has not participated in a merger for at least four quarters prior to the beginning of the merger period. In order to control for possible changes on the demand side that may differ between the control banks and affected banks and that may impact the deposit rate a bank offers, I include in the estimation model covariates for a number of observable bank characteristics likely to be important to consumer demand for deposit services. Bank fixed effects are also included. Similarly, a number of covariates intended to control for the supply of deposit services are included. I use the results on the estimated merger effects to compare the simulation based screen to the HHI based screen for each of the 10 mergers. In particular, I analyze the number of false positives and false negatives that result from each screen.

¹⁷ I select five percent as the threshold in the simulation based screen because this is the level of price increase most often used by the Agencies as representative of a “small but significant” increase in price according to the Horizontal Merger Guidelines.

¹⁸ When an adequate control group is not available, one alternative is to estimate a reduced form model where price is regressed on demand and cost variables.

¹⁹ This approach also requires that any factors affecting only the price of either the control or the affected group are not also related to the decision to merge or else the estimates would be biased. See Hunter, Leonard, and Olley (2008) for a discussion on the required assumptions for using this approach.

²⁰ Weinberg (2007) provides a survey of methods used to estimate the price effects of horizontal mergers.

The remainder of the paper is organized as follows. In Section 1.2 I briefly discuss where this work fits in with the existing literature. An overview of the commercial banking industry is given in Section 1.3. In Section 1.4 I describe generally the merger simulation and difference-in-differences methodologies. I introduce the data in Section 1.5. I conduct merger simulations using the PCAIDS model and use the results to compare the current and proposed screens in Section 1.6. In Section 1.7 I conclude.

1.2 Relevant Literature

A number of authors have advocated for an alternative to the current HHI screen. Epstein and Rubinfeld (2001) argue for a screen based on the PCAIDS demand system used in this paper. Building on ideas presented in Werden (1996) and O'Brien and Salop (2000), Farrell and Shapiro (2010) suggest a screen that does not rely on quantifying post merger prices, but rather seeks to identify mergers that are likely to create "upward pricing pressure" due to increases in market power dominating the downward pricing pressure from any merger induced marginal cost savings. To my knowledge, this is the first paper to provide empirical comparisons of a simulation based application screen relative to the HHI screen. However, this paper is also closely related to the merger simulation and merger retrospective literatures. A complete review of all works implementing merger simulation models is beyond the scope of this paper, but the following examples indicate the widespread use of merger simulation models. Baker and Bresnahan (1985) were among the first to apply pre-merger data to a demand system in order to simulate the price effects of a proposed merger in an industry with differentiated products. The authors estimate residual demand curves to predict the impact of a merger between firms in the U.S. brewing industry. Feldman (1994) considers a merger of health care plans; Hausman and Leonard (1997) and Nevo (2000) investigate mergers in the breakfast cereal market, Peters (2006) uses post-merger data to test simulation predications in the airlines industry, while Molnar (2008) implements a logit based merger simulation model in the Finnish banking market to evaluate the three hypothetical mergers. A number of authors have also analyzed various properties of simulation models. For example, Crooke et al (1999) implement multiple simulations based on a common initial elasticity of demand but differing in whether an AIDS, logit, linear, and log-linear demand system is presumed. The authors show that the price predictions depend critically on the curvature of the imposed demand system as the curvature dictates how demand elasticities change as price changes. Budzinski and Ruhmer provide a survey of the use of merger simulation and competition policy, while Walker (2005) and Slade (2006) provide critical analyses of the method as a policy tool.

This paper also relates to the merger retrospective literature. Ashenfelter and Hosken (2008) note the asymmetry between the large amount of resources devoted to pre-merger analysis and the relatively little attention paid to the actual competitive effects of consummated mergers. Ashenfelter et al (2009) and Carlton (2009) make a similar point and argue that retrospective analysis is necessary in order to build an empirical basis for antitrust enforcement. A number of papers in the banking industry investigate post-merger outcomes of consummated mergers. Prager and Hannan (1998) investigate the post-merger price outcomes in the U.S. commercial banking industry and find that, for the year preceding and the year following the mergers, deposit interest rates are lower in markets where a significant merger occurs than in markets in

which no merger occurred.²¹ Focarelli and Panetta (2003) evaluate price outcomes of mergers between Italian banks and find that over a longer post-merger period, customers of merging banks received higher interest rates than customers of banks not involved in a merger. Weinberg (2007) provides a summary of literature on the price effects of horizontal mergers.

1.3 Overview of Commercial Banking Industry

In this section I briefly give an overview of aspects of the commercial banking industry that impact how I construct measures of the variables required to implement the proposed screen and the difference-in-differences model used to estimate the merger price effects. In particular, I describe the product and geographic markets as well as detail how I measure market shares and prices.

Although a variety of financial institutions accept deposits, including commercial banks, retail banks, thrifts (savings banks and savings and loan institutions), and credit unions, empirical evidence suggests that non-commercial bank deposit institutions are not significant competitors of commercial banks for consumer deposit services. For example, Amel and Hannan (1999) estimate residual supply curves to test whether various types of deposit institutions compete in the same product market and find that banks do not face significant competition from non-bank institutions. Adams et al (2007) estimate demand elasticities and obtain results that suggest limited substitution between bank depositors and thrift depositors. Consequently, I define the product market to be comprised of commercial banks. In addition, case law and empirical evidence support a geographic market that is local in scope. For example, in *United States v. Philadelphia National Bank* (1963), based on evidence that customers tend to cluster their deposit accounts at a single institution and that local customers are an important class of customers to banks the Court found the appropriate geographic market for bank competition to be local. In the empirical literature, Amel and Starr-McCluer (2002) find evidence from consumer surveys that the vast majority of consumers place their deposits in a local bank. Further, despite debate on expanding the geographic market, Amel, Kennickell, and Moore (2008) discuss evidence that consumers acquiring checking accounts, savings accounts, money market accounts, and certificates of deposit continue to obtain these products from local banks. Of course, commercial banks offer various types of loans and other credit instruments in addition to providing deposit services. However, the empirical literature on demand for banking services treats the deposit and credit product lines independently and predominantly focuses on deposit services due largely to the absence of reliable data on the appropriate geographic market for loan products. Specifically, loan consumers appear more likely to search outside of their local market to obtain a loan making it less clear that the geographic market for credit services is locally constrained. Measuring market shares for loan services, therefore, is difficult as it is not clear that loans in a given branch have been acquired by consumers in the local market. Taking into account the findings in the banking literature, I define the market to be deposit services at local commercial banks. In empirical practice, the local geographic market is defined according to Metropolitan Statistical Areas (MSA), which are county-based areas identified by the U.S. Office of

²¹ The authors define a significant merger to be one in which the merger would have been flagged based on a post-merger of at least 1800 and a change in HHI of at least 200.

Management and Budget (OMB) to have a high degree of economic and social integration.²² However, regulators do not necessarily follow the same convention when implementing merger policy. For example, the Federal Reserve Board constructs markets that often do not follow county-lines.²³ The inconsistency between the definition of the local market used in the empirical literature and the definition used by regulators to implement policy is due largely to data availability as much of the publicly available data are collected at the county-level. Despite this potential discrepancy, Laderman and Pilloff (2007) find that analyses using local markets that are county-based are relevant for evaluating merger policy even when regulators use local markets that are not county-based. For instance, the authors find that profitability regression results are similar whether they are based on variables measured over Federal Reserve markets or over MSAs and non-MSA counties. Thus, as is standard in the empirical banking literature, I define the local geographic deposit market as either a Metropolitan Statistical Area (MSA) or a non-MSA county and market shares are calculated as a bank's share of deposits in the local market. I also follow the convention in the banking literature of imputing a measure of the annual interest rate on deposits from data in the Call Reports.²⁴ Specifically, for each bank, I use the ratio of interest expense on deposits-to-the stock of deposits as the estimate of the average deposit rate. Although some survey data exist on actual rates offered by banks, such data is not available for entire sample period and does not cover each bank in the sample. Moreover, such surveys tend to be biased towards rates at larger banks. Ors and Rice (2006) investigate the impact of using imputed rates in place of offered rates and suggest that when imputing deposit rates from the Call Reports, using the average quarterly stock reported in the Call Reports is more appropriate than the end-of-quarter stock of deposits that is also reported. Therefore, I use the average stock as the denominator when imputing the deposit rate. It is worth reiterating that because the price at issue is the deposit rate, price increases are analogous to deposit rate decreases.

1.4 Merger Simulation and Difference-in-Differences Methods

I now describe the merger simulation methodology and how to implement simulations using the PCAIDS demand model introduced by Epstein and Rubinfeld (2001). Additionally, I give a brief overview of the difference-in-differences method for estimating the price effect of mergers.

1.4.1 Merger Simulation

Horizontal mergers are troublesome to the antitrust authorities to the extent that the joint ownership of assets that were separately owned pre-merger endows the acquiring firm with an increase in market power.²⁵ Of course, the combination of assets may result in pro-competitive

²² The Census Bureau's website provides more details on MSAs, <http://www.census.gov/population/www/metroareas/aboutmetro.html>.

²³ For example, the Ranally Metropolitan Areas (RMA) often used by the Federal Reserve Banks when defining a local market are not confined by county boundaries and are difficult to implement with available data on deposits.

²⁴ See, again, Dick (2002, 2008), Ishii (2005), Miller (2008) for examples.

²⁵ Antitrust authorities are also concerned with vertical mergers, however, I do not address such mergers in this paper.

outcomes as well. If there are economies of scale, for instance, a merger could result in efficiency gains. Whether or not market prices increase or decrease, then, depends on which effect is stronger. The merger simulation methodology forecasts post-merger equilibrium outcomes by explicitly modeling the impact of a merger on the profit maximization problem facing each firm. Formally, consider an industry with n firms pre-merger. For simplicity, I assume that each firm owns a single brand, although the model generalizes in a straight forward manner if firms own more than a single brand.²⁶ Each firm faces the following profit function:

$$\pi_i = [p_i - mc(q_i)]q_i - F_i$$

where p_i is the price Firm i receives for its product, $mc(q_i)$ is Firm i 's marginal cost of producing q_i units, and F_i are the Firm's fixed costs. The solution to the Firm's profit maximization problem depends on the choice variable. In markets with differentiated products, price (Bertrand) competition is generally assumed. Under Bertrand competition, the Firm's pre-merger profit maximization problem can be stated as:

$$\max_{p_i} \pi_i = [p_i - mc(q_i)]q_i - F_i \quad (1)$$

Recognizing that the quantity produced by Firm i is a function of all prices, the first-order condition (FOC) for profit maximization, $\frac{\partial \pi_i}{\partial p_i} = 0$, is given by:

$$q_i + [p_i - mc(q_i)] \frac{\partial q_i}{\partial p_i} = 0$$

Or, incorporating Firm i 's own-price elasticity, $\varepsilon_{ii} = \frac{\partial q_i}{\partial p_i} \frac{p_i}{q_i}$, the pre-merger FOC can be rewritten as:

$$q_i + \frac{p_i - mc(q_i)}{p_i} \varepsilon_{ii} q_i = 0 \quad (2)$$

Suppose now that Firm i acquires Firm j . Post-merger, then, Firm i earns profits on its own sales as well as sales going to and Firm j . Thus, Firm i 's post-merger profit maximization problem becomes:

$$\max_{p_i} \pi_i = [p_i - mc(q_i)]q_i + [p_j - mc(q_j)]q_j - F_i \quad (3)$$

Solving Firm i 's post-merger FOC in the same manner as the pre-merger FOC yields:

²⁶ Specifically, firms will maximize the sum of profits from each brand.

$$q_i + \frac{p_i - mc(q_i)}{p_i} \varepsilon_{ii} q_i + \frac{p_j - mc(q_j)}{p_j} \varepsilon_{ji} q_j = 0 \quad (4)$$

where ε_{ji} is the cross-price elasticity of demand for product j .²⁷ Thus, the model accounts for the fact that post-merger Firm i is able to internalize any sales it loses to Firm j as a result of a price increase. The post-merger equilibrium price is then found by finding the vector of prices that solves the system of post-merger FOCs for each firm in the market. Notice that all variables in the post-merger FOCs are taken at their post-merger values. Post-merger equilibrium quantities will be pre-merger quantities plus the changes in quantity due to the change in price. Because the change in quantity due to a change in price is determined by the demand function, post-merger equilibrium quantities therefore depend on the demand function. Likewise, changes in the elasticities of demand are determined by the (curvature of the) demand function. Finally, observe from Equation (2) that once the (pre-merger) own-price elasticity has been calculated from the estimated demand system parameters, data on pre-merger prices and quantities allow the pre-merger marginal costs to be recovered.²⁸ Implementing simulation models, then, typically proceeds by first using pre-merger data to estimate a presumed demand model and then calculating elasticities based on the estimated demand parameters.

The importance of the presumed demand system on simulation models is now clear – different demand systems will yield different pre-merger elasticity estimates.²⁹ Moreover, as Crooke et al (1999) illustrate, the curvature of a demand model also has a significant impact on post-merger price predictions as it is the curvature of the demand system that determines how elasticity changes with price. Therefore, even if simulation models are implemented with the same pre-merger elasticities, post-merger predictions will vary based on the particular demand system used. Despite the dependence of the simulation predictions on the presumed demand system model, a range of demand systems have been employed in the merger simulation literature. For example, Werden and Froeb (1994) apply the logit model to the U.S. long-distance carrier industry; Hausman and Leonard (1997) implement the AIDS model to analyze a merger in the bathroom tissue industry while Peters (2006) adopts a number of demand models that include a log-linear and generalized extreme value (GEV) model in his paper on mergers in the airline industry. In addition to there being no consensus on the important issue of which demand system to use, the few works that confront merger simulation predictions with post-merger data fail to find that simulations result in consistently accurate predictions of post-merger outcomes.³⁰ Walker (2005) provides relevant examples and discussion of predicted and measured post-merger outcomes to argue against the simulation methodology as a substitute method for competitive effects analysis. Nonetheless, though it may be the case the merger simulation

²⁷ Firm j 's post-merger FOC would similarly reflect the new joint-ownership structure.

²⁸ It is standard practice to assume that marginal costs are constant over the relevant range so that pre- and post-merger costs are the same. Alternatively, the simulation model could also be implemented to test the size of efficiencies necessary to keep prices constant by solving for post-merger costs keeping prices constant at pre-merger levels.

²⁹ Clearly, the functional form of the supply curve matters too. However, the convention of keeping marginal costs abstracts away from the issue of the impact of different functional forms for the supply curve.

³⁰ See, for example, Peters (2006) and Weinberg and Hosken (2008).

models have not evolved (and may not evolve) to the point to where the predictions of such models can be relied upon to predict the precise price outcome of a proposed merger, because the simulation framework explicitly models changes in the competitive environment (via changes in the FOCs), it is likely to provide more information on the potential competitive effects than a simple measure of market share concentration. That is, a merger simulation based screen is likely to be an improvement over the current HHI based screen. However, in order for the simulation methodology to be practical as a merger application screen, the required parameters must be obtained by a means other than estimating a demand system for each application. Epstein and Rubinfeld's (2001) PCAIDS model meets this criterion as it requires only information on pre-merger market shares and estimates of two elasticities. I now describe how to obtain the required inputs for the model introduced in Epstein and Rubinfeld (2001).

The basis of the PCAIDS model is the Almost Ideal System (AIDS) introduced by Deaton and Muellbauer (1980), which is flexible enough to provide a first-order approximation of any demand system while simultaneously satisfying the axioms of choice. The flexibility and tight link to microeconomic theory are strengths of the AIDS model. However, the AIDS model often requires that a large number of parameters be estimated econometrically. Epstein and Rubinfeld (2001) describe a general method to calibrate the AIDS demand model using minimal data and refer to this as the Proportionality-Calibrated AIDS (PCAIDS) model. The PCAIDS model is predicated on the simplifying assumption that a firm's lost sales resulting from a price increase are diverted to competitors in proportion to the relative market shares of the rival firms.³¹ In particular, Epstein and Rubinfeld (2001) show that the PCAIDS model can be fully calibrated using only information pre-merger market shares, the own-price elasticity of demand for a single firm in the market and the industry price elasticity of demand – all of which are likely to be available to the regulators. Using the authors' notation, the model assumes that in an industry with n firms, Firm i 's share is a linear function of the natural log of the price of all products in the market.

$$s_i = a_i + \sum_{j=1}^n b_{ij} \ln(p_j) \quad (5)$$

Totally differentiating the share equation with respect to each firm's price yields an equation for the share change as a function of the percentage change in price:

$$ds_i = \sum_{j=1}^n b_{ij} \left(\frac{dp_j}{p_j} \right) \quad (6)$$

The b_{ij} are the own- and cross-price effects of price changes on the share of Firm i . Under the proportionality assumption, lost sales due to an increase in price from any firm are allocated to the rival firms in accordance to each rival's market share (exclusive of the share of the firm implementing the price increase). For instance, if Firm j increases price, the portion of lost sales

³¹ This is equivalent to the Independence of Irrelevant Alternatives (IIA) assumption implied by the logit model.

going to Firm i is given by $\frac{s_i}{1-s_j}$. The cross-price effects of Firm j on Firm i 's shares can be expressed as:

$$b_{ij} = -\left(\frac{s_i}{1-s_j}\right)b_{jj} \quad (7)$$

It now demonstrate how if pre-merger market shares, any single firm's own-price elasticity, ε_{ii} , and the industry elasticity, ε , are known, then the own-price effect of Firm i can be computed. Epstein and Rubinfeld (2001) show that the PCAIDS own- and cross-price elasticities are:

$$\varepsilon_{ii} = -1 + \frac{b_{ii}}{s_i} + s_i(\varepsilon + 1) \quad (8)$$

and

$$\varepsilon_{ij} = \frac{b_{ij}}{s_i} + s_j(\varepsilon + 1) \quad (9)$$

Solving Equation (8) for the own-price effect yields:

$$b_{ii} = s_i[\varepsilon_{ii} + 1 - s_i(\varepsilon + 1)] \quad (10)$$

Without loss of generality, let any single firm in the market be designated as Firm 1. Then Firm 1's own-price effect is given by:

$$b_{11} = s_1[\varepsilon_{11} + 1 - s_1(\varepsilon + 1)] \quad (11)$$

That is, the own-price effect of Firm 1 can be calculated with estimates of Firm 1's pre-merger market share, s_1 , own-price elasticity, ε_{11} , and the industry elasticity of demand, ε . Employing the proportionality assumption, the additional own-price effects of the other firms in the market can be calculated as multiples of Firm 1's own-price effect:³²

$$b_{ii} = \left(\frac{s_i}{1-s_1}\right)\left(\frac{1-s_i}{s_1}\right)b_{11} \quad (12)$$

³² Adding up and homogeneity are also imposed. Adding up requires that shares sum to one, and homogeneity ensures that an equal percentage change in all prices do not affect shares. See the Appendix in Epstein and Rubinfeld (2001) for additional properties of the AIDS and PCAIDS models.

Once the own-price effects have been calculated they can be substituted into Equations (7) – (9) to obtain the own- and cross-price elasticities. The assumption of proportionality thus allows all necessary parameters to be recovered using only pre-merger market shares, estimates of the own-price elasticity of but one firm, and the industry elasticity.

Implementing a merger simulation model using the share based PCAIDS model is now straight forward. Letting s_i be shares, μ_i be profit margins, and ε_{ii} be the own-price elasticity of Firm i , the pre-merger FOCs written in share form are:

$$s_i + \mu_i \varepsilon_{ii} s_i = 0 \quad (13)$$

The own-price elasticities are calculated from the PCAIDS model using pre-merger market shares, estimates of the one firm's own-price elasticity, and the industry elasticity as described above. Pre-merger margins are then recovered by substituting the pre-merger shares and own-price elasticity estimates into (13). Note that neither pre-merger prices nor marginal costs are required to obtain any of the ε_{ii} and therefore are not required to calculate the pre-merger margins under this formulation.

Post-merger, the acquiring firm (Firm i) faces the following FOC if it acquires Firm j :

$$s_i + \mu_i \varepsilon_{ii} s_i + \mu_j \varepsilon_{ji} s_j = 0 \quad (14)$$

where all of the variables, including elasticities, are taken at their post-merger values. As shown in Equation (6), post-merger shares are a function of price changes. Post-merger elasticities are functions of post-merger shares, and are therefore functions of the price changes as well. Further, Epstein and Rubinfeld (2001) show that the post-merger margins can be formulated as functions of the pre-merger margin and the price change.³³ Therefore, the system of post-merger FOCs is written entirely in terms of price changes so that the predicted post-merger equilibrium prices are obtained from the vector of price changes that solves the system of FOCs.

1.4.2 Measuring Merger Effects with Difference-in-Differences

Because firms may change prices for reasons unrelated to a merger, observed price changes following a merger likely reflect a combination of merger-related and non-merger related factors. Measuring the effect of a merger on a firm's price, therefore, involves separating merger related price changes from non-merger related price changes. Letting Δp_i be the total change in Firm i 's price, Δp_i^{merger} be the portion of the total change in Firm i 's price due to the merger, and $\Delta p_i^{nonmerger}$ represent the portion of the total change in Firm i 's price that is due to non-merger factors, it is then straight forward to see that the merger related change in price is just the total change in price less the portion of the change due to non-merger related factors:

$$\Delta p_i = \Delta p_i^{merger} + \Delta p_i^{nonmerger}$$

³³ For details, see the Appendix of Epstein and Rubinfeld (2001).

$$\Delta p_i^{merger} = \Delta p_i - \Delta p_i^{nonmerger}$$

Unfortunately, data on non-merger related price changes, $\Delta p_i^{nonmerger}$, are not available for firms affected by a merger. Therefore, to estimate the merger effect on the price requires a proxy for the change in price that would have occurred even absent the merger. One method to obtain such a proxy is to construct a set of control firms that are presumed to be identical to the affected firms in all non-merger related dimensions that influence the price. If an appropriate set of controls can be obtained, then the observed change in price of the controls can be used as an approximation of the change in the price of the affected firms that would have occurred absent the merger and the change in price due to the merger can be estimated as a difference-in-differences:

$$\Delta p_{affected}^{merger} = \Delta p_{affected} - \Delta p_{control} = (p_{affected}^{post} - p_{affected}^{pre}) - (p_{control}^{post} - p_{control}^{pre})$$

Estimating the price-effects of mergers using the difference-in-differences method is common in the merger retrospective literature (Weinberg 2007) and can be implemented with the following model:³⁴

$$p_{it} = \beta_0 + \beta_1 Affected_i + \beta_2 Merger_t + \beta_3 (Affected_i * Merger_t) + \epsilon_{it}$$

where p_{it} is the price charged by Firm i in period t ; $Affected_i$ is an indicator variable that takes on the value of one if Firm i was affected by the merger and zero if Firm i is a control bank; $Merger_t$ is an indicator variable that is equal to one in the merger period. To see that β_3 is a difference-in-differences estimator, notice that if Firm i is affected by a merger, then expected prices pre- and post-merger are:

$$E[p_{it} | Affected_i = 1, Merger_t = 1] = \beta_0 + \beta_1 + \beta_2 + \beta_3$$

and,

$$E[p_{it} | Affected_i = 1, Merger_t = 0] = \beta_0 + \beta_1$$

Thus, the expected difference between the pre-merger price and the post-merger price for firms affected by a merger,

$$E[p_{it} | Affected_i = 1, Merger_t = 1] - E[p_{it} | Affected_i = 1, Merger_t = 0]$$

is given by:

$$[(\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_1)]$$

³⁴ Estimation also requires that any factors specific to either the control or affected firms do not also influence the decision to merge, otherwise the estimated merger effects will be biased.

Similarly, if Firm i is part of the control group, the expected difference between the pre-merger price and the post-merger price:

$$E[p_{it}|Affected_i = 0, Merger_t = 1]$$

and,

$$E[p_{it}|Affected_i = 0, Merger_t = 0]$$

is given by:

$$(\beta_0 + \beta_2) - \beta_0$$

Therefore, the difference-in-differences is given by β_3 since:

$$[(\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_1)] - [(\beta_0 + \beta_2) - \beta_0] = \beta_3$$

Although I use a slightly different specification below, the basic method and interpretation remain the same.

1.5 Data

Data come from three main sources. Every national bank, state member bank, and insured state nonmember bank is required to file a Report of Condition (bank balance sheet) and Report of Income (bank income statement) as of the last calendar day of each calendar quarter. The Reports of Condition and Income are collectively known as “Call Reports.”³⁵ The Call Reports are available from the Federal Reserve Bank of Chicago's website and contain data on deposit levels, loan levels, number of employees, interest payments, and other bank characteristics. Although many banks are comprised of numerous branches, the Call Report data are reported at the bank-level. Branch-level data are from the Federal Deposit Insurance Corporation (FDIC), which requires every FDIC-insured commercial bank, FDIC-supervised savings bank, and insured U.S. branch of foreign banks to file a Summary of Deposit (SOD) report as of June 30th of each year. The SOD reports contain data on the amount of deposits in a bank's main office and each branch location operating as of June 30th and are available electronically beginning in 1994.³⁶ The final data set on bank characteristics and markets shares is comprised of all commercial banks filing both the Call Report and the Summary of Deposit in a given year from 1994-2007. Data on mergers in the banking industry from 1994-2007 were obtained from the Federal Reserve System's National Information Center (NIC) transformation table via a Freedom of Information Act (FOIA) request. The NIC data include the transaction type, the effective date

³⁵ The term “Call Reports” come from the fact that originally only a subset of banks was “called” on to file the financial statements.

³⁶ I drop branches that are categorized as non-deposit offices, administrative offices, military facilities, or trust offices as non-deposit and administrative offices do not accept deposits, military facilities are not accessible to the general public, and trust offices only conduct trust activities. These categories and their descriptions are obtained from the Summary of Deposits filing instructions.

of the transaction, and unique identifier codes for each participant in the transaction. The descriptions of the alphanumeric variables reported in the Call Reports, SOD surveys, and NIC merger data were obtained from the Micro Data Reference Manual (MDRM) available on the Federal Reserve Bank of Chicago's website.³⁷ Although I have data on all consummated bank mergers, this is not a random sample. It does not include, for example, banks that proposed a merger that was prevented due to government intervention; neither does it contain banks that would have proposed a merger but for the belief that the merger would be disallowed.³⁸ One must therefore be careful when generalizing from the results uncovered through analysis of this selected sample.

1.6 Results

I now select the bank mergers on which to base the comparison of screens and use pre-merger data to conduct the simulations based on the PCAIDS model. I then combine pre- and post-merger data to implement a difference-in-differences model to estimate the price effect of each merger and use the estimated effects as the basis for comparisons of the simulation based screen and the current HHI screen.

1.6.1 Simulated Mergers

In order to evaluate the merger simulation model as a screening mechanism, I select mergers with features that suggest they would be particularly good candidates for the simulation method. Specifically, I investigate mergers involving banks that participate in a single merger over the merger period to prevent the need to disentangle the effects of multiple mergers from observed price changes. Additionally, I ensure that no entry or exit occurs in the market over the merger period as the standard simulation model does not incorporate entry or exit. If the method does not provide a useful screen for the selected mergers, it is unlikely to provide a useful screen for more complicated mergers. I also limit my analysis to mergers occurring in the second quarter as this corresponds to the quarter in which the SOD reports used for constructing market shares are filed. This leaves me with 10 mergers, which, though small in absolute terms, compares favorably to similar studies. Peters (2006), for example, uses pre- and post-merger data from six mergers in the airline industry to test simulated predictions. Similarly, Weinberg and Hosken (2008) investigate simulated outcomes of two mergers, and Ashenfelter and Hosken (2008) use the outcomes of five mergers in their evaluation of the effectiveness of U.S. horizontal merger policy. Tables 1.1 and 1.2 summarize the 10 mergers obtained.

After selecting the merger sample, I utilize pre-merger data to simulate the post-merger prices using the PCAIDS model.³⁹ Letting M be the total market size, s_i Bank i 's market share, mc_i the

³⁷ <http://www.federalreserve.gov/reportforms/mdrm/index.htm>

³⁸ I do not know of any data that would allow me to identify banks that failed to merge due to government intervention.

³⁹ Recall that a price increase is equivalent to a decrease in deposit rates.

marginal cost, and F_i fixed costs, I follow Dick (2002, 2008) and write Bank i 's profit function as:⁴⁰

$$\pi_i = (p_i - mc_i)Ms_i - F_i$$

An important consideration in implementing the simulation model is determining the type of competitive interaction that is prevalent in the market. Commercial banks differ from one another in a number of dimensions that matter to consumers of deposit services. Dick (2002, 2008), for example, finds that consumer demand is responsive to the interest rates offered on deposits, the number of branches a bank has in the market, and the number of states in which a bank has a presence. On the supply side, Molnar (2008) finds that observed bank margins are closer to a model of Bertrand competition than collusion. Thus, I assume that banks engage in Bertrand (price) competition and each Bank i 's first order condition (FOC) for profit maximization pre-merger is as in Equation (13):

$$s_i + \mu_i \varepsilon_{ii} s_i = 0$$

And, if Bank i acquires Bank j , then the post-merger FOCs for Firm i is as in Equation (14):⁴¹

$$s_i + \mu_i \varepsilon_{ii} s_i + \mu_j \varepsilon_{ji} s_j = 0$$

Using data from the Summary of Deposits, I calculate the pre-merger shares as follows. Bank i 's market share is the ratio of Bank i 's deposits over all deposits in commercial banks in the local market. The estimates for the own-price elasticity of the acquiring bank come from Adams et al (2007). I use the mean elasticity reported for commercial banks and reduce it by the reported standard deviation. I reduce the reported mean elasticity in order to bias the simulation based screen away from false negatives. Similarly, I assume an industry elasticity of negative one as this is conservative for the present purpose. I then obtain the remainder of the parameter estimates from the PCAIDS model as described in Equations (8) – (11) and simulate the post-merger prices by solving the system of post-merger FOCs.

1.6.2 Merger Effects

As explained above, measuring the effect of a merger on a bank's deposit rate requires separating merger related deposit rate changes from non-merger related deposit rate changes. I now describe my estimation strategy. I categorize a bank as being affected by a merger if it is either a participant in a merger or if it has at least one branch in a market in which a merger occurred. I assign a bank to the control group if it does not have a presence in a market in which a merger has occurred, and if it has not participated in a merger for at least four quarters prior to the

⁴⁰ In this specification, p_i is the interest banks receive on loans plus the service fees received less the interest paid on deposits.

⁴¹ Firm j 's post-merger FOC similarly changes to reflect the impact of joint ownership on the profit function.

merger period under investigation.⁴² Thus, control banks have not participated in a merger for at least a thirteen quarter period surrounding the merger, and are not present in a market where a merger has occurred over that same time period. Changes in the control banks' deposit rates, then, should be due to only non-merger factors. After constructing the control groups for each merger, I estimate the effect of a merger on prices as:⁴³

$$\ln(p_{it}) = \alpha + \delta Affected_i + \varphi Merger_t + \beta(Affected_i * Merger_t) + \sum_{Q=1}^{13} \gamma Q_t + z v_{it} + \epsilon_{it}$$

where p_{it} is the average deposit rate of Bank i at time t . $Merger_t$ is a dummy variable that is equal to one if t is in the merger period; $Affected_i$ is a dummy variable that is equal to one if Bank i was either a participant in the merger or was present in the market in which the merger occurred; Q_t is a dummy variable for each quarter, v_{it} is vector of control variables for Bank i in time period t , and ϵ_{it} is an error term that varies across banks and over time. The variables that comprise v_{it} are included as an attempt to control for bank specific factors that may influence deposit rates. For example, on the demand side, I follow Dick (2002) and assume that a measure of bank size captures differences in diversity of products and know-how. A measure of the number of states in which banks have a presence is included to control for differences in network size and geographic scope. I also attempt to capture effects due to bank reputation by controlling for bank age. Dick (2002) estimates a structural model of consumers demand and finds all of these bank characteristics to be statistically significant over all bank markets. Bank fixed effects are also included. Similarly, a number of covariates intended to control for the supply of deposit services are included. Because banks that belong to a holding company likely have cheaper access to funds, I include a variable indicating whether a bank is part of a holding company. Banks use consumer deposits to provide credit instruments and Miller (2008) points out that banks with higher loans-to-assets ratios may have a higher demand for deposits, while banks with higher loan charge-offs may have lower demands for deposits due to greater lending costs. Therefore, I also control for loan side conditions that may impact deposit rates through the inclusion of the loans-to-assets ratio and the charge-offs-to-loan ratio. The ratios of expenses on premises and fixed assets-to-assets and other expenses-to-assets are also included as controls for more general cost differences. The estimation results indicate that the deposit rates in three of the merger markets decreased by more than five percent relative to the deposit rates of the control banks. None of the estimated merger effects for the other seven mergers were statistically significant at the 95% confidence-level. The estimated merger effect on deposit rates are shown in Table 1.3.

1.6.3 Comparisons

As previously explained, the current policy flags a bank merger application if the post merger HHI is at least 1800 and the change in HHI due to the merger is at least 200. I define a

⁴² Only control banks that are present in all thirteen quarters are kept.

⁴³ As discussed earlier, this method implicitly assumes that any factors specific to the control or affected banks do not also influence the decision to merge. I am not aware of any data that would allow me to test this assumption.

simulation based screen whereby a merger is flagged for further review if the simulation model predicts that market deposit rate will decrease by at least five percent.⁴⁴ I compare which mergers are flagged under the current HHI policy and which mergers are flagged under the proposed screen to illustrate the impact of utilizing information beyond what is captured by the current HHI screen. Based on the available pre-merger data, the PCAIDS model predicts a price increase of five percent or more in seven of the ten merger markets. As Table 1.2 shows, all 10 mergers exceed the HHI thresholds and would have been flagged under the current policy.⁴⁵ Figures 1.1 and 1.2 illustrate a significant overlap in the level of post-merger HHI, the change in HHI, and the size of the simulated decrease in the market deposit rate. Indeed, Figure 1.2 shows a one-to-one relationship between the rank orders of the change in HHI and the simulated deposit rate decrease for the mergers in the sample. That is, the ordering of mergers by the size of change in the HHI is exactly the same as the ordering of mergers by the size of simulated decrease in market deposit rate. This relationship is due to both screens being based in part on measures of market share. In addition to market concentration, though, the merger simulation model also takes into account estimated substitution patterns and margins. As a result, although all 10 of the mergers would have been flagged under the HHI screen, the proposed simulation screen would have been more discriminate as only seven of the mergers would have been flagged. However, an important question remains. Namely, is the proposed screen too discriminate in that it would fail to flag mergers that resulted in adverse price effects? Table 1.4 indicates which mergers would have been flagged under each screen, as well as which mergers have resulted in statistically significant price changes. Importantly, all three of the mergers estimated to have had an adverse effect on market deposit rates would have been flagged by the simulation screen, suggesting that while more discriminate than the HHI screen, the simulation is not so discriminate that it fails to flag the applications of mergers that appear to have resulted in a harmful outcome. I illustrate the sensitivity of the simulation flag to the own-price elasticity input in Table 1.5 and Table 1.6. As shown in Table 1.5, using a conservative estimate of the acquiring bank's own-price elasticity resulted in seven mergers being flagged, including all three of the mergers that the data suggest resulted in an adverse effect on deposit rates. In contrast, Table 1.6 shows that implementing the simulation screen using the mean own-price elasticity as reported in Adams et al (2007) without reducing it by a full standard deviation would have resulted in only three of the mergers being flagged for further scrutiny.⁴⁶ Moreover, only one of the three mergers that appear to have resulted in lower deposit rates would have been flagged, meaning that the screen would have yielded two false negatives. That merger simulation predictions are sensitive to the elasticity estimates is a well known result. It is also well known that the elasticity estimates are sensitive to the presumed demand form. I do not interpret this sensitivity as evidence against the use of a simulation based application screen. Rather, I interpret this as evidence of the importance of implementing the screen using conservative estimates as this preserves the goal of biasing away from false negatives while taking into account the reality that the estimated elasticities may not be accurate.

⁴⁴ I select five percent as the threshold in the simulation based screen because this is the level of price increase most often used by the Agencies as representative of a “small but significant” increase in price according to the Horizontal Merger Guidelines.

⁴⁵ Because all 10 mergers are flagged by the HHI screen, there is no possibility in this sample that the HHI screen could produce a false negative.

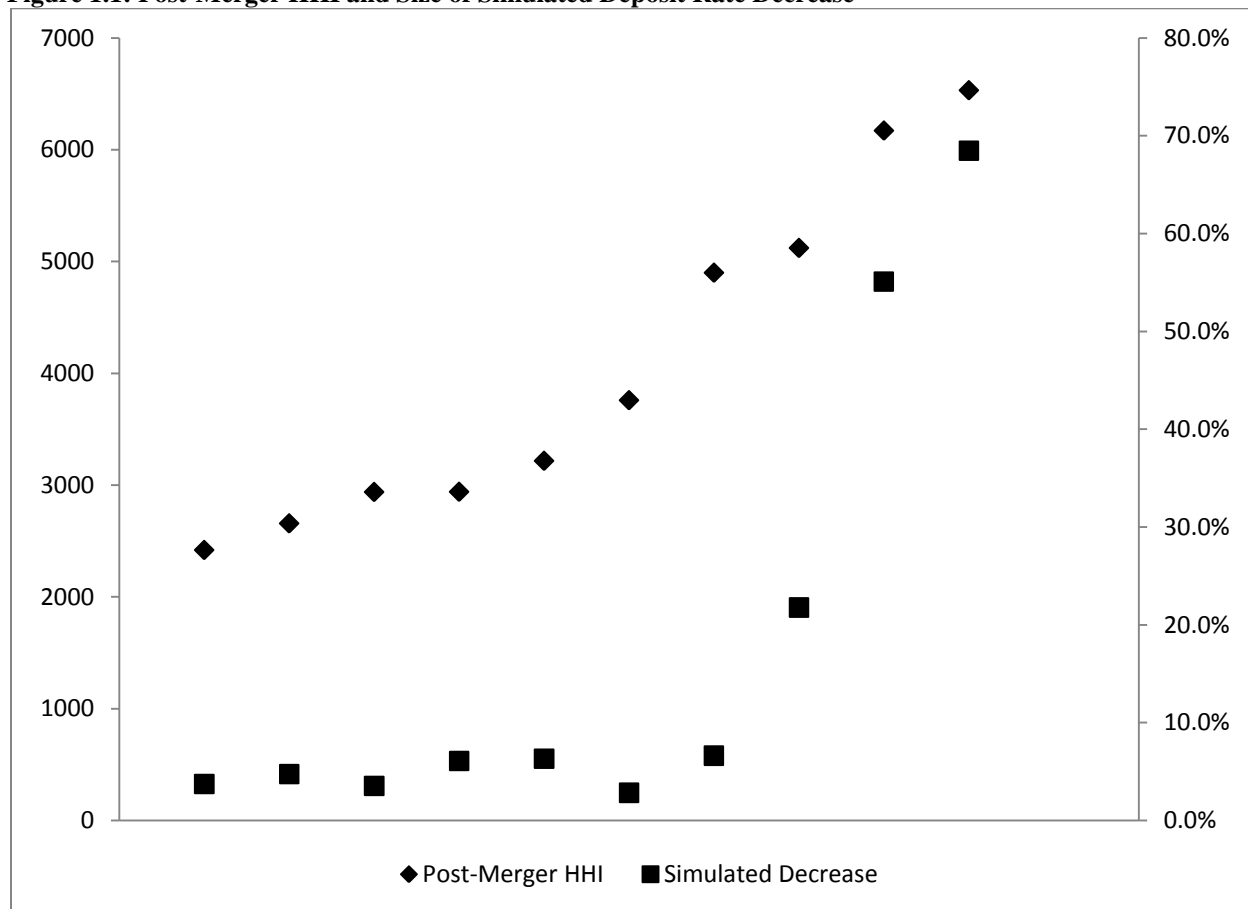
⁴⁶ Specifically, the mean reported elasticity used from Adams et al (2007) is -2.5, while the adjusted (“conservative”) elasticity is -1.63.

1.7 Conclusion

Antitrust agencies face the daunting task of evaluating a large number of merger applications under statutory time constraints. Traditionally, measures of market concentration have been employed to screen merger applications for further review. While simple to implement, this method is not tightly linked to economic theory. Methods based on more complicated theory, on the other hand, often fail the test of offering a practical alternative. Simplified merger simulation models have been proposed as potential replacements for traditional screens. I evaluate one such screen implemented using Rubinfeld and Epstein's (2001) PCAIDS demand model and compare it to the current HHI screen. Combining pre- and post-merger data to estimate a difference-in-differences model of the merger effects suggests that the simulation based screen reduced the number of false positives relative to the HHI screen without producing any false negatives for a selected sample of 10 consummated horizontal bank mergers. I interpret this as evidence that a simulation based screen, which incorporates elements of demand, supply, and the competitive environment in its predictions, may be more informative than a screen based only on measures of market concentration. Not surprisingly, the simulation flag is sensitive to the estimated elasticity used as an input. However, incorporating conservative assumptions on the available elasticity estimates can mitigate this sensitivity for purposes of using the results as an application screening device. A number of questions remain for further research. For instance, the subset of mergers analyzed was selected precisely because these mergers were *a priori* the best candidates for a simplified merger simulation framework. Future research could examine whether the findings are replicated in markets in which entry or exit does occur or where multiple mergers occur in the same market. Further, it is not clear that the results generalize to the larger MSA markets in the banking industry, or to other industries. I have also not addressed how other proposed screens such as the logit model suggested by Werden, Froeb and Tardiff (1996) or the UPP diagnostic introduced by Farrell and Shapiro (2010) compare to the PCAIDS based screen. Additional work could provide direct comparisons of these alternative proposed screens.

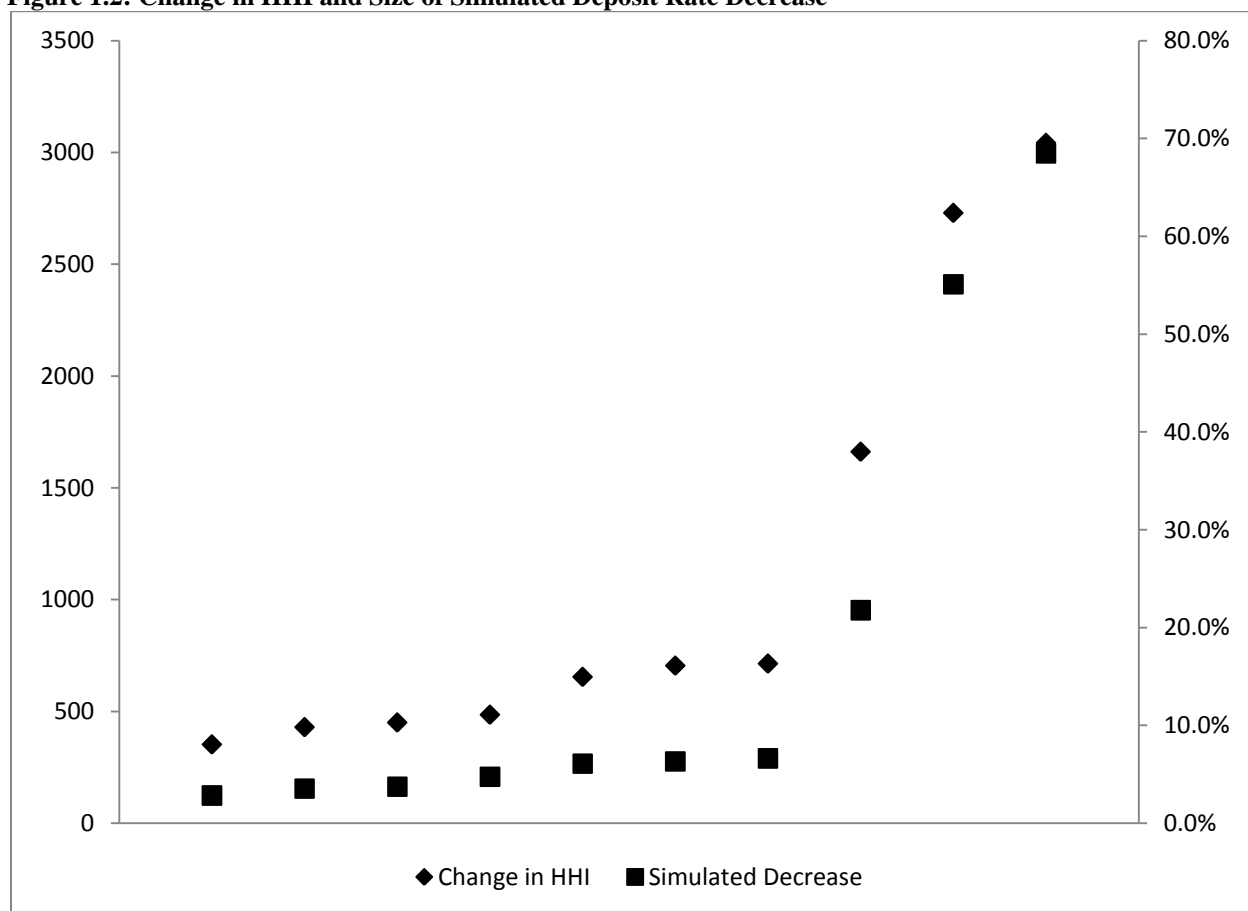
Figures

Figure 1.1: Post-Merger HHI and Size of Simulated Deposit Rate Decrease



Note: The secondary vertical axis gives the magnitude of the simulated deposit rate *decrease*

Figure 1.2: Change in HHI and Size of Simulated Deposit Rate Decrease



Note: The secondary vertical axis gives the magnitude of the simulated deposit rate *decrease*

Tables

Table 1.1: Merging Banks

Year	Bank Market	Acquiring Bank	Acquired Bank
1996	Roosevelt	First Community Bank	Culbertson State Bank of Culbertson
1996	Grimes	First Bank	The Security State Bank
1997	Bullock	The American National Bank of Union Springs	The First National Bank of Union Springs
1999	Norton	First Security Bank & Trust Company	The Exchange Bank of Lenora
1999	Burt	First National Bank Northeast	The Farmers and Merchants National Bank of Oakland
2001	Fillmore	Geneva State Bank	Shickley State Bank
2001	LaMoure	Security State Bank of Edgeley	Kulm State Bank
2001	Cumberland	The First National Bank in Toledo	The Greenup National Bank
2002	Polk	Cornerstone Bank, National Association	Citizens State Bank
2003	Caledonia	Union Bank	Citizens Savings Bank and Trust Company

Source: NIC Transformation table

Table 1.2: Summary of Merger Markets

Bank Market	Acquiring Bank's Share	Acquired Bank's Share	Pro Forma Share	Pre-Merger HHI	Change in HHI	Post-Merger HHI
Roosevelt	14%	16%	29%	2509	430	2938
Grimes	13%	17%	30%	1969	450	2419
Bullock	34%	40%	74%	3441	2730	6171
Norton	27%	13%	40%	2512	705	3217
Burt	48%	17%	65%	3460	1661	5121
Fillmore	42%	8%	50%	2286	654	2940
LaMoure	24%	15%	39%	4186	714	4900
Cumberland	44%	35%	79%	3489	3043	6532
Polk	19%	9%	28%	3407	352	3759
Caledonia	7%	33%	40%	2172	485	2657

Pro Forma Share is the sum of the pre-merger shares of the merging banks

Table 1.3: Estimated Merger Effects with 95% Confidence Interval

Year	Bank Market	Estimated Effect	Upper Bound	Lower Bound
1996	Roosevelt	-0.3%	4.3%	-4.8%
1996	Grimes	1.5%	5.6%	-2.7%
1997	Bullock	-10.9%*	-5.7%	-16.2%
1999	Norton	0.5%	4.5%	-3.6%
1999	Burt	-1.3%	3.3%	-6.0%
2001	Fillmore	-5.2%	0.7%	-11.0%
2001	LaMoure	-8.6%*	-0.2%	-16.9%
2001	Cumberland	7.2%	15.5%	-1.1%
2002	Polk	-4.8%	4.3%	-13.9%
2003	Caledonia	-10.4%*	-2.6%	-18.2%

* Significant at the 95% level

Upper Bound and Lower Bound are the 95% confidence interval bounds

Table 1.4: Merger Screen Comparison

Year	Bank Market	HHI Flag	PCAIDS Flag	Estimated* Adverse Effect	HHI False Negative	PCAIDS False Negative	PCAIDS False Positive
1996	Roosevelt	1	0	0	1	0	0
1996	Grimes	1	0	0	1	0	0
1997	Bullock	1	1	1	0	0	0
1999	Norton	1	1	0	1	1	0
1999	Burt	1	1	0	1	1	0
2001	Fillmore	1	1	0	1	1	0
2001	LaMoure	1	1	1	0	0	0
2001	Cumberland	1	1	0	1	1	0
2002	Polk	1	0	0	1	0	0
2003	Caledonia	1	1	1	0	0	0

* Estimated Adverse Effect indicates whether a statistically significant (at the 95% confidence level) adverse effect was estimated

Table 1.5: PCAIDS with Conservative Own-Price Elasticity

Year	Bank Market	Estimated Adverse Effect	PCAIDS Flag	False Positive	False Negative
1996	Roosevelt	0	0	0	0
1996	Grimes	0	0	0	0
1997	Bullock	1	1	0	0
1999	Norton	0	1	1	0
1999	Burt	0	1	1	0
2001	Fillmore	0	1	1	0
2001	LaMoure	1	1	0	0
2001	Cumberland	0	1	1	0
2002	Polk	0	0	0	0
2003	Caledonia	1	1	0	0

The conservative estimate of the own-price elasticity is -1.63 and comes from reducing the mean deposit rate elasticity reported Adams et al (2007) by one SD

Table 1.6: PCAIDS with Unadjusted Own-Price Elasticity

Year	Bank Market	Estimated Adverse Effect	PCAIDS Flag	False Positive	False Negative
1996	Roosevelt	0	0	0	0
1996	Grimes	0	0	0	0
1997	Bullock	1	1	0	0
1999	Norton	0	0	0	0
1999	Burt	0	1	1	0
2001	Fillmore	0	0	0	0
2001	LaMoure	1	0	0	1
2001	Cumberland	0	1	1	0
2002	Polk	0	0	0	0
2003	Caledonia	1	0	0	1

The unadjusted own-price elasticity is -2.5 and comes from Adams et al (2007)

Chapter 2

Are Branch Divestitures Sufficient Antitrust Remedies in Banking Mergers?

2.1 Introduction

Prior to the pre-merger notification requirements of the Hart-Scott-Rodino Antitrust Improvements Act of 1976 (HSR), the antitrust authorities were frequently unaware of mergers and acquisitions until after they were consummated. Consequently, in the event that post-merger behavior was deemed anticompetitive, the agencies were forced to attempt to retroactively restore competition and divestitures of assets were an oft used tool in the agencies' policy kit (FTC, 1999). However, evidence suggests that these divestitures often failed at establishing viable post-merger competitors (Elzinga, 1969 and Rogowsky, 1986). Indeed, due in large part to the difficulty of restoring competition *ex post* – to say nothing of mitigating any harm experienced prior to intervention – the HSR Act requires almost all parties intending to merge to file a pre-merger notification with the appropriate government agency.⁴⁷ Consequently, following the HSR Act the antitrust authorities' task became one of prohibiting mergers likely to lessen competition, a mandate requiring the agencies to *a priori* identify harmful mergers and, when necessary, to implement sufficient remedies to alleviate the competitive concerns. As was the case prior to the HSR Act, divestitures have remained the most common tool for “fixing” troublesome mergers (FTC, 1999). However, subsequent to the HSR Act, the agencies take a more active role in establishing the terms of any divestitures, potentially increasing their effectiveness as a competitive effects remedy. For example, to prevent acquiring firms from retaining market power by delaying the implementation of required divestitures, before approving a merger involving divestitures the agencies typically require the merging parties to commit to make any agreed upon divestitures within a matter of months following consummation of the merger. The agencies may also stipulate other details of the divestiture, for instance, that assets be divested to a competitor that was not previously in the market, or that the assets to be divested are those of the acquired firm. Whether the combination of requiring pre-merger notification and the increased agency involvement in negotiating the terms of the remedies has in fact improved the effectiveness of divestitures in promoting a competitive environment, however, is an empirical question.

Early inquiries into the effectiveness of divestitures focused mainly on whether the divestitures occurred within the required time limits.⁴⁸ In 1995, looking to further the understanding of the performance of divestitures, the staff of the Bureau of Competition and the Bureau of Economics

⁴⁷ While the DOJ and the FTC are the primary antitrust agencies, the set of agencies responsible for any particular merger depends in part on the industry in which the merger will occur. For example, the Federal Reserve Board, the Office of the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Office of the Thrift Supervision are all involved in enforcing the antitrust laws in the U.S. banking industry. Hereafter, the terms Agency or Agencies are inclusive of the appropriate set of regulators for any particular merger.

⁴⁸ In particular, see Elzinga (1969) and Rogowsky (1986).

at the Federal Trade Commission (FTC) obtained authorization to survey the buyers of divested assets in an attempt to undertake a systematic study (the Study) of the Commission's divestiture process. Based on divestiture orders from (fiscal years) 1990 – 1994, the Study focused on whether the buyer of the divested assets was able to enter the market and maintain operations. The FTC finds that the success rate of the divested assets in the sample is comparable to that of privately negotiated mergers and acquisitions and takes this as evidence that the divestitures have been successful. Similarly, Burke (1997) and Piloff (2002) present evidence on the survival rates and market shares of divested bank branches to suggest that branch divestitures have provided successful antitrust remedies in bank mergers.

While the evidence appears to support the notion that divestitures are an adequate remedy for preserving the market *structure*, it is the post-merger market *performance* that is at the heart of the antitrust laws. Although market power can adversely affect non-price performance such as quantity, quality, and innovation, in practice, price is often the focus.⁴⁹ Understanding how a particular merger transaction is likely to affect pricing behavior requires an evaluation of countervailing forces. Borrowing terminology from Farrell and Shapiro (2010), a merger between two rivals generates upward pricing pressure by removing a competitor, while any efficiencies gains from the transaction create opposing downward pricing pressures. In the event that upward pricing pressure dominates, price increases. Conversely, the price decreases when downward pricing pressure prevails. It is precisely the balance of these two counteracting forces that the authorities seek when ordering divestitures. As Constance K. Robinson, then Director of Operations, Antitrust Division, U.S. Department of Justice, explained in her speech “Bank Mergers and Antitrust” before the 31st Annual Banking Law Institute, the agencies attempt to implement divestitures that “both resolve our [competitive] concerns and ensure that the merging parties obtain the efficiencies of the deal.”⁵⁰ Research on post-divestiture pricing is useful for understanding how successful the policy has been at protecting competition.

Empirical studies on post-merger pricing behavior have reached opposing conclusions regarding the adequacy of divestitures in preserving and promoting competition. For example, Cotterill, Dhar, and Franklin (1999) find evidence that prices ultimately increased after in divestiture markets and conclude that the divestitures were not sufficient to promote or preserve competition following the merger of two supermarkets in Connecticut. Tenn and Yun (2009), however, find pricing evidence that divestitures in Johnson & Johnson's acquisition of Pfizer's consumer health division were sufficient to maintain the pre-merger level of competition. In addition to reaching conflicting conclusions, both Cotterill, Dhar, and Franklin (1999) and Tenn and Yun (2009) are case studies. As such, it is not possible to draw conclusions about whether divestiture policy as whole is adequate.⁵¹

In this paper I attempt to add to the literature by examining the post-divestiture pricing behavior from a sample of mergers. Specifically, I use the Federal Reserve Board Orders (FRB Orders) from 2000 to identify approved bank merger notifications in which divestitures occurred in at least of one of the merger markets. I then compare the behavior of deposit rates offered to

⁴⁹ For a detailed discussion of the guiding principles of the Department of Justice and Federal Trade Commission when reviewing merger applications, see the Horizontal Merger Guidelines.

⁵⁰ Robinson (1996).

⁵¹ Carlton (2009) discusses this topic in more detail.

banking customers in markets in which divestitures occurred (“divestiture markets”) to deposit rates offered in merger markets in which no divestitures occurred (“non-divestiture markets”). The analysis includes 22 merger markets from five separate mergers, with divestitures occurring in 10 of these markets. Post-merger data suggest that depositors in divestiture markets experienced post-merger declines in deposit rates compared to depositors in the non-divestiture markets. The increased gap in deposit rates between the divestiture and non-divestiture markets resulted in depositors in the divestiture markets receiving approximately \$110 million dollars less on their deposits than they would have received in the non-divestiture markets.

The remainder of the paper is organized as follows. In Section 2 I briefly describe the existing literature and where this paper fits. An overview of the merger review process for the banking industry is given in Section 3. I introduce the data and present results in Section 4. I conclude in Section 5.

2.2 Relevant Literature

Horizontal mergers, whereby competing firms combine and operate as a single entity, may provide an opportunity for firms to create or enhance market power and have long been recognized to play a central role in economic wellbeing as firms with market power may charge higher prices, restrict output, produce lower quality goods, or reduce innovation.⁵² Consequently, a significant amount of resources has been devoted to merger policy by the antitrust authorities. Indeed, largely in response to unrest caused by the business practices of large corporations and trusts in the late 1800s, the United States Department of Justice (DOJ) and the Federal Trade Commission (FTC) were created by Congress with the purpose of implementing and enforcing the antitrust laws in order to promote the competitive health of the American economy.⁵³ The importance of merger policy is further highlighted in annual reports to Congress that show mergers to be both pervasive and of significant magnitude.⁵⁴ For example, there were over 1,000 merger and acquisition notifications filed with the antitrust agencies in each year from 1999-2008 (and over 4,000 notifications in some years), with these mergers covering a wide range of industries that include banking and insurance, health services, pharmaceuticals, and energy. Moreover, these transactions have been valued at over \$1 trillion dollars in assets annually. Jonathan Baker, former Director of the Bureau of Economics at the FTC, estimates antitrust enforcement to cost hundreds of millions of dollars per year (this estimate represents only direct government outlays and ignores any private costs).⁵⁵ Surprisingly, given the substantial amount of resources both affected by and devoted to competition policy, there is a recognized lack of evidence regarding the effectiveness of antitrust policy.⁵⁶ Kovacic (2001) discusses a number of

⁵² Horizontal Merger Guidelines, Issued jointly by the DOJ and FTC on August 19, 2010.

⁵³ Massimo Motta, 2004, “Competition Policy: Theory and Practice.” Cambridge University Press, p. 1.

⁵⁴ All annual reports to Congress pursuant to the Hart-Scott-Rodino Act can be found at <http://www.ftc.gov/bc/anncompereports.shtm>. All reported statistics above can be found in the report for Fiscal Year 2008.

⁵⁵ Jonathan B. Baker, 2003. “The Case for Antitrust Enforcement.” *Journal of Economic Perspectives*, vol. 17, no. 4, pp. 27-50.

⁵⁶ See, for example, Ashenfelter, Hosken, and Weinberg (2009), and Carlton (2009). Carlton, a former commissioner on the Congressional Antitrust Modernization Commission, also points out that the absence of a strong empirical foundation on antitrust policy performance is not without consequence, arguing that “the inadequacy of our current state of knowledge regarding the effectiveness of antitrust policy towards mergers...” has resulted in there being “...no reliable guide for determining whether our antitrust policy is too lax in some areas and too stringent in others.”

obstacles that may explain why antitrust agencies spend relatively few resources conducting such ex post studies. I now discuss some of the modest body of literature that does exist and describe how the present work adds to this area.

Empirical work that analyzes post merger outcomes is often referred to as a merger retrospective and generally focuses on post-merger pricing behavior. Weinberg (2007) provides a survey of the merger retrospective literature on the price effects of horizontal mergers. Based on recent work suggesting that mergers may have led to increased prices, he concludes that merger policy appears to be too lax. However, the study does not indicate which mergers, if any, required divestitures or provide any comparison of pricing behavior between divestiture and non-divestiture markets.

An early empirical study on the effectiveness of divestitures prior to the HRS Act was performed by Elzinga (1969). The author considers cases from 1960 – 1964 in which the courts granted merger amendment requests of structural relief filed by the Government.⁵⁷ Elzinga (1969) categorizes a relief case as successful, sufficient, deficient, or unsuccessful based on the degree to which an acquired firm is re-established as an independent firm following the relief order and whether anticompetitive effects are averted subsequent to the merger. The author concludes that, taking into account the amount of time that elapsed between divestitures being ordered and when they actually occurred, structural relief was a failure. Rogowsky (1986), in part, updates and expands Elzinga (1969) and similarly deems most divestiture cases to be either deficient or unsuccessful.

Following the enactment of the HSR Act in 1976, divestitures remained an important antitrust remedy but the post-HSR divestiture policy changed in ways that may have led to increased effectiveness relative to the pre-HSR divestiture orders. Importantly, following passage of the HSR Act, divestitures are typically agreed to before the merger is consummated, thus mitigating the need to use them as a tool to “unscramble the eggs.” Moreover, the agencies are now more involved in setting the terms of the divestitures, including requirements that divestitures occur in a timely manner. To understand whether these changes impacted the effectiveness of divestitures, the staff of the Bureau of Competition and the Bureau of Economics made the recommendation in 1995 to survey buyers of divested assets in an attempt to undertake a systematic study of the Commission’s divestiture process (the Study). In 1997 the Office of Management and Budget (OMB) authorized the Study. Based on divestiture orders from (fiscal years) 1990 – 1994, the Study focused on whether the buyer of the divested assets was able to enter the market and maintain operations and finds that 28 of the 37 divestitures studied remained viable. The FTC claims that the success rate of the divested assets is comparable to that of privately negotiated mergers and acquisitions and takes this as evidence that the divestitures have been successful. However, the Commission admits that the Study was not designed to be a complete competitive effects analysis, or to provide definitive conclusions on the performance of the divested markets.

Noting the absence of any empirical work on the effectiveness of divestitures as a remedy in bank mergers, Burke (1999) gathers data on mergers from 1985-1992 to offer such evidence. Specifically, the author uses the post-divestiture survival rates and market shares of divested

⁵⁷ Not all remedies were divestitures.

branches to conclude that divestitures have indeed provided an effective remedy for bank mergers. Like Burke (1999), Pilloff (2002) focuses on evidence of the survival and market share performances of divested banks (June 1989 – June 1998) to assess the effectiveness of divestiture policy. All of the studies considered thus far provide some evidence that as a structural remedy, divestiture policy following HSR has been successful. The fundamental concern of the antitrust agencies regarding horizontal mergers is not the impact on market structure, however, but rather the potential for the transaction to create or enhance the resulting firm's market power. Understanding the post-merger pricing behavior of firms following divestitures offers evidence that is more directly linked to the agencies' concerns. Moreover, as Kovacic (2001) argues, the uncertainty surrounding the predicted impact of proposed remedies necessitates *ex post* analyses of past decisions for sound public policy decisions.

One work that looks at pricing behavior following divestiture is Cotterill, Dhar, and Franklin (1999), who conduct a case study on the pricing behavior in seven local markets to answer the question of whether divestiture was adequate to preserve or promote competition following a merger between two supermarkets in Connecticut.⁵⁸ Comparing the pricing patterns of the five markets where divestitures occurred to the two markets in which there were no divestitures, the authors find that, despite an initial decline, prices ultimately become higher in divestiture markets. Thus, Cotterill, Dhar, and Franklin conclude that the divestitures were not adequate remedies for protecting competition. In another case study, Tenn and Yun (2009) use “before-after” and “difference-in-difference” estimators on the sales, distribution, and price of six brands that were required to be divested in the J&J – Pfizer merger and come to the opposite conclusion. The results indicate that the price of every divested brand fell following the divestiture. Additionally, comparison with a control group of products does not find a significant change in the relationship between the comparison group and the divested brands subsequent to divestiture. However, Tenn and Yun (2009) point out that their results suffer from diminished statistical power and are not robust to different assumptions on the counterfactual performance of the divested brands.

The little work on the success of divestiture policy on preserving or promoting post-merger competition that has been done, then, has been mixed. Moreover, an inherent weakness exists in the use of case studies as a method to evaluate policy because outcomes of a particular case study cannot shed light on whether any particular policy is systematically biased. Carlton (2009) makes this point in more detail and notes that the group of unchallenged mergers that included remedies may be of interest. It is precisely this set of bank mergers I analyze. Specifically, I attempt to add to the merger retrospective literature by analyzing the relative pricing behavior in divestiture and non-divestiture markets subsequent to a set of unchallenged bank mergers that involved divestitures in at least one market.

2.3 Bank Merger Review

The merger review process in the banking industry is distinct from other industries in that it is the bank regulatory agencies and not the DOJ or FTC that approves or denies proposed bank

⁵⁸ The merger analyzed was Royal Ahold's 1996 acquisition of Stop & Shop.

mergers.⁵⁹ In the present study, merger approval decisions rest with the Federal Reserve Board. Subsequent to a vote by the Board of Governors, the FRB issues a Board Order to approve or deny a proposed merger depending on the outcome of the vote. The Board Orders provide a description of the institutions seeking to merge, a section highlighting the competitive factors the Board considered when attempting to determine whether the proposed acquisition would be likely to substantially lessen competition or tend to create a monopoly in any relevant banking market, the specific geographic and product markets used to define the relevant banking markets, and details on any divestitures that are to occur. The main competitive factors considered in the Board Orders are the number of competitors in a banking market, the share of deposits controlled by each of the participants, the degree of concentration in the market, and the effects of the merger on market structure. In general, the fewer the number of competitors in a particular banking market and the larger the share of deposits controlled by the participating banks, the more worrisome is the acquisition to the FRB. In the event that the merger would result in significant increases in market concentration, the merging banks may divest one or more branches in at least one market to avoid the merger being challenged.⁶⁰ When divestitures are to occur, the Board Orders stipulate the terms of the divestiture, including whether the divested branch (or branches) will go to a competitor already in the market or to a bank that did not operate in the market at issue prior to the merger, that the divestiture will occur within 180 days of the merger becoming effective, and a commitment that if the divestiture is not completed within 180 days, then the branch will be turned over to an independent trustee who will promptly sell the branch to a purchaser that the FRB considers to be competitively suitable.

However, despite the fact that bank merger approvals are at the discretion of the FRB, the Department of Justice (DOJ) and the Federal Trade Commission (FTC) are involved in a number of ways. The DOJ, for example, has a 30 day post-approval period during which it can file suit to block a bank merger. Consequently, the FRB explicitly takes into account how a proposed merger is likely to be viewed by the DOJ when reviewing a merger application. In particular, the DOJ has informed the FRB that (under normal circumstances) unless a transaction would violate specific market concentration thresholds, a merger will not be challenged by the DOJ and the Board Orders explicitly consider whether the proposed merger would violate the thresholds established by the DOJ.⁶¹ Bank merger policy, then, is similar in practice to merger policy as carried out by other antitrust agencies.

⁵⁹ The FRB is responsible for approving or denying any merger involving a bank holding company or a state member bank. Pilloff (2002).

⁶⁰ Acquisitions that are deemed anticompetitive may still be approved if the Board finds that “the anticompetitive effects of the proposal are clearly outweighed in the public interest by the probable effects of the proposal in meeting the convenience and needs of the community to be served.” See, for example, Federal Reserve System Board Order Approving the First Bancorp Acquisition of First Savings Bancorp, Inc., August 21, 2000.

⁶¹ The following statement is included in each of the reviewed Board Orders. “The Department of Justice has informed the Board that a bank merger or acquisition generally will not be challenged (in the absence of other factors indicating anticompetitive effects) unless the post-merger HHI is at least 1800 and the merger increases the HHI by more than 200 points.” The appendix lists each the Board Order used in this analysis.

2.4 Data and Results

The Board Orders published by the Federal Reserve Board provide a variety of useful data.⁶² For one, they supply a list of bank merger applications and divestiture markets. Additionally, the Board Orders contain pre-merger data on market structure such as market shares and levels of market concentration. I reviewed all 50 Board Orders issued in the year 2000 to determine which approved mergers included divestitures in at least one banking market.⁶³ Of the 50 Board Orders, 30 were merger approvals and of these, seven included divestitures.⁶⁴ Two of the seven Board Orders requiring divestitures were dropped because they are based on data that do not coincide with the annual data used for the other five mergers. The remaining five mergers consisted of 71 separate banking markets. As detailed below, data required for constructing market shares are not available at the level of Ranally Marketing Areas that are sometimes used by the FRB as part of the geographical market definition so markets based on RMA's are dropped, leaving observations on 22 banking markets. Because banks typically operate in multiple banking markets while divestitures often occur only in a subset of the markets in which the merging parties compete, the set of merger markets can be divided into two subsamples, one in which divestitures were required and another in which divestitures were not required. The final sample of five mergers consists of 10 divestiture markets and 12 non-divestiture markets. Table 2.1 identifies the banking markets and indicates, for each market, whether the Board Order states that at least one divestiture was to occur.

Deposit data used to construct markets shares are from the Federal Deposit Insurance Corporation's (FDIC) Summary of Deposit (SOD) reports. All FDIC-insured institutions, including all FDIC-insured commercial banks and FDIC-supervised savings banks, are required to report annually the deposits in each branch as of June 30.⁶⁵ The FRB (and courts) considers the relevant geographic banking market to be local in scope with appropriate geographic market defined according to "indicia of economic integration and transmission of competitive forces among banks" for clusters of banking products and services.⁶⁶ Examples of indicia of economic integration and transmission of competitive forces enumerated in the Orders include population density, worker commuting patterns, and the usage and availability of banking products. Although the FRB may use a mixture of local geographies that include Ranally Metro Areas (RMAs), counties, partial counties and cities, the SOD data do not include RMAs.⁶⁷ Therefore, I am not able replicate market shares that include an RMA as part of the geographic market definition.⁶⁸ For the 22 banking markets I am able to construct from the data, I follow the same

⁶² The Board Orders on banking applications from 1996 – present are available electronically from the Federal Reserve Board, <http://www.federalreserve.gov>.

⁶³ As discussed in more detail below, banks typically have branches in multiple banking markets and divestitures are generally required in only a subset of the markets in which the merging banks operate.

⁶⁴ Board Orders may also be published for non-merger related activities that include, for example, requests to engage in non-bank activities.

⁶⁵ Federal Deposit Insurance Corporation Summary of Deposits, "Reporting Instructions." June, 30, 2008.

⁶⁶ See, for example, Federal Reserve System Board Order Approving the First Bancorp Acquisition of First Savings Bancorp, Inc., August 21, 2000.

⁶⁷ Ranally Metro Areas (RMA) are geographic areas defined by Rand McNally that are also intended to capture economically integrated areas. Details of the particular criteria used for assigning an area to an RMA can be found in Rand McNally's annual *Commercial Atlas and Marketing Guide*.

⁶⁸ I am also not able to replicate markets based on definitions that are listed as, for example, the "eastern half" of a particular county.

process described in the FRB Orders for constructing the market shares. Specifically, depository institutions are defined to be commercial banks, savings banks, and savings associations. Credit Unions are not included in the analysis. When calculating a deposit institution's share of the local market, deposits at thrifts (savings banks and savings associations) are included at 50 percent. However, in the event that the bank to be acquired is a thrift, its deposits are included at 100 percent when forecasting the post-merger market shares.

Following calculation of market shares, a measure of concentration, the Herfindahl-Hirschman Index (HHI), is constructed from the market shares. Specifically, if there are n firms in the market, and the i^{th} firm has a market share of ms_i percent, then the HHI is given by:

$$HHI = \sum_{i=1}^n (ms_i)^2 \quad (1)$$

The HHI ranges from a theoretical minimum of zero (under perfect competition with an infinite number of firms each having an infinitesimal market share) to a maximum of 10,000 when the market is monopolized. Larger HHI values, therefore, are presumed to be indicative of less competitive markets, all else equal. Post-merger market shares and HHI are predicted using pro forma calculations of market share, whereby the pre-merger market shares of the merging firms are simply added together and the market shares of banks not involved in the transaction are presumed to remain at their pre-merger level. If any divestitures are to be made, the pro forma market shares are adjusted accordingly.⁶⁹ Table 2.2 shows the mean HHI prior to the merger, the merger-induced change in HHI (accounting for any divestitures), and the post-merger HHI by market type (divestiture or non-divestiture).⁷⁰ As expected, in this sample the pre-merger HHI in markets not involving divestitures is smaller than the pre-merger HHI in markets involving at least one divestiture.

The goal of the present paper is to obtain evidence of the behavior of prices in divestiture markets relative to prices in non-divestiture markets. I now describe how prices are measured. Consumers of bank deposit services receive interest payments on their deposits and the interest rates paid by the banks to the depositors can be considered (negative) prices. Higher deposit rates are more beneficial to depositors but more costly to banks. Although interest rates charged on loans are another important type of price in the banking industry, identifying the appropriate geographic market for loans is typically not possible (see for example, Dick, 2008 or Laderman and Pilloff, 2007). Most empirical and regulatory work on banking markets, therefore, tends to focus on deposit rates.⁷¹ Specifically, interest rates on various types of deposit accounts are often imputed using data in the Consolidated Reports of Condition and Income (Call Reports) that every national bank, state member bank, and insured nonmember bank is required to file as of the close of business on the last business day of each calendar quarter.⁷² I follow this

⁶⁹ For example, in a merger involving Bank A and Bank B, if Bank A controls 10 percent of the market pre-merger, and Bank B controls 5 percent, then the post-merger share would be assumed to be 15 percent. If a divestiture of 2 percent was a condition of the merger, the share would instead be 13 percent.

⁷⁰ The assumptions on the post-merger market shares imply that the merger induced change in the HHI is twice the product of the merging firm's pre-merger market share. Post-merger HHI is then the sum of the pre-merger HHI and the merger-induced change in HHI.

⁷¹ See, for example, Dick (2008), Ishii (2004), and Miller (2008).

⁷² An exception to this is Prager and Hannan (1998) who use survey data on bank prices. However, survey data are not available for every year and tend to be biased towards representing large banks.

convention and impute a bank's average interest rate as the ratio of interest expense over the stock of deposits. In particular, for each bank in a market, I construct a measure of the annual interest rates on time deposits under \$100,000, checking deposits, and savings deposits. Since bank customers tend to cluster all of their deposit accounts at a single bank (Amel, Kennickell, and Moore, 2008), I also construct an overall deposit rate as the ratio of total interest expense for all deposits over the stock of all deposits. It is worth pointing out that the Call Report data are the interest paid at the bank level as opposed to the branch level. Thus, interest rates constructed from the Call Reports should be interpreted as the bank's average interest rate paid on a particular type of a deposit account across all markets. However, banks claim to charge a single rate across markets and there is some empirical evidence that this is indeed the case (Dick, 2008) so this may not be too much of a simplification. I then calculate a measure of the various deposit rates at the market level as the deposit share-weighted average for each type of deposit rate. Although the deposit rate of any single bank is the same across markets, there is heterogeneity in the market deposit rates as the set of banks comprising the local market varies by market. Table 2.3 shows the pre-merger deposit rates separately for non-divestiture and divestiture markets.

2.4.1 Post-Merger Price Behavior

Banks operate in multiple markets but divestitures that are used as a remedy to competitive concerns in a merger transaction typically only occur in a subset of market in which the parties seeking to merge compete. Consequently, it is possible to separate the post-merger pricing behavior in the divestiture markets from the post-merger pricing behavior in the non-divestiture markets. One interesting question that can be answered from the sample of mergers, then, is what is the relationship between the change in the deposit rates offered in divestiture markets and non-divestiture markets? A measure of the difference between the deposit rates is captured by the spread of the rates by market type, where the spread is calculated as the interest rate in the divestiture markets less the interest rate in the non-divestiture markets. I use basis points, which correspond to 1/100th of a percentage point, to measure the spreads between each of the time, savings, checking, and total deposit rates. I then calculate the percentage change in the spread for each type of deposit rate for the second and third year following the merger. The spread for the year immediately following the merger was not used because the merger was not reflected in the data for multiple mergers. Table 2.4 and Table 2.5 show the interest rate spreads between divestiture and non-divestiture markets for the second and third year following a merger. Based on interest data from the June 30th, 1999 Call Reports, the last interest rate data available prior to the merger, there was no statistical difference between the interest rates on time or savings accounts in divestiture and non-divestiture markets.⁷³ However, following the merger, both the time and savings rates in divestiture markets were statistically different from the rates in non-divestiture markets.⁷⁴ In 2001, the spread between each of the various deposit accounts had increased, with the spread on the overall deposit rate increasing by about 135 percent. That is, the gap between the overall deposit rate in divestiture and non-divestiture markets more than doubled by the second year following the merger. In dollar terms, consumers in divestiture markets received \$66.7 million less in interest payments relative to what they would have

⁷³ Pre-merger rates are calculated using data in the June 30, 1999 Call Reports.

⁷⁴ Significance is at the 5 percent level.

received had their deposits been placed in non-divestiture markets.⁷⁵ By 2002, the spread on all but the checking rate remained above pre-merger levels, with the spread on the overall deposit rate still nearly 40 percent above its pre-merger level. The increases in spreads indicate that following the mergers, consumers in divestiture markets received nearly \$110 million less in interest payments over the second and third years following the merger than they would have received if they had placed their deposits in the non-divestiture markets.

2.5 Conclusion

In lieu of challenging a proposed merger that is deemed likely to substantially lessen competition, the antitrust authorities may work with the merging parties to take steps that would mitigate the anticompetitive concern. An agreement to divest assets has long been the policy tool used most often by the authorities to remedy troublesome merger proposals. The relatively small number of studies that have been published since the HSR Act was passed (1976) have generally found evidence that divestitures have preserved measures of market structure. However, it is not clear whether competition itself has been preserved as studies on post-divestiture pricing find conflicting results. Cotterill, Dhar, and Franklin (1999), for instance, find evidence that prices are higher in divestiture markets, while Tenn and Yun (2009) conclude that there is some evidence that the prices of divested brands decline following the divestiture. Moreover, both of these were case studies and thus the results do not speak to divestiture policy as a whole. In the present study, I use data on interest rates in 22 markets following five mergers and find that the gap between deposit rates in divestiture markets and non-divestiture markets increased following a merger, resulting in depositors in divestiture markets receiving approximately \$110 million dollars less than they would have received had they placed their deposits in a non-divestiture market. While understanding whether a difference in post-divestiture pricing exists is a first step, future research could, for example, investigate how the relatively lower deposit rates in divestiture markets relate to a benchmark of deposit rates from non-merger markets.

⁷⁵ All dollar figures are deflated to the year 2000.

Tables

Table 2.1: Bank Merger Markets

Banking Market	Pre-merger HHI	Change in HHI	Divestiture Market
Adams County	2353	0	Yes
Hall County	1420	171	No
Lincoln	2048	234	Yes
Colorado Springs	960	1	No
Bluefield	1677	47	No
Emporia	2362	200	Yes
Moore County	1797	349	Yes
South Lake Tahoe	2010	0	Yes
Truckee-Tahoe	2271	214	No
Hailey	2562	0	Yes
Sandpoint	2052	166	No
Twin Falls	2268	203	No
Carson City	1829	175	Yes
Rio Arriba County	3323	26	No
Deschutes	1957	115	No
Box Elder	3361	0	Yes
Park City	2668	0	Yes
Ames	1809	30	No
Cedar Rapids	1394	268	No
Des Moines	1616	314	Yes
Marshall	2180	213	No
Rock Island-Davenport	1004	107	No

Source: Federal Reserve Board Orders (A complete listing of the Board Orders used in the analysis is given in the Appendix).

The Change in HHI reported accounts for any proposed divestiture as reported in the FRB Order.

The Appendix gives a complete listing of the geographies included in the banking market.

Table 2.2: Market Structure Variables by Market Type

	Divestiture Markets	Non-divestiture Markets
Pre-merger HHI	2261	1860
Change in HHI	127	130
Post-merger HHI	2388	1990

Each measure is a simple average of the figures reported in the FRB Orders by market type.

Table 2.3: Pre-Merger Deposit Interest Rates by Market Type

	Divestiture Markets	Non-divestiture Markets
Time Deposits	4.50%	4.74%
Saving Deposits	2.39%	2.61%
Checking Deposits	1.64%	2.26%
All Deposits	3.29%	3.49%

Pre-merger deposit rates based on data from the June 30, 1999 Call Reports.

Only the difference between the interest rates on checking deposits is statistically significant at the 0.05 level.

Table 2.4: 2001 Deposit Interest Rate Spreads

	2001 Spread (in basis points)	% Change in Spread Since 1999
Time Deposits	50**	110%
Saving Deposits	46**	107%
Checking Deposits	67	8%
All Deposits	49**	135%

Spreads are calculated as the average rate in divestiture markets less the average rate in non-divestiture markets.

One basis point represents 1/100th of a percent.

**Statistically significant at the 0.05 level.

2001 deposit rates based on data from the June 30, 2001 Call Reports.

Table 2.5: 2002 Deposit Interest Rate Spreads

	2002 Spread (in basis points)	% Change in Spread Since 1999
Time Deposits	36**	49%
Saving Deposits	23**	4%
Checking Deposits	14	-77%
All Deposits	29*	40%

Spreads are calculated as the average rate in divestiture markets less the average rate in non-divestiture markets.

One basis point represents 1/100th of a percent.

**Statistically significant at the 0.05 level.

*Statistically significant at the 0.10 level.

2002 deposit rates based on data from the June 30, 2002 Call Reports.

Table 2.6: "Lost" Interest Payments in Divestiture Markets

Year	Deposits	"Lost" Interest
2001	\$13.7 billion	\$66.7 million
2002	\$14.6 billion	\$42.4 million
	Total	\$109.1 million

2001 deposits are based on data from the 2001 SOD Reports. 2002 deposits are based on data from the 2002 SOD Reports. "Lost" Interest for each year is calculated as the product of deposits in the divestiture markets and the spread in the overall deposit rate between divestiture and non-divestiture markets.

2.6 Appendix

Geographic Banking Market Definitions

Banking Market	Geographies
Adams County	Adams County, Nebraska
Hall County	Hall County, Nebraska
Lincoln	Lancaster County, Nebraska
Colorado Springs	El Paso and Teller Counties, Colorado
Bluefield	Mercer County, West Virginia, and Tazewell County, Virginia
Emporia	Greenville County and the city of Emporia, all in Virginia
Moore County	Moore County, North Carolina
South Lake Tahoe	The towns of South Lake Tahoe in California and Stateline and Zephyr Cove in Nevada
Truckee-Tahoe	The towns of Kings Beach, Tahoe City, and Truckee in California and Incline Village in Nevada
Hailey	The towns of Bellevue, Hailey, Ketchum, and Sun Valley, all in Utah
Sandpoint	The towns of Ponderay, Priest River, and Sandpoint in Idaho and Newport in Washington
Twin Falls	The towns of Buhl, Filer, Gooding, Hagerman, Hazelton, Jerome, Kimberly, Richfield, Shoshone, Twin Falls, and Wendell, all in Idaho
Carson City	The towns of Carson City, Dayton, Gardnerville, Minden, and Virginia City, all in Nevada
Rio Arriba County	Rio Arriba County, New Mexico
Deschutes	The towns of Bend, La Pine, Redmond, Sisters, Sunriver, and Terrebonne, all in Oregon
Box Elder	The towns of Brigham City and Tremonton, Utah
Park City	The towns of Coalville, Heber City, Kamas, and Park City
Ames	Boone and Story Counties, and Clear Lake, Ellsworth, Lincoln, Lyon, Marion, and Scott Townships in Hamilton County, all in Iowa
Cedar Rapids	Linn County and Jefferson Township in Johnson County, Iowa
Des Moines	Polk County and Linn Township in Warren County, Iowa
Marshall	Marshall County and Carlton, Highland, Indian Village, and Spring Creek Townships in Tama County, Iowa
Rock Island-Davenport	Scott County and Farmington Township in Cedar County, Iowa, and Rock County except for Buffalo Prairie and Drury Townships, and Colona, Edgord, Geneseo, and Western Townships in Henry County, Illinois

Sources for Banking Market Definitions

Banking Market(s)	Board Order
Adams County, Hall County, Lincoln, and Colorado Springs	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of First Commerce Bancshares, Inc., May 30, 2000
Bluefield and Emporia	Federal Reserve System Board Order Approving the BB&T Corporation Acquisition of One Valley Bancorp, Inc., May 30, 2000.
Moore County	Federal Reserve System Board Order Approving the First Bancorp Acquisition of First Savings Bancorp, Inc., August 21, 2000
South Lake Tahoe, Truckee-Tahoe, Hailey, Sandpoint, Twin Falls, Carson City, Rio Arriba County, Deschutes, Box Elder, and Park City	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of First Security Corporation, October 10, 2000
Ames, Cedar Rapids, Des Moines, Marshall, and Rock Island-Davenport	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of Brenton Banks, Inc., October 23, 2000

Chapter 3

Using Federal Reserve System Board Orders to Improve Bank Merger Retrospectives

"Antitrust laws... are the Magna Carta of free enterprise. They are as important to the preservation of economic freedom and our free enterprise system as the Bill of Rights is to the protection of our fundamental personal freedoms." – *U. S. Supreme Court, 1972*⁷⁶

"The dearth of [antitrust] studies and measures means that there is no reliable guide for determining whether our antitrust policy is too lax in some areas and too stringent in others." – Dennis Carlton, University of Chicago and member of Congressional Antitrust Modernization Committee, 2009⁷⁷

3.1 Introduction

As articulated by the United States Supreme Court in the opening quote, it is hard to overstate the value of the antitrust statutes on the economic wellbeing of consumers. In fact, the Court's focus on the importance of the competition laws to the economic freedoms and to the free enterprise system fails to fully capture their significance as anticompetitive behavior can have impacts that extend well beyond the economic arena. In 2009, for example, the Federal Trade Commission (FTC) challenged Thoratec Corporation's (Thoratec) acquisition of rival medical device maker HeartWare International, Inc. (HeartWare) on the grounds that the transaction would likely allow Thoratec to maintain its monopoly on a particular "life-sustaining technology for treating end-stage heart failure patients who...are likely to die while waiting for a donor heart or are ineligible for a heart transplant."⁷⁸ The FTC believed that because HeartWare was Thoratec's most significant competitor, the merger would remove current and future pressures to

⁷⁶ *United States v. Topco Associates, Inc.*, 405 U.S. 596 [1972].

⁷⁷ Carlton, 2009.

⁷⁸ Administrative Complaint (Redacted Version), Before the Federal Trade Commission In the Matter of Thoratec Corporation, and HeartWare International, Inc., available from the Federal Trade Commission at <http://www.ftc.gov/os/adjpro/d9339/090730thorateadminccmpt.pdf>. For further details of the transaction, see <http://www.ftc.gov/os/adjpro/d9339/index.shtm>.

innovate the heart technology at issue and “thereby [deny] patients the potentially life-saving benefits of competition.”⁷⁹ Of course, mergers can have pro-competitive effects as well, such as efficiency gains that may reduce costs and facilitate improvements in price, quality, or innovation. In the case of Thoratec’s proposed acquisition of HeartWare, for example, it is possible that efficiency gains from combining the firms could have accelerated the innovation of emergency heart devices.⁸⁰ An effective merger policy, then, is one that prevents mergers that would lessen consumer choice while not so stringent that it prohibits efficiency enhancing combinations. Although the focus of merger analysis is often on potential price effects, as the Thoratec case illustrates, in practice the reach of merger policy can extend well beyond consumers’ wallets – indeed, at times the impact can be felt all the way to the surgery table.

The importance of effective antitrust policy to society was formally recognized by the Government when competition laws were embodied in the Sherman Antitrust Act of 1890 and the antitrust authorities were created with the purpose of preserving and promoting competition.⁸¹ Merger policy is one branch of antitrust policy and mergers that involve the combination of competing firms (“horizontal mergers”), such as Thoratec and HeartWare, are of particular concern to the competition authorities as these transactions necessarily reduce the number of firms in a market and may increase or allow the exercise of market power.⁸² Because restoring competition can be difficult or impossible, prior to consummation, the parties must inform the appropriate agency of their intent to merge.⁸³ Subsequent to receiving a merger notification, the agency reviews details of the merger in order to make a prediction as to the likely competitive effects. Based upon the review, one of three decisions is made. In the event that the merger does not cause the agency competitive concerns, the application is approved and the parties are free to execute the merger. When a proposed merger transaction is viewed by the authorities as likely to substantially lessen the competition, remedies to alleviate competitive concerns, most typically divestiture of assets, may be proposed in order to allow the merger to proceed. If, however, the authorities and the parties to the merger cannot come to an agreement, the agencies can formally challenge the transaction in court in an attempt to block the merger.

In the more than 100 years that the antitrust laws have been in effect, the antitrust agencies have reviewed and made decisions on tens of thousands of merger applications in their mandate of preserving and promoting competition.⁸⁴ So after over a century of antitrust policy applied to tens of thousands of mergers, how well has antitrust policy performed in the quest to preserve and promote competition? Unfortunately, the most accurate appears to be, we don’t know.

⁷⁹ Administrative Complaint (Redacted Version).

⁸⁰ The true outcome of a Thoratec-Heartware combination, however, will remain unrealized as Thoratec abandoned the proposed acquisition on July 31, 2009. For details see: <http://www.ftc.gov/os/adjpro/d9339/090805jointmodismisscmplt.pdf>.

⁸¹ While the DOJ and the FTC are the primary antitrust agencies, the set of agencies responsible for any particular merger depends in part on the industry in which the merger will occur. For example, the Federal Reserve Board, the Office of the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Office of the Thrift Supervision are all involved in enforcing the antitrust laws in the U.S. banking industry. Hereafter, the terms Agency or Agencies are inclusive of the appropriate set of regulators for any particular merger.

⁸² Reducing the number of firms in a market may also facilitate collusion amongst the remaining firms.

⁸³ Some small transactions that do not meet a minimum threshold do not have to file. The FTC provides details of the thresholds on their website.

⁸⁴ From 1991 through 2004 alone, over 37,000 merger or acquisition notifications were filed with the agencies, Ashenfelter and Hosken, 2008.

Consider the following sample of comments that have been made over the period spanning the years 2001-2009:

*“For the most part, competition authorities seem to regard the analysis of outcomes as a costly exercise that diverts resources from enforcement programs rather than as an integral part of the policymaking process.”*⁸⁵ - William E. Kovacic, FTC General Counsel (2001-2004), FTC Commissioner (2006 – Present), FTC Chairman (2008-2009)

*“Surprisingly, given the complexity of the regulators [sic] task, there is remarkably little empirical evidence on the effects of mergers to guide regulators.”*⁸⁶ – Orley C. Ashenfelter, Princeton University; Daniel Hosken, FTC; Matthew Weinberg, FTC

*“The antitrust policies of the United States should be reviewed periodically to make sure that policies are promoting not impeding competition...The dearth of such studies and measures means that there is no reliable guide for determining whether our antitrust policy is too lax in some areas and too stringent in others.”*⁸⁷ – Dennis Carlton, University of Chicago and member of Congressional Antitrust Modernization Committee

An obvious question is, given the importance of antitrust laws and the clear recognition of a lack of evidence on their effectiveness, why has this void persisted? A number of explanations are available. On the Agency side, a reluctance to divert scarce resources away from new cases and enforcement, difficulties in the measurement and collection of the necessary data, and perhaps even the possibility of finding unfavorable results have been offered as obstacles to evaluating post-merger behavior (Kovacic, 2001). While none of these explanations seem sufficient in light of the consequences of ineffective merger policy, the fact remains that the need to collect the appropriate data to effectively evaluate merger policy has endured.

Because of the tight link between the field of industrial organization and antitrust policy, there is also a body of academic research on merger related topics.⁸⁸ Unfortunately, while this literature has contributed a number potentially useful tools for policy makers, relatively little evidence on the effectiveness of these tools have been provided. Merger simulation, in which structural models suggested by oligopoly theory are combined with econometric techniques to forecast (“simulate”) the competitive effects of a merger transaction, provides a good example.⁸⁹ Introduced in the academic literature, merger simulation has been described by the FTC as one of the “remarkable developments in the quantitative analysis of horizontal mergers.”⁹⁰ Although there is a large and growing body of academic work on merger simulation models, the focus has been almost exclusively on the properties of the various models used and not on the accuracy of the predictions.⁹¹ Indeed, as captured in the following quote, the commentary on the lack of post-merger evidence on the accuracy of simulated outcomes closely parallels that of merger policy.

⁸⁵ Kovacic, 2001.

⁸⁶ Ashenfelter, Hosken, and Weinberg, 2009.

⁸⁷ Carlton, 2009.

⁸⁸ Kwoka and White, Fourth Edition, Introduction.

⁸⁹ Budzinski and Ruhmer, 2009, provide a good overview of merger simulation and survey its use in competition policy.

⁹⁰ As quoted in Epstein and Rubinfeld, 2003.

⁹¹ See, for example, Crooke et al, 1999.

“Despite the tremendous amount of public and private resources toward analyzing horizontal mergers, very little research has evaluated the efficacy of these forecasting tools.”⁹²

Similar to the obstacles facing the antitrust agencies, possible explanations for the relative neglect of academic research into the actual performance of merger forecasts likely includes difficulty in obtaining the requisite data. It is also the opinion of the present author that publishing and academic prestige are much more likely to go to authors introducing or modifying components of the models than to authors performing what amounts to audits of previously suggested models, thereby providing strong disincentives for allocating research efforts to merger retrospectives.⁹³ Admittedly, an incentive structure that encourages hypothesis formation while at the same time undervalues data on the results of implementing such hypothetical models seems a bit perverse for a field that aspires to be considered scientific. Surely the scientific method relies at least as much on testing predictions as on proposing theoretical relationships. Moreover, the very real impact that competition policy can have on society would seem to require the testing of the effectiveness of merger policy. Nonetheless, the fact remains that the need to collect the appropriate data to effectively analyze merger models has persisted.

In an attempt to provide some guidance in addressing this gap, Carlton (2009) and Ashenfelter, Hosken and Weinberg (2009) discuss a variety of types of data would be useful for evaluating merger policy, including pre- and post-merger market data as well as information on the post-merger predictions of behavior made by the agencies. Furthermore, Carlton points out a number of issues with some of the merger retrospectives that have been conducted. For instance, because regulators attempt to block any merger they believe is likely to result in a price increase, an analysis based solely on a sample of unchallenged mergers is inherently biased downward in terms of price effects as these are precisely the mergers expected to have non-positive price effects. Additionally, merger retrospectives often evaluate the outcomes of a particular merger, but observations on post-merger prices collected in a single case study are not sufficient to determine whether there is systematic error in antitrust policy. Moreover, Carlton shows that even if a retrospective study on a sample of mergers shows that prices fell on average, it is still possible that merger policy is too “lax” (systematically biased towards allowing too many mergers) and explains how information on the government’s predicted price changes would allow for a more accurate test. Finally, Carlton points out that in many instances the decision to challenge a merger or not is guided by assumptions on the likelihood of entry, product repositioning, market shares, and other measurable predictions and “few if any” studies investigate the validity of these assumptions. Absent such studies, there is no way to evaluate and provide meaningful guidance on merger policy.

In this paper I attempt to contribute to the merger retrospective literature by pointing out a publicly available data source that includes information on the government’s underlying assumptions regarding post-merger market shares, levels of market concentration, and likelihood of entry. In addition, I take advantage of the same data source as the Federal Reserve Board to calculate market shares and compare pre- and post-merger market shares on a sample of merging

⁹² Weinberg and Hosken, 2008. The authors offer one of the few studies on the efficacy of merger simulations, using post-merger data to evaluate the simulated price effects of a merger in the motor oil and another merger in the breakfast cereal industry.

⁹³ Indeed, it would be a large oversight on my part not to point out at this time the good fortune I have had in having a dissertation committee that not only allowed me to pursue such research, but actually encouraged it.

banks to provide some evidence on post-merger behavior. That is, this combination provides for both types of data identified by Carlton (2009) as necessary for reliable analysis of antitrust policy – pre- and post merger market data, as well as data on the specific predictions of the agencies about the market post-merger.

The rest of the paper is organized as follows. I describe in some detail the relevant parts of the Board Orders that the FRB publishes after reviewing and deciding on bank merger proposal in Section 2. In Section 3 I describe the data and present the results. I conclude in Section 4.

3.2 Overview of the Federal Reserve Board’s Merger Review Process

In the present study, merger approval decisions were determined via a vote by the Board of Governors of the Federal Reserve Board.⁹⁴ Following the vote, the FRB issues a Board Order to approve or deny the merger application that is publicly available and outlines both the facts considered and the reasoning used to reach a conclusion on the likely competitive effects should the merger be consummated. In particular, the Board Orders include a description of the institutions seeking to merge, a section highlighting the competitive factors that the Board considered when attempting to determine the likely competitive effects of the merger in each of the involved banking markets, the specific geographic and product markets used to define the relevant banking markets, and details on any divestitures that are to occur.⁹⁵ Importantly, the description of the competitive factors the Board considered when evaluating the proposed merger enumerate a number of underlying assumptions. For example, the FRB explicitly states its assumptions on the number of competitors expected to remain in the market, the presumed relative market shares and concentration levels of deposits, and the likelihood of entry. Thus, the Board Orders provide evidence that could improve merger policy by understanding whether, for instance, any post-merger price increases are associated with unexpected market exit, lack of entry in markets where entry was assumed to be likely, or unpredicted changes in market shares or market structures.

The decision process for evaluating the competitive factors that is articulated in the Board Orders implies that the Board first obtains estimates of the post-merger concentration level of bank deposits in the relevant market and the merger induced change in deposit concentration. The measure of market concentration used by the FRB (as well as the DOJ and FTC) is the Herfindahl-Hirschman Index (HHI). Formally, when there are n firms in the market, and the i^{th}

⁹⁴ The merger review process in the banking industry is distinct from other industries in that it is the bank regulatory agencies and not the DOJ or FTC that approves or denies proposed mergers. Nonetheless, the Federal Reserve Board explicitly considers the recommendations of the DOJ when making decisions. Moreover, the DOJ is provided a 30-day post-approval period in which it can challenge the merger. Thus, in practice the merger policy as implemented by the FRB is similar to that of other industries.

⁹⁵ Acquisitions that are deemed anticompetitive may still be approved if the Board finds that “the anticompetitive effects of the proposal are clearly outweighed in the public interest by the probable effects of the proposal in meeting the convenience and needs of the community to be served.” This does not apply to any of the Board Orders in the present study.

firm has a market share of ms_i percent, the index of market concentration is calculated as follows.⁹⁶

$$HHI = \sum_{i=1}^n (ms_i)^2 \quad (1)$$

Specifically, the initial screen used by the Board considers whether the proposed merger would result in a post-merger HHI of at least 1800 and a change in the HHI of at least 200 as the Department of Justice had notified the FRB that, in the absence of other factors indicating anticompetitive concerns, bank mergers falling below these thresholds were unlikely to be challenged.⁹⁷ Note that competitive factors other than the HHI are considered regardless of whether the proposed merger violates the thresholds established in the above screen as mitigating competitive factors are considered when the threshold is exceeded and potential anticompetitive factors are considered when the threshold is not exceeded. Therefore, the 1800/200 criterion is a starting point and not a determinant in the Board's merger review process.

As is clear from (1), calculating the HHI requires the relevant market to be defined so that market shares can be obtained. Banks typically operate branches in a number of locations and the FRB analyzes data on population density, worker commuting patterns, the use and availability of banking products, and other measures of economic integration in an effort to determine a reasonable geographic market of effective competition between the parties seeking to merge.⁹⁸ Once the geographic market definition has been set, data on branch deposits from the annual Summary of Deposit (SOD) Reports available from the Federal Deposit Insurance Corporation (FDIC) are aggregated over the relevant banking market to construct relative deposit shares.

Estimates of the merger-induced changes in the HHI can then be calculated from equation (1) and assumptions on the post-merger market share. In particular, the FRB assumes that the only changes in market share are from the direct effects of the mergers. That is, the post-merger market share of the combined bank is taken to be the sum of their pre-merger market shares ("pro forma" shares), while the market shares of all other banks in the market are presumed to be unaffected. It follows directly from (1) and the assumption on post-merger market shares that the change in the HHI due to the merger is twice the product of the merging firms' pre-merger market shares. To see this, consider a market with only three banks, Bank A, Bank B, and Bank C, and a merger involving Bank A and Bank B.⁹⁹ The pre-merger HHI is simply,

⁹⁶ The HHI ranges from a theoretical minimum of zero (under perfect competition with an infinite number of firms each having an infinitesimal market share) to a maximum of 10,000 when the market is monopolized. Larger HHI values, therefore, are presumed to be indicative of less competitive markets, all else equal.

⁹⁷ The following statement is included in each of the Board Orders used in the present study. "The Department of Justice has informed the Board that a bank merger or acquisition generally will not be challenged (in the absence of other factors indicating anticompetitive effects) unless the post-merger HHI is at least 1800 and the merger increases the HHI by more than 200 points."

⁹⁸ Banking markets may include some combination of full or partial cities, towns, counties. A listing of the geographic areas included in each banking market used in the present study is included in the Appendix.

⁹⁹ If Bank A controls 10 percent of the market pre-merger, and Bank B controls 5 percent, then the post-merger share would be assumed to be 15 percent. If a divestiture of 2 percent was a condition of the merger, the post-merger share would instead be 13 percent.

$$HHI^{pre} = (ms_A^{pre})^2 + (ms_B^{pre})^2 + (ms_C^{pre})^2 \quad (2)$$

Letting ms_{A+B}^{post} be the post-merger market share of the merged bank, the post-merger HHI is given by,

$$HHI^{post} = (ms_{A+B}^{post})^2 + (ms_C^{post})^2$$

Under the assumption that the only changes in market shares are those that occur directly to the merger, the post merger market share of the merged bank is simply $ms_A^{pre} + ms_B^{pre}$ and Bank C is assumed to maintain its pre-merger market share so that $ms_C^{post} = ms_C^{pre}$. Thus, the post-merger HHI can be re-written as follows.

$$HHI^{post} = (ms_A^{pre} + ms_B^{pre})^2 + (ms_C^{pre})^2$$

$$HHI^{post} = (ms_A^{pre})^2 + (ms_B^{pre})^2 + (ms_C^{pre})^2 + 2(ms_A^{pre} * ms_B^{pre}) \quad (3)$$

The merger induced change in HHI, ΔHHI , can now be estimated as (3) – (2).

$$\Delta HHI = HHI^{post} - HHI^{pre} = 2(ms_A^{pre} * ms_B^{pre}) \quad (4)$$

The estimated post-merger HHI and change in HHI are then evaluated by the FRB to determine whether the estimates fall within the 1800/200 guideline. As mentioned above, in the event that the predicted change in HHI causes concern, the FRB considers whether any factors are present that suggest that adverse competitive effects are unlikely despite violations of the 1800/200 threshold, for example, if entry by new competitors is likely. In addition, absent any such mitigating factors, branch divestitures (and all associated deposits) may be used to reduce the predicted post-merger market share in order to lessen the predicted impact on market structure.¹⁰⁰ This process is repeated for each banking market and since merger applicants often compete in multiple markets, the Board Orders provide the FRB's predictions on competitive factors for a variety of bank markets.

Finally, the Board Orders indicate the data source the FRB used to calculate market shares and this data source, discussed below, allows post-merger market shares to be calculated. The post-merger behavior of the surviving bank's market share is interesting for a couple of reasons. For one, the use of the pro forma share as an estimate of the post-merger share of the surviving bank underlies the post-merger HHI and change in HHI calculation. Secondly, the post-merger behavior of the market share of the surviving bank may be informative of the competitive effects of the merger. For instance, increases in market share would be consistent with price decreases while decreases in market share would be consistent with a restriction in output. Therefore, I

¹⁰⁰ Likewise, if the estimated post-merger HHI and change in HHI fall below the thresholds, a merger may still be challenged if there are factors that suggest the merger is likely to result in adverse effects.

obtain the market definitions used by the FRB in a sample of approved mergers and calculate the pro forma share from the pre-merger market shares for the merging banks and the post-merger market share for the surviving bank using the same data source as the FRB. I then compare the post-merger market share to the pro forma market share. Since the much of the discussion on competitive effects is discussed in terms of the market concentration, each market's post-merger HHI and change in HHI based on pro forma shares are also calculated and compared to the post-merger values observed in the data.

3.3 Data and Results

Data come from the following sources. The banking markets analyzed are the 10 divestiture markets in the previous chapter and span five separate mergers. The specific geographies included each of the 10 bank market definitions are obtained from the Board Orders.¹⁰¹ Deposit data used to construct markets shares are from the Federal Deposit Insurance Corporation's (FDIC) Summary of Deposit (SOD) reports. All FDIC-insured institutions, including all FDIC-insured commercial banks and FDIC-supervised savings banks, are required to report annually the deposits in each branch as of June 30.¹⁰² These are the same data used by the FRB to calculate the pre-merger market shares given in the Board Orders. Additionally, the Board Orders state that it is the practice of the FRB to include the deposits of thrift institutions at 50 percent when calculating the amount of deposits in the market.¹⁰³ I follow these same rules to calculate the pre-merger market shares of the merging banks. To verify that I implement the rules correctly, all pre-merger market shares I calculated from the SOD reports were checked to ensure that they match the pre-merger market shares reported in the relevant Board Order. Table 3.1 lists the pre-merger market shares for the acquiring and acquired banks as well as the pre-merger HHI for each bank market.

To evaluate the behavior of post merger market shares, I obtain the market shares of the surviving bank in each banking market using data from the June 30, 2001 and June 30, 2002 SOD Reports employing the same rules that were used to calculate the pre-merger shares. I do not include the year 2000 because this is the year of the merger and the approved transaction was often not reflected in the available deposit data. Table 3.2 shows the pro forma shares of the merging banks and the observed market shares of the surviving bank. Tables 3.3 and 3.4 do the same for the change in HHI and post-merger HHI. The data reveal that market shares and HHI levels in 2001 were below pro forma levels in seven of the 10 markets. In 2002, market shares and HHI levels in eight of the markets were below pro forma levels.¹⁰⁴ On average, the acquiring bank's 2001 market share was 2.6 percent lower than the pro forma share and the 2002 market share was 4.1 percent below the pro forma share. Similarly, the observed 2001 HHI levels were an average of 144 points below what they would have been had the pro forma share prevailed and were 230 points lower in the 2002 data.

¹⁰¹ The Appendix gives the geographies included in each bank market as well as identifies each Board Order used.

¹⁰² Federal Deposit Insurance Corporation Summary of Deposits, "Reporting Instructions." June, 30, 2008.

¹⁰³ In the event that a merger transaction involves the acquisition of a thrift institution, those deposits are included at 100 percent in the calculation of the post-merger share.

¹⁰⁴ Note that the markets with lower than predicted market shares are not necessarily the same markets with lower than predicted HHIs in any given year.

3.4 Conclusion

The present results suggest that the use of pro forma market shares typically results in overestimates of the surviving bank's market share. This reinforces Carlton's (2009) claim that the validity of underlying assumptions that guide merger policy, such as post-merger market shares, should be verified empirically. Additionally, the finding that post-merger market shares are below the pro forma levels is consistent with the surviving banks restricting output and should draw the attention of the competition authorities. Moreover, the present study illustrates another point. Namely, that the gap in the evidentiary record of merger policy is not entirely shielded by significant data obstacles. The Board Orders are publicly available and provide clearly stated assumptions on market shares, levels of concentration, and other competitive factors. Data on pre- and post-merger market shares are also available from the FDIC.

Sadly, however, in the greater than 100 years that the competition laws have been in existence, antitrust authorities and economists have not made sufficient use of such data to empirically establish the effectiveness of merger policy or the accuracy of guiding assumptions. Imagine if the Federal Drug Administration (FDA) required only theoretical explanations of why a particular chemical combination should work before granting approval of a drug to pharmaceutical companies. Thankfully, such a policy is so clearly insufficient to protect people that drug companies typically must submit large bodies of expensive and time-consuming data validating theoretical claims before a drug is approved.¹⁰⁵ And yet, although the impact of merger policy can extend beyond economic goods and services like bank deposit accounts to also influence the availability of products like life-saving medical equipment, empirical validation of merger policy continues to be largely missing. With this reality in mind, I reiterate the words Kovacic (2001) wrote regarding antitrust policy a decade ago.

“Assuming as a matter of faith that chosen public policies produce beneficial outcomes is an unacceptable substitute for empirical testing.”

¹⁰⁵ A description of the drug approval process required by the Food and Drug Administration website, <http://www.fda.gov/Drugs/ResourcesForYou/Consumers/ucm143534.htm>.

Tables

Table 3.1: Pre-Merger Market Structure in Federal Reserve Board Banking Markets

Bank Market	Acquiring Bank's Share	Acquired Bank's Share	HHI
Emporia	15.4%	26.2%	2362
Adams County	34.3%	28.1%	2353
Lincoln	6.2%	36.6%	2048
Moore County	11.3%	12.5%	1797
South Lake Tahoe	22.6%	9.7%	2010
Hailey	10.9%	38.3%	2562
Carson City	32.2%	12.6%	1829
Box Elder	14.6%	53.9%	3361
Park City	6.9%	38.2%	2668

Source: June 30, 1999 FDIC Summary of Deposits Report. The Appendix lists the FRB Board Order associated with each bank market

Table 3.2: Pro Forma and Observed Post-Merger Market Shares

Bank Market	Pro Forma Share	Share in 2001	Share in 2002
Emporia	32.1%	32.9%	41.1%
Adams County	34.3%	32.1%	31.7%
Lincoln	39.5%	29.7%	25.9%
Moore County	30.8%	27.4%	26.0%
South Lake Tahoe	22.6%	23.3%	23.8%
Hailey	38.3%	33.4%	28.7%
Carson City	36.0%	31.5%	34.2%
Box Elder	53.9%	52.6%	48.0%
Park City	38.2%	36.5%	29.7%
Des Moines	39.3%	39.7%	35.1%

2001 figures for each table are based on market shares calculated from June 30, 2001 FDIC Summary of Deposit Report

2002 figures for each table are based on market shares calculated from June 30, 2002 FDIC Summary of Deposit Report

Table 3.3: Pro Forma and Observed Post-Merger Changes in HHI

Bank Market	Pro Forma Change in HHI	2001 Observed Change in HHI	2002 Observed Change in HHI
Emporia	200	67	213
Adams County	0	-162	-164
Lincoln	234	-383	-551
Moore County	349	173	170
South Lake Tahoe	0	32	53
Hailey	0	-237	-363
Carson City	175	-117	-39
Box Elder	0	-121	-426
Park City	0	181	-12
Des Moines	314	400	91

2001 figures for each table are based on market shares calculated from June 30, 2001 FDIC Summary of Deposit Report

2002 figures for each table are based on market shares calculated from June 30, 2002 FDIC Summary of Deposit Report

Table 3.4: Pro Forma and Observed Post-Merger HHI Levels

Bank Market	Pro Forma HHI	HHI in 2001	HHI in 2002
Emporia	2562	2429	2575
Adams County	2353	2191	2189
Lincoln	2282	1665	1497
Moore County	2146	1970	1967
South Lake Tahoe	2010	2042	2063
Hailey	2562	2325	2199
Carson City	2004	1712	1790
Box Elder	3361	3240	2935
Park City	2668	2849	2656
Des Moines	1930	2016	1707

2001 figures for each table are based on market shares calculated from June 30, 2001 FDIC Summary of Deposit Report

2002 figures for each table are based on market shares calculated from June 30, 2002 FDIC Summary of Deposit Report

3.5 Appendix

Geographic Banking Market Definitions

Banking Market	Included Geographies
Adams County	Adams County, Nebraska
Lincoln	Lancaster County, Nebraska
Emporia	Greenville County and the city of Emporia, all in Virginia
Moore County	Moore County, North Carolina
South Lake Tahoe	The towns of South Lake Tahoe in California and Stateline and Zephyr Cove in Nevada
Hailey	The towns of Bellevue, Hailey, Ketchum, and Sun Valley, all in Utah
Carson City	The towns of Carson City, Dayton, Gardnerville, Minden, and Virginia City, all in Nevada
Box Elder	The towns of Brigham City and Tremonton, Utah
Park City	The towns of Coalville, Heber City, Kamas, and Park City
Des Moines	Polk County and Linn Township in Warren County, Iowa

Source: FRB Board Orders

Sources for Banking Market Definitions

Banking Market(s)	Board Order
Adams County and Lincoln	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of First Commerce Bancshares, Inc., May 30, 2000
Emporia	Federal Reserve System Board Order Approving the BB&T Corporation Acquisition of One Valley Bancorp, Inc., May 30, 2000
Moore County	Federal Reserve System Board Order Approving the First Bancorp Acquisition of First Savings Bancorp, Inc., August 21, 2000
South Lake Tahoe, Hailey, Carson City, Box Elder, and Park City	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of First Security Corporation, October 10, 2000
Des Moines	Federal Reserve System Board Order Approving the Wells Fargo & Company Acquisition of Brenton Banks, Inc., October 23, 2000

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