Who do regulators care about? Recovering welfare weights from bank merger decisions

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Abstract

How much do banking regulators care about borrowers and depositors relative to bankers and public insurance costs? We combine novel data on bank merger applications with a structural model of merger review to quantify regulators' welfare weights on different agents. First, we show that regulators rarely deny applications; when they do, denials target risky banks. Second, we show that regulators do not deny mergers that raise anti-competitive concerns; instead, they impose branch divestitures. Estimating our merger model on filed and potential applications (to address selection concerns), we find that, normalizing borrower welfare to 1, regulators assign relative weights of 0.47 to FDIC losses, 0.02 to depositors, and approximately zero to bank profits. The results are consistent with a model of regulators acting in the public interest, rather than primarily protecting the interests of the regulated (Stigler, 1971).

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1 Introduction

One of the crucial roles faced by antitrust regulators is to decide whether two institutions should be allowed to merge. In most industries, the consumer welfare effects of mergers balance the tradeoff between the increase in market power versus the decrease in marginal costs that arise from M&A (Nocke and Whinston, 2022; Bhattacharya et al., 2024). In banking, the effects on competition are further complicated by the negative externalities that banking distress can impose on economic growth (He and Krishnamurthy, 2013). That is, mergers that decrease competition by consolidating endangered banks could still benefit some consumers by reducing the costs of financial distress.

Although much research has studied the effects of bank mergers on borrower and depositor outcomes, little is known about how regulators have considered the tradeoffs between the welfare of different agents in the economy that are affected by M&A transactions. How much do regulators care about bankers vs. consumers? How much do regulators value the direct cost of financial distress, which the regulators directly incur when a bank is placed into resolution? And who ultimately benefits from regulators' actions? In this paper, we use novel data on U.S. bank merger applications embedded in a structural model of bank mergers to quantify how much regulators care about different agents in the economy. We find that regulators prioritize borrowers compared to other agents in the economy. On average, regulators place 47% as much weight on the FDIC as compared to borrowers, 2% as much weight on depositors as compared to borrowers, and almost no weight (0%) on bankers as compared to borrowers.

Our strategy for identifying regulators' preferences relies on a revealed-preference approach. Namely, we use regulators' decisions on bank merger applications to infer the welfare weights that they assign to different agents in the economy. M&A transactions are significant decisions made by regulators, which reshape both bank risk and competition in loan and deposit markets. As a result, merger applications and regulators' decisions provide important insights into the weights that regulators assign to bankers, borrowers, depositors, and themselves.

To provide evidence that bank mergers are an appropriate setting through which we can study regulators' welfare weights, we document several facts that suggest regulators face important tradeoffs when evaluating merger applications. First, we show that bank mergers can provide social benefits, as they are associated with cost reductions of $\approx 2\%$ due to synergies that arise from consolidation.[1] Bank mergers also disproportionately occur between banks operating in the same markets, with 68% of mergers occurring between banks that operate in at least one shared market. These two facts highlight the standard trade-offs that regulators face when evaluating mergers for anti-competitive concerns: marginal costs decrease but concentration increases, creating ambiguous welfare effects. However, bank mergers also raise tradeoffs unique to the banking industry: The average merger reduces bank regulatory capital by 120 basis points, or 7-10%, which highlights the potential that mergers have to make banks riskier – especially in the eyes of their regulators.

Next, we study the factors that influence regulators' merger application decisions. Using novel data on bank merger applications across all federal banking agencies, we find that regulators rarely deny merger applications: Less than 4% of applications are denied. However, when mergers are denied, they are typically driven by the risk of the applicant institutions. Applicant banks that are in top 5% of non-accrual loans are 4% (percentage points) more likely to see their merger application denied; similarly, applicant banks with forthcoming

[1] This aspect of bank mergers is more thoroughly explored by Kaplan and Walsh (2026).

or open enforcement actions are 9% and 4% (percentage points) more likely to have their application denied, respectively. By contrast, large increases in deposit market concentration are not associated with merger application denial; instead, we find that regulators are 26% (percentage points) more likely to require branch divestitures when M&A will substantially increase concentration.

Unlike merger denial, which affects the entire application, divestitures are targeted remedies. That is, regulators require merging banks to sell branches to competitors *specifically* in markets that see extraordinary increases in concentration. We show that when mergers can increase deposit market concentration, regulators are 20% (percentage points) more likely to require divestiture in markets where concentration concerns are greatest. This requirement is conditional on a merger taking place; we do not observe branch sales or divestitures when the M&A application is denied. Further, in over 80% of markets with divestiture, 100% of divested branches are sold to new entrants – suggesting that regulators view divestitures as tool that preserves market competition. From this evidence, we infer that denial and divestiture are complimentary tools used by regulators to address different concerns raised by a merger application: Denial is used to address risk, while divestiture is used to address market power.

Our reduced form facts suggest that regulators weigh both bank health (FDIC losses) and consumer welfare when evaluating bank merger applications. However, the reduced form evidence does not allow us to quantify how much relative weight regulators place on each agent in the economy. To study this question, we develop a structural model of bank mergers to translate data on prices, quantities, and market structure into measures of utility that regulators care about.

Our structural model is a deliberately stylized depiction of the banking industry, streamlined to study the tradeoff between depositors, borrowers, bankers, and the FDIC. In our model, banks engage in oligopolistic competition in both deposit and loan markets across different locations. Banks' existing risky assets affect their pricing decisions, since new loans will increase their leverage and the potential they will be placed into FDIC receivership. Bank mergers can reduce borrower and depositor welfare by reducing competition and increasing leverage; however, these effects can be offset by reductions in marginal costs due to synergies between the merging institutions (Kaplan and Walsh, 2026) as well as diversification gains across existing risky asset portfolios.

The purpose of our model is to construct the measures of interest in regulators' choice set at the time of a bank merger application. That is, our model allows us to map data on prices and quantities into the expected utility of each agent under three potential scenarios for each merger application: (i) approval; (ii) denial; and (iii) approval, subject to branch divestiture. However, using data solely from filed bank merger applications will bias our estimates due to selection concerns: First, banks with low marginal benefits for merging will not file an application, even if they are likely to be approved by the regulator, due to the fixed costs of merger applications. Second, banks with high marginal benefits to merge but low likelihood of approval will not apply, since they are unlikely to recoup the fixed cost of application if regulators will certainly deny their application.

We address these concerns explicitly by modeling banks' application decisions and jointly estimating regulators' welfare weights using both filed and potential merger applications. Our selection model (Heckman, 1979) and joint estimation procedure is partially identified by

functional form assumptions. However, to mitigate concerns that our results are driven by these assumptions, we exploit variation in merger fixed costs using: (1) state laws that affect bank merger costs (Rice and Strahan, 2010; Li, 2025); and (2) regional variation in lawyers' compensation (a proxy for legal fees for M&A applications). This variation serves as plausibly exogenous "instruments" for which banks choose to apply to merge.

Leveraging our merger instruments and welfare simulations, we find that regulators' decisions on merger applications are rationalized by an average welfare weight of ≈ 0 on banks relative to borrowers, 0.47 on the FDIC relative to borrowers, and 0.02 on depositors relative to borrowers. However, there is significant variation within regulators across applications, consistent with evidence of within regulator preference heterogeneity (Agarwal et al., 2024). We also find substantial fixed costs to applying: The average fixed costs are $\approx$ \$27 million, although state barriers to competition increase M&A fixed costs by \$16 million on average.

The large relative weight on borrowers is driven by the benefits of diversification on borrower welfare. When mergers make banks less risky through diversification, banks are more willing to compete in loan markets, which benefits borrowers, banks, and the FDIC. The relatively low average welfare weight on banks is driven by the fact that regulators are more likely to deny applications from banks that substantially increase profits, after conditioning on borrower welfare improvements.

The remainder of our paper is structured as follows. Section 2 provides a summary of our contribution to existing literature. Section 3 provides an overview of the institutional setting and novel data that we use in our analysis. Section 4 details reduced-form analysis of M&A applications and regulators' decisions. Section 5 presents our structural model which we estimate in Section 6. Section 6.1 describes our estimation strategy for the industry equilibrium model, and in Section 6.2 we describe our procedure for estimation regulators' social welfare weights via our selection model. We then use the results of our estimated model to back-out regulators' preferences for bank health vs. depositor welfare in Section 7. Section 8 concludes.

2 Literature

Our paper contributes to several strands of the literature. First, we contribute to the broader literature studying competition, and specifically competition in banking. The literature on competition is vast, and typically studies the effects of market structure on outcomes, such as price, quality, and quantity. In banking, this has included the effects of competition on pricing contracts,[2] branching decisions,[3] and even monetary policy transmission.[4] For a large part of

[2]Significant research on deposit market competition has evaluated how monetary policy affects depositor savings rates. Granja and Paixao (2024) show that banks offer the same deposit rates across most locations, and study the implications of this phenomenon. Egan et al. (2026) shows that depositors sleepiness affects prices, while Benetton et al. (2026) shows that banks target sleepy depositors with sign-up teasers. Outside of monetary policy, Egan et al. (2017) shows that competition and risk can generate multiple pricing equilibria in oligopolistic banking markets through uninsured depositors' pricing decisions. On the lending side, Buchak and Jorring (2025) shows that market concentration increases loan fees (but not prices). An entire strand of literature also studies how competition with shadow banks affects the banking sector, including Jiang (2023), Buchak et al. (2024), and Begenau and Landvoigt (2022) – an aspect of financial intermediation that is minimally covered in our analyses.

[3]Jiang et al. (2026) show that digital technology improves quality and depositor welfare, but leads to local branch reductions – especially in younger areas.

[4]Drechsler et al. (2017) shows how deposit market power can improve monetary policy transmission, while Wang et al. (2022) adds that loan market power reduces the effects of monetary policy transmission.

this literature, the goal is understanding how market structure affects outcomes; this is because once researchers understand how markets function, they can simulate feasible policy changes that regulators can implement to improve welfare. In contrast to this approach, we seek to understand how regulators' decisions reveal whose welfare they care more about. Instead of asking what policies can increase the size of the economic pie, we ask how regulators have chosen to cut the pie and divvy up slices among different economic agents.

To answer this question, we must first: (a) understand how regulators affect market competition; and (b) use regulators' decisions to invert their preferences. In studying how regulators affect competition, specifically through merger applications, we contribute to the literature on bank mergers. Prior research has examined why banks merge (Houston et al., 2001; Akkus et al., 2016), how dynamics affect merger incentives (Corbae et al., 2026), how bank mergers affect loan quantity and prices (Sapienza, 2002; Erel, 2011; Panetta et al., 2009), and how anti-trust remedies affect local competition (Liebersohn, 2024). We contribute to this literature in two ways. First, most closely related to Kaplan and Walsh (2026), we show that bank mergers reduce operating costs, increase concentration, and meaningfully increase leverage of the combined institutions. These facts imply that mergers can sometimes increase total surplus while other times redistribute utility from consumers and the FDIC to bankers. Second, we show that regulators' decisions actively consider these tradeoffs: They are more likely to deny applications that increase FDIC costs and they are more likely to impose branch divestiture on applications that substantially increase market concentration.

One of our key contributions is analyzing regulators' decisions and understanding what that reveals about their objective function. In studying this question, our work follows the tradition of Stigler (1971), who first asked: Who is regulation for, consumers or the regulated entities themselves? Important research on the political economy of banking has focused on actions of legislatures and legislators (e.g., Mian et al., 2014; Rajan and Ramcharan, 2016; Agarwal et al., 2018). Our focus on agencies rather than legislators relates more closely to the nascent literature on banking supervision. Research in this area has shown significant heterogeneity across regulators (Agarwal et al., 2014), bias within regulators (Agarwal et al., 2024) and in favor of supervising large firms (Eisenbach et al., 2022), distortions in the FDIC's approach to resolving failed banks (Kang et al., 2014; Allen et al., 2023), and the beneficial effects of supervisors on risk, returns, and failure (Hirtle et al., 2020; Ivanov and Wang, 2024; Correia et al., 2025b). Outside of banking, research on government preferences has found that liquor authorities can act like monopolists (Seim and Waldfogel, 2013) and non-bank merger agencies act sub-optimally in high-profile cases (Lyu and Xu, 2026). To our knowledge, we are the first to use bank merger application decisions to recover how much regulators care about borrowers, depositors, bankers, and themselves.

3 Institutional Details & Data

In this section, we provide background on the history of bank merger approval authority in the U.S. We also provide high-level details and summary statistics on our novel dataset of bank merger applications. More details on how our dataset is constructed can be found in Appendix A.

Bank Merger Authority: Bank merger policy in the U.S. has evolved significantly over the past century. Prior to the late 1950s, merger transactions were not overseen by federal regulators. Only after Congress passed the Bank Holding Company Act of 1956 and the

Bank Merger Act of 1960 did regulators start reviewing merger applications for several policy considerations, including anti-competitive effects and the financial and managerial resources of the institutions involved.

In the early years of bank merger reviews, the federal banking agencies and the Department of Justice (DOJ) were primarily concerned with anti-competitive practices, and often denied merger applications on these grounds. There were also sometimes disagreements among federal agencies, which resulted in DOJ lawsuits to block mergers that were approved by federal banking agencies. However, starting in the late 1970s and through the 1980s, federal focus on anti-trust factors in merger review diminished, consistent with a larger retreat from anti-trust enforcement across industries. Further, in 1995, the DOJ together with the federal banking agencies issued joint bank merger guidelines, which increased consistency across agencies in terms of anti-competitive thresholds for bank merger policy review.[5]

Since the mid-1990s, bank merger approval authority has largely been concentrated among the federal prudential regulators: The Federal Reserve (Fed), the Office of the Comptroller of the Currency (OCC), the Federal Deposit Insurance Corporation (FDIC), and the Office of Thrift Supervision (OTS) (until it was abolished by Congress in 2011). The authority is divided among regulators, as depicted in Table 1, depending on type of charter that will be retained by the surviving institution from the merger.[6] The DOJ will provide a competitive factor analysis for all bank merger transactions; however, since 1995, the DOJ has not sued in federal court to block any proposed bank merger transaction that was approved by its primary federal regulator.[7]

Table 1: **Merger Approval Authorities:** This table describes which federal banking agency retains approval authority for bank merger transactions. The agency responsible for reviewing and deciding upon the bank merger application largely depends on the charter of the surviving institution, with some exceptions.

Agency	Survivor Type	Other Criterion
OCC	National Bank	
FDIC	Non-Member Bank	Bank acquires non-bank
OTS	Savings Association	
Fed	Member Bank	Holding companies merge
State Regulators	State-Chartered Bank	
DOJ	All	

When regulators review merger transactions, they evaluate the proposed transaction according to several factors of importance which they are required by law to evaluate. These factors include:

[5]For a more detailed discussion of the history of bank merger policy, see Kress (2022).

[6]Within each regulator, merger approval authority can also be delegated to regional principals. For example, at the Fed, the 12 Regional Banks have delegated authority to review merger transactions that do not pose significant anti-competitive concerns. At the FDIC, representatives from the relevant supervisory region are responsible for analyzing the regulatory considerations for proposed transactions within their region.

[7]Prior to the joint guidance between the DOJ and banking regulators on bank competition, the DOJ would regularly sue to block or amend merger transactions after banks received approval from the responsible banking authority. For example, in 1992, the DOJ sued to force Ameritrust Corporation to divest branches acquired from Society Corporation after the Federal Reserve already approved the proposed merger transaction.

1. *Competition:* Regulators are required to evaluate how potential mergers affect competition, which they have primarily interpreted through the lens of deposit market competition.[8] As part of the 1995 joint guidance, federal regulators set an explicit threshold for transactions that raise anti-competitive concerns: If in any Fed-defined deposit market, the post-merger Herfindahl-Hirschman Index (HHI) will increase by more than 200 points resulting in a post-merger HHI of greater than 1800 points, the agencies will consider this transaction to raise potential anti-competitive concerns.[9]

2. *Safety & Soundness of the Merging Institutions:* The financial health and soundness of the merging and proposed institutions is also considered by regulators, across various criterion in their manuals.[10] Ultimately, regulators care whether the merging institutions will have sufficient financial resources, capable management, and will not take undue risks. Institutions with weak asset quality or insufficient equity will raise concerns with regulators.[11]

3. *Other:* Federal regulators will also consider other factors, including banks' record of combating money laundering (i.e. their BSA/AML programs),[12] their record of serving the community (e.g., their Community Reinvestment Act ratings, and any fair lending complaints), and risks to financial stability.[13]

As part of their M&A transaction review, regulators may determine that the proposed transaction poses anti-competitive concerns or raises safety and soundness considerations. For mergers that decrease competition, regulators can ask the merging institutions to divest (sell) branches in the affected markets in order to reduce post-merger concentration (Liebersohn, 2024); regulators consider divestiture an acceptable remedy that can alleviate anti-competitive concerns (Kress, 2022). However, if the applicant banks cannot address regulators' concerns, then the regulator will inform applicant banks in advance of their decision that the application will be denied. Rather than face a public denial, most applicants will withdraw their application prior to an official decision.[14]

[8]The FDIC's merger manual notes that deposits are used as a key measure for competition: "Generally, **total deposits adequately serves as a rough proxy for overall share of the banking business in the RGM.** [emphasis added] As such, the FDIC will initially focus on the respective shares of total deposits held by the merging institutions and the other financial service providers with offices in the RGM, unless the other providers' loan, deposit, or other business varies markedly from that of the merging institutions."

[9]Some agencies also impose population screens on the size of the market affected by a merger. For instance, the OCC's handbook chapter on mergers notes: "The OCC has concluded that geographic markets with populations of less than 10,000 are not economically significant for the purpose of this analysis, and therefore, any anti-competitive effects in these markets are considered negligible. Generally, the OCC does not object to a proposed combination in such a market on anticompetitive grounds."

[10]For instance, the FDIC captures this under their review of "Financial & Managerial Resources" and "Future Prospects of the Existing and Proposed Institutions." The OCC's handbook chapter on bank combinations has a specific section on "Safety & Soundness" concerns.

[11]The OCC's handbook for bank mergers notes this concern explicitly. It states: "Applications from banks in troubled condition or from sound banks seeking to acquire banks in less than satisfactory condition may raise questions regarding the safety and soundness of the resulting institution." The FDIC also reviews bank merger applications to determine whether "the resulting institution would maintain an acceptable risk profile."

[12]The requirement to consider money laundering programs as part of merger applications was added by the PATRIOT Act in October 2001.

[13]The consideration of financial stability in bank merger applications was introduced as part of the Dodd-Frank Act.

[14]Most banking agencies have noted this publicly, either in reports or in Congressional testimony. FDIC Senior Executive James L. Anderson noted in Congressional testimony on May 1, 2024: "As described in the FDIC's APM, when applications are recommended for denial, FDIC staff is directed to contact applicants, describe their

Data: Our main dataset consists of bank merger applications filed with the federal banking regulators over the past 30 years, with varying degrees of coverage for each regulator. These data were hand-collected from the relevant banking agencies, through freedom of information act (FOIA) requests and web-scraping, and were cleaned using Optical Character Recognition (OCR), string-matching, and manual hand-matching to other regulatory databases.

For each merger application, we observe both the applicant and target bank, the final regulatory decision, and the date on which that regulatory decision was provided. To create our final sample, we primarily focus on applications that were filed with regulators but ultimately were not consummated – that is, they were denied, withdrawn, or returned by the regulator. For this subset of applications, we manually review contemporaneous news reports and subsequent supervisory filings to identify transactions that were withdrawn due to reasons other than regulatory concerns.[15] We drop these applications and then combine the remaining applications (our "denied" sample) with the set of realized bank mergers from the NIC database to form our primary sample. For each merger transaction, we also identify whether that transaction was subject to branch divestiture based on data from Granja and Paixao (2024), which we supplement with our manual collection of additional mergers subject to divestiture not included in their sample. More detail on the cleaning procedure can be found in Appendix A.

We combine this novel data with several additional sources, including bank call reports, bank structure data, and public enforcement action filings, to identify financial and supervisory characteristics of both applicant and target banks. Finally, to replicate regulators' competitive factor analyses, we leverage annual deposit market data from the FDIC's Summary of Deposits and market definition shape files between 2009-2021 from the Federal Reserve Bank of St. Louis CASSIDI's shape files. These market definition files provide the same geographic boundaries that regulators consider when evaluating mergers for anti-competitiveness concerns. More details on how we use each of these datasets can also be found in Appendix A.

Ultimately, our sample consists of 7,198 merger applications between 1995 and 2021, as described in Table 2. Our sample is composed mostly of applications to the Fed and OCC, given that we only observe FDIC merger applications starting in 2013. Only 4% (256) of M&A applications in our sample are denied, and only 3% (214) of applications in our sample raise anti-competitive concerns in deposit markets. Of the applications that raise anti-competitive concerns, in only 26% (56) do we observe branch divestiture. Most of the applicants in our sample are small banks, with the median applicant having $1.3 billion in assets. However,

concerns, and provide a final opportunity to provide additional information that might influence the decision. The APM also states that, at its discretion, the FDIC may offer applicants the opportunity to withdraw the application. **Applicants that choose to withdraw an application frequently do so before receiving a public denial.** [emphasis added]". On the Federal Reserve's website, SR 14-2 notes: "From 2009 to 2012, there were approximately 7,000 applications and notices filed with the Federal Reserve. Over the same time period, approximately 700 applications and notices were withdrawn. The majority of the filings were withdrawn at the prerogative of the filer; however, **more than a third of the withdrawals were due to significant issues identified by Federal Reserve staff during the application review process that would have led to staff recommending denial to the Board.** [emphasis added]"

[15] Certain applications that are withdrawn are due to changes in transaction structure or subsequent conflicts that arise between the merging parties. For example, the application by Wilson & Muir Bancorp, Inc. to the Federal Reserve Bank of St. Louis to acquire Farmers Bank of Vine Grove was withdrawn on Oct. 28, 1999; however, the subsidiary bank of Wilson & Muir Bancorp – Wilson & Muir Bank & Trust Company – acquired Farmers Bank of Vine Grove less than a month after this application was withdrawn, indicating a change in transaction structure. Alternative, the merger application between First Guaranty Bancshares and Douglass National Bank filed with the Federal Reserve Bank of Atlanta was withdrawn on Oct. 17, 2007 due to subsequent conflicts that arose between the merging banks' boards of directors, as noted in SEC filings.

applicant banks are typically drawn from the upper ends of the size distribution (Corbae et al., 2026), as shown in Figure 1; the median applicant is 6x larger than the target it is applying to acquire.

Table 2: Summary statistics by regulator

Statistic	FDIC	Fed	OCC	OTS	All
Num. M&A Apps	1,005	3,755	1,711	727	7,198
Num. Denied Apps	27	128	59	42	256
Num. Mkt. Concentration Concerns	37	121	69	14	241
Num. Apps w/ Branches Divested	6	37	21	2	66
Median App Size (MM)	991.05	1599.79	1548.18	932.85	1403.82

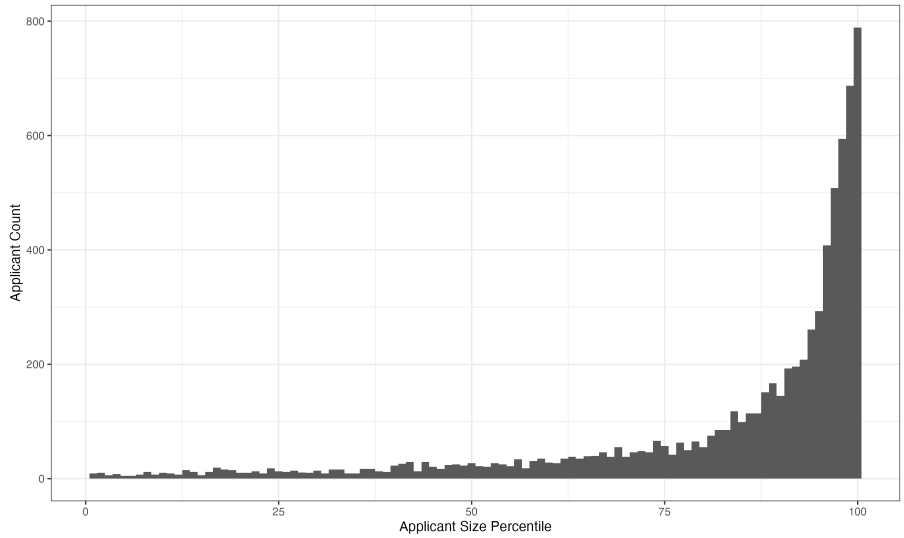


Figure 1: **Distribution of M&A Applicant Size**. This figure displays a histogram of applicant bank size, as measured by the size percentile of the applicant at the time of the merger application (as compared to all other banks).

4 Empirical Analysis

In this section, we provide reduced form facts about bank mergers and regulators' decisions on merger applications. First, we motivate the consumer welfare tradeoffs in bank mergers by showing that mergers reduce costs (Kaplan and Walsh, 2026), but increase market consolidation and bank leverage. Next, we provide novel reduced form evidence documenting how regulators approach these tradeoffs: Namely, regulators are more likely to deny applications from risky banks, but impose branch divestiture (forced sales) on applications that substantially increase market concentration.

4.1 Effects of mergers

To study the tradeoffs involved in bank mergers, we first construct a pro-forma sub-sample of bank mergers in our data. By "pro-forma", we mean that for two banks a and b that merge at

time $t = 0$, we create a "synthetic" bank, $a + b$, by constructing:

$$y_{(a,b),t} = y_{a,t} + y_{b,t}$$

for variables y on each bank's balance sheet and income statement, in the quarters $t < 0$ prior to the merger being consummated.[16] We then study the evolution of these variables in the quarters surrounding a bank merger, by estimating equations of the following form:

$$y_{(a,b),t} = \alpha_{(a,b)} + \tau_t + \beta_t X_{(a,b)} + \varepsilon_{(a,b),t}$$

where $\alpha_{(a,b)}$ are merged pair fixed effects, τ_t are time fixed effects, and β_t are time-varying coefficients on merged bank characteristics. To ensure this analysis is not affected by the presence of multiple mergers over a short period of time, we restrict to a sub-sample of banks who only engage in one merger transaction within a 2-year window before and after the transaction we consider. Our identifying assumption is that merger synergies cannot be realized until the two separate legal entities have been consolidated through the merger process.

Starting with factors that affect bank costs, Panels (a) and (b) of Figure 2 shows the evolution of two key variables that affect bank costs: expense efficiency and staffing levels. In Panel (a), we plot the time series evolution of compensation and fixed asset expenses relative to bank size. We can see that within two years after the merger is consummated, the combined entity has reduced annualized expenses by 0.05% of assets – approximately a 2% reduction in expenses. In Panel (b), we see that the merger also reduces employment by around 2% at consummation, which suggests that part of the cost reduction comes from reducing inputs to production (namely, labor).

Next, turning to the effects on market consolidation, Panels (c) and (d) Figure 2 provides evidence that mergers typically increase market concentration, sometimes substantially. Panel (c) plots the share of realized mergers (blue) vs. the share of potential but unrealized mergers (orange) by deposit market overlap. While over 99% of potential mergers between two randomly drawn banks in the U.S. would occur between institutions that do not share any market overlap, over 65% of realized bank mergers occur between institutions with at least partial market overlap. In fact, 15% of all bank mergers that occurred between 1994 and 2021 were between banks that operated entirely within the same market. This suggests that at the extensive margin, banks choose to merge with other banks operating in similar markets. At the intensive margin, Panel (d) plots the distribution of the effects of realized mergers on market concentration for banks in overlapping markets. While most mergers have small impacts on market concentration, around 8% of mergers increase market HHI by at least 200 points – a threshold that can raise anti-competitive concerns for banking regulators.

Together, the panels in Figure 2 suggest the standard tradeoff that regulators face when evaluating merger transactions: While costs can decrease (Panels (a) and (b)), market concentration can increase (Panels (c) and (d)) which leads to ambiguous effects for consumer welfare. Importantly, in Figure 9 in the Appendix, we provide evidence that cost reductions are greater for mergers between banks that increase market concentration, suggesting that benefits of cost reduction are largest when the threat of monopoly power is most severe.

[16] There is no need to conduct pro-forma adjustments in the quarters after a merger is consummated, i.e. for $t \geq 0$. After the merger is consummated, the financial statements of the surviving entity reflect the economics of the two now-consolidated institutions.

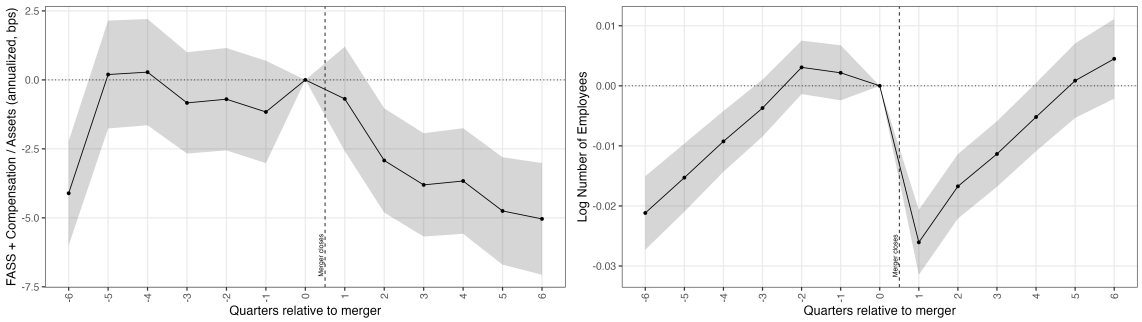
Figure 2: **Standard competition tradeoffs in merger analysis.** This figure plots two sets of graphs that highlight the standard trade-offs in merger analysis.

Panels (a) and (b) plot time series coefficients τ_t for cost variables at merged banks, which provide evidence that costs typically decrease after bank mergers. Panel (a) plots compensation and fixed asset expense, relative to bank size (assets), while Panel (b) plots the log number of employees. Both variables are normalized to 0 at $\tau = 0$, the quarter before the banks' merger is consummated.

Panels (c) and (d) plot evidence that bank mergers increase market concentration, and potentially harm competition. Panel (c) plots the share of realized and potential but unrealized bank mergers by whether the banks previously operated in the same Fed-defined market. Panel (d) plots the merger-level histogram of $\max_m \Delta\text{HHI}_{(a,b),m}$ for each realized merger (a, b) with at least one overlapping market (i.e., conditional on $\max_m \Delta\text{HHI}_{(a,b),m} > 0$). The vertical red line at Δ HHI = 200 reflects the interagency guideline for mergers that potentially raise anti-competitive concerns. The x-axis is in log-10 scale.

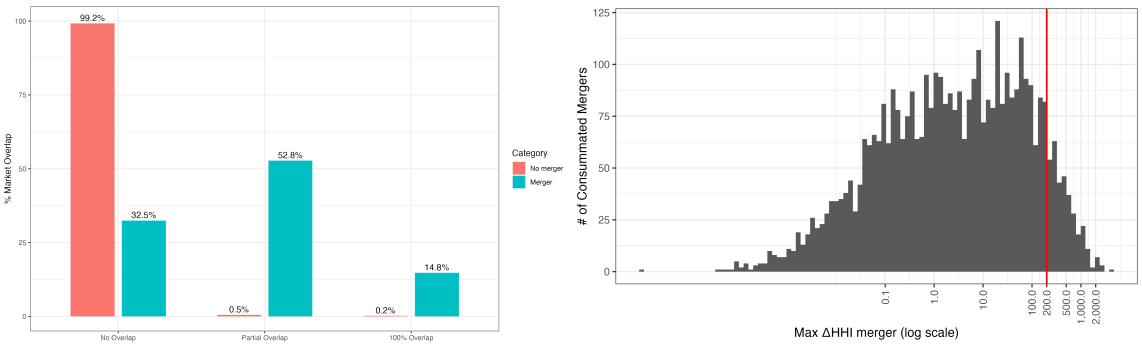
(a) Compensation & Fixed Asset Expenses, divided by Tangible Assets

(b) Log # of Employees



(c) Market overlap for realized vs. unrealized mergers

(d) Distribution of Δ HHI across realized mergers.



However, bank mergers also pose an additional tradeoffs unique to banking, namely their effects on leverage. In Figure 3, we plot the effects of merger transactions on bank regulatory capital, namely the Tier 1 Risk-Based Capital ratio. Panel (a) of Figure 3 shows that at consummation of a merger, pro-forma regulatory capital ratios decrease by over 120 basis points (by about 7-10%).

There are three reasons for this large and economically significant decrease in regulatory capital. The first is that cash paid by the acquirer to the target bank shareholders is economically

equivalent to an extraordinary dividend. In Panel (b) of Figure 3, we show that for acquirers that purchase the target bank entirely in cash (blue), pro-forma regulatory capital decreases by 200 basis points on average following the merger – a drop of over 100 basis points more than for partial-stock transactions (orange).

The second is the markdown on target bank assets. In Panel (c) of Figure 3, we show that required mark-to-market losses on target bank loan books also affect capital levels at the pro-forma institution. For a sub-sample of recent mergers where we observe MtM losses on target bank loan portfolios, Panel (c) provides suggestive evidence of a larger reduction in bank capital ratios (by 30-70 basis points) at banks with the most write-downs of target bank loan portfolios, compared to banks with the least (or 0%) write-downs of target bank loan portfolios.[17]

The final reason for the large decrease in bank regulatory capital comes from accounting effects that create a wedge between regulatory capital and the market value of equity. Acquirers typically pay a purchase premium for target banks in excess of their market value of equity on a stand-alone basis. The acquisition premium reflects a portion of the NPV of synergies generated by consolidating the two businesses, and is recorded on the acquirer's balance sheet as intangible assets (e.g. Goodwill) following consummation of the transaction. However, regulators exclude Goodwill and other intangible assets from regulatory capital due to their limited ability to absorb losses in periods of stress.[18] In Panel (d), we show that these effects are large: Intangible assets increase by around 100 basis points of RWA following a merger, which accounts for a meaningful portion of the decrease in average capital requirements following a merger.

Together, these facts suggest that bank mergers have a significant effect on bank regulatory capital – in part driven by economic considerations (cash paid to target bank shareholders), in part driven by accounting considerations (intangible asset creation), and in part driven by factors that affect both economics and accounting (mark-to-market losses on target bank loans). In Appendix B.2, we show that when merging banks are riskier, they are even more likely to acquire target institutions with 100% cash financing – suggesting that the effects on regulatory capital are more severe for banks with a greater need for capital. Given that capital ratios are a key determinant of bank failure (Correia et al., 2025a), this suggests that regulators may be concerned about mergers of institutions already teetering on the brink of insolvency.

4.2 Regulators' decisions

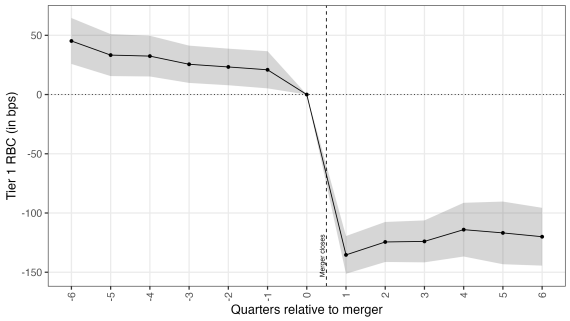
We now turn to the key object of study in this paper: Understanding regulators' decision-making process. To understand what factors are associated with regulators' M&A application decisions, we estimate OLS specifications of the following form on our panel of bank merger

[17] We restrict to a subsample of mergers that are consummated after Jan. 2009, since market values on target bank loan books are only available starting in 2009. We further exclude banks that report $0 in acquired target loans. Our treatment variable ("MTM Loss") is the gross contractual value of loans acquired for which the acquiring bank does not expect to collect full repayment, divided by the pro-forma RWA of the combined institution. This provides a "joint size-weighted" measure of the effect of the mark-to-market losses on the combined institutions' capital ratio.

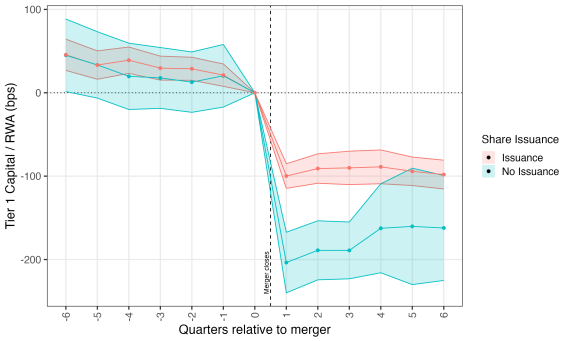
[18] In their original implementation of Tier 1 Capital rules in 1989, regulators wrote (p. 25) that "Experience has shown that the value of many intangibles declines when the condition of a bank deteriorates, the most critical point at which capital is needed. It is because of this inherent weakness in the value of certain intangibles that goodwill and most intangible assets cannot be relied upon for capital support."

Figure 3: **Evolution of bank regulatory capital around M&A transactions.** This figure plots the effects of bank mergers on pro-forma bank regulatory capital ratios (Tier 1 Risk-Based Capital). Panel (a) plots the average effect over time, τ_t. Panel (b) separately plots the effects for banks that purchase the target entirely in cash (blue) vs. banks that issue equity in connection with their merger transaction (orange). Panel (c) restricts to a subsample of mergers where we observe purchase information on target loan portfolios, and shows the effect on Tier 1 RBC for the top quartile and bottom quartile of Mark-to-Market (MtM) losses. Panel (d) plots the average increase in intangible assets relative to RWA, which is deducted from Tier 1 Capital.

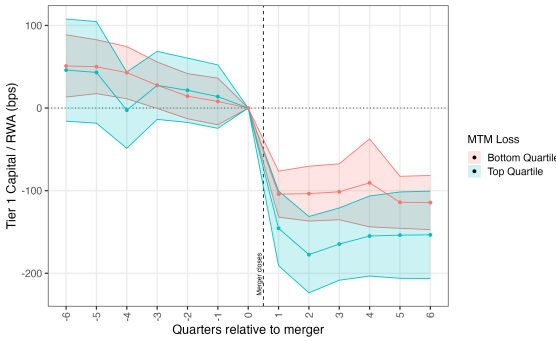
(a) Tier 1 Capital / RWA



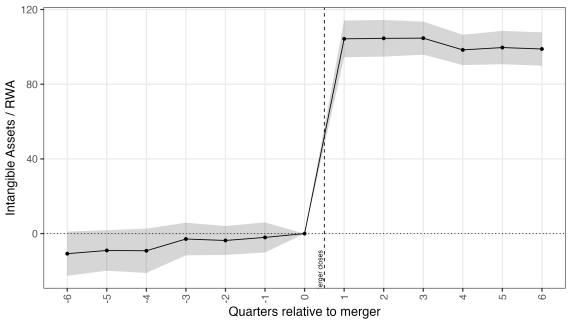
(b) Tier 1 Capital / RWA, by equity issuance decision



(c) Tier 1 Capital / RWA, by target loan MtM loss



(d) Intangible Assets / RWA



applications:

$$\mathbf{1}(\text{Denied}_{a,b,r,t}) = \beta_1^T X_{a,t} + \beta_2^T X_{b,t} + \beta_J^T X_{a,b,t} + \tau_{r,t} + \varepsilon_{a,b,r,t}$$
$$\mathbf{1}(\text{Divest}_{b_1,b_2,r,t}) = \beta_1^T X_{a,t} + \beta_2^T X_{b,t} + \beta_J^T X_{a,b,t} + \tau_{r,t} + \varepsilon_{a,b,r,t}$$

where $X_{a,t}$ and $X_{b,t}$ are a vector of applicant (a) and target (b) characteristics at the time of the application, $X_{a,b,t}$ are joint characteristics related to the application, and $\tau_{r,t}$ are regulator r by time t fixed effects. The dependent variables are whether the application is denied by the regulator, $\mathbf{1}(\text{Denied}_{a,b,r,t})$, or whether the application is approved by the regulator but branch divestiture is imposed, $\mathbf{1}(\text{Divest}_{a,b,r,t})$. The results are presented in Table 3.

Starting with merger application denials, we see that factors most strongly associated with denial are risk characteristics of the applicant bank. Banks that have lower capitalization, higher levels of foreclosed assets[19] or non-performing loans on their balance sheets, or that are subject to (or are currently negotiating with regulators over) enforcement actions are significantly more likely to have their applications denied. These effects are also economically meaningful:

[19]Other real estate owned (OREO) is a measure of mortgage foreclosures on bank balance sheets.

	Deny	Divest
$(\frac{\text{Equity}}{\text{Assets}})_{\text{Applicant}} \leq q_{5\%}$	0.032+	-0.001
	(0.019)	(0.007)
$(\frac{\text{OREO}}{\text{Assets}})_{\text{Applicant}} \geq q_{95\%}$	0.043*	-0.002
	(0.020)	(0.003)
$(\frac{\text{Nonaccrual Loans}}{\text{Loans}})_{\text{Applicant}} \geq q_{95\%}$	0.041*	-0.000
	(0.019)	(0.003)
$\text{Assets}_{\text{Applicant}} \geq q_{95\%}$	-0.025***	0.014***
	(0.005)	(0.002)
Δ HHI $\geq$ 200 & Pro-Forma HHI $\geq$ 1800	0.005	0.265***
	(0.011)	(0.031)
Forthcoming Enforcement Action	0.088***	0.008
	(0.018)	(0.007)
Open Enforcement Action	0.043**	0.003
	(0.014)	(0.005)
Weak CRA Rating	0.066	-0.003
	(0.077)	(0.005)
Num.Obs.	7181	7181
R2	0.132	0.261

Table 3: **Impact of bank characteristics on agency M&A decisions.** This table displays the OLS coefficients from a regression of $\mathbf{1}(\text{Denied}_{a,b,r,t})$ and $\mathbf{1}(\text{Divest}_{a,b,r,t})$ on applicant and target bank characteristics. In the first four rows, we include indicator variables for whether the applicant bank is in the bottom 5% (book equity / assets) or top 5% (other real estate owned, nonaccrual loans and assets) as compared to all other banks in the quarter the application was filed. ΔHHI $\geq$ 200 & Pro-Forma HHI $\geq$ 1800 is an indicator for whether the merger application violates the interagency competition guidelines in any market affected by the merger. "Forthcoming" and "Open" enforcement actions refer to whether the applicant institution will be subject to any enforcement action over the next two years, or is already subject to an enforcement action at the time of the merger application. "Weak CRA Rating" refers to whether the applicant institution's CRA rating is weaker than Satisfactory at the time of the merger application. We include additional controls related to bank interest rates, a "Bank HHI" measure capturing the average competition that the applicant bank faced in the year of its application (Drechsler et al., 2017), and agency-time fixed effects. Robust standard errors. Statistical significance: + at 10%, $\star$ at 5%, $\star\star$ at 1% and $\star\star\star$ at 0.1%.

For example, an applicant bank in the top 5% of non-accrual loans is 4.1% (percentage points) more likely to have their merger application denied than a bank with a smaller share of risky loans. By contrast, market concentration is not associated with application denial. In fact, larger banks are less likely to file applications that result in denial. Less-than-Satisfactory CRA ratings are also not associated with M&A denial, consistent with banks "window dressing" their CRA lending in the year immediately preceding a merger (Kress and Zhang, 2026).

Turning to cases where the regulator approves the merger application but imposes branch divestiture, we can see that risk characteristics are not largely predictive of branch divestiture decisions. Instead, measures of market power – including the applicants' size and the violation of inter-agency guidance for deposit market competition – are highly predictive of whether mergers are associated with branch divestiture. Applications that increase market

concentration above the interagency guidelines are 26% (percentage points) more likely to result in branch divestiture.

One reason regulators may use branch divestiture as a remedy for anti-competitive mergers is because divestiture can be used as a tool to target specific markets that will be adversely affected by bank consolidation (Kress, 2022). By contrast, denial is an extensive margin decision that affects the entirety of the merger application. To further understand whether regulators use divestiture as a targeted remedy for "excess" consolidation, we estimate specifications of the following form:

$$\begin{aligned}\mathbf{1}(\text{Divest}_{a,b,m,t}) = \beta \mathbf{1}(\Delta\text{HHI} \geq 200,\ \text{Pro-Forma HHI} \geq 1800)_{a,b,m,t} \times X_{a,b,m,t} \\ + \eta_{(a,b)} + \tau_{m,t} + \varepsilon_{a,b,m,t}\end{aligned}$$

Here, $\mathbf{1}(\text{Divest}_{a,b,m,t})$ is an indicator for whether applicant bank a or target bank b was required to divest branches in market m as a condition of their merger transaction,[20] $\mathbf{1}(\Delta\text{HHI} \geq 200,\ \text{Pro-Forma HHI} \geq 1800)_{a,b,m,t}$ is an indicator for whether the merger violates interagency guidelines in market m, $\eta_{(a,b)}$ are merger-fixed effects and $\tau_{m,t}$ are market-year fixed effects. Our coefficient of interest is β, the correlation between deposit-market concentration and branch divestiture. We also run two specifications that include interaction terms, $X_{a,b,m,t}$. For our interaction terms, we consider (1) an indicator for whether the merger application is ultimately denied by the regulator; and (2) an indicator for whether the merger was facilitated by the FDIC's resolution process. For the final specification only, we include both "standard" mergers and business combinations that result from the sale of failed banks.

The results of our estimation are in Table 4. Starting with the first column, we see that violation of interagency guidelines is associated with an 20% (percentage point) increase in the likelihood of branch divestiture, relative to markets without excessive concentration within the same merger and to mergers in the same market and year that don't excessively increase deposit market concentration. Turning to Column (2), we see that this effect is entirely reversed for applications that are ultimately denied by the regulator. This suggests that divestiture and denial are alternative remedies that regulators can impose on banks – that is, regulators only impose divestiture when the merger is consummated and poses anti-competitive concerns.

Finally, in Column (3), we add to our sample 542 bank failures that occurred between 2000 and 2021. By directly comparing divestiture outcomes for traditional mergers and business combinations where divestiture has direct costs for the FDIC, we provide suggestive evidence for how regulators trade off consumer welfare vs. FDIC costs. Given that local banks are willing to pay higher prices to acquire nearby failed institutions (Granja et al., 2017) and the FDIC is averse to high cost resolutions (Allen et al., 2023),[21] it is unsurprising that we see that the effect of market concentration on branch sales is almost completely reversed for banks that are purchased through the FDIC's resolution process.[22] Forcing divestiture to reduce market concentration could lower the sales price of the failed bank, which would increase costs to the FDIC.

[20]For robustness, we also run a version where $\mathbf{1}(\text{Divest}_{a,b,m,t})$ is an indicator for whether applicant bank a or target bank b sold branches in market m to an unaffiliated competitor between t and $t+1$, in line with the proxy for divestiture used in Liebersohn (2024). These results are in Appendix B.3.

[21]In fact, the FDIC's resolution process is governed by cost minimization for the FDIC, so we should expect that the consumer welfare implications of business transactions may have little weight in these transactions.

[22]In only one failed bank acquisition did regulators require branch divestiture as a condition of merger consummation: Wells Fargo's acquisition of Wachovia in the middle of the 2007-2008 financial crisis.

Table 4: **Deposit divestiture, by final application decision and in comparison with banks acquired in failure.** This table estimates regressions of bank divestiture outcomes on pro-forma market impacts. The unit of observation is a market m affected by a bank merger (a, b). Market impacts are calculated based on Summary of Deposits data and using Fed market definition shape files. Divestiture is defined based on observed divestitures from Granja and Paixao (2024) and manual collection. Standard errors are double clustered at the market and year level.

	Dependent variable:		
	$\mathbf{1}(\text{Divest})_{a,b,m}$		
	(1)	(2)	(3)
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800	0.202***	0.203***	0.204***
	(0.058)	(0.058)	(0.057)
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800 $\times$ Denial		−0.203***	
		(0.058)	
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800 $\times$ Fail			−0.203***
			(0.057)
Num Mergers	7187	7187	7187
Num Failed	0	0	542
Observations	107,233	107,233	120,204
R^2	0.644	0.644	0.644
Adjusted R^2	0.491	0.491	0.497
Note:			·p<0.1; ··p<0.05; ···p<0.01

While the evidence in Column (3) of Table 4 suggests that regulators are willing to accept consumer welfare loss to reduce FDIC costs – that is, they do not require divestiture when they sell failed banks to acquirers that substantially increase market concentration – this test is conditional on a sale, and does not reflect the FDIC's outside options (i.e. other potential buyers). To account for the FDIC's outside option as part of the resolution process, we examine in Appendix C to what extent regulators are willing to auction failed banks in resolution to bidders that will substantially increase market concentration. Consistent with the evidence in Column (3), we find that regulators do not appear to consider market concentration when auctioning off failed banks and focus primarily on least cost resolution (as required by statute). However, interestingly, this motive appears to diminish as the number of bidders increases, suggesting that regulators may consider the tradeoff between these two forces (costs vs. competition) when they have the discretion to do so.

5 Bank Merger Model

We now turn to our model of bank merger applications and banking industry competition, which we will use to concretely define the objects of interest to bank regulators (i.e. agents'

utility). Our model consists of three periods, as described in Figure 4. In the first period (the "Application" period), banks decide whether to apply to merge, based on the costs of merging vs. the expected benefits if their merger is approved. In the second period (the "Competition" period), banks take the industrial structure as given and compete in loan and deposit markets to maximize expected *shareholder* profits. In the third period (the "Losses & Failure" period), losses on existing assets are realized and failed banks are auctioned by the FDIC.

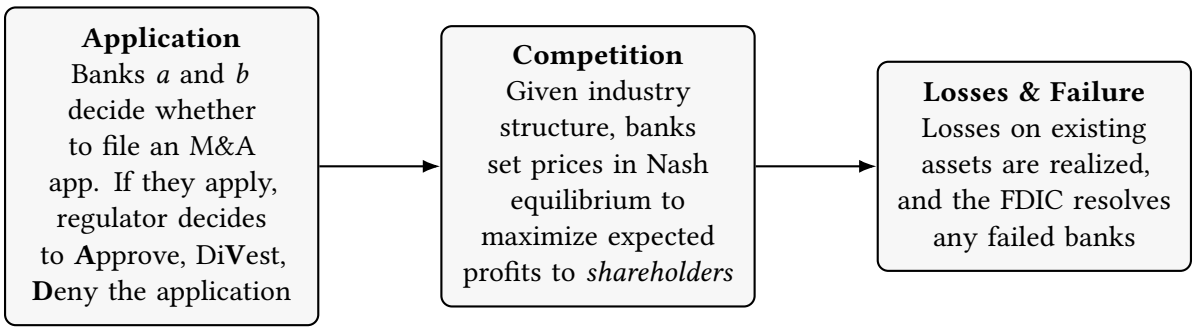


Figure 4: Timeline of model structure

We start by describing the model of competition in the second period, which incorporates the expectation of payoffs in the final period. After defining the objects of interest to the regulators (agent welfare) and bankers (bank profits), we then turn to the model of selection in the first period.

5.1 Industry Competition Period

Our second period model of competition is a deliberately stylized depiction of the banking industry, streamlined to study the tradeoff between bankers, consumers, and the FDIC – which insures depositors if banks fail. Banks possess market power and set deposit and loan rates to maximize expected profits to shareholders. However, because banks have existing risky assets and face regulatory capital constraints, in some states of the world they will be placed into insolvency by their regulator. Mergers affect bank market power, their marginal costs of providing services, and their probability of failure.

Borrowers: In each loan market m, there are a continuum of borrowers with total mass L_m that each demand \$1 to invest in a project. Each bank operating in market m offers a gross interest rate $r^L_{b,m}$ for borrowing. Borrowers make a discrete choice over which bank to borrow from in order to maximize their utility, which is given by:

$$u^f_{i,b,m} = -\alpha^f r^L_{b,m} + \beta^{f,\text{branches}} \log(\#\text{Branches}_{b,m}) + \delta^f_b + \gamma^f_m + \nu^f_{b,m} + \varepsilon^f_{i,b,m}$$

where $\alpha^f > 0$ is their dis-utility from paying back the bank, δ^f_b is a bank-quality fixed effect, γ^f_m is an observable market-demand fixed effect, $\nu^f_{b,m}$ is a market-specific demand for bank b in market m that is unobservable to the econometrician, and $\varepsilon^f_{i,b,m}$ are taste shocks with Type 1 extreme value distribution. We also include a coefficient on bank market presence, captured by $\log(\#\text{Branches}_{b,m})$.[23] In addition to borrowing from the banks operating in market m, the borrower faces an outside option to borrow in bond markets at the prevailing market

[23] In Appendix D.1, we show that including $\log(\#\text{Branches}_{b,m})$ in the borrower's utility function is equivalent to a model with branch-specific fixed effects δ^f_k and uniform pricing across all branches in the same market.

price. This provides them with a utility normalized to 0. This implies that given loan rates $\{r^L_{b,m}\}_{b \mid m \in \mathcal{M}_{\geq}}$, the quantity of loans originated by bank b in market m is given by:

$$L_{b,m}(r^L_{b,m}, r^L_{-b,m}) = L_m \times s^L_{b,m}(r^L_{b,m}, r^L_{-b,m})$$

where $s^L_{b,m}(r^L_{b,m}, r^L_{-b,m})$ is the standard logit demand market share.

Depositors: In each deposit market m, there are a continuum of depositors with mass D_m that are each endowed with \$1 in cash. Each bank operating in market m offers a gross interest rate $r^D_{b,m}$ to deposit funds with that bank. Depositors makes a discrete choice over which bank to deposit their funds in order to maximize their utility, which is given by:

$$u^d_{i,b,m} = \alpha^d r^D_{b,m} + \beta^{d,\text{branches}} \log(\#\text{Branches}_{b,m}) + \delta^d_b + \gamma^d_m + \nu^d_{b,m} + \varepsilon^d_{i,b,m}$$

where $\alpha^d > 0$ is their utility from interest on savings, δ^d_b is a bank-quality fixed effect, γ^d_m is an observable market-demand fixed effect, $\nu^d_{b,m}$ is a market-specific demand for bank b in market m that is unobservable to the econometrician, and $\varepsilon^d_{i,b,m}$ are taste shocks with Type 1 extreme value distribution and shape parameter 1. In addition to depositing with banks operating in market m, the borrower faces an outside option, which gives them utility that we normalize to 0. This implies that given deposit rates $\{r^D_{b,m}\}_{b \mid m \in \mathcal{M}_{\geq}}$, the quantity of deposits raised by bank b in market m is given by:

$$D_{b,m}(r^D_{b,m}, r^D_{-b,m}) = D_m \times s^D_{b,m}(r^D_{b,m}, r^D_{-b,m})$$

where $s^D_{b,m}(r^D_{b,m}, r^D_{-b,m})$ is the standard logit demand market share.

Banks: The core agent in our model are banks. Each bank b is endowed with existing cash I_b, existing deposits D_b, existing regulatory capital E_b, and existing risky assets A_b. Risky assets have an uncertain return θ_b, such that regulatory capital net of losses will be $E'_b = E_b - (1 - \theta_b)A_b$ after uncertainty is realized. A key friction in our model is that the bank faces a regulatory capital constraint: If it becomes under-capitalized after losses are realized, namely if

$$\frac{E'_b}{A'_b} \leq N$$

where A'_b is the value of the bank's risk-weighted assets next period, then regulators will close the bank and place it into FDIC receivership.

Given the potential for failure, the bank makes pricing decisions today to maximize the expected profits to *shareholders* in the next period. That is, the bank chooses loan and deposit rates $(r^L_{b,m}, r^D_{b,m})$ to maximize expected profits to shareholders across all markets. When the bank survives, profits to shareholders consist of interest income $r^L_{b,m}$ paid on new loans less marginal costs κ_L of issuance, flow income on existing assets that have not failed, $r_A \theta A_b$, interest income r on cash at the Fed I'_b, less interest expense $r^D_{b,m}$ and marginal costs κ_D paid on deposits. When the bank fails, shareholders receive 0 and the bank is sold by the FDIC at auction.

The bank's maximization problem can be written as:

$$\Pi_b(E_b, D_b, A_b, I_b) = \max_{r^L_{b,m}, r^D_{b,m}} \quad E_\theta\Bigg[\Bigg(\overbrace{r_A\theta A_b + rI'_b}^{\text{Income on existing assets and liquidity}} - \overbrace{\sum_{m\in\mathcal{M}_b}(r^D_{b,m}+\kappa_D)D'_{b,m}(r^D_{b,m}, r^D_{-b,m})}^{\text{Expenses on deposits}} + \underbrace{\sum_{m\in\mathcal{M}_b}(r^L_{b,m}-\kappa_L)L_{b,m}(r^L_{b,m}, r^L_{-b,m})}_{\text{Income on new loan origination}}\Bigg) \times \mathbf{1}(\theta \geq \underline{\theta})\Bigg]$$

$$\text{s.t.} \quad I'_b = I_b + \sum_m [(D'_{b,m}(r^D_{b,m}, r^D_{-b,m}) - D_{b,m}) - L_{b,m}(r^L_{b,m}, r^L_{-b,m})]$$

$$\underline{\theta} = \frac{1}{1-N}\left(1 - \frac{E_b}{A_b} + N\left(\frac{\sum_m L_{b,m}(r^L_{b,m}, r^L_{-b,m})}{A_b}\right)\right)$$

where $D_{b,m}$ and $L_{b,m}$ are the quantity of deposits raised and loans originated by bank b in market m, respectively. The first constraint is the bank's balance sheet constraint: liquid investments I'_b are equal to existing cash I_b plus net new deposits, $\sum_m D'_{b,m} - D_{b,m}$, less net new loans $\sum_m L_{b,m}$. The second equality is the bank's default condition: When losses on existing risky assets are sufficiently high ($\theta < \underline{\theta}$), the bank is placed into FDIC receivership. The failure threshold $\underline{\theta}$ is decreasing in the bank's existing capital ratio, $\frac{E_b}{A_b}$, but is increasing in new loan origination $L_{b,m}$, since new loans receive 100% risk-weight under regulatory capital rules.[24]

To consider the effect of bank mergers, we model the problem of two merged banks a and b as similar to that of un-merged banks, subject to three key changes. First, we assume the merged bank $h = \{a\} \cup \{b\}$ manages a consolidated balance sheet: That is, E_h, A_h, I_h and D_h reflect the sum of the merging banks' balance sheets. We also allow the merger to affect the consolidated bank's balance sheet through merger-related costs, such as payments to the target bank shareholders which reduces overall equity ($E_h \leq E_a + E_b$). Second, we allow the merger to reduce the marginal costs of each subsidiary, as well as the potential for losses (distribution of θ). Third, because the merged bank acts as if it runs two subsidiary "brands", it will internalize the effects of its pricing decisions on market shares of the other "brands." Formally, the problem

[24]The derivation of $\underline{\theta}$ comes from the law of motion for equity, $E'_b = E_b - (1-\theta_b)A_b$, and the law of motion for assets, $A'_b = \theta_b A_b + \sum_{m\in\mathcal{M}_b} L_{b,m}$, and is defined by the value of θ at which the regulatory capital constraint holds with equality, $\frac{E'_b(\theta)}{A'_b(\theta)} = N$.

of a merged bank can be written as:

$$\Pi^{M}_{(a,b)}(E_h, D_h, A_h, I_h) = \max_{\substack{r^L_{a,m}, r^D_{a,m} \\ r^L_{a,m}, r^D_{a,m}}} \quad E_\theta \Bigg[\Bigg(\overbrace{r_{h,A}\theta A_h + r I'_h}^{\text{Income on merged assets and liquidity}} - \overbrace{\sum_{i\in\{a,b\}} \sum_{m\in\mathcal{M}_i} (r^D_{i,m} + \kappa_{i,D}) D'_{i,m}(r^D_{i,m}, r^D_{-i,m})}^{\text{Expenses on deposits}} + \underbrace{\sum_{i\in\{a,b\}} \sum_{m\in\mathcal{M}_i} (r^L_{i,m} - \kappa_{i,L}) L_{i,m}(r^L_{i,m}, r^L_{-i,m})}_{\text{Income on new loan origination}} \Bigg) \times \mathbf{1}(\theta \geq \underline{\theta}) \Bigg]$$

$$\text{s.t.} \quad I'_h = I_h + \sum_{i\in\{a,b\}} \sum_{m\in\mathcal{M}_i} [(D'_{i,m}(r^D_{i,m}, r^D_{-i,m}) - D_{i,m}) - L_{i,m}(r^L_{i,m}, r^L_{-i,m})]$$

$$\underline{\theta} = \frac{1}{1-N}\left(1 - \frac{E_h}{A_h} + N\left(\frac{\sum_{i\in\{a,b\}} \sum_{m\in\mathcal{M}_i} L_{i,m}(r^L_{i,m}, r^L_{-i,m})}{A_h}\right)\right)$$

where the subscript h denotes the consolidated balance sheet, net of merger-related costs. We discuss our modeling assumptions for merger-related costs in Section 6.

For both the merged bank and un-merged bank, a key assumption of our model is that we allow banks to set both loan and deposit prices at the market level, rather than uniformly across markets. While existing evidence supports uniform deposit pricing across markets (Begenau and Stafford, 2025; Granja and Paixao, 2024), our evidence on regulators' divestiture decisions – namely, that they occur specifically in markets with excess concentration resulting from M&A – suggests that regulators view the effects on consumer welfare as if banks engaged in market-specific deposit pricing. Since the purpose of our model is to construct the agent welfare *as perceived by regulators*, we allow for market-specific rates for both loans and deposits.

FDIC: The final agent in our model is the FDIC. Given that the FDIC is assumed to insure all depositors in failure, the cost to the FDIC's deposit insurance fund can be written as the face value of outstanding deposits less the bank's cash on hand, less the recovery value of the bank's assets at default. In the language of the model, this can be expressed as:

$$\text{Cost}_b = \left(\sum_{m\in\mathcal{M}_b} D_{b,m}(r^D_b, r^D_{-b}) - (I'_b)_+ - \alpha_{DWL}(r_A \theta A_b + \sum_{m\in\mathcal{M}_b} L_{b,m}(r^L_b, r^L_{-b})) \right)_+ \mathbf{1}(\theta < \underline{\theta})$$

where $\alpha_{DWL} \in [0,1]$ reflects the dead-weight loss from bankruptcy that destroys risky asset value.

Equilibrium: A *Nash equilibrium* in the second period model is defined as in standard industry organization models. An equilibrium is a set of interest rates on loans and deposits for each bank $(r^L_{b,m}, r^D_{b,m})_{b\in\mathcal{B}}$ such that

1. Each bank b sets interest rates on loans $r^L_{b,m}$ and deposits $r^D_{b,m}$ to maximize profits, taking the interest rates set by other banks $r^L_{-b,m}$ and $r^D_{-b,m}$ as given.
2. Each borrower chooses to borrow from the subsidiary bank b that maximizes their utility.
3. Each depositor chooses to place funds at the subsidiary bank b that maximizes their utility.

4. The FDIC guarantees all depositors in the event of failure.

Intuition: To understand the intuition behind the economic forces in our second period model of competition, it is helpful to consider the first order conditions of an un-merged bank. Starting with interest rates on deposits, the bank's first order condition is given by the standard Bertrand Nash equilibrium pricing rule:

$$r^D_{b,m} = \underbrace{r - \kappa_D}_{\substack{\text{Marginal} \\ \text{benefit}}} - \underbrace{\frac{1}{\alpha^D(1 - s^D_{b,m}(r^D_{b,m}, r^D_{-b,m}))}}_{\text{Markdown}}$$

Because banks have market power, they pay depositors a mark-down based on their marginal investment opportunity. This *mark-down* is increasing in both the bank's market concentration ($s^D_{b,m}(r^D_{b,m}, r^D_{-b,m})$) and the bank's marginal costs (κ_D). This equation highlights the standard tradeoff in industry equilibrium models of competition: If mergers reduce marginal costs ($\downarrow \kappa_D$), banks will provide depositors with higher rates and increase welfare. However, increasing concentration ($\uparrow \ s^D_{b,m}(r^D_{b,m}, r^D_{-b,m})$) leads banks to increase markdowns, reducing depositor welfare.

Turning to the first order condition for interest rates on loans, banks face similar choices in lending markets. Their first order condition is given by:

$$r^L_{b,m} = \underbrace{r + \kappa_L}_{\substack{\text{Marginal} \\ \text{cost}}} + \underbrace{\frac{1}{\alpha^L(1 - s^L_{b,m})}}_{\text{Markup}} + \underbrace{(\frac{N}{1-N})(\frac{h(\underline{\theta})}{\Gamma(\underline{\theta})})\Big(\Pi^{def}_b(\underline{\theta}) + \sum_{m'} \frac{L_{b,m'}}{A_b} \frac{1}{\alpha^L(1 - s^L_{b,m'})}\Big)}_{\substack{\text{Failure-adjusted: (1) marginal profit lost at failure, plus} \\ \text{(2) quantity weighted-average markup}}}$$

where $h(\theta) = \frac{g(\theta)}{1-G(\theta)}$ is the hazard ratio of the risky asset value and $\Gamma(\theta) = f(h(\theta)) < 1$ is also a function of bank default risk, and $\Pi_b(\theta)$ is the marginal non-lending profit rate the bank would receive at failure.[25] To ensure equilibrium existence in our model, we assume that the distribution of θ is such that $h'(\theta) > 0$. While competition in loan markets also captures the standard tradeoff between marginal costs (κ_L) and market concentration ($s^L_{b,m}(r^L_{b,m}, r^L_{-b,m})$), there is an additional force that affects banks' lending decisions: the risk of failure. New loan origination increases the bank's risk of failure, since it increases their risk-weighted assets. Banks internalize this effect and increase markups on loans (decrease quantities of lending) to avoid failure. This feedback loop on pricing is more severe when banks are closer to failure. This suggests an additional channel why regulators may be averse to bank mergers between risky banks, other than a potential increase in FDIC costs: Namely, higher risk of failure may lead to a contraction in loan provision, harming borrowers.[26]

[25]The exact formulas for $\Gamma(\theta)$ and $\Pi^{def}_b(\theta)$ are given by:

$$\Gamma(\underline{\theta}) = 1 - (\frac{N}{1-N})h(\underline{\theta})\frac{\sum_m L_{b,m}(r^L_b, r^L_{-b})}{A_b}$$

$$\Pi^{def}_b(\underline{\theta}) = r_A\underline{\theta} + r(\frac{I_b - D_b}{A_b}) + \sum_m (r - r^D_{b,m} - \kappa_D)\frac{D'_{b,m}(r^D_b, r^D_{-b})}{A_b}$$

Note that if $r_A > r$, then $\Pi^{def}_b(\underline{\theta}) > 0$.

[26]This feedback loop is related to incentives in classic banking theories, for example Hellmann et al. (2000) and Allen and Gale (2004), whereby deposit market power incentivizes banks to take less risk. In our model, higher deposit market power leads banks to increase loan rates, which reduces their RWA (and chance of being placed into resolution by the FDIC).

If we consider the first order conditions for the merged bank (between original banks a and b), we can more clearly see the effect of mergers on pricing decisions. In deposit markets, the merged bank's deposit rate choice for subsidiary b in market m is given by:

$$r_{b,m}^{D,\text{merged}} = \underbrace{r - \kappa_D^{\text{merged}}}_{\substack{\text{Marginal} \\ \text{benefit}}} - \underbrace{\frac{1}{\alpha^D(1 - s_{b,m}^D(r_{b,m}^{D,\text{merged}}, r_{-b,m}^D) - s_{a,m}^D(r_{a,m}^{D,\text{merged}}, r_{-a,m}^D))}}_{\text{Markdown}}$$

This formulation makes clear the tradeoff discussed earlier: The merged bank $h = \{a\} \cup \{b\}$ will pay higher deposit rates if their marginal cost κ_D^{merged} decreases; however, merged subsidiary bank b internalizes that increasing deposit rates will steal business from subsidiary a and thus the merged bank internalizes the market shares of both subsidiaries. Similarly, in loan markets, the merged bank's first order condition for loan rates for subsidiary b in market m is given by:

$$r_{b,m}^L = \overbrace{r + \kappa_L^{\text{merged}}}^{\text{Marginal cost}} + \overbrace{\frac{1}{\alpha^L(1 - s_{b,m}^L - s_{a,m}^L)}}^{\text{Markup}}$$
$$+ \underbrace{\left(\frac{N}{1-N}\right)\left(\frac{h(\underline{\theta})}{\Gamma^{\text{merged}}(\underline{\theta})}\right)\left(\Pi_b^{def}(\underline{\theta}) + \sum_{m'} \frac{L_{b,m'} + L_{a,m'}}{A_b} \frac{1}{\alpha^L(1 - s_{b,m'}^L - s_{a,m'}^L)}\right)}_{\substack{\text{Failure-adjusted: (1) marginal profit lost at failure, plus} \\ \text{(2) quantity weighted-average markup}}}$$

where the definition of $\Gamma^{\text{merged}}(\underline{\theta}) = 1 - h(\underline{\theta})(\frac{N}{1-N})(\frac{L_a+L_b}{A_h})$ now includes total loans across both subsidiaries. Thus, we see the same tradeoff present in deposit market competition also affects loan market competition. However, we see that this tradeoff is amplified by the effects of bank mergers in two ways. First, when mergers reduce pro-forma capitalization, they increase $\underline{\theta}$, which amplifies the increase in loan prices resulting from the merger. Second, when diversification benefits reduce the probability of failure by changing $h(\cdot)$, banks respond by decreasing loan rates to more aggressively compete for new business.

Welfare Criterion: Finally, the last important piece of our second period model is that it allows us to map prices and quantities into expected welfare for borrowers, depositors, bankers, and the FDIC. The expected welfare of each agent in our model is given by:

$$\begin{aligned}
\text{Borrower Welfare}_m &= \frac{1}{\alpha^F} E[\max_b u_{i,b,m}^f] \\
\text{Depositor Welfare}_m &= \frac{1}{\alpha^D} E[\max_b u_{i,b,m}^d] \\
\text{Banker Welfare}_b &= E_{\theta_b}[\Pi_b \times \mathbf{1}(\theta_b \geq \underline{\theta}_b)] \\
\text{FDIC Welfare}_b &= -E_{\theta_b}[\text{Cost}_b]
\end{aligned}$$

Borrower and depositor welfare are defined for each market m to which the agent belongs, and are normalized by α^F and α^D, respectively, to convert into units of money-metric utility. Banker and FDIC welfare are defined for each institution b that is in operation. These definitions will become important when we turn to the regulator's problem in the first period, of whether or not to approve a bank merger application. Details on welfare calculations are provided in Appendix D.2.

5.2 Application Period

We now turn to the first period of our model, when two banks a and b decide whether to apply to the regulator to merge. We model this as a three-stage decision process. In the first stage, the two banks receive a draw $\aleph_{a,b} \sim f_{\aleph}(\cdot|\sigma_{\aleph})$ which measures the fixed cost the banks will incur if they apply to the regulator to merge. In the second stage, if the banks have applied to the regulator to merge, the regulator will decide whether to: (a) approve the application, (b) deny the application, or (c) approve the application, conditional on branch divestiture. In the third stage, if the merger is approved or approved with divestiture, the merged bank will optimize their value by choosing how much equity in the target bank to pay out as an immediate dividend. This can be interpreted as the portion of the merger transaction that is financed via cash instead of equity.

To solve for the equilibrium actions in this period, we first turn to the regulators' problem in the second stage. We assume that the regulator is a constrained social planner that faces a discrete choice on a bank merger application. The regulators' problem is given by:

$$\max_{i \in \left\{ \begin{smallmatrix} \text{Approve,} \\ \text{Deny,} \\ \text{Divest} \end{smallmatrix} \right\}} \overbrace{\left(\text{Borrower Welfare}_{(a,b),i} + \lambda_d \text{Depositor Welfare}_{(a,b),i} \right)}^{\text{Consumer surplus}} + \lambda_b \text{Bank Welfare}_{(a,b),i} + \lambda_{FDIC} \text{FDIC Welfare}_{(a,b)} + c_i$$

where the agent's $\text{Welfare}_{(a,b),i}$ refers to the expected (money metric utility) welfare of the agent under the second period industry competition assuming that the regulator chooses decision i for the merger application between banks a and b, and c_i is the relative cost (in money metric utility) for the regulator to choose option i. The relative welfare weights on depositors as compared to borrowers, λ_d, bankers as compared to borrowers, λ_b, and on the FDIC relative to borrowers, λ_{FDIC}, are the central objects of interest in this paper.

Following Allen et al. (2023), we assume that welfare weights are not deterministic but randomly distributed for each transaction. Economically, welfare weights might vary across transactions depending on which manager within a regulator is assigned to review a transaction (Agarwal et al., 2024), overall news salience that affects regulators' incentives (Lyu and Xu, 2026), and idiosyncratic pressure that regulators receive from Congress or the media related to specific transactions. Nevertheless, the non-deterministic nature of welfare weights λ_d, λ_b, and λ_{FDIC} imply that for a parametric distribution, $(\lambda_d, \lambda_b, \lambda_{FDIC}) \sim \Lambda(\cdot|\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)$, each potential merger maps to a probability $p_{(a,b),i}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)$ that the regulator will decide option i on merger application (a, b).

While approval and denial of bank merger applications are clearly defined options for the regulator, divestiture is a less well-defined option because the regulator can affect agents' welfare by modifying the *quantity* of divestiture in each market m where banks a and b both compete. To make this option tractable, we model divestiture as the forced sale of all target bank branches in a market m to a de novo competitor with the same marginal costs as the target bank. This is consistent with empirical evidence in Appendix B.4, which shows that in $\approx 30\%$ of divestitures, the divesting bank sells 100% of their branches to a competitor, which 80% of the time is an out-of-market competitor. Further, we assume that this option is only available to the regulator when the pro-forma merger impact is sufficiently large, $\Delta\text{HHI}_{(a,b),m} \geq 200$.

Now, turning to the bank's application decision in the first stage of this period, we can see

that banks a and b will apply to merge if and only if the expected joint surplus from merging exceeds the fixed cost of applications, $\aleph_{(a,b)}$. That is, banks will apply to merge if and only if:

$$\begin{aligned}\aleph_{(a,b)} \leq\ & p_{(a,b),\text{Approve}}(\lambda_b, \lambda_{FDIC}, \sigma_\varepsilon)\Big(\Pi^{\text{Approve}}_{(a,b)} - \Pi^{\text{Deny}}_{(a,b)}\Big) \\ & + p_{(a,b),\text{Divest}}(\lambda_b, \lambda_{FDIC}, \sigma_\varepsilon)\Big(\Pi^{\text{Divest}}_{(a,b)} - \Pi^{\text{Deny}}_{(a,b)}\Big)\end{aligned}$$

where $\Pi^{i}_{(a,b)}$ reflects the expected joint profits available to shareholders of the merged bank (a, b) under regulator decision i. For tractability in modeling the banks' merger decision, we make two key assumptions. First, we ignore negotiation between the acquirer and target banks. Instead, we assume that they maximize the joint value of the combined bank. That is, conditional on merger approval, in the third stage of this period, the newly merged entity chooses the optimal cash payment to target shareholders to maximize their joint expected value:

$$\Pi^{\text{Approve}}_{(a,b)} = \max_{\phi \in [0,1]} \quad \Pi^{M}_{(a,b)}(E_a + (1-\phi)E_b, D_a + D_b, A_a + A_b, I_a + I_b - \phi E_b) + (r+\rho)\phi E_b$$

where $\Pi^{M}_{(a,b)}(\cdot)$ is the value function of the merged bank, E_b is the value of equity of the target bank, ϕE_b is the portion of the acquisition that is financed in cash, and $\rho \geq 0$ is a present bias for consumption. We assume that total cash dividends are capped at the book value of the target bank's equity, E_b. Derivations of the banks' optimal choice of ϕ are provided in Appendix D.3. Second, we assume that the optimal financing choice for the M&A transaction is decided after regulatory approvals have been provided.[27] This assumption allows us to ignore the effects that financing strategy has on regulators' decisions, which greatly simplifies the estimation problem.

6 Estimation Procedure

We now turn to our estimation approach for regulators' preference weights. First, we discuss the estimation approach for the industry equilibrium model, including the demand and supply side parameters. Second, we discuss our estimation approach for regulators' preference parameters, including our simulation of bank mergers and our weighted maximum likelihood estimator of regulators' preferences.

6.1 Estimation of Industry Equilibrium Model

Estimation of the industry equilibrium model components proceeds in three steps. First, we estimate which characteristics that affect bank loss rates, since the distribution of losses on existing risky assets is a key model parameter for each bank (b, t). Second, we estimate borrower and depositor demand parameters, using standard marginal cost shifters (e.g., Ho and Ishii, 2011; Wang et al., 2022; d'Avernas et al., 2025; Egan et al., 2026). Third, taking the estimated loss rate function and demand parameters as given, we invert the banks' first order conditions to recover their marginal costs. A summary of estimated parameters is included in Table 5.

[27] Economically, this is equivalent to the merging banks being unable to commit to their financing choice at the time they submit their merger application to the regulator for approval. Practically, even though banks submit their proposed financing method for regulatory approval, they have the option to adjust the total form of that financing ex-post through dividends / share repurchase decisions after the merger has been approved.

Table 5: **Industry Equilibrium Model Parameters.** This table summarizes the model parameters used in the industry equilibrium model for bank competition. This includes factors that affect the distribution of loss rates, $\theta \sim N(\mu_{b,t}, \sigma)$, sensitivity of demand to prices and quality, and other parameters (e.g. dead-weight loss from bankruptcy, α^{DWL}.)

Parameter	Value	Estimation Strategy
$E[1-\theta]$		
$(\frac{\text{OREO}}{\text{Assets}})_{b,t-1}$	0.316	OLS
$r^{\text{Loan}}_{b,t-1}$	0.285	OLS
Outstanding Enforcement Action$_{b,t-1}$	0.006	OLS
Forthcoming Enforcement Action$_{b,\tau\in[t,t+1]}$	0.012	OLS
σ_θ	0.0162	OLS Residuals
Demand Parameters		
α^D	348.5	2SLS
α^L	63.7	2SLS
$\beta^{D,\text{branches}}$	1.312	2SLS
$\beta^{L,\text{branches}}$	1.287	2SLS
Other Parameters		
N	0.04	PCA Guidelines: Critical Under-capitalization
α^{DWL}	0.5	Berndt et al. (2025)

Loss Rate Estimation: A key object of our model is the distribution of $\theta_{b,t}$, the recovery rate on banks' existing risky assets. For the purposes of estimation, we assume that loss rates follow the distribution $1-\theta_{b,t} \sim N(\mu_{b,t}, \sigma^2)$. To estimate $\mu_{b,t} = E[1-\theta_{b,t}|X_{b,t}]$, we estimate OLS specifications of the following form:

$$\text{Loss Rate}_{b,t} = \alpha_b + \tau_t + \beta^T X_{b,t} + \varepsilon_{b,t}$$

where $X_{b,t}$ are bank characteristics that explain potential future loss rates, α_b are bank fixed effects, and τ_t are time fixed effects. The results of our estimation approach are described in Appendix E.1. Unsurprisingly, risky assets, high risk premia, and the existence of enforcement actions are highly predictive of future loan losses. For the purposes of our industry equilibrium model, we will estimate banks expected recovery rates, $E[\theta_{b,t}] = 1-\mu_{b,t}$, using the specification with time fixed effects (Column 2 of Table 12). We then estimate the variation in loss rates σ as the standard deviation of OLS residuals from that specification.

Demand Estimation: To estimate demand elasticities, we first require a definition of both loan and deposit markets to measure quantities and market shares. For both products, we define markets geographically, using the Fed market definitions provided by CASSIDI. Deposit market shares are sourced from the Summary of Deposits (SOD) data. Loan market shares are derived from call report data on new loan origination proxies at the bank-level, allocated across markets based on deposit market shares. The outside option for deposits are calculated from aggregate U.S. money market fund holdings, allocated across geographies based on median income. The outside option for loans are calculated from aggregate U.S. non-bank loan origination, allocated across geographies based on median income. For more details on market share construction, see Appendix A.

We also require a marginal cost shifter to instrument for both loan and deposit rates. In line with existing banking literature, we use proxies for bank compensation and expenditure on

fixed assets as our marginal cost shifter (Ho and Ishii, 2011; Wang et al., 2022; d'Avernas et al., 2025). Specifically, we use measures of peer bank compensation and state-level utility prices interacted with bank characteristics to instrument for these forces. We lag these measures by one year to address possible endogeneity concerns from the exclusion restriction, as described below. Our identifying assumptions are:

1. *Relevance:* Peer bank compensation and state utility prices affect bank product prices (interest rates on loans and deposits) as specified by the banks' first order conditions.
2. *Exclusion:* Peer bank compensation and state utility prices affect borrower and/or depositor demand solely through prices, conditional on other observables.

We demonstrate relevance of our instruments in Columns (1) and (3) of Table 6, where we can see that the marginal cost shifters enter the deposit and loan pricing equations with the theoretically correct coefficient sign. To justify our exclusion restriction, we note that the variation we exploit in bank expenses arise from different local labor markets (peer compensation) and different levels of utility bills (electricity prices) – factors that should affect bank costs but which are unlikely to affect borrower or depositor demand for banking services.

Table 6: **Loan and Deposit Demand Estimation.** This table displays first stage and 2SLS estimates of depositor and borrower demand parameters. Market shares calculated from Summary of Deposits data (deposits) and SOD data and call reports (loans). Bank-level prices are calculated from call report data. Standard errors are double clustered at the market and bank level.

	Dep: 1st	Dep: 2nd	Loan: 1st	Loan: 2nd
Peer Compensation × Num. Employees / Assets	-0.062***		0.010	
	(0.015)		(0.032)	
Electricity Prices × Num. Branches / Assets	-0.094**		0.753***	
	(0.033)		(0.189)	
log(Num. Branches)		1.312***		1.287***
		(0.011)		(0.010)
$r_{b,t}^{\text{Deposit Rate}} - r_{b,t}^{\text{Depositor Charges}}$		348.541***		
		(57.913)		
$r_{b,t}^{\text{Loan Rate}}$				-63.683***
				(18.004)
N	438519	438519	438519	438519
Market-Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes

The result of our demand estimation are in Table 6. Our estimate of depositor price sensitivity, α^D, is higher than average α^D in d'Avernas et al. (2025) who estimate Berry et al. (1995)-style demand with heterogeneous sensitivity, but in line with Egan et al. (2026) (Table 3(b)) who use a control function approach.

Marginal Costs: The final component required to simulate the industry equilibrium model is to use the banks' first order conditions for loan and deposit rates, the estimated demand parameters (α^D and α^F), and observed prices ($r_{b,t}^D$ and $r_{b,t}^L$) and market shares ($s_{b,m,t}^D$ and $s_{b,m,t}^L$) to back-out marginal costs. We assume that marginal costs are fixed at the bank level, so that we can aggregate market-level first order conditions to a bank-level first order condition and back out bank-level marginal costs. The details of this calculation are in Appendix E.2.

In-Sample Validation: Before using our model to simulate several thousand merger transactions, we verify that our modeling approach can accurately replicate existing banking industry dynamics. To do this, we simulate model-implied prices in loan and deposit markets for the banking industry in 2019, using our model-implied marginal costs ($\kappa^L_{b,2019}$, $\kappa^D_{b,2019}$), bank fixed effects (δ^D_b, δ^L_b), market fixed effects (η^D_m, η^L_m), and bank-market fixed effects ($\nu^D_{b,m}, \nu^L_{b,m}$). In Figure 15, we show that our model fits the 2019 data quite well.

6.2 Estimation of Selection Model

To estimate regulators' preference parameters, we proceed in two main steps. First, we simulate the industry equilibrium model on a set of realized (and unrealized) bank merger applications. Second, we use the results of our equilibrium simulations and exogenous fixed cost shifters to estimate regulator preferences using weighted maximum likelihood estimation. These phases are described below.

Equilibrium Simulation: The process for simulating equilibrium has three key components. First, we draw a random sample of unrealized bank merger applications to finalize our simulation sample of realized and unrealized mergers. We simulate both realized and unrealized merger applications to address selection concerns, described below. Second, for a given cash dividend $\phi \in [0, 1]$, we simulate equilibrium prices, quantities, and agent welfare under three scenarios: (a) merger denial; (b) merger approval; and (c) merger approval, conditional on branch divestiture (where considered). Third, we store the values of prices, quantities and welfare from the equilibrium $\phi^\star$ which maximizes the merging banks' joint objective function.

In order to simulate mergers, we make five key assumptions regarding the structural effects of mergers, consistent with our empirical evidence. First, we combine our reduced form estimates on the effect of mergers on average costs (Panel (a) of Figure 2) and the pass-through of average costs to marginal costs (Table 13), to estimate marginal cost synergies from merging. Second, we assume that the merged banks' risky asset process follows a distribution with a mean given by

$$E[\theta_{(a,b)}] = w_a E[\theta_a] + (1 - w_a)E[\theta_b]$$

where $w_a = \frac{A_a}{A_a + A_b}$ is the share of risky assets coming from bank a. Given our assumption that $\theta \sim N(E[\theta], \sigma^2)$, diversification benefits arise naturally since the probability of failure is convex when $\mu_{(a,b)} > \underline{\theta}_{(a,b)}$.[28] Third, when we simulate equilibrium, we only allow banks in markets affected by the merger transaction to re-optimize their loan and deposit rates; we hold constant the prices set by all other banks in the economy. Fourth, since we do not observe the price that banks pay each other to purchase divested branches, when we simulate divestiture, we assume that 50% of the expected profits of the new entrant are paid as a dividend

[28] Specifically, since $\theta_{(a,b)} \sim N(\mu_{(a,b)}, \sigma^2)$, the probability of failure is given by $\Phi(\frac{\underline{\theta}_{(a,b)} - \mu_{(a,b)}}{\sigma})$. In the region $\mu > \underline{\theta}$, the probability of failure is convex in both μ and $\underline{\theta}$. Thus, we have

$$\begin{aligned}\Phi\Big(\frac{\underline{\theta}_{(a,b)} - \mu_{(a,b)}}{\sigma}\Big) &< w_a\Phi\Big(\frac{\underline{\theta}_{(a,b)} - \mu_a}{\sigma}\Big) + (1 - w_a)\Phi\Big(\frac{\underline{\theta}_{(a,b)} - \mu_b}{\sigma}\Big) \\ &< w_a\Phi\Big(\frac{\underline{\theta}_a - \mu_a}{\sigma}\Big) + (1 - w_a)\Phi\Big(\frac{\underline{\theta}_b - \mu_b}{\sigma}\Big)\end{aligned}$$

which implies that the total expected probability of failure decreases as a result of the merger. This implies potential welfare benefits that will show up in estimation.

to the shareholders of the divesting / merging bank as the "price" of the branch divestiture. Finally, when calculating welfare of borrowers and depositors, we assume that regulators are primarily focused on the welfare of the agents in markets directly affected by the merger transaction.

Our last important assumption about merger simulations is the bankers' present bias for consumption, $\rho \geq 0$. We calibrate ρ by matching the realized share of M&A financed entirely via cash with the share of M&A financed via cash implied by the model. That is, we choose ρ to minimize:

$$\widehat{\rho} = \arg\min_{\rho} \left(\underbrace{\frac{\sum_{(a,b)} \mathbf{1}(\phi^{\star}_{(a,b)}(\rho) \equiv 1)}{\#\text{M\&A Applications}}}_{\text{Simulated M\&A}} - \underbrace{\frac{\sum_{(a,b)} \mathbf{1}(\text{M\&A Financed 100\% Cash}_{(a,b)})}{\#\text{M\&A Applications}}}_{\text{Realized M\&A}} \right)^2$$

Given our simulated merger transactions, this implies a value of present bias of $\rho \equiv 0.001$, as can be seen in Figure 5.

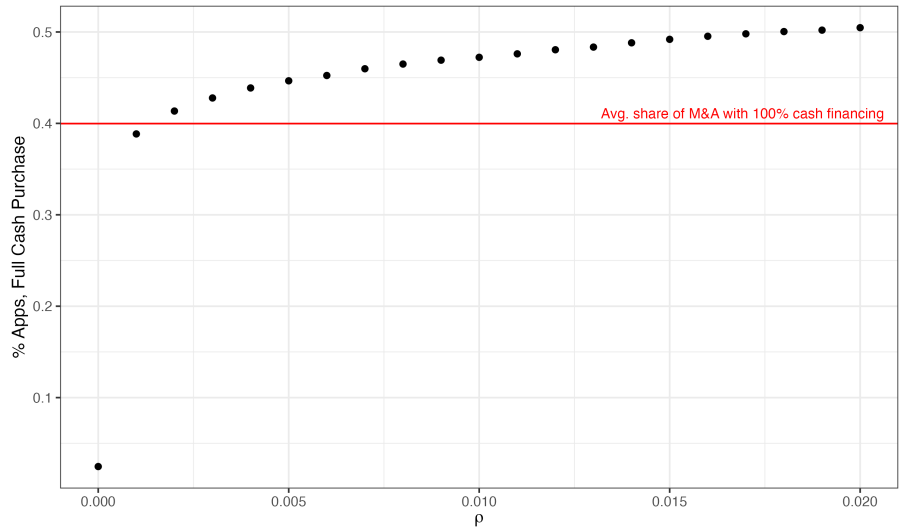


Figure 5: **Share of simulated M&A that are finance 100% in cash, as a function of ρ.** This figure plots the share of simulated M&A that are financed 100% in cash ($\phi^{\star}_{(a,b)}(\rho) \equiv 1$) as a function of banks' present bias ρ.

Weighted Maximum Likelihood Estimation: In order to map our model from Section 5 to the data, we define the following terms: Let $y_{(a,b)} \in \{0, 1\}$ reflect the decision of banks (a, b) to apply to merge, and let $x_{(a,b)} \in \{\text{Approve}, \text{Deny}, \text{Divest}\}$ reflect the regulators' decision on an application that it receives. Then given a set of social welfare weight parameters $(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)$ and parameters $\sigma_\aleph$ governing the distribution of merger application fixed costs, we can write the probability that banks (a, b) apply to merge is given by:

$$q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph) = F_\aleph\Bigg(p_{(a,b),\text{Approve}}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)\left(\Pi^{\text{Approve}}_{(a,b)} - \Pi^{\text{Deny}}_{(a,b)}\right) + p_{(a,b),\text{Divest}}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)\left(\Pi^{\text{Divest}}_{(a,b)} - \Pi^{\text{Deny}}_{(a,b)}\right) | \sigma_\aleph \Bigg)$$

where $F_\aleph(\cdot|\sigma_\aleph)$ is the CDF of the merger fixed cost distribution. That is, banks apply to merge if their fixed cost draw is sufficiently low. Thus, we can write the log-likelihood function for

observing the data of who applies ($\{y_{(a,b)}\}$) and how the regulator decides on an application ($\{x_{(a,b)}\}$) as:

$$\begin{aligned}\mathcal{L}(x_{(a,b)}, y_{(a,b)}|\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph) = &\sum_{(a,b)} y_{(a,b)} \log(q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph)) \\ &+ \sum_{(a,b)} (1 - y_{(a,b)}) \log((1 - q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph))) \\ &+ \sum_{(a,b)} y_{(a,b)} \sum_{\substack{\text{Reg.} \\ i \in \text{choice} \\ \text{set}}} \mathbf{1}(x_{a,b} = i) \log(p^i_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda))\end{aligned}$$

where the sum (a, b) is taken over *all possible* mergers in the economy, and the sum over the regulators' choice set depends on whether divestiture is a feasible choice for the given application. However, given the infeasibility of simulating 1.8 billion mergers between 1994-2021, we cannot estimate our full MLE specification on the population of all potential mergers. Instead, we can define $w_{(a,b)}$ as:

$$w_{(a,b)} = \begin{cases} 1 & \text{if } y_{(a,b)} = 1 \quad ((a,b) \text{ apply to merge}) \\ \frac{N_t^{\text{Potential}}}{N_t^{\text{Simulated}}} & \text{if } y_{(a,b)} = 0 \quad ((a,b) \text{ do not apply to merge}) \end{cases}$$

where $N_t^{\text{Potential}}$ are the set of potential bank mergers at time t and $N_t^{\text{Simulated}}$ are the set of bank mergers that we randomly choose to simulate, due to computation constraints. Then, we can write the log-likelihood of observing our simulated observations as:

$$\begin{aligned}\mathcal{L}(x_{(a,b)}, y_{(a,b)}|\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph) = &\sum_{(a,b)} w_{(a,b)} y_{(a,b)} \log(q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph)) \\ &+ \sum_{(a,b)} w_{(a,b)} (1 - y_{(a,b)}) \log((1 - q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph))) \\ &+ \sum_{(a,b)} w_{(a,b)} y_{(a,b)} \sum_{\substack{\text{Reg.} \\ i \in \text{choice} \\ \text{set}}} \mathbf{1}(x_{a,b} = i) \log(p^i_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda))\end{aligned}$$

which will converge in probability to the full population log-likelihood estimator, under the assumption that our simulated sample is a representative sample of the potential set of all bank merger applications.

For the purposes of estimation, we assume that in the regulators' problem, the regulators welfare weights λ_d, λ_b and λ_{FDIC} are independent and normally distributed (i.e. $\lambda_i \sim N(\lambda'_i, \sigma_i^2)$). We also assume that the fixed cost distribution is also normally distributed, $\aleph_{(a,b)} \sim N(\mu_{(a,b)}, \sigma_\aleph)$, where the average fixed cost $\mu_{(a,b)} = \mu_0 + \beta^T X_{(a,b)}$ is a linear function of applicant and target bank characteristics. Importantly, to ensure unbiased estimation of λ_d, λ_b and λ_{FDIC} parameters, we require "instruments" for bank mergers: That is, we include a set of merger characteristics $X_{(a,b)}$ that affect the fixed costs of merging, but are unrelated to (1) the benefits of merging, $X_{a,b} \perp \Pi_{a,b}^{\text{Merged}}$, and (2) the probability that the regulator approves the merger transaction, $X_{(a,b)} \perp p^i_{(a,b)}$. Specifically, we use: (1) measures of *state-level regulations* for bank mergers (Rice and Strahan, 2010; Li, 2025); and (2) regional variation in lawyers' compensation as plausibly exogenous variation in the fixed costs of applying to merge.

To motivate the relevance of these merger characteristics, in Table 7, we estimate OLS specifications of the following form:

$$\mathbf{1}(\text{Bank is involved in M\&A}_{b,t+1}) = \tau_t + \beta X_{b,t} + \varepsilon_{b,t}$$

on an unbalanced annual panel of banks and BHCs, where τ_t are time fixed effects, and $X_{b,t}$ are "instruments" for bank merger activity. The purpose of these regressions is to provide suggestive evidence for the strength these merger characteristics as "instruments" for bank mergers. As we can see from Table 7, all three instruments have economically and statistically significant effects on the probability that a bank is involved in a merger in the following year. "Underage" banks, banks in states with high merger barriers, and banks located in regions with high lawyer costs are 1.5-2 percentage points less likely to be involved in M&A in the subsequent year, consistent with intuition.

Table 7: **State Regulation Instruments for Banks Involved in M&A.** This table displays OLS regressions of bank b being involved in M&A in year $t+1$ as a function of state-level banking barriers, which vary over time. $\text{Age}_b \leq \text{Acquisition Minimum}_{s(b),t}$ is a bank-level measure based on state acquisition thresholds. $\text{High State Barriers}_{s(b),t}$ is a state-level measure based on state-level merger stringency. $\frac{\perp\text{Lawyer Fees}_{m(b),t}}{\text{Assets}_{b,t}}$ is an instrument for fixed costs of M&A (lawyers fees), orthogonal to banking costs (bankers' compensation). Standard errors clustered at the state (HQ) level.

	Dependent variable:	
	$\mathbf{1}(\text{Bank is involved in M\&A}_{b,t+1})$	
	(1)	(2)
$\text{Age}_b \leq \text{Acquisition Minimum}_{s(b),t}$	-0.020^{***}	-0.014^{***}
	(0.003)	(0.003)
$\text{High State Barriers}_{s(b),t}$	-0.017^{***}	-0.015^{***}
	(0.004)	(0.004)
$\frac{\perp\text{Lawyer Fees}_{m(b),t}}{\text{Assets}_{b,t}}$	-0.014^{***}	-0.014^{***}
	(0.004)	(0.004)
Year FE	No	Yes
F Stat	29.85	15.9
Observations	298,855	298,855
R^2	0.002	0.008
Note:		$^{\cdot}$p<0.1; $^{\cdot\cdot}$p<0.05; $^{\cdot\cdot\cdot}$p<0.01

7 Regulator Welfare Weights

In this section, we use the merger simulations calculated from Section 5 and our estimation procedure in Section 6 to estimate regulators' welfare weights over different agents in the economy. Our main estimates are in Table 8. In the first column, we estimate our MLE procedure jointly across all regulators. In the next four columns, we estimate our MLE procedure separately for each regulator.

Our first set of parameter estimates relate to the fixed costs of filing merger applications. Focusing on our pooled MLE estimation, banks perceive that it is quite expensive to file a merger application, on average costing $27.5 million, with significant variation across regulator ($3 thousand to $27.2 million). Our estimation procedure implies significant average merger costs because very few bank merger pairs apply to merge in any given year (less than 1% of

Parameter	Pooled	Fed	OCC	FDIC	OTS
μ_0	27,489.55	3.43	19,442.41	27,266.62	25,240.09
	(224.05)	(0.14)	(559.93)	(20,597.11)	(43,619.82)
$\mu_{\text{High State Barriers}}$	16,032.20	-1.37	12,751.66	8,658.59	19,402.23
	(938.00)	(0.01)	(871.50)	(1,930.65)	(11,761.85)
$\mu_{\perp \frac{\text{Lawyer Costs}_{\text{App.}}}{\text{Assets}}}$	8,335.65	1.30	8,040.55	2,756.61	10,088.78
	(18.62)	(0.81)	(1083.33)	(4,478.11)	(33,456.57)
$\mu_{\text{Target "Underage"}}$	198.66	1.03	48.29	0.06	287.93
	(6.64)	(0.15)	(4.99)	(4.51)	(214.96)
σ_{app}	22,026.47	22,026.47	22,026.47	22,026.47	22,026.47
	(258.98)	(19.55)	(135.89)	(14,525.68)	(31,504.87)
λ'_d	0.02	0.48	6.13	0.05	115.53
	(0.00)	(0.00)	(1.26)	(0.06)	(385.19)
λ'_b	0.00	0.16	0.20	0.00	0.00
	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)
λ'_{FDIC}	0.47	0.00	0.00	0.00	40.24
	(0.00)	(0.00)	(0.00)	(0.01)	(91.11)
σ_{λ_d}	0.00	2.20	8.15	0.28	103.17
	(0.00)	(0.00)	(1.49)	(0.11)	(260.06)
σ_{λ_b}	0.18	0.38	0.14	0.18	10.32
	(0.00)	(0.00)	(0.02)	(0.24)	(6.20)
$\sigma_{\lambda_{FDIC}}$	9.26	38.23	3.96	0.07	26.18
	(0.00)	(0.26)	(0.87)	(18.19)	(42.60)
$c_{\text{deny}} - c_{\text{approve}}$	-19.98	-20.00	-20.00	-20.00	-20.00
	(0.00)	(5.42)	(2.31)	(48.22)	(53.25)
$c_{\text{divest}} - c_{\text{approve}}$	-15.53	-4.42	-20.00	-0.00	-0.00
	(0.00)	(0.04)	(5.02)	(0.18)	(0.00)
Observations	45,572	27,646	8,926	7,771	1,229

Table 8: **Weighted MLE Estimates of Regulator Preference Weights**. This table displays estimates of regulators' preference weights and the fixed costs of merger applications, based on the likelihood estimator described in Section 6.2. We calibrate $\rho = 0.001$ to match the share of transactions that are 100% financed via cash. Column (1) estimates weighted MLE using the full sample of merger applications and regulatory decisions. Columns (2) through (5) estimate the weighted MLE procedure on the subset of applications and potential applications that would be reviewed by the relevant regulatory authority. Fixed cost estimates are in $ thousands. MLE robust standard errors in parenthesis.

possible pairs apply to merge in a given year). We also see that, consistent with reduced form evidence in Table 7, state regulations and legal fees impose significant additional cost on bank merger transactions. We estimate that high state barriers increase merger costs by $16 million. An increase in lawyer costs by 1% of bank assets is associated with an $830 thousand increase in merger costs. There is also significant variation ($22 million) in merger costs.

Our next set of parameter estimates are our main coefficients of interest: The average welfare weight on each agent, relative to borrowers. In our pooled estimation, we find that on average, regulators place only 2% as much weight on depositors as borrowers, close to 0% as much weight on bankers as borrowers, and 47% as much weight on the FDIC as on borrowers. Across

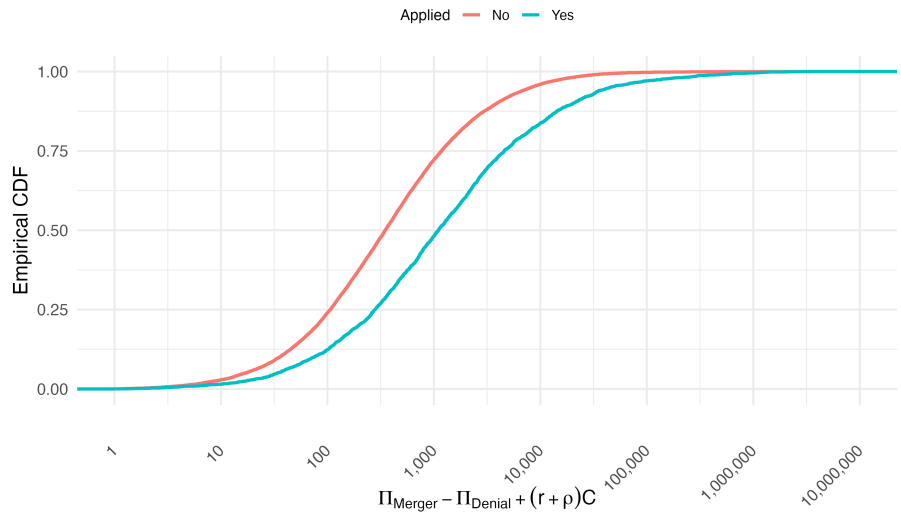


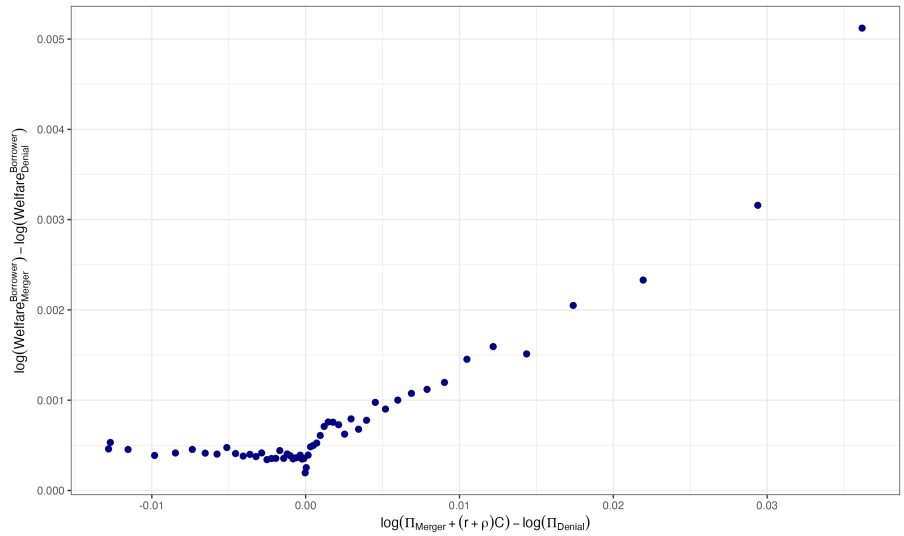
Figure 6: **Empirical CDF of Δ M&A profits for banks that apply vs. banks that don't apply to merge (x-axis in log-scale).** We restrict to the subsample of M&A for which simulations indicate a positive benefit to merging. Profits are in $ thousands.

all four regulators, borrowers typically receive the highest welfare weights. Interestingly, while depositor average welfare weights are typically lower than borrower welfare weights, they are on average higher across all regulators than the welfare weights placed on bankers.

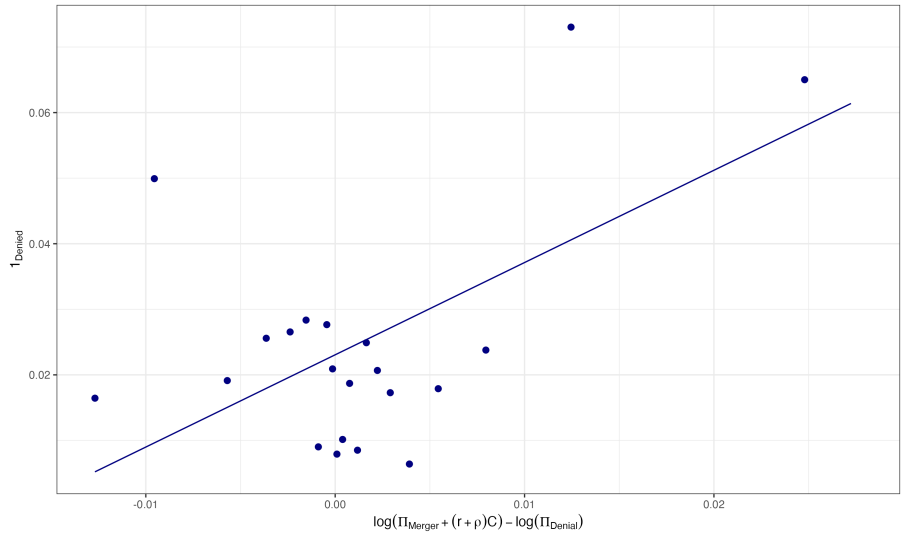
To understand the intuition behind our coefficient estimates, Figure 6, Figure 7, and Figure 8 plot moments from our simulation that help identify our parameter estimates. Starting with the fixed cost of M&A applications, Figure 6 plots the CDF of profit gains for banks that apply to merge vs. banks that don't apply to merge, conditional on bank profits increasing from the M&A transaction ($\Pi_{\text{Merger}} + (r+\rho)\phi^{\star}E_b > \Pi_{\text{Denial}}$). The fact that banks that apply to merge have significantly higher benefits from merging than banks that don't apply to merge helps us to identify parameters related to the fixed costs of M&A applications.

Turning to welfare weights λ_i', Panel (a) of Figure 7 plots the relationship between borrower welfare gains from M&A transactions vs. bank profit gains from M&A transactions. Strikingly, there is a large positive correlation between bank profits and borrower welfare. The reason for this positive correlation is that diversification gains from bank mergers improves both bank expected profits (by reducing their chance of failure) and borrower welfare (by increasing banks' desire to compete in lending markets). Thus, to understand why our MLE estimation places low weight on banker welfare relative to borrowers, Panel (b) plots the relationship between regulators' decisions on filed applications and bank profits from M&A, controlling for the effects on borrower welfare. Because regulators are more likely to deny applications from banks with greater profits – conditional on borrower welfare gains / losses – our MLE estimation procedure infers that regulators place low average weight on bankers relative to borrowers.

Finally, in Figure 8 we plot how divestiture decisions are informative about regulators' preferences for depositors vs. bankers. When regulators consider divestiture as a potential remedy in a merger application, they typically apply divestiture in cases where the benefits to depositors are large even when the cost to bankers is high. This is consistent with estimates of average welfare weights that are on average higher for depositors than for bankers.



(a) Binsreg (Cattaneo et al., 2024) of % change in borrower welfare (in money metric utility) from M&A vs. % change in banker profits plus dividends from M&A



(b) Binsreg (Cattaneo et al., 2024) of $\mathbf{1}(\text{Deny}_{(a,b)})$ on bank profit gains from M&A, controlling for borrower welfare gains / losses due to M&A. We restrict to the subsample of simulated M&A where we observe bank applications ($y_{(a,b)} = 1$).

Figure 7: **Merger Simulations of Profits and Welfare**. Panel (a) plots the change in borrower welfare from M&A vs. the change in banker welfare from M&A. Panel (b) plots regulators' denial decisions as a function of the change in bank merger profits, controlling for the effects on borrower welfare (in money metric utility).

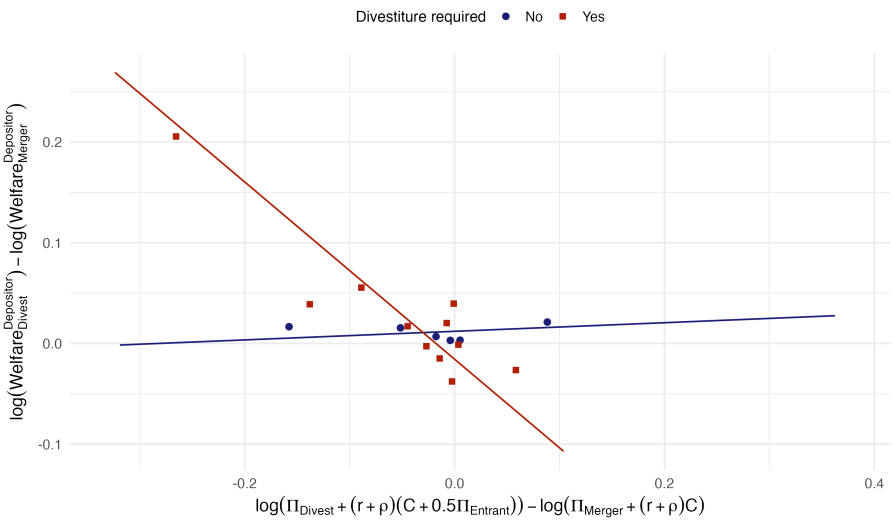


Figure 8: **Binsreg (Cattaneo et al., 2024) of the benefit to depositors from branch divestiture vs. the loss to bank profits from imposing divestiture.** We restrict to the subsample of merger applications for which divestiture was considered by regulators as a potential remedy for the merger application ($\max_m \Delta\text{HHI}_m^{(a,b)} \geq 200$)

8 Conclusion

Bank merger policy sits at the intersection of antitrust enforcement and prudential regulation. This paper uses regulators' decisions on bank merger applications to recover how they trade off the welfare of borrowers, depositors, bank shareholders, and the FDIC. We first show that bank mergers create the central tradeoffs regulators are asked to evaluate: they reduce operating costs, increase local market concentration, and can lower regulatory capital. We then show that regulators use different policy instruments for different concerns. Denial is primarily associated with applicant risk, while branch divestiture is targeted toward mergers that raise local concentration concerns.

To quantify these tradeoffs, we develop and estimate a structural model of bank merger review. The model maps prices, quantities, market structure, bank balance sheets, and failure risk into the welfare of affected agents under approval, denial, and approval with divestiture. Because banks *choose* whether to file merger applications, we jointly model banks' application decisions and regulators' approval decisions, using both realized and potential merger applications. This revealed-preference approach allows us to recover the implicit welfare weights that rationalize observed regulatory choices.

Our estimates imply that regulators place the greatest weight on borrowers. Normalizing borrower welfare to one, we estimate that regulators place moderate weight on expected FDIC losses, little weight on depositors, and essentially no weight on bank profits. These estimates suggest that ordinary-course bank merger review is not well described as a process that primarily protects the interests of the regulated (Stigler, 1971). Instead, regulators' decisions appear most consistent with a framework in which borrower welfare and bank failure costs are central, while depositor welfare and banker profits receive substantially less weight.

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A Data

Our analysis relies on several data sources, some of which are novel and have been hand-collected and cleaned by the authors. These include: (1) bank merger applications for each of the primary federal banking regulators; (2) shape files that contain bank market definitions over time; (3) standard banking data sources, such as call reports, enforcement actions, and structure data. We describe our collection and cleaning process for each of these sources below.

Bank Merger Applications: Our primary novel dataset is the collection of bank merger applications across the federal banking regulators: The Federal Reserve (Fed), the Office of the Comptroller of the Currency (OCC), the Office of Thrift Supervision (OTS), and the Federal Deposit Insurance Corporation (FDIC). We describe the process of data cleaning for each regulator below.[29]

Fed Applications: We sourced information on Federal Reserve bank merger applications from the Federal Reserve's website ("Actions, Orders and Other Documents"). We scraped all orders that were listed under the category of "Bank Merger," as well as all actions that mentioned either "acquire" or "merge" under the categories of "Bank Holding Companies" and "Saving and Loan Holding Companies."[30] This included all merger applications decided by the Fed since November 1996 until December 2024, as well as non-merger applications that we filter out of our final sample in the manner described below.

To structure the data from an unstructured "glob" of text, we sequentially submitted each application decision to OpenAI's API for ChatGPT to process the data and identify the following fields: (1) name of applicant bank; (2) location of applicant bank; (3) name of target bank; (4) location of target bank; (5) name of responsible Federal Reserve Bank that processed the application; (6) decision on the application; (7) date on which the application was decided. If there were multiple targets or acquirers, we picked the first one listed.[31]

We next link the applicant and target banks in our dataset to the historic NIC attributes table to recover their RSSDs, using a combination of string-matching and filtering on shared locations. We keep all matches that were above a certain threshold [EXPLAIN]. For all unmatched banks, we manually identify their RSSDs using the FFIEC's institution search website. We dropped merger applications for which we could not verify the RSSD of the applicant institution. Finally, to ensure our sample only captures mergers of non-affiliate banks, we excluded the following categories of applications from our sample:

[29] As noted in our acknowledgements section, we greatly appreciate the assistance of Yiyang Han for his string-matching algorithm and of Mark Cooperman and Brenda Levinson, for their manual review of several thousand bank merger applications to ensure we appropriately capture the applicant and target bank RSSD.

[30] Rather than scraping this information from the Federal Reserve's website, we had requested the underlying database be provided to us "as-is" via a FOIA request. Our FOIA request to receive the information in our requested format was denied, as the information was already publicly available (FOIA Request: FOIA-2025-00569).

[31] This is without loss of generality, since we subsequently needed to manually review several thousand merger application rows to ensure appropriate RSSDID matching. During that review, we saw that on many occasions, the listing of multiple institutions was primarily driven by the following factors: (1) multiple companies within the same family acquiring shares in a subsidiary; (2) a single parent acquiring multiple banks as part of an affiliated bank consolidation; (3) the acquisition of both a holding company and bank, which is economically providing the services of one banking institution; and (4) the acquisition of a bank and other non-bank subsidiaries. In most of these cases, the economic M&A transaction was one parent acquiring one target. Only in case (2) is there meaningful consolidation of separate entities; however, we exclude affiliate merger transactions from our main analyses, so these are also irrelevant.

1. The formation of bank holding companies (BHC) as parent entities to subsidiary banks.
2. The acquisition of bank or BHC shares by Employee Stock Ownership Plans (ESOPs).
3. Applications by banks or bank holding companies to purchase non-bank entities (such as data processors or insurance agencies).
4. Mergers of two foreign banks with operations in the U.S.
5. Acquisitions of de novo banks, interim banks, or banks that are in formation.
6. Mergers between affiliated banks. We flag affiliated merger transactions as mergers between two institutions that shared the same ultimate parent company 120 days prior to the application decision date.

OCC & OTS Applications: We obtained information on OCC and OTS bank merger applications via a FOIA request to the OCC.[32] The FOIA request provided us with merger application attributes from the OCC's corporate applications search database, in PDF format, from 1990 through 2024. We then used Amazon Textract – an Optical Character Recognition (OCR) tool – to extract the merger attributes from the provided PDF.

The merger attributes provided by the OCC included information about both the applicant and target institution, the dates on which the application was filed and decided, the ultimate decision / result of the application, a unique merger application number, and categorical variables describing the type of application received. For applicant and target institutions with valid charter numbers, we matched those charter numbers to Fed RSSD's using the NIC attributes table. For merger applications with missing applicant or target RSSDs, we used a string-matching procedure to match the name (and, where available, location) of the institution to the NIC attributes table to retrieve valid RSSDs. For the several thousand observations for which the string-matching procedure did not provide a sufficiently strong match, we manually searched for the appropriate applicant and target bank RSSD using the NIC database and the OCC's corporate applications database.

To filter to our final sample, we restricted our attention to all merger applications that were designated and processed as non-affiliate mergers by the OCC or OTS.[33]

FDIC Applications: We obtained information from the FDIC's bank merger applications by scraping the agency's website on bank application actions. We selected all applications between Jan. 1, 2013 and Dec. 31, 2024 that were of the type "Merger – Interim", "Merger – Regular", or "Merger – Reorganization," although our final sample restricts attention to mergers of the type "Merger – Regular." The FDIC's website on bank applications contains information about the applicant bank, the FDIC certificate number of the applicant bank, the date on which the application was received, the supervisory region of the bank, the final action by the FDIC on the application, and the date on which that action took place.

However, the FDIC's application website only contains information about the applicant institution; to obtain information about the target institution, as well, we proceeded in two

[32] After the OTS was abolished, its functions were assumed (in part) by the OCC. The OCC became the custodian of records for the OTS. As a result, our FOIA request for OCC bank merger applications also covered merger applications filed with and decided by the OTS.

[33] In some circumstances, the OCC may process a merger between two unaffiliated institutions as an affiliate merger if the institutions simultaneously file a holding company merger application with the Fed. As these mergers are labeled as affiliate transactions, they are excluded from our OCC sample but included in our Fed sample.

steps. First, to match all merger applications that were not withdrawn by the applicant, we downloaded the FDIC's annual report to Congress. We then used Amazon Textract to extract the relevant information about non-affiliate bank mergers via OCR, which we then merge with our web-scraped data based on the FDIC's unique application number. Second, to obtain information about applications that were withdrawn before the FDIC provided its final decision, we submitted a FOIA request to the FDIC for the cover sheet of all bank merger applications that were withdrawn.[34] We then manually extracted the identifying information for the target banks in the provided applications.

Because all applicant banks in the FDIC sample contain an FDIC certificate, we were able to match those certificates to Fed RSSDs using the NIC attributes table.

[34]This was FOIA request: 2025-FDIC-FOIA-01014. In the FDIC's response, they noted that of the 104 applications that we requested, they were unable to find information for 11 of those requests.

B Additional M&A Evidence

In this section, we provide additional evidence on bank merger transactions. In Appendix B.1, we show that mergers reduce average costs more for banks in overlapping markets.

B.1 Average Costs, by Market Overlap

To study how mergers may differentially affect average costs depending on characteristics of the merging institution, we estimate equations of the following form:

$$y_{(a,b),t} = \alpha_{(a,b)} + \tau_t + \varepsilon_{(a,b),t}$$

where $\alpha_{(a,b)}$ are merged pair fixed effects, τ_t are time fixed effects. Specifically, we estimate these equations separately for banks that share overlapping geographic markets prior to the M&A transaction and banks that *do not* share any overlapping geographic markets prior to M&A. Our coefficients of interest are τ_t, how pro-forma costs evolve around a merger event.

Figure 9 plots the evolution of pro-forma cost variables at merged banks similar to Panels (a) and (b) of Figure 2. As we can see, in Panel (a) of Figure 9, the reduction in average costs following bank mergers is largely concentrated in the subset of mergers where the merging institutions overlapped in at least one geographic market prior to the M&A transaction. In Panel (b), we similarly see that labor force reduction is proportionately larger for merging banks that share at least one market.

B.2 Factors Correlated with Cash Acquisitions

To understand what factors are correlated with the financing choice of two banks' M&A transaction, we estimate OLS specifications of the following form:

$$\mathbf{1}(\text{Target Purchased with 100\% Cash}_{a,t,q}) = \alpha_a + \tau_q + \beta X_{a,t,q} + \varepsilon_{a,t,q}$$

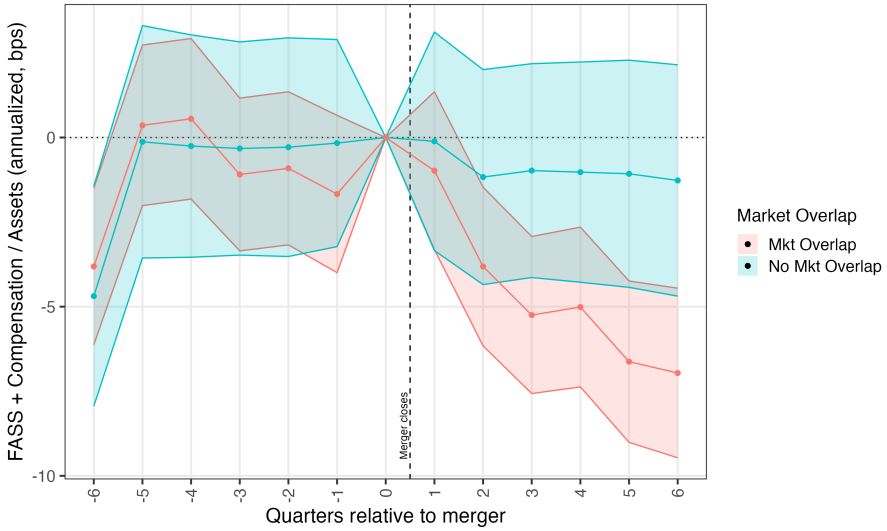
where α_a are applicant fixed effects, τ_q are time fixed effects, and $X_{a,t,q}$ are merger characteristics that might influence a banks' financing choice. The results of our estimation are in **??**.

In all three specifications, we see that some form of risk characteristic – either pro-forma share of non-accrual loans ($\frac{\text{Non-Accrual Loans}_{a,q-1}+\text{Non-Accrual Loans}_{t,q-1}}{\text{Loans}_{a,q-1}+\text{Loans}_{t,q-1}}$) or pro-forma share of foreclosed assets ($\frac{\text{OREO}_{a,q-1}+\text{OREO}_{t,q-1}}{\text{Assets}_{a,q-1}+\text{Assets}_{t,q-1}}$) – are predictive of the applicants' choice to purchase the target using cash. The magnitudes are also economically meaningful: An increase of pro-forma non-accrual loans by 1% is associated with a 2.1-9.3% (percentage point) increase in the probability that the acquirer purchases the target with 100% cash financing.

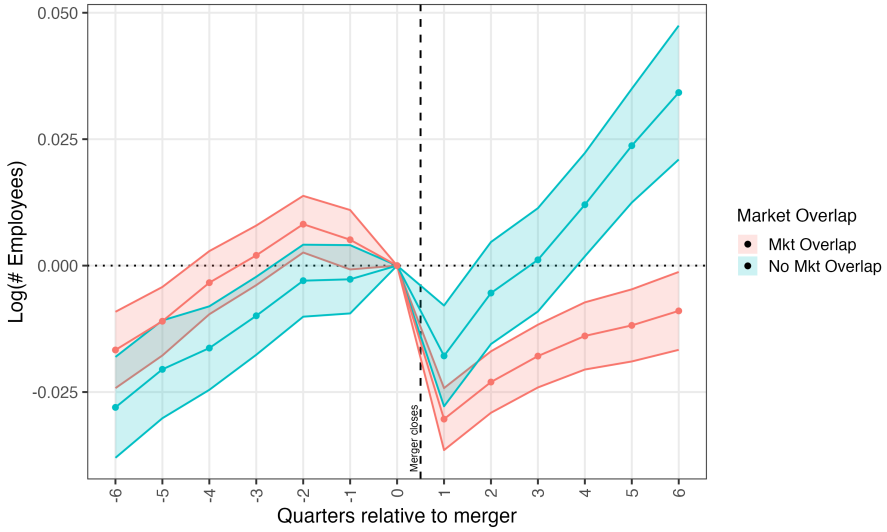
We can also see these forces more clearly in Figure 10, where we plot a bin scatter (Cattaneo et al., 2024) of whether the M&A transaction is financed 100% via cash on the share of non-accrual loans at the pro-forma merged institution.

B.3 Divestiture Robustness

To ensure that our result on local divestiture is robust to our identification procedure for when regulators impose branch divestiture, we instead follow Liebersohn (2024) and define



(a) Average Fixed Asset & Compensation Expense, by Market Overlap



(b) Log(# Employees), by Market Overlap

Figure 9: **Effects of Bank Mergers on Average Costs, by Market Overlap.** This figure plots the time series coefficients τ_t for pro-form cost variables at merged banks, split by mergers that share overlapping markets vs. mergers that do not share any overlapping markets. Panel (a) plots pro forma fixed asset and compensation expenses as a share of bank assets. Panel (b) plots the log(#) of bank employees.

Table 9: **Explanatory Factors of Bank Mergers that Use Stock.** This table displays OLS regressions of merger characteristics on whether the merger is funded 100% via cash payments to target shareholders. Stock-based funding is identified using RIAD4356 and BHCK4356 in the call reports (Changes incident to business combinations, net). Merger characteristics include the size of the target relative to the combined institution, the pro-forma size of the merged institution, the liquidity (cash / assets) of the acquirer, and measures of risk of the pro-forma institution. Robust standard errors.

	Dependent variable:		
	$\mathbf{1}(\text{Target Purchased with 100\% Cash}_{a,t,q})$		
	(1)	(2)	(3)
$\frac{\text{Non-Accrual Loans}_{a,q-1}+\text{Non-Accrual Loans}_{t,q-1}}{\text{Loans}_{a,q-1}+\text{Loans}_{t,q-1}}$	9.340***	2.115	4.554**
	(1.400)	(1.604)	(1.904)
$\frac{\text{OREO}_{a,q-1}+\text{OREO}_{t,q-1}}{\text{Assets}_{a,q-1}+\text{Assets}_{t,q-1}}$	5.271*	11.287***	−7.809*
	(2.915)	(3.113)	(4.529)
Time FE	No	Yes	No
Acquirer FE	No	No	Yes
Observations	5,446	5,446	3,916
R^2	0.052	0.117	0.623

Note: ·p<0.1; ¨p<0.05; ¨·p<0.01

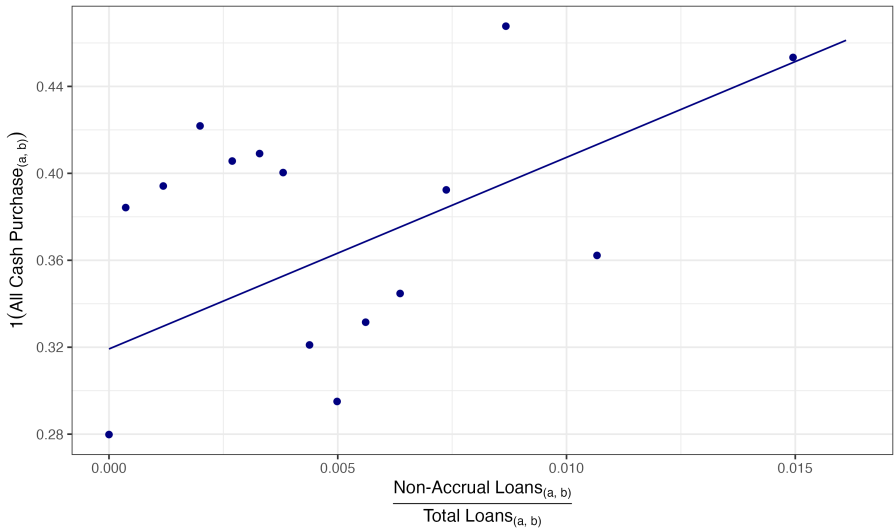


Figure 10: **Bin scatter (Cattaneo et al., 2024) of 100% cash financing on pro-forma % non-accrual loans.** We control for additional merger characteristics, including the size of the target relative to the acquirer, the pro-forma size of the merged institution, the liquidity (cash / assets) of the acquirer, and the pro-forma share of foreclosed assets.

divestiture as the sale of branches by applicant or target banks to unaffiliated competitors in the year following a merger transaction.

The results of this analysis are in Table 10. In line with our findings in Table 4, we see that even when using the alternative definition of divestiture, when mergers that exceeds inter-agency guidance in particular markets, they are 17% (percentage points) more likely to require divestiture. This effect entirely reverses for denied merger applications (Column 2) and for mergers that result from failed bank auctions (Column 3).

	Dependent variable:		
	$\mathbf{1}(\text{Divest})_{a,b,m}$		
	(1)	(2)	(3)
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800	0.170^{***}	0.171^{***}	0.168^{***}
	(0.039)	(0.039)	(0.039)
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800 $\times$ Denial		-0.171^{***}	
		(0.039)	
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800 $\times$ Fail			-0.174^{***}
			(0.039)
Num Mergers	7187	7187	7187
Num Failed	0	0	542
Observations	107,233	107,233	120,204
R^2	0.575	0.575	0.565
Adjusted R^2	0.392	0.392	0.386
Note:			$^{\cdot}$p<0.1; $^{\cdot\cdot}$p<0.05; $^{\cdot\cdot\cdot}$p<0.01

Table 10: **Deposit divestiture, by final application decision and in comparison with banks acquired in failure.** This table estimates regressions of bank divestiture outcomes on pro-forma market impacts. The unit of observation is a market m affected by a bank merger (a, b). Market impacts are calcualted based on Summary of Deposits data and using Fed market definition shape files. Divestiture is defined following Liebersohn (2024), based on the sale of branches by applicant or target banks to unaffiliated competitors in the year following a merger transaction. Standard errors are double clustered at the market and year level.

B.4 Implementation of Divestiture

In this section, we provide evidence for how divestiture is implemented in practice. First, Figure 11 plots the share of divesting bank deposits sold to competitors in markets where divestiture is mandated. As we can see, in $\approx$ 30% of merger markets with divestiture, either the applicant or target bank sells all of their deposits to a competitor institution. Second, Figure 12 plots the market share of new entrants who purchase divested branches in the year prior to divestiture. As we can see, in $\approx$ 80% of markets with divestitures, purchasers of divested branches had a 0% market share in that market prior to their entry via divestiture purchase; that is, they enter the market via purchase of divested branches.

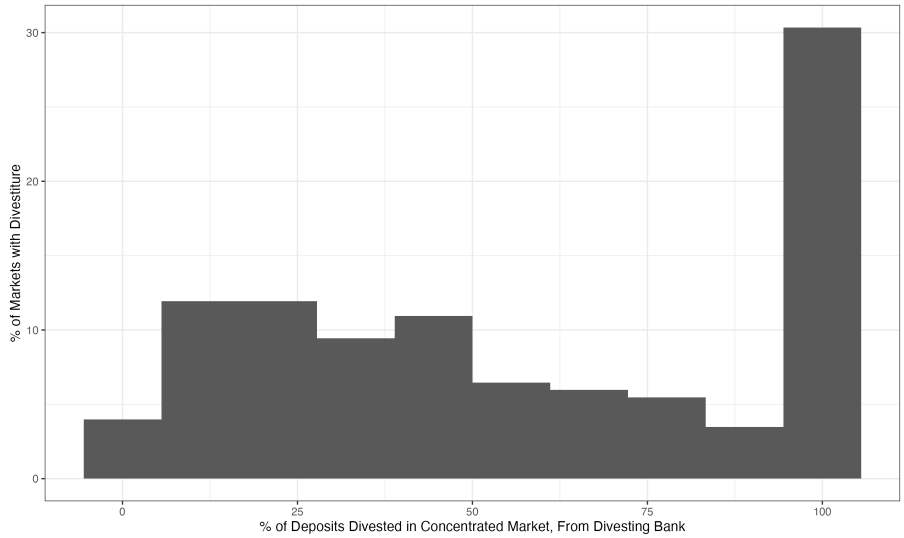


Figure 11: **Fraction of Deposits Sold to Competitors in Divesting Markets.** This figure plots a histogram of the % of divesting bank deposits sold to competitors in divesting markets. While divesting banks are typically merger targets, in some M&A transactions and markets, the acquirer chooses to divest its branches and retain the target's market presence.

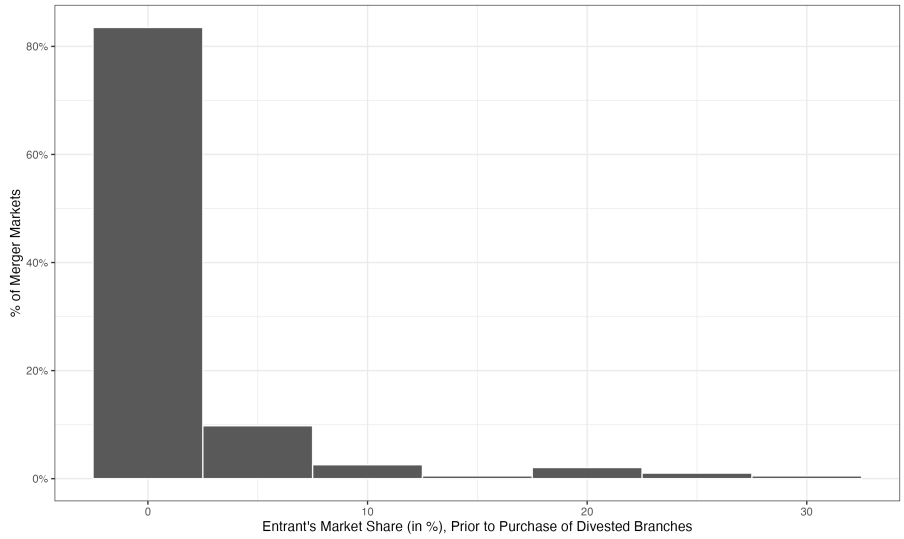


Figure 12: **Market Share of New Entrant, Prior to Divestiture Purchase.** This figure plots a histogram of the market share (in %) of new entrants who purchase divested branches in the year prior to their purchase of divested branches. Most purchasers of divested branches have 0% market share prior to their purchase of those branches.

C FDIC Auctions

In this section, we study FDIC auctions of failed banks (Granja et al., 2017; Allen et al., 2023) to study how regulators directly trade off market concentration vs. costs of bank failures.

Specifically, to examine the extent that regulators are willing to auction failed banks to bidders that will substantially increase market concentration, we estimate linear probability regressions of the following form:

$$\mathbf{1}(\text{Winner})_{b,f} = \alpha_f + \beta_1 \mathbf{1}(\Delta\text{HHI Flag}_{b,f}) + \beta_2 \mathbf{1}(\Delta\text{HHI Flag}_{b,f}) \times \#\text{Bidders}_f + \varepsilon_{b,f}$$

where $\mathbf{1}(\text{Winner})_{b,f}$ is an indicator for whether bidder bank b wins the auction for failed bank f, α_f are failed bank fixed effects, and $\mathbf{1}(\Delta\text{HHI Flag}_{b,f})$ is an indicator for whether the consolidation of banks b and f would substantially increase market concentration. Our identifying variation comes from auctions where the FDIC faces a choice between at least one buyer that substantially increases market concentration and at least one buyer that does not substantially increase market concentration; as a result, we estimate this linear probability model on the subset of 35 auctions where the FDIC faces this tradeoff.

Table 11: **Failed bank sale, by effects on competition.** This table estimates regressions of winning bank probabilities at FDIC failed bank auctions as a function of the market concentration effects that would result from this consolidation. Our sub-sample is restricted to the subset of applications where the FDIC faces a choice between bidders that substantially increase concentration and bidders that do not substantially increase concentration. Standard errors clustered at the auction level.

	Dependent variable:	
	$\mathbf{1}(\text{Winner})_{b,f}$	
	(1)	(2)
Δ HHI $\geq$ 200	0.810**	
	(0.360)	
Δ HHI $\geq$ 200 $\times$ # Bidders	−0.199**	
	(0.079)	
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800		0.847**
		(0.367)
Δ HHI $\geq$ 200, Pro-Forma HHI $\geq$ 1800 $\times$ # Bidders		−0.238***
		(0.081)
Num. Failed Banks	35	35
Observations	133	133
R^2	0.095	0.104
Note:		·p<0.1; ¨p<0.05; ···p<0.01

The results of our estimation procedure are in Table 11. In the first column, we only consider a large increase in market concentration (Δ HHI $\geq$ 200), while in the second column we also

require that the post-merged entity operate in a highly concentrated market after the auction (Pro-Forma HHI $\geq$ 1800). Interpreting these regressions, we see that banks that increase market concentration are much more likely to win than other banks when auctions attract fewer bidders. In an auction with two bidders, the bank that substantially increases market concentration is 40% (percentage points) more likely than the alternative bidder to win the auction. This is consistent with nearby banks willing to pay higher acquisition prices (Granja et al., 2017) coupled with the FDIC's aversion to high cost resolutions (Allen et al., 2023). However, when the number of bidders increases to four or more, the high market-concentration bidders are equally or less likely than other bidders to win. This suggests a potential tradeoff between market concentration and cost of failure not previously documented in the literature.

We can confirm this trend visually in Figure 13, which plots the share of auctions won by a concentrated bidder (y-axis) as a function of the number of bidders at the auction (x-axis). The red dots indicate the null hypothesis that a randomly chosen bidder is selected by the FDIC to purchase the failed institution. When the FDIC faces few bidders, the bidder that substantially increases market concentration is more likely to win. By contrast, when the FDIC faces many bidders, it is no longer the case that the bidder who substantially increases concentration will be the winning bid at the auction.

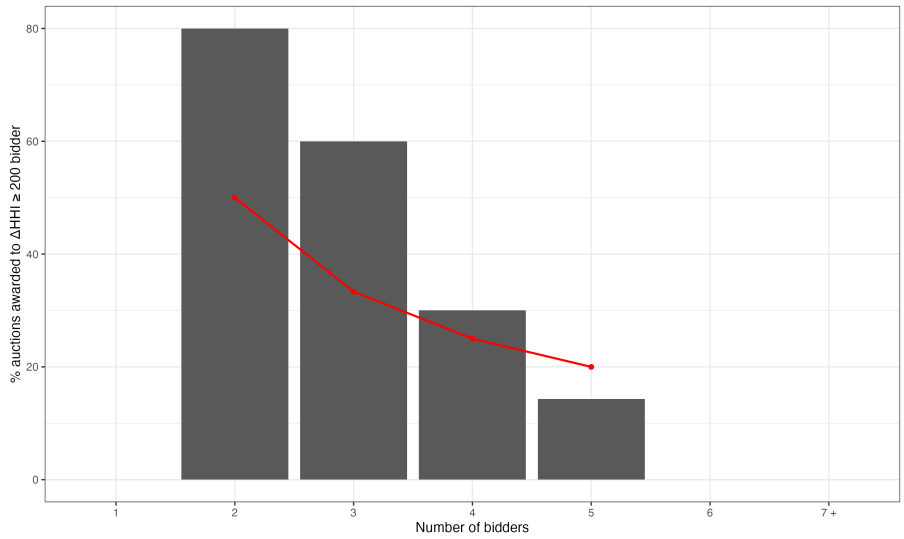


Figure 13: **Percentage of FDIC Failed Bank Auctions Won by Concentrated Bidder vs. # of Bidders at Auction.** This figure uses data from FDIC failed bank auctions (Granja et al., 2017; Allen et al., 2023) to plot the share of FDIC auctions where the winning bidder substantially increases market concentration vs. the number of bidders in the auction. We restrict to the subsample of 35 failed bank auctions where there is at least one bidder that will substantially increase market concentration ($\max_m \Delta\text{HHI}_m \geq 200$) and there is at least one bidder that will not substantially increase market concentration ($\max_m \Delta\text{HHI}_m < 200$).

D Model Derivations

In Section 5, we summarize key aspects of our model. In this section, we provide further details on the derivation of key model equations.

D.1 Micro-foundation of log(#Branches) in Preferences

In this section, we provide a micro-foundation for the presence of $\log(\#\text{Branches}_{b,m})$ in borrower and depositor utility. Specifically, we show that it is equivalent to a model with unobserved branch "quality" fixed effects and uniform pricing by banks within a given market. To show this, we consider a model where depositors have preferences given by:

$$u_{i,k,m} = \alpha r_{b(k),m} + \delta_k + \gamma_{k,m} + \varepsilon_{i,k,m}$$

where $r_{b(k),m}$ is the *uniform* deposit rate offered by bank b that owns branch k in market m, δ_k are branch k's fixed quality observed by the econometrician, $\gamma_{k,m}$ are aspects of branch k's fixed quality that are observed by banks but not the econometrician, and $\varepsilon_{i,k,m}$ are Type 1 extreme value taste shocks. The key assumption is that $r_{b(k),m}$ is constant for all branches of bank b within the same market m. Then, the market share of bank b in market m is given by:

$$s^D_{b,m} = \sum_{k \in \mathcal{M}_b} \frac{\exp(\alpha r_{b(k),m} + \delta_k + \gamma_{k,m})}{1 + \sum_{b'} \sum_{k' \in \mathcal{M}_{b'}} \exp(\alpha r_{b'(k'),m} + \delta_{k'} + \gamma_{k',m})}$$

Define the following modified bank-market fixed effect:

$$\delta_{b,m|\{k\}} = \log\left(\frac{1}{|\mathcal{M}_b|^{\beta^{\text{Branch}}}} \sum_{k \in \mathcal{M}_b} \exp(\delta_k + \gamma_{k,m}) \right)$$

where $|\mathcal{M}_b|$ are the number of branches owned by bank b in market m. Then the market share of bank b in market m can be re-written as:

$$s^D_{b,m} = \frac{\exp(\alpha r_{b(k),m} + \beta^{\text{Branch}} \log(|\mathcal{M}_b|) + \delta_{b,m|\{k\}})}{1 + \sum_{b' \in \mathcal{M}} \exp(\alpha r_{b'(k'),m} + \beta^{\text{Branch}} \log(|\mathcal{M}_{b'}|) + \delta_{b',m|\{k\}})}$$

which is the same market-share equation as specified in Section 5. Again, given our key assumption that banks engage in uniform pricing within markets m, we have that $\log(|\mathcal{M}_b|)$ and $\delta_{b,m|\{k\}}$ are sufficient statistics to calculate market shares. In our model, these can be estimated via standard logit demand estimation (two-stage least squares).

D.2 Welfare

Given that both borrowers and depositors face discrete choice problems of which banks to borrow or invest their deposits in, the welfare of these agents can be written as:

$$\text{Borrower Welfare}_m = \log\left(1 + \sum_{b \in \mathcal{M}} \exp(-\alpha^L r^L_{b,m} + \beta^{L,\text{branches}} \log(\#\text{Branches}_{b,m}) + \delta^L_b + \gamma^L_m + \nu^L_{b,m})\right)$$

$$\text{Depositor Welfare}_m = \log\left(1 + \sum_{b \in \mathcal{M}} \exp(\alpha^D r^D_{b,m} + \beta^{D,\text{branches}} \log(\#\text{Branches}_{b,m}) + \delta^D_b + \gamma^D_m + \nu^D_{b,m})\right)$$

where the value $1 = e^0$ appears because the utility of the outside option for borrowers and depositors are normalized to 0 in each market.

D.3 Optimal Dividend Choice

Conditional on merger approval, in the third stage of this period, the newly merged entity chooses the optimal cash payment to target shareholders to maximize their joint expected value:

$$\Pi^{\text{Approve}}_{(a,b)} = \max_{\phi \in [0,1]} \quad \Pi^{M}_{(a,b)}(E_a + (1-\phi)E_b, D_a + D_b, A_a + A_b, I_a + I_b - \phi E_b) + \Big(r + \rho\Big)\phi E_b$$

where $\Pi^{M}_{(a,b)}(\cdot)$ is the value function of the merged bank, E_b is the value of equity of the target bank, ϕE_b is the portion of the acquisition that is financed in cash, $\rho \geq 0$ is a present bias for consumption.

Note that because $\Pi^{M}_{(a,b)}$ reflects an optimized equilibrium profit as a function of merged-bank balance sheet choices, we can apply the Envelope Theorem to calculate the merged banks' optimal choice of ϕ. That is, the first order condition for the merged bank's choice of dividend payment is given by:

$$E_b \times \Bigg[\overbrace{\rho + rG(\overline{\theta}(\phi))}^{\text{Benefit of cash today}} - \frac{g(\overline{\theta}(\phi))}{1-N} \underbrace{\left(\Pi^{def}_{(a,b)}(\overline{\theta}(\phi)) - r\phi \frac{E_b}{A_{(a,b)}} + \sum_{i \in \{a,b\}} \sum_{m \in \mathcal{M})i} (r^{L}_{i,m} - \kappa_{i,L}) \frac{L_{i,m}}{A_{(a,b)}} \right)}_{\text{Lost revenue when the bank defaults, due to high capital losses}} \Bigg]$$

where $r^{L}_{i,m}$ and $r^{D}_{i,m}$ are the optimal choice of loan and deposit rates given the capital structure of the merged bank. This FOC is composed of two forces. The first is the marginal benefit of dividends today, which includes the certainty of receiving $\rho \geq 0$ in cash today plus the benefit of eliminating the risk of failure ($G(\overline{\theta})$) by taking payments today. The second force is the cost of dividends, which marginally increases the probability of failure ($g(\overline{\theta})$); the value of this cost is the lost revenue the bank forfeits when it fails.

E Estimation

This section provides further details and assumptions about the estimation procedure for our structural model in Section 5.

E.1 Loss Rates

To estimate the conditional loss rate distribution, $\mu_{b,t} = E[1 - \theta_{b,t}|X_{b,t}]$, we estimate OLS specifications of the following form:

$$\text{Loss Rate}_{b,t} = \alpha_b + \tau_t + \beta^T X_{b,t} + \varepsilon_{b,t}$$

where $X_{b,t}$ are bank characteristics that explain potential future loss rates, α_b are bank fixed effects, and τ_t are time fixed effects. The results of our estimation approach are in Table 12.

Table 12: **Explanatory Factors of Bank Loss Rates.** This table displays OLS regressions of bank loss rates on characteristics, including weak assets, interest rates and open and forthcoming enforcement actions. Standard errors are double clustered at the bank and year level.

	Dependent variable:		
	$E[1-\theta]$		
	(1)	(2)	(3)
$(\frac{\text{OREO}}{\text{Assets}})_{b,t-1}$	0.386^{***}	0.316^{***}	0.267^{***}
	(0.072)	(0.062)	(0.037)
$r^{\text{Loan}}_{b,t-1}$	0.174^{***}	0.285^{***}	0.090^{***}
	(0.025)	(0.025)	(0.026)
Enforcement Action Oustanding$_{b,t-1}$	0.006^{***}	0.006^{***}	0.005^{***}
	(0.002)	(0.001)	(0.001)
Enforcement Action Issued$_{b,\tau\in\{t,t+2\}}$	0.013^{***}	0.012^{***}	0.010^{***}
	(0.002)	(0.002)	(0.001)
Time FE	No	Yes	Yes
Bank FE	No	No	Yes
Observations	285,039	285,039	285,039
R^2	0.137	0.192	0.450
Note:			$^{\cdot}$p<0.1; $^{\cdot\cdot}$p<0.05; $^{\cdot\cdot\cdot}$p<0.01

Across all specifications, we see that existing risky assets ($\frac{\text{OREO}}{\text{Assets}}$), high risk premia ($r^{\text{Loan}}_{b,t-1}$), and the existence of negative supervisory signals (existing and forthcoming enforcement actions against the bank), are predictive of higher future losses. The magnitudes are also meaningful: Banks with negative supervisory signals and that receive enforcement actions within the next two years have loss rates that are 1-1.3 percentage points higher than banks without similar non-public private signals. The fact that negative supervisory information also predicts future bank losses is aligned with evidence from Table 3 that regulators are more likely to deny applications from banks with forthcoming enforcement actions.

E.2 Marginal Costs

To back out marginal costs, we assume that marginal cost parameters are fixed at the bank level. Given that we observe one weighted-average loan and deposit rate at the bank level, we aggregate the banks' market-level first order conditions via the following calculations:

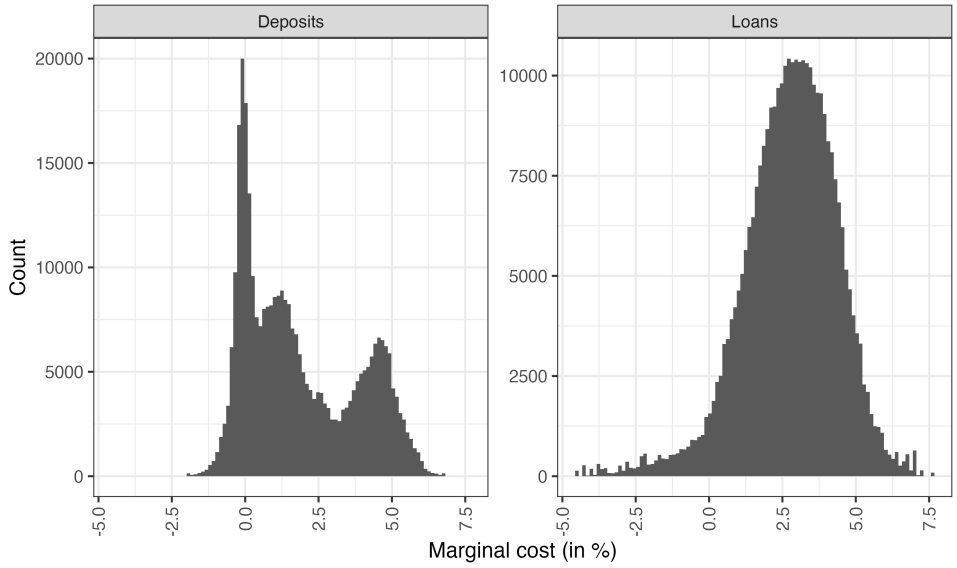
$$\kappa^L_{b,t} = \overbrace{\sum_{m\in\mathcal{M}_b} w^L_{b,m,t} r^L_{b,m,t}}^{\equiv r^L_{b,t}} - r - \frac{1}{\alpha^L}\sum_{m\in\mathcal{M}_b} w^L_{b,m,t}\left(\frac{1}{1-s^L_{b,m,t}}\right)$$
$$-\left(\frac{N}{1-N}\right)\left(\frac{h(\underline{\theta})}{\Gamma(\underline{\theta})}\right)\left(\Pi^{def}_b(\underline{\theta}) + \frac{L_b}{A_b}\frac{1}{\alpha^L}\sum_{m'\in\mathcal{M}_b} w^L_{b,m,t}\left(\frac{1}{1-s^L_{b,m,t}}\right)\right)$$
$$\kappa^D_{b,t} = r - \underbrace{\sum_{m\in\mathcal{M}_b} w^D_{b,m,t} r^D_{b,m,t}}_{\equiv r^D_{b,t}} - \frac{1}{\alpha^D}\sum_{m\in\mathcal{M}_b} w^D_{b,m,t}\left(\frac{1}{1-s^D_{b,m,t}}\right)$$

where $w^D_{b,m,t} = \frac{D_{b,m,t}}{\sum_m D_{b,m,t}}$ and $w^L_{b,m,t} = \frac{L_{b,m,t}}{\sum_m L_{b,m,t}}$ are the weights of each deposit and loan market in the bank's overall portfolio, and

$$r^L_{b,t} \equiv \sum_{m\in\mathcal{M}_b} w^L_{b,m,t} r^L_{b,m,t} \quad \text{and} \quad r^D_{b,t} \equiv \sum_{m\in\mathcal{M}_b} w^D_{b,m,t} r^D_{b,m,t}$$

are the interest rates on loans and deposits at bank b in quarter t, as computed from bank call reports. Figure 14 shows the distribution of marginal costs for loans and deposits. The marginal cost distribution is for deposits is multi-modal, with peaks around 0%, 1.25%, and 5%. The marginal cost distribution for loans peaks around 3%, in line with typical default risk-premia that banks charge borrowers.

Figure 14: **Histogram of bank marginal costs, in %.** Marginal costs for deposits, $\kappa^D_{b,t}$, and loans, $\kappa^L_{b,t}$, are backed out via the banks' first order condition.



To examine which factors explain bank marginal costs, we estimate specifications of the form:

$$\kappa^i_{b,t} = \tau_t + \beta^T X_{b,t} + \varepsilon_{b,t}$$

where τ_t are time fixed effects, and $X_{b,t}$ are bank characteristics such as key operating expense ratios. In Table 13, we see that fixed asset and compensation expenses both have significant pass-through to marginal costs.

	Dependent variable:	
	$\kappa^L_{b,t}$	$\kappa^D_{b,t}$
	(1)	(2)
$(\frac{\text{Fixed Asset Expense}}{\text{Assets}})_{b,t}$	0.182^{***}	0.390^{***}
	(0.065)	(0.057)
$(\frac{\text{Compensation Expense}}{\text{Assets}})_{b,t}$	0.266^{***}	0.060^{***}
	(0.036)	(0.013)
Time FE	Yes	Yes
Bank FE	No	No
Observations	298,552	298,552
R^2	0.396	0.942
Adjusted R^2	0.396	0.942
Note:	$^{\cdot}$p<0.1; $^{\cdot\cdot}$p<0.05; $^{\cdot\cdot\cdot}$p<0.01	

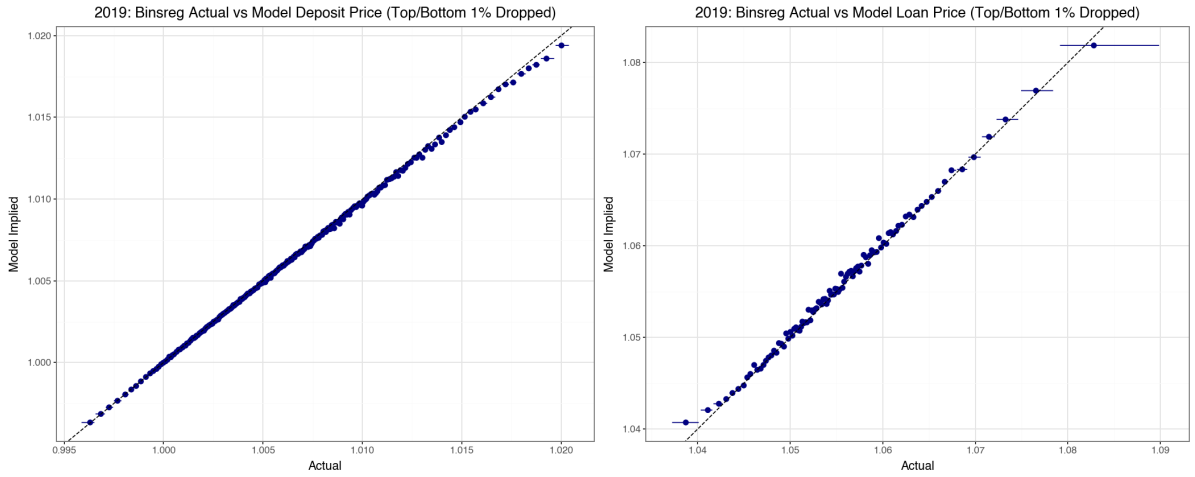
Table 13: **Factors that explain bank marginal costs.** This table displays OLS estimates of marginal costs on bank characteristics. Standard errors are double clustered at the bank and year level.

E.3 In-Sample Validation

In this section, we provide evidence that our model procedure can accurately recover bank prices in the data. Specifically, Figure 15 shows a bin scatter fit of model-implied loan and deposit rates vs. data-calculated loan and deposit rates for 2019 data.

E.4 Likelihood Estimation

In this section, we describe the calculations of the maximum likelihood estimator described in Section 6.2. First, we provide detailed formulas for calculating the probabilities of application and approval, given a set of preference parameters. Next, we calculate the score function of our log-likelihood function.



(a) Deposit Rates (Model-Implied vs. Data)

(b) Loan Rates (Model-Implied vs. Data)

Figure 15: **Model-implied Deposit and Loan Rates vs. Data.** This figure displays bin scatters (Cattaneo et al., 2024) of model-implied loan and deposit rates on bank-level loan and deposit rates from bank call reports. We trim the top 1% and bottom 1% of model-implied and data-calculated loan and deposit rates.

E.4.1 Choice Probabilities

For simplicity of notation, we define

$$\begin{aligned}
\Delta C^i_{(a,b)} &= \text{Borrower Welfare}^i_{(a,b)} - \text{Borrower Welfare}^{\text{Deny}}_{(a,b)} \\
\Delta D^i_{(a,b)} &= \text{Depositor Welfare}^i_{(a,b)} - \text{Depositor Welfare}^{\text{Deny}}_{(a,b)} \\
\Delta \Pi^i_{(a,b)} &= E[\Pi^i_{(a,b)} \mathbf{1}(\theta \geq \underline{\theta}) + (r+\rho)C^i] - E[\Pi^{\text{Deny}}_{(a,b)} \mathbf{1}(\theta \geq \underline{\theta})] \\
\Delta F^i_{(a,b)} &= \text{FDIC Welfare}^i_{(a,b)} - \text{FDIC Welfare}^{\text{Deny}}_{(a,b)} \\
\Delta c_i &= c_i - c_{\text{Deny}}
\end{aligned}$$

for regulator choice $i \in \{\text{Approve}, \text{Divest}\}$, where $E[\Pi^i_{(a,b)} \mathbf{1}(\theta \geq \underline{\theta})]$ is the expected payoff to shareholders (inclusive of dividends C). Given our assumption $\aleph_{(a,b)} \sim N(\mu_{a,b}, \sigma_\aleph)$, we can write the probability that (a,b) apply to merge as:

$$q_{(a,b)} = \Phi\left(\frac{p^{\text{Approve}}_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)\Delta\Pi^A_{(a,b)} + p^{\text{Divest}}_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)\Delta\Pi^V_{(a,b)} - \mu_{(a,b)}}{\sigma_\aleph} \right)$$

Note that given our assumption that λ_i are independently distributed with $\lambda_i N(\lambda'_i, \sigma^2_i)$, we can simplify the expression for $p^{\text{Approve}}_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda)$. In cases where divestiture does not enter the regulators' choice set, we have:

$$\begin{aligned}
p^{\text{Approve}}_{(a,b)} &= \Phi\left(\frac{\Delta C^A_{(a,b)} + \lambda'_d \Delta D^A_{(a,b)} + \lambda'_b \Delta \Pi^A_{(a,b)} + \lambda'_{FDIC} \Delta F^A_{(a,b)} + \Delta c_A}{\sqrt{\sigma^2_d (\Delta D^A_{(a,b)})^2 + \sigma^2_b (\Delta \Pi^A_{(a,b)})^2 + \sigma^2_{FDIC} (\Delta F^A_{(a,b)})^2}} \right) \\
p^{\text{Deny}}_{(a,b)} &= 1 - p^{\text{Approve}}_{(a,b)}
\end{aligned}$$

In cases where divestiture enters the regulators' choice set, we can write the regulators' choice probabilities as given by:

$$
\begin{aligned}
p^{\text{Approve}}_{(a,b)} &= \int_{-\infty}^{z_{A\succ D}} \Phi\Big(\frac{z_{A\succ V} - x \times \rho_{A\succ D, A\succ V}}{\sqrt{1-\rho^2_{A\succ D, A\succ V}}}\Big)\phi(x)dx \\
p^{\text{Divest}}_{(a,b)} &= \int_{-\infty}^{z_{V\succ D}} \Phi\Big(\frac{z_{V\succ A} - x \times \rho_{V\succ D, V\succ A}}{\sqrt{1-\rho^2_{V\succ D, V\succ A}}}\Big)\phi(x)dx \\
p^{\text{Deny}}_{(a,b)} &= 1 - p^{\text{Approve}}_{(a,b)} - p^{\text{Divest}}_{(a,b)}
\end{aligned}
$$

where we define the operator $\Delta_{A-D}(\cdot)$ to reflect the difference between welfare for approved vs. denied mergers, and following terms for simplicity of notation:

$$
\begin{aligned}
\sigma^2_{A\succ D} &= \sigma^2_d(\Delta_{A-D}D_{(a,b)})^2 + \sigma^2_b(\Delta_{A-D}\Pi_{(a,b)})^2 + \sigma^2_{FDIC}(\Delta_{A-D}F_{(a,b)})^2 \\
z_{A\succ D} &= \frac{\Delta_{A-D}C_{(a,b)} + \Delta_{A-D}c + \lambda'_d\Delta_{A-D}D_{(a,b)} + \lambda'_b\Delta_{A-D}\Pi_{(a,b)} + \lambda'_{FDIC}\Delta_{A-D}F_{(a,b)}}{\sigma_{A\succ D}} \\
\rho_{A\succ D, A\succ V} &= \frac{\sigma^2_d(\Delta_{A-D}D_{(a,b)})(\Delta_{A-V}D_{(a,b)})}{\sigma_{A\succ D}\times\sigma_{A\succ V}} + \frac{\sigma^2_b(\Delta_{A-D}\Pi_{(a,b)})(\Delta_{A-V}\Pi_{(a,b)})}{\sigma_{A\succ D}\times\sigma_{A\succ V}} \\
&\quad + \frac{\sigma^2_{FDIC}(\Delta_{A-D}F_{(a,b)})(\Delta_{A-V}F_{(a,b)})}{\sigma_{A\succ D}\times\sigma_{A\succ V}}
\end{aligned}
$$

where we define the choice differences for other parameter pairs (e.g. $A \succ V$) in a similar manner

E.4.2 Score Function

Next, we consider the score function, which is the derivative of the log-likelihood function with respect to the model parameters. Recall that the weighted log-likelihood function is given by:

$$
\begin{aligned}
\mathcal{L} = &\sum_{(a,b)} w_{(a,b)}y_{(a,b)}\log(q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph)) \\
&+ \sum_{(a,b)} w_{(a,b)}(1-y_{(a,b)})\log((1-q_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda, \sigma_\aleph))) \\
&+ \sum_{(a,b)} w_{(a,b)}y_{(a,b)} \sum_{\substack{\text{Reg.} \\ i\in\text{choice} \\ \text{set}}} \mathbf{1}(x_{a,b}=i)\log(p^i_{(a,b)}(\lambda'_d, \lambda'_b, \lambda'_{FDIC}, \sigma_\lambda))
\end{aligned}
$$

where $y_{(a,b)} \in \{0,1\}$ is an indicator variable for whether banks (a,b) apply to merge, and $x_{(a,b)} \in \{A, D, V\}$ is an indicator variable for the regulator's decision on a bank merger application. To compute the score function, note that the derivative of the log-likelihood function with respect to parameter ω is given by:

$$
\frac{\partial\mathcal{L}}{\partial\omega} = \sum_{(a,b)} w_{(a,b)}\left(\Big[\frac{y_{(a,b)}}{q_{(a,b)}} - \frac{1-y_{(a,b)}}{1-q_{(a,b)}}\Big]\frac{\partial q_{(a,b)}}{\partial\omega} + y_{(a,b)}\sum_{\substack{\text{Reg.} \\ i\in\text{choice} \\ \text{set}}} \frac{\mathbf{1}(x_{a,b}=i)}{p^i_{(a,b)}}\frac{\partial p^i_{(a,b)}}{\partial\omega}\right)
$$

Note that given our formula for the probability that banks (a, b) apply to merge, we can write the derivative of that probability with respect to a model parameter as:

$$\frac{\partial q_{(a,b)}}{\partial \omega} = \phi\left(\frac{p^{\text{Approve}}_{(a,b)} \Delta\Pi^{A}_{(a,b)} + p^{\text{Divest}}_{(a,b)} \Delta\Pi^{V}_{(a,b)} - \mu_{(a,b)}}{\sigma_{\aleph}} \right) \times \frac{\partial}{\partial \omega}\left(\frac{p^{\text{Approve}}_{(a,b)} \Delta\Pi^{A}_{(a,b)} + p^{\text{Divest}}_{(a,b)} \Delta\Pi^{V}_{(a,b)} - \mu_{(a,b)}}{\sigma_{\aleph}} \right)$$

Also, given our formula for the probability that regulators approve a merger, conditional on receiving the application, we can write the derivative of that formula as:

$$\frac{\partial p^{\text{Approve}}_{(a,b)}}{\partial \omega} = \phi(z_{A \succ D}) \frac{\partial z_{A \succ D}}{\partial \omega}$$

when the regulator's choice set only includes approval and denial. When the regulator's choice set also includes approval with divestiture as a potential option, we can write the derivative of that formula as:

$$\begin{aligned} \frac{\partial p^{\text{Approve}}_{(a,b)}}{\partial \omega} = & \frac{\partial z_{A \succ D}}{\partial \omega} \Phi\left(\frac{z_{A \succ V} - z_{A \succ D} \times \rho_{A \succ D, A \succ V}}{\sqrt{1 - \rho^2_{A \succ D, A \succ V}}} \right) \phi(z_{A \succ D}) \\ & + \frac{\partial}{\partial \omega}\left(\frac{z_{A \succ V}}{\sqrt{1 - \rho^2_{A \succ D, A \succ V}}} \right) \int_{-\infty}^{z_{A \succ D}} \phi\left(\frac{z_{A \succ V} - x \times \rho_{A \succ D, A \succ V}}{\sqrt{1 - \rho^2_{A \succ D, A \succ V}}} \right) \phi(x) dx \\ & - \frac{\partial \rho_{A \succ D, A \succ V}}{\partial \omega} (1 - \rho^2_{A \succ D, A \succ V})^{-\frac{3}{2}} \int_{-\infty}^{z_{A \succ D}} x \phi\left(\frac{z_{A \succ V} - x \times \rho_{A \succ D, A \succ V}}{\sqrt{1 - \rho^2_{A \succ D, A \succ V}}} \right) \phi(x) dx \end{aligned}$$