Bank lending relations and downstream competition

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Abstract

Lenders may internalize competition among rival borrowers. When financing multiple firms in an industry, banks help facilitate tacit collusion by steering borrowers' investments either through direct control or by alleviating debt overhang. I estimate this portfolio effect using bank mergers as exogenous shocks to the lending network within an industry, and find that common lending decreases investment rates by 3 percentage points, with market power playing a role in the effect on loan amount and credit spreads.

1 Introduction

Investments by US firms have been declining over the past decades, with the annual rate dropping from around 18% in the mid 1980s to 10% in 2019.[1] The decline is not limited to one asset type, spanning multiple classes, including intellectual property, equipment, and structures; nor is it unique to the US, as similar trends have also been observed in other developed economies (International Monetary Fund 2015; Furman 2015). Meanwhile, the US banking sector has undergone a substantial wave of consolidation in the 1990s and 2000s. At its peak, annual M&A transactions reached over 1000 in number and valued at nearly $500B. Several pieces of federal legislation, such as Riegle-Neal Interstate Banking and Branching Efficiency Act (1994) and Gramm-Leach-Bliley Act (1999) have facilitated this development, and a general consolidation trend has continued ever since, with the number of total bank charters declining from over 14000 in the mid 1980s to about 4000 today.

This paper relates the two phenomena, and proposes a channel through which bank mergers may affect investments in the real economy by internalizing downstream competition. For borrowers within a given industry, the more concentrated the banking sector, the more likely it is for any one bank to finance competing firms. Lending to rival firms exposes the bank to the adverse effects of competition, as aggressive product market strategies may increase

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[1] The investment rate is defined as the ratio of capital expenditures to the total stock of plant, property, and equipment (PP&E).

the probability of default, but not to the benefits, as those are captured by the borrowers' shareholders. It may then be in the bank's best interest to incentivize less aggressive competition between its borrowers, as cooperative strategies tend to generate less volatile cash flows, increasing the value of debt holders.

I study how bank lending relations affects competition between borrowers. I use capital investments as a proxy for competition (Aghion et al. 2018), where higher investment rates indicate more aggressive strategies, and exploit bank mergers as exogenous shocks to the lending network within an industry.[2] My empirical strategy compares *in-market* mergers, where both merging banks have pre-existing lending relations with borrowers in the same industry, to *out-of-market* mergers, where only one of the merging banks has such relations. By combining the merging banks' industry portfolios, in-market mergers generate exogenous variation in the extent of common lending, where a bank finances rival firms. The identifying assumption is that the timing of bank mergers is unrelated to the prospects or investment decisions of any particular borrower, other than through the market effects discussed here. This seems plausible, as the average merging bank serves about 44 borrowers across 11 industries.[3]

I find that common lending decreases investment rates by about 3 percentage points, or 20%, in the years following the merger. This drop is not a result of firms substituting leasing for the ownership of capital, nor is it driven by particular industries or time periods. It is also not the result of banks gaining market power post merger, as I can compare firms within the same bank merger. The drop in investment is also accompanied by a decrease in R&D expenses and patent filing and issuance, consistent with Aghion et al. (2018). The effect is concentrated among riskier firms, where default probabilities are higher, smaller firms, where the bank is relatively stronger, and firms with high Tobin's Q ratio, where investment opportunities are higher.

How may banks drive down borrowers' investment and facilitate tacit collusion? First, anecdotal evidence indicates that banks may directly steer firm investments. This is in line with Rajan (1992), suggesting that banks may monitor firms and control their investment decisions.[4] Examining the phrasing of loan covenants, I find that banks may explicitly restrict the scope of projects a borrower undertakes, or even require the borrower to seek the bank's approval before making any investment.[5] Generally, absent direct control, theory

[2]A similar approach that exploits mergers was used to study liquidity provision or wages (Giannetti and Saidi 2019; Benmelech, Bergman, and Kim 2020).

[3]Industries are defined according to the Fama-French 49 industry classification.

[4]This is also a fairly accurate depiction of financiers' crucial historical role in determining the fate of their borrowers - from private bankers supporting kingdoms in waging war and conquest, to modern credit markets setting interest rates in real time. In central Europe, universal banks wielded significant power over borrowers, having seats on their boards for direct control of business decisions. Banks have also made efforts to steer the path of entire markets and industries to their benefit. Perhaps one of the starkest examples is the establishment of the Österreichische Kontrollbank für Industrie und Handel in 1913 Austria-Hungary by a consortium of 10 banks, and whose explicit role was to restrict competition and enforce cartels in borrowing industries.

[5]Using the covenant notes in the DealScan data set, I find that "permitted investments" and "permitted acquisitions" are mentioned, with higher occurrence rates among loans issued in the years following bank mergers. Unfortunately, the data are too sparse for a systematic analysis, but I take it as a proof of concept

suggests a bank may do one of the following to dampen downstream competition, depending on market conditions. If the credit market is not competitive and lenders hold power over borrowers, the bank may be in a position to restrict credit supply to limit the extent of projects a borrower may undertake. This would be the case for small, opaque, or financially constrained borrowers, who cannot easily substitute away from the bank to other sources of finance, like the bond market. If, on the other hand, the credit market is competitive, then the bank cannot exert market power, since borrowers would substitute away to a different bank or to the bond market.

Instead, the bank may want to *increase* the supply of credit and offer a *lower* interest rate, as to reduce debt overhang and the incentives to aggressively invest and compete. The theory here builds on the inherent conflict of interest between debt and equity holders (Jensen and Meckling 1976; Myers 1977), where oligopolistic firms issue debt as a commitment device to an aggressive product market strategy (Brander and Lewis 1986). The basic intuition is that when cash flows are uncertain, a higher debt burden reduces the possible states of the world in which equity holders receive positive payoffs. Debt creates an incentive for the firm to raise returns in good states of the world at the expense of returns in bad states, when the bondholders are the residual claimants. Because of limited liability, a leveraged firm might take greater risks and invest or produce beyond the optimum of an all-equity one, which lowers the firm's debt value. The higher the debt burden, the more aggressive is the optimal product market strategy. When a bank lends to two competitors, internalizing the competitive effects that the firms impose on each other, it is optimal for a common lender to offer lower rates and reduce debt overhang, which would soften product market strategies and increase debt holder value. I find evidence for both mechanisms at play: common lending decreases credit spreads by 14 basis points (10%) when banks do not have market power, but increases by 22 basis points (15%) when they do.

This work relates to several strands of literature. First, I contribute to the growing literature on the recent secular decline in investment in the US economy. Some of the early work had focused on documenting the emerging trend in investment (Gutiérrez and Philippon 2016; Autor et al. 2017), while later studies linked it to a rise in product market concentration (Gutiérrez and Philippon 2017; Grullon, Larkin, and Michaely 2019b; Covarrubias, Gutiérrez, and Philippon 2020), the increase in profits and markups (De Loecker, Eeckhout, and Unger 2020), or the growth of intangibles (Alexander and Eberly 2018; Crouzet and Eberly 2018; Crouzet and Eberly 2019). Saidi and Streitz (2021) relate the above changes to recorded shifts in the financial sector, suggesting that increased concentration in the banking sector is linked to product market competition through the softening of lending conditions.

The usual suspect of enabling a steady increase in market concentration is lax merger control by the Federal Trade Commission and Department of Justice, clearing anti-competitive and welfare-reducing mergers. However, such claims seem unsubstantiated: Although industry concentration is increasing, it remains at levels which "do not raise significant competition concerns" (Carlton 2020). Instead, this paper provides a channel to micro-found these observed macro trends of recent decades. Driven by bank consolidation, higher concentration in the financial sector increases the probability of rival firms borrowing from a common

that banks may in principle directly steer borrowers' investments.

lender, which in turn may work to reduce competition by driving investments down. The same forces may deter entry and reduce exits, lowering overall dynamism (Gutiérrez and Philippon 2017).

Second, this work contributes to a growing literature on competition and market coordination. Early work was mostly theoretical and explored models of indirect collusion by a common agent. Rotemberg (1984) shows how reducing competition works in the interest of diversified shareholders, even without any explicit coordination, and Bernheim and Whinston (1985) demonstrate how a common marketing agent is able to coordinate pricing choices of rival firms, resulting in a perfectly cooperative equilibrium. Others had proposed models that relate capital structure and the particular identity of lenders to outcomes in the product market: Brander and Lewis (1986) show how firms may use debt as a commitment device to more aggressive product market strategies, and Poitevin (1989) finds that borrowing from a common lender may achieve collusive outcomes in the output market.

Later papers offered empirical evidence for coordination facilitated by different agents, like the state through price control (Knittel and Stango 2003), financiers (Cetorelli and Strahan 2006; Saidi and Streitz 2021), shareholders (Azar, Schmalz, and Tecu 2018; Schmalz 2018; Ederer and Pellegrino 2022), or directors (Begley, Haslag, and Weagley 2023). Particularly, the channel of common ownership, where the equity of rival firms is mutually held, thus causing firms to internalize their competitive effects, received increased attention in recent years (Azar, Schmalz, and Tecu 2018; Backus, Conlon, and Sinkinson 2019; Lewellen and Lowry 2021). This paper proposes a novel mechanism of how lending relations and the structure of debt may dampen competition and facilitate tacit collusion: unlike a common owner, which may benefit from picking winners and foreclosing on rivals, a common lender's upside is limited by the outstanding debt, and cannot directly gain from any one firm's success over another.

Finally, my paper also relates to the broad literature on finance and competition, where seminal empirical work stressed the importance of competition and market concentration among lenders on credit supply (Petersen and Rajan 1995), establishing links between capital structure and product market competition (Chevalier 1995), and between lending quality and economic growth (Jayaratne and Strahan 1996). Particular interest was devoted to the effects of the financial system on credit supply and loan contracts: Sapienza (2002) demonstrates that bank consolidation reduces interest rates due to efficiency gains, but the effect is offset as market power increases; and Cestone and White (2003) study how the credit market may facilitate entry deterrence, when the investors' stake in the incumbent firms is sensitive to the incumbent performance enough to offset any gains from competition. Gorodnichenko and Schnitzer (2013) provide a theoretical model and empirical evidence that financial constraints can decrease investment and innovation, suggesting that credit supply may be used as a lever. Spatareanu, Manole, and Kabiri (2019) build on the above model and introduce bank distress, showing how cutting back on lending can decrease innovation. Recent studies have demonstrated the importance of lenders' market power in loan pricing, where higher credit market concentration allows banks to set higher loan spreads (Drechsler, Savov, and Schnabl 2017), and the role of lending relations in mitigating shocks (Schwert 2018). Others have studied how product market competition may drive up corporate dividend policy (Grullon, Larkin, and Michaely 2019a) and how the ownership structure of rival firms affects market prices and bears antitrust implications (Schmalz 2018; Azar, Schmalz, and Tecu 2018).

The remainder of the paper is structured as follows. Section 2 discusses the main institutional details of the US syndicate loans market, as well as the wave of bank consolidation and the changes to banking regulation that facilitated it. Section 3 reviews the data sources used for the empirical analysis, providing descriptive statistics and stylized facts, and in Section 4 I propose a simple theoretical model that captures the main mechanisms at play. Section 5 presents the empirical strategy and regression specifications, and discusses the results. Section 6 concludes.

2 Institutional background

2.1 Syndicated loans

A loan syndicate comprises a lead bank and several participant banks. The lead bank arranges a loan: it performs the necessary ex ante due diligence, negotiates terms with the borrower, and is responsible for ex post monitoring. It forms the syndicate by selling pieces of the loan to other banks - the participants. The borrowing rate, the share retained by the lead, and the spread paid to the participants are determined by standard information asymmetries between borrowers and lenders, but also by information asymmetries between the syndicate members on the one hand, and the banks' diversification needs on the other.

First, information asymmetry between the lead and participants generates adverse selection of loans offered by the arranger: ex ante, participants must rely on the lead bank to collect information regarding the borrower and its prospects, with no way to verify or monitor. This gives the lead bank incentives to unload the riskiest or worst loans, offering those for syndication, while skimming the cream for itself. However, syndication also creates moral hazard on the side of the lead bank: the smaller the retained share of the loan, the less incentive the bank has to effectively monitor.

One way to credibly convey information about the quality of the loan and avoid paying an offsetting premium to the participant banks is for the lead to retain a larger share of the loan, committing to high monitoring effort by having more skin in the game. At the same time, banks would not like to hold large shares of any particular loan due to diversification needs. The resulting shares and spreads are set in the asymmetric information and diversification equilibrium. This tension is explored in Sufi (2007), where borrowers differ in their "opaqueness", or the degree to which they require monitoring and due diligence. Easy to monitor, "transparent", borrowers generate less moral hazard, as the lead can more credibly commit to monitoring. The more opaque the borrower, the larger the lead's share must be. The endogeneity of share and price is addressed in Ivashina (2009), using shifts in the lead's credit-risk exposure.

This literature implies that banks are more valuable for less transparent borrowers, since monitoring is more important when information asymmetry between lenders and borrowers is high. The more valuable banks are, the less they can be substituted by either bonds or other banks (because of established lending history), and the more market power they possess. Therefore, we should expect a larger effect of bank mergers on firms when firms have less access to the bond market, their credit rating is lower, or are of smaller size. I use some of the information asymmetry measures that this literature suggests, like indicators for whether a firm is public or has issued debt, its credit rating, size, and lending history. A more direct measure would be the within-firm spread between similar loans and bonds, in terms of amount, maturity, and seniority, which would be a close estimate of the value of banks to borrowers (Schwert 2020). Indeed, I document a larger drop in investment rates after a bank merger when a firm's lowest rated bond is high-yield (compared to investment grade), when borrowers issue debt less often (up to once a quarter), and for smaller firms in terms of either total assets or sales.

2.2 Bank deregulation and merger wave

From the early 1930s to the mid 1980s, the US banking sector had been highly fragmented, with about 14000 commercial banks in operation throughout the period. Around the mid 1980s, the number of bank charters had rapidly begun to decline by roughly 250 banks every year, to about 4000 today (Figure 2.1). This exit of banks was not driven by a particular crisis, nor following an industry-wide contraction in financial services, as the value of assets and number of branches kept growing, but mostly due to mergers and acquisitions among banks.

This unprecedented wave of consolidation was made possible, in part, by a series of legislative changes. First, the Competitive Equality Banking Act (1987) introduced provisions for emergency bank acquisitions. Soon after, the Riegle-Neal Interstate Banking and Branching Efficiency Act (1994) removed existing restrictions on cross-state bank acquisitions and branch network consolidation, repealing parts of the McFadden Act (1927). The Gramm-Leach-Bliley Act (1999) permitted mergers between different types of financial institutions, allowing commercial banks, investment banks, securities firms, and insurance companies to consolidate, repealing the Glass-Steagall Act (1933) which prohibited affiliations between commercial and investment banks.

Recently there has been a resurgence of interest in banking competition and some steps were made to increase it. In an attempt to walk back some of the above changes, the Bank Merger Review Modernization Act (2021) was introduced, seeking to increase bank merger scrutiny and discourage consolidation by introducing additional financial stability standards and stress tests, and involving financial regulators like the Consumer Financial Protection Bureau (CFPB) in merger review processes. Also in 2021, a presidential order encouraged the Department of Justice (DoJ), the Federal Reserve, the Federal Deposit Insurance Corporation (FDIC), and the Office of the Comptroller of the Currency to "update guidelines on banking mergers to provide more robust scrutiny of mergers".

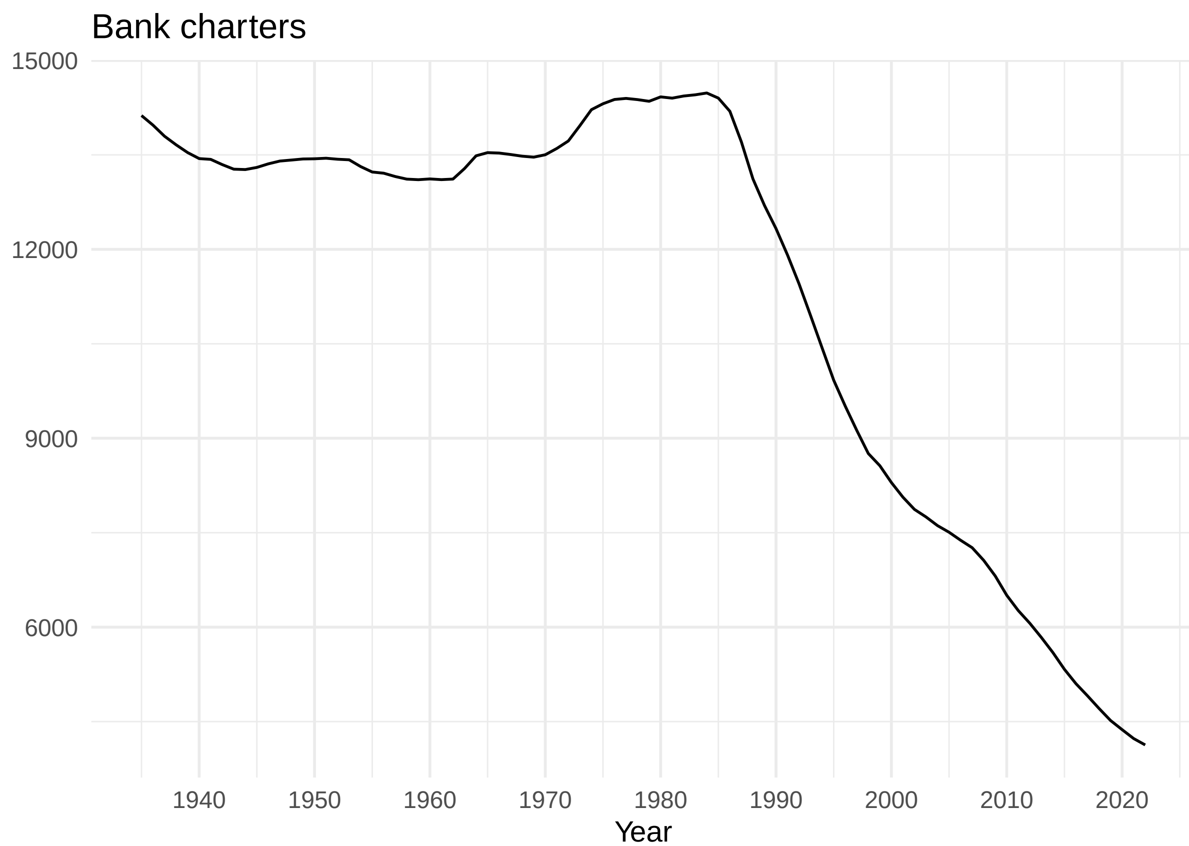


Figure 2.1: Total number of FDIC-insured commercial banks over time, 1934-2022.

3 Data

The primary source of data is Thomson-Reuter's LPC DealScan, which provides transaction-level data on corporate lending. Loans are organized in *packages* and *facilities*, where a package represents the entire lending deal, comprised of facilities. Within a package, separate facilities may correspond to either different loan types, like a revolver or bridge loan, different loan purposes, like working capital or stock buyback, or to different lenders. All loans have only one borrower, but usually have several lenders who form a syndicate. Members of a syndicate may fulfilling different roles, but the standard structure is a single lead arranger originating the loan, which then sells off parts of it to participating banks. Additionally, I observe various loan characteristics, such as issue date, duration, amount, and purpose.

The DealScan data set also contains borrower and lender characteristics. Borrower features include firm type, the identity of its parent and ultimate ownership, country, state, and industry affiliation (at the 4-digit SIC level). For lenders, I additionally observe their role, share, and interest rate spread for any given loan. Note that spreads may vary within a loan, representing differential compensation for varying roles and bargaining power among syndicate members, and not necessarily the price paid by the borrower.

I focus on loans originated in the United States, issued to publicly traded US firms, and denominated in USD. I further restrict the sample to loans recorded between 1989 and 2019, as the data are very sparse before that. Importantly, I restrict the sample to *active* lenders. I define an *active* lender to be one whose role in a syndicated loan relates to managing, arranging, leading, or administrating. In contrast, *passive* lenders almost exclusively have the role of participant. Naturally, all non-syndicated loans have their sole lender also defined as *active*, regardless of reported lender role. The decision to subset the sample to what I define as *active* lenders only is informed by the research question and hypothesis. I study the effect of common lending on borrowers, through the channel of internalizing competitive externalities. A passive lender, one that in general only provides funds and takes no part in monitoring performance and investments, does not do that by definition. Moreover, while expanding the sample to include the passive versus active margin could be informative, it also introduces the endogeneity of lender selection into roles within a syndicate.

I supplement the lending data with annual balance sheets and income statements of lenders and borrowers from Compustat. Important variables of note here are *markup*, defined as the ratio of sales (Compustat annual data item "sale") to cost of goods (Compustat annual data item "cogs"); and *investment rate*, the ratio of capital expenditure (Compustat annual data item "capx") to property, plants and equipment (Compustat annual data item "ppegt").

3.1 Stylized facts

Figure 3.1 illustrates the decline in investment and the consolidation in the banking sector. Panel A plots the average investment rate among public US firms. It documents a secular decline of about 0.25pp per year, from about 18% in 1985 to a little over 10% in 2019, with notable crashes during the early 2000s recession after the dot-com bubble, and in the late 2000s following the great recession. Panel B plots the ratio of the number of banks to the number of borrowers, as reported in the DealScan data set. Data pre-1990 are sparse and less reliable. Normalizing the ratio in 1990 to 100, we see that today borrowers have about half as many different lenders to choose from. Note how the ratio of banks to borrowers increases during the recessions, likely because borrowers go out of business at a much higher rate than banks.

Figure 3.2 describes the composition of bank portfolios across industries, defined by either 2 or 4 digit SIC codes. Panel A plots the average industry portfolio size, or the number of borrowers belonging to the same industry per bank. Over time banks have increased common lending and are financing more and more firms within the same industry: In 1990, a bank would lend to about 2-2.5 firms within the same industry, while today it lends to about 3-5 - an increase of 50% to 100%, depending on the preferred industry definition. Panel B plots the average number of industries per bank to which its portfolio firms belong. This measure captures the extent to which banks specialize in lending to specific industries versus diversifying across many different ones. At the 2-digit granularity, the number is rather stable at about 5 industries per bank, while at the 4-digit level it has been increasing from about 7 to 10 industries per bank. Taken together, the figure suggests that banks lend to more firms within the same industry, and that the increase is not driven by banks specializing in fewer industries.

3.2 Portfolio size and firm characteristics

The more borrowers a bank finances in an industry, the lower are the investment rate and credit spread of each borrower, and the higher is the amount lent. I estimate the linear relation between outcomes of interest and industry-portfolio size using the following equation:

$$Y_{bmt} = \beta \times \text{Portfolio size}_{bmt} + \xi_{mb} + \nu_{mt} + \mu_{bt} + \varepsilon_{bmt} \tag{1}$$

Where $Y_{bmt} \in \{\text{Investment rate}, \text{Credit spread}, \text{Loan amount}\}$ is the outcome of interest, averaged across borrowers of bank b in industry m at time t. Industries are defined at the 3-digit SIC code, and time at the monthly level. Portfolio size_{bmt} is the number of borrowers in the industry portfolio - the number of firms with outstanding debt to bank b in industry m and month t. ξ_{mb} is a bank-industry fixed effect, ν_{mt} is an industry-month fixed effect, and μ_{bt} is a bank-month fixed effect. ε_{bmt} is an *iid* error term.

Table 3.1 presents the results of Equation 1, where $Y_{bmt} = \text{Investment rate}_{bmt}$: how the average investment rate among borrowers in a bank's industry portfolio relates to the number of borrowers comprising the portfolio. Column (1) includes no fixed effects, and captures the unconditional relation between portfolio size and investment rate. Column (2) includes industry-time fixed effects, and captures the relation between portfolio size and investment rate across banks *within* an industry-time pair. Column (3) includes bank-time fixed effects, and captures the relation between portfolio size and investment rate across industries *within* a bank-time pair. Column (4) includes bank-industry fixed effects, and captures the relation between portfolio size and investment rate over time *within* a bank-industry pair. The relation is negative and significant across the models, indicating that every additional borrower

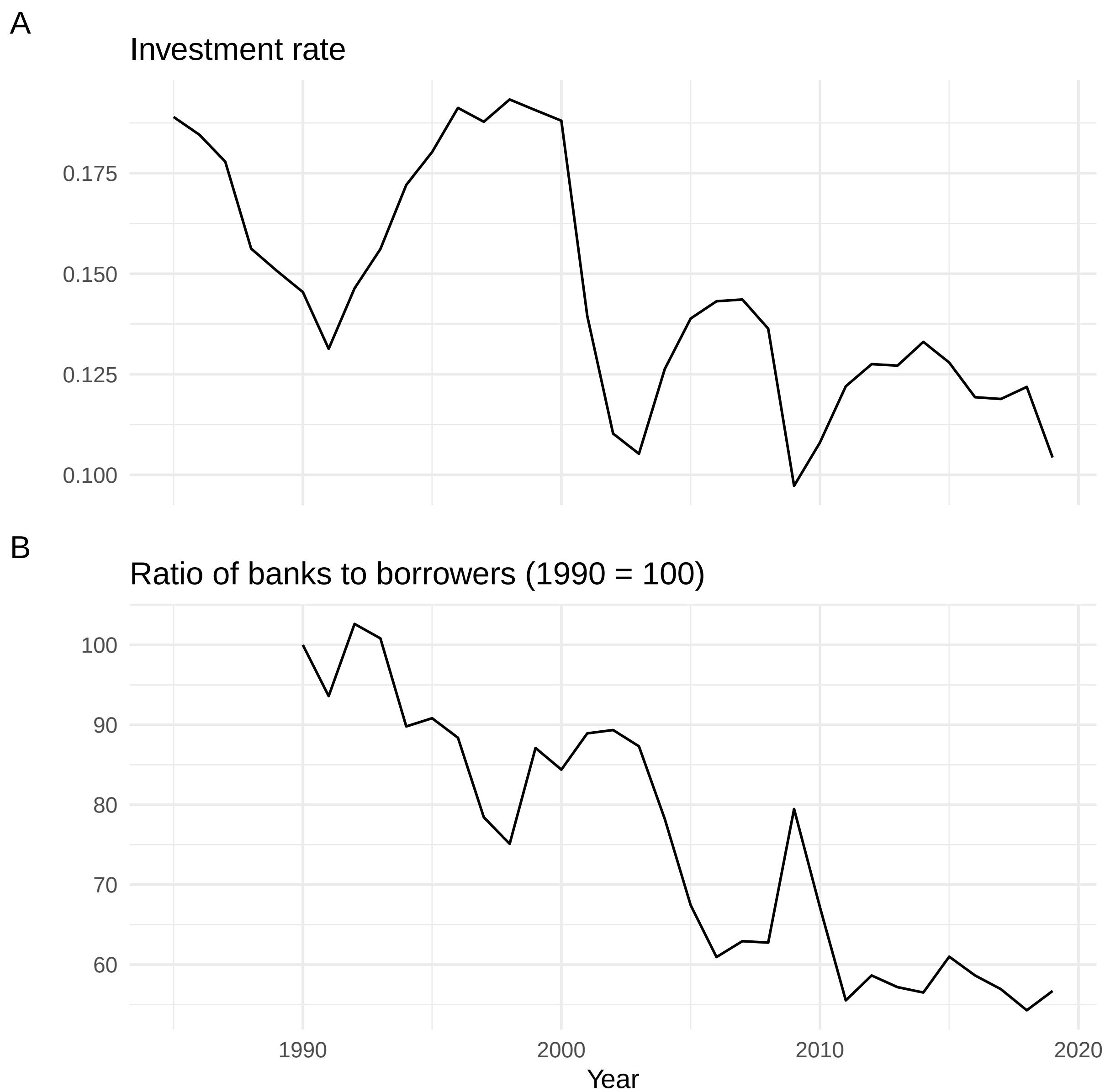


Figure 3.1: Decline in investment and bank consolidation. Panel A plots the average investment rate among public US firms. The investment rate is defined as the ratio of capital expenditures to the total stock of plant, property, and equipment (Compustat items 'capx' to 'ppegt'). Panel B plots the ratio of the number of banks to the number of borrowers in the DealScan data set. The ratio in 1990 is normalized at 100.

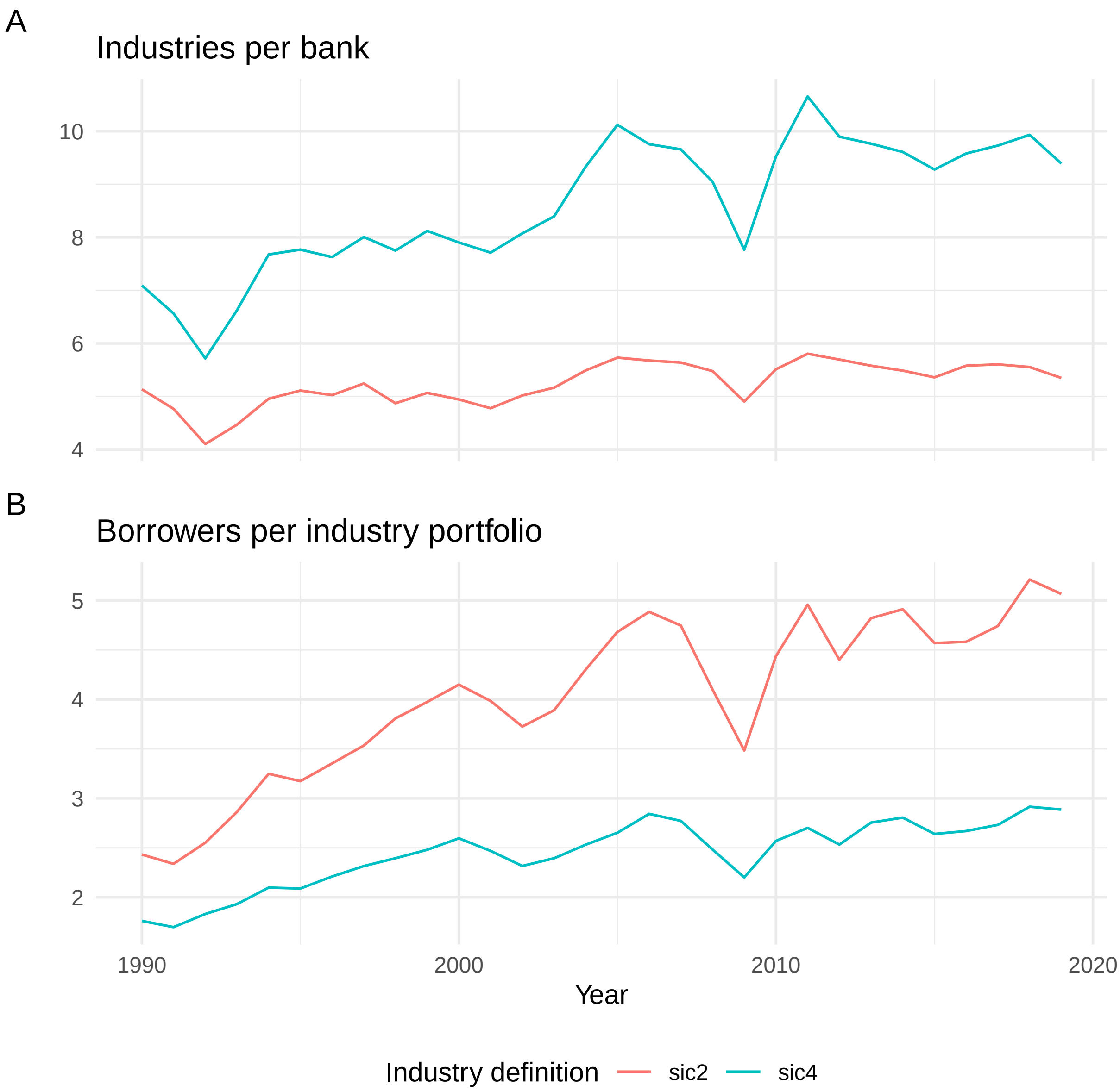


Figure 3.2: Common lending and specialization. Panel A plots the average number of industries per bank. Panel B plots the average number of borrowers of the same industry per bank. Industries are defined by either 2 or 4 digit SIC codes.

Table 3.1: Portfolio size and investment rates

	Investment rate × 100			
	(1)	(2)	(3)	(4)
Constant	11.012***			
	(0.355)			
Number of firms	-0.364***	-0.279***	-0.054***	-0.283***
	(0.062)	(0.058)	(0.013)	(0.038)
Dependent variable mean	10.420	10.420	10.420	10.420
Observations	220,002	220,002	220,002	220,002
R^2	0.000	0.221	0.271	0.990
Quarter-Industry fixed effects		✓		
Bank-Quarter fixed effects			✓	
Industry-Bank fixed effects				✓

Notes: The table reports the results of a regression of the average investment rate among borrowers in a bank's industry portfolio on the number of borrowers in the industry portfolio. The columns include fixed effects at the quarter-industry, bank-quarter, and bank-industry levels. Standard errors are clustered at the bank-quarter level.

in the industry portfolio is associated with a 0.05 to 0.35 percentage point decrease in the average investment rate of those borrowers. The results of columns (2)-(4) suggest that the variation is mostly driven by differences across banks within industry-time and over time within bank-industry pairs, rather than differences across industries within bank-time pairs.

Tables 3.2 and 3.3 repeats the above exercise, using Credit spread$_{bmt}$ and Loan amount$_{bmt}$ as the dependent variables in Equation 1: regressing the average loan amount and price among borrowers in a bank's industry portfolio on the number of borrowers in the portfolio. Table 3.2 present the results for the average credit spread, in basis points, and Table 3.3 present the results for the average loan amount, in billion USD. An additional borrower in the industry portfolio is associated with a 7.6 basis point (about 3%) decrease in the average credit spread of all firms in the portfolio. Decomposing the variation, the effect is similar in magnitude across the bank, industry, and time margins. An additional borrower in the industry portfolio is also associated with an 80 million USD (about 7%) increase in the average loan amount of all firms in the portfolio. This variation is explained by differences in portfolio size across industries within bank-time pairs, more-so than across the other margins.

Finally, I estimate Equation 2, which is a less restrictive model than Equation 1, where the independent variable is a vector of dummy indicators that correspond to the number of borrowers in the industry portfolio, rather than the number of borrowers itself. This specification relaxes the linear assumption and allows for a more flexible relation between portfolio size and the outcomes of interest.

Table 3.2: Portfolio size and loan spread

	Spread			
	(1)	(2)	(3)	(4)
Constant	266.43***			
	(0.72)			
Number of firms	-7.60***	-3.30***	-3.43***	-2.46***
	(0.14)	(0.13)	(0.12)	(0.19)
Dependent variable mean	254.082	254.082	254.082	254.082
Observations	220,256	220,256	220,256	220,256
R^2	0.009	0.616	0.510	0.786
Month-Industry fixed effects		✓		
Bank fixed effects		✓		
Bank-Month fixed effects			✓	
Industry fixed effects			✓	
Industry-Bank fixed effects				✓
Month fixed effects				✓

Notes: The table reports the results of a regression of the average credit spread (in basis points over the LIBOR) among borrowers in a bank's industry portfolio on the number of borrowers in the industry portfolio. The columns include fixed effects at the quarter-industry, bank-quarter, and bank-industry levels. Standard errors are clustered at the bank-quarter level.

Table 3.3: Portfolio size and loan amount

	Amount			
	(1)	(2)	(3)	(4)
Constant	1.12***			
	(0.01)			
Number of firms	0.08***	0.01***	0.02***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Dependent variable mean	1.245	1.245	1.245	1.245
Observations	220,256	220,256	220,256	220,256
R^2	0.006	0.630	0.492	0.708
Month-Industry fixed effects		✓		
Bank fixed effects		✓		
Bank-Month fixed effects			✓	
Industry fixed effects			✓	
Industry-Bank fixed effects				✓
Month fixed effects				✓

Notes: The table reports the results of a regression of the average loan size (in billion USD) among borrowers in a bank's industry portfolio on the number of borrowers in the industry portfolio. The columns include fixed effects at the quarter-industry, bank-quarter, and bank-industry levels. Standard errors are clustered at the bank-quarter level.

$$Y_{bmt} = \sum_{k=2}^{15} \beta_k \times \mathbb{I}[\text{Portfolio size}_{bmt} = k] + \xi_{mb} + \nu_{mt} + \mu_{bt} + \varepsilon_{bmt} \tag{2}$$

Where again $Y_{bmt} \in \{\text{Investment rate}, \text{Credit spread}, \text{Loan amount}\}$, averaged across borrowers of bank b in industry m at time t. $\mathbb{I}[\text{Portfolio size}_{bmt} = k]$ is an indicator function that takes the value of 1 if the portfolio size is equal to k, and 0 otherwise, ξ_{mb} is a bank-industry fixed effect, ν_{mt} is an industry-time fixed effect, and μ_{bt} is a bank-time fixed effect. ε_{bmt} is an *iid* error term. I omit portfolio sizes above 15, as they are too sparse to be informative (accounting for under 1% of observations), and I use the natural log of the average loan amount instead of the average loan amount itself.

I plot the estimated β_k coefficients from Equation 2 in Figure 3.3. The omitted category is the portfolio size of 1, i.e. no common lending. Conditional on a comprehensive set of fixed effect, we see the same generally monotone negative relation between portfolio size and investment rate or credit spread, and the same positive relation between portfolio size and loan amount, as in Tables 3.1, 3.2, and 3.3. For example, compared to single-firm industry portfolios, firms that share a bank with 4 other rivals (a lending portfolio of size 5) have about 1 percentage point lower investment rates, 10 basis points lower credit spreads, and 7% larger loans. The only exception is the relative plateau in the effect on spread starting around portfolio sizes of 9-10, perhaps due to borrowing rates reaching the competitive price level.

Overall, the results suggest that the more borrowers a bank finances in an industry, the lower the investment rate and credit spread of each borrower, and the higher the amount lent. This is consistent with the hypothesis that, under competitive credit markets, banks would want to increase credit supply and lower interest rates to reduce debt overhang and the incentives of borrowers to aggressively invest and compete. This is not explained either by banks specializing in lending to particular industries nor by time trends at the bank or industry level. This result could, however, be confounded by banks learning over time about any particular industry, or reaching certain market shares that affect pricing via market power or economies of scale. I address these concerns in the next sections, where I propose a model of endogenous investment and debt, and use bank mergers as natural experiments.

4 A model of lending and competition

To rationalize the observed patterns in the data, where interest rates decline in the number of borrowers, I propose a model of endogenous production and debt. In a market with an arbitrary number of competitors with a given debt burden, firms choose the optimal level of output that maximizes the expected value of equity holders. Banks take lending relations as given, anticipate firm behavior, and issue optimal levels of debt. The model builds on two important theoretical features: (a) The pro-competitive role of debt, and (b) common lenders' incentive to internalize competition among borrowers. This section covers the model setup and equilibrium results.

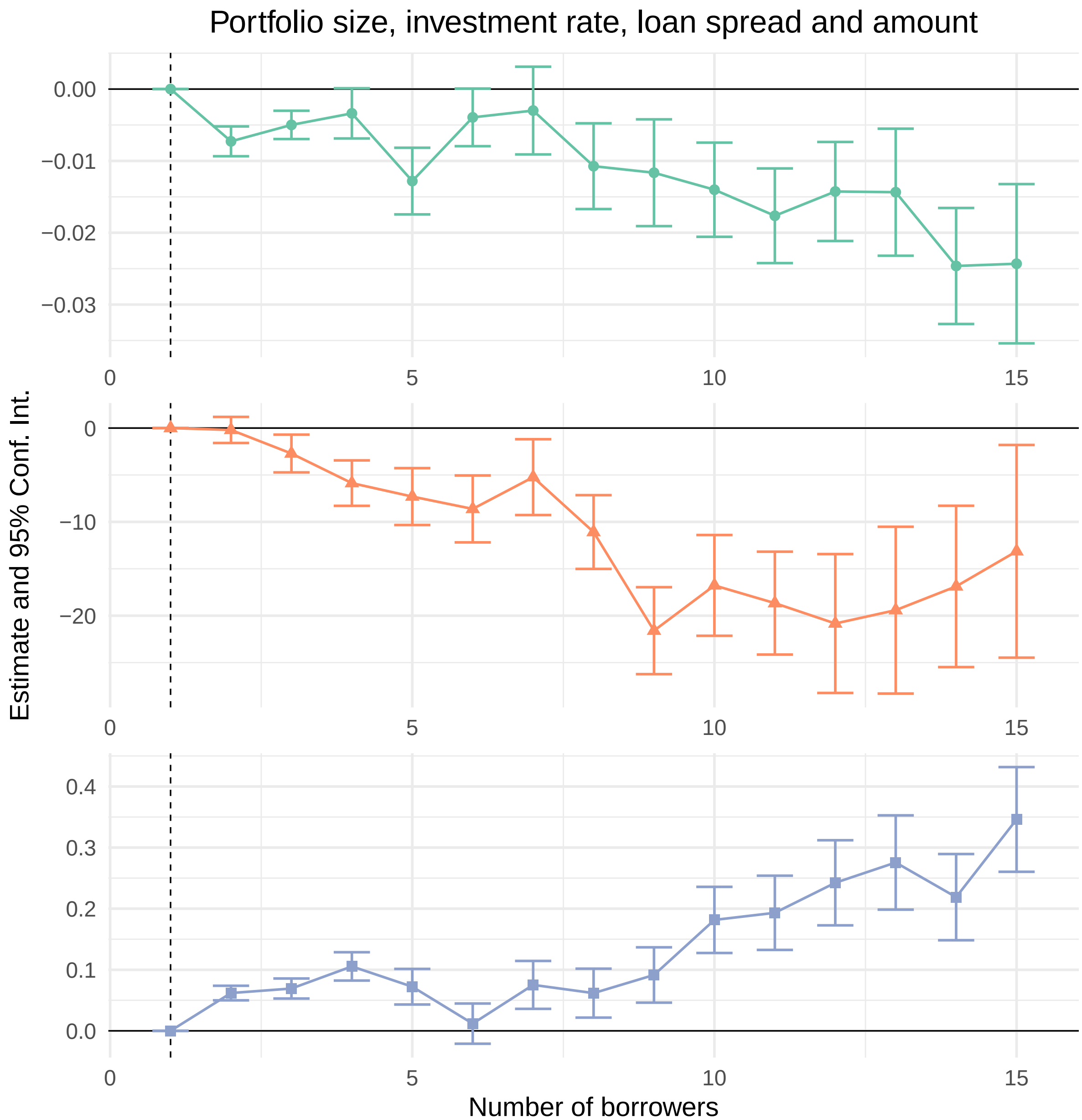


Figure 3.3: Borrower investment rate, credit spread, and loan amount as a function of common lending. This figure plots the coefficients from Equation 2, which estimates a linear regression of three characteristics of a bank's industry-portfolio firms and the size of the industry-portfolio. Observations are at the bank-industry-year level. The dependent variables are the average investment rate, the average credit spread, and the natural log of the average loan amount among borrowers in a bank's industry-portfolio, as a function of the number of borrowers in the portfolio. All models include fixed effects at the month-industry, bank-month, and bank-industry levels. Standard errors are clustered at the bank-month level. See Table 3.4 for more detail.

Table 3.4: Portfolio size, investment rate, loan spread and amount

	Investment rate (1)	Spread (2)	log(Amount) (3)
Number of firms = 2	-0.007***	-0.200	0.062***
	(0.001)	(0.710)	(0.006)
Number of firms = 3	-0.005***	-2.712***	0.069***
	(0.001)	(1.027)	(0.008)
Number of firms = 4	-0.003*	-5.869***	0.105***
	(0.002)	(1.236)	(0.012)
Number of firms = 5	-0.013***	-7.302***	0.072***
	(0.002)	(1.548)	(0.015)
Number of firms = 6	-0.004*	-8.618***	0.012
	(0.002)	(1.821)	(0.017)
Number of firms = 7	-0.003	-5.232**	0.075***
	(0.003)	(2.062)	(0.020)
Number of firms = 8	-0.011***	-11.084***	0.062***
	(0.003)	(2.006)	(0.020)
Number of firms = 9	-0.012***	-21.598***	0.091***
	(0.004)	(2.364)	(0.023)
Number of firms = 10	-0.014***	-16.771***	0.182***
	(0.003)	(2.739)	(0.028)
Number of firms = 11	-0.018***	-18.662***	0.193***
	(0.003)	(2.798)	(0.031)
Number of firms = 12	-0.014***	-20.835***	0.242***
	(0.004)	(3.777)	(0.036)
Number of firms = 13	-0.014***	-19.410***	0.276***
	(0.005)	(4.536)	(0.039)
Number of firms = 14	-0.025***	-16.878***	0.219***
	(0.004)	(4.386)	(0.036)
Number of firms = 15	-0.024***	-13.137**	0.346***
	(0.006)	(5.783)	(0.044)
Dependent variable mean	0.104	254.185	20.132
Observations	219,598	219,852	219,852
R^2	0.994	0.891	0.916
Bank-Month fixed effects	✓	✓	✓
Industry-Month fixed effects	✓	✓	✓
Industry-Bank fixed effects	✓	✓	✓

Notes: The table reports the results of a regression of the average investment rate, credit spread, and loan amount among borrowers in a bank's industry portfolio on the number of borrowers in the portfolio. The columns include fixed effects at the month-industry, bank-month, and bank-industry levels. Standard errors, clustered at the bank-month level, are in parentheses.

4.1 Setup

Let firm debt be given by d_j and earnings by

$$R_j = (p(Q) - mc_j + \varepsilon_j) \times q_j$$

Where $p(Q)$ is the inverse demand function, q_j is the quantity produced, mc_j is the marginal cost of production and $\varepsilon_j \sim F_\varepsilon(q_j)$ is a mean-zero random variable with variance that increases in q_j. I abstract from the mapping of investment to output, and assume that investment is directly proportional to output, so that q_j can be viewed as the investment level. ε_j captures the risk to firm payoff stemming from an aggressive product market strategy: higher production levels increase tail event probabilities. It captures the consequences of high-risk, high-reward decisions in the real world, such as attaining economies of scale on the one hand, or massive product recalls on the other.

Let equity holders' payoff be

$$\pi_j = \begin{cases} R_j - d_j, & R_j > d_j \\ 0, & R_j \leq d_j \end{cases}$$

The presence of debt gives rise to moral hazard on the side of equity holders. The latter get a payoff of 0 in default, i.e. when $R_j \leq d_j$, so their objective function is not maximizing the total enterprise value, but rather solving

$$\max_{q_j} \mathbb{E}[\pi_j] = \max_{q_j} \left[\mathbb{E}\left[R_j - d_j | R_j > d_j\right] \times \mathbb{P}[R_j > d_j]\right]$$

with the FOC *wrt* q_j is

$$\frac{\partial}{\partial q_j} \mathrm{P}\left(\left(p(Q) - mc_j + \varepsilon_j\right) q_j > d_j\right) \mathrm{E}\left[\left(p(Q) - mc_j + \varepsilon_j\right) q_j - d_j\right]$$
$$+ \mathrm{P}\left(\left(p(Q) - mc_j + \varepsilon_j\right) q_j > d_j\right) \frac{\partial}{\partial q_j} \mathrm{E}\left[\left(p(Q) - mc_j + \varepsilon_j\right) q_j - d_j\right] = 0$$

Further derivation or analysis would require making additional assumptions on the functional form. For now, keeping notation in the most general form, I denote the optimal output level as

$$q_j^* = \underset{q_j}{\operatorname{argmax}} \mathbb{E}\left[R_j - d_j | R_j > d_j\right] \times \mathbb{P}\left[R_j > d_j\right]$$

Banks, on their part, issue loans to firms and collect debts in good states, or the remaining firm earnings (if any) in bad states. In solving the bank's problem, I ignore the initial loan term, which enters the payoff expression with a negative sign, and treat it as a sunk cost at the time decisions are made. I also abstract from the demand for credit, and assume that banks directly set the debt level d_j.

Bank b's payoff from lending to firm j is given by

$$\pi_{jb} = \begin{cases} d_j, & d_j \leq R_j \\ R_j, & 0 < R_j < d_j \\ 0, & R_j \leq 0 \end{cases}$$

However, the bank may have a portfolio of borrowers, so it maximizes the total payoff:

$$\begin{aligned} \max_{\mathcal{D}_b} \mathbb{E}[\pi_b] &= \max_{\mathcal{D}_b} \mathbb{E}\left[\sum_{j \in \mathcal{J}_b} \pi_{jb}\right] \\ &= \sum_{j \in \mathcal{J}_b} \left(d_j \times \mathbb{P}\left[R_j \geq d_j\right] + \mathbb{E}\left[R_j | 0 < R_j < d_j\right] \times \mathbb{P}\left[0 < R_j < d_j\right]\right) \end{aligned}$$

Where $\mathcal{J}_b$ is the set of firms financed by bank b and $\mathcal{D}_b$ is the corresponding set of outstanding debts.

Solving the FOC *wrt* an individual loan d_k, we get

$$\begin{aligned} \sum_j \Bigg(& \delta_{jk} \mathbb{P}\left(d_j \leq R_j\right) \\ & + d_j \frac{\partial}{\partial d_k} \mathbb{P}\left(d_j \leq R_j\right) \\ & + \frac{\partial}{\partial d_k} \mathbb{P}\left(0 \leq R_j \leq d_j\right) \mathbb{E}\left[R_j | 0 \leq R_j \leq d_j\right] \\ & + \mathbb{P}\left(0 \leq R_j \leq d_j\right) \frac{\partial}{\partial d_k} \mathbb{E}\left[R_j | 0 \leq R_j \leq d_j\right] \Bigg) = 0 \end{aligned}$$

where δ_{jk} is an indicator function which equals 1 when $j = k$ and 0 otherwise. The important terms to note here are the cross-firm components, which determine how firm k's debt reflects on firm j's performance. These partial derivatives capture the extent of internalization on the side of common lenders.

4.2 Results

To illustrate, I proceed with some basic functional form assumptions. Let inverse demand be a known function, marginal costs be constant, and ε_j have a known distribution:

$$\begin{aligned} P(Q) &= 10e^{-Q} \\ mc_j &= mc = 2 \quad \forall j \\ \varepsilon_j &\sim \text{Gumbel}(\sqrt{q_j}, -\gamma\sqrt{q_j}) \end{aligned}$$

Where $\gamma \approx 0.577$ is the Euler–Mascheroni constant, ensuring that $\mathbb{E}[\varepsilon_j] = 0$.

Figure 4.1 plots the expected payoff of equity holders (solid lines) and optimal output (red dots) as a function of quantity produced, debt burden, and rival output. The left panel holds rival output constant and varies debt (colors), and the right panel - vice versa. Profits monotonically decrease in debt and rival output, while having an optimal level of production. Both panels illustrate the pro-competitive effect of debt: It is qualitatively identical to increased competitive pressure. Higher debt and competition drive profits down and incentivize managers to take a more aggressive stance in the product market.

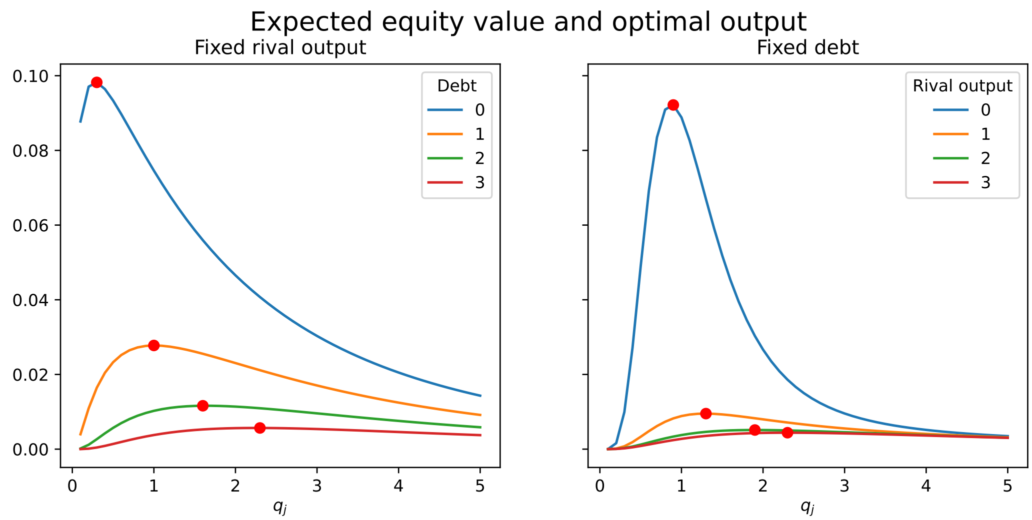


Figure 4.1: The value of firm equity as a function of its debt, own output, and rival output. Own output is on the horizontal axis. Expected equity value is on the vertical axis. The different colors denote the level of debt in the left panel, and rival output in the right panel. The red dots mark the profit-maximizing output level.

Figure 4.2 plots the optimal firm output choice and the corresponding expected value as a function of its debt burden and the number of rival firms. The firm assumes rivals have the same production function and level of debt as it does. In the left panel, when debt levels are very low we observe the standard Cournot outcome, where entrants steal market share from the incumbent, reducing its output. However, as the debt burden increases, the firm is pushed to increase output for the slim chance of turning a profit. At a certain point, all the lines cross and reverse order: The more competition the firm faces, the more it will produce. The right panel demonstrates why that is the case. When competition is fierce, profits are driven down to zero faster, and the firm resorts to very risky behavior sooner than, e.g., a monopolist would.

Finally, Figure 4.3 plots the optimal debt level set by the bank as a function of market size (total number of firms), portfolio size (number of borrowers it finances), and accounting for all firms behaving optimally, as described above. Given the number of borrowers, the bank would choose a lower debt burden in a more competitive market, as captured by the vertical variation across the colored lines. However, given a market, i.e. moving along the colored lines, the bank would also choose lower debt when it finances additional competitors, as it internalizes their competitive externalities through the partial derivatives in the solution to

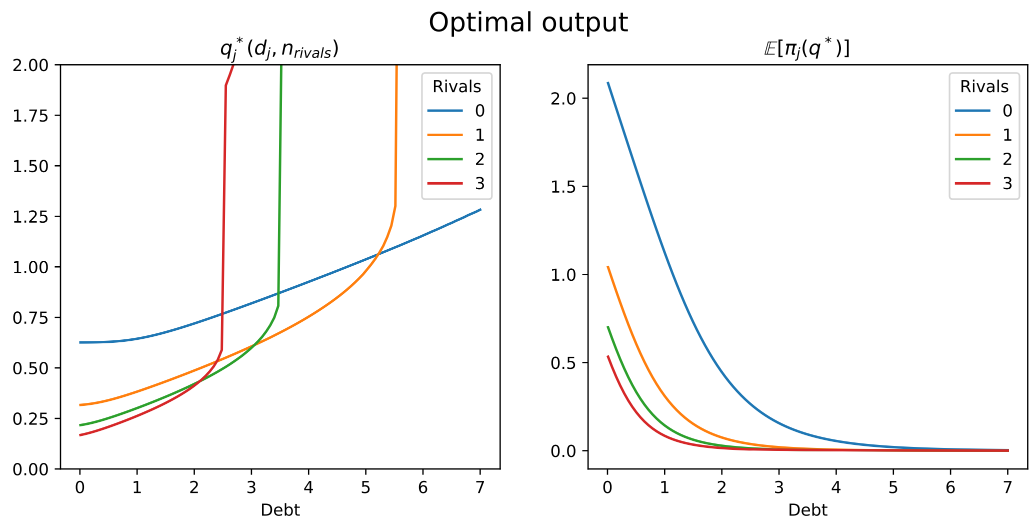


Figure 4.2: Firm's optimal output and expected profits as a function of its debt and the number of rivals. The number of firms in the borrowing market is denoted by the different colors. The debt level is on the horizontal axis. on the vertical axis is the output level in the left panel, and the expected profit in the right panel.

the bank's problem.

5 The effects of common lending

5.1 Conceptual framework

Competition among rival firms may manifest along various dimensions, such as price, product differentiation, or marketing efforts. One standard competitive metric is investment - resources that firms forfeit today to increase profits tomorrow. Acquisitions of new plants and equipment for the increase of future production capacity, R&D expenses for product improvement and innovation, or advertisement campaigns to further brand value and reputation would all fall under this category.

I use bank mergers as a natural experiment to identify the effect of common lending on borrower investment. The idea is that when two banks merge, they consolidate their lending portfolios, and the number of borrowers in the industry portfolio exogenously increases. This allows me to plausibly identify the effect of common lending on borrower investment, and to distinguish it from other potential confounding factors. However, bank mergers do more than just induce lending to competitors, and may also affect the investment rate of borrowers by other means, which would pose a challenge to the identification strategy. I hypothesize that lender mergers affect the investment rate of firms in a borrowing industry through three confounding channels: (a) Pass-through of efficiency gains; (b) increase in market power; and (c) internalizing competition. Assuming linear additivity, this can be represented as the following equation:

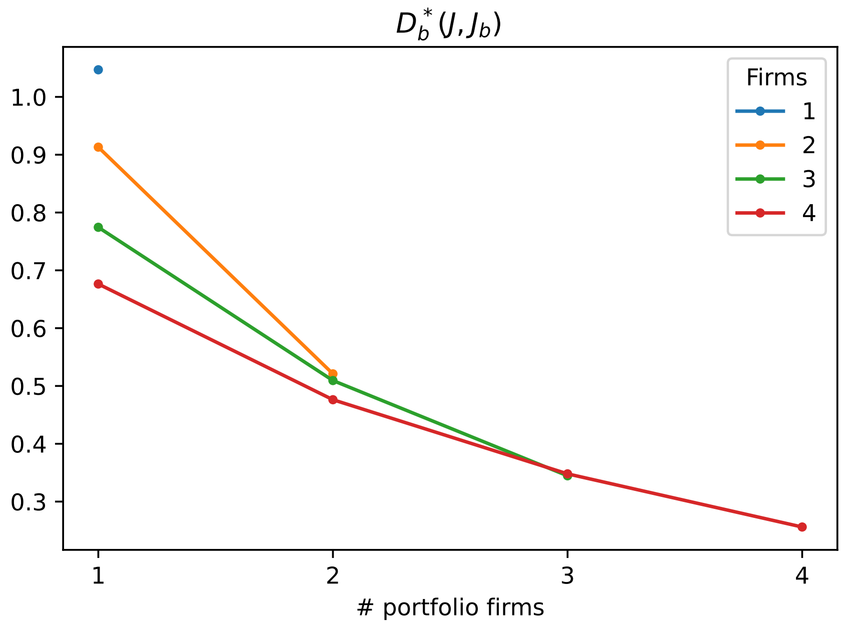


Figure 4.3: Bank's optimal debt level as a function of market and portfolio size. The number of firms in the borrowing market is denoted by the different colors. The number of firms financed by the bank is on the horizontal axis. The debt level is on the vertical axis.

$$\text{Total merger effect} = \text{Efficiency gains} + \text{Market power} + \text{Internalized competition}$$

First, a larger bank may benefit from economies of scale, pushing down its cost structure. As long as credit demand is somewhat elastic, an increase in the credit supply would pass some of the efficiency gains through to the borrowers, which could impact their investment decisions. Second, market power is derived from alternatives: The better a lender is compared to its rivals, and the fewer rivals it has, the more power it has over borrowers. A merger of two banks removes an incumbent from the credit market, thinning the set of borrowing alternatives, and increases the market power of all remaining lenders, allowing them all to raise rates and decrease credit supply. Finally, the acquiring bank also discretely increases its customer base, serving new borrowers whose performance adversely affects their rivals through investment. Internalizing this effect, and maximizing total debt value across all borrowers, the lender is incentivized to dampen downstream competition and reduce borrower investment. Taken together, the sign of the total effect of bank mergers on borrower investment is ambiguous, especially when there is reason to think that cost savings are substantial enough to outweigh both market power and the portfolio effect.

To illustrate how the different channels may be decomposed, consider an economy with a banking sector and two real sectors. There are three banks, $\{A, B, C\}$, that lend to five firms - firms 1 through 5. Firms 1 and 2 compete in sector 1 (top), while firms 3, 4, and 5 compete in sector 2 (bottom). Competition takes the form of investment, and to finance investments firms must borrow from banks, which are the only source of credit. Suppose that bank A

lends to firms 1 and 3, bank B lends to firms 3 and 4, and bank C lends to firms 2 and 5. Bank B does not finance firms in sector 1 and, for the purpose of this exercise, poses no threat of entry. I summarized the entire setup and lending network in Panel A of Figure 5.1, where the arrows denote lending relations.

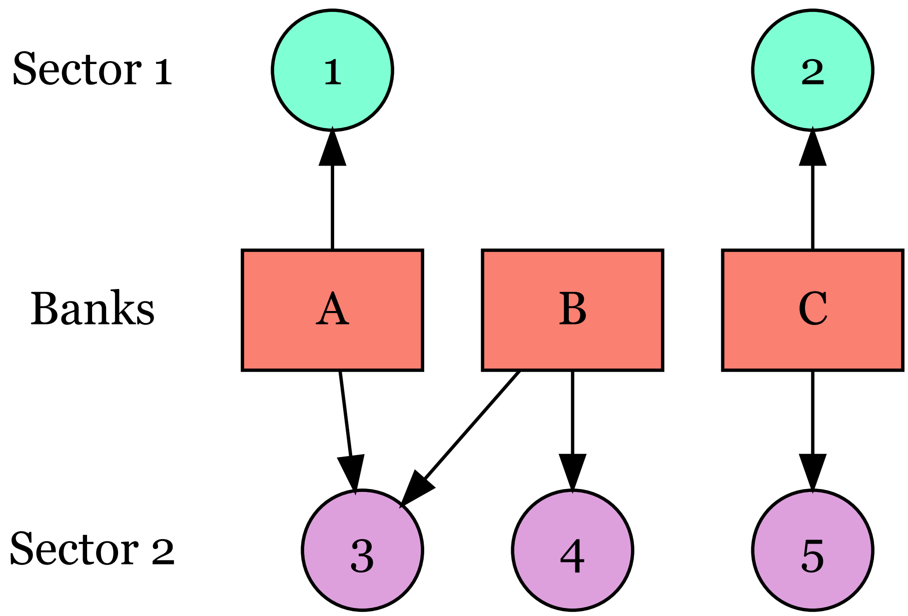
Now suppose bank A acquires bank B to form bank AB, as in Panel B of Figure 5.1. First, the merger would generate efficiency gains, which may pass through to the borrowers of A and B, regardless of their respective sector. This can benefit firms through improved access to capital, leading to more favorable product market outcomes. Second, the merger eliminates bank B as an independent lender, which makes the merger both an *out-of-market* merger in sector 1 (top), since bank B was not an active lender there, and an *in-market* merger in sector 2 (bottom), where both merging banks operate.[6] This implies that all firms in the bottom sector are affected through the market power channel due to a bank exit, regardless of their financing bank, while there is no change to the set of lending alternatives for firms in the top sector. Third, after acquiring bank B and its lending portfolio, bank A now finances both firms 3 and 4, suddenly exposing it to the adverse competitive effects the firms impose on each other. This additional portfolio effect is only present in the bottom sector, where the merger is in-market, and only among borrowers financed by the merging parties.

Despite the confounding total effect, the three channels can be disentangled by comparing outcomes across sectors and borrowers, before and after the merger. My focus is the portfolio effect of the merger, which is only present in the bottom sector, where the merger is in-market, and only among borrowers financed by the merging parties. We can then express the portfolio effect in terms of the total effect and the other components:

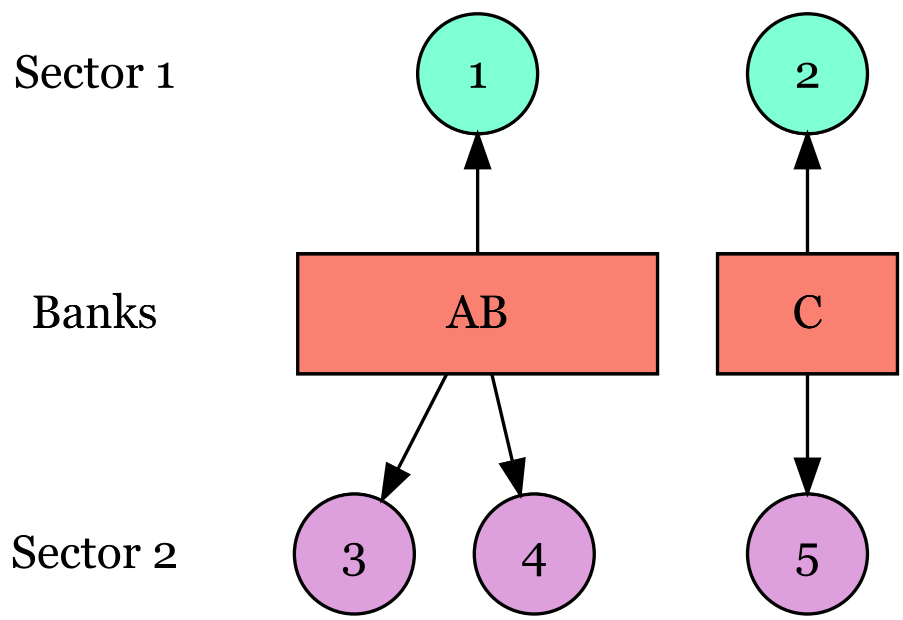
$$\text{Internalized competition} = \text{Total effect} - \text{Efficiency gains} - \text{Market power}$$

Next, we can use a difference-in-differences framework to identify each component. First consider the *out-of-market* merger in sector 1. I hypothesize that the merger generates efficiency gains with no change in market power, since no lender has exited the market. Firm 1 is then better off, as it benefits from the pass-through of efficiency gains, while firm 2 is completely unaffected. Comparing the outcomes of firms 1 and 2 before and after the merger identifies the efficiency gains component and the synergies passed through to borrowers. Now consider bank C and its borrowers across both sectors. The merger eliminates a competitor in the bottom sector alone, with no other effect on bank C. Comparing the outcomes of firms 5 and 2 before and after the merger identifies the market power channel. Finally, we can subtract the above two comparisons from the difference in outcomes of firm 3 to identify the internalized competition channel. Denoting the outcomes of firms i before and after the merger as f_i^t, we have

[6] This is where the above assumption that bank B poses no threat of entry into sector 1 comes into play. Otherwise, one could argue that the merger has, in fact, removed bank B's threat of entry into sector 1, which in itself had pro-competitive effects in restraining incumbents, and thus increased the market power of banks in lending to both sectors.



(a) Pre merger



(b) Post merger

Figure 5.1: Lending network. The figure illustrates the lending network before and after a bank merger. The nodes represent sectors, banks, and firms. The edges represent lending relations. The colors denote the sectors and the shapes denote the type of entity.

$$\text{Internalized competition} = \underbrace{(f_3^{\text{post}} - f_3^{\text{pre}})}_{\text{Total effect}} - \underbrace{((f_1^{\text{post}} - f_1^{\text{pre}}) - (f_2^{\text{post}} - f_2^{\text{pre}}))}_{\text{Efficiency gains}} - \underbrace{((f_5^{\text{post}} - f_5^{\text{pre}}) - (f_2^{\text{post}} - f_2^{\text{pre}}))}_{\text{Market power}}$$

5.2 Empirical strategy

This section presents the main results of the paper: the negative effect of common lending on borrowers' investment. I use variation in the structure of the lending network that is induced by bank mergers to identify the effect of common lending on borrowers. Conditional on firm observables, I compare changes in the investment rate of borrowers before and after a merger involving one of their lenders. At the industry level, I differentiate between *out-of-market* and *in-market* mergers, where in-market mergers involve two lenders that have been financing firms in that industry, and therefore increase common lending after merging. In contrast, a merger is out-of-market for a given industry if only one of the merging banks was lending to firms in it, and thus the merger does not increases the joint industry-portfolio of borrowers. Any one bank merger can be - and usually is - in-market for some industries and out-of-market for others. Identification relies on the assumption that, from a borrowing firm's point of view, the timing of a merger that involves one of its lenders and whether it happens to be in-market or out-of-market for its industry are uncorrelated with unobservables that determine the investment or borrowing rates, like the firm's future prospects, other than through the mechanism described above.

I begin by documenting the decline in the investment rate of borrowers following mergers that involve their financiers, and then proceed to explore the underlying mechanisms. I estimate Equation 3:

$$I_{jt} = \sum_{k=-5}^{5} \alpha_k \mathbb{I}[\tau_{jt} = k] + X_{jt}\gamma + \delta_j + \xi_t + \varepsilon_{jt} \tag{3}$$

Where I_{jt} is the investment rate of firm j in year t, $\mathbb{I}[\tau_{jt} = k]$ is an indicator function that equals 1 if firm j in year t is k years away from a merger event involving one of its lenders. X_{jt} is a vector of firm characteristics, including firm size, market value, leverage, short and long term debt and leasing, cash holdings, and Tobin's Q. δ_j and ξ_t are firm and year fixed effects, and ε_{jt} is an *iid* error term. Standard errors are clustered at the merger level.

I plot the estimated coefficients vector α_k from Equation 3 in Figure 5.2. The figure shows that the investment rate of borrowers drops in the years after a merger which involves one of their lenders. The plot presents results from a simple unconditional model, without other covariates or fixed effect, and a saturated model, with the above covariates, firm and year fixed effects, and corrected for potential dynamic heterogeneity in the treatment effects following Sun and Abraham (2021). The results are qualitatively similar across the two models, suggesting that the effect is not driven by differences in borrowing firms or general time trends in the data. I find that the investment rate of borrowers gradually declines by about 5 percentage points, or one third, over a period of three years following a merger, and does not seem to recover in the next few years.

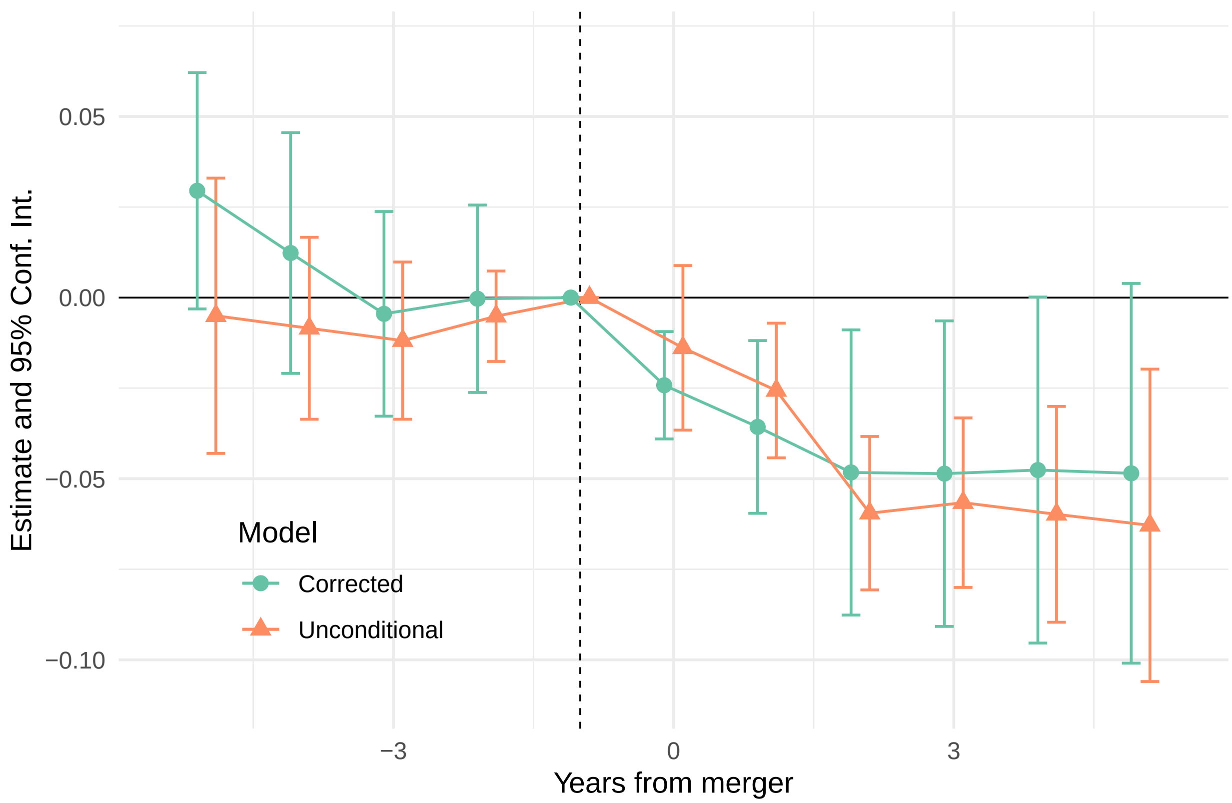


Figure 5.2: The effect of bank mergers on borrower investment rate. The figure plots the relative-year coefficients α_k from Equation 3, with and without the inclusion of firm and year fixed effects and a correction for dynamic heterogeneity in the treatment effects. Years are relative to merger-shock. Observations are at the firm-year level. Standard errors, clustered by merger, are in parentheses. See Table 5.1 for more detail.

A potential concern regarding the causal effect could be the endogeneity of borrower investments and lender mergers: First, it may be that lenders with a portfolio of high investment and high growth borrowers are more likely to become acquisition targets. If investment levels are inefficiently high, the bank may be targeted for acquisition as a result of poor performance, and investment rates are subsequently reduced. It may also be that lenders whose portfolio of borrowers is under-performing - and thus cutting back on investments - are also more likely to be targets of acquisitions. In the former case, the effect is still due to the merger, while in the latter the effect is driven by selection.

I address this by introducing a variable to capture a characteristic of the merging banks and industry: In-market$_j$ equals 1 if both banks were lending in firm j's industry prior to the merger, and 0 otherwise. I estimate Equation 4:

Table 5.1: The effect of bank mergers on borrower investment rate

	Investment rate			
	(1)	(2)	(3)	(4)
Year = -5	-0.005	-0.005	0.029*	0.025
	(0.018)	(0.015)	(0.015)	(1.331)
Year = -4	-0.008	-0.008	0.012	-0.006
	(0.012)	(0.015)	(0.015)	(1.023)
Year = -3	-0.012	-0.012	-0.004	-0.025
	(0.010)	(0.015)	(0.013)	(0.018)
Year = -2	-0.005	-0.005	0.000	-0.013*
	(0.006)	(0.015)	(0.012)	(0.006)
Year = 0	-0.014	-0.014	-0.024***	-0.026
	(0.011)	(0.015)	(0.007)	(0.016)
Year = 1	-0.026**	-0.026	-0.036***	-0.054***
	(0.009)	(0.015)	(0.011)	(0.013)
Year = 2	-0.060***	-0.060***	-0.048**	-0.047***
	(0.010)	(0.015)	(0.018)	(0.010)
Year = 3	-0.057***	-0.057***	-0.049**	-0.048***
	(0.011)	(0.015)	(0.020)	(0.013)
Year = 4	-0.060***	-0.060***	-0.048*	-0.049**
	(0.014)	(0.015)	(0.022)	(0.018)
Year = 5	-0.063***	-0.063***	-0.049*	-0.040*
	(0.020)	(0.015)	(0.024)	(0.020)
Observations	4,635	4,635	4,635	4,611
Dependent variable mean	0.128	0.128	0.128	0.128
R^2	0.065	0.123	0.595	0.708
Firm fixed effects			✓	✓
Year fixed effects			✓	
Year-Sector fixed effects				✓

Notes: The table reports the relative-year coefficients α_k from Equation 3. Column 1 is the basic form, without other covariates. Column 2 accounts for potential dynamic heterogeneity in the treatment effects. Column 3 further includes firm and year fixed effects, and column 4 replaces the year fixed effects with year-industry. Years are relative to merger-shock. Observations are at the firm-year level. Standard errors, clustered by merger, are in parentheses.

$$I_{jt} = \sum_{k=-5}^{5} \alpha_k \mathbb{I}[\tau_{jt} = k] + \sum_{k=-5}^{5} \beta_k \mathbb{I}[\tau_{jt} = k] \times \text{In-market}_{jt} + X_{jt}\gamma + \delta_j + \xi_t + \varepsilon_{jt} \qquad (4)$$

Where In-market$_{jt}$ is the indicator function described above, and the rest of the notation is as in Equation 3. This specification allows me to differentiate between the effect of mergers involving two lenders that have been active in the same industry, and therefore increasing the joint industry-portfolio of borrowers, and mergers involving lenders that have been active in different industries, and do not increase the joint industry-portfolio of borrowers. This common lending effect is captured by the coefficient vector β_k in Equation 4, which I plot in Figure 5.3. I find that after an in-market bank merger, the investment rate of borrowers drops by about 3pp more, compared to an out-of-market bank merger. The overall effect of bank mergers on investment is driven almost entirely by in-market mergers, which I attribute to common lending, and is barely present for out-of-market mergers.

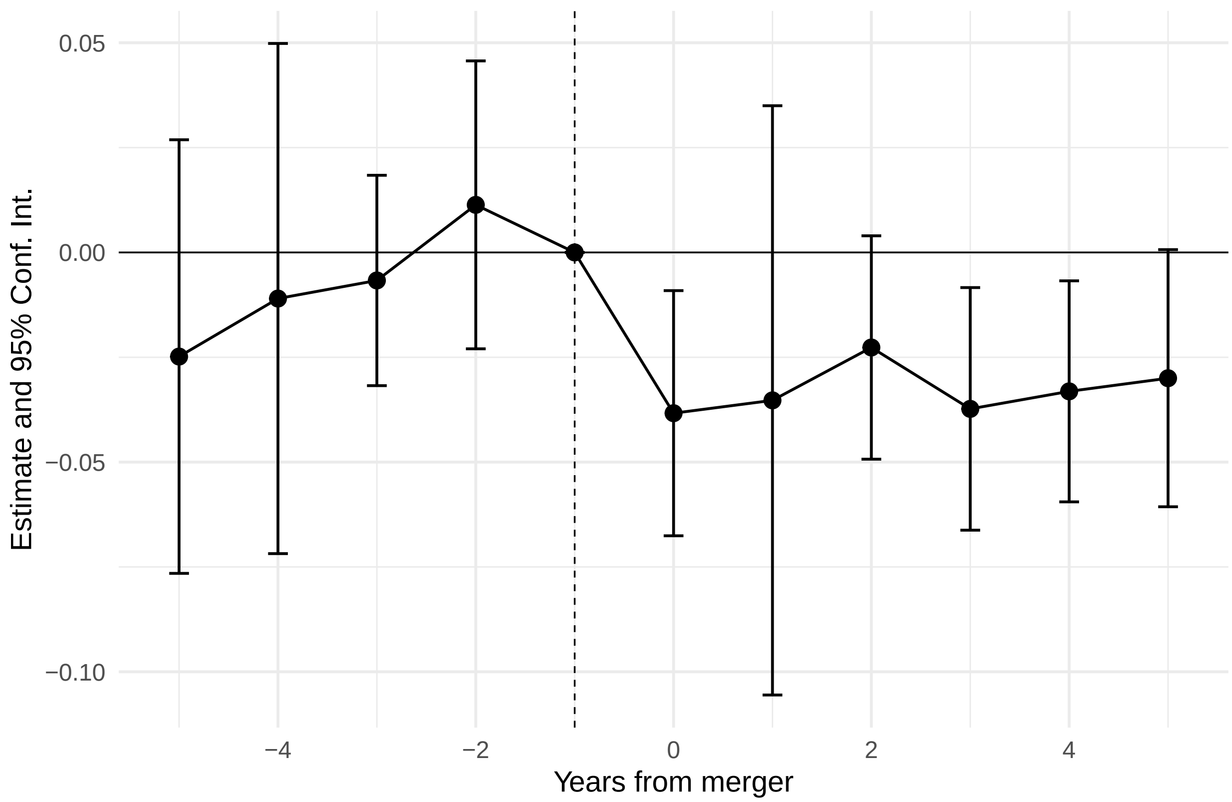


Figure 5.3: The effect of common lending on investment. The figure plots the β_k vector of coefficients from Equation 4, which captures the interaction of the in-market indicator with relative-year dummies. The estimates are corrected for dynamic heterogeneity in the treatment effect. Years are relative to merger-shock. Observations are at the firm-year level. The estimation includes firm and sector-year fixed effects. Standard errors, clustered by merger, are in parentheses. See Table A.2 for more detail.

Theory suggests that the effect of common lending is stronger when banks have market power over borrowers. To test this, I estimate the differential effect of common lending on borrowers by whether firms have good outside options. As a proxy for the existence of good outside options, I use the credit rating of a borrower's lowest rated bond issue, in the year prior to the merger, as a dummy variable: investment-grade versus high-yield. The intuition is that for smaller and more opaque borrowers, banks have an advantage over the market in their ability to collect information and monitor, and therefore can both offer better terms and be harder to replace, making borrowers more dependent on the bank for credit. I estimate Equation 5, the static version of Equation 4, interacted with a dummy variable to capture bank market power:

$$\begin{aligned} I_{jt} = {} & \beta_1 \text{Post}_{jt} \times \text{In-market}_j \times \text{Low rating}_j \\ & + \beta_2 \text{Post}_{jt} \times \text{In-market}_j \\ & + \beta_3 \text{Post}_{jt} \times \text{Low rating}_j \\ & + X_{jt}\gamma + \delta_j + \xi_t + \varepsilon_{jt} \end{aligned} \tag{5}$$

Where Low rating_j is an indicator variable that equals 1 if the borrower's credit rating is below investment grade in the year prior to the merger, and 0 otherwise. The static specification allows me to interact the time and treatment variables with firm characteristics without losing statistical power, and estimate the effect of common lending on different types of borrowers. The post-merger and low rating interaction coefficient, β_3, captures the market power effect of a merger, while the post-merger and in-market interaction coefficient, β_2, captures the common lending effect. β_1 captures the added portfolio effect of common lending in the presence of market power. I report the results in Tables 5.2 and 5.3.

Table 5.2 uses the investment rate as the dependent variable and compares several specifications. The dependent variable is the investment rate of the borrower in columns (1) and (2), and the natural log of the investment rate in columns (3) and (4). All specifications include firm and year fixed effects, and standard errors are clustered by merger. The results suggest that both market power and common lending have a negative effect on investment rates. Bank mergers reduce investment rates by about 2.5pp (25%) due to the rise in bank market power, and by 1.7pp (17%) due to internalized competition among borrowers. The triple interaction term, capturing the joint effect of market power and common lending is slightly positive and statistically insignificant, suggesting that the effect of common lending is similar for borrowers with low and high credit ratings, and is independent of market power. It also can not be explained by differences across borrowers, seasonality, or differences along the business cycle, nor by changes in borrower characteristics. The proposed mechanism of direct control versus debt overhang, however, in theory does depend on market power.

Table 5.3 introduces credit spread and loan size as the dependent variables, offering some insight into the mechanism behind the previous results. Column (1) repeats the preferred specification from Table 5.2 and uses the investment rate as the dependent variable, while columns (2) and (3) instead use credit spread and loan amount, respectively. The results suggest that common lending has a differential effect on loan spreads and amount across borrowers with and without market power. In column (2), I show that common lending decreases credit spreads for borrowers with market power by 14 basis points (bp), but increases them by 22bp for borrowers without market power. Column (3) complements the above findings in a qualitative sense, although the estimates are too noisy to have a precise interpretation: loan size seems to increase for borrowers with market power, but decrease for borrowers without market power.

The results are consistent with the differential treatment suggested above. In-market mergers are more likely to induce common lending, creating incentives for banks to dampen investment and competition. These incentives are present regardless of the bank's market power, but the means of achieving the goals are different. For borrowers with good alternatives, banks cannot arbitrarily restrict supply, increasing credit spreads and decreasing loan sizes. Instead, they do the opposite: offer cheaper credit to incentivize less aggressive product-market strategies on the side of borrowers, thanks to lower debt overhang. Conversely, for borrowers without good alternatives, banks can exert market power, restricting supply without great substitution, on top of their ability to directly exercise control, steering the extent and purpose of borrower investments through loan covenants.

Table 5.2: The effect of common lending on borrower investment rates

	Investment rate		log(Investment rate)	
	(1)	(2)	(3)	(4)
Post × Low rating	-0.024**	-0.025**	-0.292***	-0.254**
	(0.008)	(0.009)	(0.090)	(0.088)
Post × In-market	-0.016***	-0.017***	-0.158***	-0.175**
	(0.002)	(0.004)	(0.045)	(0.070)
Post × Low rating × In-market	0.006	0.010	0.131	0.131
	(0.014)	(0.015)	(0.094)	(0.090)
Observations	5,988	5,988	2,845	2,845
Dependent variable mean	0.066	0.066	-2.245	-2.245
R^2	0.686	0.715	0.676	0.689
Firm fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Firm characteristics		✓		✓

Notes: The table reports coefficients from Equation 5. Observations are at the firm-year level. The estimation includes firm and year fixed effects. Firm characteristics are size, markup, leverage, Tobin's Q, and mean loan maturity. Standard errors, clustered by merger, are in parentheses.

5.3 Within firm variation

Finally, I use within-firm variation across loans to decompose changes in credit spreads and loan amounts into margins that can be attributed to efficiency gains due to a merger,

Table 5.3: The effect of common lending on borrowers

	Investment rate (1)	Spread (2)	log(Amount) (3)
Post × Low rating	-0.025**	10.638	0.199
	(0.009)	(16.739)	(0.152)
Post × In-market	-0.017***	-13.947*	0.172
	(0.004)	(7.363)	(0.203)
Post × Low rating × In-market	0.010	22.745***	-0.066
	(0.015)	(5.744)	(0.167)
Observations	5,988	5,988	5,987
Dependent variable mean	0.066	140.605	5.159
R^2	0.715	0.681	0.766
Firm fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓
Firm characteristics	✓	✓	✓

Notes: The table reports coefficients from Equation 5. Observations are at the firm-year level. The estimation includes firm and year fixed effects. Firm characteristics are size, markup, leverage, Tobin's Q, and mean loan maturity. Standard errors, clustered by merger, are in parentheses.

market power due to the exit of a rival bank, and portfolio effects due to common lending. The results of the previous subsection are derived from data aggregated at the firm-year level, and may therefore confound changes in credit supply by the merging banks with those by other banks in the market. For example, a decrease in credit spreads by the merging banks may quickly be matched by rival banks, causing me to overestimate the effect of common lending. I address this using higher resolution data at the borrower-bank-year level, and estimate Equation 6:

$$\begin{aligned} \mathrm{Y}_{jbt} = {} & \beta_1 \mathrm{Post}_{jt} \times \text{In-market}_j \times \mathrm{Merged}_b \\ & + \beta_2 \mathrm{Post}_{jt} \times \text{In-market}_j \\ & + \beta_3 \mathrm{Post}_{jt} \times \mathrm{Merged}_b \\ & + X_{jbt}\gamma + \delta_{jb} + \xi_t + \varepsilon_{jbt} \end{aligned} \tag{6}$$

Where Y_{jbt} is the outcome of interest - either credit spread or loan amount - for firm j's borrowing from bank b in year t. Post_{jt} is an indicator variable that equals 1 for years after the merger, In-market_j is an indicator variable that equals 1 if both merging banks are financing firms in j's industry, and Merged_b is an indicator variable that equals 1 if bank b is one of the merging parties. δ_{jb} is a bank-firm fixed effect, and ξ_t is a year fixed effect. ε_{jbt} is an *iid* error term.

The omitted category represents loans from banks that are not involved in a merger, to firms where only one of the merging banks is active, after the merger. β_3 captures changes in lending by a merging party, across borrowers and industries where the counterparty was not lending (and thus the merger did not involve bank exit), after a merger. I interpret this as a measure of the passthrough of efficiency gains due to the merger. I find that synergies due to bank mergers, or their passthrough, are overall minimal: A 1.5-3.8 basis points (1 to 3 percent) decrease in credit spreads, and an insignificant change in loan amounts. β_2 captures changes in lending by a bank that is not part of a merger, in industries where two rival banks merged. Such banks experience no direct efficiency gains from the merger, but may gain market power due to the exit of a rival bank. I find that the competitive effect is an order of magnitude larger than the synergistic: A rival bank's exit increases credit spreads by 15bp (12%) and decreases lending by 69 million USD (21%). Finally, β_1 captures changes in lending by a merging bank, in industries where the two rival banks merged. Such banks experience both direct efficiency gains from the merger, and indirect gains from the exit of a rival bank, but this margin captures the additional portfolio effect: the increase in common lending to competing borrowers. The portfolio effect seems to dominate the other two margins: common lending decreases credit spreads by 73bp (58%) and increases lending by 82-87 million USD (25 to 27 percent).

5.4 Changes in load purpose

I have presented empirical evidence that common lending decreases investment rates among borrowers, and propose two different mechanisms by which lenders may achieve this: direct

Table 5.4: Efficiency gains, market power, and portfolio effects

	Amount			Spread		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × In-market	-69.42**			14.66**		
	(22.47)			(4.58)		
Post × Merged	-4.41	-14.30	-35.71	-3.52	-1.50*	3.78*
	(14.59)	(13.10)	(49.55)	(5.47)	(0.59)	(1.81)
Post × In-market × Merged	19.75	81.58***	86.82*	-27.03***	-48.52***	-72.65***
	(32.40)	(15.66)	(38.43)	(5.34)	(4.12)	(1.68)
Observations	5,031	5,031	5,031	4,467	4,467	4,467
Dependent variable mean	323.1	323.1	323.1	123.0	123.0	123.0
R^2	0.310	0.501	0.709	0.739	0.840	0.925
Firm fixed effects	✓	✓		✓	✓	
Bank fixed effects	✓	✓		✓	✓	
Year fixed effects	✓			✓		
Year-Sector fixed effects		✓	✓		✓	✓
Firm-Bank fixed effects			✓			✓

Notes: The table reports the results of estimating Equation 6. Observations are at the borrower-bank-year level. The dependent variable is either the loan amount or the credit spread. Standard errors, clustered by merger, are in parentheses.

control and credit restriction when banks hold market power over borrowers, or more favorable terms for borrowers with good outside options. How can we tell if these measures achieve the intended goal? Are banks successful in steering their borrowers away from aggressive strategies? I investigate this using data on the stated purpose of corporate loans.

I follow Berg, Saunders, and Steffen (2020) and classify loans into four categories: corporate, working capital, transaction, and other. In particular, I classify a loan's purpose as "transaction" if its reported use is any of the following purposes: merger, takeover, acquisition line, spinoff, leveraged buyout (LBO), management buyout (MBO), secondary buyout (SBO), and dividend recapitalizations. I find that after bank mergers, loans are less likely to be used for "aggressive" purposes, like acquisitions.

Figure 5.4 plots the average share of loans in each category, by year and bank. Notably, in the years after a lender's merger, the share of loans it issues for transaction purposes decreases in half, from about 30% to 15%. Instead, the share of working capital loans increases by roughly the same amount, from about 5% to 20%, accounting for most of the decline in the transaction category of loans. These data suggest borrowers tend to less aggressive strategies after their lenders merge, which is consistent with the hypothesis that lenders may incentivize or steer their borrowers away from fierce competition.

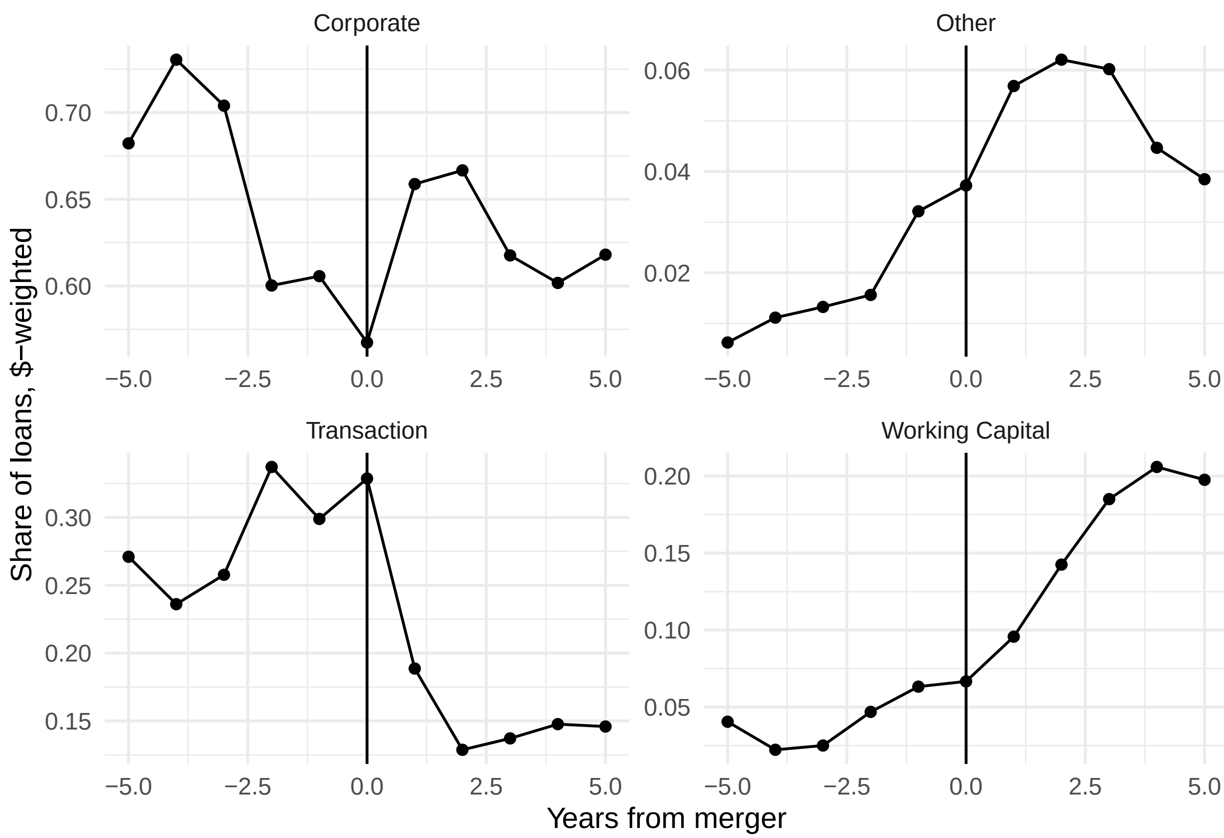


Figure 5.4: Share of loans by primary purpose. This figure plots the average share of loans in each category, by year relative to merger, weighted by loan value. The categories are corporate, working capital, transaction, and other, following Berg, Saunders, and Steffen (2020).

5.5 Counterfactual investment rates

Finally, I estimate the counterfactual investment rates of borrowers, had their lenders not merged. I use the same specification as in Equation 4, the dynamic DID model, while capping τ_{jt} from above at -1. In other words, I recode any post-merger year as pre-merger, and use the model to estimate the predicted counterfactual investment rate. I then aggregate these predictions to the year level, and plot them against the actual investment rates.

Figure 5.5 shows the observed and counterfactual average investment rates of borrowers, by year. The figure suggests that the counterfactual investment rates are higher than the actual rates, especially in later years. Absent the mergers, investment rates would have remained stable, or even increased slightly, instead of dropping by 8pp over the past three decades. If not for the mergers, investment rates would have increased by about 2pp throughout the sample, reaching about 16-17pp in later years, or a 4-6pp increase over the actual investment rates of 11-12pp.

6 Conclusion

This paper relates two contemporaneous trends in the US economy: the decline in corporate investment and the consolidation of the banking sector. I propose a market mechanism that links the two: bank mergers lead to more frequent common lending - where a single bank lends to multiple competing firms - which in turn incentivizes banks to dampen competition among their borrowers.

I develop a stylized model of lender-borrower relations that builds on the problem of debt overhang and its inherent moral hazard: shielded from downside risk, equity holders may be incentivized to pursue aggressive strategies that are detrimental to debtholder value. I show how debt overhang can incentivize more aggressive competition and greater investment, and how a bank lending to rivals can internalize these incentives and optimally offer better terms to dampen competition.

I use events of bank mergers and data on corporate loans and firm accounting to show the effects of common lending. I find that common lending decreases investment rates by 1.7pp, or about 25%. Exploring the effects on credit spreads and loan amounts, I find that it relates to market power: banks may be able to exert direct control over investments through loan covenants or restrict overall credit supply when it is costly for borrowers to switch, while they tend to offer better terms to borrowers with good outside options. The portfolio effect of common lending decreases credit spreads by 73 basis points and increases loan size by 87 million USD (27%). These efforts to reduce competition seem to be effective, as firms are about half as likely to borrow for aggressive purposes, like acquisitions, after their lenders merge. Combined, bank mergers can account for a large part of the documented decline in investment rates among corporate borrowers, and in counterfactual analysis, I find that investment rates could have remained stable, had banks not consolidated.

My results shed new light on the interactions of lenders and borrowers, and provide evidence of banks serving as market coordinators due to spillover of competitive effects. It is possible

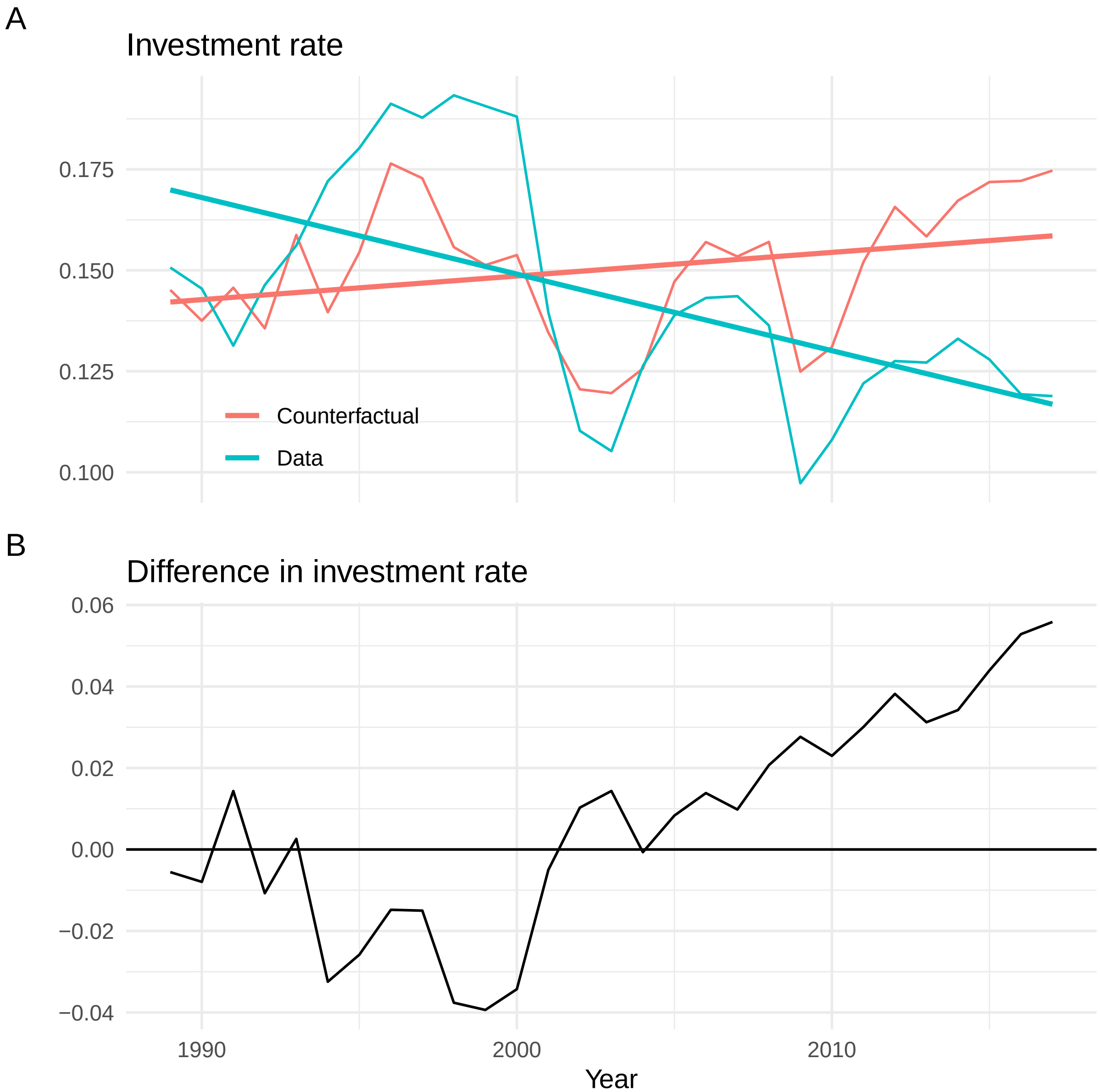


Figure 5.5: Counterfactual investment rates, levels and difference. Panel A plots the observed average investment rate of borrowers, by year, against the counterfactual investment rates, had the lender not merged. Linear fits are included. Panel B plots the difference between the two. The counterfactual rates for each borrower are estimated using the dynamic DID model, and aggregated at the year level.

that banks are coercing firms into suboptimal rates of investment by exploiting the incentive structure of shareholders. It could also be that this channel of tacit collusion may drive firms to intentionally establish strategic relationships with banks who also finance their rivals, and use common lenders to tie all firms to the mast. Regardless, this portfolio channel of bank mergers has been generally overlooked by competition authorities in merger evaluation, despite the potential for indirect inefficiency and welfare loss. Taken into account, it may warrant stricter merger control with respect to the financial sector.

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A Additional figures and tables

Table A.1: Summary statistics of US corporate borrowers. The table reports the mean, standard deviation, median, and 5th and 95th percentiles of key variables for US corporate borrowers. Assets, debt, sales, CapEx, PP&E, and loan amount are in USD million, loan spread is in basis points, loan maturity is in months, investment rate, inventory needs, and intangible asset share are in percentage points. Observations are at the firm-year level.

	Obs	Mean	Std. dev.	Median	5%	95%
Loan amount	30042	441.14	1650.15	100.00	4.00	1750.00
Loan spread	26667	215.73	139.60	200.00	32.50	455.00
Loan maturity	28241	47.28	26.07	48.00	12.00	86.00
Investment rate	30042	0.14	0.13	0.10	0.03	0.40
Inventory needs	30042	0.11	0.12	0.09	0.00	0.31
Total assets	30042	4200.26	15402.54	608.36	21.13	18247.64
Intangible assets	27100	1099.97	5923.16	58.08	0.00	3825.84
Intangible asset share	27100	0.19	0.21	0.11	0.00	0.62
Debt, short-term	30042	180.58	1198.21	6.28	0.00	673.77
Debt, long-term	29993	1105.38	3767.82	150.54	0.00	5108.28
Total sales	30042	3800.94	15305.88	580.26	20.10	15613.35
CapEx	30042	244.00	1087.24	26.62	0.58	1020.65
PP&E	30042	2538.31	12200.16	254.67	5.09	10380.55

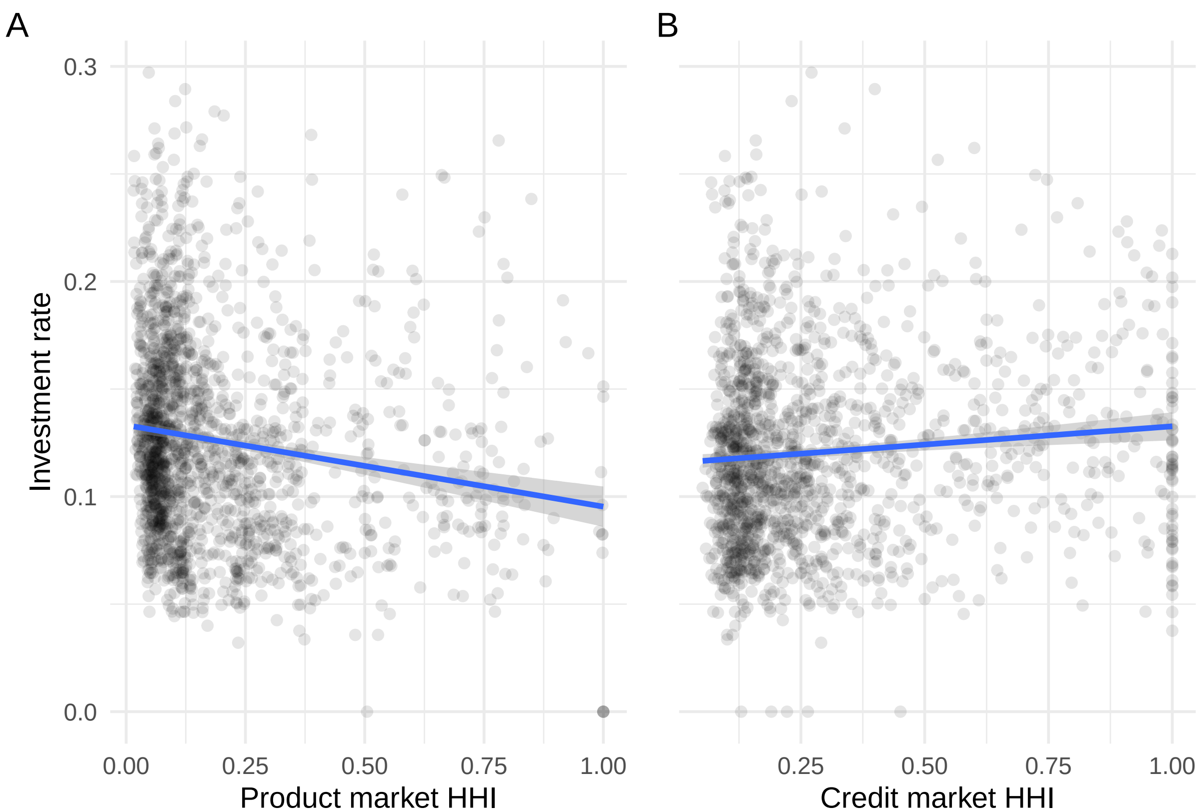

Figure A.1: Product market concentration, credit market concentration, and investment rates. The figure shows the relationship between investment rates and market concentration in the product and credit markets. The left panel shows the relationship between investment rates and the Herfindahl-Hirschman index (HHI) in the product market. The right panel shows the relationship between investment rates and the HHI in the credit market.

Table A.2: The effect of common lending on borrower investment rate

	Investment rate			
	(1)	(2)	(3)	(4)
In-market × Year = -5	-0.001	0.002	-0.010	-0.011
	(0.015)	(0.015)	(0.015)	(0.007)
In-market × Year = -4	-0.001	0.002	0.005	0.001
	(0.011)	(0.015)	(0.027)	(0.024)
In-market × Year = -3	-0.002	0.001	-0.003	-0.001
	(0.009)	(0.015)	(0.011)	(0.004)
In-market × Year = -2	0.004	0.007	0.029	0.025
	(0.006)	(0.015)	(0.017)	(0.015)
In-market × Year = 0	-0.003	0.000	-0.030*	-0.040**
	(0.013)	(0.015)	(0.016)	(0.014)
In-market × Year = 1	-0.015**	-0.012	-0.018	-0.020
	(0.007)	(0.015)	(0.033)	(0.034)
In-market × Year = 2	-0.038***	-0.035**	-0.016	-0.011**
	(0.008)	(0.015)	(0.010)	(0.004)
In-market × Year = 3	-0.043***	-0.039**	-0.023*	-0.010
	(0.012)	(0.015)	(0.012)	(0.012)
In-market × Year = 4	-0.049***	-0.046***	-0.028**	-0.025***
	(0.016)	(0.015)	(0.013)	(0.004)
In-market × Year = 5	-0.051**	-0.048***	-0.034*	-0.031***
	(0.021)	(0.015)	(0.016)	(0.004)
Observations	5,654	5,653	5,654	5,653
Dependent variable mean	0.126	0.126	0.126	0.126
R^2	0.052	0.114	0.589	0.619
Firm fixed effects			✓	✓
Year fixed effects			✓	✓

Notes: The table reports the relative-year coefficients β_k from Equation 4. Column 1 is the basic form, without additional covariates. Column 2 corrects for dynamic heterogeneity in the treatment effects. Column 3 includes firm and year fixed effects, and column 4 both corrects for dynamic heterogeneity in the treatment effects and includes firm and year fixed effects. Years are relative to merger-shock. Observations are at the firm-year level. Standard errors, clustered by merger, are in parentheses.

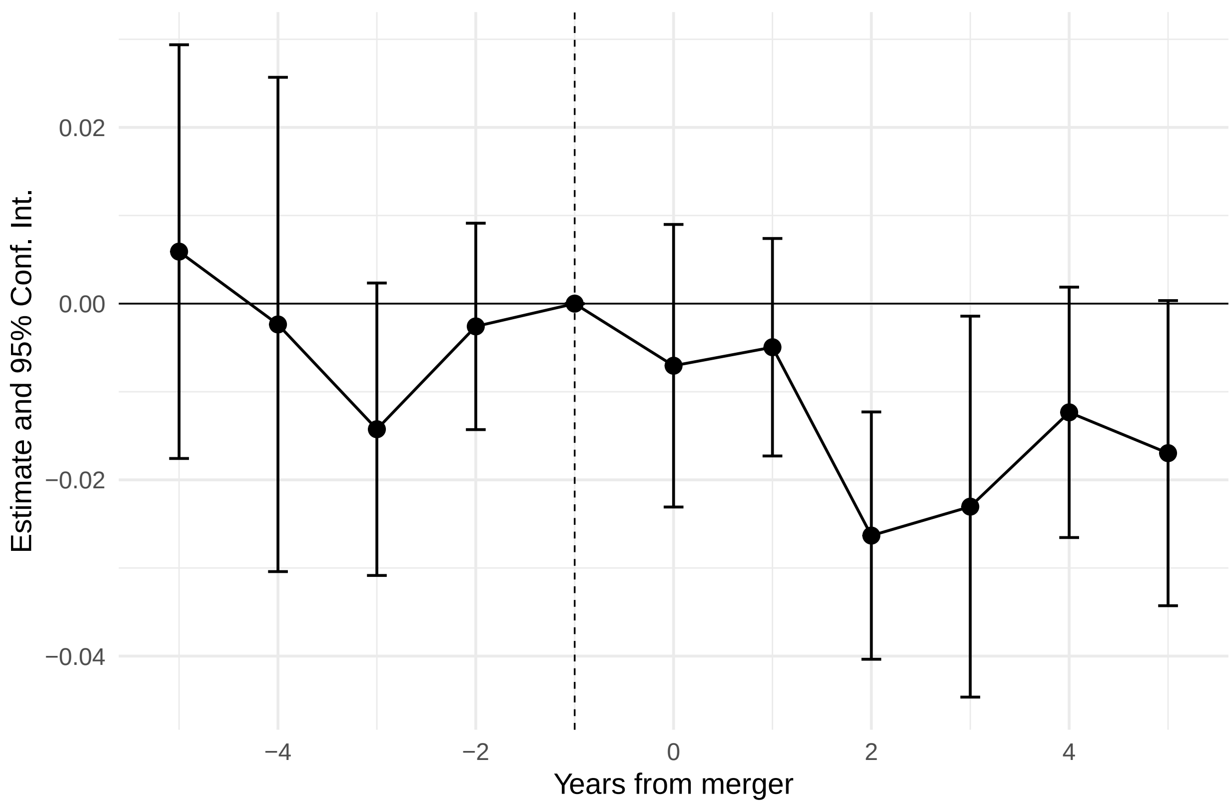

Figure A.2: Robustness: bond ratings. The figure repeats the results of 5.3 and A.2, using bond ratings to proxy for outside options, instead of the in-market indicator. Firms are considered to have good access if their lowest rated bond is investment grade. Years are relative to merger-shock. Observations are at the firm-year level. The estimation includes firm and sector-year fixed effects. Standard errors, clustered by merger, are in parentheses.

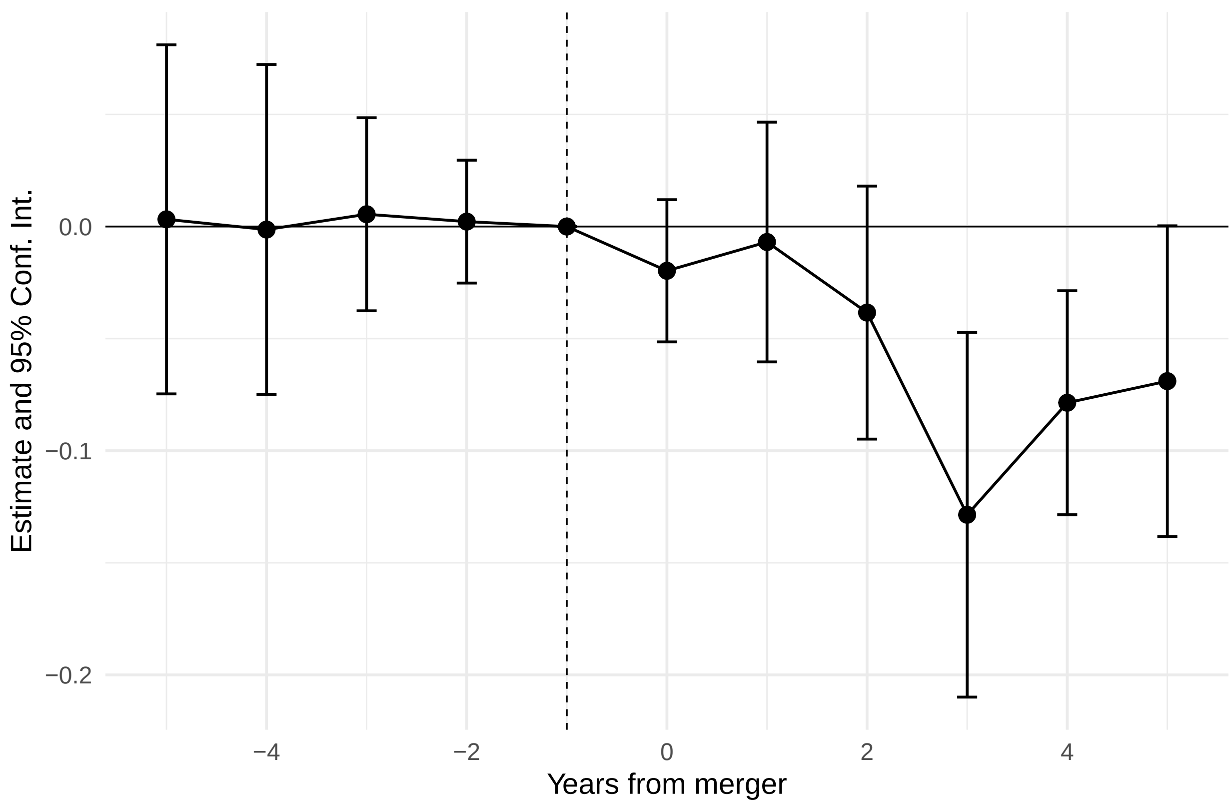

Figure A.3: Robustness: bond market access. The figure repeats the results of 5.3 and A.2, using the bond market access as a proxy for outside options, instead of the in-market indicator. Firms are considered to have good access if they issue more than one bond per quarter. Years are relative to merger-shock. Observations are at the firm-year level. The estimation includes firm and sector-year fixed effects. Standard errors, clustered by merger, are in parentheses.