

The Boundaries of the Farm and the Death of Small Banks

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Abstract

Using a novel source of exogenous variation in borrowers' structure driven by subsidy-induced consolidation in the agricultural sector, I show that as farms consolidate, large banks capture a greater share of deposits because large borrowers demand large loans, creating a comparative advantage for large banks. In response, large banks expand their branch networks and small bank mergers become more common, creating more concentrated local credit markets. The resulting structure reduces competition and reduces local deposit rates. These findings reveal how consolidation in the real economy can drive structural change within the banking sector and affect credit pricing.

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1 Introduction

How do lenders respond to consolidation in the industries to which they lend? Over the past few decades, firm consolidation has been widespread, with more than 75% of U.S. industries experiencing an increase in concentration (Grullon, Larkin, and Michaely (2019)). Prior research shows that, in product markets, consolidation among buyers strengthens their bargaining power, leading suppliers to cut prices, merge, or exit (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009); Bhattacharyya and Nain (2011)). In credit markets, where banks are the suppliers of credit, the implications of borrower consolidation are less clear.

Following from industrial organization (IO) theory, as smaller borrowers are acquired and the remaining firms expand in scale, credit demand may shift toward larger loans, allowing banks with the capacity to supply them to gain market share and increasing concentration in the financial sector (Cooley and Quadrini (2001); Crouzet and Mehrotra (2020)). Yet, banking theory shows that incumbent banks have informational advantages, making it costly for borrowers to establish new ties and for new banks to enter (Diamond (1984); Rajan (1992); Boot (2000); Dell’Ariccia (2001)). When small businesses consolidate, they may continue their existing relationships with the banks that financed them initially, consistent with Brennecke, Jacewitz, and Pogach (2025). In this case, consolidated firms may channel new credit demand toward these incumbent lenders, limiting the extent to which industry consolidation reorganizes the structure of banking markets.

This paper establishes a causal connection between the consolidation of product markets and the structure of financial markets. Using an exogenous shock to an industry’s optimal firm size, I show that borrower consolidation reorganizes local banking markets, altering the composition of lenders and the interest rates offered on broader retail financial products. As small firms grow in scale, large banks gain more deposits and expand their branch networks relative to small banks, suggesting that lending relationships tied to firm size do not persist once firms expand.

To test whether firm consolidation changes the structure of banking markets, I use a policy shock that accelerated borrower consolidation in U.S. agriculture. The 1996 Federal Agriculture Improvement and Reform (FAIR) Act replaced six decades of price supports, which guaranteed farmers a price floor, with fixed, decoupled payments based on a farm’s historical base acres and yields from 1981-1985. Unlike earlier subsidy programs that tied payments to planting decisions, the FAIR Act was intended to reduce government intervention and let production decisions follow market demand. The policy applied to major “commodity” crops (wheat, corn, sorghum, barley, oats, rice, upland cotton, and later oilseeds

and peanuts), where profitability primarily depends on expanding acreage and lowering per-unit costs through scale economies (Duffy (2009); Langemeier (2013); Sumner (2014)). By providing predictable cash transfers to otherwise liquidity-constrained farms (Khanal and Omobitan (2020); Thakor (2023)), the program enabled larger operations to borrow, expand landholdings and equipment investment, and exploit economies of scale, which accelerated consolidation (Becker (2001); Roberts and Key (2008)).

I construct an instrumental variable (IV) using a difference-in-differences model in the first stage that exploits variation in predicted subsidy payments to isolate exogenous shifts in farm consolidation. The instrument assigns estimated county-year subsidy exposure based on historical crop planting patterns that farmers could not have anticipated at the time they made those planting decisions and national, crop-specific subsidy rates set uniformly by federal policy from 1996 to 2014. Because the agricultural industry is place-based, local lenders typically play a central role in agricultural credit markets, making this an ideal setting to study how borrower-side consolidation affects local banking markets (Akhavein et al. (2004)).

Following the agricultural economics literature, I measure county-level farm concentration using harvested acre-weighted median farm size (the “midpoint”) (Roberts and Key (2008)). In the first stage of my IV strategy, I use a continuous difference-in-differences design to estimate whether increased subsidy payments lead to increased farm concentration. Consistent with the findings of Roberts and Key (2008), I first document that subsidy payments contribute to a 65% increase in county-level farm concentration between 1997 and 2012. I then use this variation as an instrument for borrower consolidation. A one standard deviation increase in predicted farm concentration of about 359 acres leads to a 4% rise in local banking concentration, comparable to two out of ten banks exiting a county. Importantly, if farm consolidation drives banking consolidation, the effect should be most visible in areas where the policy shock matters. Consistent with this prediction, I find that banking consolidation is concentrated in rural counties, where agricultural activity dominates the local economy, and absent in urban counties, where the agriculture-specific shock has little relevance.

My identification strategy isolates the causal effect of farm consolidation on bank consolidation only through the component of farm consolidation that is driven by the subsidy payments. The exogeneity of the instrument rests on two key features. First, historical crop shares were determined before the policy was enacted, and second, national subsidy rates are uniform, predetermined in six-year intervals with each farm bill authorization, and set independently of local economic conditions. I also include county and year fixed effects and control for banking deregulation using Célerier and Matray (2019)’s state-year-level index.

A strong first-stage relationship further supports the interpretation that shifts in borrower structure, rather than changes in banking structure, drive the results.

Borrower consolidation may not only increase local credit market concentration but also change the composition of banks. Because of scale and regulatory rules, small banks may be unable to finance the larger loans demanded by consolidated borrowers. In 2004, banks warned the Office of the Comptroller of the Currency that the single-borrower cap of 15% of risk-based capital reduced community banks' competitiveness, as farm consolidation had "resulted in fewer, but larger, farms with expanded credit needs" (Office of the Comptroller of the Currency (2004)). Even after the cap was raised, lending limits remained binding for many small agricultural banks (Ellinger (2012)). These constraints suggest that small banks may be structurally disadvantaged when serving larger borrowers, whereas large banks may be better positioned to expand in consolidating markets.

Moreover, the traditional advantages of small banks, relationship lending and the use of soft information, become less valuable as borrowers grow (Petersen and Rajan (1994)). As borrowers consolidate, their financing needs may shift towards hard-information intensive credit demands, such as many credit lines or commodity-linked hedging services. Large banks, with broader product offerings, larger internal capital markets, and dedicated risk-management services, may be better positioned to meet these demands (DeYoung, Hunter, and Udell (2004); Berger et al. (2005)). As a result, borrower consolidation may reallocate market share in local credit markets toward large entrants and away from smaller incumbents (Dell'Ariccia and Marquez (2004)).

I find that borrower consolidation reallocates credit toward banks with the scale and capacity to serve larger borrowers, while smaller banks adapt primarily through consolidation rather than expansion. On the extensive margin, large banks are 7.6% more likely to enter consolidated counties following a one standard deviation increase in farm concentration. On the extensive margin, they expand more aggressively once present, adding about 29% more new branches than small banks every five years and gaining on average \$6,638 more deposits per resident. In contrast, mergers between small banks increase but remain unchanged for other banks. This pattern suggests that small banks, facing lending constraints due to their size, adapt through consolidation, whereas large banks increase their presence and market share. Consistent with the role of regulatory limits, banks whose lending caps are below the nationwide median reduce their branch counts by 10% and experience nearly four times lower deposit growth per capita than unconstrained banks following a one standard deviation increase in farm consolidation.

If large banks are entering to serve larger borrowers, their lending portfolios should reflect an increase in agricultural loan volumes. Using imputed county-level data (following Key,

Burns, and Lyons (2019) and Ifft et al. (2024)), I find that a one standard deviation increase in farm concentration raises large banks' total agricultural loan volume by 64.5%. Small banks show no overall change. Decomposing by loan type, I find that real estate loans, often collateralized by farmland, increase for large banks but remain flat for small banks, consistent with small banks being unable to extend loans that match the collateral value of consolidated farms. In the case of non-real estate loans, both large and small banks increase lending, but large banks expand their volumes by nearly three times as much, suggesting that borrower consolidation primarily benefits institutions capable of serving larger clients.

The effects are even larger for banks that specialize in agricultural lending. In response to a one standard deviation increase in farm concentration, large agricultural banks are over three times more likely to enter a county than large banks overall. They also see deposits per capita rise by 116% following a one standard deviation increase in farm concentration, compared to 35% among small agricultural banks. The effect of farm concentration on lending is similarly magnified within this subset: agricultural lending volumes rise by 125% for large agricultural banks and by 18% for small agricultural banks. Taken together, these results indicate that the shift toward large banks is not just market-wide but is especially pronounced among large agricultural banks, suggesting that institutions with relevant industry expertise capture greater market share in the actively consolidating industry.

Having shown that borrower consolidation influences the structure of local banking markets, I next study its effects on the prices offered by commercial banks for broader consumer financial products. Existing IO theory shows that the effect of buyer consolidation on the prices offered by suppliers depends on the competitiveness of the supplier market (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009)). On one hand, if suppliers have market power, buyer consolidation weakens competition among buyers for supply and leads suppliers to lower prices for all buyers in the market (Galbraith (1952); Snyder (1996)). On the other hand, if suppliers are able to price discriminate, then when buyers consolidate, suppliers will lower prices for large buyers and raise prices for small buyers (Inderst and Valletti (2011)). Within my setting, Kropp and Whitaker (2011) document that farms with more base acres, and therefore larger cash payments under the FAIR Act, receive lower interest rates on their operating loans because these subsidies provide a risk-free source of income. However, it remains unclear whether or how changes in borrower structure spillover into broader consumer financial markets. Consolidated local banking markets could raise prices by exercising market power or lower them to attract deposits and retail customers.

To test the spillover effects, I examine interest rates on the consumer financial products that banks offer, focusing on deposit products and auto loan rates. Following Drechsler, Savov, and Schnabl (2017), I examine the rates offered on three deposit products: savings

deposits (\$10,000 money market accounts), checking deposits (interest-bearing checking accounts), and time deposits (12-month \$10,000 certificates of deposit (CDs)). I find that real savings and checking rates fall by 36 and 21 basis points, respectively. The magnitudes are large: real interest rates change by 30% and 13% relative to their unconditional means, respectively. Time deposit rates are unchanged on average but fall by 36 basis points among large banks, consistent with large banks exerting greater pricing power.

On the lending side, I analyze interest rates on auto loans, which are standardized, broadly held products, and unrelated to farm lending, making them a useful test for spillovers into consumer credit markets. I find that large banks increase the interest rates they offer on auto loan rates by 1.1%, contributing to an overall rise of 81 basis points in auto loan rates for the average county. In contrast, small banks reduce their auto loan rates, potentially to shift their market share toward smaller borrowers. These results show that borrower consolidation affects not just the structure of the banking market, but that this change in structure also leads to follow-on effects on local credit prices.

2 Literature Contributions

This paper contributes to four strands of literature by introducing borrower consolidation as a structural shift in credit demand that alters the supply and composition of financial intermediation.

First, it contributes to research on the determinants of banking market structure. Prior work emphasizes supply-side drivers of consolidation such as deregulation, technology, and economies of scale (Jayaratne and Strahan (1998); Berger, Demsetz, and Strahan (1999); Calomiris (2000)). I highlight a complementary demand-side channel, which follows from IO theory and empirical work showing that buyer concentration can cause supplier concentration (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009)). However, in credit markets, banks of different sizes tend to have different comparative advantages. Small banks rely on soft information and local ties (Petersen and Rajan (1994); Berger and Udell (1995); DeYoung, Hunter, and Udell (2004)), while large banks specialize in standardized and scale-intensive lending (Boot and Thakor (2000); Berger et al. (2005); Alessandrini, Presbitero, and Zazzaro (2009)). Recent empirical work finds that declines in small firm growth reduce deposit growth at small banks, indicating that the decline of one customer base affects the growth of the banks that serve them (Brennecke, Jacewitz, and Pogach (2025)). I show that when small businesses grow and consolidate, the additional credit demand does not translate directly into increased deposit growth at small banks. Instead, borrower consolidation reorganizes local banking markets, with large banks entering affected markets, expanding their

deposit base and branch networks, and changing the composition of local banking. Moreover, building on Brickley, Linck, and Smith (2003), who show that large banks concentrate in urban areas where borrower scale supports centralized operations, I demonstrate that borrower composition can shift through industry consolidation and induce entry by large banks into markets they previously avoided.

Second, it contributes to the literature on the connection between product and credit markets. Prior work shows that credit markets affect product market outcomes, as leverage can commit firms to more aggressive output, and banks can influence competition among firms in product markets by limiting entry and softening price competition (Brander and Lewis (1986); Cetorelli and Strahan (2006); Saidi and Streitz (2021)). Other work shows that banking concentration affects deposit pricing, loan spreads, and firm dynamics (Berger and Hannan (1989); Drechsler et al. (2017); Nguyen (2019)). However, it is difficult to view this as the only source of connection between lender and borrower concentration, because as borrowers grow in scale and complexity, their financing needs evolve, changing not only how much they borrow but also, possibly, from whom. I establish a causal connection between the structure of product market industries and financial industries that adds an additional dimension to what prior studies show.

Third, it relates to research on banking structure and real economic outcomes. Prior studies show that bank market power affects firm entry, competition, and community development (Cetorelli and Strahan (2006); Garmaise and Moskowitz (2006); Nguyen (2019); Saidi and Streitz (2021)). Higher banking concentration is associated with lower deposit rates, higher loan spreads, and reduced competition in local markets (Berger and Hannan (1989); Neumark and Sharpe (1992); Drechsler, Savov, and Schnabl (2017); Bord (2017); Buchak and Jørring (2021)). My findings add a borrower-driven mechanism to this literature by showing how shifts in industry structure spill over into retail financial products. Importantly, Kropp and Whitaker (2011) show that banks extend favorable terms to farms with more base acres because subsidies provide a risk-free source of income. If banks extend better terms to larger, consolidated borrowers, they may raise prices on broader consumer financial products, shifting the burden to marginal customers (Inderst and Valletti (2011)). My results support this hypothesis. In counties with greater borrower consolidation, consumer financial product prices increase, highlighting the broader implications of borrower-driven shifts in banking markets.

Lastly, I contribute to research on agricultural finance and the role of federal policy in structuring rural credit markets. Existing work documents how decoupled subsidy programs influence land allocation, farm consolidation, and credit access (Burfisher and Hopkins (2003); Roberts and Key (2008); Coble et al. (2008); Bhaskar and Beghin (2010); Gardner,

Hardie, and Parks (2010); Bekkerman, Belasco, and Watson (2015); Ifft, Kuethe, and Morehart (2015); Ifft et al. (2024)). I show that these policy-induced shifts in farm structure trigger broader changes in local financial intermediation as borrower consolidation pushes credit demand toward larger institutions.

3 Institutional Background

The 1996 FAIR Act marked a sharp break from 60 years of price-contingent farm support. Since the New Deal, federal policy had stabilized farm income through a combination of price floors, nonrecourse loans, and later countercyclical deficiency payments (Effland (2001)). In exchange for these supports, farms had to maintain base acreage allocations, meaning that program payments were tied to producing designated crops on enrolled land.

The FAIR Act replaced this system with seven years of fixed annual payments determined solely by a farm’s historical acres and yields, regardless of current production or prices (Coble et al. (2008)). The key innovation was to decouple support from planting decisions, yields, and market prices, allowing farmers to respond to market signals rather than government incentives.¹ Payments were determined by the number of base acres, defined as the average number of acres planted of program crops (wheat, corn, sorghum, barley, oats, rice, and upland cotton) between 1981 and 1985. The shift toward decoupled payments aimed to reduce production distortions, phase down subsidies, and comply with World Trade Organization (WTO) rules.

The FAIR Act removed planting restrictions, so farms with more base acres automatically received higher payments, regardless of what they planted or produced. Although the federal government limited payments to \$180,000 annually per person classified as actively engaged in farming, many large farms bypassed these limits by subdividing operations into multiple entities or assigning ownership shares to passive investors (United States General Accounting Office (2004)).

Between 1996 and 2014, the federal government disbursed about \$54 billion, or about \$5-6 billion per year, in direct payments. At the time of implementation, the program represented the bulk of all federal support for farmers. By 1998, about 79% of all subsidies under the FAIR Act were distributed as direct payments (Williams-Derry and Cook (2000)). The payments were not only important for farms’ financial health (Ifft et al. (2012)) but also predictable and likely capitalized into land values and rents (Kropp and Katchova (2011); Paulson (2011)). According to the Government Accountability Office (GAO), the top 25%

¹See Statement on Signing the Federal Agriculture Improvement and Reform Act of 1996 (<https://www.presidency.ucsb.edu/documents/statement-signing-the-federal-agriculture-improvement-and-reform-act-1996>).

of recipients collected 73% of all direct payments in 2011 (United States Government Accountability Office (2012)). To illustrate the magnitude of these payments, in 1998, \$30,000 would have covered the annual interest payments on a 600-acre farm in Texas at prevailing market rates, an operation about double the size of Rice University.²

Congress renewed the program in 2002 under the Farm Security and Rural Investment (FSRI) Act, which expanded eligibility to include oilseeds, such as soybeans and peanuts, and allowed base acres to be updated based on average plantings between 1998 and 2001. In 2008, the federal government renewed the program again but without adding new crops or updating base acres. Figure 1 shows a timeline outlining the policy changes.

[Insert Figure 1 Here]

4 Hypothesis Development

This section outlines the mechanisms through which borrower consolidation influences the structure of rural credit markets. The argument proceeds in three steps. First, fixed-payment subsidies relax farms' financial constraints, enabling investment and expansion, particularly among large farms. These investments increase midpoint farm size and accelerate consolidation. Second, as farms grow, credit demand shifts toward larger loans and more sophisticated financial products. Third, banks respond to this evolving borrower landscape. Institutions equipped to meet these financing needs expand their footprint, while others exit, merge, or scale back. These changes in the composition of borrowers and lenders may ultimately affect the pricing of consumer financial products in rural communities.

Commodity crop producers have strong incentives to expand. Advances in mechanization, chemical inputs, and crop management practices lower the marginal cost of managing additional acres, making expansion more efficient (Paul and Nehring (2005); Duffy (2009)). Due to high fixed costs and increasing returns to scale, larger farms enjoy lower average costs than smaller farms and account for a growing share of production (Hoppe and Banker (2006); Khanal and Omobitan (2020)). In competitive commodity markets where farms are price takers (Stiers (2022)), expansion becomes the primary strategy to improve margins and cost efficiency (Langemeier (2013); Hoppe (2014)).

Yet expansion requires capital. Land acquisition, machinery purchases, and seasonal operating inputs require substantial upfront investment. Many farms operate with limited internal liquidity or collateral, making them reliant on external finance to fund growth (Hubbard

²Based on Texas average cropland values in 1998 of \$701 per acre and interest rate of farm loans in Texas of 8%. See Agricultural Land Values (<https://downloads.usda.library.cornell.edu/usda-esmis/files>).

and Kashyap (1992); Barry, Bierlen, and Sotomayor (2000)). Interviews with farmers further confirm that cash constraints remain a central obstacle to investment (Thakor (2023)).

Cash subsidies may help relax these constraints. The fixed direct payments introduced by the 1996 FAIR Act provided farms with predictable annual transfers tied to historical base acres. Because base acres were correlated with farm size, larger farms systematically received larger total payments (Young and Westcott (2000); Roberts and Key (2008)). These payments increased liquidity, particularly for large operations. Anecdotally, reports from the time suggest that large farms used these subsidies to go out “trolling for land”.³ Thus, these subsidies incentivized larger farms to actively pursue land acquisitions, accelerating the pace of consolidation.

Debt may help scale farms’ expansion. Between 1994 and 2017, total farm sector debt rose by 69% in real terms, reaching \$459 billion in 2025 dollars (U.S. Department of Agriculture Economic Research Service (2025)). Most of this increase came from real estate borrowing, supported by rising farmland values and stronger collateral positions, which may themselves have been influenced by the capitalization of fixed payments (Ciaian and Swinnen (2009); Ifft et al. (2012); Kuethe (2015)). Credit use also differs sharply by farm size. For example, 82% of farms with under \$10,000 in sales carried no debt, compared to only 21% of farms with over \$1 million in sales. Among large farms, 35% borrowed from multiple lenders, reflecting diversified and complex credit needs (Key (2019)). These facts suggest that debt markets play an important role in financing agricultural investments, particularly among large farms.

As farms grow larger, the nature of credit demand shifts. Larger borrowers require more diverse, multi-purpose credit, spanning land, equipment, working capital, and operating lines. Predictable cash subsidies facilitate this transition by both financing expansion and enhancing borrower balance sheets, improving repayment capacity, and reducing perceived credit risk (Kropp and Katchova (2011)). Theoretically, higher net worth mitigates moral hazard by improving borrower incentives and reducing monitoring costs (Holmstrom and Tirole (1997)). Empirically, farms with more base acres receive lower interest rates on operating loans (Kropp and Whitaker (2011)), and farms with higher net worth obtain more favorable lending terms (Hubbard and Kashyap (1992); Roberts and Key (2008)). Lastly, monetary policy research shows that when credit conditions ease, such as when the average borrowers’ liquidity increases, banks expand lending (Jiménez et al. (2014)). Together, these factors suggest that a more liquid borrower pool may change how credit is allocated.

Small banks have traditionally maintained a comparative advantage in lending to small, opaque farms through relationship-based lending and local information acquisition. But as

³See Federal Subsidies Turn Farms Into Big Business (<https://www.washingtonpost.com/archive/politics/2006/12/21>).

farms consolidate and become more creditworthy and transparent, these informational advantages diminish. Moreover, the financing needs of large farms often exceed the lending capacity of small institutions (LaDue and Duncan (1996); DeYoung et al. (2004)). In contrast, large banks are better positioned to serve these borrowers due to their deeper balance sheets, geographic diversification, and specialized lending teams. These mechanisms suggest that borrower consolidation may induce shifts in the structure of rural banking markets. Large banks may be more likely to enter or expand in areas where borrower scale increases, whereas small banks may lose market share, merge, or exit.

5 Data Sources and Sample Construction

To examine how borrower consolidation influences rural banking markets and financial outcomes, I construct a panel dataset linking county-level farm structure with data at the bank-, branch-, and crop-level from 1992 to 2014. This section outlines the measurement of key dependent variables, instrumental variables, and controls. Additional technical details are provided in Appendix B.

5.1 Dependent Variables

The core banking market outcomes include measures of local concentration, bank composition, and consolidation activity. I measure banking concentration using the Herfindahl-Hirschman Index (HHI), calculated from the FDIC’s Summary of Deposits (SOD). For each county-year, I compute the deposit share of each bank, square the shares, and sum them to obtain a concentration index ranging from 0 to 1, where 1 indicates a monopoly and lower values reflect greater competition. To capture changes in the composition of banks, I merge SOD data with the Federal Financial Institutions Examination Council’s (FFIEC) Consolidated Reports of Condition and Income (Call Reports) to classify each branch as belonging to a small or large bank, based on a \$10 billion inflation-adjusted asset threshold. This threshold follows the Federal Reserve’s definition of community banks as institutions with under \$10 billion in assets.⁴ I then construct the number of branches and total deposits per capita in each county separately by bank size. I use the county-year-level population measure from the Bureau of Economic Analysis (BEA). In separate analyses, I classify each branch as belonging to a constrained or unconstrained bank, depending on whether its lending limit to a single borrower is below or above the nationwide annual median. I calculate a bank’s lending limit as 15% of its capital, which is the general cap on loans to a single borrower under OCC regulations (Office of the Comptroller of the Currency (2004)). Although state-

⁴See Community & Regional Financial Institutions (<https://www.federalreserve.gov/supervisionreg>).

chartered banks are not formally subject to OCC rules, most states adopt similar lending limit provisions, so this measure provides a consistent benchmark across institutions.

To track consolidation activity, I use the Chicago Federal Reserve’s Bank Merger database to construct three county-level outcomes aggregated over five-year intervals. The first, *Large Acquires Small*, measures the total number of mergers or acquisitions in which a large bank acquires or merges with a small bank. The second and third, *Small Acquires Small* and *Large Acquires Large*, capture the total number of mergers or acquisitions between two small banks and between two large banks, respectively.

I also measure each bank’s exposure to agriculture using data on farm real estate loans and loans for agricultural production and farm-related activities from Call Report Schedule RC-C. I classify a bank as an agricultural lender if the share of agricultural loans in the bank’s total portfolio exceeds 5% in a given year. To estimate county-level farm loan volumes, I allocate each bank’s agricultural lending across the counties in which it operates using a weighted average based on each county’s share of total interest expenses for farm real estate and production loans, as reported in the most recent Census of Agriculture. For example, if a bank operates in three counties with equal farm interest expenses, I allocate one-third of its total agricultural lending to each county. I repeat this process for each bank and aggregate separately for small and large banks. This approach follows similar allocation strategies used in Key et al. (2019) and Ifft et al. (2024).

Although this method serves as a proxy for county-level farm loan volumes, it has limitations. First, banks may lend outside their branch networks, which is not captured. Second, the weighted average assumes that banks lend proportionally to historical local demand, proxied by interest expenses, which may not reflect current lending behavior. Nonetheless, the method provides evidence on the geographic distribution of agricultural lending.

To examine how borrower consolidation and subsequent bank responses affect pricing in consumer financial markets, I use deposit and loan interest rate data from RateWatch. I focus on time deposits (12-month \$10,000 certificates of deposit), savings deposits (\$10,000 money market accounts), interest deposits (interest-bearing checking accounts), and auto loans, the most widely reported consumer credit product in the dataset. I average the weekly branch-level data to the annual level and convert it to real terms using the annual inflation rates from the Bureau of Labor Statistics (BLS). I merge these interest rates with county-level farm and bank characteristics. Because the FDIC collects its data in June, I average interest rates over a 12-month window from July of the previous year through June of the current year to align the panels.

To assess whether federal lending offsets the effects of market-driven consolidation, I also use annual data on direct loans issued by the USDA’s Farm Service Agency (FSA).

These loans are targeted to small, new, or socially disadvantaged farmers who cannot access commercial credit. I aggregate the number and volume of direct ownership and operating loans at the county level from 1994 to 2014.

5.2 Instrumental Variable: Borrower Consolidation

Following the agricultural economics literature, I measure borrower consolidation using the harvested acre-weighted median farm size (the “midpoint”) from the USDA’s Census of Agriculture (Key and Roberts (2006)). The midpoint is defined as the acreage at which half of a county’s harvested cropland lies on larger farms and half on smaller farms. For example, if a county has 2,800 total harvested acres and the eight smallest farms account for 1,400 acres, then the ninth-largest farm marks the midpoint. If that farm operates 700 acres, then the midpoint farm size is 700 acres.

Because the public Census of Agriculture only reports the number of farms in acreage categories (1-9, 10-49, 50-69, 70-99 acres, etc.), I use bin midpoints to estimate acreage distribution. This is standard in the literature for two reasons. First, individual farm sizes are not publicly reported. Second, the distribution of production is skewed: most cropland is harvested by a small number of very large farms, while most farms are relatively small. The midpoint therefore more accurately captures shifts in the scale of production than the simple median.

To address endogeneity concerns, I instrument for farm concentration using county-level exposure to fixed-payment subsidies under the 1996 FAIR Act and subsequent updates in 2002 and 2008. I use the total number of county-level base acres per crop and the nationally allocated annual subsidy amount per crop to determine estimated subsidy amounts per year. The farm concentration measure is lagged by two years to allow time for borrower consolidation to influence downstream banking outcomes.

5.3 Controls

To account for local land-use patterns, I include several farm-level controls from the Census of Agriculture: idle cropland, pastureland, and unharvested cropland. I also include economic controls from the BEA, including per capita income and the employment rate. For additional analyses, I also use measures of the lagged log number of total branches, log of population, and the log of total interest expenses on farm loans.

To examine heterogeneous effects in rural areas, I use county classifications from the National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme. I define urban counties as those ever designated as large central metropolitan areas (in either 1990

or 2006) and define all others as rural. I interact these indicators with my instrument to estimate the heterogeneous effects of subsidy payments across urban and rural areas.

5.4 Sample Construction and Summary Statistics

My primary analysis uses a county-level panel observed in five-year intervals between 1992 and 2012. The USDA Census of Agriculture provides farm structure data every five years, which I merge with banking data from the FFIEC’s Call Reports and FDIC’s SOD for the corresponding periods between 1994 and 2014. Farm variables are lagged by two years to allow sufficient time for structural changes in agriculture to influence banking outcomes. I exclude 57 metropolitan counties from the main sample to focus on counties where agriculture may be a dominant industry.

For the analysis of interest rate outcomes, I construct a separate annual panel from 2002 to 2014, merging branch-level data from RateWatch with bank- and county-level information from the SOD and Call Reports. Because the Census of Agriculture is conducted only every five years, I estimate instrumented farm consolidation using census-year data and carry the fitted values forward to annual frequency. This approach reflects the gradual nature of farm consolidation and assumes slow-moving structural change between census years (MacDonald, Hoppe, and Newton 2018). I align interest rates with SOD data timing by averaging weekly observations over a July-to-June window.

Table 1 presents descriptive statistics. Agricultural subsidies are widespread and highly skewed. On average, counties receive \$1.35 million in subsidies per year, with a standard deviation of \$1.84 million between counties and \$1.18 million within counties over time. These descriptive statistics suggest that there is substantial cross-sectional and time-series variation in subsidy exposure.

[Insert Table 1]

6 Identification Strategy

There are two main challenges with studying the effect of borrower consolidation on the structure of local credit markets. First, borrower consolidation and bank consolidation may be jointly driven by local characteristics. For example, rural areas with limited economic activity may have fewer banks and fewer, but larger, farms simply due to low population density or substantial land availability. The second is due to reverse causality. Banking consolidation may itself induce borrower consolidation. In areas with more concentrated banking markets, limited competition can restrict capital access for smaller farms. These farms may be forced to exit or sell to larger operators, accelerating consolidation. Alternatively, a larger, more

consolidated banking sector, less suited to lend to informationally opaque borrowers, may have a preference for lending to larger farms (Berger and Udell (2002)). In both scenarios, the structure of the local banking market could itself cause borrower consolidation.

To address these concerns, I use a shift-share-like IV strategy that isolates variation in the optimal size of farms that is unlikely to reflect local credit market conditions. The instrument measures county-level exposure to fixed subsidy payments introduced under the 1996 FAIR Act and extended through both the 2002 Farm Security and Rural Investment (FSRI) Act and the 2008 Food, Conservation, and Energy Act. These policies replaced price-contingent support with fixed payments based on historical planting patterns, decoupled from current production or market conditions (see Section 2 for institutional background).⁵

The instrument is defined as the inner product of (a) each county’s fixed crop-level base acre shares and (b) the national crop-level subsidy amounts in a given year from 1996 to 2014, when the program ended. For example, if a county holds 5% of the nation’s corn base acres and the national allocation for corn is \$5 billion in a given year, that county would be assigned an exposure of $5\% \times \$5$ billion. Base acres are fixed in advance, determined by planted acres from 1981 to 1985 or, for farms that updated in 2002, from 1998 to 2001. The national allocations vary over time and apply uniformly across all counties. Thus, the identifying variation comes from changes over time in national payment levels for each crop interacted with county-level crop shares, as measured by their crop-level base acres. Because both components are determined outside the local banking environment, one by historical planting decisions and the other by national policy, the resulting variation in exposure is plausibly exogenous with respect to local credit conditions.

This strategy addresses both challenges. First, the instrument relies on historical crop shares fixed a decade before the FAIR Act, so it is not influenced by present-day local conditions that may jointly drive farm and bank consolidation. Second, for reverse causality to invalidate the instrument, banking consolidation would need to be systematically correlated with subsidy exposure in a way unrelated to expansion, since the instrument extracts the component of farm consolidation that is due to federal subsidies. Reverse causality would be a concern if, for instance, banks consolidated in anticipation of the policy or if historical planting patterns were predictive of future credit market conditions. This is unlikely. The 1996 FAIR Act marked a sharp and largely unexpected break with six decades of price-contingent support, facing considerable political uncertainty and multiple filibusters prior to passage (Orden et al. (1999)). As a result, the policy was not easily anticipated by banks, and planting decisions made more than a decade earlier are unlikely to reflect expectations about future credit conditions. Finally, I lag farm concentration by two years in all baseline

⁵See 1996 Farm Bill (<https://www.ers.usda.gov/>).

specifications to study the subsequent effect on banking consolidation. The results remain robust to alternative lag structures, including three- and four-year lags (Table A.1).

I construct a difference-in-differences-style instrument that captures county-level exposure to policy allocated pre-announced national subsidies. The specification is:

$$\begin{aligned} Farm\ Concentration_{i,t} = & \alpha + \beta_1 \sum_c \left(\frac{Base\ Acres_{c,i,t}}{\sum_c Base\ Acres_{c,t}} \times Natl\ Allocation_{c,t} \right) \\ & + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}, \quad (1) \end{aligned}$$

where c represents the crop type, i represents the county, t represents the year, and d represents state-level banking deregulation. $Base\ Acres_{c,i,t}$ is the number of historical base acres of crop c in county i and year t , and $Natl\ Allocation_{c,t}$ is the total federal subsidy amount allocated for a given crop and year. $X_{i,t}$ is a vector of control variables, including county-level economic characteristics and farm characteristics to control for land availability. These controls include employment rate, log income per capita, and lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested. I control for state-level branching deregulation using the index from Célerier and Matray (2019), which captures the staggered implementation of interstate branching reforms between 1994 and 2005. County and year fixed effects absorb time-invariant county characteristics and national shocks. Identification therefore comes from changes in national subsidy amounts and base acre allocations within a county.

The dependent variable, $Farm\ Concentration_{i,t}$, is measured as the midpoint farm size (see Section 5.2 for details). Figure 2 presents the estimated effect of subsidy exposure on farm concentration using the estimator defined by de Chaisemartin and D’Haultfœuille (2020) to accommodate continuous treatment. I find that the county-level midpoint farm size increases by nearly 400 acres, or about 65%, over 16 years.

[Insert Figure 2 Here]

The first-stage estimates reveal a strong relationship between subsidy exposure and subsequent farm consolidation, with an unconditional correlation of 52%. Figure 3 illustrates this relationship. Panel A plots the increase in farm concentration over time, and Panel B shows where direct payments were most concentrated geographically.

[Insert Figure 3 Here]

As shown in the following sections, the F -statistics from the first stage exceed the Stock and Yogo (2005) thresholds for weak instruments, satisfying the relevance condition. This supports the interpretation that the policy alters the structure of borrowing.

The second-stage estimates capture how exogenous changes in borrower structure affect the organization of local credit markets. The baseline second-stage specification is:

$$Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{\text{Farm Concentration}}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}, \quad (2)$$

where subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The outcome variable $Y_{i,t}$ represents various measures of the structure of local banking markets at the county level, including the Bank Deposits HHI. All variables are measured in five-year intervals from 1994 to 2014. The vector of control variables $X_{i,t-2}$ includes the lagged economic variables (lagged log income per capita and employment rate) aligned with the timing of the farm data in the first stage.

To examine heterogeneity across bank size, I construct separate county-level measures of banking network presence for small and large banks. I estimate the IV model using a control function approach following Wooldridge (2015). I estimate the first stage via OLS, obtain residuals, and include them as a correction term in the second stage. Following Cohn, Liu, and Wardlaw (2022), I estimate the second stage using a Poisson model because about 22% of county-year observations in my sample do not contain a large bank. The second stage specification is:

$$\begin{aligned} E[Y_{i,t} | \text{Farm Concentration}_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] \\ = \exp(\alpha + \beta_1 \text{Farm Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}), \end{aligned} \quad (3)$$

where subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The vector of control variables $X_{i,t-2}$ includes the same control variables as in Equation 2, with the addition of the lagged log number of bank branches to compare counties with similar pre-existing banking infrastructure. Because the model is estimated in two stages, I bootstrap the full procedure 1,000 times, clustering standard errors at the county level to preserve the panel structure. All analyses separating large and small banks, excluding linear probability models, follow this estimation strategy.

7 Empirical Results

7.1 Farm Consolidation and Bank Consolidation

In this section, I test whether farm consolidation increases banking consolidation. Fixed cash payments may have exogenously shifted farm consolidation in two ways. First, prior literature finds that increased liquidity and reduced financial risk encourage farms to expand acreage and specialize production (O'Donoghue and Whitaker (2010); Thakor (2023)). Sec-

ond, by reducing idiosyncratic income volatility, these subsidies may improve farms' access to credit. Together, these mechanisms may encourage larger farms to grow, accelerating structural change in the agricultural sector.

I first examine whether fixed subsidy payments lead to increased farm concentration using Equation 1. I find that they do. A one standard deviation increase in county-level subsidy payments leads to a 25% increase in farm concentration every five years, equivalent to an expansion of about 175-189 acres (Table 2, Columns 1 and 2). For the average corn farmer in my sample, an additional 189 base acres would generate \$3,553 in extra fixed cash payments.⁶

[Insert Table 2 Here]

As farms grow and consolidate, the structure of agricultural borrowing may shift, with the average borrower becoming larger and the number of borrowers declining. In local credit markets, particularly in rural areas where agriculture is a core industry, this shift may reduce the number of potential clients and change the nature of credit demand. Banks better able to serve larger borrowers may gain market share, while other banks may exit, merge, or be acquired. This mechanism reflects a broader insight from IO. As demand becomes more concentrated, supply often consolidates in response (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009)).

To test this mechanism, I estimate the effect of farm concentration on local banking market concentration. I find that a one standard deviation increase in farm concentration raises local banking market concentration, measured through the county-level bank deposits HHI, by about 4% (Table 2, Columns 3 and 4). This change is economically meaningful, comparable to two out of ten banks exiting a county, or a county moving from the 10th to the 25th percentile in local banking market concentration within my sample.⁷ To address concerns about autocorrelated residuals, I also show that the results hold in a first-difference specification (Table A.2).

Without correcting for the endogeneity of farm consolidation, the OLS estimates may conflate the causal effect of farm consolidation with other factors that jointly influence both farm structure and banking outcomes. Table A.3 presents OLS estimates of this relationship. These coefficients are smaller in magnitude than the IV estimates, suggesting the endogeneity of farm concentration generates a downward bias. One potential source of this bias is

⁶The average corn yield in my sample is 79 bushels per acre. At the 2002 payment rate of \$0.28 per bushel and the program's adjustment factor of 0.85, an additional 189 base acres would generate: $79 \times 0.28 \times 189 \times 0.85 = \$3,553$.

⁷Assuming deposits are initially evenly distributed across ten banks, and that when two banks exit, their deposits are reallocated equally to two of the remaining banks.

urbanization. As the local population increases, farmland may be converted to residential or commercial uses, reducing the midpoint farm size. At the same time, banking concentration may rise due to urban market dynamics or the exit of small rural banks. These two events would induce a negative correlation between farm size and local banking market concentration, biasing the OLS estimates downward. Figure 4 shows the negative relationship between population growth and the local banking market concentration. To mitigate the effect of outliers, counties with a bank deposits HHI above 0.5 or below 0.1 are excluded. The relationship is even more pronounced when outliers are included.

[Insert Figure 4 Here]

If farm consolidation drives changes in the structure of agricultural credit markets, the effect should be muted in urban areas, where farming is not a major economic activity. I find results consistent with that hypothesis. I find no relationship between farm concentration and banking concentration in metropolitan counties (Table 3).

[Insert Table 3 Here]

7.2 Farm Concentration and the Structure of Local Credit Markets

Borrower consolidation also alters the competitive dynamics between banks. Unlike traditional buyer-supplier relationships, the bank-firm relationship involves information processing and monitoring costs. Small community banks have historically relied on relationship lending to serve smaller or more opaque borrowers effectively (Berney et al. (1999); Carter et al. (2004); Berger et al. (2005)). However, as farms consolidate and grow larger, they become more attractive to large banks that can offer larger loans, more sophisticated products, and potentially lower rates due to their access to wholesale funding (LaDue and Duncan (1996); DeYoung et al. (2004); Mkhaiber and Werner (2021)). Additionally, large banks face fewer regulatory constraints on lending limits, allowing them to issue larger loans (LaDue and Duncan (1996); DeYoung et al. (2004)).

It follows that large banks are more likely than small banks to enter markets with increasingly concentrated borrowers. Table 4 presents the results. I find that large banks are about three times more likely to enter counties with a one standard deviation increase in farm concentration than small banks. The results suggest that large banks may be more sensitive to changes in the composition and scale of local credit demand.

[Insert Table 4 Here]

To further assess banks' responses to farm consolidation, I examine two outcomes: branch presence and deposits per capita. The former captures banks' investment behavior. Specifically, whether banks are committing physical resources to a market (Cohen and Mazzeo (2010)). The latter reflects consumer behavior. Namely, revealing consumer preferences for different types of institutions. Table 5 shows that large banks increase their deposits per capita 1.2 times more than small banks following a one standard deviation increase in farm concentration. A similar pattern emerges for branch networks. Large banks expand their local branch presence by about 29%, compared to 19% for small banks. These findings indicate that large banks are capturing a disproportionate share of market growth in areas with consolidated borrowers.

[Insert Table 5 Here]

Again, these effects are concentrated in rural counties. In metropolitan areas, where agriculture represents a smaller share of economic activity, farm consolidation has no measurable impact on the structure of either large or small banks (Table 6). The absence of significant effects in urban markets suggests that the patterns observed are not driven by broader macroeconomic trends in banking or agriculture. Moreover, the weak first-stage F -statistics for urban counties indicate that subsidy exposure does not meaningfully predict farm concentration in these areas. This distinction is important as it suggests that the effects of borrower consolidation are strongest when the consolidating sector is central to the local economy.

[Insert Table 6 Here]

Rather than expanding, small banks appear to consolidate. I find that mergers and acquisitions among small banks increase by 24%, whereas all other merger activity is not meaningfully impacted (Table 7). These results suggest that small banks, facing competitive pressure from larger institutions and shifting credit demand, opt for defensive consolidation rather than expansion. The remaining small banks thus become fewer but larger, further diminishing the presence of smaller community lenders in rural markets.

[Insert Table 7 Here]

These findings align with theoretical predictions that structural shifts in downstream markets, such as the rise of larger borrowers, can trigger consolidation among upstream suppliers (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009)). In this case, small banks may merge to match the greater loan sizes demanded by larger, consolidated farms.

Rather than expanding, small banks consolidate internally, altering the composition and competitiveness of the local banking sector.

Finally, I examine whether lending capacity constraints affect banks' responses to borrower consolidation. I classify banks as regulatory constrained if their maximum loan size, 15% of their risk-based capital, falls below the annual nationwide median. Consistent with the capacity channel, constrained banks reduce their branch presence by about 10% and increase deposits per capita by only 13% following a one standard deviation increase in farm consolidation. In contrast, unconstrained banks expand their branch networks by about 30% and increase their deposits per capita by about 52% (Table 8). These findings suggest that when borrowers consolidate, banks' ability to compete for market share is affected by their lending capacity. Capital-constrained institutions adapt primarily through reducing their physical market presence, while less constrained banks expand, reinforcing the reallocation of market power toward those able to meet the credit demands of larger farms.

[Insert Table 8 Here]

7.3 Farm Concentration and Agricultural Loan Growth

If borrower consolidation increases credit demand among large farms, we should observe a corresponding increase in agricultural loan volumes. Because my data are at the bank level, I interpolate agricultural loan volumes at the bank-branch level within each county (see Section 5.1 for details). Table 9 presents the results. I find that large banks increase their total agricultural lending by about 65%. Disaggregating agricultural loans into real estate and non-real estate loans, I find that both categories increase significantly, suggesting that large banks perceive limited default risk in these consolidated markets. Small banks, on the other hand, only experience growth in production loans of about 23%. One potential explanation involves regulatory lending limits: the OCC's lending limits tie maximum loan size to bank capital, which can bind for smaller banks in agricultural markets. In 2004, the OCC acknowledged this constraint, noting that farm consolidation had "resulted in fewer, but larger, farms with expanded credit needs" and that existing limits were too restrictive for national banks (Office of the Comptroller of the Currency (2004)). Rising land values and production costs further tightened these constraints. For example, in 2001, an operating loan of the same size could finance nearly twice the land area as in 2012 (Ellinger (2012)).

[Insert Table 9 Here]

7.4 Farm Concentration and the Structure of Agricultural Banks

To understand whether these patterns are driven by agricultural lending, I restrict the sample to banks with greater exposure to the farm sector, defined as those institutions

holding more than 5% of their assets in farm loans in a given year. Table 10 shows that large agricultural banks are nearly three times more likely to enter rural counties following a one standard deviation increase in farm consolidation than large banks overall, indicating that large banks' market expansion is closely tied to shifts in agricultural credit demand. These banks also expand deposits per capita 3.3 times more than small agricultural banks and increase their branch networks by about 59%, after a one standard deviation increase in farm consolidation. In contrast, small agricultural banks show no significant expansion in branch presence. Moreover, large agricultural banks experience a 116% increase in deposits per capita, compared to a 35% increase for small agricultural banks. Both small and large banks see greater growth than in the main sample, but large agricultural banks exhibit the largest increase, with per capita deposits growing nearly three times more than those of large banks overall.

[Insert Table 10 Here]

These findings suggest that both banks' size and their industry specialization affect their responsiveness to borrower consolidation. As agricultural production becomes increasingly concentrated, the large, agriculturally specialized institutions gain market share disproportionately.

Lastly, Table 11 shows that most of the agricultural loan growth is driven by large agricultural banks, across both real estate and non-real estate lending. This finding complements the evidence in Table 10 and shows that the same institutions that are expanding their branch networks and deposit bases in response to borrower consolidation are also those driving increases in credit lending. These results expand on prior evidence that banks with larger asset bases and stronger deposit growth are more likely to expand agricultural lending, particularly among high-growth lenders (Nam et al. (2007)). Taken together, these findings suggest that as borrowers consolidate, large banks, especially those that have industry-specific knowledge of the sector, gain a growing share of the market.

[Insert Table 11 Here]

Lastly, the results are monotonic with respect to the 5% threshold: as the share of agricultural lending drops below 5%, the effects become weaker (Tables A.4 and A.5).

7.5 Falsification Test: Direct Loans by the USDA's Farm Service Agency (FSA)

Although my main results show that fixed subsidy payments lead to increased farm consolidation, one alternative mechanism is that these payments reduce income risk and

encourage new entry into farming. Cash subsidies may also simply increase credit demand more broadly rather than specifically among large, consolidating operations. If either of these mechanisms were at work, we would expect to see a rise in federal direct loans, which are targeted to small, new, or socially disadvantaged farmers. However, I find no relationship between subsidy-induced consolidation and the number or volume of direct loans (Table 12).

[Insert Table 12 Here]

Because I measure consolidation as the county-level midpoint farm size, these results support the interpretation that subsidies primarily facilitate the expansion of existing farms rather than widespread entry. New entry by small farms would reduce, not raise, the midpoint size. The absence of a response in direct loans points to a consolidation effect driven by incumbents, not by an overall expansion in credit access.

7.6 Farm Concentration and Interest Rates on Broader Consumer Products

IO theory suggests that buyer consolidation can influence prices through two distinct channels. First, consolidated buyers may gain bargaining power over suppliers, allowing them to negotiate more favorable prices (Snyder (1996)). Second, consolidation may trigger restructuring on the supplier side, leading to concentration among the most efficient firms, which can result in unchanged or even higher prices (Galbraith (1952); Fee and Thomas (2004); Becker and Thomas (2009)). In the context of agricultural credit markets, Kropp and Whitaker (2011) find that farms with greater base acreage, which received larger fixed subsidy payments, secure lower interest rates on their operating loans, suggesting that larger farms are able to obtain better terms.

However, the broader effects of borrower consolidation and banking market structure on consumer financial products remain ambiguous. On the one hand, new banks entering consolidated markets may lower consumer interest rates to attract customers. On the other hand, incumbent banks gaining market power may raise rates. Moreover, large banks tend to offer lower deposit rates due to access to wholesale funding, while small banks may offer higher deposit rates to attract local retail deposits and fund their lending activities (Park and Pennacchi (2009)). To assess these spillover effects, I examine how borrower-side consolidation affects the pricing of consumer deposit and loan products, focusing on rural credit markets.

Among deposit products, I focus on three commonly offered products: time, savings, and checking deposits. These deposit types differ in liquidity, interest elasticity, and their role

in bank funding strategies. Liquid deposits, such as savings and checking deposits, make up banks' core funding base, providing a stable and relatively inelastic source of funds. Because these deposits are less sensitive to rate changes and typically not withdrawn even when interest rates fall, they allow banks to maintain low-cost funding. In contrast, time deposits are more rate-sensitive and often used to fund longer-term lending, such as commercial or agricultural loans (Drechsler, Savov, and Schnabl (2017); Supera (2021)).

If borrower consolidation shifts market power among banks, those gaining market share may reduce deposit rates. Consistent with this hypothesis, I find that a one standard deviation increase in farm concentration is associated with a 36-basis point decline in the county-level average savings deposit rate, which is about a 30% reduction relative to the unconditional mean. This decline is driven almost entirely by small banks, which lower their savings rates by about 29 basis points (Table 13, Panel A, Columns 1-3). County-level time deposit rates remain flat on average, but large banks reduce their time deposit rates by 36 basis points, while small banks leave theirs unchanged, possibly to preserve funding for agricultural or commercial lending (Table 13, Panel A, Columns 4-6). Finally, both large and small banks reduce rates on interest checking accounts (Table 13, Panel A, Columns 7-9). These patterns suggest that banks, particularly those gaining relative market power, respond to borrower consolidation by lowering deposit rates across the broader retail market.

[Insert Table 13 Here]

I next examine the effects on consumer credit, focusing on auto loans. These are among the most widely reported and standardized consumer lending products reported to Rate-Watch. Because auto loans require relatively little soft information, they allow meaningful comparisons across banks of different sizes and structures (Keys et al. (2010)). I find that large banks increase interest rates offered on auto loans by 1.11%, raising the county average by 81 basis points. In contrast, small banks reduce interest rates offered on auto loans by about 31 basis points, potentially to increase their market share among smaller consumer borrowers (Table 13, Panel B). These results suggest that borrower consolidation not only shifts deposit pricing but also grants large banks greater pricing power in consumer credit markets, leading to less competitive loan terms in consolidated rural banking environments.

8 Conclusion

In this paper, I introduce a novel driver of the structure of local banking markets: borrower consolidation. Using U.S. agriculture as a setting, I show that farm consolidation, driven by fixed cash subsidies, led to changes in local banking market structure. Stable,

predictable subsidies enabled larger farms to invest and expand, resulting in a borrower pool increasingly concentrated among high-income, creditworthy operations.

These larger farms held more stable income flows and greater financing needs, making them more aligned with the operating models of large banks. I find that large banks were significantly more likely to enter rural counties undergoing borrower consolidation and expanded both their deposit base and branch networks, particularly when they already had exposure to agricultural lending.

However, large banks also proved more responsive to negative income shocks. When farm incomes declined in the following decade, the earlier expansion reversed. Between 2015 and 2019, the top 30 banks reduced their farm loan portfolios by \$3.9 billion, or 17.5%.⁸ JPMorgan Chase had expanded its farm lending by 76% between 2008 and 2015 to \$1.1 billion, but later pulled back, reducing its farm lending by about 22%.⁹ Thus, while borrower consolidation may attract large-scale lenders in the short run, it may also reduce long-run financial stability.

⁸See Rabobank takes on US agriculture's lending gap as large banks exit(<https://www.bankingdive.com/news/rabobank-us-agriculture-lending-gap>) and Big banks exiting farm loan business (<https://www.proag.com/news/big-banks-exiting-farm-loan-business/>).

⁹See Wall Street banks bailing on troubled U.S. farm sector (<https://www.reuters.com/article/business/wall-street-banks-bailing-on-troubled-us-farm-sector>).

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Table 1. Descriptive Statistics

The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). Subscript i represents the county and t represents the year. *Farm Concentration* $_{i,t-2}$ is the acreage-weighted midpoint farm size. *Bank Deposits HHI* $_{i,t}$ is the Herfindahl-Hirschman Index, a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. *Large Bank Presence* $_{i,t}$ and *Small Bank Presence* $_{i,t}$ are indicator variables for whether a large or small bank, respectively, enters a county in a given year. *Number of Large Bank Branches* $_{i,t}$ and *Number of Small Bank Branches* $_{i,t}$ refer to the number of branches operated by large and small banks at the county level. *Large Banks' Per Capita Deposits* $_{i,t}$ and *Small Banks' Per Capita Deposits* $_{i,t}$ measure total deposits per capita held at large and small banks, respectively. *Large Acquires Small* $_{i,t}$ measures the total number of mergers or acquisitions in which a large bank acquires a small bank, aggregated over five-year intervals. *Small Acquires Small* $_{i,t}$ and *Large Acquires Large* $_{i,t}$ record the number of mergers between two small or two large banks, respectively, also aggregated over five-year intervals. *Total Agricultural Loans* $_{i,t}$ is the total imputed agricultural loan volume at the county level, disaggregated by bank size. *Agricultural Real Estate Loans* $_{i,t}$ and *Agricultural Non-Real Estate Loans* $_{i,t}$ represent county-level imputed loan volumes used for real estate purchases and production expenses, respectively. *Urban* $_{i,t}$ is an indicator variable for whether the county is a large central metropolitan area, and vice versa for *Rural* $_{i,t}$. *Savings Deposit Rate* $_{i,t}$ is the nominal interest rate offered on \$10,000 money market accounts, and *Time Deposit Rate* $_{i,t}$ is the rate on 12-month \$10,000 certificates of deposit. *Checking Deposit Rate* $_{i,t}$ refers to interest-bearing checking accounts. Each rate is reported separately for all banks, large banks, and small banks. The instrument, *Subsidy Amount* $_{i,t}$, is a continuous normalized measure of the predicted value of total fixed subsidy payments in a given county-year. Control variables include measures of land availability (lagged idle cropland, pastureland, and fallow or unharvested cropland from the prior Census of Agriculture) and local economic conditions (lagged county employment rate, log income per capita, and total number of branches).

Variable	Mean	SD	P10	P50	P90	N
<i>Main Dependent Variables</i>						
Farm Concentration _{<i>i,t-2</i>} (Acres)	744	795	65	327	2,072	13,808
Bank Deposits HHI _{<i>i,t</i>}	0.31	0.20	0.13	0.25	0.55	13,808
Large Bank Presence _{<i>i,t</i>}	0.78	0.42	0.00	1.00	1.00	13,808
Small Bank Presence _{<i>i,t</i>}	0.96	0.20	1.00	1.00	1.00	13,808
Number of Large Bank Branches _{<i>i,t</i>}	13	29	0	3	33	13,808
Large Banks' Per Capita Deposits _{<i>i,t</i>} (\$)	7,498	24,887	0	5,684	15,437	13,808
Number of Small Bank Branches _{<i>i,t</i>}	9	10	1	7	19	13,808
Small Banks' Per Capita Deposits _{<i>i,t</i>} (\$)	11,814	9,679	1,552	9,836	24,462	13,808
Large Acquires Small _{<i>i,t</i>}	1	2	0	0	4	13,808
Small Acquires Small _{<i>i,t</i>}	1	1	0	1	3	13,808
Large Acquires Large _{<i>i,t</i>}	1	1	0	0	3	13,808
Large Banks' Total Agricultural Loans _{<i>i,t</i>} (\$1,000s)	13,940	30,006	0	4,161	34,552	13,774
Small Banks' Total Agricultural Loans _{<i>i,t</i>} (\$1,000s)	28,422	38,780	220	12,775	78,614	13,774
Large Banks' Agricultural Real Estate Loans _{<i>i,t</i>} (\$1,000s)	6,417	13,030	0	1,946	16,600	13,774
Small Banks' Agricultural Real Estate Loans _{<i>i,t</i>} (\$1,000s)	13,784	18,802	105	6,409	36,964	13,774
Large Banks' Agricultural Non-Real Estate Loans _{<i>i,t</i>} (\$1,000s)	7,410	17,621	0	1,753	18,019	13,774
Small Banks' Agricultural Non-Real Estate Loans _{<i>i,t</i>} (\$1,000s)	14,551	22,398	6	4,757	43,457	13,774
Direct Loan Amounts _{<i>i,t</i>} (\$)	335,281	680,437	0	65,000	976,000	13,808
Number of Direct Loans _{<i>i,t</i>}	12	24	0	3	35	13,808
Urban _{<i>i,t</i>}	0.01	0.12	0.00	0.00	0.00	14,059
Rural _{<i>i,t</i>}	0.99	0.12	1.00	1.00	1.00	14,059
<i>Agricultural Banks' Dependent Variables</i>						
Number of Large Agricultural Bank Branches _{<i>i,t</i>}	1.52	4.26	0.00	0.00	4.00	13,808
Large Agricultural Banks' Per Capita Deposits _{<i>i,t</i>} (\$)	1,548	3,589	0	0	5,229	13,808
Number of Small Agricultural Bank Branches _{<i>i,t</i>}	4.50	4.90	0.00	3.00	11.00	13,808
Small Agricultural Banks' Per Capita Deposits _{<i>i,t</i>} (\$)	8,745	10,246	0	5,166	22,796	13,808

Variable	Mean	SD	P10	P50	P90	N
<i>Interest Rate Dependent Variables</i>						
Savings Deposit Rate _{i,t} (%)	0.82	0.77	0.10	0.62	1.88	42,185
Large Banks' Savings Deposit Rate _{i,t} (%)	0.62	0.68	0.07	0.37	1.50	32,370
Small Banks' Savings Deposit Rate _{i,t} (%)	0.92	0.82	0.12	0.71	2.10	37,370
Time Deposit Rate _{i,t} (%)	1.90	1.43	0.26	1.72	4.00	42,340
Large Banks' Time Deposit Rate _{i,t} (%)	1.61	1.37	0.16	1.27	3.68	32,521
Small Banks' Time Deposit Rate _{i,t} (%)	2.03	1.45	0.35	1.82	4.19	37,751
Checking Deposit Rate _{i,t} (%)	0.32	0.33	0.05	0.22	0.75	36,809
Large Banks' Checking Deposit Rate _{i,t} (%)	0.17	0.20	0.03	0.10	0.40	28,465
Small Banks' Checking Deposit Rate _{i,t} (%)	0.41	0.37	0.07	0.28	0.93	32,691
Auto Rate _{i,t} (%)	6.54	1.73	4.15	6.74	8.68	36,159
Large Banks' Auto Rate _{i,t} (%)	6.31	1.90	3.78	6.51	8.68	30,753
Small Banks' Auto Rate _{i,t} (%)	6.76	1.52	4.69	6.86	8.68	23,556
Auto Loan Maturity (Months)	47.88	2.71	44.49	48.27	50.50	36,159
Large Banks' Auto Loan Maturity _{i,t} (Months)	48.37	3.06	44.25	49.18	51.21	30,753
Small Banks' Auto Loan Maturity _{i,t} (Months)	47.26	2.49	44.23	47.50	50.40	23,556
<i>Instrument</i>						
Subsidy Amount _{i,t} (\$1,000s)	1,367	2,193	0	277	4,265	13,808
<i>Control Variables</i>						
Income Per Capita _{i,t-2}	36,523	9,217	27,227	34,930	47,124	13,808
Employment Rate _{i,t-2}	0.50	0.13	0.34	0.49	0.66	13,808
Population _{i,t-2}	63,234	115,890	5,909	25,013	149,639	13,808
State-Level Deregulation Index _{i,t-2}	1	2	0	1	4	13,808
Number of Branches _{i,t-2}	22	36	3	11	49	13,808
Idle Land _{i,t-2} (Acres)	9,577	13,477	751	4,851	23,274	13,808
Otherwise Unharvested Land _{i,t-2} (Acres)	20,072	35,616	1,047	7,868	48,167	13,808
Pastureland _{i,t-2} (Acres)	142,326	273,841	6,864	40,479	387,947	13,808

Table 2. Effect of Farm Consolidation on Bank Concentration

This table reports the first- and second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on the bank deposits Herfindahl-Hirschman Index (HHI). The specifications for the first and second stages, respectively, are: $\widehat{Farm\ Concentration}_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $Y_{i,t} = \alpha + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). Columns 1 and 2 report the first-stage regressions, where the dependent variable is $Farm\ Concentration_{i,t-2}$ (measured as the midpoint farm size at the county level). Columns 3 and 4 report the second-stage results, where the dependent variable is the bank deposits HHI. The outcome variable, $Bank\ Deposits\ HHI_{i,t}$, is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. The instrument, $Subsidy\ Amount_{i,t-2}$, is a continuous normalized measure of the predicted value of total fixed subsidy payments in a given county-year. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	First Stage		Second Stage	
	Farm Concentration		Bank Deposits HHI	
Farm Concentration $_{i,t-2}$			0.042*** (0.007)	0.041*** (0.007)
Subsidy Amount $_{i,t-2}$	174.587*** (9.112)	189.479*** (10.617)		
Log Income Per Capita $_{i,t-2}$		215.676*** (67.092)		-0.004 (0.011)
Employment Rate $_{i,t-2}$		-229.977 (148.114)		0.021 (0.030)
Idle Land $_{i,t-7}$		59.221*** (10.239)		
Other Cropland $_{i,t-7}$		-29.857*** (8.614)		
Pastureland $_{i,t-7}$		30.850 (31.937)		
Observations	13,808	13,808	13,808	13,808
R-squared	0.851	0.852	0.931	0.931
<i>F</i> -statistic	367.047	98.833	367.047	98.833
Deregulation Index FE	No	Yes	No	Yes
County & Year FE	Yes	Yes	Yes	Yes
Mean of Dependent Variable	742.6	742.6	0.313	0.313

Table 3. Rural vs. Urban: Effect of Farm Concentration on Bank Concentration

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on the bank deposits Herfindahl-Hirschman Index (HHI) by county type. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} \times County\ Type_i = \alpha + \beta_1 \widehat{Subsidy\ Amount}_{i,t} \times County\ Type_i + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$ and $Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} \times County\ Type_i + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). For this analysis, the sample includes large metropolitan counties. The dependent variable is the bank deposits HHI. The $Bank\ Deposits\ HHI_{i,t}$ is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. $Urban_i$ is an indicator variable for whether the county is a large central metropolitan area, and vice versa for $Rural_i$. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Rural	(2) Urban
	Bank Deposits HHI	
$\widehat{Farm\ Concentration}_{i,t-2} \times Rural_i$	0.040*** (0.007)	
$\widehat{Farm\ Concentration}_{i,t-2} \times Urban_i$		0.017 (0.022)
Observations	14,059	14,059
F -statistic	100.087	1.007
County Controls	Yes	Yes
Deregulation Index FE	Yes	Yes
County & Year FE	Yes	Yes
Mean of Dependent Variable	0.312	0.179

Table 4. Effect of Farm Concentration on the Probability of Large and Small Bank Entry

This table shows the second-stage estimates of the heterogeneous effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $\widehat{Farm\ Concentration}_{i,t} = \alpha + \beta_1 \widehat{Subsidy\ Amount}_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$ and $Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The outcome variable is an indicator variable for whether a large bank or small bank enters the county in a given year, respectively. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. $\widehat{Farm\ Concentration}_{i,t-2}$ is the fitted lagged midpoint farm size estimated in the first stage. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Large Bank	Small Bank
	Probability of Entering	
$\widehat{Farm\ Concentration}_{i,t-2}$	0.076** (0.035)	0.028*** (0.010)
Observations	13,808	13,808
F -statistic	99.093	99.093
County Controls	Yes	Yes
Deregulation Index FE	Yes	Yes
County & Year FE	Yes	Yes
Mean of Dependent Variable	0.777	0.960

Table 5. Effect of Farm Concentration on the Presence and Deposit Share of Large and Small Banks

This table shows the second-stage estimates of the heterogeneous effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). In Columns 1 and 3, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 2 and 4, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in large and small banks, respectively. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Large Bank		Small Bank	
	Branches	Deposits Per Capita	Branches	Deposits Per Capita
$Farm\ Concentration_{i,t-2}$	0.289*** (0.079)	0.410** (0.163)	0.185*** (0.038)	0.333*** (0.045)
Observations	13,808	13,808	13,808	13,808
F -statistic	99.093	99.093	99.093	99.093
County Controls	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes
Mean of Dependent Variable	12.81	7498	9.082	11814

Table 6. Urban Counties: Effect of Farm Concentration on Large and Small Banks

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks in urban counties using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} \times Urban_i = \alpha + \beta_1 Subsidy\ Amount_{i,t} \times Urban_i + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2} \times Urban_i, \hat{\epsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} \times Urban_i + \beta_2 X_{i,t} + \beta_3 \hat{\epsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2} \times Urban_i$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). For this analysis, the sample includes large metropolitan counties. In Columns 1 and 3, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 2 and 4, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in large and small banks, respectively. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. $Urban_i$ is an indicator variable for whether the county is a large central metropolitan area. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Large Bank	(2) Large Bank	(3) Small Bank	(4) Small Bank
	Branches	Deposits Per Capita	Branches	Deposits Per Capita
$\widehat{Farm\ Concentration_{i,t-2} \times Urban_i}$	-0.112 (0.079)	-0.099 (0.124)	0.009 (0.256)	0.165 (0.363)
Observations	14,059	14,059	14,059	14,059
F -statistic	1.016	1.016	1.016	1.016
County Controls	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes
Mean of Dependent Variable	298.5	31055	60.08	2629

Table 7. Effect of Farm Concentration on Bank Acquisitions by Bank Size

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on bank acquisitions by bank size. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). In Column 1, the outcome variable is $Large\ Acquires\ Small_{i,t}$, which measures the total number of mergers or acquisitions in which a large bank acquires a small bank, aggregated over five-year intervals. Columns 2 and 3 report $Small\ Acquires\ Small_{i,t}$ and $Large\ Acquires\ Large_{i,t}$, which capture the total number of mergers or acquisitions occurring between two small banks and between two large banks, respectively, also aggregated over five-year intervals. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Acquisition Type		
	Large Acquires Small	Small Acquires Small	Large Acquires Large
$\widehat{Farm\ Concentration}_{i,t-2}$	-0.230 (0.238)	0.241** (0.115)	-0.284 (0.195)
Observations	13,808	13,808	13,808
F -statistic	99.093	99.093	99.093
County Controls	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes
Mean of Dependent Variable	1.126	0.946	0.827

Table 8. Effect of Farm Concentration on the Presence and Deposit Share of Lending Constrained and Unconstrained Banks

This table presents second-stage instrumental variable estimates of the heterogeneous effect of a one standard deviation increase in farm concentration on banks that are less likely and more likely to be constrained by regulatory lending limits. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). In Columns 1 and 3, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 2 and 4, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in unconstrained and constrained banks, respectively. Constrained banks are those whose lending capacity, proxied by the Office of the Comptroller of the Currency (OCC) lending limit to a single borrower of 15% of Tier 1 and Tier 2 capital, is below the annual nationwide median; unconstrained banks are those above the median. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Unconstrained Bank		Constrained Bank	
	Branches	Deposits Per Capita	Branches	Deposits Per Capita
$Farm\ Concentration_{i,t-2}$	0.296*** (0.076)	0.517** (0.243)	-0.102*** (0.026)	0.125*** (0.029)
Observations	13,808	13,808	13,808	13,808
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Mean of Dependent Variable	8.382	4578	11.77	13613

Table 9. Effect of Farm Concentration on Agricultural Loan Growth

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on agricultural loan growth using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). In Columns 1 and 2, the outcome variable, $Total\ Agricultural\ Loan\ Growth_{i,t}$, is the growth in total agricultural loan volume relative to the prior period in a given county-year, by bank size. The outcome variable in Columns 3 and 4 is $Real\ Estate\ Loan\ Growth_{i,t}$, and the outcome variable in Columns 5 and 6 is $Non-Real\ Estate\ Loan\ Growth_{i,t}$; both are similarly measuring the loan volume relative to the prior period. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Large Bank	Small Bank	Large Bank	Small Bank	Large Bank	Small Bank
	Total Agricultural Loan Growth		Real Estate Loan Growth		Non-Real Estate Loan Growth	
Farm $\widehat{Concentration}_{i,t-2}$	0.645*** (0.226)	0.097 (0.060)	0.520* (0.308)	-0.006 (0.089)	0.601*** (0.183)	0.229*** (0.057)
Observations	13,808	13,808	13,808	13,808	13,808	13,808
F -statistic	95.711	95.711	95.375	95.375	95.711	95.711
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.818	0.829	1.161	1.088	0.722	0.744

Table 10. Agricultural Banks: Effect of Farm Concentration on Large and Small Banks

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specification for the first stage is: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 \widehat{X}_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. The specifications for the second stage are: $Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \epsilon_{i,t}$ in Columns 1 and 4 and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t-2} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$ in the remaining columns using a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The sample is further restricted to agricultural banks, which I define as those holding more than 5% of their total assets in farm loans in a given year. In Columns 1 and 4, the outcome variable, $Probability\ of\ Entry_{i,t}$, is an indicator variable for whether a large or small bank enters the county in a given year, respectively. In Columns 2 and 5, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 3 and 6, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in large and small banks, respectively. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F-statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Large Bank			Small Bank		
	Probability of Entry	Branches	Deposits Per Capita	Probability of Entry	Branches	Deposits Per Capita
$\widehat{Farm\ Concentration}_{i,t-2}$	0.243*** (0.038)	0.589*** (0.171)	1.160*** (0.209)	0.041** (0.017)	0.053 (0.036)	0.349*** (0.050)
Observations	13,808	13,808	13,808	13,808	13,808	13,808
F-statistic	99.045	99.045	87.132	99.045	99.045	87.132
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.343	1.523	1548	0.762	4.499	8745

Table 11. Agricultural Banks: Effect of Farm Concentration on Agricultural Loan Growth

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specification for the first stage is: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. The specifications for the second stage are: $Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \epsilon_{i,t}$ in Columns 1 and 4 and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$ in the remaining columns using a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The sample is further restricted to agricultural banks, which I define as those holding more than 5% of their total assets in farm loans in a given year. In Columns 1 and 2, the outcome variable, $Total\ Agricultural\ Loan\ Growth_{i,t}$, is the growth in total agricultural loan volume relative to the prior period in a given county-year, by bank size. The outcome variable in Columns 3 and 4 is $Real\ Estate\ Loan\ Growth_{i,t}$, and the outcome variable in Columns 5 and 6 is $Non-Real\ Estate\ Loan\ Growth_{i,t}$; both are similarly measuring the loan volume relative to the prior period. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Large	Small	Large	Small	Large	Small
	Bank	Bank	Bank	Bank	Bank	Bank
	Total Agricultural Loan Growth		Real Estate Loan Growth		Non-Real Estate Loan Growth	
$\widehat{Farm\ Concentration}_{i,t-2}$	1.254*** (0.333)	0.184*** (0.069)	1.280** (0.522)	0.039 (0.085)	1.177*** (0.278)	0.239*** (0.065)
Observations	13,808	13,808	13,808	13,808	13,808	13,808
F -statistic	62.052	62.052	60.929	60.929	61.200	61.200
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.818	0.829	1.161	1.088	0.722	0.744

Table 12. Effect of Farm Concentration on Federal Government Loans

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on access to subsidized loans using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. For this specification, I use a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The outcome variables in Columns 1 and 2 are the $Total\ Amount_{i,t}$ and $Total\ Number_{i,t}$ of direct loans, respectively, issued at the county level by the federal government. These direct loans are specifically targeted toward small, new, or socially disadvantaged family farms that are unable to secure credit at reasonable rates from commercial banks. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Direct Loan	
	Total Amount	Total Number
$Farm\ Concentration_{i,t-2}$	0.078 (0.267)	-0.255 (0.210)
Observations	13,808	13,808
F -statistic	99.093	99.093
County Controls	Yes	Yes
Deregulation Index FE	Yes	Yes
County & Year FE	Yes	Yes
Mean of Dependent Variable	12.81	11.94

Table 13. Effect of Farm Concentration on Advertised Interest Rates, 2002 to 2014

This table shows the second-stage estimates of the heterogeneous effect of a one standard deviation increase in farm concentration on the average annual real interest rates advertised by large and small banks using an instrumental variable strategy. The specifications for the first and second stages, respectively, are: $\widehat{Farm\ Concentration}_{i,t} = \alpha + \beta_1 \widehat{Subsidy\ Amount}_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$ and $Y_{i,t} = \alpha_{i,t} + \beta_1 \widehat{Farm\ Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data on an annual level (see Section 5 for sample construction details). Panel A reports deposit rates and Panel B reports lending rates. The outcome variables in Panel A, Columns 1–3 are real interest rates on savings deposit accounts, defined as \$10K money market accounts, advertised by all banks, large banks, and small banks, respectively. The outcome variables in Panel A, Columns 4–6 are real interest rates on time deposit accounts, defined as 12-month \$10K certificates of deposit, advertised by all banks, large banks, and small banks, respectively. The outcome variables in Panel A, Columns 7–9 are real interest rates on checking deposit accounts, defined as interest-bearing checking accounts for the same three bank groups. The outcome variables in Panel B, Columns 1–3 are real interest rates on auto loans, advertised by all banks, large banks, and small banks, respectively. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. $\widehat{Farm\ Concentration}_{i,t-2}$ is the fitted lagged midpoint farm size estimated in the first stage and carried forward annually until the next census observation. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Deposit Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Savings Deposit Rates			Time Deposit Rates			Checking Deposit Rates		
	Overall	Large Banks	Small Banks	Overall	Large Banks	Small Banks	Overall	Large Banks	Small Banks
Farm Concentration $_{i,t-2}$	-0.355*** (0.068)	-0.104 (0.086)	-0.285*** (0.070)	-0.060 (0.046)	-0.360*** (0.072)	0.085 (0.058)	-0.208*** (0.049)	-0.086** (0.043)	-0.145*** (0.050)
Observations	66,045	66,045	66,045	66,045	66,045	66,045	66,045	66,045	66,045
<i>F</i> -statistic	35.770	35.770	35.770	35.770	35.770	35.770	35.770	35.770	35.770
Deregulation Index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	-1.206	-1.375	-1.106	-0.123	-0.361	0.00804	-1.626	-1.765	-1.543

Panel B. Auto Lending Rates

	(1)	(2)	(3)
	Auto Loan Interest Rates		
	Overall	Large Banks	Small Banks
Farm Concentration $_{i,t-2}$	0.808*** (0.155)	1.109*** (0.194)	-0.314* (0.174)
Observations	66,045	66,045	66,045
<i>F</i> -statistic	35.770	35.770	35.770
Deregulation Index	Yes	Yes	Yes
County Controls	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes
Mean of Dependent Variable	4.914	4.745	5.050

Figure 1. Timeline of U.S. Farm Policy Changes from 1996 to 2014

This figure illustrates the timeline of base acre reference periods and key policy events under successive U.S. farm bills. The 1996 Federal Agriculture Improvement and Reform (FAIR) Act introduced fixed direct payments based on planted acres from 1981 to 1985. The 2002 Farm Security and Rural Investment (FSRI) Act expanded the program to include oilseeds and allowed base acres to be updated to reflect plantings from 1998 to 2001. The program was renewed in the 2008 Food, Conservation, and Energy Act and ended in the 2014 Agricultural Act.

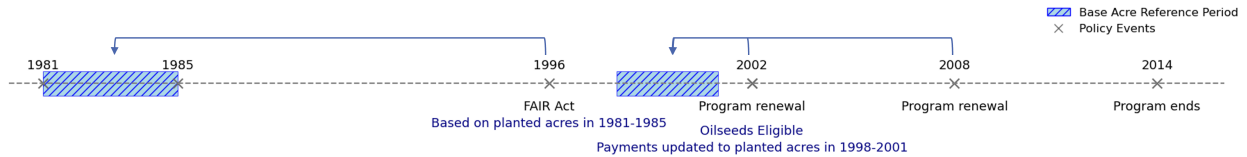


Figure 2. Effect of Subsidies on Farm Concentration

Estimates are obtained using the difference-in-differences estimator developed by de Chaisemartin and d'Haultfoeuille (2023), which accommodates continuous treatments and addresses biases in two-way fixed effects models. The specification is: $Farm\ Concentration_{i,t} = \alpha + \beta_1\ Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t}$. Subscript i represents the county and subscript t represents the year. The observations are at the county-year level. The sample is restricted to non-metropolitan counties with available Census of Agriculture data from 1987 to 2012 (see Section 5 for sample construction details). The outcome variable is $Farm\ Concentration_{i,t}$, which is the county-level acre-weighted median farm size. $Subsidy\ Amount_{i,t}$ is a continuous normalized measure of the predicted value of total fixed subsidy payments in a given county-year. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. Coefficient estimates are plotted with 95% confidence intervals based on standard errors clustered by county.

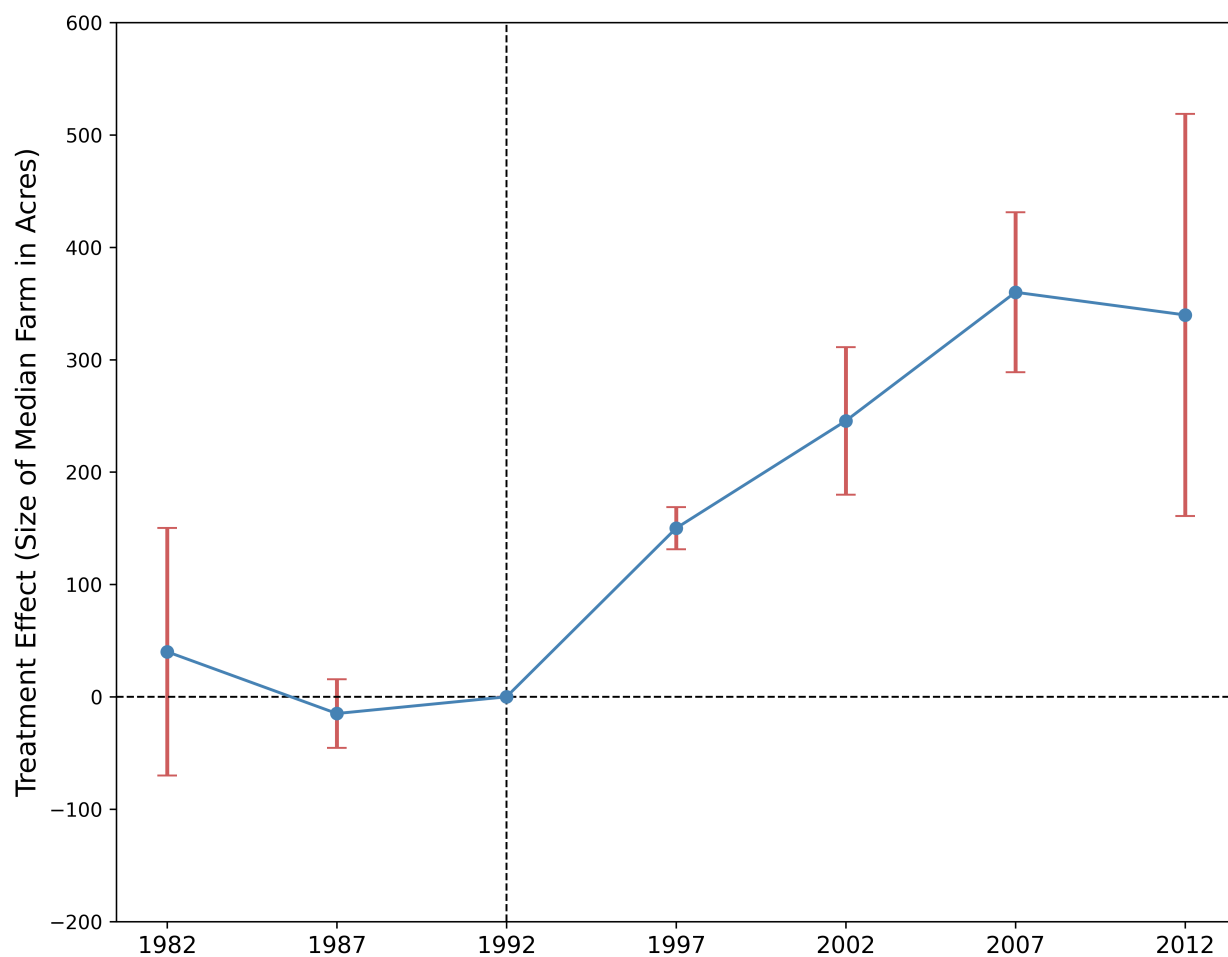
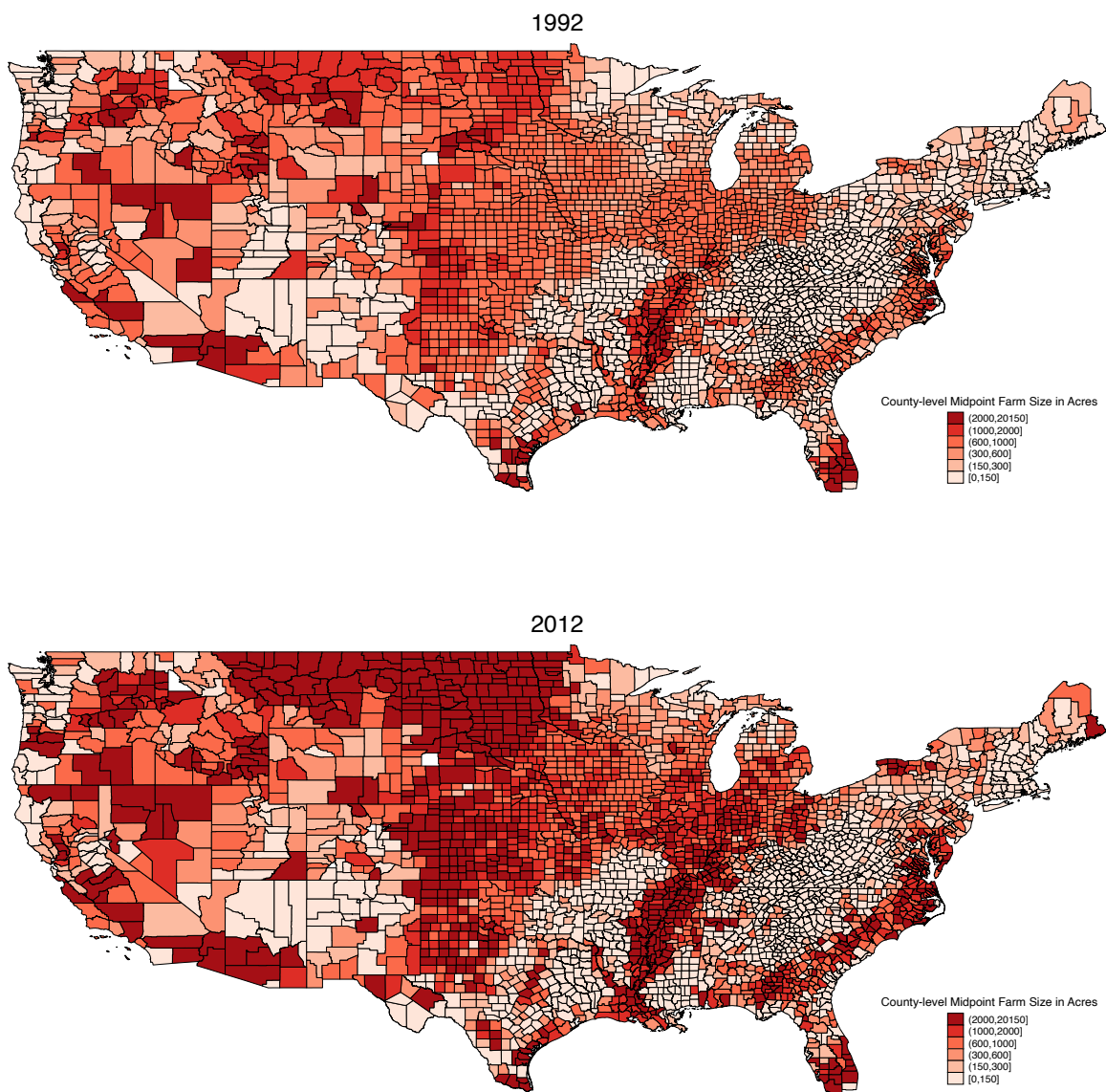


Figure 3. Changes in Farm Concentration and County-Level Program Payments

Panel A shows farm concentration in 1992 compared to 2012, and Panel B shows the total fixed payments paid per county in 2012.

Panel A. Farm Concentration, 1992 and 2012



Panel B. Distribution of Total Program Payments in 2012

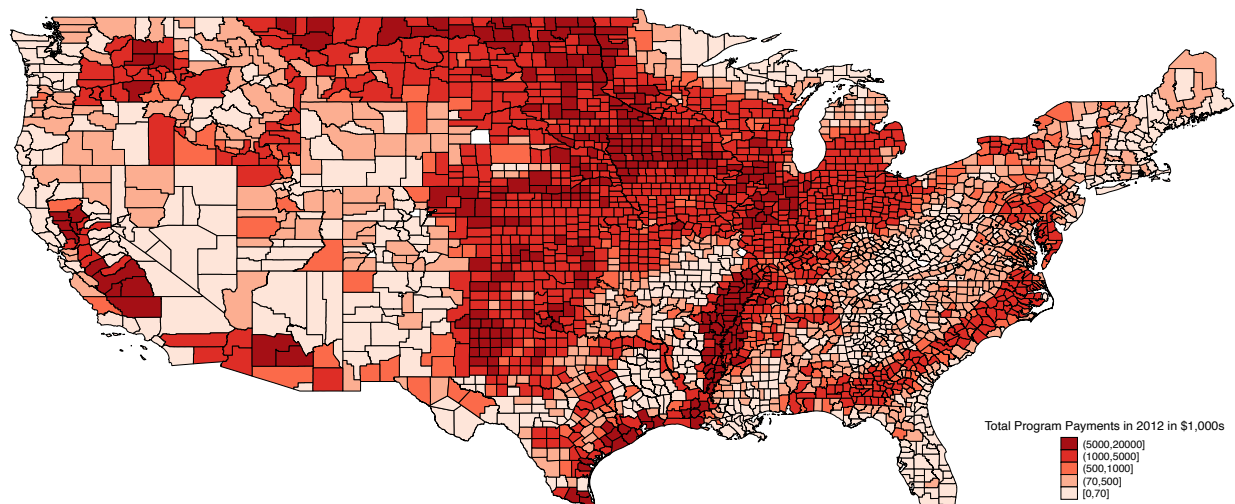
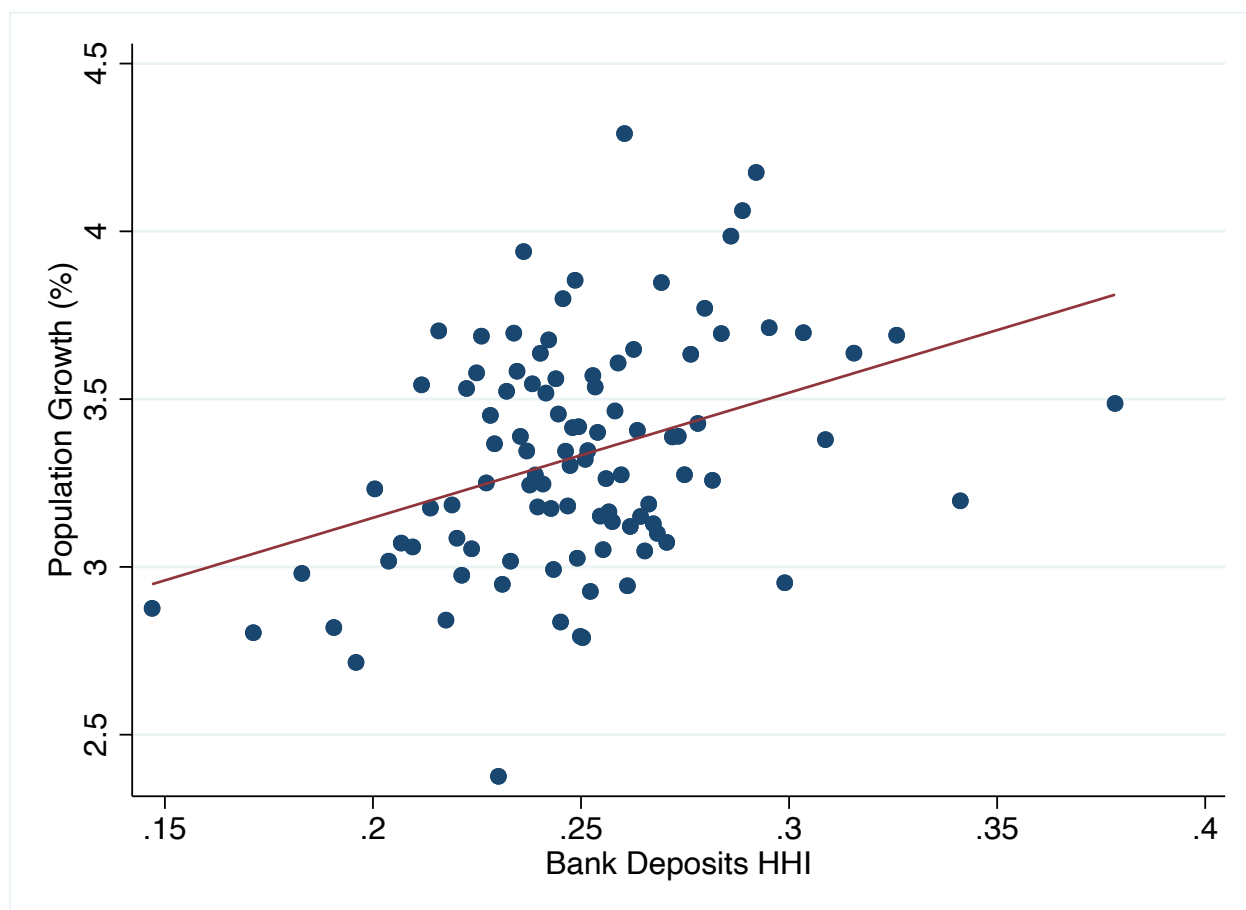


Figure 4. Relationship Between Population Growth and Bank Deposits HHI

This figure illustrates the relationship between county-level population growth and the bank deposits Herfindahl-Hirschman Index (HHI). Population growth is measured as the ratio of a county's population to its population in the previous period, using five-year intervals. The Bank Deposits HHI is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. To mitigate the effect of outliers, the figure excludes counties with a Bank Deposits HHI above 0.5 or below 0.1.



Appendix A. Additional Analyses

Table A.1. Alternative Lag Structures: Effect of Farm Concentration on Large and Small Banks

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy with alternative time lags for the second stage. The specification for the first stage is: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. The specifications for the second stage are: $Y_{i,t} = \alpha_{i,t} + \beta_1 Farm\ Concentration_{i,t-k} + \beta_2 X_{i,t-k} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$ in Columns 1 and $E[Y_{i,t} \mid Farm\ Concentration_{i,t-k}, \hat{\varepsilon}_{i,t-k}, X_{i,t-k}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-k} + \beta_2 X_{i,t-k} + \beta_3 \hat{\varepsilon}_{i,t-k} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t})$ in Columns 2–5. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). In Panels A and B, the first stage is lagged by three and four years, respectively, to test the sensitivity of the results to alternative lag structures. In Column 1, the outcome variable, $Bank\ Deposits\ HHI_{i,t}$, is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. In Columns 2 and 4, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 3 and 5, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in large and small banks, respectively. $Farm\ Concentration_{i,t-k}$ is the midpoint farm size, lagged by either three or four years. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. First Stage Lagged Three Years

	(1)	(2)	(3)	(4)	(5)
		Large Bank		Small Bank	
	Bank Deposits HHI	Branches	Deposits Per Capita	Branches	Deposits Per Capita
Farm Concentration $_{i,t-3}$	0.037*** (0.007)	0.281*** (0.098)	0.578*** (0.190)	0.187*** (0.036)	0.355*** (0.049)
Observations	13,808	13,808	13,808	13,808	13,808
<i>F</i> -statistic	99.433	96.392	96.392	96.392	96.392
County Controls	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.312	13.02	7809	8.921	11627

Panel B. First Stage Lagged Four Years

	(1)	(2)	(3)	(4)	(5)
		Large Bank		Small Bank	
	Bank Deposits HHI	Branches	Deposits Per Capita	Branches	Deposits Per Capita
Farm Concentration $_{i,t-4}$	0.038*** (0.007)	0.217*** (0.076)	0.580*** (0.156)	0.208*** (0.033)	0.388*** (0.051)
Observations	13,808	13,808	13,808	13,808	13,808
<i>F</i> -statistic	98.551	95.434	95.434	95.434	95.434
County Controls	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.311	13.30	8146	8.728	11497

Table A.2. First Differences: Effect of Farm Concentration on Bank Concentration

This table reports the first- and second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on the bank deposits Herfindahl-Hirschman Index (HHI). To correct for autocorrelation, this specification uses first differences, where the first and second stage, respectively, are: $\Delta Farm\ Concentration_{i,t} = \alpha + \beta_1 \Delta Subsidy\ Amount_{i,t} + \beta_2 \Delta X_{i,t} + \delta_t + \phi_d + \epsilon_{i,t}$ and $\Delta Y_{i,t} = \alpha_{i,t} + \beta_1 \Delta Farm\ Concentration_{i,t-2} + \beta_2 \Delta X_{i,t-2} + \delta_t + \phi_d + \epsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). Columns 1 and 2 report the first-stage regressions, where the dependent variable is $\Delta Farm\ Concentration_{i,t-2}$, measured as the midpoint farm size at the county level. Columns 3 and 4 report the second-stage results, where the dependent variable is the change in bank deposits HHI. The $\Delta Bank\ Deposits\ HHI_{i,t}$ is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county, differenced each period. The instrument, $\Delta Subsidy\ Amount_{i,t-2}$, is a continuous normalized measure of the predicted change of total fixed subsidy payments in a given county-year. The control variables account for county-level land availability using differenced and lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the differenced county-level employment rate and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	First Stage		Second Stage	
	Δ Farm Concentration		Δ Bank Deposits HHI	
Δ Farm Concentration $_{i,t-2}$			0.460*** (0.154)	0.447*** (0.113)
Δ Subsidy Amount $_{i,t-2}$	68.695*** (6.987)	98.046*** (8.128)		
Δ Log Income Per Capita $_{i,t-2}$		105.917* (60.002)		-59.696 (90.679)
Δ Employment Rate $_{i,t-2}$		-152.565 (116.198)		76.153 (277.481)
Δ Idle Land $_{i,t-7}$		0.003*** (0.001)		
Δ Other Cropland $_{i,t-7}$		0.001*** (0.000)		
Δ Pastureland $_{i,t-7}$		0.000 (0.000)		
Observations	13,166	13,166	13,166	13,166
F -statistic	43.653	43.653	43.653	43.653
Deregulation Index FE	No	Yes	No	Yes
County & Year FE	Yes	Yes	Yes	Yes
Mean of Dependent Variable	118.6	118.6	12.65	12.65

Table A.3. OLS Results: Effect of Farm Concentration on Bank Concentration

This table shows OLS estimates of a one standard deviation increase in farm concentration on the bank deposits Herfindahl-Hirschman Index (HHI). The specification is: $Y_{i,t} = \alpha_{i,t} + \beta_1 \text{Farm Concentration}_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t}$. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The dependent variable is the *Bank Deposits HHI* $_{i,t}$, which is a continuous variable ranging from 0 to 1 calculated as the sum of squared deposit shares held by each bank within a county. *Farm Concentration* $_{i,t-2}$ is the midpoint farm size at the county level. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	OLS	
VARIABLES	Bank Deposits HHI	
Farm Concentration $_{i,t-2}$	0.003** (0.002)	0.003* (0.001)
Log of Income Per Capita $_{i,t-2}$		0.008 (0.011)
Employment Rate $_{i,t-2}$		0.024 (0.029)
Idle Land $_{i,t-7}$		-0.003** (0.001)
Other Cropland $_{i,t-7}$		-0.002 (0.002)
Pastureland $_{i,t-7}$		-0.000 (0.004)
Observations	13,778	13,778
R-squared	0.930	0.930
Deregulation Index FE	No	Yes
County & Year FE	Yes	Yes
Mean of Dependent Variable	0.313	0.313

Table A.4. Alternative Definition of Agricultural Banks: Effect of Farm Concentration on Large and Small Banks

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specification for the first stage is: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. The specifications for the second stage are: $Y_{i,t} = \alpha_{i,t} + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \epsilon_{i,t}$ in Columns 1 and 4 and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t-2} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$ in the remaining columns using a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The sample is further restricted to agricultural banks, which I define as those holding more than 1% of their total assets in farm loans in a given year. In Columns 1 and 4, the outcome variable, $Probability\ of\ Entry_{i,t}$, is an indicator variable for whether a large or small bank enters the county in a given year, respectively. In Columns 2 and 5, the outcome variable is $Branches_{i,t}$, which is the county-level number of branches owned by large and small banks, respectively. In Columns 3 and 6, the outcome variable is $Deposits\ Per\ Capita_{i,t}$, which is the deposits per capita in large and small banks, respectively. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Large Bank			Small Bank		
	Probability of Entry	Branches	Deposits Per Capita	Probability of Entry	Branches	Deposits Per Capita
$Farm\ Concentration_{i,t-2}$	0.145*** (0.036)	0.469*** (0.128)	0.996*** (0.161)	0.036** (0.015)	0.089** (0.035)	0.358*** (0.048)
Observations	13,808	13,808	13,808	13,808	13,808	13,808
F -statistic	99.096	99.096	83.626	99.096	99.096	83.626
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.746	11.26	6664	0.939	7.383	10836

Table A.5. Alternative Definition of Agricultural Banks: Effect of Farm Concentration on Agricultural Loan Growth

This table reports the second-stage results from an instrumental variable strategy to estimate the effect of a one standard deviation increase in farm concentration on large and small banks using an instrumental variable strategy. The specification for the first stage is: $Farm\ Concentration_{i,t} = \alpha + \beta_1 Subsidy\ Amount_{i,t} + \beta_2 X_{i,t} + \gamma_i + \delta_t + \phi_d + \varepsilon_{i,t}$. The specifications for the second stage are: $Y_{i,t} = \alpha_{i,t} + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t-2} + \gamma_i + \delta_t + \epsilon_{i,t}$ in Columns 1 and 4 and $E[Y_{i,t} | Farm\ Concentration_{i,t-2}, \hat{\varepsilon}_{i,t-2}, X_{i,t-2}, \gamma_i, \delta_t, \phi_d] = \exp(\alpha + \beta_1 Farm\ Concentration_{i,t-2} + \beta_2 X_{i,t} + \beta_3 \hat{\varepsilon}_{i,t-2} + \gamma_i + \delta_t + \phi_d + \epsilon_{i,t})$ in the remaining columns using a control function approach. In the table, I include a hat on $Farm\ Concentration_{i,t-2}$ to indicate this is an IV regression. Subscript i represents the county, t represents the year, and d represents state-level banking deregulation. The county-year level data are from merged bank and agriculture data (see Section 5 for sample construction details). The sample is further restricted to agricultural banks, which I define as those holding more than 1% of their total assets in farm loans in a given year. In Columns 1 and 2, the outcome variable, $Total\ Agricultural\ Loan\ Growth_{i,t}$, is the growth in total agricultural loan volume relative to the prior period in a given county-year, by bank size. The outcome variable in Columns 3 and 4 is $Real\ Estate\ Loan\ Growth_{i,t}$, and the outcome variable in Columns 5 and 6 is $Non-Real\ Estate\ Loan\ Growth_{i,t}$; both are similarly measuring the loan volume relative to the prior period. $Farm\ Concentration_{i,t-2}$ is the lagged midpoint farm size. Small banks are those with less than \$10 billion in inflation-adjusted assets, and large otherwise. The control variables account for county-level land availability using lagged measures of idle cropland, pastureland, and cropland left fallow, lost to crop failure, or otherwise unharvested from the prior Census of Agriculture. I also control for local economic conditions using the county-level employment rate, lagged log number of branches, and log income per capita. F -statistics are from the first stage. Standard errors clustered at the county level are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Large	Small	Large	Small	Large	Small
	Bank	Bank	Bank	Bank	Bank	Bank
	Total Agricultural Loan Growth		Real Estate Loan Growth		Non-Real Estate Loan Growth	
$Farm\ Concentration_{i,t-2}$	0.904*** (0.237)	0.139** (0.060)	0.836** (0.332)	-0.004 (0.089)	0.854*** (0.197)	0.249*** (0.058)
Observations	13,808	13,808	13,808	13,808	13,808	13,808
F -statistic	76.801	76.801	76.365	76.365	76.694	76.694
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Deregulation Index FE	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Variable	0.818	0.829	1.161	1.088	0.722	0.822

Appendix B. Data Methods and Technical Details

This appendix provides additional detail on the procedures used to construct key variables and allocate bank- and loan-level data to the county level for empirical analysis.

B.1 Estimating County-Level Agricultural Lending

Because agricultural loan volumes are reported at the bank level in the FFIEC Call Reports, I allocate each bank’s total agricultural lending across the counties in which it operates using a demand-weighted procedure based on the Census of Agriculture. Specifically, I calculate each county’s share of total farm interest expenses, aggregated across real estate and production loans, and use this share to allocate agricultural lending from each bank across counties. For example, if a bank operates in three counties and each county accounts for one-third of total farm interest expenses, I assign one-third of the bank’s agricultural lending to each county. This process is repeated for each bank and year, then aggregated by county and by bank size group (small vs. large).

This method follows the approach used in Key, Burns, and Lyons (2019) and Ifft et al., (2024), which estimate spatial lending exposures using historical agricultural activity. While the method provides a tractable proxy for local credit allocation, it has limitations. First, banks, particularly larger institutions with centralized lending divisions, may extend loans beyond the counties in which they maintain branches. Second, the method assumes that a bank’s lending is proportional to local demand as measured by past interest expenses, which may not reflect current lending decisions. Nevertheless, this allocation approach provides a consistent basis for constructing county-level measures of agricultural lending intensity in the absence of branch-level loan data.

B.2 Instrument Construction and Interpolation

My instrumental variable leverages exogenous variation in fixed-payment subsidies introduced under the 1996 FAIR Act and subsequently extended and modified under the 2002 Farm Security and Rural Investment (FSRI) Act. Initially, payments were based on base acres and yields from 1981 to 1985, scaled by national per-acre payment rates. The 2002 FSRI Act permitted farmers to update base acres using planting data from 1998 to 2001 and expanded eligibility to include oilseeds such as soybeans and peanuts.

To construct predicted subsidy exposure, I combine each county’s updated base acres with national payment rates by crop and year, following a Bartik-style continuous difference-in-differences design. Because base acres are fixed by legislation and national rates vary only over time, identification comes from differential county-level exposure based on historical

planting patterns and program eligibility. This approach captures both the original 1996 eligibility criteria and the 2002 updates.

In the five-year panel, I compute predicted subsidies in each census year and use them as instruments for changes in farm structure. For the annual panel used in the RateWatch analysis, I estimate fitted values of farm consolidation (midpoint farm size) from the first-stage regression in each census year and carry these values forward until the next census observation. Although this approach may introduce measurement error, it biases results conservatively toward zero.

B.3 Lag Structure and Timing Alignment

To allow time for structural changes in agriculture to influence financial outcomes, all farm variables, including the midpoint and land-use controls, are lagged by two years in the five-year panel. In the annual panel, the timing of banking data (from the FDIC) reflects branch activity as of June of each year. To align RateWatch interest rate data with this calendar structure, I average weekly rates from July of the previous year through June of the current year.

B.4 USDA Direct Loan Program

To assess whether subsidy-driven borrower consolidation affects access to federal agricultural credit, I use administrative data from the USDA’s Farm Service Agency (FSA) on direct loan issuance. These loans are targeted primarily toward family farms, defined as operations where the majority of the business is owned and operated by individuals within a family. The program is designed to assist small, new, or socially disadvantaged farmers, offering credit at reasonable rates to support farm ownership, operation, or expansion.

Eligibility does not depend on a minimum credit score. Although applicants must demonstrate reasonable ability to repay and cannot be delinquent on other federal debt, individuals with no formal credit history may still qualify. The program includes both ownership and operating credit. Farm ownership loans can be used to purchase farmland or expand physical infrastructure, with a loan limit of \$600,000 and repayment terms of up to 40 years. Operating loans are designed for inputs such as seed, livestock, or equipment, with a loan limit of \$400,000 and repayment terms of up to 7 years.

I use annual data on direct loans issued between 1994 and 2014, aggregating both the total number of loans and the dollar amount issued each year. These data allow me to examine whether borrower-side consolidation, triggered in part by fixed-payment subsidies, influences the scale and allocation of federally supported agricultural credit.