Costly External Financing and Monetary Policy Transmission: Evidence from a Natural Experiment*

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Abstract

I provide new evidence that large and small banks have different external financing costs, which generates cross sectional variation in a deposits market pricing power channel of monetary policy transmission. I do so by exploiting a natural experiment using anti-trust related bank branch divestitures. In these divestitures branches are transferred from large to small banks such that the branches are largely preserved and market structure remains unchanged. Consistent with the existence of capital market imperfections at small banks, I find that – holding market concentration constant – lending declines in areas local to branches newly owned by small banks, and deposit rates increase by more, when interest rates increase. My results are confirmed with geographically granular tests utilizing the entire sample of data, and indicate that financing frictions still matter for the transmission of monetary policy through banks.

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1. Introduction

In the traditional bank lending channel of Kashyap and Stein (1995, 2000) – KS hereafter – when the Fed raises rates, it does so through open market operations that reduce the volume of reserves in the banking system. Because of a reserve requirement, banks then experience an outflow of deposits, and smaller banks – with imperfect access to non-deposit funding – must cut back on lending. However there is little empirical evidence supporting the link between reserves and deposits[1]. Furthermore, nowadays the Fed pays interest on reserves – hence the traditional lending channel originally proposed by KS no longer operates. While KS provide compelling evidence of size related financing frictions at banks, it has been unclear what drives the outflow of deposits at during monetary tightening in the first place and if financing frictions still matter for monetary policy transmission.

As a result the literature has searched for alternative channels that explain deposit outflows and lending declines after rate increases. Dreschler, Savov and Schnabl (2017) (DSS hereafter) have more recently proposed and tested one such channel: market power. In the deposits channel of DSS, banks operating in more concentrated markets, widen the interest spreads they charge on deposits when the Fed raises rates, causing these deposits to flow out of the banking system leading to a contraction in bank lending. In this setting, banks with pricing power, for which market concentration is a proxy, trade-off extracting rents in deposits markets with a decline in lending.

In this paper, I provide evidence that imperfect access to non-deposit financing helps to explain cross sectional variation in the transmission of monetary policy through a pricing power channel such as that proposed by DSS. This is because, in a Modigliani Miller world with no financing frictions, an outflow of deposits can be corrected by accessing other funding markets at no additional cost. Hence an outflow of deposits caused by an exertion of market power after a rate increase need not result in a decline in lending, absent imperfect access to non-deposit forms of funding. In this paper I show – holding market concentration constant – smaller banks, who are more likely to have difficulty accessing non-deposits funding, must cut back on lending and raise deposit rates by more in order to retain deposits, relative to larger banks. My results demonstrate that imperfect access to non-deposit forms of funding may be particularly important for explaining cross sectional variation in the operation of a deposits channels and the strength of the channel in the aggregate.

Table 1 motivates this point by using a simple two way sort on bank size (a proxy for imperfect access to non-deposit funding) and HHI (a proxy for bank pricing power), to show

[1]Reserves are only required to be held against a very small fraction of deposits, and granger causality tests show it is unlikely that changes in reserves are causing changes in deposits - see Carpenter and Demiralp (2010).

that there is substantial variation in lending changes after rate increases along the bank size dimension, "holding constant" HHI. In other words, holding "constant" the deposits channel of DSS, bank size seems to matter for the transmission of monetary policy.

While this simple sort is instructive, Figure 1 demonstrates the need to more carefully disentangle imperfect access to non-deposit funds from pricing power in order to assess whether or not and to what extent financing frictions still matter for the transmission of monetary policy. Figure 1 highlights that HHI, which is the typical measure of pricing power used in the existing literature, is correlated with bank size. Hence it is necessary to disentangle the two dimensions in order to understand the *separate* impact of imperfect access to non-deposit funds on monetary policy transmission[2]. Furthermore, as is well documented in the existing literature, smaller banks are more likely to lend to small borrowers, who are more likely to be adversely affected by an increase in rates and reduce demand for borrowing[3]. Hence in order to isolate the effect, if any, of imperfect access to non-deposit funding on lending outcomes after rate changes, it is necessary to separate effects of pricing power from bank size, whilst holding demand conditions constant.

My empirical tests are designed with this in mind: I argue that I isolate the role that imperfect access to non-deposits funding play in a pricing power channel of monetary policy transmission by exploiting a natural experiment whereby bank size varies quasi-exogenously and market concentration and borrower demand conditions are held constant. The experiment consists of antitrust-related bank-branch divestitures that are required by the U.S. Department of Justice (DoJ) as a part of the bank merger process. In these divestitures, branches within a given deposit market (typically a metropolitan statistical area) are divested to out of market banks such that the market-level Herfindahl-Hirschman index (HHI) for deposits is unaffected by the merger. Bank regulators determine which banks are allowed to acquire the divested branches, and the "winning" bank must agree to keep all systems, existing personnel, and relationship managers (i.e., soft information) in place at the newly-acquired branches following the acquisition. Importantly, the banks acquiring these divested branches are typically much smaller than the previous owners, and have no prior presence in the markets where the divestitures take place[4]. Hence these divested branches are effectively transferred from a large owner to a small owner, with no other material changes taking

[2]Note in Table 1 the sort within market concentration buckets by bank size is not an inadvertent sort again on market concentration – the average concentration within the small and large buckets is roughly the same across all concentration buckets. Yet Figure 1 highlights the need to identify these two sources of variation more cleanly than a double sort.

[3]For example through the balance sheet channel of Bernanke and Gertler (1989)

[4]This is because the requirement is that the acquiring bank is out of market, which automatically limits the pool of potential buyers to smaller banks, since it is less likely that larger banks don't operate in that market.

place at the branches themselves or within the branches' competitive markets. I combine these quasi-exogenous changes in bank size with detailed branch-level data on deposit prices, and census tract-level data on loan quantities, to isolate the impact of imperfect access to non-deposit funding on monetary policy transmission.

My results provide strong evidence that imperfect access to non-deposits funding, for which bank size is a proxy, induces cross sectional variation in a pricing power channel of monetary policy transmission. I find that, following divestitures of bank branches from large owners to small owners, a 100 basis point increase in interest rates leads to a 3.6% reduction in lending to small-business borrowers in census tracts surrounding divested branches over the following year. These results scale up to a total reduction in small-bank lending of approximately 0.5% of total lending relative to large banks - after a 100 basis point increase in the Fed Funds rate. Furthermore, I find evidence that imperfect access to non-deposit funding induces variation in deposit rate responses to changes in interest rates - deposit rates at divested branches newly owned by smaller banks increase by 6bp more after a 100 basis point increase in the Fed Funds rate, consistent with smaller banks raising deposit rates by more after a Federal funds rate increase in an attempt to make up lost funds in markets in which they dont face financing frictions. I argue that these findings are economically important since even though the magnitudes are small, they represent a heterogeneous perhaps unintended impact of monetary policy transmission on small banks and hence the consumers that choose to bank with small banks. Furthermore, my results indicate that while the original lending channel of KS no longer operates, financing frictions still matter for the transmission of monetary policy through banks.

My findings survive a number of robustness checks. First, additional tests are conducted that exploit the whole sample of data by running difference in difference tests at extremely local levels (within zip code) with zip code x time fixed effects, for all branches and census tracts, that deliver similar findings and magnitudes to those delivered in the divestiture setting. For example deposit rate changes in response to changes in the Federal Funds rate are compared at branches belonging to a small bank to branches belonging to large banks located in the same zip code within the same market. Within the same zip code, deposit rates at branches belonging to smaller banks will increase by more after an increase in the Federal Funds rate than deposit rates at branches belonging to larger banks. It is unlikely that differences in local market concentration at such a granular level would be driving these results. Similar tests at the census tract level show that lending in census tracts populated with small banks decline by more than lending in census tracts populated with large banks within the same zip code after an increase in the Federal Funds rate. Zip code/time fixed effects are included to absorb any time varying local demand conditions. Given the granu-

larity of these tests, it is unlikely that anything other than differences in financing frictions, for which bank size is a proxy, are driving these results. Further robustness checks confirm the main results.

Finally, I address external validity concerns and concerns that other differences between small banks and large banks - distinct from differential access to non-deposit forms of funding - might be driving my results.

This paper contributes to a long strand of empirical literature on lending channels of monetary policy. A number of existing studies test various components of bank lending channels (Schnabl (2012), Leroy (2013), Jiminez, Mian, Peydro and Salas (2014), Iyer, Peydro, da Rocha Lopes, and Schoar (2014), Becker and Ivashina (2014), Bottero, Lenzu and Mezzanotti (2015), Morais, Peydro and Ortega (2016), Drechsler, Savov and Schnabl (2017)). This paper demonstrates that while various frictions may cause deposit outflows during monetary tightening, financing frictions are necessary for a lending effect to be present; this paper shows that financing frictions will impact cross sectional variation in the strength of a lending channel. Furthermore this paper complements work by Beraja, Fuster, Hurst and Vavra (2018) who show that heterogeneity in the cross section plays a crucial role in determining the aggregate effects of monetary policy.

This paper is also related to the literature on the determination of deposit prices through market power. Neumark and Sharpe (1992) and Driscoll and Judson (2013) provide empirical evidence of the impact of market power on deposit rates. DSS extend this earlier literature on deposit pricing power by providing evidence that banks trade-off extracting rents by restricting the supply of deposits after an increase in the Federal Funds rate, and bank lending. This paper demonstrates that the degree of financing frictions the bank faces, may influence the degree to which the bank exerts pricing power in deposits markets.

Finally, this paper also broadly contributes to the literature on bank capital structure. In particular, a recent literature (e.g. Admati et al. (2010), Admati et al. (2012)) argues that increases in bank capital requirements are unlikely to have a first-order effect on lending, since any Modigliani Miller violations on the liability side of banks balance sheets (such as interest tax shields) are likely to be economically small. In contrast, I document that financing frictions likely related to bank size has a meaningful effect on the cross sectional transmission of monetary policy changes through banks, and highlight that the degree of financing frictions overall likely determine the strength of the channel overall in the aggregate.

The rest of the paper is organized as follows: Section 2 outlines the details of my method of identification, section 3 contains empirical results, section 4 contains a discussion of the results and section 5 concludes.

2. Anti-Trust Related Bank Branch Divestitures

There are two key identification challenges in identifying the effect of imperfect access to non-deposit funding on bank lending and deposit rates when interest rates change. First changes in loan supply resulting from financing frictions must be disentangled from changes in loan demand after interest rates change. This is because lending may also decline after interest rate increases as a result of a reduction in demand for credit as in the balance sheet channel of Bernanke and Gertler (1989) [5]. Furthermore, borrowers of smaller banks may be fundamentally different from borrowers of larger banks for example smaller firms tend to borrow more from smaller banks. Existing literature has documented that demand for loans of smaller firms is more adversely affected after an increase in the Fed Funds rate than demand for loans of larger firms[6]. Hence a decline in lending at small banks after Fed Funds rate increases may be a result of imperfect access to non-deposits funding at small banks which impacts loan supply, or borrowers of smaller banks simply demanding relatively less loans than borrowers of larger banks.

Second, as Figure 1 demonstrates, bank size, a proxy for financing frictions, is correlated with market concentration, a proxy for market power. In particular the most concentrated markets contain the smallest banks. Hence a reduction in lending in highly concentrated markets might be due to the pricing power channel of DSS, or imperfect access to non-deposit funding at small banks, or both.

In order to isolate the impact that financing frictions have on lending independent of the balance sheet channel of Bernake and Gertler (1999) or the market power channel of DSS, it is necessary to hold both borrower demand effects and market concentration constant, whilst varying access to non-deposit funding.

I achieve this by making use of a natural experiment that I argue induces quasi-exogenous variation in bank size – and hence variation in the degree of financing frictions – whilst holding other factors steady.The experiment consists of antitrust-related bank branch divestitures that are required by the U.S. Department of Justice (DoJ) as a part of the bank merger process. Sometimes during bank mergers, the bank regulator - both the DoJ and the Federal Reserve[7]- will intervene and require that the merging banks divest branches in areas

[5]For example, borrower net worth can be reduced by reductions in collateral values, increases in short-term interest expenses, or reductions in consumer demand. In addition to the balance sheet channel, the standard pure money view of monetary policy predicts that loan demand will decline when the Fed raise since after the Fed implements monetary tightening through restricting reserves and hence deposits, if prices don't adjust immediately then agents' real holdings of money declines. To restore equilibrium, the real interest rate will rise, which increases the cost of planned investment, and hence investment and production will decline. This would lead to a decline in *demand* for loans.

[6]Bernanke and Gertler (1995)

[7]The Federal Reserve must approve or deny all mergers in which the resulting firm would be a bank

where the combined market share of the new entity would otherwise be too large and cause anti-competitive concerns.

The regulators primary concern is the effect of the divestiture on the structure of the market. One preference of the regulator is that the entire collection of branches belonging to one of the merging banks within a market is divested in a 'clean sweep' to out of market bank. This is because a divestiture to a bank without an existing presence in the market leaves the number of firms, and the HHI or market structure, unchanged. These divestitures - whereby branches are divested to out of market banks such that the market structure remains exactly the same both prior to and post the divestiture - are the focus of my study.

A critical element of divestitures being an effective tool for antitrust policy is that the bank that purchases the divested branches is able to operate them effectively. The DoJ therefore monitors the sale process to ensure the buyers suitability and quality of the branches divested. Prior to and following the divestiture the DoJ requires that the merging and divesting banks comply strictly with their agreements such as the commitment of the acquirer not to close divested branches, the commitment of the merging banks not to solicit customers defection from divested branches, and the commitment of the selling bank to facilitate the buyers communications with customers and employees of divested branches to ensure that customers and employees remain with the divested branches. In particular, the DoJ requires that personnel, relationship managers and existing systems are retained at the divested branches. In other words, the soft information is retained at the divested branches to maximize the chance that the newly divested branches will become a strong and viable competitor in the market going forward and much about the branch itself is preserved[8].

Importantly, branches are usually transferred from larger bank holding companies to much smaller banks. This is because the requirement that the acquiring bank is out of market automatically restricts the pool of potential buyers to mainly small banks since it is likely that large banks operate in most markets. The average size ratio in my sample is 62 x. Therefore, branches are transferred from large owners to small owners with no material changes taking place either at the branches themselves or in the branches competitive markets. The divestiture thus acts as a quasi-exogenous shock to bank size. This setting is used to identify whether or not imperfect access to external funding impacts the transmission of monetary policy.

This setting allows me to overcome the two key challenges discussed above. First, by

holding company or a state member bank - the Federal Reserve was involved in every divestiture used in my study.

[8]See Pilloff (2002), Federal Reserve and Justice Department Release FAQs on Antitrust Review of Bank Mergers and Bank Mergers and Acquisitions Handbook By American Bar Association. Section of Antitrust Law for more details.

combining bank branch divestitures with census tract-level small-business lending data made available by the Community Reinvestment Act, the effects of financing frictions on loan supply can be isolated from the effects of loan demand after interest rate changes since I argue borrower demand effects are largely held constant for a number of reasons. First, given that the whole loan book is required to be divested, it is likely that the borrowers remain the same pre and post divestiture. Second, the regulator requires that the relationship managers are retained at the divested branches, ensuring that soft information remains preserved. Third, antitrust-related divestitures occur in very specific markets at fairly random points in time, and are hence likely to be uncorrelated with shocks to local borrowers' demand for loans. Finally, by including a market times year fixed effect and comparing lending in areas local to divested branches to lending in areas not local to divested branches but *within* the same market I am able to soak up any time varying changes in local demand. As argued by KS, small businesses are more likely to be dependent on bank loan financing and less likely to be able to frictionlessly substitute to other forms of financing[9]. Hence, by focusing on a dataset of small business borrowing available *at the location of the borrower*, I am able to show that lending quantities decline by greater amounts exactly where we would expect them to: in the loans made to small businesses who have difficulty substituting to other forms of financing. As such, the changes observed in lending local to divested branches newly owned by small banks after changes in the Fed Funds rate are most likely driven by changes in loan supply - stemming from financing frictions at small banks - rather than changes in loan demand.

Furthermore, I study divestitures in which branches are transferred from large to small banks while the HHI of the market remains *unchanged*. Hence I study the differences in lending outcomes in areas local to small banks relative to areas local to large banks, within the same market, where market concentration and hence effects resulting from the lending channel of DSS, are held fixed.

A typical example of a divestiture used in my sample is the divestiture of 3 branches from National Commerce to Greene County Bancshares as a result of the merger between National Commerce and SunTrust in October 2004. In total $63mn of deposits representing 13.3% of the market were divested to Greene County Bancshares in the Lawrence County market in Tennessee. National Commerce had total assets of $24bn and Greene County Bancshares had assets of $1.4bn at the time of the divestiture, so that National Commerce was approximately 18 x the size of Greene County Bancshares. Please see Figure 3 for a schematic of this divestiture.

My sample contains 20 divestitures of this kind, with 313 branches divested in 50 markets.

[9]including loans from other banks

On Average 10 % of the market in divested and the average size ratio is 62 x. I combine these quasi-exogenous changes in bank size with detailed branch-level data on deposit rates, census tract level data on loan quantities, and zip code level data on small businesses, to measure the impact that financing frictions have on the transmission of monetary policy. The next section contains more details of the empirical methods used to carry out this analysis.

2.1. Empirical Design

A difference in differences methods is employed to understand the effect of a quasi-exogenous shock to bank size and hence imperfect access to non-deposits funding, on deposits rates and lending outcomes. Specifically I run a difference in differences regression of the form:

(1)

$$\begin{aligned} y_{i,t} = {} & \beta_0 + \beta_1 FF_t + \beta_2 PostDivestiture + \beta_3 TreatedBranches + \beta_4 FF_t \times PostDivestiture \\ & + \beta_5 FF_t \times TreatedBranches + \beta_6 PostDivestiture \times TreatedBranches \\ & + \beta_7 FF_t \times PostDivestiture \times TreatedBranches + \delta + \epsilon_{i,t} \end{aligned}$$

Where $y_{i,t}$ is the outcome variable which is either census tract level annual lending amounts or branch level weekly deposit rate. Here (i, t) is the frequency of the data. The coefficient of interest is the loading on the triple interaction term which can be thought of as a change in the elasticity with respect to the Federal Funds rate. In other words, the empirical design allows me to test how elasticities of deposits rates and lending relative to the Federal Funds rate changes pre vs post divestiture relative to a control group.

$TreatedBranches$ takes a value of 1 for the treatment group - which is either the divested branches, or the census tracts containing the divested branches for lending tests. $TreatedBranches$ takes a value of 0 for the control group. $PostDivestiture$ takes a value of 1 for the period post the divestiture, and a value of 0 for the period before the divestiture and FF_t is the Fed Funds rate averaged over the time period t. For deposit rate data, I take the pre-period to be the weeks within the two quarters prior to the completion date of the merger, and the post period to be the weeks within the two quarters post the completion date of the merger. For lending outcomes, I take the pre-period to be the year ending December 31st prior to the year in which the merger was completed, and the post-period to be the year ending December 31st after the year in which the merger was completed. Time varying fixed effects δ are included and are discussed in detail below.

Taking the National Commerce/Greene County Bancshares divestiture as an example - the completion date of the merger was the 1st October 2004. I therefore collect weekly

deposits rate data for the National Commerce branches in Lawrence County for the weeks in the 2nd and 3rd quarter of 2004, and for the weeks in the 1st and 2nd quarter of 2005 as components of the treatment group. Similarly, I collect weekly deposits rate data for all other branches in the market except branches that belong to merging banks, for the 2nd and 3rd quarter of 2004 and the 1st and 2nd quarter of 2005 as components of the control group. Bank and year/quarter/market fixed effects are included in the difference in differences specification in equation (1). The inclusion of these fixed effects soak up any time varying changes in market demand, and help to rule out alternative effects driving my main results. See the robustness checks section for more details on the fixed effects used in this study.

For the lending tests, the treatment group comprises all census tracts within zip codes containing National Commerce branches in the Lawrence County market, where census tracts are matched to zip codes using U.S. Census relationship files. The control group comprises all other zip codes in the Lawrence County market that do not contain divested or merging branches as. Census tracts in the treatment and control census tracts are then matched to CRA annual data, for the year ending Dec 31st 2003 and the year ending Dec 31st 2005. Year/market fixed effects are included in the difference in differences specification in equation (1).

The next section outlines the data, results and robustness checks performed to rule out that alternative forces, other than financing frictions are driving my results.

3. Empirics

3.1. Data

Details of bank branch divestitures are obtained from Orders Approving the Merger of Bank Holding Companies published by the Federal Reserve, and U.S Justice Department press releases. Branch addresses are collected from the Department of Justice press releases, and are hand matched to Uninumbers, which are unique FDIC bank branch identifiers, in the FDIC Summary of Deposits data (SOD). Details of HHI changes and market share changes are gathered from the Federal Reserve reports.

The divestiture sample runs from 1999-2014 and comprises 20 divestitures that contained divestitures in markets in which the market structure/HHI index remained unchanged. I restrict the analysis to the period 1999-2008 since there are no Fed Funds rate changes after December 2008. There are a total of 303 branches divested in 50 markets with no change to the market structure. On average 10% of the market is divested and in total approximately $ 10 bn of deposits were divested in my sample. Figure 4 reports the number

of divestiture markets in the sample each year, and Figure 5 highlights states that contain divested branches used in the study. Figures 4 and 5 show that the divestitures are spaced fairly randomly through time and geographically.

Deposit weekly branch level deposit rate data by product is obtained from Ratewatch. Rates are collected for interest checking accounts and savings accounts with a zero minimum balance. I use savings and checking account rates for accounts that have no minimum balance as the best proxy for rates paid on insured deposits[10].

The FDIC SOD data is annual as of June 30th each year and contains Uninumbers which are unique branch identifiers that I use to link Ratewatch accounts to their bank charter and bank holding company. Furthermore, the FDIC SOD data contains the zip code, state, county and MSA that the branch is located in. The markets used in this study in which the branch is located is defined in the FDIC SOD. U.S. Census relationship files are used to match zip codes to census tracts, which are then matched to lending data from the Community Reinvestment Act data.

Loan data is made available by the Community Reinvestment Act published by the FFIEC. All depository institutions with assets greater than $1billion are required to submit details on annual lending activity to small businesses with revenues smaller than $1 million at the census tract level. While these data only capture lending by CRA eligible banks, Greenestone et al (2014) use call report data to estimate that these account for approximately 86% of all loans under $1 million[11]. The CRA data is based on the location of the borrower and not the bank and is available at the census tract level. For a given tract the data measure the total number of loans made to borrowers located in those census tracts regardless of the location of the lending branches.

Branches are linked to banks using FDIC identifiers in the SOD data. FRY-9C data and FFIEC031 data (call report data) contains balance sheet and income statement data for banks. Some of the small banks that have acquired divested branches and appear in my sample do not have bank holding company structures and so do not belong to a bank holding company. In these cases data from the regulatory highest holder, or in other words the bank charter itself, is used.

Business patterns data is obtained from the U.S. Census, is annual and contains the number of establishments by zip code and establishment size.

[10] i.e. the smaller the minimum balance the smaller the account on average and the more likely the actual size is lower than the insurance limit of $100k/$250k.

[11] Nguyen (2014).

3.2. Results

Table 2 contains bank summary statistics of the divesting and acquiring banks in the sample. Table 2 shows that divesting banks tend to be larger, and pay lower deposit rates both checking and savings - than smaller acquiring banks[12], fund assets with less deposits, and hold riskier assets on average[13]. These summary statistics are in line with those in Appendix Table A3 that document summary statistics of the full universe of banks over the sample period split into small medium and large banks[14]. Table A3 also documents that large banks on average change deposit rates by less than small banks do, after both an increase and a decrease in the Fed Funds rate. Comparing Table 2 and Table A3 highlights that while there are clearly differences between characteristics of merging and acquiring banks, these differences seem to be consistent with differences in bank size. See Appendix Tables A1 and A2 for a detailed breakdown of merging, divesting and acquiring banks used in my sample including the size ratio of divesting to acquiring banks, the dollar amount of deposits divested and percent of the market divested.

Table 3 documents further summary statistics of divestiture markets including average CRA lending per census tract that the divesting and acquiring banks operate in, the average checking and savings deposit rates for bank branches as reported by Ratewatch, and the average number of establishments per zip code as recorded in the Zip Code Business Patterns data from the U.S. Census. Table 3 also documents these summary statistics for the full sample. There are no material differences in CRA lending in census tracts that contain divested branches and those that don't, and there seems to be no material difference in CRA lending per census tract in divestiture markets and the full sample as a whole. Furthermore, differences in deposit rates are in line with differences in bank size; merging/divesting banks tend to be large, and savings and checking deposit rates are higher at branches belonging to banks in the rest of the market than at branches belonging to merging banks.

An outflow of deposits at banks after the Fed raises rates will have no impact on bank lending in a Modigliani-Miller world since banks will be able to costlessly replace lost deposits with other funding sources. However if banks have imperfect access to non-deposit forms of funding, they will find it harder to replenish lost deposits and hence might cut back on lending, or in other words reduce loan supply when rates increase. Hence we would expect

[12]Note these findings are consistent with Bord (2018)

[13]The size ratio in Table 2 is smaller than 62x reported above. This is because for remaining tests I restrict the sample to divestitures where the acquiring bank had assets greater than $1b. This is because banks smaller than this do not need to report small business lending. Including acquiring banks with assets smaller than $1b would create a bias in the amount of lending being reported in the post vs pre period.

[14]Small banks have assets smaller than the 50th percentile, medium banks have assets between the 50th and 90th percentile and large banks have assets greater than the 90th percentile

lending to decline more at small banks after an increase in the Fed Funds rate than at large banks, conditional on a deposits outflow, if smaller banks face greater financing frictions than larger banks. If banks exertion of pricing power in deposits markets induces a deposits outflow at banks[15], then in order to assess the impact of financing frictions it is first necessary to hold constant market concentration, the leading proxy for bank pricing power.

Loan demand might also decline by more at small banks relative to large banks after an increase in the Fed Funds rate. This is because, as in Bernanke and Gertler (1995), loan demand will decline after monetary tightening through the balance sheet channel , and smaller firms may be more adversely affected. Given that smaller firms tend to borrow more from smaller banks[16], a reduction in lending at small banks relative to large banks after a rate increase will likely be due to a combination of both loan demand and loan supply effects.

Hence in order to assess the impact that imperfect access to non-deposits funding has on loan supply after interest rate changes it is necessary to hold constant both market concentration and loan demand effects, which i argue the divestiture setting allows. First – I only study divestitures where the market share and hence the HHI of the market in which the branches are located remains the same pre and post divestiture. As a result, market power, for which market concentration is a proxy, is held constant, and thus lending effects resulting from a pricing power channel of monetary policy transmission are held constant. Second – after the divestiture of bank branches from large to smaller banks, it is likely that the borrowers local to divested branches remain the same[17]. Furthermore, much at the branch is preserved in the divestiture including soft information through the retention of loan officers. Hence by observing small business lending responses to changes in the Fed Funds rate in areas local to divested branches, it is likely that we are observing lending to the same borrower, and less stringently to at least the same borrower type, where demand effects are held constant.

In order to capture the impact of imperfect access to non-deposits funding on lending outcomes when interest rates change, I run a difference in differences test to identify changes in the elasticity of census tract level lending made available by the CRA with the Fed Funds rate. I define treated census tracts as all census tracts contained in zip codes that contain branches divested from large to small banks, and I define control census tracts as all census tracts contained in zip codes of all other branches in the market that do not belong to merging banks. Census tracts that contain branches of both merging and divesting banks are excluded. In order to analyze the relationship of lending with the Fed Funds rate with

[15]See DSS

[16]See for example Berger, Goulding and Rice (2014)

[17]One of the key goals of the regulator is that the divestiture preserve local markets and leave local services uninterrupted, especially lending to small businesses.

CRA lending before vs after the divestiture, a period dummy is created taking a value of 1 for the 3 years post the year of divestiture and a value of 0 for the 3 years prior to the year of the divestiture. CRA lending per census tract is then regressed on the interaction of the period dummy, with the census tract treatment dummy and the Fed Funds rate as outlined in equation (1). In this setting, we would expect the triple interaction term in equation (1) to be negative and significant. In other words, local areas that contain branches divested from large to small banks should see lending decline relative to areas with no divested branches after a Fed Funds rate increase, relative to prior to the divestiture. Results are presented in Table 4, and the economic magnitude of the triple interaction term is that an increase of 100 basis points in the Fed Funds rate results in a decline in total amount of lending by approximately 3.6 % relative to areas with no divested branches[18]. In dollar amounts, this translates to a reduction in lending of approximately $44k per census tract and $25m per market[19]. Given that the average number of census tracts acquiring banks operate in is 600, this translates to an average decline in lending at acquiring banks of approximately 0.5% of total lending, or $\$2.1b$, after an increase in the Fed Funds rate of 100bp. These results are consistent with the existence of size related financing frictions. I argue that these findings are economically important. First the average loan size in my sample is roughly $\$30k$, hence a decline in lending of 0.5% of total lending at small banks - or $\$2.1b$ results in a decline in the number of loans of close to $80k$, which would affect roughly 1.4% of all small businesses. While the overall decline in lending in total dollar amounts is relatively small in magnitude, I argue it is important nonetheless. Given that small banks lend heavily to small firms[20], and small firms play an important role in the economy[21], it is important to understand how monetary policy changes will affect small banks and hence small firms and the distributional impact of these effects.

I next use the divestiture setting to measure the impact that financing frictions have on deposit rate dynamics resulting from interest rate changes. Smaller banks facing financing frictions and an outflow of deposits after monetary tightening may raise deposit rates by more than larger banks in an effort to win back lost deposits[22].

These predictions indeed play out in the data; I again use a difference in differences

[18]Note, the variables are standardized with mean 0 and standard deviation 1. Log (total loans) has a mean of 6.6 and a standard deviation of 1.4. The Fed Funds has a mean of 1.9 and a standard deviation of 2.2.

[19]Note average annual lending per census tract is roughly $1.2m and there are approximately 600 census tracts per market on average.

[20]Small banks hold approximately 50% of all small business loans at commercial banks

[21]more than $\frac{3}{4}$ of all small businesses have less than 10 employees, and small firms with less than 500 employees account for about $\frac{1}{2}$ of all private sector employment and $\frac{2}{3}$ of net new job creation in the U.S.

[22]See KS (1995)

method as outlined in equation (1) to asses deposit rate sensitivity to changes in the Fed Funds rate at divested branches pre vs post the divestiture. I take all divested branches as the treatment group, and compare deposit rate sensitivity to the Fed Funds rate relative to a control group, which is the rest of the market excluding merging bank branches. The market is defined as either the metropolitan statistical area, or county, and market definitions are taken from the FDIC SOD data. A period dummy is created taking a value of 1 for the weeks in the 2 quarters post the quarter of the divestiture and a value of 0 for the weeks in the 2 quarters prior to the quarter of the divestiture. In this setting, we would expect the triple interaction term in equation (1) to be positive and significant. Table 5 documents the results of this exercise and shows that the triple interaction term is indeed positive and significant. In other words, at branches divested from large to small banks, deposit rates increase by more after an increase in the Fed Funds rate, which is consistent with the existence of size related financing frictions at banks. The magnitudes translate to an increase of 100 basis points in the Fed Funds rate results in an increase in deposit rates of 6 basis points more at divested branches relative to the control group post divestiture[23]. These results are of the same order of magnitude as those of the less well unidentified tests that exploit the full sample of data reported and discussed later. In addition to including market x year/quarter fixed effects in these tests, I run various robustness tests, outlined in section 3.3, to check that demand for deposits in the divestiture markets is not changing post divestiture and the small acquiring bank is not constrained by the acquisition, to ensure that these findings are driven by supply side frictions and not demand or the acquisition itself. While these magnitudes are small, I argue that they are economically important. First these results demonstrate that bank size is influential in the determination of deposit rates; existing literature up until this point has attributed market wide pricing power, for which market concentration is a proxy, as the key driver of deposit rates. This is potentially important for policy makers as regulators are concerned about product market competition especially during bank mergers. Furthermore these results are consistent with evidence supporting the existence of financing frictions at smaller banks.

These results show that smaller banks cut back lending by more than larger banks and raise deposit rates by more after an increase in the Fed Funds rate and together provide strong evidence of financing frictions. If borrowers are able to switch to other lenders once they face a reduction in lending from their bank after monetary tightening however, then it is unlikely that financing frictions will have any real effects. For example if small businesses are able to switch to another lender after a reduction in loan supply, it is unlikely they

[23]Note, the variables are standardized - deposit rates have a mean 28bp and standard deviation 43bp, the Fed Funds has a mean 1.6% and standard deviation 2.1%

will have to cut back on investment, close, or not form in the first place. The ideal way to measure real effects in this setting is to utilize data on small business formation. However the most granular level data available from the U.S. Census Business Patterns data is at the zip-code level. In order to use the divestiture setting to measure real effects, zip-codes containing *only* branches from divesting banks must be compared to zip-codes containing *no* branches from divesting banks. This exercise results in a very small sample size[24].

In order to demonstrate the real effects of imperfect access to non-deposits funding, I next turn to tests that utilize the entire data sample. These tests are outlined in the next section.

3.3. Robustness Checks

3.3.1. Full Sample Tests

In this section, I exploit the granularity of the data in my sample by using the full universe of data. In particular, I designate census tracts as small or large depending on the size of the largest bank of any branch operating in that census tract. I then assess lending responses to changes in the Fed Funds rate in small census tracts relative to large census tracts within the same zip-code. Table 6 documents the results of this exercise where CRA lending to small businesses is regressed on Small, which is a dummy variable taking a value of 1 for census tracts containing only small bank branches, and a value of 0 otherwise, interacted with the Fed Funds rate. A small bank is defined to have assets between \$1b and \$10b, and a large bank is defined to have assets greater than \$75b [25]. The interaction term captures the relationship of lending to small businesses with the Fed Funds rate in census tracts that contain branches belonging to large banks to census tracts containing branches belonging only to small banks. Furthermore, zip code x year fixed effects are included. Table 6 shows that when the Fed Funds rate increases, lending to small businesses declines by more in census tracts that contain branches only belonging to small banks than census tracts that contain branches belonging to large banks. In particular, after a 100bp increase in the Fed Funds rate, lending to small businesses declines by 4% more in census tracts that only contain branches belonging to small banks relative to census tracts that contain branches belonging to large banks[26].

[24]Note while these unreported results are consistent with financing frictions causing real effects, the estimates are noisy.

[25]These cutoff levels are comparable to the total assets of acquiring and divesting banks in the divestiture sample, accounting for the fact that banks with assets smaller than \$1b are not required to report CRA lending

[26]Note the variables are standardized to have mean 0 and standard deviation 1, in the full sample Log (total loans) has mean 6.5 and standard deviation 1.4, and the Fed Funds has mean 1.9 and standard deviation 2.2

Table 7 next contains the results of an OLS regression of branch level deposit rates on the Fed Funds rate interacted with a dummy variable again labeled Small. Small in this case takes a value of 1 if the branch belongs to a small bank and a value of 0 if the branch belongs to a large bank. Again, a small bank is defined as a bank with assets between \$1b and \$10b, and a large bank is defined as a bank with assets greater than \$75b. Zip code x year/week fixed effects are included. Table 7 shows that *even* within the same zip code, deposit rates at branches that belong to small banks are more sensitive to changes in the Fed Funds rate than branches that belong to large banks. In particular, a smaller bank will raise deposit rates at branches by 4bp more than a larger bank within the same zip code, after a 100bp increase in the Fed Funds rate[27]. These findings are consistent with the magnitudes reported in the bottom panel of Table A3 and Table 5. These results provide compelling evidence that bank size is an important determinant of deposit rate dynamics and provide an additional perspective to existing literature that focuses on market level competition such as Neumark and Sharpe (1992) and DSS.

Similar results hold when assessing small business formation. Table 8 contains results of an OLS regression of the Log of the number of establishments of various sizes, on the Fed Funds rate interacted with a dummy variable Small. Small takes a value of 1 for zip codes containing only branches belonging to small banks, and a value of 0 for zip codes containing branches of large banks where small and large are defined in the same way as above and county x year fixed effects are included. Again, the coefficient on the interaction term is negative indicating that within the same county small business formation declines by more when the Fed Funds rate increases for zip codes that contain branches belonging only to small banks relative to zip codes containing branches belonging to large banks[28].

Results in Tables 6-8 provide additional compelling evidence that there seem to be differences in deposit rate, lending and small business dynamics in relation to the Fed Funds rate at small banks relative to large banks. Furthermore, while these tests are not as well identified as those in Tables 4-5, they use the entire sample of data and the locality of the tests back up the divestiture tests. Nonetheless, it could be that small banks locate branches in local areas with small businesses that are inherently different to small businesses in local areas where large banks locate branches. Or on the other hand, deposits competition could

[27]Note, these tests use standardized variables with mean 0 and standard deviation 1. In the full sample, the mean rate is 48bp and the standard deviation is 55bp. The mean Fed Funds rate is 1.8% and the standard deviation is 2%.

[28]Note the variables are standardized, and the coefficients translate into a reduction of approximately 1 firm per size group per zip group after an increase in the Fed Funds rate of 100bp. While this seems small, it's quite a strong test in the sense that closing of businesses or lack of formation in the first place because of a reduction in credit supply is a fairly extreme outcome. The ideal variables to look at would be employment and investment - but this data is not available at a granular level.

be so local that pricing power might even vary within a zip code. However, these alternative stories seem implausible at such a granular level (i.e. within a zip code).

3.3.2. Additional Robustness Tests

A key assumption for the difference in differences method to yield unbiased results, is that in the absence of treatment the response variable would have been the same for both treatment and control groups. This is captured in the parallel trends assumption, which states that the trend in the outcome variable during the pre-treatment period is the same for both the treatment and the control groups. Figures 6 and 7 document parallel trends for lending and deposit rates and show that the assumption holds in the data. Even given that the parallel trends holds, the identification strategy is much more likely to fail if assignment to the treatment group is based on some characteristic of the group. i.e. the event (being divested) should not be a response to pre-existing differences between the treatment and the control group as this would essentially results in a latent fixed effect across the two groups that will confound any comparison between the two groups. A crucial feature of my divestiture setting is that I only focus on situations where the entire collection of branches within a market is *required* to be divested by the DoJ. Hence the bank *does not choose* which branches to divest.

I further run tests within divestiture markets themselves, comparing branches and areas local to divested branches within the same market, essentially conditioning on any endogeneity arising from the fact that divestiture markets are likely highly concentrated. Similarly, I re-run the main baseline tests comparing divested branches relative to branches of the surviving merging banks within the divestiture market, hence conditioning on the merger itself and any endogeneity associated with that.

Table 9 contains results of these within merger lending tests - where the treatment group is defined to be census tracts contained in zip codes that contain divested branches, and the control group is defined to be all other zip codes containing tracts with branches of merging banks, within divestiture markets. Results are reported in Table 9 and again are quantitatively similar to results in Table 4[29].

I next conduct similar tests for deposits rates where the control group is all divested branches, and the treatment group is all remaining non-divested branches of merging banks in divestiture markets. Results in Table 10 are quantitatively very similar to results in Table 5. These within merger tests indicate that potential endogeneity arising from the divestiture

[29]Note significance is lacking in these tests since the sample size is particularly small since the requirement that the census tract contains *only* branches of the merging bank vs divested branches is quite restrictive - yet while the estimates are noisy, they are of similar magnitude to baseline tests.

setting are not likely driving the main results in Tables 4 and 5.

Another matter is that the divestitures might cause demand in in the market to change and the effects that I am picking up are a function of a change in demand, not a change in supply. First, market x time fixed effects are included in all tests and hence any time varying changes in demand are absorbed and accounted for. Furthermore I run a number of tests to rule out the concern that demand could be changing differentially or unevenly in the market as a result of the divestiture.

First, I check that deposits rates of the rest of the branches in the market that don't belong to merging/acquiring/divesting banks are not changing relative to a control group. If prices in the rest of the market do not change post divestiture, this provides evidence that the rest of the market is not changing as a result of the divestiture. I compare branches within divestiture markets that do not belong to merging/divested/acquiring banks to branches of the same banks in non-divestiture markets. Results are reported in Table A4 which again show that economically and statistically there seems to be no differences between branches of other banks in the market and branches of the same bank in non-divestiture markets. I perform a similar exercise for lending and report results in Table A5. These results demonstrate that it is unlikely that the divestiture caused a material change in market conditions *heterogeneously* alleviating the concern that the market x time fixed effect is not adequately capturing changes in market wide demand.

Finally, related to heterogeneous changes in demand, Burke (1998) shows that in the mega-divestitures of the 1990s divested branches saw temporary deposit outflows at the time of the divestiture. In unreported tests using branch level deposit quantities I do not find a significant outflow at the time of divestiture[30], and furthermore, I find that there is no impact on levels of lending at the time of the divestiture i.e. it is unlikely that a deposit outflow is affecting lending which is exactly in line with the goal of the use of branch divestitures as an anti-trust remedy. It might be the case that the deposit rate increase recorded in Table 5 could be attributed to the bank having to increase deposit rates in order to retain customers and stop them from fleeing, yet the rate differential recorded in the double interaction term is consistent with the unconditional differences in rates when observing averages across large and small banks of similar size. If checkings and savings depositors do flee they are more likely to be the flighty depositors, who are more likely to be more sensitive to monetary policy changes and the stickier depositors are more likely to be left behind; if anything this would bias my results in the opposite direction. Finally the

[30]Note, the Summary of Deposit deposit data includes all types of deposits including checkings, savings, small time and large time. My study focuses solely on checkings and savings which are impossible to separate from the Summary of Deposits data.

changes in sensitivity to monetary policy changes recorded in Table 5, are consistent with the results in Table 7 that utilize the entire data set and do not rely on the divestiture setting.

Another potential concern is that *as a result of* the acquisition, the acquiring bank became more constrained and hence the resulting effects documented in Tables 4-5 are a function of the fact that the acquisition of the divested branches caused a change in ease of access to financing. In order to assess this, I run a number of tests that compare branches of the acquiring bank in non-divestiture markets to other branches of banks operating in the non-divestiture markets. I exclude markets from this analysis that contain branches of the merging banks and include a market x year fixed effect to soak up any time varying market specific changes in demand. If acquiring bank constraints as a result of the acquisition of divested branches are driving the main results, then these effects would be apparent not only in divestiture markets, but also in all other markets that the acquiring bank operates in. Table A6-A8 contains results of these tests and show that there are no material differences in deposit rates, lending, or small business patterns for acquiring banks in non-divestiture markets relative to other banks operating in those markets. As a final test, I compare balance sheet characteristics of acquiring banks to other banks operating in non-divestiture markets that are of a similar size to the acquiring bank[31]. Table A9 contains results of this exercise and show that not surprisingly acquiring banks are becoming larger as a result of the acquisition of divested branches, but if anything, these banks seem to be acquiring good quality assets as risk weighted asset density and allowance for loan and lease losses declines. The results in Tables A6-A9 confirm that it is unlikely that constrainedness of the acquiring bank are driving my main results.

Another confounding factor that could obscure the interpretation of my main results is that the decision to merge and divest is correlated with poor demand in the area i.e. being divested is a function of an unobservable characteristic of the divested branches, that does not affect the other branches in the market, but that affects the outcome variables of the divested branches. Furthermore, for example, poor demand could affect branches of merging banks differentially to other branches in the market because the divested branches are part of merging banks. Alternatively, if the branches being divested are systematically of poor quality, then the divestiture itself caused the cost of supplying wholesale funds at acquiring banks to change. Another concern is that merging banks can anticipate divestitures and so secretly sabotage branches in the run up to the divestiture in order to improve competition conditions for the new merged bank post completion of the merger. Again results in Table A10 provide evidence that rule out these concerns as potential channels that are driving my results. If small banks are systematically acquiring weak branches, then we would expect

[31]With total assets between 75% and 125% of total assets of the acquiring bank.

their balance sheet characteristics, or risk characteristics to change. Table A10 shows that risk weighted asset density and allowance for loan losses seems to be if anything lower than that of the acquiring banks peers. These results help to rule out that the systematic acquisition of poorly performing branches is driving my main results.

Another way in which my identification method might fail is if monetary policy changes affect small banks differently to larger banks, that might also cause small banks to cut back on making loans for reasons unrelated to financing frictions. One potential channel could be through effects stemming from regulatory capital requirements. As Van Den Heuvel (2007) describes, given that bank loans have on average a longer maturity than bank liabilities, monetary tightening affects bank profits negatively, which in turn deteriorates a banks capital adequacy. If banks find it costly to issue new equity, then in order to meet the capital requirement banks must cut back on making loans. Hence if changes in monetary policy affect bank profitability differently for small banks relative to large banks, there could be additional effects on lending working through a regulatory capital channel. However we know from Drechsler Savov and Schnabl (2017) that if anything smaller banks have a smaller maturity mismatch than larger banks[32], and smaller banks have higher equity capital ratios than larger banks[33], so it is less likely that their profitability will be adversely affected and their regulatory capital will be more binding . Second, as Table A10 demonstrates, smaller banks in fact see a relative increase in their equity ratios relative to larger banks during periods of monetary tightening, and a relative drop in risk weighted asset density which implies that their regulatory capital ratios seem to relax relative to large banks during periods of monetary tightening. Hence it is unlikely that this channel is driving my results.

Alternatively -Stein (2002) highlights that large banks have a more hierarchical organizational structure relative to small banks who have a more decentralized structure. This, Stein argues, affects the processing of soft information. It could be the case that after the small bank acquires divested branches the lending decision changes and hence the borrowers change[34]. The double interaction term in the lending results[35] is both economically and statistically insignificant. This suggests that in the short post period time span, it does not look like the acquisition of divested branches is resulting in a change in the levels of lending my results indicate that the effects of a reduction in lending are coming through effects induced by changes in the Fed Funds rate[36]. My intuition is that given the relationship

[32] 3.5 years vs 3 years for the largest 5% of banks relative to the whole sample

[33] See for example Campello (2002)

[34] Or for example loan officer incentives might be different although there is no evidence to suggest that loan officer incentives are systematically different at small and large banks

[35] Treated x Period where all variables are standardized so this represents the levels change in lending that results from the divestiture

[36] One could argue that even though the levels didnt change- the composition of borrowers did. This seems

managers/loan officers remain, and the lending decision is at the loan officer level, it was just business as usual after the divestiture, at least in the short to medium term, which is precisely what the DoJ intended.

My within merging bank tests support my findings of my baseline results in Tables 4 to 5 - and deliver results of a similar magnitude. These results provide comfort that my findings are not driven by endogeneity driven by the merger itself. Furthermore, tests that check whether any other branches or areas within divestiture were affected by the merger and divestiture show that it is not likely that conditions, or demand, changed within the market as a result of the divestiture. Finally further tests show that it is unlikely that acquiring bank constrainedness, systematic quality differences in divested branches or systematic differences in how monetary policy affects small vs large banks - separate from financing frictions - are driving my results. Importantly, results in Tables 4 and 5 are quantitatively and economically similar to results in Tables 6 and 7, where tests do not rely on the divesture setting and only on a size differential.

4. Discussion

The original lending channel of KS relies on a link between deposits and reserves -so that open market operations that change the volume of reserves in the banking system will then cause deposit inflows or outflows. These deposit flows will affect lending outcomes depending on the ease with which banks can access non-deposits funding, which KS show is related to bank size. However, in today's world with interest on reserves, the original lending channel of KS no longer operates, and the literature has searched for alternative mechanisms that might drive these deposits flows that occur when rates change. DSS proposed and tested one such mechanism pricing power, for which market concertation is a proxy. In this pricing power channel, banks trade off exerting their pricing power in deposit markets by keeping deposit rates low and hence losing depositors when the Fed Funds rate increases, with not having enough funds to make all positive NPV loans.

However in a Modigliani-Miller world banks can costlessly substitute to other forms of financing and hence lending should not be impacted after banks exert pricing power in deposits markets and experience deposit outflows as a result. Imperfect access to non-deposits funding on the other hand, will limit a bank's ability to substitute after deposit outflows and hence banks that experience greater financing frictions should see larger lending declines all else equal. Indeed in this paper I show that holding market concentration constant, bank

implausible since given the lending is at the location of the borrower, after acquisition of the branches the loan officers would have to stop lending to existing local borrowers and start lending in the same quantity to systematically different small borrowers who werent previously borrowing

size is related to cross sectional variation in lending outcomes and deposit rate changes when interest rates change.

Anti-trust related bank branch divestitures provide an ideal setting in which to isolate the effects of imperfect access to non-deposits funding on deposit rates and lending outcomes. Bank branch divestitures, whereby branches are divested from large to small out-of-market banks, along with relationship managers and hence soft information, act like a quasi-exogenous shock to bank size and hence financing frictions. The setting is particularly fitting to study the effect of financing frictions on lending outcomes and deposit rates because first, much about the local borrower is likely preserved and second I only study divestitures in which the market concentration remains the same before and after the divestiture. Hence concerns that borrower demand effects are driving my results[37] are mitigated, and I am able to study the impact that cross sectional variation in imperfect access to non-deposit funding has on lending outcomes and deposit rates after interest rate changes holding constant a market power channel of monetary policy transmission.

While these divestitures are not randomly assigned[38], DOJ procedures help here. First I only study divestitures where the *entire collection* of one of the merging banks branches within a market is *required* to be divested - this removes any choice by the banks in the branches that are to be divested. In other words the banks have no choice at all. Second, the regulators primary concern is that the divested branches become a strong and viable competitor in the market going forward and hence monitors the branches in the run up to the divestiture. Furthermore, the DoJ monitors any communication from divesting banks to branch customers to ensure that divesting banks are not trying to solicit customers or sabotage the branches[39]. Merging banks will ex ante anticipate this, and given that it is costly for the merging banks to have their merger proposal denied, they will likely not engage in activity that hampers the ability of the branch to operate post divestiture.

An additional source of bias could arise from the fact that the acquirer is also not randomly assigned. Again DoJ procedures help here. First, the acquiring bank in my setting must be out of market which then automatically limits the sample of possible banks to smaller banks[40]. Second the acquiring bank must ultimately be approved by the DoJ as competitively suitable and the package of divested branches must allow the acquiring bank to compete effectively in the market. In other words the buyer must demonstrate that it can effectively control the assets.

[37] i.e. through the "balance sheet channel " of Bernanke and Gertler (1989)

[38] the DoJ does not randomly assign who they will challenge in mergers

[39] See Bank Mergers and Acquisitions Handbook: Section of Anti-Trust Law by the American Bar Association for more details on the requirements and process

[40] large banks usually operate in many markets and so are much less likely to be eligible as an acquirer

The specifics of the divestiture setting itself, DoJ procedures and my empirical design and robustness tests rule out many potential sources of endogeneity as potentially driving my results. Furthermore, tests using the entire sample of data, conducted at an extremely granular level confrim are in line with results obtained using quasi-exogenous shocks to bank size and hence imperfect access to non-deposit forms of funding.

5. Conclusion

In this paper I show that imperfect access to non-deposit forms of funding, for which bank size is a proxy, can explain cross sectional variation in a pricing power channel of monetary policy transmission through banks.

I identify this cross sectional variation by exploiting a natural experiment that induces quasi-exogenous variation in bank size holding market concentration and borrower demand effects constant. The experiment consists of antitrust-related bank branch divestitures that are required by the U.S. Department of Justice (DoJ) as a part of the bank merger process. In these divestitures, branches within a given deposit market are divested to outside market banks in a manner that keeps the market-level HHI exactly the same both prior to and following the bank merger thereby ruling out any direct changes in deposits market-wide pricing power.

Importantly, the bank acquiring the divested branches is typically much smaller than the previous owner, and has no prior presence in the market where the divestiture takes place. Furthermore DoJ procedures ensure that much about the branches, including soft information, is largely preserved. Hence, these divested branches are effectively transferred from a large owner to a small owner, with no other material changes taking place at the branches themselves or within the branches competitive markets. In other words, the divestitures deliver a change in bank size that is uncorrelated with the HHI or changes in borrower demand.

These quasi-exogenous changes in bank size are then combined with detailed tract level data on loan quantities and branch-level data on deposit prices, to identify the impact of imperfect access to non-deposits funding on the transmission of monetary policy. Lending declines by approximately 3.6% per tract after an increase of 100 basis points in the Fed Funds rate in zip codes that contain branches divested from large to small banks. This amounts to a total decline in lending to corporations by small banks of roughly 0.5% of total small bank lending after an increase in the Fed Funds rate of 100 basis points. These results are consistent with costly external financing at small banks.

Finally my results using the full sample of data confirm these results outside of the

divestiture setting and provide evidence of real effects - the number of small businesses decline in zip codes with branches belonging to small banks only after an increase in the Fed Funds rate relative to zip-codes that contain branches belonging to large banks. A number of robustness checks rule out that other channels could be driving these results.

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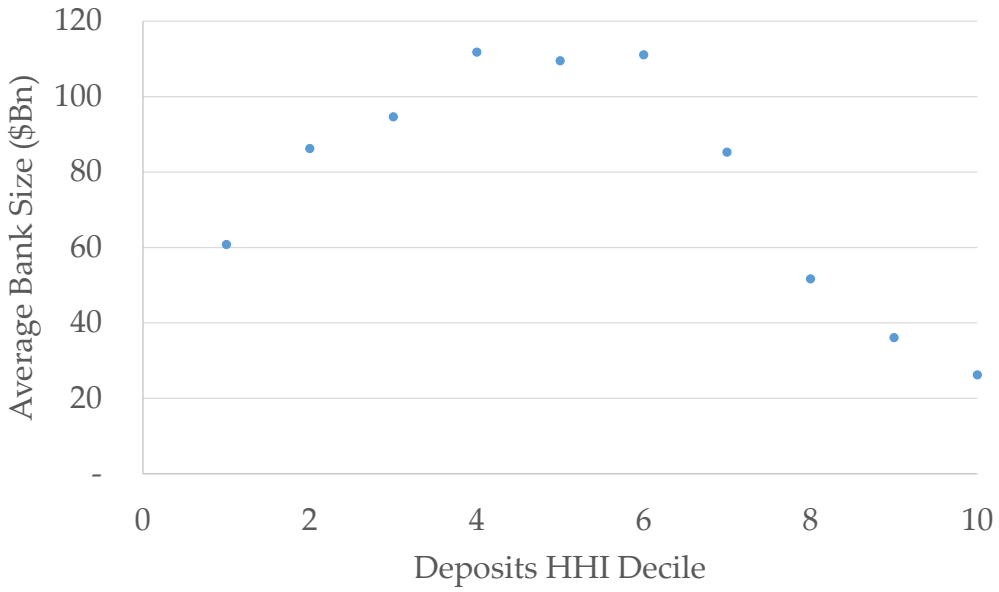
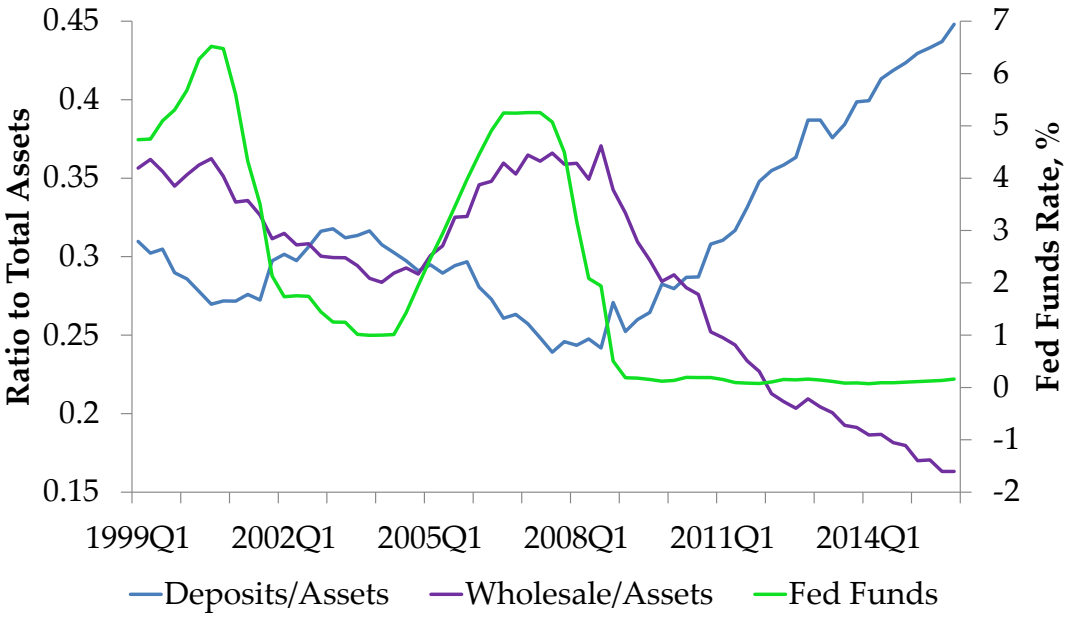


Figure 1: This diagram plots average bank size in markets ranked by deposits HHI decile.



Source: FRY-9C Forms

Figure 2: This chart plots aggregate deposits and wholesale Bank debt as a fraction of total assets against the Federal Funds rate.

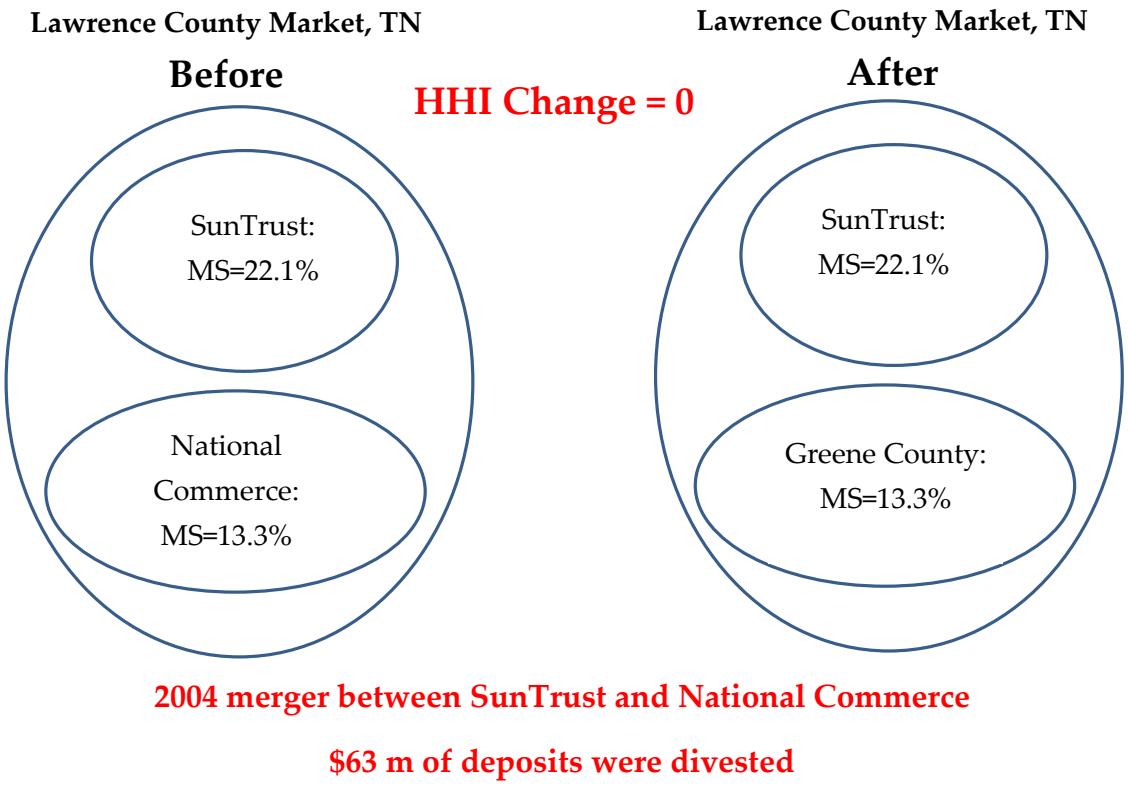


Figure 3: This diagram illustrates a typical divestiture used in my sample.

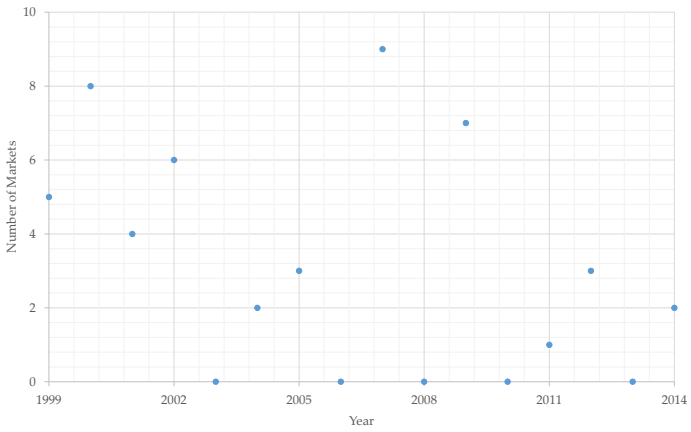


Figure 4: This diagram charts the number of divestiture markets in the sample with no market share change, containing branches divested from large to small banks each year.

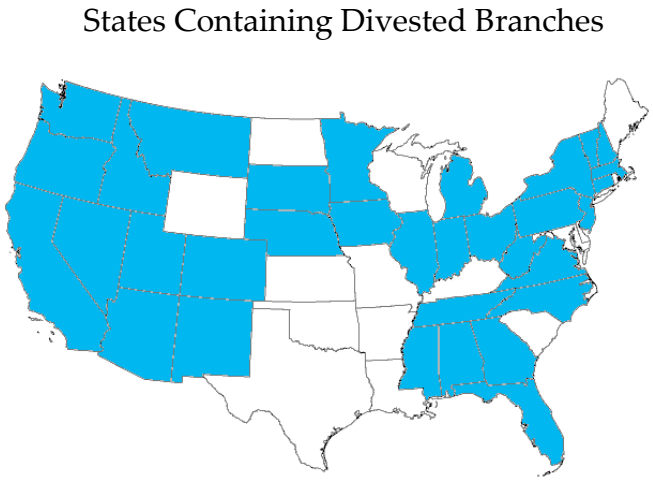


Figure 5: States highlighted in blue contain divested branches during the divestiture sample running from 1999-2014.

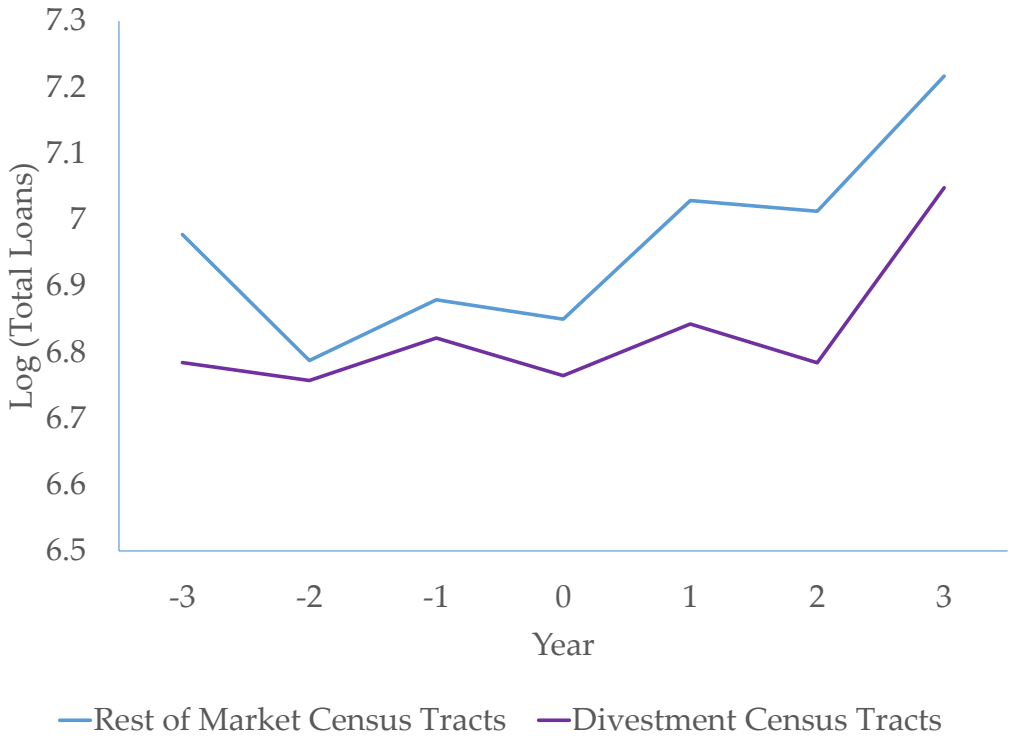


Figure 6: This diagram documents parallel trends in small business lending in census tracts local to divested branches vs census tracts in the rest of the market.

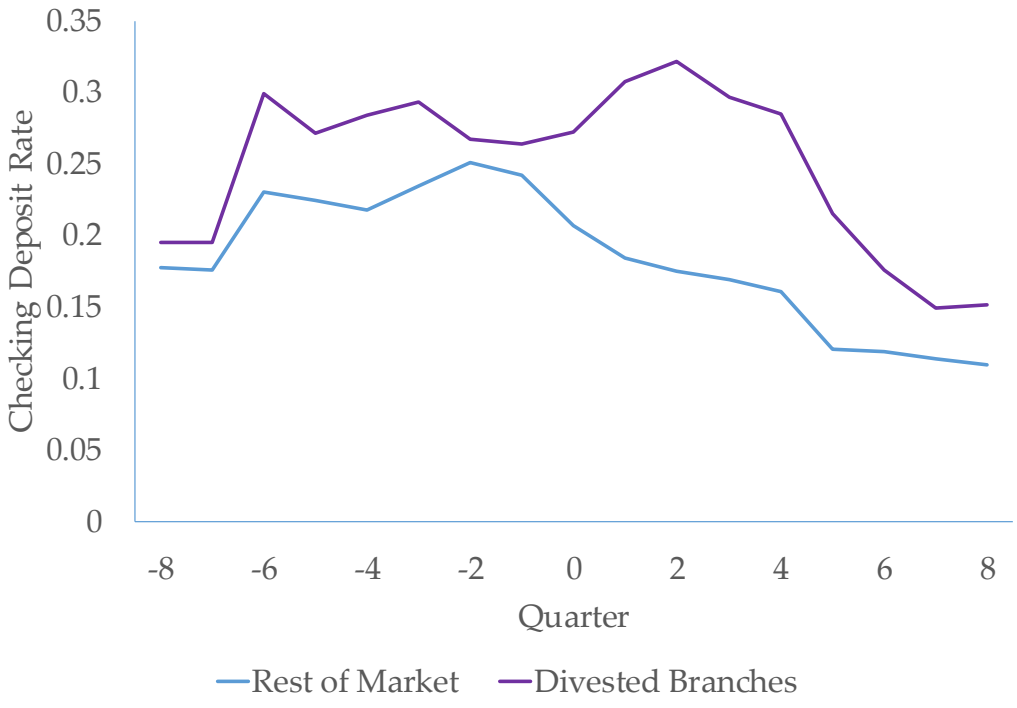


Figure 7: This diagram documents parallel trends in deposit rates at divested branches vs branches in the rest of the market.

Table 1: . This table presents results of a double sort by size and market concenrtration of changes in deposit rates and lending growth after a 100bp increase in the Fed Funds rate. In the top panel, branches are first sorted into market concentration buckets - low, medium and high, depending on the HHI of the market the branch resides in. Low concentration is HHI smaller than the 25th percentile, medium concentration is HHI between the 25th and 75th percentile, and high concentration is HHI greater than the 75th percentile. Within each market concentration bucket, branches are then sorted into small vs large buckets depending on the size of the bank the branch belongs to. Small is banks with assets smaller than the 25th percentile and large is banks with assets greater than the 75th percentile. Similarly, census tracts are sorted into low, medium and high concentration buckets following the same method above, and are next sorted into small vs large buckets depending on the largest bank operating in that census tract. The reverse sort is conducted for the bottom panel. Checking rate is the checking account rate for a deposit checking account with a $0 minimum balance, obtained from Ratewatch. Lending growth is the annual growth in lending per census tract in the year following an Fed Funds rate increase.

	Low Concentration			Medium Concentration			High Concentration		
	Small	Large	**Difference**	Small	Large	**Difference**	Small	Large	**Difference**
Checking Rate	0.150	0.093	**0.057**	0.149	0.101	**0.048**	0.160	0.092	**0.068**
Lending Growth	-8.9%	-8.5%	**-0.4%**	-8.0%	-7.0%	**-1.0%**	-10.2%	-6.8%	**-3.3%**
	Small			Medium			Large		
	Low	High	**Difference**	Low	High	**Difference**	Low	High	**Difference**
Checking Rate	0.194	0.202	**-0.008**	0.142	0.158	**-0.016**	0.136	0.166	**-0.030**
Lending Growth	-6.6%	-9.4%	**2.8%**	-7.6%	-7.8%	**0.2%**	-7.0%	-7.0%	**-0.1%**

Table 2: This table contains summary statistics of divesting and acquiring banks in the divestiture sample. Data is obtained from FRY-9C forms for bank holding companies, and FFIEC-031 forms when the bank does not have a holding company structure. RWA/Assets is risk weighted assets divided by total assets. Deposits/Assets is total deposits (the sum of checking, savings, and small and large time deposits) divided by total assets. Equity/Assets is book equity divided by total assets. The average number of branches is the average number of branches listed in the FDIC SOD database for each bank holding company or bank charter if there is no bank holding company. The average number of markets is the average of the number of markets that each bank operates in given by the number of distinct markets that each bank has at least one branch in. The checking deposit rate and savings deposit rate respectively is obtained from RateWatch data, and is the average of the rate on $0k balance checking and savings account respectively. Average CRA lending is the average lending per census tract to businesses with revenues smaller than $1m for all census tracts that contain a branch of the divesting and acquiring banks.

	Divesting Banks	Acquiring Banks
Total Assets ($ Billions)	105	7.1
RWA/Assets	78.2%	71.5%
Deposits/Assets	67.4%	77.0%
Equity/Assets	9.8%	10.1%
Average Number Branches	768	127
Average Branch Size ($ Millions)	48.4	35.1
Average number of markets	77	39
Checking Deposit Rate	0.35	0.47
Savings Deposit Rate	0.58	0.83
Average CRA lending per Census Tract ($ Millions)	1.32	1.29

Table 3: This table contains summary statistics of local data in the full sample and divestiture sample. CRA lending per census tract is average lending to small businesses with revenues smaller than $1m. CRA lending data is annual and is made available by the Community Reinvestment Act (CRA) where all banks with assets greater than $1bn must report all lending to firms with revenues smaller than $1m. CRA data is obtained from the FFIEC website. The checking rate and savings rate are obtained from RateWatch data, and is the average of the rate on $0k balance checking and savings deposit account respectively. No. Est per Zip Code are the number of businesses per zip code and is obtained from annual business patterns data from the U.S. Census Bureau. The first column reports average data for the full sample (divestititure and non-divestiture markets) from 1999-2014, the second column reports average data for census tracts/branches/zip codes of divested branches, the third column reports results for census tracts/branches/zip codes of branches within the divestiture markets that are not divested branches and do not belong to the merging surving bank, and the final column reports average data for census tracts/branches/zip codes of branches belonging to the surving merging bank.

	Full Sample	Divestiture Markets		
		Divested Branches	No Divested Branches	Surviving Bank Branches
CRA Lending per Census Tract ($1000's)	1253	1073	1,121	1,244
Checking Rate	0.37	0.21	0.33	0.19
Savings Rate	0.60	0.45	0.62	0.48
No. Est per Zip Code	497	528	490	585

Table 4: This table contains results of a census tract/year difference in difference regression using standardized variables with mean 0 standard deviation 1. Period is a dummy variable taking a value of 0 for the 3 years prior to the year in which the divestiture occurred and a value of 1 for the 3 years post the year in which divestiture occurred. Divestitures are those in which market structure remained unchanged. Treated Tracts is a dummy variable taking a value of 1 for treated tracts which are tracts within the zip code of the branch that was divested, and 0 for all other tracts within the divestiture market. Census tracts containing branches of the surviving merging banks are removed. Loan origination data is CRA data obtained from the FFIEC CRA database which contains loan origination data for loans to small businesses by location of the borrower disclosed by banks that have assets greater than $1bn. Markets were only included in the tests if both divesting banks and acquiring banks divesting and acquiring within the county had assets of greater than $1 billion in both periods. Log (Total Loans) is the log of the total amount of loans that were originated to businesses within the census tract that have revenues smaller than $1 million. Fed Funds is the daily Federal Funds rate averaged over the year. Market x year fixed effects are included, and standard errors are clustered by year

Dependent Variable	Log (Total Loans)
Treated Tracts x Period x Fed Funds	-0.0567**
	(0.0260)
Treated Tracts	-0.207***
	(0.0261)
Treated Tracts x Period	-0.0251
	(0.0453)
Treated Tracts x Fed Funds	-0.0091
	(0.0089)
Market x Year Fixed Effects	Y
Observations	5,560
R-squared	0.167

*** p<0.01, ** p<0.05, * p<0.1

Table 5: This table contains results of a branch/week difference in differences test using standardized variables with mean 0 and standard deviation 1. Treated Branches is a treatment dummy variable which takes a value of 1 for branches in divestiture markets that were divested and a value of 0 for branches in divestiture markets that were not divested. Divestiture markets are defined as markets in which divestitures occurred where branches were divested from larger to smaller bank holding companies, with no subsequent change in the HHI of that market. Period is a period dummy variable which takes a value of 0 for the weeks in the two quarters ending prior to the completion date of the merger and a 1 for the weeks in the two quarters ending after the completion date of the merger. The dependent variable is the weekly deposits rate, either checking or savings deposit rates. The Federal Funds rate is the weekly Fed Funds rate from the St Louis Fed. All regressions contain product, market x year/quarter and bank fixed effects and standard errors are clustered by bank.

Dependent Variable	Rate
Treated Branches x Period x Fed Funds	0.280***
	(0.0422)
Treated Branches	0.163
	(0.794)
Treated Branches x Period	0.763***
	(0.0707)
Fed Funds	0.129
	(0.0757)
Treated Branches x Fed Funds	-0.205
	(0.344)
Period x Fed Funds	0.166
	(0.166)
Market x Year/Quarter Fixed Effects	Y
Product Fixed Effects	Y
Observations	35,423
R-squared	0.849

*** p<0.01, ** p<0.05, * p<0.1

Table 6: This table contains results of a census tract/year OLS regression of the log of the total amount of lending by census tract to businesses with revenues smaller than $1m on the Federal Funds rate for census tracts containing small and large banks, using standardized variables with mean 0 and standard deviation 1. Lending data is annual and is made available by the Community Reinvestment Act (CRA) where all banks with assets greater than $1bn must report all lending to firms with revenues smaller than $1m. CRA data is obtained from the FFIEC website. Weekly Federal Funds rate data is obtained from the St Louis Fed and averaged over the year. The sample runs from 1999-2014. Small is a dummy variable taking a value of 1 if the largest bank the census tract contains is a bank with total assets greater than $1b and smaller than $ 10b, and a value of 0 if the largest bank the census tract contains is a bank with total assets greater than $ 75b - these size cut-offs are used to reflect the size ratio in the divestiture sample. Zip code x year fixed effects are included. The coefficient on the interaction term represents the difference between lending to small businesses sensitivity to changes in the Federal Funds rate, in census tracts containing small vs large banks within the same zip code. Standard errors are clustered by year.

Dependent Variable	Log (Total Loans)
Small x Fed Funds	-0.0638**
	(0.0254)
Small	-0.239***
	(0.0231)
Zip Code x Year Fixed Effects	Y
Observations	836,671
R-squared	0.509

*** p<0.01, ** p<0.05, * p<0.1

Table 7: This table contains results of a branch/week OLS regression of deposit rates on the Federal Funds rate for branches belonging to small and large banks using standardized variables with mean 0 and standard deviation 1. Deposit rate data is weekly and is obtained from Ratewatch and weekly Federal Funds rate data is obtained from the St Louis Fed. The sample runs from 1999-2015. Rate is either the rate on a no minimum balance savings account, or checking account - deposit account type fixed effects are included. Small is a dummy variable taking a value of 1 if the branch belongs to a bank with total assets greater than $1b smaller than $ 10b, and a value of 0 if the branch belongs to a bank with total assets greater than $ 75b - these size cut-offs are used to reflect the size ratio in the divestiture sample. Zip code x year/quarter fixed effects are included. The coefficient on the interaction term represents the difference between branch deposit rate sensitivity to changes in the Federal Funds rate, for small vs large banks within the same zip code. Standard errors are clustered by bank.

Dependent Variable	Rate
Small x Fed Funds	0.145***
	(0.0455)
Small	0.636*
	(0.331)
Fed Funds	0.208***
	(0.0104)
Zip Code x Year/Quarter Fixed Effects	Y
Product Fixed Effects	Y
Observations	6,951,558
R-squared	0.806

*** p<0.01, ** p<0.05, * p<0.1

Table 8: This table contains results of a zipcode/year OLS regression of the log of the number of small businesses in a given zip code on the Federal Funds rate for zip codes containing small and large banks using standardized variables with mean 0 and standard deviation 1. Zip code businesses patterns data is annual and is obtained from the U.S. Census Bureau. The Federal Funds rate is the weekly Federal Funds rate, obtained from the St Louis Fed, and averaged over the year. The sample runs from 1999-2014. Log (No.1-49) is the log of the number of businesses with between 1 and 49 employees, Log (No.50-99) is the log of the number of businesses with between 50 and 99 employees, Log (No.100-249) is the log of the number of businesses with between 100 and 249 employees and Log (No.250-499) is the log of the number of businesses with between 250 and 499 employees. Small is a dummy variable taking a value of 1 if the largest bank the zip code is a small bank defined as having total assets greater than $1b and smaller than $ 10b, and a value of 0 if the largest bank in the zip code is a large bank defined as having total assets greater than $ 75b - these size cut-offs are used to reflect the size ratio in the divestiture sample. Zip code x year fixed effects are included. The coefficient on the interaction term represents the difference between the relationship between the number of small businesses and the Federal Funds rate in zip codes containing small vs large banks. Standard errors are clustered by year.

Dependent Variable	Log(1 -49)	Log(50-99)	Log(100-249)	Log(250_499)
Small x Fed Funds	-0.00900	-0.0272**	-0.0322***	-0.0605**
	(0.00810)	(0.0120)	(0.00840)	(0.0225)
Small	-1.170***	-1.075***	-1.048***	-0.356***
	(0.00928)	(0.0129)	(0.00820)	(0.0219)
County x Year Fixed Effects	Y	Y	Y	Y
Observations	212,305	181,262	212,308	74,200
R-squared	0.665	0.494	0.525	0.275

*** p<0.01, ** p<0.05, * p<0.1

Table 9: . This table presents results of a census tract/year difference in difference regression using standardized variables with mean 0 and standard deviation 1. Divestiture markets are markets in which divestitures occurred where larger bank holding companies divested branches to smaller bank holding companies where the HHI remained unchanged post divestiture. Treated Tracts is a dummy variable taking a value of 1 for census tracts containing divested branches in divestiture markets, and a value of 0 for all other census tracts containing branches (not divested) of merging banks within divestiture markets. Period takes a value of 1 for the three years following to the year of the completion date of the merger and 0 for the three years prior to the year of the completion date of the merger. FF is the weekly Federal Funds rate, averaged over the year. Merger x Market x Year fixed effects are included and standard errors are clustered by year.

Dependent Variable	Log (Total Loans)
Treated Tracts x Period x Fed Funds	-0.0748
	(0.257)
Treated Tracts	0.360
	(0.291)
Treated Tracts x Period	0.146
	(0.349)
Treated Tracts x Fed Funds	0.0294
	(0.212)
Market x Year Fixed Effects	Y
Observations	1,405
R-squared	0.299

*** p<0.01, ** p<0.05, * p<0.1

Table 10: . This table presents results of a branch/week difference in difference regression using standardized variables with mean 0 and standard deviation. Divestiture markets are markets in which divestitures occurred where larger bank holding companies divested branches to smaller bank holding companies where the HHI remained unchanged post divestiture. Treated Branches is a dummy variable taking a value of 1 for branches divested in divestiture markets, and a value of 0 for all other branches (non divested) of merging banks within divestiture markets. Period takes a value of 1 for the weeks in the two quarters following the completion date of the merger and 0 for the weeks in the two quarters prior to the completion date of the merger. Fed Funds is the weekly Federal Funds rate. Merger x Market x Year/Week fixed effects are included and standard errors are clustered by year.

Dependent Variable	Rate
Treated Branches x Period x Fed Funds	0.221**
	(0.0882)
Treated Branches	0.152**
	(0.0661)
Treated Branches x Period	0.699***
	(0.0998)
Fed Funds	0.0234
	(0.0373)
Treated Branches x Fed Funds	-0.452***
	(0.0650)
Period x Fed Funds	0.415***
	(0.0913)
Market x Merger x Year/Quarter Fixed Effects	Y
Product Fixed Effects	Y
Observations	19,332
R-squared	0.789

*** p<0.01, ** p<0.05, * p<0.1

Table A1: This table contains summary statistics of the divestitures used in this study. The two merging banks are listed - for a list of divesting and acquiring banks please see Appendix table B1. Merge Bank 1 and Merge Bank 2 are the two banks that are merging and are required by the DoJ to divest branches. Year is the year in which the merger is completed as listed on the FFIEC National Information Center website. Total Amount Divested is the total amount of deposits divested by either of the two merging banks. Av. No. of Branches Divested is the average number of branches divested averaged over markets in which divestitures are required. Av. Amount Divested is the average amount divested in each of the divestiture markets. Av. % of Market Divested is the average percentage of the market that is required to be divested. No MS Change takes a value of yes if in at least one of the divestiture markets an entire collection of branches is required to be divested so that the HHI and market shares remain unchanged. All market share data are collected from Federal Reserve Press Releases. If the data in the table are left blank it is because that data does not exist.

Merge Bank 1	Merge Bank 2	Year	Total Amount Divested ($Bn)	Av. No. Branches Divested	Av. Amount Divested ($ bn)	Av. % of Market Divested	No MS Change
Wells Fargo	Norwest	1998	1.180	1.9	0.084	13.2	Yes
City Holding	Horizon	1998	0.095	1.0	0.047	4.6	Yes
Northwest	U.S.Bancorp	1998	0.035	1.0	0.035	0.2	No
Chittenden	Vermont Fin. Services	1999	0.497	2.3	0.062	11.8	Yes
Fleet Financial	Bank Boston	1999	13.000	25.4	1.109	10.0	Yes
First Commerce	Wells Fargo	2000	0.213	1.5	0.115	28.1	Yes
Permanent Bank	Old National Bank	2000	0.043	2.0	0.043	0.9	No
Wells Fargo	First Security	2000	1.400	4.1	0.158	8.1	Yes
Brenton Banks	Wells Fargo	2000	0.110	3.0	0.110	2.0	No
Triangle Bancorp	Centura	2000	0.131	3.0	0.053	12.1	Yes
Summit Bancorp	Fleet Financial	2001	0.100	5.0	0.100	2.8	No
F&M	BB&T	2001	0.201	2.0	0.050	18.2	Yes
Wachovia	First Union	2001	1.500	3.1	0.116	8.1	Yes
Firstar	U.S. Bancorp Inc.	2001	0.718	11.0	0.718	1.8	No
Old Kent	Fifth Third	2001	0.206	1.0	0.029	6.2	Yes
Huntingdon National	Suntrust	2002	0.168	2.3	0.056	2.9	No
American Bancorp	Wesbanco	2002	0.017	1.0	0.017	5.8	No
Wells Fargo	Texas Financial	2002	0.304	2.3	0.076	17.4	Yes
First Virginia	BB&T	2003	0.290	1.3	0.036	17.4	Yes
Park National	First Federal	2004	0.013	1.0	0.013	1.1	No
Southtrust	Wachovia	2004	0.275	5.0	0.145	1.4	No
Pacific Northwest	Wells Fargo	2004	0.032	1.0	0.032	10.1	Yes
Redwood Empire	Westamerica	2005	0.043	1.0	0.043	7.4	No
National Commerce	Suntrust	2005	0.063	3.0	0.063	13.3	Yes
Amsouth	Regions Financial	2006	0.142	1.3	0.093	17.3	Yes
First Citizens	BB&T	2006	0.029	1.0	0.029	6.2	No
Republic	Citizens Banking	2006	0.210	7.0	0.210	4.8	No
Glacier Bancorp	Citizens Dev. Co.	2006	0.024	1.0	0.024	12.1	Yes
Partners Trust	M&T	2007	0.095	3.0	0.095	3.7	No
Main Street Trust	First Busey	2007	0.110	5.0	0.110	2.7	No
Fina Bancorp	1st source	2008	0.006	1.0	0.006	3.0	No
First Niagra	HSBC Bank USA	2011	0.757	26.0	0.757	-	Yes
Umpqua	Sterling	2014	0.208	3.0	0.115	13.1	Yes
Toronto Dominion Bank	The South Fin. Gp	2011	0.059	1.0	0.059	8.1	No
Wells Fargo	Wachovia	2009	1.460				No
Hancock Holding Company	Whitney Holding	2011	0.202	3.0	0.1	6.7	Yes
PNC	National City	2008	4.100	20.0	1.3		No
BB&T	Susquehanna	2015	0.063	0.1	2.0	0.1	No
Legacy Bancorp	Berkshire Hills	2011	0.158	0.2	4.0	0.2	No
Banner Corp	Starbuck Bancshares	2013	0.027	0.0	1.0	0.0	No

Table A2: This table contains a summary of all of the divesting and acquiring banks used in my study. The completion date is the date found in the FFIEC National Information Center where the date on which the two merged entities become one is recorded. The size ratio is the average assets over the quarter ending before the completion date of the divesting bank divided by the average assets of the acquiring bank. Asset Growth Acquire 1 year is the asset growth of the acquiring bank from one quarter before the completion date to two quarters after the completion date. In some cases, for the smallest bank charters - balance sheet data are not available and so asset growth is left blank.

Divesting Bank	Acquiring Bank	Completion Date	Size Ratio	Asset Growth Acquire 1 year
Wells Fargo	California Federal Bank	03 Nov 1998	2.7	1.529
Wells Fargo	California Federal Bank	03 Nov 1998	3.1	1.529
Wells Fargo	Compass Bancshares, Inc.	03 Nov 1998	6.1	1.170
Wells Fargo	Compass Bancshares, Inc.	03 Nov 1998	6.8	1.170
Northwest Bancshares	**Centennial Bancorp**	**15 Dec 1998**	**0.7**	1.211
City Holding	First Century Bankshares	31 Dec 1998	5.5	1.291
Horizon	Summit Financial Group	31 Dec 1998	5.6	1.489
Vermont Fin. Services Corp	**Charter One Financial**	**28 May 1999**	**0.1**	1.248
Vermont Fin. Services Corp	Factory Point Bancorp, Inc.	28 May 1999	12.8	1.375
Vermont Fin. Services Corp	General Educational Fund	28 May 1999	3.3	1.134
Bank Boston	Farmington Savings Bank	01 Oct 1999	154.1	1.089
Bank Boston	Sovereign Bank	01 Oct 1999	2.9	1.257
Bank Boston	Urban Financial Group	01 Oct 1999	1,175.1	-
Fleet Financial	CCBT Financial Companies	01 Oct 1999	82.7	1.018
Fleet Financial	Eastern Bank Corp.	01 Oct 1999	39.1	1.235
Fleet Financial	Enterprise Bancorp, Inc.	01 Oct 1999	261.8	1.337
Fleet Financial	Independent Bank Corp.	01 Oct 1999	69.2	1.195
Fleet Financial	Sovereign Bank	01 Oct 1999	4.1	1.257
Fleet Financial	Sovereign Bank	01 Oct 1999	4.1	1.257
Fleet Financial	Sovereign Bank	01 Oct 1999	4.1	1.257
Centura	Capital Bank Corp.	19 Feb 2000	41.1	1.546
Centura	First South Bancorp, Inc.	19 Feb 2000	20.7	1.305
Centura	Gateway Financial Holdings	19 Feb 2000	206.4	2.501
Centura	Heritage Bancshares	19 Feb 2000	72.9	1.735
Centura	Southern Bancshares	19 Feb 2000	13.6	1.201
Triangle Bancorp	Capital Bank Corp.	19 Feb 2000	10.6	1.546
Triangle Bancorp	Waccamaw Bankshares	19 Feb 2000	41.0	1.767
First Commerce Bancshares	Pinnacle Bancorp	17 July 2000	1.2	1.111
Wells Fargo	**Heritage Bank**	**17 July 2000**	**1.0**	2.082
Permanent Bank	First Federal Savings Bank	28 July 2000	7.2	-
First Security	BNP Paribas	25 Oct 2000	1.9	1.206
First Security	BNP Paribas	25 Oct 2000	1.9	1.206
First Security	Colonial Bancgroup	25 Oct 2000	1.8	1.089
First Security	Glacier Bancorp	25 Oct 2000	19.9	2.039
Wells Fargo	Glacier Bancorp	25 Oct 2000	234.7	2.039
Brenton Banks	First American Bank	02 Dec 2000	4.2	1.496
Firstar	Otto Bremer Foundation	27 Feb 2001	97.1	2.028
Summit Bancorp	Richmond County Savings Bank	01 March 2001	12.4	1.145
Fifth Third	Chemical Financial Corp.	02 Apr 2001	15.3	1.147
Fifth Third	Chemical Financial Corp.	02 Apr 2001	15.3	1.147

Table A2 Ctd: This table contains a summary of all of the divesting and acquiring banks used in my study. The completion date is the date found in the FFIEC National Information Center where the date on which the two merged entities become one is recorded. The size ratio is the average assets over the quarter ending before the completion date of the divesting bank divided by the average assets of the acquiring bank. Asset Growth Acquire 1 year is the asset growth of the acquiring bank from one quarter before the completion date to two quarters after the completion date. In some cases, for the smallest bank charters - balance sheet data are not available and so asset growth is left blank.

Divesting Bank	Acquiring Bank	Completion Date	Size Ratio	Asset Growth Acquire 1 year
Old Kent	1St Source	02 Apr 2001	7.5	1.069
Old Kent	Chemical Financial Corp.	02 Apr 2001	8.0	1.147
BB& T	First Community Bancshares	10 Aug 2001	50.7	1.138
F & M	First Community Bancshares	10 Aug 2001	3.3	1.138
F & M	River Bancorp	10 Aug 2001	191.9	1.922
F & M	**Susquehanna Bancshares**	**10 Aug 2001**	**0.8**	1.075
First Union	National Commerce	01 Sept 2001	13.7	1.163
Wachovia	National Commerce	01 Sept 2001	4.2	1.163
Huntingdon National Bank	Floridafirst Bancorp	18 Feb 2002	45.0	1.284
Huntingdon National Bank	**Southtrust**	**18 Feb 2002**	**0.6**	1.041
American Bancorp	First West Virginia Bancorp	01 Mar 2002	3.0	1.139
Texas Financial	**First Federal Capital Corp.**	**13 July 2002**	**0.3**	1.378
First Virginia Banks	Virginia Financial Group, Inc	02 July 2003	9.9	1.228
First Virginia Banks	Virginia Financial Group, Inc	02 July 2003	9.9	1.228
Pacific Northwest	Cashmere Valley Financial Corp.	03 Nov 2003	5.3	1.197
National Commerce	Greene County Bancshares	01 Oct 2004	21.6	1.255
Southtrust	R & G Financial Corp.	01 Nov 2004	5.9	1.265
First Federal Bancorp	Peoples National Bancshares	31 Dec 2004	3.1	1.116
Redwood Empire Bancorp	**Savings Bank Of Mendocino**	**01 Mar 2005**	**0.7**	1.085
First Citizens Bancorp	Peoples Bancshares Of TN	01 Aug 2006	5.0	1.264
Glacier Bancorp	Countricorp	01 Oct 2006	48.9	1.501
Amsouth	Cbs BancCorp.	04 Nov 2006	62.7	1.495
Amsouth	First South Bancorp	04 Nov 2006	37.6	1.308
Amsouth	Royal Bank Of Canada	04 Nov 2006	2.6	1.215
Republic Bancorp	First Place Financial Corp.	12 Dec 2006	2.0	1.073
Fina Bancorp	Indiana Bank Corp.	01 June 2007	17.1	1.866
Main Street Trust	PnB Holding Co.	01 Aug 2007	5.2	1.383
Partners Trust Financial Group	**Chemung Financial Corp.**	**01 Dec 2007**	**0.7**	1.090
First Union	1867 Western Financial Corp.	31 Dec 2008	432.1	1.088
First Union	BNP Paribas	31 Dec 2008	71.5	1.206
First Union	Great Western Bancorp	31 Dec 2008	1,158.0	0.996
First Union	Premierwest Bancorp	31 Dec 2008	516.8	1.166
National City	Emclaire Financial Corp	31 Dec 2008	405.3	1.289
National City	First Niagra Financial Group	31 Dec 2008	154.3	15.660
National City	Marquette Savings Bank	31 Dec 2008	280.6	1.266
Whitney Holding Corp.	First Bancshares	05 June 2011	21.2	1.334
Hsbc Bank Usa	Keycorp	18 May 2012	3.9	1.021
Sterling Financial Corp	Banner Corp.	19 Apr 2014	2.3	2.183

Table A3: The top panel of this table contains summary statistics at the bank holding company level if the bank has a holding company structure, or at the bank charter level otherwise for all banks that report deposit rates to Ratewatch in the sample period from 1999-2015. The savings rate and checking rate is the deposit rate on savings accounts and deposit accounts respectively with zero minimum balance requirements. Assets are total assets at the bank holding company level reported in $ billions. Deposits/Assets is the sum of checking, savings and small time deposits divided by total assets. Wholesale/Assets is the sum of large time deposits, repo, commercial paper and other short term bank debt which is the sum of other borrowed money with maturity less than 1 year, and other debt, all divided by total assets. Loans/Assets is total loans divided by total assets. RWA is risk weighted assets and equity ratio is book equity divided by total assets. Summary statistics presented are averages over the full sample for small medium and large banks. The bottom panel contains changes in savings deposits rates for small medium and large banks when the Federal Reserve changes the target rate by +50 basis points and -50 basis points respectively. Small banks have assets smaller than the 50th percentile medium banks have assets between the 50th percentile and the 90th percentile and large banks have assets greater than the 90th percentile where total assets is measured at the bank holding company or charter level if the bank does not have a holding company structure.

	Panel A: Summary Statistics			
	Full Sample	Small	Medium	Large
Savings Rate	0.94	0.97	0.81	0.62
Checking Rate	0.62	0.66	0.51	0.36
Assets (Billions)	6.420	0.193	1.528	112.663
Deposits/Assets	66.7%	68.2%	66.1%	57.4%
Wholesale/Assets	20.8%	19.8%	21.1%	27.4%
Loans/Assets	64.7%	63.5%	66.3%	62.5%
RWA/Assets	69.2%	66.8%	71.4%	74.7%
Equity Ratio	10.0%	10.9%	9.1%	9.6%
	Deposits Rate Change (bps)			
Fed Funds Change	Full Sample	Small	Medium	Large
+50bps	0.18	0.20	0.18	0.15
-50bps	-0.23	-0.27	-0.22	-0.19

Table A4: . This table contains results of a branch/week difference in difference test. The dependent variable is deposits rate where deposit rate is either the checking or savings deposit rate at the weekly branch level. Treated branches are all branches belonging to non merging/acquiring/divesting banks in the divestiture market. Control branches are all other branches of non merging/divesting/acquiring banks in all other non-divestiture markets. Treated Branches is a dummy variable taking a value of 1 if branches are treatment branches and 0 if branches are control branches. Period takes a value of 1 for the weeks in the two quarters following the completion date of the merger and 0 for the two quarters prior to the completion date of the merger. Fed Funds is the weekly Fed Funds rate. Standard errors are clustered at the bank level.

Dependent Variable	Deposits Rate
Treated Branches	0.04222
	(0.063035)
Treated Branches x Period	-0.009911
	(0.04187)
Treated Branches x Fed Funds Rate	-0.02009
	(0.0148)
Treated Branches x Period x Fed Funds Rate	-0.0058
	(0.00995)
Bank Fixed Effects	N
Bank x Year/Week Fixed Effects	Y
Year/Week Fixed Effects	N
Market Fixed Effects	Y
Observations	89,513
R-squared	0.672

*** p<0.01, ** p<0.05, * p<0.1

Table A5: . This table contains results of a census tract/year difference in difference test. The dependent variable is log of total lending to businesses with revenues smaller than $1mn. Treated tracts are all census tracts containing branches belonging to non merging/acquiring/divesting banks in the divestiture market. Control tracts are all other census tracts containing branches of non merging/divesting/acquiring banks in all other non-divestiture markets. Treated tracts is a dummy variable taking a value of 1 if census tracts are treatment tracts and 0 if census tracts are control tracts. Period takes a value of 1 for the year ending December 31st following the year of the completion date of the merger and 0 for the year ending December 31st prior to the year of the completion date of the merger. Fed Funds is the weekly Fed Funds rate annualized from December 31st to December 31st of each year. Standard errors are clustered by year.

Dependent Variable	Log (Total Loans)
Treated Tracts	0.165
	(0.680)
Treated Tracts x Period	0.0967
	(0.904)
Treated Tracts x Fed Funds Rate	0.0199
	(0.132)
Treated Tracts x Period x Fed Funds Rate	-0.0141
	(0.188)
Zip Code Fixed Effects	N
Bank x Year Fixed Effects	Y
Year Fixed Effects	N
Market Fixed Effects	Y
Observations	144,546
R-squared	0.153

*** p<0.01, ** p<0.05, * p<0.1

Table A6: This table contains results of a branch/week difference in differences test where Treated Branches is a treatment dummy variable which takes a value of 1 for branches that belong to acquiring banks (in markets other than divestiture markets) and a value of 0 for all other branches that are not branches of the acquiring bank, in the markets the acquiring bank operates in that are non-divestiture markets, and also excluding markets that contain branches of merging banks. Divestiture markets are defined as markets in which divestitures occurred where branches were divested from larger to smaller bank holding companies, with no subsequent change in the HHI of that market. Period is a period dummy variable which takes a value of 0 for the period before the divestiture and a value of 1 for the period after the divestiture. The period before the divestiture is defined as the two quarters ending prior to the completion date of the merger. The period after the divestiture is defined as the two quarters ending after the completion date of the merger. The dependent variable is the weekly deposits rate from Ratewatch, and are either checking or savings deposit rates.The Federal Funds rate is the weekly Fed Funds rate from the St Louis Fed, over the same pre and post period. All regressions contain product, market x year/quarter and bank fixed effects and standard errors are clustered by bank.

Dependent Variable	Rate
Treated Branches	-0.114**
	(0.0506)
Treated Branches x Period	-0.0262
	(0.149)
Treated Branches x Fed Funds Rate	0.00143
	(0.0246)
Treated Branches x Period x Fed Funds Rate	-0.00386
	(0.0431)
Market x Year/Quarter Fixed Effects	Y
Bank Fixed Effects	Y
Product Fixed Effects	Y
Observations	84,223
R-squared	0.717

*** p<0.01, ** p<0.05, * p<0.1

Table A7: This table contains results of a census tract/year difference in difference regression. Period is a dummy variable taking a value of 0 for the 3 years prior to the year in which the divestiture occurred and a value of 1 for the 3 years post the year in which divestiture occurred. Divestitures are those in which market structure remained unchanged. Treated Tracts is a dummy variable taking a value of 1 for census tracts that contain branches of the acquiring bank in markets other than divestiture markets or markets that contain branches of the merging banks, and 0 for all other census tracts within markets in which the acquiring bank operates, again excluding markets that contain divested branches or branches of the merging banks. Loan origination data is CRA data obtained from the FFIEC CRA database which contains loan origination data for loans to small businesses by location of the borrower disclosed by banks that have assets greater than $1bn. Banks were only included in the tests if both divesting banks and acquiring banks divesting and acquiring within the market had assets of greater than $1 billion in both periods. Log (Total Loans) is the log of the total amount of loans that were originated to businesses within the county that have revenues smaller than $1 million. Fed Funds is the daily Federal Funds rate averaged over the year. Market x year fixed effects are included, and standard errors are clustered by year

Dependent Variable	Log (Total Loans)
Treated Tracts	0.051*
	(0.0255)
Treated Tracts x Period	0.0123
	(0.0502)
Treated Tracts x Fed Funds Rate	-0.00395
	(0.0163)
Treated Tracts x Period x Fed Funds Rate	0.0145
	(0.0181)
Market x Year Fixed Effects	Y
Observations	23,492
R-squared	0.267

*** p<0.01, ** p<0.05, * p<0.1

Table A8: This table contains results of a zipcode/year difference in difference regression. Period is a dummy variable taking a value of 0 for the 3 years prior to the year in which the divestiture occurred and a value of 1 for the 3 years post the year in which divestiture occurred. Divestitures are those in which market structure remained unchanged. Treated zip codes is a dummy variable taking a value of 1 for zip codes that contain branches of the acquiring bank in markets other than divestiture markets or markets that contain branches of the merging banks, and 0 for all other zip codes within markets in which the acquiring bank operates, excluding markets that contain divested branches or branches of the merging banks. Zip code business patterns data obtained from the U.S. Census which contains the number of small businesses by zip code. Log (No.1-49) is the log of the number of businesses with between 1 and 49 employees, Log (No.50-99) is the log of the number of businesses with between 50 and 99 employees, Log (No.100-249) is the log of the number of businesses with between 100 and 249 employees and Log (No.250-499) is the log of the number of businesses with between 250 and 499 employees. Fed Funds is the daily Federal Funds rate averaged over the year. Market x year fixed effects are included, and standard errors are clustered by year.

Dependent Variable	Log (No. 1-49)	Log (No. 50-99)	Log (No. 100-249)	Log (No. 250-499)
Treated Zip Codes	0.721***	0.559***	0.429***	0.180***
	(0.0111)	(0.0109)	(0.00977)	(0.0105)
Treated Zip Codes x Period	0.0407	0.0414	0.0453	0.0252
	(0.0464)	(0.0561)	(0.0473)	(0.0260)
Treated Zip Codes x Fed Funds Rate	0.0120**	0.0155***	0.0200***	0.0169***
	(0.00427)	(0.00326)	(0.00300)	(0.00289)
Treated Zip Codes x Period x Fed Funds Rate	-0.00124	-0.00241	0.00223	-0.00209
	(0.0115)	(0.0146)	(0.0122)	(0.00690)
Market x Year Fixed Effects	Y	Y	Y	Y
Observations	212,305	181,262	166,088	74,200
R-squared	0.665	0.494	0.420	0.275

*** p<0.01, ** p<0.05, * p<0.1

Table A9: This table contains results of a bank/quarter difference in differences test where Treated Banks is a treatment dummy variable which takes a value of 1 for bank charters of acquiring banks and a value of 0 for bank charters of banks of similar size (defined to have assets within 75 % and 125% of the total assets of the acquiring bank) operating in markets that the acuiring bank operates in, excluding divestiture markets or markets that contain branches of merging banks. Period is a dummy variable which takes a value of 0 for the four quarters in the year prior to the year of the divestiture and a value of 1 for four quarters in the year post the year of the divestiture. Log (Assets) is the log of total bank assets, Equity Ratio is book equity divided by total assets, RWA density is total risk weighted assets divided by total assets, and All. Loan Loss/Loans is the allowance for loan and lease losses reported on the balance sheet. All regressions contain bank and year/quarter fixed effects and standard errors are clustered by bank. Data is quarterly and is obtained from FFIEC031 regulatory filings.

Dependent Variable	Log (Assets)	Equity Ratio	RWA Density	All. Loan Loss/Loans
Period x Treated Banks	0.296***	0.00607	-0.0247**	-0.00222**
	(0.109)	(0.00546)	(0.0123)	(0.000868)
Bank Fixed Effets	Y	Y	Y	Y
Year/Quarter Fixed Effects	Y	Y	Y	Y
Observations	861	706	706	706
R-squared	0.996	0.864	0.904	0.841

*** p<0.01, ** p<0.05, * p<0.1

Table A10: This table contains results of a bank/quarter difference in differences test where Small is a dummy variable which takes a value of 1 for banks that have assets smaller than $\$7bn$ and 0 for banks that have assets greater than $\$75bn$ - these size cut-offs were chosen to reflect the average size of acquiring vs divesting banks in the lending tests. Fed Funds is the daily average of the Federal Funds rate over the quarter. RWA/Assets is the risk weighted asset density - or risk weighted assets divided by total assets. Equity Ratio is total equity divided by total assets, and Loan Loss/Loans is the loan loss provision divided by total loans. All regressions contain bank and year/quarter fixed effects and standard errors are clustered by bank and year/quarter. Data is quarterly and is obtained from FRY9C regulatory filings.

Dependent Variable	RWA/Assets	Equity Ratio	Loan Loss/Loans
Small x Fed Funds	-0.0110***	0.00235***	-0.000219
	(0.00360)	(0.000660)	(0.0114)
Bank Fixed Effects	Y	Y	Y
Year/Quarter Fixed Effects	Y	Y	Y
Observations	98,149	115,320	34,959
R-squared	0.758	0.731	0.574

*** p<0.01, ** p<0.05, * p<0.1