How did the Big Banks Grow Bigger?

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Abstract

Conventional wisdom holds that big banks have grown by mergers. We investigate the growth in large banks by expanding the time period to include the last two decades. We find that deposit growth has been fueled half by mergers and half by faster organic growth. While the importance of mergers is expected, this paper documents faster organic growth of large banks, especially after the crisis, despite recent efforts to control the size of systemically important financial institutions. Deposit concentration at the hands of a few large banks has important consequences for competition in the local deposit market. We show that large banks do not respond to competition in the local deposit market through their deposit rates, but do respond to the presence of other large banks. Consequently, the significant growth of a few large banks on the national scale has made them less responsive to competition in the local deposit market, thereby having adverse effects on consumer welfare.

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I Introduction

The financial intermediation sector has grown significantly over the last three decades (Greenwood and Scharfstein, 2013; Philippon, 2015). Within the sector, the literature has documented that the big banks have become bigger since 1930s (Alhadeff and Alhadeff, 1964; Janicki and Prescott, 2006).[1] Researchers before us have investigated the impact of regulation and changing technology on the size distribution, investment banking activities and systemic risk of large banks (see, for example, Berger, Kashyap, Scalise, Gertler, and Friedman, 1995; Kroszner and Rajan, 1994; Kroszner and Strahan, 1999, 2014; Lucas, 2013).

However, the question of *how* big banks have grown bigger as depository institutions and how such growth affects consumers has not been investigated. This paper investigates how large banks have grown bigger in the last two decades in the specific area of depository banking. We find that the growth of big banks in the U.S. has been fueled half by mergers and half by faster organic growth. We provide evidence of growth of larger banks, especially after the crisis, despite recent efforts to control the size of systemically important financial institutions. Furthermore, we show that big banks are able to "cherry-pick" areas for their expansion. Big banks are more likely to open new branches and to acquire branches from other banks in the richer and more profitable markets.

While the deposit concentration in the hands of a few big banks might in itself be of concern, we examine the impact of the growth of large banks on consumer welfare. To this end, we analyze how big and small banks compete for consumer deposits and

[1] Alhadeff and Alhadeff (1964) document the phenomenon for 1930 to 1960. Janicki and Prescott (2006) discuss the increasing concentration in the U.S. banking sector from 1960 to 2005.

how such competition affects deposit rates. We find that the benefits of competition between banks that are passed on to consumers come mainly from small banks. In addition to better rates due to competition, small banks provide higher deposit rates as the presence of large banks grow. Large banks do not respond to measures of overall competition, but do respond to the presence of other large banks, with half the sensitivity of small banks. In essence, as a few large banks grow even bigger on a national level, they stop responding to competition in the local deposit market. We thus show that the industrial organization of the banking sector and the competitive strategy of banks has important effects on consumer welfare in terms of deposit rates offered.

To understand how banks have grown in the U.S., we utilize bank branch level data and divide growth into three parts (i) growth by acquisition of another bank, (ii) growth by opening new branches, and (iii) same-branch deposit growth.[2] Using three different approaches, we show that organic growth accounted for between 36.1% and 65.1% of total growth in the big banks' deposit market share. To allay concerns about omitted variables and to directly control for specific confounding effects, we run a multivariate regression with bank and year fixed effects and include controls for bank size, profitability, past growth and local economic conditions. The results suggest that organic growth accounts for 49.8% of total deposit growth of large banks in the U.S. during the period 1999 to 2015. Thus, it is not the case that the growth of large banks is only driven by mergers.

In order to understand the growth strategy of large banks during the 1999-2015 period, we begin by examining where large banks choose to establish new branches

[2] An important concern is survival bias. To address this, we fix the set of large banks at the beginning of the sample period.

compared to small banks. We proxy for the attractiveness of a county for establishment of new bank branches using (i) median income, (ii) total deposits, and (iii) per capita deposits. In all cases, we find that large banks open more branches in more prosperous counties compared to small banks. The results look very similar when we examine where large banks choose to acquire branches from other banks. The evidence suggests that big banks have a comparative advantage in the deposit business and in operating branches.

Profitability of a consumer base should lead to surplus for banks only if the competitive landscape in the local market allows for the extraction of surplus. Hence, we next ask if large banks are more likely to open branches in profitable counties that have relatively lower competition (where they can extract more surplus given less competition). The results show this to be the case. Thus, large banks are able to organically grow selectively in the U.S. in more profitable areas, especially those with less competition.

How is the changing organization of the depository institutions affecting consumers? To answer this question, we analyze the deposit rates offered at each branch in the U.S. in the last two decades. As previous researchers have shown on the lending side (Cetorelli and Strahan, 2006; Rice and Strahan, 2010), we find that greater competition is associated with higher interest rates on deposits. However, we discover that the size of a bank's total deposit across all counties has a direct effect on the competition at the local deposit market. Essentially, the nature and extent of competition in a county depends not only on each bank's share in the county's deposit market, but also on the bank's share in the national deposit market. This result contrasts with previous studies of profitability and market power that generally use only a single

measure of competition, such as the county's HHI or three-firm concentration ratio at the county.

Using our two-dimensional measure of competition at the county level, we find that the benefits of competition that are passed on to depositors mainly come from small banks. In addition to responding to competition (as measure by HHI), small banks pay an additional premium to attract deposits as the presence of large banks grows in the county. Large banks however, do not respond to competition (as traditionally measured, for example, using HHI) by offering higher rates to depositors. The large banks do respond to the presence of other large banks by paying a higher interest rate. We thus show that the industrial organization of the banking sector and the competitive strategy of banks has important effects on consumer welfare in terms of deposit rates offered.

The impact of growth of large banks on the economy is multifaceted. A large literature has focused on the impact of large banks on systemic risk. The seminal work of Diamond and Dybvig (1983) regarding bank runs gets additional significance in case the run is on a large bank. Another seminal work by Allen and Gale (2000) shows that small liquidity shocks can spread across the banking system depending on the completeness of the interconnections between banks. Recently, Acemoglu, Ozdaglar, and Tahbaz-Salehi (2015) argue that if the negative shock affecting financial institutions is large, densely connected banks propagate shocks. Since the large banks are more densely connected, the Basel Committee on Banking Supervision (BCBS) has introduced specific regulation for many large banks that have been classified as Systemically Important Financial Institutions (SIFIs).

Another strand of literature has investigated the amount of risk taken by large

banks, the optimal capital requirements of large banks, and the transmission of monetary policy through them. Santos (2001) reviews the theoretical literature on bank capital regulation. Adrian and Shin (2010) show that when bank capital constraints are relaxed, risk-taking in lending increases. Jiménez, Ongena, Peydró, and Saurina (2014) study the impact of stimulative monetary policies on composition of supply of credit and find that less capitalized banks take more risk in presence of stimulative policies. Thus, less capital requirements for large banks can increase the amount of risk in the economy. In contrast, Thakor (1996) argues that capital requirements linked solely to credit risk increase equilibrium credit rationing and lower aggregate lending.

However, literature has not investigated how large banks have grown in their traditional role as depository institutions. The importance of this facet is manifest as this directly affects the welfare of savers in the economy. In addition, in light of the literature above, how depository capital is allocated across the banking sector in response to competitive behavior by banks affects the amount of idiosyncratic and systemic risk in the economy. We show that depository capital has become more concentrated in the bigger banks, and these banks do not respond to general competition across banks but just to competition from other large banks.

The outline of the rest of the paper is as follows. Section II develops the hypotheses tested in this paper. Section III discusses the datasets. Section IV documents the growth dynamics of the banks in the U.S. in the last two decades. Section V discusses the growth strategy of banks, and Section VI presents the determinants of the strategy behind offered in interest rates on depository capital. Section VII provides robustness tests. Section VIII concludes.

II Hypothesis Development

We start with the well researched observation that global financial system have been consolidating since the 1980s and have become even more concentrated after the financial crisis. DeYoung, Evanoff, and Molyneux (2009) provides a review of the recent financial institution mergers and acquisition (M&A) literature covering over 150 studies. However, as far as we know, what fraction of the growth in large banks has been driven by mergers is unknown. This is our first hypothesis.

H1: *The growth of large banks is driven by mergers.*

As we will show later, mergers only explain approximately half of the total growth of large banks. Next, we delve deeper in the growth strategy of large banks by asking *where* are large banks growing organically. It is reasonable to assume that large banks with cross-country presence are less constrained regarding choice of geography to grow in. Additionally, the literature on scale economies in banking suggest that large banks have a cost advantage over their smaller peers. Based on these two facts, we may expect to find that large banks "cherry-pick" more profitable counties.

H2: *Large banks grow disproportionately in prosperous counties.*

Finally, we focus on the impact of competitive strategy of large and small banks to obtain depository capital. An important question is how do banks compete for additional capital. Alternatives include new branches, more competitive rates at existing branches or acquisition of depository capital at other banks through M&A.

Researchers have investigated the impact of growing concentration in the financial industry on equity holders and borrowing customers, but mainly from the perspective of mergers.[3] However, the impact of consolidation in the banking sector (i) through

[3] Laeven and Levine (2007) investigates whether the diversity of activities conducted by financial

organic growth and (ii) on depositors have not been studied. This motivates our final two hypotheses:

H3(a): *Large banks do not compete as much as small banks for deposits, leading to lower consumer surplus.*

A related question is how do large banks and small banks compete in presence of competition from other larger banks.

H3(b): *Large banks show equal sensitivity to competition by other large banks or small banks.*

Ultimately, we conduct a back of the envelope calculation that provides us an estimate of the benefits of competition as they accrue to depositors through higher interest rates. We estimate how these benefits as an aggregate have changed over time, and what fraction of the surplus are provided by larger or smaller banks.

III Data

We combine various data sets to analyze the growth of big banks and to evaluate the industrial organization impact of this growth on consumer surplus. In this section, we describe the data and provide summary statistics on important variables.

institutions influences their market valuations and find that there is a diversification discount. Delong and DeYoung (2007) show that merging banks, and investors pricing bank mergers, learn by observing information that spills over from previous bank mergers. Berger, Saunders, Scalise, and Udell (1998) examine the effects of bank M&As on small business lending using data on over 6000 U.S. bank M&As and find that consolidation reduces small business lending. However, competition from other banks helps offset the effect. Karceski, Ongena, and Smith (2005) that borrowers of target banks face a negative impact in terms of equity value in presence of bank mergers. They also find that firms with low switching costs switch banks, while similar firms with high switching costs are locked into their current relationship.

III.A Branch Deposit Data

The Federal Deposit Insurance Commission (FDIC) publishes annual Summary of Deposit (SOD) information on branch level deposits as of June 30 for all FDIC-insured institutions, including insured U.S. branches of foreign banks. Along with deposits at each branch of a bank, the SOD data contains detailed information about the geographical location of each branch, its date of establishment, and the location and identity of the bank's headquarters.

Using a bank-branch's permanent identifier and information about the chartered bank to which the branch belongs in a given year, we can also track a bank-branch's acquisition history over time. Hence, we are able to determine whether a given bank-branch in a year is an existing branch of a bank, a branch newly acquired from another bank, or a new branch opened by the bank. (We use a branch's date of establishment to determine a new branch opening). For the sample period of our study (1999-2015), the SOD data contains 1,581,201 branch-year observations from 11,905 unique chartered banks.

III.B Deposit Rates

Information on deposit rates comes from a proprietary data that is collected and maintained by RateWatch. The dataset contains weekly branch level deposit rates for twenty four different types of deposit accounts, including interest checking account, savings account, money market account, and certificate of deposit.[4] For our analysis, we use the offered deposit rates on six-months certificate of deposit (CD) with a

[4] Matvos, Hortacsu, and Egan (2016) use data from RateWatch to study bank fragility and the demand for uninsured deposits.

minimum deposit of $10K. The six-month CD has the most comprehensive coverage during our analysis period of 1999-2015. Over this period, we have 3,178,972 observations from 96,196 branches of 8,377 deposit taking institutions. None of our results change if we use the deposit rates on any other deposit account. This weekly branch level data can be merged with the annual SOD data using identifiers provided by RateWatch.

III.C Other Data Sources and Summary Statistics

We supplement the above mentioned datasets with detailed financial data for each individual bank from the *Reports on Condition and Income* (the "Call Reports"). The Call Reports include complete balance sheet and income statement information for each bank and is reported on a quarterly basis. We use the quarterly reports ending as of June 30 to align with the SOD data.

We combine the three datasets to construct a panel at the bank-branch, county and bank holding level over time at the annual frequency to identify the growth and competitive strategy of depository institutions in the U.S. Table I provides summary statistics for the variables of interest in our sample.

IV Growth Dynamics

IV.A Preliminary Univariate Analysis

This section conducts a univariate analysis of the growth and industrial organizational dynamics of U.S. banks. Since our focus is how large banks fared compared to smaller

banks over time, we begin by analyzing the growth in deposit market share held by the twenty largest banks in the U.S. Table II lists the twenty largest banks by deposits and by number of branches. The question we ask is: what share of growth of large U.S. banks is driven by organic growth as opposed to acquisitions?

The analysis presented is at the bank level, and not at the bank holding company (BHC) level.[5] The analysis below uses total bank deposit in the year 2015 to identify the twenty largest banks.[6] The deposit market share of the twenty largest banks has grown from 17.2% in 1999 to 57% in 2015.

What Fraction of Bank Growth Comes from Organic Expansion?

Figure 1(a) investigates what fraction of this market share growth comes from organic deposit growth. To construct the figure, bank branches that were acquired by the top 20 banks after 1999 are dropped from the sample after acquisition (instead of being counted as part of these top 20 banks). Thus, starting from a market share of 17.2%, we examine the growth in the market share of large banks over the next two decades that come from establishing new branches and from deposit growth at all of its non-acquired branches ("organic expansion"). Deposit market share of the largest twenty banks calculated in this manner increases from 17.2% to 42.3%, thereby explaining 63.1% of the total growth in deposit market share of these banks (Figure 1(a)).

Is There a Bias?

A slightly different approach to treat the acquired bank-branches is to drop them altogether from the dataset (as against retaining them in the dataset until they get

[5] We plan to conduct analysis at the BHC level as well.
[6] The results are very similar if we instead use number of branches.

acquired). This ensures that there is no mechanical bias (in the first approach, every time a small bank gets acquired and hence dropped from the sample, the denominator in the calculation of big bank market share mechanically gets smaller). Our new approach ensures that this mechanical bias does not drive the increase in market share of larger banks. Deposit market share of the largest twenty banks calculated in this manner increases from 16.2% to 42.1%, there by explaining 65.1% of the total growth in deposit market share of these banks (Figure 1(b)).

A More Conservative Approach

The most conservative approach would be to ignore all acquisitions. The acquired bank-branches remain in the sample and are treated as belonging outside the largest twenty banks. Deposit market share of the largest twenty banks calculated in this manner increases from 17.2% to 31.5%, there by explaining 36.1% of the total growth in deposit market share of these banks (Figure 1(c)).

Thus, even with the most conservative calculations, we find that a significant share of the growth in market share of the largest twenty banks comes from organic expansion.

IV.B Examining Big Bank Growth - Multivariate Analysis

In this section, we continue to investigate the same question as in Section IV.A using a multivariate regression. To allay concerns about omitted variables and to directly control for specific confounders, we include bank and year fixed effects as well as controls for bank size, profitability, past growth and local economic conditions

To begin with, we calculate total deposit growth, organic growth and inorganic

growth for each bank year observation. Organic growth is defined as increase in deposits at existing branches of a bank and deposits at new branches opened by the bank, scaled by total deposits in the previous year. Inorganic growth is defined as deposits at branches acquired by a bank in a given year, scaled by total deposits in the previous year. Notice that organic and inorganic growth together sum to total deposit growth. We calculate the growth rate of the banks as follows:

$$dg_{b,t} \equiv \frac{\text{Deposit}_{b,t} - \text{Deposit}_{b,t-1}}{\text{Deposit}_{b,t-1}}; \quad og_{b,t} \equiv \frac{\text{Deposit}_{b(og),t} - \text{Deposit}_{b,t-1}}{\text{Deposit}_{b,t-1}}, \tag{1}$$

where dg and og represent the total and organic deposit growth rate of bank b at time t, respectively. $b(og)$ includes the branches that were part of the bank at both time t and time $t-1$, or were newly opened by the bank in year t. b includes all branches that are part of the bank at time t.

Using the above definition, we analyze bank growth using the following specification:

$$dg_{b,t} = \mu\, og_{b,t} + \rho\, dg_{b,t-1} + \gamma_1 \text{Asset}_{t-1} + \gamma_2 \text{GDP}_{b,t-1} + \gamma_3 \text{ROA}_{b,t-1} + \delta_b + \eta_t + \epsilon_{b,t}. \tag{2}$$

Thus, the most exhaustive specification includes bank and year fixed effects, and seeks to measure the average importance of organic growth to the total depository growth of the top 20 U.S. banks, as defined by their size in the year 2015. Since organic growth and inorganic growth sum up to unity, we have only included organic growth in the specification. The economic interpretation is that $\frac{1}{\mu}$ is the average fraction of total depository growth that can be attributed to organic growth of the banks.

Table III reports the results. Column (1) reports the correlation between organic

growth of banks and total depository growth. Column (2) includes year fixed effects. Column (3) includes bank fixed effects. Column (4) controls for bank size, past growth rate and economic conditions captures through GDP growth. Column (5) includes profitability.

Column (1) shows that indeed organic growth explains approximately 59.9% of total depository growth. Accounting for aggregate economic and regulatory conditions, among other things, using year fixed effects decreases the importance of organic growth to 53.9% in Column (2). Column (3), shows that bank fixed effects do matter, as in their presence the relative contribution of organic growth declines to 51.9% in explaining the total depository growth. Column (4) shows that even among these largest 20 U.S. banks, bank size is statistically and economically significant in explaining deposit growth. One percent increase in assets, leads to 0.2 percent additional total depository growth. Notice that this is not the total effect of bank size on deposit growth. 0.2 percent represents the contribution of size to total growth that does not come through organic growth. In later sections, we directly analyze how size contributes to organic growth. Further, the deposit growth is mean reverting as noted by the negative coefficient on lagged deposit growth. Finally, Column (5) reports our most exhaustive specification. Profitability adds no additional explanatory power. The final contribution of organic growth to total deposit growth is estimated to be 49.8%.

V Growth Strategy of Large Banks

In this section, we investigate the growth strategy of large banks in the U.S. during our sample period.

V.A Do Large Banks Grow Selectively?

We first test if large banks are selectively starting new branches in the richer areas of the country. We utilize three different measures of relative prosperity: (i) median income of the county, (ii) total deposits at the county level, and (iii) per capita deposit in the county. The observation set is all branches in a given year in each county. The dependent variable is a dummy that takes the value of 1 if a given branch is a new branch established in that year. The specification essentially calculates the likelihood that a given branch of a bank in a given county in a given year is a newly opened branch based on county characteristics and whether the bank is a large or a small bank. This is different from asking whether a new branch belongs to a large or a small bank (in which case, our observation set would only contain new branches and the dummy would indicate whether a branch belongs to a large or a small bank).

Notice that the specification used here automatically controls for the fact that larger banks have more branches to begin with and hence are more likely to open a new branch in a given location. For example, if a bank has only nine existing branches in a county and it opens a new branch in the same county, this translates to a 10% probability that a given branch of the bank in the county is a new branch. On the other hand, if a bank that already has 98 existing branches in the county opens two new branches in the county, the probability that a given branch of the bank in the

county is a new branch is just 2% – suggesting that the first bank is more aggresive in opening branches in the county. This illustration, of course, uses a linear probability model. However, the effect would be very similar in a probit specification. To summarize, the probit specification used here tests for the differential likelihood of opening a new branch in a county by a large versus a small bank based on county characteristics after controlling for the fact that large banks have more branches to begin with.[7]

Table IV reports the results. Columns (1)–(3) report the results for the three measures. All columns include year and bank fixed effects. Column (1) shows that on average large banks open less branches. We note from the positive coefficient on the measure of country prosperity that the relative number of branches opened in more prosperous counties is higher. The main variable of interest is the interaction term, which shows that large banks open disproportionately more branches in more prosperous counties.

Columns (2) and (3) corroborate these findings with the other two measures of county prosperity. Table VIII in the Robustness section shows that on the intensive margin as well, large banks grow disproportionately more in richer counties.

V.B Profitability and Market Power

The previous section focused on growth strategy of large banks based on profitability of a geographical region. However, profitability of the customer base only leads to

[7]Had our specification only retained new branches and the dummy indicated whether a given new branch belongs to a large or a small bank, then we would need to explicitly control for the fact that the likelihood of a new branch belonging to a particular bank would depend on the extent of that bank's presence in the county. For the example discussed above, if these were the only two banks in the county, then the likelihood that a new branch belongs to the large bank would be 66.6%. Unless we explicitly control for the fact that the larger bank has many more branches in the county, we might conclude that the larger bank is opening new branches at a faster rate.

surplus for the bank if the bank has some market power. Therefore, in this section, we investigate if the growth strategy of large banks depends on the potential market power in the areas that the bank is expanding to.

Table V investigates if large banks are expanding more in more profitable areas compared to smaller banks. All columns include year fixed effects. Column (1) shows that large banks on average open less branches. On average banks open less branches in less competitive areas. The coefficient of interest is the interaction term which suggests that large banks expand more compared to small banks in areas where they can exercise more market power.

The interaction coefficient of Column (2) is positive and statistically significant. It suggests, as in Column (1) but with a stronger magnitude, that large banks are more likely to open branches in profitable counties where they can extract more surplus given less competition. On the other hand, the coefficient of the interaction term in Column (3) suggests that large banks are less likely to expand in less profitable counties even if they have less competition. Thus, in the less profitable areas, large banks expand in more competitive counties.

VI Impact of Market Organization on Interest Rates

This section investigates the competitive strategy of large and small banks in terms of attracting new deposits. Consequently, this section also provides information about how competition between banks affects depositor welfare through higher interest rates on deposits.

VI.A Deposit Concentration and Deposit Share of Large Banks

The specification that estimates the impact of competition in general, measured by Herfindahl-Hirschman Index hhi of deposits in county c in time t on bank b's interest rate ir is as follows:

$$ir_{b,t} = \mu\, hhi_{c,t} + \rho\, sh_{c,t} + \delta_c + \eta_t + \epsilon_{b,t}, \tag{3}$$

where sh is the share of large banks in the county. Interest rates are scaled by dispersion of interest rates in the nation in that year. Table VI reports the results. All columns include year and county fixed effects.

Column (1) shows that for 10% decrease in Herfindahl index in terms of deposits in a county, which means more competition, the average interest rate offered by a bank increases by 0.47 standard deviation. This result confirms the general finding in the literature that competition is beneficial to consumers. Column (2) shows that if 10% additional deposits at the mean are with large banks in a county, then the interest rates offered by banks on average increase by 0.67 standard deviations. To address the possible concern that these two effects are driven by competition, Column (3) includes both independent variables together. The results remain quantitatively similar to those in Columns (1) and (2), showing that the two effects are separate.

In addition to understanding the determinants of deposit rates offered by the average bank, an important question is whether large and small banks behave differently in response to competition and in presence of other large banks. Columns (4) and (5) split the sample into large and small banks and re-estimate Equation 3. Surprisingly, Column (4) shows that large banks do not seem to respond to competition *per se*: the

estimated coefficient on HHI differs insignificantly from zero. Their response in terms of interest rates to attract deposits is limited to the share of deposits with large banks in the county. Column (5) reports the estimates for small banks. In the case of small banks, we find that for 10% decrease in Herfindahl index in terms of deposits in a county, which means more competition, the average interest rate offered by a small bank increases by 0.81 standard deviation. This effect is twice that of the average effect estimated in Column (3). Thus, the positive effect of competition in terms of higher deposit interest rates are driven by small banks. In addition, the sensitivity of interest rates to the share of large banks (0.167) is approximately twice that in Column (4) (0.0782). This suggests that large banks, even when they respond to competition from other large banks, have half the sensitivity of small banks.

The results provide a nuanced picture of the benefits of competition in terms of higher deposit rates to consumers. The benefits of competition between banks that are passed on to consumers come mainly from small banks. In addition to better rates due to competition, small banks provide additional higher deposit rates as presence of large banks grow. Large banks do not respond to competition, but do respond to presence of other large banks, with half the sensitivity of small banks.

VI.B A New Measure of Banking Competition

This paper recognizes the differences in competitive strategy of large and small banks. Large banks compete in multiple local markets, and also nationally with other large banks. Thus, a measure of competition that considers only local competition or national competition provides an incomplete picture. Consider two counties A and B which have similar Herfindahl Index in terms of deposit concentration. However,

county A has only local banks while deposits in county B are half in large banks and half in small banks. The analysis in Section VI.A shows that banks in these counties will compete for deposits using different competitive strategies, resulting in very different interest rates on deposits for consumers.

To take this dual nature of competition into account, where local share and national share both matter, we suggest a simple measure of banking competition which we refer to as the Herfindahl Hirschmann Index National Local:

$$\text{HHINL} = \sum \text{(local share)} \times \text{(national share)}. \tag{4}$$

The measure tends to 0 if small local banks divide the market share. The measure reaches 1 if a large national bank has monopoly in a county. In other words, in the presence of competition only by small banks, this measure correlates strongly with the Herfindahl Index for local deposits. However, as the share of large banks grows in a geographical location, the HHINL increases from 0 to 1. If the competition is primarily between national banks, the measure is largest. Thus, we argue that the banks respond to local competition, national competition, and the interaction of national and local competition:

$$\text{Bank Strategy} = f(\text{local comp., national comp., interaction of local \& natl. comp.}). \tag{5}$$

Motivated by the above statement, we estimate next the following specification, in county c at time t on bank b's interest rate ir:

$$ir_{b,t} = \mu\ hhi_{c,t} + \rho\ hhinl_{c,t} + \delta_c + \eta_t + \epsilon_{b,t}, \tag{6}$$

The national Herfindahl Index is absorbed in time fixed effect η_t. Interest rates are scaled by dispersion of interest rates in the nation in that year. Table VII reports the results. All columns include year and county fixed effects.

Column (2) shows that as HHINL increases, the average interest rate paid by the average bank increases. However, the results are not statistically significant. In Column (3), we estimate Equation 5 empirically, i.e. Equation 6. Noting the coefficient of HHI index, we find that 10% decrease in the index, i.e. more competition increases interest rates in a county on an average by 0.70 standard deviation. However, after controlling for competition in general, we find that the coefficient for HHINL shows that as number of large banks increase *conditional on the same competition*, the average interest paid by banks in the county increases further.

To investigate if these gains of competition are passed on by large or small banks, Columns (4) and (5) split the sample into large and small banks. As before, Column (4) shows that large banks do not seem to respond to deposit competition as measured by Herfindahl Index. In addition, large banks seem to reduce interest rates as HHINL goes up, which suggest oligopolistic surplus extraction. However, the results are not statistically indistinguishable from 0. Yet, they still suggest that large banks are not responding to competition, and thus are not passing on additional surplus to consumers. This result is similar to that in Scharfstein and Sunderam (2015) who find that high concentration in mortgage lending reduces the sensitivity of mortgage rates and refinancing activity to mortgage-backed security (MBS) yields.

Column (5) reports that small banks respond strongly to competition as measured by HHI by passing on higher deposit rates to consumers. In addition, if the concentration of large banks increases, i.e. HHINL increases, then small banks return additional

surplus to consumers.

VII Robustness and Additional Discussion

In Section V.A, we argued that large banks have selectively been able to open new branches in profitable counties. In this section, we show that even on the intensive margin, large banks have grown faster compared to the smaller banks in the more profitable counties. Table VIII investigates the importance of various measures of prosperity in a county to test whether large banks grow selectively. To perform this analysis, we calculate the county-level deposit for each bank present in the county. We then define the dependent variable as the growth in county level deposit for each bank. The county characteristics that we use to measure attractiveness from a bank's perspective includes median county income, size of the county deposit market, and per capita deposit in the county.

As the results in Table VIII suggest, large banks on an average have a lower growth rate in county-level deposit. This is to a large extent driven by the scale effect – a lot of small local banks have large percentage increases in county-level deposit; however, on a dollar basis, these are much smaller than the deposit growth of large banks. As expected, prosperous counties measured by any of the three proxies, seem to have larger growth in bank level deposits. Our coefficient of interest, the interaction between large banks and attractive counties, suggest that large banks grow relatively faster in counties that are more attractive for banks. Our most restrictive specification, which uses both year and bank fixed effects, still shows an economically and statistically significant coefficient on the interaction term.

Table IX further analyzes growth dynamics at banks by looking at the three sources of growth in deposits at the county level – same-branch growth in deposit, opening of new branch, and acquisition of a branch. We calculate the share of total county level deposit growth for each bank that comes from each of the three sources. Columns (1)–(3) show as markets become more competitive, growth is driven by new branches and acquisition. Growth at the same branch decreases in importance as competition increases. Columns (4)–(6) show a similar trend in terms of profitability of a county.

VIII Conclusion

The financial intermediation sector and specifically the U.S. banking sector has grown significantly over the last three decades. Researchers before us have investigated the impact of the growth and concentration of banking activity among a few players in terms of trading activity, equity holder welfare and systemic risk. However, how banks have grown in the traditional business of deposit banking and the effect of the changing banking landscape on depositors has received limited attention.

We find that in contrast to the conventional wisdom that the growth of big banks in the U.S. has been fueled by mergers, half of the growth is from faster organic growth. This growth has increased in recent years after the financial crisis despite efforts to control the size of systemically important financial institutions. We further show that the benefits of competition between banks that are passed on to consumers come mainly from small banks. In addition to better rates due to competition, small banks provide additional higher deposit rates as the fraction of deposits in large banks in the same geography grows. Large banks do not respond to competition but do respond

to the presence of other large banks, with half the sensitivity of small banks.

The results have important policy implications regarding consumer welfare. While presence of higher competition from national banks is beneficial to the consumers, the benefits are small banks are willing to pass on more surplus. At a certain point, as large banks capture more of the market share, the average interest rate on deposits falls as the benefits of competition are outweighed by the smaller fraction of deposits with the small banks.

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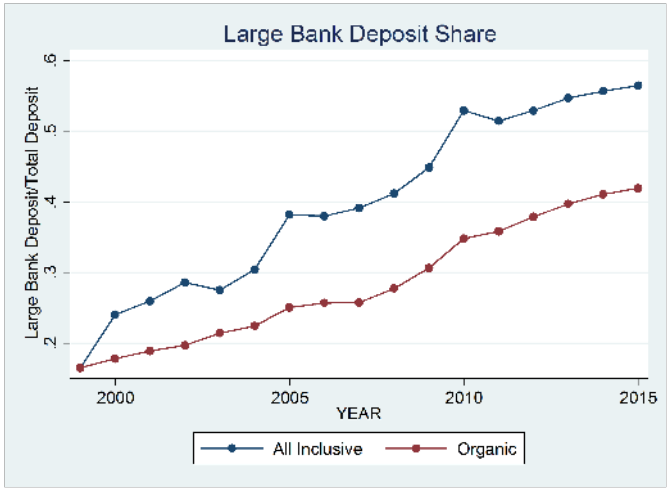
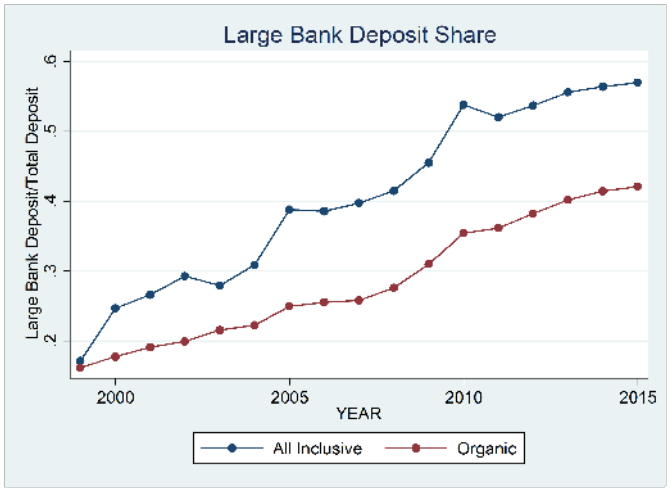


(a)



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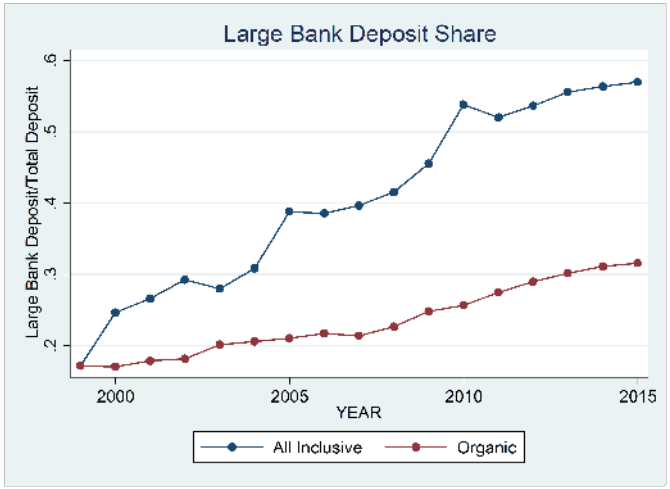

(c)

Figure 1: Deposit Market Share.

This figure analyzes the growth in deposit market share held by the largest twenty banks in the United States. The blue line denotes the total market share held by the large banks from 1999-2015. The red line denotes the market share held by these large banks if we exclude deposits from all of their acquired bank branches. In figure 1(a), all branches acquired by large banks are dropped from the sample after their acquisition. In figure 1(b), all branches that get acquired by the large banks at some point during our analysis are dropped altogether from the sample. In figure 1(c), all acquisitions by large banks are ignored and such branches are assumed to still belong outside the large banks.

Table I: Summary Statistics

This table provides summary statistics of the variables of interest in our sample. Total Deposit is the total domestic deposit for a bank. ROA is the return on asset for a bank and is calculated as net income over asset. Deposit HHI is the Herfindahl-Hirschman Index index of the deposits at the county level. New Branch Share is the fraction of branches in a county that were newly established in a given year. Large bank Deposit Share is the share of total deposit in a county that belong to the twenty largest banks.

	(N)	(Mean)	(Std. Dev.)	(Median)	(5 Pct.)	(95 Pct.)
Bank Level Data						
Total Deposit ($ mil.)	123327	836.1	1413.7	95.9	8.3	1153.9
Deposit Growth (%)	110733	26.212	88.482	5.4724	-8.833	116.11
Asset ($ mil.)	123327	1474.6	27105.2	133.8	25.0	1604.9
ROA (%)	123195	0.430	1.610	0.464	-0.386	1.075
County Level Data						
Deposit HHI	52885	0.318	0.207	0.255	0.111	0.791
Deposit Growth (%)	49769	3.831	13.058	3.044	-5.645	14.696
New Branch Share	52885	0.017	0.045	0	0	0.091
Large Bank Deposit Share	52885	0.166	0.211	0.077	0	0.601
Per Capita Deposit	52885	0.016	0.025	0.013	0.005	0.032

Table II: Largest US Banks

This table lists the twenty largest US banks as of June 30, 2015 based on their total deposits and based on the number of branches.

	by total deposits	by number of branches
1	Bank of America, National Association	Wells Fargo Bank, National Association
2	Wells Fargo Bank, National Association	JPMorgan Chase Bank, National Association
3	JPMorgan Chase Bank, National Association	Bank of America, National Association
4	Citibank, National Association	U.S. Bank National Association
5	U.S. Bank National Association	PNC Bank, National Association
6	PNC Bank, National Association	Branch Banking and Trust Company
7	Capital One, National Association	Regions Bank
8	TD Bank, National Association	SunTrust Bank
9	The Bank of New York Mellon	Fifth Third Bank
10	SunTrust Bank	TD Bank, National Association
11	Branch Banking and Trust Company	KeyBank National Association
12	HSBC Bank USA, National Association	Citizens Bank, National Association
13	State Street Bank and Trust Company	Capital One, National Association
14	Charles Schwab Bank	Citibank, National Association
15	Morgan Stanley Bank, National Association	The Huntington National Bank
16	Fifth Third Bank	Woodforest National Bank
17	Regions Bank	Manufacturers and Traders Trust Company
18	MUFG Union Bank, National Association	Santander Bank, N.A.
19	Goldman Sachs Bank USA	Compass Bank
20	BMO Harris Bank National Association	BMO Harris Bank National Association

Table III: Deposit Growth over Time

This table investigates the contribution of organic expansion towards the growth rate in deposits at the largest twenty banks in the U.S. The dependent variable is total growth in deposits for a given bank. The explanatory variables are organic growth in deposit, lagged total growth, lagged asset size, lagged bank deposit weighted state GDP, and lagged value of return on asset. The specification also includes bank and year fixed effects. Standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)	(5)
Organic Growth	1.670***	1.856***	1.924***	2.004***	2.007***
	(0.139)	(0.153)	(0.159)	(0.168)	(0.168)
Asset				0.192***	0.195***
				(0.0600)	(0.0601)
Deposit Growth [-1]				-0.0835*	-0.0842*
				(0.0498)	(0.0499)
Weighted GDP Growth				-0.635	-0.795
				(2.315)	(2.323)
ROA					6.124
					(6.836)
Year fixed-effects	No	Yes	Yes	Yes	Yes
Bank fixed-effects	No	No	Yes	Yes	Yes
Observations	304	304	304	283	283
R^2	0.324	0.389	0.441	0.477	0.478

Standard errors in parentheses

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

Table IV: Where Do Large Banks Open New Branches?

This table reports the results of a probit regression where the dependent variable is new branch openings. The explanatory variables are a dummy indicating whether a given bank is large or small, and county characteristics such as median income (column 1), total county level bank deposit (column 2), and county level per capita deposit (column 3). The standard errors are clustered at the county level.

	(1)	(2)	(3)
Large Bank	-1.029***	-0.549***	-0.113***
	(0.270)	(0.0446)	(0.00541)
Log County Median Income	0.229***		
	(0.0116)		
Large Bank X Log County Median Income	0.0818***		
	(0.0243)		
County Level Bank Deposit		0.0498***	
		(0.00118)	
Large Bank X County Level Bank Deposit		0.0240***	
		(0.00269)	
Per Capita Deposit			0.0996***
			(0.0208)
Large Bank X Per Capita Deposit			0.203***
			(0.0399)
Year fixed-effects	Yes	Yes	Yes
Observations	1562833	1571117	1571117

Standard errors in parentheses

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

Table V: Does Local Market Competition Affect Branch Opening?

This table reports the results of a probit regression where the dependent variable is a dummy that denotes whether a given bank branch is a new branch or not. A bank branch will be denoted a new branch if it was established during the reporting year ending June 30. We use a branch's date of establishment to determine new branch opening. The main explanatory variables are a dummy indicating whether a given bank is a large bank or not, and the lagged Herfindahl-Hirschman Index of the deposits at the county level. "All" denotes all counties (column 1), "More Profitable" denotes counties that have a median income greater than that for the median county (column 2), and "Less Profitable" counties are those with a median income below that for the median county (column 3).

	All	More Profitable	Less Profitable
Large Bank	-0.125***	-0.132***	-0.0458*
	(0.0105)	(0.0116)	(0.0257)
County Deposit HHI Index [-1]	-0.526***	-0.419***	-0.648***
	(0.0247)	(0.0302)	(0.0440)
Large Bank X HHI[-1]	0.104*	0.199***	-0.610***
	(0.0557)	(0.0613)	(0.139)
Year fixed-effects	Yes	Yes	Yes
Observations	1487400	1033838	453562

Standard errors in parentheses

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

Table VI: Determinants of County-level Bank Interest Rates

The table reports the determinants of deposit rates in U.S. banks for the period of . The dependent variable is the deposit rate offered by each bank in a county in a given year where it is present, scaled by the standard deviation of interest rates in the year across U.S. The explanatory variables are the Herfindahl-Hirschman Index index of the deposits at the county level and the share of large banks in terms of deposits at the county level.

		All Banks		Large Banks	Small Banks
	(1)	(2)	(3)	(4)	(5)
HHI	-0.0470**		-0.0596***	-0.00627	-0.0810***
	(0.0224)		(0.0225)	(0.0418)	(0.0240)
Large Banks' Share		0.0667***	0.0690***	0.0782***	0.167***
		(0.0103)	(0.0103)	(0.0183)	(0.0113)
Year FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
Observations	228825	228825	228825	44112	184713
R^2	0.925	0.925	0.925	0.948	0.932

Standard errors in parentheses

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

Table VII: Determinants of County-level Bank Interest Rates

The table reports the determinants of deposit rates in U.S. banks for the period of . The dependent variable is the deposit rate offered by each bank in a county in a given year where it is present, scaled by the standard deviation of interest rates in the year across U.S. HHI refers to the Herfindahl-Hirschman Index index of the deposits at the county level. “HHI Natl. Local" is a sum of ratio of local deposits of a bank multiplied by ratio of national deposits of the same bank. The variable thus captures the interaction of local market share with national market share of banks in a county.

	All Banks			Large Banks	Small Banks
	(1)	(2)	(3)	(4)	(5)
HHI	-0.0470**		-0.0701***	0.0235	-0.0849***
	(0.0224)		(0.0247)	(0.0471)	(0.0264)
HHI Natl. Local.		1.943	4.356**	-1.849	6.324***
		(1.803)	(1.994)	(3.850)	(2.107)
Year FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
Observations	228825	228825	228825	44112	184713
R^2	0.925	0.925	0.925	0.948	0.932

Standard errors in parentheses

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

Table VIII: Bank Deposit Growth at Each County

This table reports the results of the regression where the dependent variable is the growth rate of deposit for a given bank in a given county. The main explanatory variables are a dummy denoting large bank, and a county-level characteristics that represents profitability for banking activities in the county. The three measures used are median county income, size of the county deposit market, and per capita deposit in the county. Standard errors are clustered at the county level.

	(1)	(2)	(3)	(4)	(5)	(6)
Large Bank	-0.497***	-0.562***		-0.0393***	-0.0345***	
	(0.106)	(0.106)		(0.00193)	(0.00196)	
Log County Median Income	0.0810***	0.0774***	0.122***			
	(0.00594)	(0.00587)	(0.00970)			
Large Bank X Median Income	0.0429***	0.0493***	0.0125			
	(0.00975)	(0.00974)	(0.0120)			
Rich County				0.0157***	0.0150***	0.0264***
				(0.00169)	(0.00168)	(0.00293)
Large Bank X Rich County				0.0293***	0.0307***	0.0211***
				(0.00302)	(0.00305)	(0.00385)
Year fixed-effects	No	Yes	Yes	No	Yes	Yes
Bank fixed-effects	No	No	Yes	No	No	Yes
Observations	219786	219786	219786	222005	222005	222005
R^2	0.005	0.009	0.077	0.003	0.007	0.076

	(1)	(2)	(3)	(4)	(5)	(6)
Large Bank	-0.106***	-0.112***		-0.0192***	-0.0138***	
	(0.0171)	(0.0173)		(0.00178)	(0.00184)	
County Level Bank Deposit	0.0166***	0.0160***	0.0181***			
	(0.000885)	(0.000890)	(0.000961)			
Large Bank X Bank Deposit	0.00513***	0.00592***	0.00487***			
	(0.00128)	(0.00129)	(0.00140)			
Per Capita Deposit				0.235**	0.231**	0.0640
				(0.0975)	(0.0986)	(0.0422)
Large Bank X Per Capita Deposit				-0.0263	-0.0221	0.122**
				(0.0439)	(0.0446)	(0.0584)
Year fixed-effects	No	Yes	Yes	No	Yes	Yes
Bank fixed-effects	No	No	Yes	No	No	Yes
Observations	222005	222005	222005	222005	222005	222005
R^2	0.010	0.014	0.080	0.002	0.006	0.074

Standard errors in parentheses

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

Table IX: Contribution to County Level Bank Deposit Growth

This table reports results from the analysis of the three sources of bank deposit growth. The dependent variable is the share of total county level deposit growth for each bank that comes from (i) same-branch growth in deposit, (ii) opening of new branch, or from (iii) acquisition of a branch. The main explanatory variables are median county income and a given bank's share of the total deposit market at the county.

	(1) SameBr	(2) NewBr	(3) AcqdBr	(4) SameBr	(5) NewBr	(6) AcqdBr
Competitive Market	-0.624***	0.0589**	0.565***			
	(0.0809)	(0.0296)	(0.0749)			
Profitable County				-0.193***	0.0702***	0.123*
				(0.0733)	(0.0218)	(0.0670)
Bank Deposit Share	-0.0320	-0.149*	0.181	0.607**	-0.185**	-0.422*
	(0.262)	(0.0810)	(0.253)	(0.249)	(0.0748)	(0.238)
Observations	45486	45486	45486	45486	45486	45486
R^2	0.027	0.004	0.027	0.026	0.005	0.026

Standard errors in parentheses

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

Table X: Determinants of County-level Bank Interest Rates

The table reports the determinants of deposit rates in U.S. banks for the period of . The dependent variable is the deposit rate offered by each bank in a county in a given year where it is present. The explanatory variables are the Herfindahl-Hirschman Index index of the deposits at the county level and the share of large banks in terms of deposits at the county level.

		All Banks		Large Banks	Small Banks
	(1)	(2)	(3)	(4)	(5)
HHI	-0.0196**		-0.0184**	-0.00626	-0.0312***
	(0.00922)		(0.00881)	(0.0133)	(0.0110)
Large Banks' Share		0.00595	0.00415	-0.00105	0.0116*
		(0.00604)	(0.00584)	(0.00818)	(0.00696)
Bank-Year FE	Y	Y	Y	Y	Y
Observations	93278	93278	93278	49482	43796
R^2	0.982	0.982	0.982	0.980	0.982

Standard errors in parentheses

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

Table XI: Determinants of County-level Bank Interest Rates

The table reports the determinants of deposit rates in U.S. banks for the period of . The dependent variable is the deposit rate offered by each bank in a county in a given year where it is present. HHI refers to the Herfindahl-Hirschman Index index of the deposits at the county level. "HHI Natl. Local" is a sum of ratio of local deposits of a bank multiplied by ratio of national deposits of the same bank. The variable thus captures the interaction of local market share with national market share of banks in a county.

		All Banks		Large Banks	Small Banks
	(1)	(2)	(3)	(4)	(5)
HHI	-0.0196**		-0.0228**	-0.00743	-0.0372***
	(0.00922)		(0.00999)	(0.0164)	(0.0109)
HHI_large		0.00616	0.0158	0.00382	0.0283
		(0.00861)	(0.00991)	(0.0134)	(0.0175)
Bank-Year FE	Y	Y	Y	Y	Y
Observations	93278	93278	93278	49482	43796
R^2	0.982	0.982	0.982	0.980	0.982

Standard errors in parentheses

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

Table XII: Determinants of County-level Bank Deposit Rates

The table reports the determinants of deposit rates in U.S. banks for the period of . The dependent variable is the deposit rate offered by each bank in a county in a given year where it is present. The explanatory variables are the local market share of each bank in a county (market presence) and the share of a bank's total deposit that comes from a given county (market importance).

	Small Banks			Large Banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Market Importance	-0.0694***		-0.0694***	0.0611		0.0475
	(0.0121)		(0.0142)	(0.0516)		(0.0560)
Market Presence		-0.0487***	-0.0000449		0.0111	0.00751
		(0.0148)	(0.0175)		(0.0146)	(0.0158)
Bank-Year FE	Y	Y	Y	Y	Y	Y
County-Year FE	Y	Y	Y	Y	Y	Y
Observations	26523	26523	26523	36837	36837	36837
R^2	0.992	0.992	0.992	0.990	0.990	0.990

Standard errors in parentheses

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

Appendix

A Additional Tables and Figures

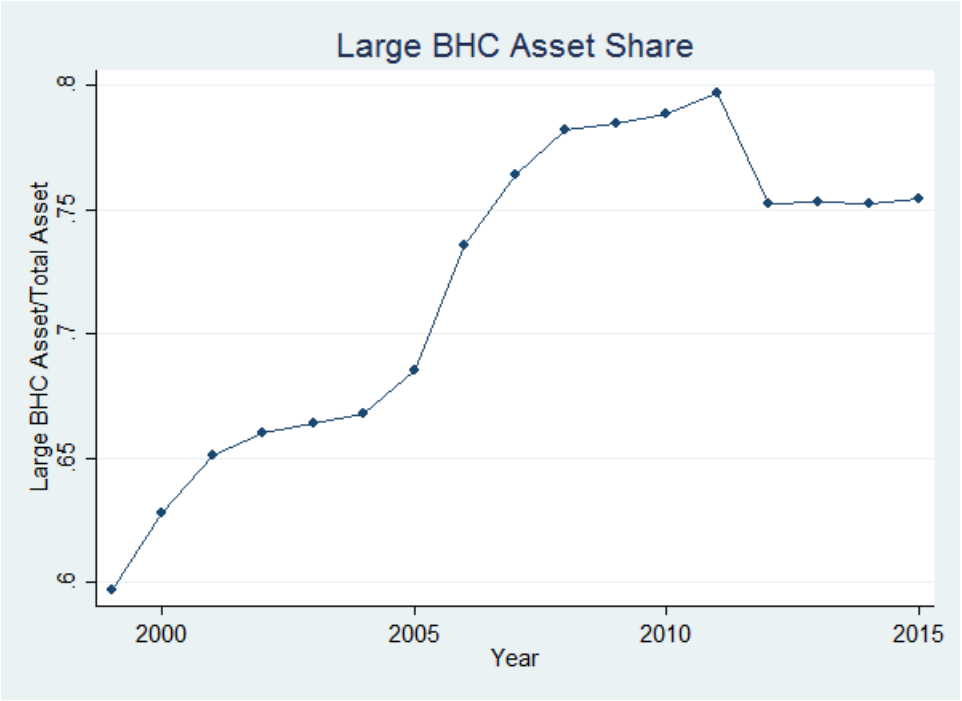

Figure A.1: Asset Share of Twenty Largest BHCs.

This figure shows the share of total banking sector asset held by the twenty largest Bank Holding Companies (BHCs). Data for this figure is obtained from the FR Y-9C that is filed by all domestic bank holding companies on a consolidated basis.

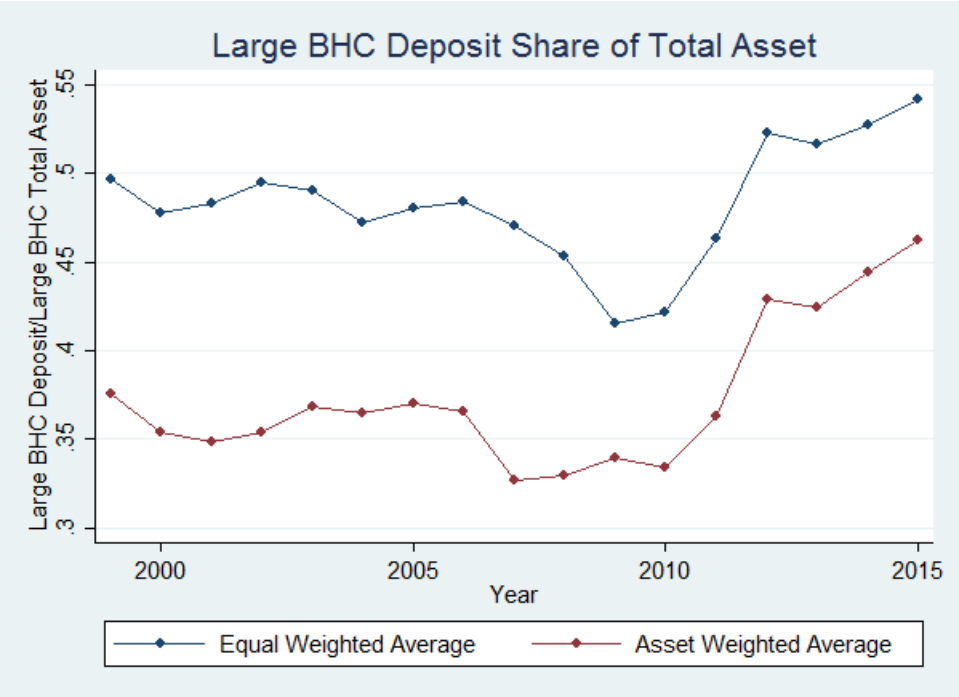

Figure A.2: Deposit Share of Total Assets for Twenty Largest BHCs.

This figure shows the share of bank deposits in total assets for the twenty largest Bank Holding Companies (BHCs). This analysis is performed for the subsection of BHCs that have data in both FR Y-9C and the Summary of Deposits.

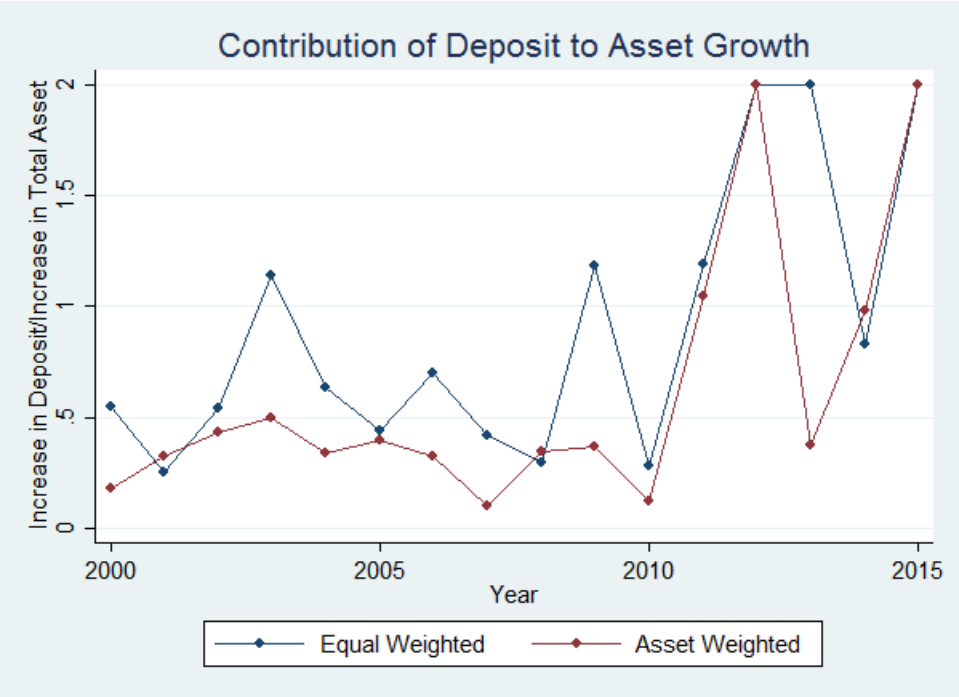

Figure A.3: Contribution of Deposits in Total Asset Growth for Twenty Largest BHCs.

This figure shows the contribution of deposit growth in total asset growth for the twenty largest Bank Holding Companies (BHCs). This analysis is performed for the subsection of BHCs that have data in both FR Y-9C and the Summary of Deposits. For better representation, deposit share in asset growth is truncated at 200%.

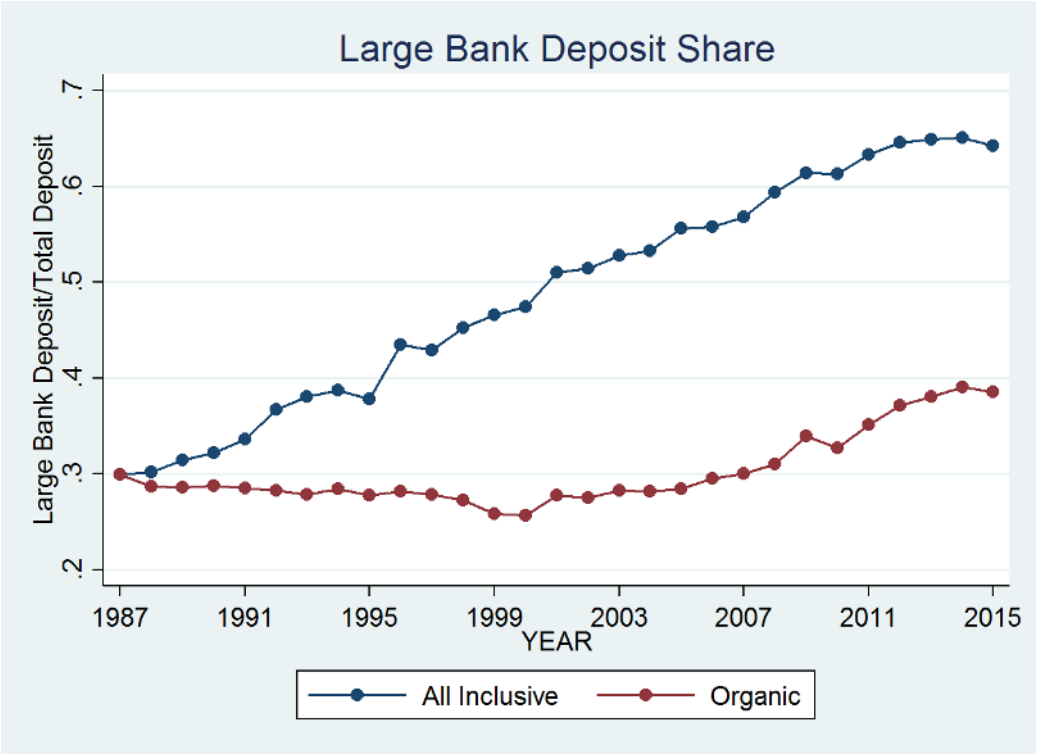

Figure A.4: Deposit Market Share of Top 20 BHCs.

This figure shows the deposit market share of the twenty largest Bank Holding Companies (BHCs) from 1987-2015. Each year, the twenty largest BHCs are determined based on their total bank deposits. The blue line denotes the total market share held by the large BHCs while the red line denotes the market share held by these large BHCs if we ignore all bank-branch acquisitions by these BHCs (we assume that these branches were never acquired and hence do not undergo a change in ownership during the period of analysis).