The Direct Costs of Bank Compliance around New Regulation

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Abstract

Bankers often comment about increased regulatory burden, and especially after the Dodd-Frank Act (DFA). This study investigates direct measures of cost and productivity for banks around major regulatory changes from 1991 to 2014. The Gramm-Leach-Bliley Act had significant reductions in employees after passage, and loans-per-employees declined after FDICIA. The DFA is clearly different with significantly higher loans per employee, salaries-to-assets, and average pay, and lower technology and fixed-asset expenditures. The burden of the DFA is worse for banks below $1 billion in assets since these banks also have significantly lower pre-tax ROA during the rulemaking period of the DFA.

Keywords: bank regulatory burden, compliance costs

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The Direct Costs of Bank Compliance around New Regulation

Abstract

Bankers often comment about increases regulatory burden, and especially after the Dodd-Frank Act (DFA). This study investigates direct measures of cost and productivity for banks around major regulatory changes from 1991 to 2014. The Gramm-Leach-Bliley Act had significant reductions in employees after passage, and loans-per-employees declined after FDICIA. The DFA is clearly different with significantly higher loans per employee, salaries-to-assets, and average pay, and lower technology and fixed-asset expenditures. The burden of the DFA is worse for banks below $1 billion in assets since these banks also have significantly lower pre-tax ROA during the rulemaking period of the DFA.

I. Introduction

Anecdotal evidence from bankers indicates increased costs of complying with new regulations and rules when regulatory changes are made. Yet, there is relatively little study of direct compliance costs for banks and the effect on loan productivity around new regulation. This study estimates the direct costs to banks around large regulatory changes from 1991 to 2014. A particular focus is on whether or not costs and productivity differ for prior major regulatory events compared to the most recent effects of the Dodd-Frank Act (DFA).

In large part, the reason that this important area has not been studied is that exact data do not exist from standard data sources. For example, there is no field in the Call reports or FR-Y9 that indicates the precise dollar amount or time spent on complying with regulations or rules. However, there are data on salaries, the number of employees, and the dollar amount of bank loans such that at least a crude measure of compliance costs can be estimated, and it is these measures that are used in this investigation.

The cost of compliance for banks is important to estimate so policymakers and other constituents can evaluate whether or not the benefits from regulatory change are worth the costs. In addition, banks would be at a competitive disadvantage to non-banks who are not subject to the same regulation if these costs are burdensome, or increasing over time. While it is difficult if not impossible to measure all the indirect costs and benefits, it is prudent to see if the claims that bankers make that the regulatory burden is too high and is increasing have any merit, and if the costs could potentially diminish the competitiveness of the industry.

The vast majority of bank regulatory research has focused on the benefits of regulation, or the unintended and indirect costs of policies such as deposit insurance or capital rules. There are literally thousands of studies that look at the indirect costs, such as moral hazard due to deposit insurance, or increased capital costs, or the macro costs of bank crises. However, few

studies look at the direct costs or the costs of different regulations for banks over time for the banks themselves. If banks are reallocating both time and resources away from managing the banking organization and implementing strategies to maximize shareholder wealth, these effects should be apparent in bank costs and profits, as well as loan production. In other words, if new regulation is burdensome, then either banks will need to hire additional employees to produce the same output, or output will fall with the same number of employees, or some combination of the two. Thus, it is the goal of this study to compare costs and productivity on as direct a basis as possible given the data, to investigate if these factors have changed since 1991, and in particular whether or not the Dodd-Frank Act (DFA) has created different effects compared to other large legislative actions over the past two decades.

II. Literature Review

Prior studies on the effects of bank regulation have focused on bank capital, deposit insurance, bank safety, and preventing bank runs or failure. For example, Diamond and Rajan (2000) develop a theory that optimal bank capital depends, at least in part, on diversification and risk management, which act as substitutes for bank capital. Deposit insurance pricing and risk incentives (e.g., moral hazard) are also widely studied. For example, Demirguc-Kunt and Kane (2002) study where deposit insurance works globally.

The literature that is germane to this study are those that review regulatory reform and legislative response to crises, and the effects of these changes on the industry. Each of these are discussed below, with the regulatory events that fall into each category in the appropriate section.

Regulation aimed at regulatory reform

Some regulation was directly aimed towards reducing regulatory burden and/or increasing efficiency in the banking industry. A good example during the 1990s was the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) of 1994, which was aimed towards streamlining the holding company structure to operate and acquire banks across state lines. The IBBEA was signed into law on September 13, 1994, the provision for acquiring institutions across state lines went into effect in September, 1995, and branching provisions went into effect June 1, 1997. If the IBBEA fulfilled the stated rationale for passage, then bank administrative costs should decline, increasing bank performance and production, all else equal.

Zou, Miller and Malamud (2011) use state-level data and find both net interest margins and return on assets increased during and after passage of the IBBEA. Their results are an extension of Nippani and Green (2002) who find that univariate ROA is higher after the passage of the IBBEA, but in multivariate regressions ROA is generally not significant. Higher accounting performance by banks is consistent with the IBBEA reducing regulatory costs, although they do not do a direct test of this hypothesis. In this study, I use ROA to measure for accounting performance differences to compare to Zou, Miller, and Malamud (2011) and many other studies that use accounting performance. In addition, ROA does not have the effect of leverage as does ROE, nor is it as impacted by interest rates as is net interest margin. Since this study uses a longer sample period, the IBBEA will be compared to a different standard than these two studies, but it is still expected that ROA and other production and performance measures will be higher for the IBBEA.

Another act targeted to reduce burden and expand banking opportunities was the Gramm-Leach-Bliley Act (GLBA) of 1999. The GLBA repealed Glass-Steagall and thereby expanded

products for commercial banks into insurance, investment banking, and real estate more easily through Financial Holding Companies. Much of the research on the effects of the GLBA study wealth effects for public banks. For example, Filson and Olfati (2014) find significantly positive Cumulative Abnormal Residuals for diversifying mergers, even into 2008—well after the passage of the GLBA. Yeager, Yeager, and Harshman (2007) find that accounting profit is statistically unchanged for those holding companies that converted to Financial Holding Company status, bringing into question the diversification benefits due to the GLBA. Given the mixed results, it is unclear whether the GLBA would cause banks to experience more or less compliance and regulatory costs, at least on average.

Regulation reform in response to industry problems or crises

In general, bank regulation that deals with a specific problem is a reaction by regulators and Congress to some major event or crisis, and is typically believed to have the side-effects of increasing regulatory burden. Key legislation that fits this description in the sample period from 1991 to 2014 include FDICIA, the PATRIOT Act, and the Dodd-Frank Act (DFA).

The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 was in response to the Savings and Loan crisis of the late 1980s. FDICIA was most noteworthy for introducing Prompt Corrective Action, but the effect most likely to increase regulatory burden was in moving the examination periods to either every 12 or 18 months and increasing internal controls. As Hirtle and Lopez (1999) note, "examinations are resource intensive for both banks and supervisors…" Shorter exam cycles and increased internal controls should increase regulatory burden and costs, all else equal.

Akhigbe and Whyte (1999) find that FDICIA significantly increased bank returns and reduced bank risk. Altamuro and Beatty (2010) find that post-FDICIA, the internal controls requirements seem to have worked since loan loss provisions are more accurate and there is earnings persistence compared to banks under the FDICIA size threshold. Collectively, the extant literature suggests that FDICIA was effective, and banks generally experienced lower risk and higher profits. Thus, prior research suggests higher ROA and performance variables after the passage of FDICIA.

The International Money Laundering Abatement and Financial Anti-Terrorism Act of 2001 was a part of the PATRIOT Act of 2001, which was a reaction to the terrorist attacks of 9/11. This act required new rules and regulations for identifying possible money laundering and other financial crimes, and as such created an additional burden on banks to comply with the new requirements. As discussed by Mojuye (2007), Section 352 of the Patriot Act requires banks to develop internal procedures and controls, designate a Compliance Officer, and provide ongoing employee training. Dolar and Shughart (2007) use total non-interest expenditures as a proxy for compliance costs and find smaller institutions are at a disadvantage since costs are proportionally larger than for bigger banks after the PATRIOT Act is enacted. In addition, Dolar and Shughart (2007) find that post-Act, non-interest expenses rose by 44.7% on average for their sample, which also included thrifts. Thus, it is plausible that the effects of the PATRIOT Act were to increase costs without increasing revenue, and thus costs should rise and profits fall. Following Dolar and Shughart (2007), I use several non-interest expenses, such as salaries-to-assets, average pay, and technology and fixed-asset expenses to evaluate cost around regulatory events. Given the Dolar and Shughart results, it is expected that costs will rise and productivity will fall across all the measures.

The Dodd-Frank Act is viewed by many as the most comprehensive financial reform since the Great Depression. As far as potential regulatory burden, Dodd-Frank has potential to increase the regulatory burden in many ways. The Act created a new regulator, the Consumer Financial Protection Bureau, and more than 400 new rules and mandates. One example of the regulatory burden due to Dodd-Frank is captured in this quote from Mr. Dale Wilson, CEO of First State Bank in San Diego, TX, in his testimony to the Financial Services Committee on Dodd-Frank:

> During the last decade the regulatory burden for community banks has multiplied ten-fold. Dodd-Frank alone has added nearly 14,000 pages of proposed and final regulations… Since the passage of Dodd-Frank there are 80 fewer Texas banks. These banks didn't fail…. These are community bankers, and I have talked to some of them personally that could not maintain profitability with regulatory cost increasing between 50-200 percent. These were good banks that for decades have been contributing to the growth and vitality of their towns but ability to serve the community is being undermined by excessive regulation and government micromanagement.

The burden from Dodd-Frank on smaller community banks has centered on Ability-to-Repay rules and the definition of a Qualified Mortgage. For larger banks, the provisions most often cited that increase the cost of doing business are the Volcker Rule that limit or prohibits proprietary trading and derivatives trading. New capital requirement rules impact both small and large banks, but more so for the largest banks declared Systemically Important Financial Institutions (SIFI).[1] In many cases, the definition of capital has been narrowed, such as disallowing Trust Preferred securities to count as capital.

Chortareas, Girardone, and Ventouri (2011) study the effects of recent regulation in a Basel III framework, but largely focus on the capital requirements. However, they find that operating costs for banks are positively related to the power of the regulator to make changes and

[1] SIFI banks were named by the Financial Stability Board in November, 2011. These institutions are subject to additional capital requirements proposed under Basel III, including surcharges for additional equity based on risk assessments up to 2% in extra capital. In the US, SIFI banks are the Bank of America, Bank of New York/Mellon, Citigroup, Goldman Sachs, JP Morgan Chase, Morgan Stanley, State Street, and Wells Fargo as of 2015.

corrections. Their measure of supervisory power is calculated through using survey responses about the power to use prompt corrective action and declare institutions insolvent. Their sample is from 11 EU countries and does not include US banks. In addition, they use inefficiency measures from a Data Envelopment Analysis (DEA) model, but find no relation between inefficiency and supervisory power. Although they do not use a direct measure of costs of regulatory burden for banks, their investigation is close to the spirit of this study.

Similar to Chortareas et al., Pasiouras, Tanna, and Zopounidis (2009) find more supervisory power is related to increases in cost efficiency and profit efficiency for banks in 74 countries. Barth, Lin, Ma, Seade, and Song (2013) study several aspects of bank regulation on bank efficiency from a DEA model. Barth et al. find that the power of the regulatory supervisor does not affect bank efficiency, at least in their sample from 1999 through 2007 across 72 countries. They do find that tighter restrictions on bank activity is negatively related to bank efficiency when a country changes regulations to prevent banks from doing activities such as underwriting or dealing in securities.

Studies related to regulatory cost

Franks, Schaefer, and Staunton (1998) study direct regulatory agency costs for financial firms in the UK compared to those in France and the US, but explicitly exclude commercial banking. They estimate compliance costs average 1.9% of operating expenses on average for securities firms and 5.8% for securities management firms.

Kahn and Santos (2005) review the optimal form of bank regulation and conclude the multi-regulator model is sub-optimal, but in such a framework, the deposit insurer is the best

choice to provide supervision. However, Kahn and Santos (2005) do not use empirical data or estimate the costs of such regulation on banks.

Boot, Dezelan, and Milbourn (2000) show that a level playing field is important for regulation, and that high quality institutions suffer when that is not the case, such as when other non-regulated firms offer their products and services. Again as in other studies, they do not measure the direct costs to banks or whether or not certain regulations impact those costs.

Klomp and de Haan (2012) find that bank supervisory control decreased both bank "liquidity and market risk" and "capital and asset risk." Klomp and de Haan do not study bank costs or performance with respect to different regulatory supervision or changes, but it is plausible that since safety and soundness is related to reducing bank risk that bank regulators have strong incentive to supervise and examine more closely when risk is prevalent. This implies that after a banking crisis supervision and therefore regulatory burden would increase, which is the central research question for this study.

III. Data and Empirical Method

The data used in this study are from the Federal Reserve FR-Y9C reports for bank holding companies in the US. Using US data avoids having different regulatory regimes and relying on indices to measure regulatory effectiveness and other structural differences across countries. It is also prudent to use holding company data since costs are reflected across all bank subsidiaries in this structure.[2] The data are quarterly from 1991 through 2014Q1. There are more than 133,000 bank-quarter observations that have sufficient data in the sample.

[2] Note that this could bias the results against the smallest banks that are not formed as holding companies and therefore are not in the sample, but these holding companies in the sample represent the vast majority of assets in US domestic banks.

Observations were trimmed at the 99% and 1% level since there were several cases of extreme outliers that would influence the results, and were likely data errors.

The goal of the investigation is to estimate bank compliance costs in terms of direct expenses in personnel and other costs. Since different size organizations have different characteristics and business models, the sample is split into five size categories: Over $50 billion in total assets, between $50 and $10 billion, between $10 and $5 billion, between $5 and $1 billion, and less than $1 billion in total assets.

In order to test whether or not there are changes in costs around regulatory events, it is important to identify large regulatory changes. While banking rules and regulations change annually, if not continuously, the focus here is on several large changes that should have the most impact on direct banking compliance and regulatory costs. These events are identified in Table 1 as:

Table 1
Major regulatory act time period definitions

Act Name	**Time Period**
Federal Deposit Insurance Improvement Act (FDICIA)	1991Q4 through 1992Q2
Interstate Branching and Banking Efficiency Act (IBBEA)	1995Q2 through 1995Q4
IBBEA branching provisions into effect	1997Q1 through 1997Q3
Gramm-Leach-Bliley Act	2000Q1 through 2000Q3
PATRIOT Act	2001 Q4 through 2002Q2
Dodd-Frank Act	2010Q3 through 2011 Q1
Dodd-Frank Act Ability to Repay and Qualified Mortgage	2013Q1 through 2013 Q4

Although mergers are not the focus of this study, many of these major regulatory changes affected the numbers and types of mergers and acquisitions. As shown in Figure 1, unassisted mergers rose after FDICIA and remained high for the IBBEA period. Since the IBBEA was aimed towards more efficient consolidation, this is as expected. At issue for this study is whether or not effects appear to be different after Dodd-Frank. Mr. Wilson's testimony to the

Financial Services Committee suggests that mergers would increase as smaller banks were acquired to overcome the increased regulatory burden via economies of scale in a larger bank. As the chart shows, unassisted mergers were lower from 2009 through 2013, but failure mergers increased as more banks failed and were merged or acquired with FDIC assistance.[3] If Mr. Wilson was referring to assisted mergers, then this evidence supports his case that Dodd-Frank increased this activity, but an increase in unassisted mergers does not appear to generalize to all US banks. Also noteworthy is the decline of new charters after the DFA to essentially zero as shown by the solid line in Figure 1. These results indicate that either the economic climate was not conducive to unassisted merger activity or new charters, or the effects of the DFA played a part in the reduction. Investigating the effects of the DFA on merger and chartering activity is beyond the scope of this study, but this chart indicates it warrants more detailed analysis. It is germane to this study since whatever industry-wide cost or productivity differences due to regulatory burden exist due to the DFA, they are not driven by increased merger and acquisition or charter activity.

Regression Model Dependent Variables

To investigate the costs and effects of regulatory change, several dependent variables are used. First, a measure of overall bank accounting performance is defined as Pre-tax return on assets (PREROA). While ROA has some issues since it is an accounting measure of performance, it is still widely used by researchers for at least a comparison to more complicated measures, such as X-efficiency. For example, Hasan, Schmiedel, and Song (2012) use ROA and

[3] Note that the data for the graph is merger and acquisition applications, which differ very slightly from other studies that use completed mergers or announcement dates since the timing of the completed merger or acquisition or the announcement might fall into a different calendar year.

ROE in addition to two efficiency measures to investigate the effects of the retail payment market on performance. The reason to use pre-tax ROA is because some banks are S Corporations and do not pay federal income taxes, thus using pre-tax numbers mitigates the effects of taxes. Other studies use measures such as cost efficiency or profit efficiency to study bank performance around many different events, including regulatory changes. However, these efficiency measures are comparative to the "best practice" bank and would create noise in measuring direct changes in costs for banks around regulatory events.[4] Bauer, Berger, Ferrier, and Humphrey (1998) show that the four X-efficiency methods they use to establish consistency across methods and over time yields mixed results. Berger and Mester (1997) show a correlation of 0.122 and 0.177 between ROA and standard profit efficiency and alternative profit efficiency respectively. Rather than cloud the issue with specification errors, or consistency issues, this study uses accounting data that has the best potential to measure costs directly.

Next, loans-per-employee is used as a measure of output. Often the amount of loans is used as in input for a model, however some researchers such as Coelho, de Mello, and Rezende (2013) directly use loans per employee to measure output. Since loans are most often the largest asset category for banks, at least on average, it is a natural measure of production. Another option for output could be to use deposits as outputs. However, in many cases as shown in Hughes, Mester, and Moon (2001), deposits behave as inputs and therefore are not a good measure of output even though some of the characteristics of deposits are consistent with an output.

[4] In order to compare the changes in X-efficiency, estimates of efficiency in the pre-regulatory period would be used to estimate changes in the post-regulation period to see how banks would have performed without the regulatory changes. In other words, the model shows how banks after the regulation compare to the "best practice banks" in the prior time period given the technology in the last period with this period's inputs and outputs. Using this method creates a percentage of inefficiency that can be compared, but the source of the inefficiency is not readily apparent.

The change in the number of employees is used to measure whether or not regulatory actions increase headcount, all else equal. Increasing employees after regulatory events is consistent with increased burden and diverting resources away from lending. Another possible effect of major regulatory actions is that banks adjust by hiring additional compliance personnel, using technology to manage the changes, or both. Similarly, banks could replace employees through normal attrition with higher-priced compliance specialists. To investigate the effects of regulation on employee salaries, two measures are used: salaries-to-assets, and average pay, defined as total salaries divided by the number of employees.

Beccalli (2007 finds that information technology expenses by banks is negatively correlated with ROA at the country level indicating that technology expenses are not offset by saving labor costs or increased revenue. Technology expenditures are not a separate line-item in the FR Y9 reports, so expenses on technology and fixed assets are used to proxy for technology expenditures.

Using these definitions, the pooled model of the costs of regulatory effects on bank costs and output is estimated as:

$$
\begin{aligned}
Y_{i,t} = \alpha &+ \beta_1 Q1 + \beta_2 Q2 + \beta_3 Q3 + \beta_4 LNASSETS + \beta_5 CAPRATIO + \beta_6 NETINTINC \\
&+ \beta_7 FIDUINC + \beta_8 EXTRAORD + \beta_9 NONACCRU + \beta_{10} AGLOANS \\
&+ \beta_{11} USCNILOAN + \beta_{12} FORCNILOAN + \beta_{13} BIGCDS + \beta_{14} ALLL + \beta_{15} PLLL \\
&+ \beta_{16} GDPGROWTH + \beta_{17} TECHNFA + \beta_{18} DEMDEPS + \beta_{19} NOW \\
&+ \beta_{20} MMDA + \beta_{21} SMALLCD + \beta_{22} FDICIA + \beta_{23} IBBEA + \beta_{24} IBBEA2 \\
&+ \beta_{25} GLBA + \beta_{26} PATRIOT + \beta_{27} DODDFRANK + \beta_{28} DODDFRANK2 \\
&+ \sum_{i=1}^{4} \lambda_i Y_{t-i} + \varepsilon_{i,t}
\end{aligned}
$$

where Q1, Q2, and Q3 are indicator variables that equal one if Quarter 1, 2, or 3 respectively, with Q4 omitted to avoid perfect multicollinearity; LNASSETS is the log of total assets to control for size differences, even within size groups. CAPRATIO is the equity-to-assets ratio as a measure of capital; NETINTINC is net interest income, defined as interest income minus interest expense, scaled by assets; FIDUINC is fiduciary income divided by assets; EXTRAORD is extra-ordinary income scaled by assets. The type of business model the bank uses will be captured by these control variables with NETINTINC capturing the effect of traditional loan and deposit business, FIDUINC is used as a proxy for non-interest earnings, and EXTRAORD to capture any merger activity, branch sales, or other non-reoccurring events.

NONACCRU is loans not accruing interest scaled by assets, a measure of future risk for the lending portfolio; AGLOANS is agricultural loans scaled by assets, a business-mix variable; USCNILOAN and FORCNILOAN are US and Foreign Commercial and Industrial loans, with both scaled by total assets to gauge business lending in the US and abroad. BIGCDS is large CDs scaled by assets to account for funding deposits with more volatile and rate-sensitive liabilities. ALLL is the allowance for loan and lease losses, divided by assets, a measure of risk as a reserve for bad debts; PLLL is the provision for loan and lease losses and is a measure of future risk as the estimate of loan losses that will be charged off in the future. GDPGROWTH is the annualized quarterly growth rate in Gross Domestic Product as a measure of economic activity; DEMDEPS is demand deposits-to-assets to capture a bank's reliance on cheap financing through interest-free checking accounts, TECHNFA is the expense on premises, fixed assets, and technology, scaled by assets; NOW is Negotiable Order of Withdrawal deposit accounts scaled by assets; MMDA is money market and savings accounts scaled by assets; SMALLCD are Certificates of Deposit less than $100,000, scaled by assets.

The regulatory variables start with FDICIA as an indicator variable for the FDIC Improvement Act and equals one if 1991Q4 through 1992Q2; IBBEA is an indicator variable for the passage of the Interstate Branching and Banking Efficiency Act and equals one if 1995Q2 through 1995Q4; IBBEA2 is an indicator equal to one if 1997Q1 through 1997Q3 when branching provisions went into effect; GLBA is an indicator equal to one if 2000Q1 through 2000Q3 after the passage of Gramm-Leach-Bliley; PATRIOT is an indicator equal to one if 2001 Q4 through 2002Q2 after the passage of the PATRIOT Act; DODDFRANK is an indicator equal to one if 2010Q3 through 2011 Q1 after the passage of the Dodd-Frank Act; DODDFRANK2 is an indicator equal to one if 2013Q1 through 2013 Q4 during the rule-making debate on Ability to Repay and Qualified Mortgages due to the passage of the Dodd-Frank Act.[5]

The summation term in the model is four lags of the dependent variable to help solve whatever serial correlation problems could exist. The dependent variables are stationary as indicated by the KPSS Stationarity Test (results not shown), however before using lagged variables some exhibited significant Dickey-Fuller statistics that indicate serial correlation. Thus, the lagged auto-regressive terms are used to account for trends and serial correlation and statistical tests indicate they are effective in handling the problem where present. Four lags are used since it spans a year, as well as the AIC statistics showing that additional terms beyond four lags add little, if any, explanatory power. Also, variance inflation factors indicate no significant problems with multicollinearity in any of the models.

[5] Note that interaction terms between the regulatory period indicators and certain independent variables based on prior research are added to the specification to see if there is a change in slope for these variables. These results are presented in the robustness section. I thank Scott Hein for this suggestion.

IV. Empirical Results

In this section is a discussion of the descriptive statistics and regression results to investigate the effects on profitability, costs, and lending productivity of the major regulatory acts since 1991. For regression result discussions, the main focus will be on the indicator variables and then the control variables will be summarized at the end of the section.

Table 2 contains the descriptive statistics for the sample. The means for the variables are listed by size groups. Since sample sizes are large, almost all differences are significantly different across groups, which is also the reason for splitting the sample by size. For the largest banks over $50 billion in Group 1, the average expenditure on salaries as a percent of assets is lower, and the average pay is higher. Salaries per assets show no pattern, but there is a decline in average pay as bank size declines. Figure 2 shows median salaries-to-assets over the sample period, and indicates a declining trend over most of the period. This implies it will be important to control for the trend for this variable. Pre-tax ROA tends to get bigger as banks are smaller. Assets per employee falls across sizes, but loans per employee are highest in Group 2, indicating the reliance on non-interest income and assets other than loans for the largest banks. Expenditures on fixed assets and technology are lowest as a percent of assets for the largest banks, but similar across size groups. The change in employees is small and relatively similar, on average, across size groups. Figure 3 shows the number of employees over time, and there is an evident negative trend, so changes are likely to be negative and will need to be controlled for by using lagged variables in the regression model. Similarly, average pay exhibits a positive trend over the sample period as shown in Figure 4, and this trend will need controls in the regression.

Auto-regression results

Table 3 presents the results for the auto-regression model for all five size groups with Pre-tax ROA as the dependent variable. The variables we are interested in are the indicators for the time periods around large changes in regulations and rules. In general, the indicators are not significant with some notable exceptions. The period where branching provisions across state lines when into effect (IBBEA2) is negative and significant indicating lower profits for banks after this rule. The negative result for ROA after branching provisions went into effect are inconsistent with the stated goal of increasing structural efficiency for banks, and is consistent with increased regulatory burden. The most consistent result is increased pre-tax ROA after the passage of the PATRIOT Act as shown by all five size groups having positive and significant estimates for PATRIOT. None of the other regulatory acts have more than two estimates out of five that are significant across the size groups. This finding in isolation would suggest costs did not increase and profits were not reduced significantly due to major regulatory events, including Dodd-Frank and the rulemaking period. Or, it could indicate that banks were able to offset these losses in other ways, such as increased productivity or substituting technology, which will be investigated through other dependent variables and discussed below.

Table 4 shows loans-per-employee regression results as an indicator of production effects of these large regulatory events. The FDICIA indicator is negative and significant for all five size groups indicating less lending after the passage of FDICIA, all else constant. This could be due to the increased regulatory burden of more frequent bank exams, or other rules that increase audit requirements and thereby cause more time to be spent away from lending. The IBBEA and IBBEA2 coefficients are almost all negative, and seven out of 10 are significant. The PATRIOT Act also has all negative coefficients, and all five size groups are significant. Collectively, these

results indicate the IBBEA and PATRIOT Act could have diverted resources away from lending, all else equal, and are consistent with increasing regulatory burden. The coefficients on DODDFRANK and DODDFRANK2 have 8 out of 10 positive and significant indicating increased loans per employee after the passage and during the rulemaking period of the DFA. This result for the DFA is in contrast to the other Acts, as well as inconsistent with a decrease in lending due to the DFA, all else constant.

The results for the percentage change in bank employees are in Table 5. There are few consistent results for the regulatory indicators. The most consistent result is that after the passage of Gramm-Leach-Bliley, employment fell more rapidly as shown by the negative sign in three out of five size group regressions. Since there are four lagged dependent variables in the auto-regressions (not shown in the table), the trend in employment falling as shown in Figure 2 is accounted for, so the result is not due to a secular trend. During the rulemaking period of the DFA, the only two significant coefficients are negative for the two smallest bank size groups. The lack of consistency for the DFA indicates that at least the number of employees did not rise significantly, on average. This finding is inconsistent with hiring net new personnel to deal with the new rules due to the DFA, but could be consistent with replacing employees who left with compliance and regulatory personnel.

If the DFA and other acts during the sample period required replacing exiting employees with either more productive personnel or more highly skilled workers with compliance and regulatory expertise, there should be an increase in salaries.[6] Note that some of the increase in salaries could accrue to the CEO, so it is not definitive, but an increase in average salaries would be consistent with more skilled employees. Table 6 contains the first measure of salaries,

[6] Although there is no direct data to test the hypothesis, it is intuitive that more productive new hires will demand higher salaries, and especially compared to those being replaced.

salaries-to-assets, which is a measure of productivity and the cost of wages. The period after the IBBEA indicates salaries-to-assets declined as shown by the negative coefficients in four out of five size groups for IBBEA. This indicates that either efficiency improved or salaries declined during the period. Because the results for loans-per-employee for the IBBEA period in Table 4 are negative, it is unlikely that productivity improved.[7] During the rulemaking period of the DFA, salaries as a percent of assets are higher as shown by the positive coefficient for DODDFRANK2 for four out of five size groups. This indicates higher salaries paid since loans-per-employee also rose during this period as shown in Table 4. In other words, these results are consistent with replacing exiting employees with higher paid employees who were more costly because they are more productive.

Table 7 contains the auto-regression results for average pay. Average pay declined during FDICIA, the passage of IBBEA, and branching provisions of the IBBEA as shown by the predominately negative coefficients, although the coefficients are not significant for every size group. The PATRIOT Act also shows significantly lower average pay after the passage in all five size groups. The big outlier in average pay is around the passage and rulemaking of the DFA. In fact, for all estimates across size groups, the coefficients are positive and significant indicating higher average pay, all else equal. This finding, coupled with the results for salaries-to-assets indicates more expense on salaries, especially during the rulemaking period of the DFA. Since productivity in producing loans increased during this period, it is likely banks responded to the new regulatory burden by hiring more skilled workers, or perhaps existing workers were more productive and banks hired higher paid compliance personnel.

[7] When using assets-per-employee, the results are the same for IBBEA2 since the coefficients are negative when they are significant. Using assets instead of loans accounts for other income producing assets that are not loans.

The last theory to explore is whether or not technology is used to offset these regulatory changes. Although our measure of technology and fixed asset expenditure is crude at best, it should give an indication of spending in the area, assuming that on average the costs of additional fixed assets is not clustered around these regulatory events. Table 8 contains the results for technology and fixed asset expenditures. The GLBA has coefficients that are positive and significant in four of five groups, indicating some substitution of technology and fixed assets to adjust to new regulations and rules. For Dodd Frank, technology expenditures are significantly lower across all size groups for both the passage of the act (DODDFRANK) and the rulemaking period (DODDFRANK2) indicating that banks reduced technology and fixed asset expenditures after the DFA. Reduced technology and fixed asset expenditures coupled with increased salaries in Tables 6 and 7 indicates that banks substituted higher skilled labor for technology after the DFA. As shown in the change in employee regressions in Table 5, there were no significant net additions of employees, so these changes came through either reassigning people to higher paying jobs, or replacing employees who left with higher paid replacements.

Control variable discussion

The majority of the control variables that are significant appear to make intuitive sense. The quarterly dummy variables are perhaps the most commonly significant control variables and show the cyclicality of the data, and therefore the importance of having these in the model. Banks with higher capital primarily have higher ROA, but mixed results for other dependent variables and size groups. Typically, any expense such as PLLL or non-accruing loans reduces pre-tax ROA or lending, but the results are inconsistent across size groups. It is clear that the largest banks are different than the smallest banks, hence the importance of separating them in

the estimations. Controls for the deposit and funding mix are inconsistent across almost every dependent variable and therefore show no discernible trend. Likewise, GDP growth is inconsistent across dependent variable regression results with the exceptions that higher GDP growth is related to higher changes in the numbers of employee and lower loans per employees. Similar to the deposit mix variables, the lending mix variables such as Agricultural loans, and US and Foreign Commercial loans show inconsistent results across size groups, indicating the diverse business models depending on bank size.

Small (Community) bank summary

Up to now, the focus has been across all bank size groups. In this subsection, the focus is on the smallest bank group, less than $1 billion in assets, which many researchers define as community banks. In each of the regression tables, these results are in the far-right column. Pre-tax ROA for community banks show mixed results across the regulatory events with FDICIA, branching changes during the IBBEA, and the PATRIOT Act all showing positive and significant increases in pre-tax ROA, all else equal. The passage of the IBBEA and the rulemaking period of the DFA show negative and significant coefficients for community banks (IBBEA and DODDFRANK2, respectively). Loans-per-employee are significantly lower for FDICIA and both IBBEA periods, but is significant and positive for both DFA periods indicating more lending per employee after the passage and during the rulemaking of Dodd-Frank, all else equal. However, the result of higher loans-per-employee for community banks could be caused by the negative and significant decline in the change in employees around the DFA as shown in the last two columns of Table 5. Dodd-Frank continues to have differential impact on community banks compared to past regulatory events as shown in salaries and average pay being

significantly higher only for the DFA. For technology and fixed-asset expenditures for community banks, again the DFA is different with significantly lower expenses in these categories for the DFA whereas only FDICIA has a significant and negative effect out of the other major regulatory changes.

To recap, the DFA appears to impact community banks differently than other major legislative events and different than large banks as well. The DFA reduced accounting profit, technology and fixed-asset expenditures, and employees, but increased salaries-to-assets, average pay, and loans-per-employees for community banks.

Robustness

There are several robustness methods to help provide confidence in the results. First, the bank size groups could be considered ad hoc and could be influencing the results. To help mitigate this concern, regressions for all groups together are estimated with only the log of assets to control for size. For the entire sample, results are the same for the main findings for the effects of the individual Acts. For example, salaries-to-assets and average pay are mostly negative for all Acts except the DFA where they are positive and significant. One difference is that pre-tax ROA is negative and significant at the one-percent level for the DFA rulemaking period, whereas it was negative for four of five size group regressions and only significant for the two smallest groups of banks when regressions are split by bank size. Loans per employee are significantly lower after the passage of FDICIA, the IBBEA, and PATRIOT Act, but higher after the GLBA and Dodd-Frank. The results for technology and fixed assets expenditures were largely the same as the grouped size-based regressions.

As another robustness test, interaction terms are added with the regulatory indicator multiplied by certain independent variables based on prior research to see if there is a change in slope. In particular, FDICIA was shown by Akhigbe and Whyte (1999) to reduce bank risk, so FDICIA is interacted with NONACCRU to see if there is a change in the risk of loans. The IBBEA indicator is interacted with US and Foreign Commercial and Industrial loan variables as well as LNASSETS (a measure of size) since Zou, Miller and Malamud (2011) find net interest margins and return on assets increased after passage of the IBBEA. The interaction is to see if this increased accounting performance after the IBBEA is due to higher proportions of lending or economies of scale. The Gramm-Leach-Bliley Act indicator (GLBA) is interacted with size since larger banks are hypothesized to be more likely to experience stronger effects on improving holding company structures, at least given the mixed results from prior research. The Dodd-Frank indicator is also interacted with the commercial loan variables and the capital ratio since the effects of DFA are most likely to influence the reaction to a potential increase in regulatory burden if banks reallocate loan production resources and build capital under new regulations.

Table 9 contains the results for only the interaction terms. The other variables are not shown, but remain similar to the main results of the study. As shown, there is very little consistency across size groups for any of the dependent variables. Pre-tax ROA is even lower during the DFA period when the bank has high capital ratios for three of five size groups. The lower Pre-tax ROA relation to capital implies that the limited results for lower Pre-tax ROA in Table 3 are even worse for the smallest two bank size groups the higher the capital ratio. This is not to imply causation, but rather indicates that at least some of the poor performance is due to banks with lower leverage (higher capital) not performing as well, perhaps due to limited growth opportunities. Loans-per-employee in Panel B of Table 9 shows no consistent pattern with the

interaction terms. The most consistent result for the change in the number of employees in Panel C is higher US Commercial Loans and lower Foreign Commercial Loans are related to a higher change in employees during the Dodd-Frank period. A larger change in employees during the DFA for this combination of lending indicates that to maintain US commercial lending the bank needed more employees, but foreign lending provided an offsetting diversification effect for banks. Even though the signs are relatively consistent for the estimates of these interaction terms between the DFA and lending, only five of ten are significant. The rest of the interaction coefficients are mixed in significance and sign and do not provide much insight into the effects of these regulatory events.

V. Conclusions and Summary

The goal of this study is to investigate the effects of major regulatory and rule changes on the direct costs of banks for personnel and technology, and profitability, and in particular compare past events to the effects of the Dodd-Frank Act (DFA). The hypothesis that banks had no changes for major regulatory events is rejected, but the relationship is more complex than simply hiring more people to do additional regulatory and compliance tasks.

Results show that the effects of the Dodd Frank Act (DFA) are clearly different from prior large regulatory changes. During the rulemaking period of the DFA, defined as 2013 when regulators were making changes to Ability-to-Repay and Qualified Mortgage rules, pre-tax ROA was significantly lower for only the smallest two bank size groups indicating economies of scale helped absorb the increased costs. Loans per employee were largely higher after the passage of the DFA and for all size groups during the rulemaking period of the DFA, even though the change in the number of employees was not significantly different except for the two smallest

groups of banks. These results indicate that the reaction to increased rules due to Dodd Frank was not simply hiring additional employees to the detriment of profitability, at least for banks above $5 billion in assets. Additionally, salaries-to-assets and average pay increased during the DFA period, indicating that either employees were reassigned to compliance tasks (perhaps in addition to their original job) and paid more, or employees who did leave were replaced with higher salaried and better performing employees. Significantly higher average pay after the DFA passage and during rulemaking is one of the most consistent results across all bank size groups. Also, technology and fixed-asset expenses were lower for the DFA for every size group in contrast to prior major changes, with the exception of FDICIA that also had negative effects.

All of these results are not all-inclusive direct measures of the costs of regulation since the data do not exist that explicitly allocate costs to compliance and regulatory tasks. Instead, the data are collected as a whole, such as total salaries or total number of employees. However, the data used should show evidence of increased cost and labor since they contain the effects of both indirect and direct expenses on costs and productivity.

The smallest banks below $1 billion in asset size (so-called "community banks") require additional attention since these are the most likely banks to bear the burden of regulatory change and in particular the DFA. Community banks had significantly lower pre-tax ROA during the DFA in contrast to all other Acts except the passage of the IBBEA. Similarly, the smallest banks had higher loans per employee around the DFA passage and rule-making period, in contrast to all other major legislative acts in the period. These small banks also had significantly lower changes in employees for the DFA in contrast to most every other size group and regulatory change, with the exception of the GLBA. Reduced number of employees for community banks indicates some of the gains in loans per employee were due to lower numbers of employees

while maintaining loan production. Likewise, salaries-to-assets were higher for the DFA for the smallest banks, however most other size groups also had higher salaries-to-assets for the DFA. Average pay was higher for all size groups for the DFA, and was not significantly positive for any bank size group for any other Act in the sample period. Technology and fixed-expenses were negative for all bank groups around the DFA, although for the smallest bank group, the coefficient for FDICIA was also negative and significant. In total, results for the smallest banks indicates that the effects of the DFA was clearly different compared to other Acts, and that community banks reacted by spending less on technology, hiring fewer employees, and paying employees more, all of which are consistent with increased burden due to the DFA on community banks that additionally lowered accounting profits.

Collectively, it appears that bankers are adept at adjusting to new rules and making acceptable accounting profits in the face of major regulatory changes even though the burden appears to be worse for smaller banks. More thorough analysis would be possible if regulators collected data on how many people, total hours, and expenses went directly to compliance, and this would be useful for future research.

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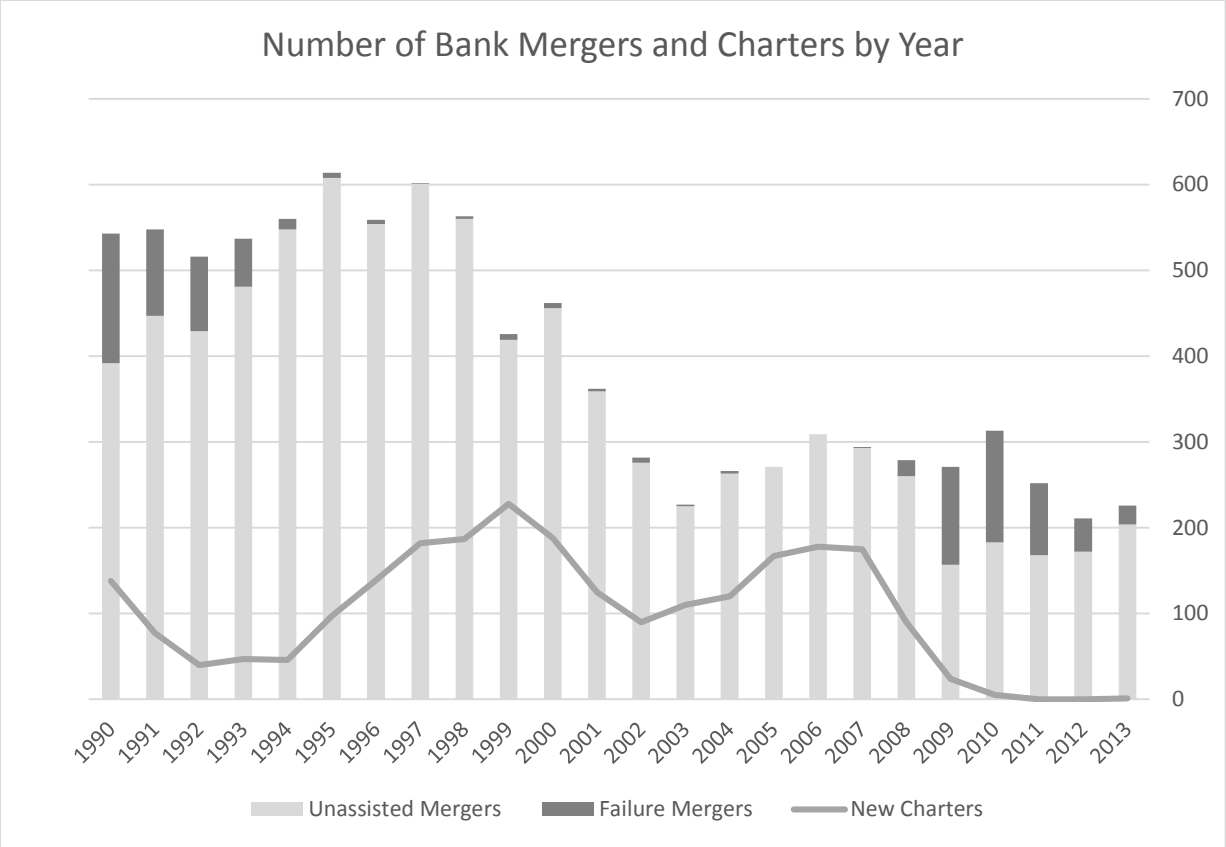

Source: FDIC website.

Figure 1

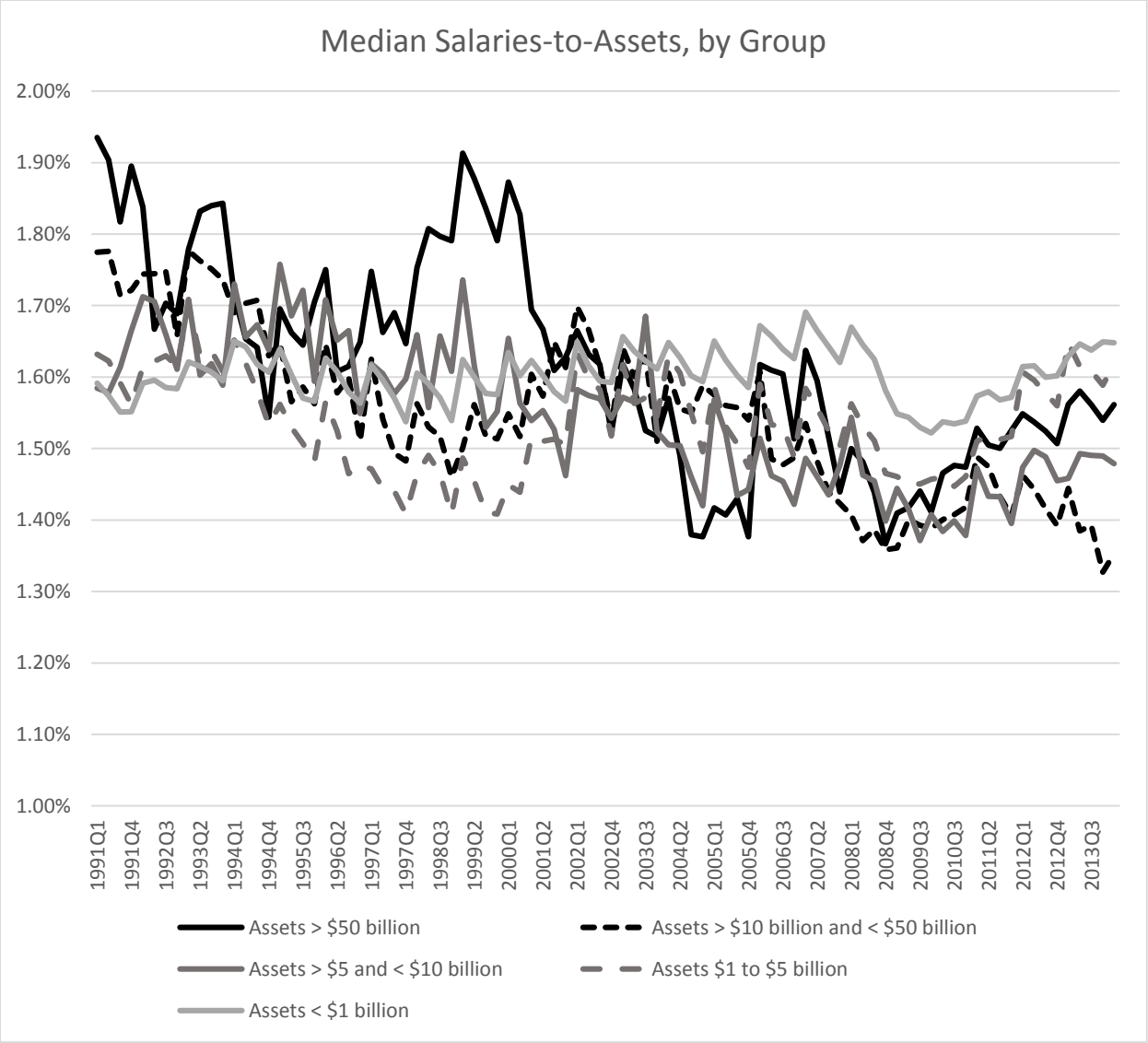
Median Salaries-to-Assets, by Group
2.00%
1.90%
1.80%
1.70%
1.60%
1.50%
1.40%
1.30%
1.20%
1.10%
1.00%
1991Q1
1991Q4
1992Q3
1993Q2
1994Q1
1994Q4
1995Q3
1996Q2
1997Q1
1997Q4
1998Q3
1999Q2
2000Q1
2001Q2
2002Q1
2002Q4
2003Q3
2004Q2
2005Q1
2005Q4
2006Q3
2007Q2
2008Q1
2008Q4
2009Q3
2010Q3
2011Q2
2012Q1
2012Q4
2013Q3
Assets > $50 billion
Assets > $10 billion and < $50 billion
Assets > $5 and < $10 billion
Assets $1 to $5 billion
Assets < $1 billion

Figure 2

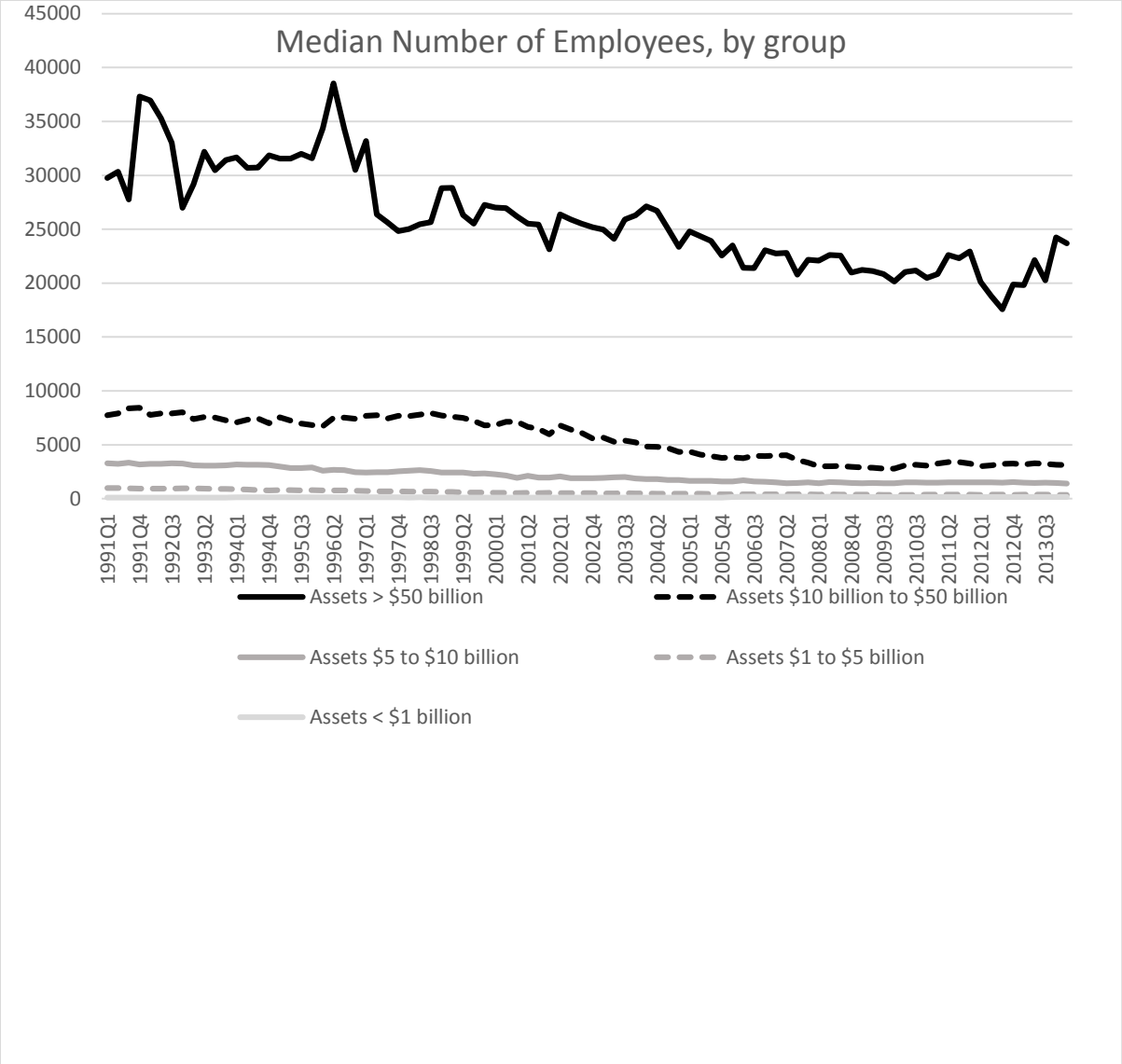
Median Number of Employees, by group
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1991Q1
1991Q4
1992Q3
1993Q2
1994Q1
1994Q4
1995Q3
1996Q2
1997Q1
1997Q4
1998Q3
1999Q2
2000Q1
2001Q2
2002Q1
2002Q4
2003Q3
2004Q2
2005Q1
2005Q4
2006Q3
2007Q2
2008Q1
2008Q4
2009Q3
2010Q3
2011Q2
2012Q1
2012Q4
2013Q3
Assets > $50 billion
Assets $10 billion to $50 billion
Assets $5 to $10 billion
Assets $1 to $5 billion
Assets < $1 billion

Figure 3

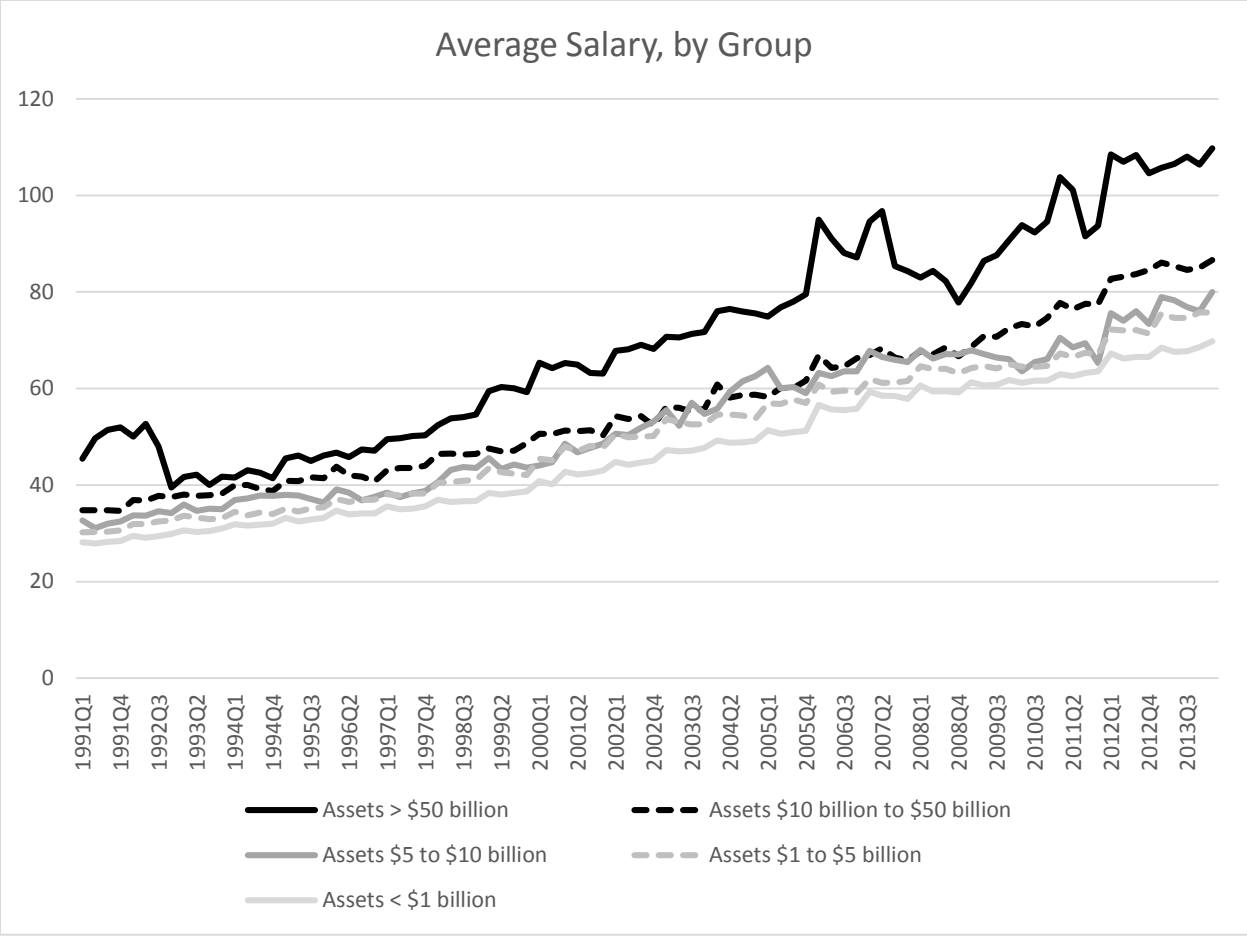
Average Salary, by Group
120
100
80
60
40
20
0
1991Q1
1991Q4
1992Q3
1993Q2
1994Q1
1994Q4
1995Q3
1996Q2
1997Q1
1997Q4
1998Q3
1999Q2
2000Q1
2001Q2
2002Q1
2002Q4
2003Q3
2004Q2
2005Q1
2005Q4
2006Q3
2007Q2
2008Q1
2008Q4
2009Q3
2010Q3
2011Q2
2012Q1
2012Q4
2013Q3
Assets > $50 billion
Assets $10 billion to $50 billion
Assets $5 to $10 billion
Assets $1 to $5 billion
Assets < $1 billion

Figure 4

Table 2
Means of selected variables

Variable	Group 1 (N=2709)	Group 2 (N = 5227)	Group 3 (N = 4642)	Group 4 (N = 24857)	Group 5 (N = 101,709)
SAL2ASST	0.0162	0.0171	0.0174	0.0168	0.0171
PREROA	0.0148	0.0157	0.0157	0.0127	0.0223
ASSTPEREMPL	7.0087	4.9652	4.2535	4.2113	2.9583
LOANPEREMPL	2.8784	3.2412	2.5914	2.6606	1.8955
TECHNFA	2.5306	2.9615	2.8979	2.8543	2.8538
NUMEMPL	50,071.27	7,107.82	2,339.80	681.61	150.29
TOTASSET	274,169,610	21,983,092	7,030,712	2,046,436	382,705
EMPLCHG%	1.2561	0.9320	1.2020	1.2027	1.1952
AVGPAY	92.7946	60.2749	58.9540	58.4475	46.3253

Group 1 is banks with greater than $50 billion in assets, Group 2 is banks with more than $10 billion and less than $50 billion in assets, Group 3 is banks with more than $5 billion and less than $10 billion in assets, Group 4 is banks with more than $1 billion and less than $5 billion in assets, Group 5 is banks with less than $1 billion in assets. SAL2ASST is salaries divided by assets, PREROA is pre-tax net income divided by total assets, ASSTPEREMPL is assets in Millions divided by the number of employees, LOANPEREMPL is loans in Millions divided by the number of employees, TECHNFA are fixed asset and technological expenses divided by assets, NUMEMPL is the number of employees, TOTASSET is total assets in $1,000s, EMPLCHG% is the percentage change in number of employees, AVGPAY is the total salaries paid divided by the number of employees, in $1,000s.

Table 3
Pre-tax return on assets dependent variable auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	**-0.0228**	0.0001	**-0.0421**	<.0001	**-0.0662**	<.0001	**-0.0206**	<.0001	**-0.0265**	<.0001
Q1	**0.0212**	<.0001	**0.0142**	<.0001	**0.0229**	<.0001	**0.0147**	<.0001	**0.0161**	<.0001
Q2	**0.0142**	<.0001	**0.0095**	<.0001	**0.0153**	<.0001	**0.0099**	<.0001	**0.0108**	<.0001
Q3	**0.0080**	<.0001	**0.0050**	<.0001	**0.0082**	<.0001	**0.0053**	<.0001	**0.0057**	<.0001
LNASSETS	0.0003	0.2227	**0.0020**	<.0001	**0.0035**	<.0001	**0.0009**	<.0001	**0.0009**	<.0001
CAPRATIO	**0.0707**	<.0001	**0.0891**	<.0001	**0.0582**	<.0001	**0.0482**	<.0001	**0.0553**	<.0001
NETINTINC	**0.7186**	<.0001	**0.6167**	<.0001	**1.0752**	<.0001	**0.9215**	<.0001	**0.8948**	<.0001
FIDUINC	**0.4090**	<.0001	**0.3258**	<.0001	**0.5910**	<.0001	**0.5051**	<.0001	**0.3323**	<.0001
EXTRAORD	**-0.5421**	0.0249	**-0.4752**	0.0001	**0.9476**	0.0348	**-0.2122**	0.0389	**0.1012**	0.0027
NONACCRU	**-0.6098**	<.0001	**-0.3346**	<.0001	**-0.2179**	<.0001	**-0.1641**	<.0001	**-0.1546**	<.0001
AGLOANS	-0.0055	0.9086	0.0106	0.5215	-0.0005	0.9637	**0.0231**	<.0001	**0.0043**	<.0001
USCNILOAN	**0.0105**	0.0044	**-0.0183**	<.0001	**-0.0075**	0.0004	**-0.0056**	<.0001	0.0005	0.1099
FORCNILOAN	-0.0016	0.8495	**-0.0352**	0.0031	0.0278	0.0630	**0.0229**	<.0001	**0.0127**	<.0001
BIGCDS	-0.0068	0.2516	**0.0076**	0.0016	**-0.0099**	<.0001	**0.0024**	0.0093	**0.0035**	<.0001
ALLL	**0.4211**	<.0001	**0.2018**	<.0001	**0.1005**	0.0022	**-0.1418**	<.0001	-0.0115	0.0546
PLLL	**-0.8223**	<.0001	**-0.8008**	<.0001	**-1.1195**	<.0001	**-1.2673**	<.0001	**-1.2451**	<.0001
GDPGROWTH	**0.1221**	<.0001	**0.0950**	<.0001	**0.0738**	<.0001	**0.0609**	<.0001	**0.0389**	<.0001
DEMDEPS	**-0.0246**	<.0001	0.0040	0.1420	**-0.0142**	<.0001	0.0018	0.1155	**0.0013**	0.0018
TECHNFA	**0.0015**	<.0001	-0.0002	0.0877	**-0.0012**	<.0001	**-0.0022**	<.0001	**-0.0022**	<.0001
NOW	**0.0281**	0.0014	**-0.0225**	<.0001	**-0.0160**	<.0001	**-0.0084**	<.0001	**0.0015**	0.0008
MMDA	**-0.0152**	<.0001	**-0.0100**	<.0001	**-0.0168**	<.0001	**-0.0051**	<.0001	**0.0014**	<.0001
SMALLCD	**-0.0237**	<.0001	**-0.0042**	0.0199	**-0.0173**	<.0001	**-0.0045**	<.0001	**0.0010**	0.0002
FDICIA	0.0027	0.2843	0.0013	0.0721	0.0010	0.2249	**0.0010**	0.0313	**0.0007**	<.0001
IBBEA	**-0.0039**	0.0269	0.0009	0.2165	-0.0007	0.4395	-0.0005	0.2666	**-0.0003**	0.0317
IBBEA2	-0.0025	0.1200	0.0004	0.5974	0.0006	0.4696	**0.0011**	0.0193	**0.0010**	<.0001
GLBA	-0.0017	0.1958	-0.0013	0.0619	0.0005	0.5721	-0.0004	0.3631	-0.0002	0.1472
PATRIOT	**0.0055**	<.0001	**0.0044**	<.0001	**0.0045**	<.0001	**0.0033**	<.0001	**0.0019**	<.0001
DODDFRANK	-0.0006	0.6676	-0.0003	0.7888	-0.0010	0.2873	**0.0012**	0.0014	-0.0001	0.5551
DODDFRANK2	0.0005	0.6899	-0.0015	0.0823	-0.0013	0.1013	**-0.0011**	0.0007	**-0.0016**	<.0001

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1. Q1, Q2, and Q3 are indicator variables equal to one if in quarter 1, 2, or 3 respectively. LNASSETS is the log of total assets. CAPRATIO is the equity-to-assets ratio. NETINTINC is net-interest income, scaled by assets. FIDUINC is fiduciary income divided by assets. EXTRAORD is extraordinary income divided by assets. NONACCRU is non-accruing loans, divided by assets. AGLOANS is agricultural loans divided by assets. USCNILOAN and FORCNILOAN are US and Foreign commercial and industrial loans, divided by assets. BIGCDS are large CDs divided by assets. ALLL and PLLL are the allowance for loan and lease losses and provision for loan and

lease losses respectively, with both scaled by assets. GDPGROWTH is the annualized quarterly growth rate in US Gross Domestic Product. DEMDEPS is demand deposits, scaled by assets. TECHNFA is technological and fixed-asset expenditures, scaled by assets. NOW, MMDA, and SMALLCD are NOW accounts, money market accounts, and small CDs, with each scaled by assets. FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA and IBBEA2 are indicators equal to one from 1995Q2 through 1995Q4 and 1997Q1 through 1997Q3 respectively for the passage of the Interstate Banking and Branching Efficiency Act and when the branching provisions went into effect. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. PATRIOT is an indicator variable equal to one from 2001Q4 through 2002Q2 after the passage of the PATRIOT Act. DODDFRANK and DODDFRANK2 are indicator variables equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act and from 2013Q1 to 2013Q4 for the rulemaking period of the Dodd-Frank Act, respectively.

Table 4
Loans-per-employee (in million dollars) dependent variable auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	**4.2651**	<.0001	**1.3114**	0.0024	**2.9740**	0.0032	**3.4728**	<.0001	**2.1995**	<.0001
Q1	**-1.7929**	<.0001	**-1.4272**	<.0001	**-0.8645**	<.0001	**-1.2537**	<.0001	**-1.0366**	<.0001
Q2	**-1.2069**	<.0001	**-0.9331**	<.0001	**-0.5949**	<.0001	**-0.8257**	<.0001	**-0.6622**	<.0001
Q3	**-0.6423**	<.0001	**-0.5496**	<.0001	**-0.3377**	<.0001	**-0.4412**	<.0001	**-0.3480**	<.0001
LNASSETS	-0.0255	0.2346	**0.1457**	<.0001	0.0453	0.4740	**0.0888**	<.0001	**0.1283**	<.0001
CAPRATIO	0.6049	0.3258	**4.1616**	<.0001	**3.8335**	<.0001	**-1.3497**	<.0001	**-2.1926**	<.0001
NETINTINC	**-16.1324**	<.0001	3.3580	0.0948	**18.1780**	<.0001	1.5303	0.2810	**-5.8155**	<.0001
FIDUINC	**-43.6606**	<.0001	**-16.0082**	<.0001	**-17.0948**	<.0001	**-17.4782**	<.0001	**-45.2098**	<.0001
EXTRAORD	-4.2540	0.8200	8.7058	0.3983	-20.9013	0.5950	-9.3856	0.3195	**-12.5239**	0.0003
NONACCRU	-2.4911	0.3953	**12.2220**	<.0001	**11.6293**	<.0001	0.6121	0.2881	**-0.4937**	0.0386
AGLOANS	4.3993	0.2360	**-12.7813**	<.0001	**-2.8036**	0.0036	**-2.3027**	<.0001	**-0.5663**	<.0001
USCNILOAN	**2.4744**	<.0001	**1.4075**	<.0001	**0.5779**	0.0020	**1.5628**	<.0001	**1.5502**	<.0001
FORCNILOAN	**3.0111**	<.0001	-1.3972	0.1604	**9.7202**	<.0001	-0.1756	0.6428	**-0.8579**	<.0001
BIGCDS	**3.8588**	<.0001	**3.5716**	<.0001	**1.4626**	<.0001	**1.4206**	<.0001	**1.6513**	<.0001
ALLL	**27.2181**	<.0001	-4.5269	0.0521	-2.9035	0.3197	**12.7286**	<.0001	**23.1403**	<.0001
PLLL	**37.1040**	<.0001	3.5885	0.2598	**9.0869**	0.0065	**9.5328**	<.0001	**-3.3511**	<.0001
GDPGROWTH	-1.8282	0.1290	**-6.3811**	<.0001	**-5.8151**	<.0001	**-9.2634**	<.0001	**-4.0724**	<.0001
DEMDEPS	-0.3568	0.2901	**-2.5514**	<.0001	**-1.5265**	<.0001	**-2.3618**	<.0001	**-1.7249**	<.0001
TECHNFA	**-0.4579**	<.0001	**-0.3951**	<.0001	**-0.4021**	<.0001	**-0.4021**	<.0001	**-0.2405**	<.0001
NOW	**-4.7138**	<.0001	-0.6755	0.0519	**-2.7998**	<.0001	**-2.3655**	<.0001	**-2.5219**	<.0001
MMDA	**2.1987**	<.0001	**0.4176**	<.0001	-0.0947	0.4489	-0.1077	0.0612	**-0.4115**	<.0001
SMALLCD	0.3523	0.3199	-0.1095	0.4936	**-1.3001**	<.0001	**-0.8303**	<.0001	**-0.8421**	<.0001
FDICIA	**-0.5346**	0.0081	**-0.6010**	<.0001	**-0.5671**	<.0001	**-0.7690**	<.0001	**-0.5712**	<.0001
IBBEA	-0.1657	0.2335	**-0.1871**	0.0198	**-0.2689**	0.0114	**-0.5197**	<.0001	**-0.3878**	<.0001
IBBEA2	**-0.4328**	0.0010	0.0835	0.3496	-0.1754	0.0959	**-0.3787**	<.0001	**-0.2067**	<.0001
GLBA	-0.1306	0.2132	0.0912	0.2679	0.0699	0.4651	-0.0636	0.2484	0.0106	0.5485
PATRIOT	**-0.4537**	<.0001	**-0.3297**	0.0005	**-0.2820**	0.0145	**-0.4174**	<.0001	**-0.0870**	<.0001
DODDFRANK	-0.0103	0.9300	**0.2728**	0.0188	0.1909	0.0927	**0.2872**	<.0001	**0.4232**	<.0001
DODDFRANK2	**0.5557**	<.0001	**0.5981**	<.0001	**0.8467**	<.0001	**0.5416**	<.0001	**0.5764**	<.0001

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1. Q1, Q2, and Q3 are indicator variables equal to one if in quarter 1, 2, or 3 respectively. LNASSETS is the log of total assets. CAPRATIO is the equity-to-assets ratio. NETINTINC is net-interest income, scaled by assets. FIDUINC is fiduciary income divided by assets. EXTRAORD is extraordinary income divided by assets. NONACCRU is non-accruing loans, divided by assets. AGLOANS is agricultural loans divided by assets. USCNILOAN and FORCNILOAN are US and Foreign commercial and industrial loans, divided by assets. BIGCDS are large CDs divided by assets. ALLL and PLLL are the allowance for loan and lease losses and provision for loan and

lease losses respectively, with both scaled by assets. GDPGROWTH is the annualized quarterly growth rate in US Gross Domestic Product. DEMDEPS is demand deposits, scaled by assets. TECHNFA is technological and fixed-asset expenditures, scaled by assets. NOW, MMDA, and SMALLCD are NOW accounts, money market accounts, and small CDs, with each scaled by assets. FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA and IBBEA2 are indicators equal to one from 1995Q2 through 1995Q4 and 1997Q1 through 1997Q3 respectively for the passage of the Interstate Banking and Branching Efficiency Act and when the branching provisions went into effect. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. PATRIOT is an indicator variable equal to one from 2001Q4 through 2002Q2 after the passage of the PATRIOT Act. DODDFRANK and DODDFRANK2 are indicator variables equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act and from 2013Q1 to 2013Q4 for the rulemaking period of the Dodd-Frank Act, respectively.

Table 5
Change in the number of employees auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	0.8639	0.7335	0.5512	0.8250	7.7345	0.1599	0.9233	0.3795	**-1.0485**	0.0133
Q1	0.3541	0.5100	-0.1058	0.7807	-0.6787	0.1403	**-1.2426**	<.0001	**-0.5854**	<.0001
Q2	0.2253	0.5760	0.3813	0.1841	0.0904	0.7889	0.0129	0.9332	**0.5238**	<.0001
Q3	-0.4741	0.1058	**-0.6619**	0.0019	**-0.4732**	0.0442	**-1.0192**	<.0001	**-0.7517**	<.0001
LNASSETS	0.0244	0.8371	0.0583	0.6754	-0.3977	0.2506	0.1225	0.0765	**0.2314**	<.0001
CAPRATIO	0.3967	0.9059	-0.0694	0.9800	0.6547	0.8056	**-6.3861**	<.0001	**-6.7876**	<.0001
NETINTINC	34.1952	0.0644	**34.4009**	0.0028	2.8751	0.8503	-4.3983	0.5527	1.0582	0.7543
FIDUINC	22.0983	0.3752	16.5688	0.4448	-29.0645	0.1352	**-95.3062**	<.0001	**-52.4935**	<.0001
EXTRAORD	7.5967	0.9422	39.6688	0.5041	**590.4876**	0.0065	45.7233	0.3701	30.7590	0.1907
NONACCRU	**-35.1749**	0.0249	-9.0349	0.1942	**-28.4258**	<.0001	**-17.4945**	<.0001	**-32.2213**	<.0001
AGLOANS	11.4334	0.5801	8.7838	0.2698	-0.2334	0.9641	0.6745	0.5435	-0.0570	0.8485
USCNILOAN	**-5.1638**	0.0009	-1.9539	0.0540	0.4546	0.6473	0.5717	0.2148	**2.6598**	<.0001
FORCNILOAN	**7.2355**	0.0491	-2.7832	0.6288	4.0219	0.5778	-1.8675	0.3630	**-3.5154**	0.0068
BIGCDS	-1.7211	0.4946	1.3023	0.2572	**4.0200**	0.0008	**2.9277**	<.0001	**2.5950**	<.0001
ALLL	-24.7561	0.2485	**-60.3601**	<.0001	-22.6935	0.1483	**-63.2764**	<.0001	**-26.5919**	<.0001
PLLL	-31.8663	0.2616	10.7377	0.5504	**-43.7788**	0.0143	-3.9877	0.6448	**13.9185**	0.0037
GDPGROWTH	5.0908	0.3488	**13.7558**	0.0013	6.9516	0.0821	**14.0424**	<.0001	**12.2991**	<.0001
DEMDEPS	-1.5960	0.4018	**-2.6654**	0.0429	-2.2767	0.0815	**1.1239**	0.0495	**0.8203**	0.0035
TECHNFA	-0.0479	0.6328	**-0.2592**	<.0001	-0.0391	0.6095	**-0.2571**	<.0001	**-0.1696**	<.0001
NOW	2.3457	0.5292	0.2081	0.9148	1.0003	0.5637	**2.3133**	0.0006	**-1.9942**	<.0001
MMDA	-0.9365	0.2470	**-1.3768**	0.0114	**-1.4210**	0.0243	-0.2846	0.3363	**-0.9588**	<.0001
SMALLCD	0.7964	0.6876	1.3356	0.1264	0.2612	0.7561	-0.3348	0.3750	0.1103	0.5486
FDICIA	-0.9412	0.3053	-0.4266	0.1901	-0.3598	0.3135	**-0.6155**	0.0015	-0.0117	0.8853
IBBEA	-0.7242	0.2318	-0.6166	0.0533	-0.7282	0.0606	**-0.5497**	0.0048	0.1053	0.2324
IBBEA2	-0.9128	0.1071	0.3782	0.2847	0.2373	0.5356	0.2730	0.1763	**0.2769**	0.0009
GLBA	-0.6062	0.1792	**-0.7376**	0.0232	**-0.8024**	0.0206	**-0.7107**	<.0001	**-0.5184**	<.0001
PATRIOT	-0.0567	0.9039	0.0052	0.9891	0.2671	0.5248	**0.4360**	0.0201	**0.4975**	<.0001
DODDFRANK	0.9021	0.0797	-0.3090	0.5115	-0.3198	0.4464	0.1161	0.4636	**-0.4568**	0.0002
DODDFRANK2	-0.3904	0.3816	0.0641	0.8667	-0.4584	0.1924	**-0.3098**	0.0174	**-0.4255**	<.0001

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1. Q1, Q2, and Q3 are indicator variables equal to one if in quarter 1, 2, or 3 respectively. LNASSETS is the log of total assets. CAPRATIO is the equity-to-assets ratio. NETINTINC is net-interest income, scaled by assets. FIDUINC is fiduciary income divided by assets. EXTRAORD is extraordinary income divided by assets. NONACCRU is non-accruing loans, divided by assets. AGLOANS is agricultural loans divided by assets. USCNILOAN and FORCNILOAN are US and Foreign commercial and industrial loans, divided by assets. BIGCDS are large CDs divided by assets. ALLL and PLLL are the allowance for loan and lease losses and provision for loan and

lease losses respectively, with both scaled by assets. GDPGROWTH is the annualized quarterly growth rate in US Gross Domestic Product. DEMDEPS is demand deposits, scaled by assets. TECHNFA is technological and fixed-asset expenditures, scaled by assets. NOW, MMDA, and SMALLCD are NOW accounts, money market accounts, and small CDs, with each scaled by assets. FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA and IBBEA2 are indicators equal to one from 1995Q2 through 1995Q4 and 1997Q1 through 1997Q3 respectively for the passage of the Interstate Banking and Branching Efficiency Act and when the branching provisions went into effect. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. PATRIOT is an indicator variable equal to one from 2001Q4 through 2002Q2 after the passage of the PATRIOT Act. DODDFRANK and DODDFRANK2 are indicator variables equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act and from 2013Q1 to 2013Q4 for the rulemaking period of the Dodd-Frank Act, respectively.

Table 6
Salaries-to-asset dependent variable auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	**0.0059**	0.0111	-0.0004	0.8635	**-0.0274**	<.0001	**0.0115**	<.0001	**0.0011**	0.0008
Q1	**0.0137**	<.0001	**0.0163**	<.0001	**0.0097**	<.0001	**0.0104**	<.0001	**0.0126**	<.0001
Q2	**0.0090**	<.0001	**0.0107**	<.0001	**0.0063**	<.0001	**0.0069**	<.0001	**0.0082**	<.0001
Q3	**0.0044**	<.0001	**0.0054**	<.0001	**0.0031**	<.0001	**0.0034**	<.0001	**0.0039**	<.0001
LNASSETS	-0.0002	0.0581	-0.0002	0.0867	**0.0016**	<.0001	**-0.0008**	<.0001	0.0000	0.6307
CAPRATIO	**0.0139**	<.0001	**0.0130**	<.0001	**0.0050**	0.0147	**0.0068**	<.0001	**-0.0098**	<.0001
NETINTINC	**0.1097**	<.0001	**0.1636**	<.0001	0.0206	0.0759	**0.0895**	<.0001	**0.2089**	<.0001
FIDUINC	**0.2163**	<.0001	**0.3006**	<.0001	**0.3675**	<.0001	**0.4785**	<.0001	**0.5395**	<.0001
EXTRAORD	0.1315	0.1675	**0.1638**	0.0046	**-0.4752**	0.0035	**0.1214**	0.0028	**-0.0554**	0.0023
NONACCRU	-0.0025	0.8633	0.0029	0.6705	-0.0075	0.1469	**0.0105**	<.0001	**0.0049**	<.0001
AGLOANS	**0.0374**	0.0481	**0.1100**	<.0001	**0.0242**	<.0001	**0.0126**	<.0001	**0.0036**	<.0001
USCNILOAN	**0.0035**	0.0160	**0.0045**	<.0001	**0.0064**	<.0001	**0.0049**	<.0001	**0.0008**	<.0001
FORCNILOAN	**-0.0150**	<.0001	**-0.0288**	<.0001	**-0.0201**	0.0002	**-0.0054**	0.0009	**0.0059**	<.0001
BIGCDS	**-0.0139**	<.0001	**-0.0025**	0.0236	0.0003	0.7201	**-0.0016**	<.0001	**-0.0007**	0.0002
ALLL	0.0014	0.9438	-0.0029	0.8230	-0.0129	0.2797	-0.0033	0.5625	**0.0278**	<.0001
PLLL	-0.0216	0.4105	-0.0319	0.0684	0.0211	0.1196	**-0.0336**	<.0001	**-0.0461**	<.0001
GDPGROWTH	-0.0040	0.4831	-0.0015	0.7124	**0.0082**	0.0179	**-0.0068**	<.0001	**-0.0088**	<.0001
DEMDEPS	**-0.0127**	<.0001	0.0015	0.2438	**0.0039**	0.0001	**0.0050**	<.0001	**0.0065**	<.0001
TECHNFA	**0.0031**	<.0001	**0.0031**	<.0001	**0.0024**	<.0001	**0.0023**	<.0001	**0.0019**	<.0001
NOW	**-0.0088**	0.0103	**-0.0125**	<.0001	**0.0104**	<.0001	**0.0042**	<.0001	**0.0005**	0.0221
MMDA	**-0.0061**	<.0001	**-0.0019**	0.0004	**0.0092**	<.0001	**0.0020**	<.0001	**0.0012**	<.0001
SMALLCD	**-0.0094**	<.0001	**-0.0081**	<.0001	**0.0014**	0.0275	**-0.0016**	<.0001	**-0.0037**	<.0001
FDICIA	-0.0009	0.3695	-0.0002	0.4867	-0.0002	0.4732	**-0.0012**	<.0001	**-0.0009**	<.0001
IBBEA	**-0.0020**	0.0029	**-0.0007**	0.0193	-0.0005	0.1616	**-0.0016**	<.0001	**-0.0011**	<.0001
IBBEA2	-0.0008	0.2137	**-0.0012**	0.0008	-0.0004	0.2943	**-0.0010**	<.0001	**-0.0004**	<.0001
GLBA	0.0002	0.7504	0.0001	0.7105	**-0.0009**	0.0044	**-0.0008**	<.0001	-0.0001	0.0838
PATRIOT	-0.0006	0.2518	**0.0008**	0.0288	-0.0006	0.1116	0.0001	0.7483	0.0000	0.8467
DODDFRANK	0.0003	0.5347	0.0001	0.7949	**-0.0007**	0.0477	0.0002	0.1494	**0.0004**	0.0008
DODDFRANK2	**0.0019**	<.0001	**0.0009**	0.0120	-0.0002	0.4717	**0.0012**	<.0001	**0.0011**	<.0001

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1. Q1, Q2, and Q3 are indicator variables equal to one if in quarter 1, 2, or 3 respectively. LNASSETS is the log of total assets. CAPRATIO is the equity-to-assets ratio. NETINTINC is net-interest income, scaled by assets. FIDUINC is fiduciary income divided by assets. EXTRAORD is extraordinary income divided by assets. NONACCRU is non-accruing loans, divided by assets. AGLOANS is agricultural loans divided by assets. USCNILOAN and FORCNILOAN are US and Foreign commercial and industrial loans, divided by assets. BIGCDS are large CDs divided by assets. ALLL and PLLL are the allowance for loan and lease losses and provision for loan and

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Table 7
Average pay dependent variable auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	**89.9505**	<.0001	**28.6065**	<.0001	2.9795	0.8598	**83.0722**	<.0001	**47.5363**	<.0001
Q1	**-15.2920**	<.0001	**-3.1333**	0.0082	**-4.3573**	0.0073	**-6.3612**	<.0001	**-1.0295**	0.0006
Q2	**-9.8792**	<.0001	**-1.8482**	0.0528	**-3.3974**	0.0091	**-4.2994**	<.0001	**-0.7770**	0.0021
Q3	**-5.6225**	<.0001	**-1.8111**	0.0191	**-2.5873**	0.0110	**-2.8580**	<.0001	**-1.1807**	<.0001
LNASSETS	**1.5005**	0.0008	**2.1004**	<.0001	**3.6690**	0.0005	**-0.6165**	0.0024	**1.1999**	<.0001
CAPRATIO	**-34.8991**	0.0073	**76.3060**	<.0001	**30.2177**	0.0004	**20.1597**	<.0001	**-22.7224**	<.0001
NETINTINC	**-644.8496**	<.0001	**-202.5738**	<.0001	**-132.1946**	0.0061	**-198.8839**	<.0001	10.6839	0.1756
FIDUINC	**744.9065**	<.0001	**846.9005**	<.0001	**436.7131**	<.0001	**790.6235**	<.0001	**819.3212**	<.0001
EXTRAORD	-349.2344	0.3747	**846.5172**	<.0001	96.6688	0.8835	135.4251	0.3669	-80.0796	0.1312
NONACCRU	**-383.6573**	<.0001	**179.1491**	<.0001	**46.4021**	0.0291	**34.4453**	0.0002	**18.4657**	<.0001
AGLOANS	**-396.3224**	<.0001	**62.8498**	0.0060	**-41.4682**	0.0100	**-14.5399**	<.0001	-1.4289	0.0419
USCNILOAN	-8.1476	0.1808	**19.8611**	<.0001	**28.7621**	<.0001	**29.1157**	<.0001	**7.4149**	<.0001
FORCNILOAN	**-71.4965**	<.0001	**-88.6939**	<.0001	**201.1262**	<.0001	**21.1196**	0.0005	**39.3372**	<.0001
BIGCDS	-8.8997	0.3562	**21.8724**	<.0001	**16.6724**	<.0001	**6.4450**	<.0001	**14.8404**	<.0001
ALLL	**638.5369**	<.0001	**-320.2838**	<.0001	**-195.7632**	<.0001	36.2861	0.0923	**122.8831**	<.0001
PLLL	**226.5993**	0.0413	**212.6164**	<.0001	**234.3720**	<.0001	**87.2276**	0.0009	**-61.9463**	<.0001
GDPGROWTH	**-183.3904**	<.0001	**-121.9760**	<.0001	**-149.8981**	<.0001	**-186.0074**	<.0001	**-118.6867**	<.0001
DEMDEPS	-9.3827	0.1837	**-24.9822**	<.0001	**-10.2652**	0.0135	-0.6649	0.7017	**6.2407**	<.0001
TECHNFA	**-1.7274**	<.0001	**-0.4819**	0.0092	**-1.2623**	<.0001	**-1.2399**	<.0001	**-0.7101**	<.0001
NOW	**-175.2017**	<.0001	**-27.5053**	<.0001	-7.2402	0.1986	**-25.2978**	<.0001	**-37.2027**	<.0001
MMDA	**6.8840**	0.0298	**26.9102**	<.0001	**36.0904**	<.0001	**11.6984**	<.0001	**1.4883**	0.0002
SMALLCD	**-101.6532**	<.0001	**-74.2940**	<.0001	**-44.7180**	<.0001	**-43.2599**	<.0001	**-31.7314**	<.0001
FDICIA	0.1784	0.9700	**-8.2456**	<.0001	**-11.9262**	<.0001	**-17.0607**	<.0001	**-12.1201**	<.0001
IBBEA	**-10.9105**	0.0012	**-3.9565**	0.0015	**-7.9618**	<.0001	**-12.6894**	<.0001	**-9.2855**	<.0001
IBBEA2	**-11.1084**	0.0005	-2.4659	0.0745	**-4.6832**	0.0135	**-8.6399**	<.0001	**-4.9514**	<.0001
GLBA	-1.6169	0.5267	0.2296	0.8570	-1.0775	0.5318	**-3.4133**	0.0004	-0.4172	0.2080
PATRIOT	**-11.7350**	<.0001	**-4.3396**	0.0033	**-8.3260**	<.0001	**-7.0282**	<.0001	**-2.8520**	<.0001
DODDFRANK	**11.0958**	<.0001	**8.1364**	<.0001	**6.7431**	0.0009	**8.6568**	<.0001	**12.5288**	<.0001
DODDFRANK2	**17.9825**	<.0001	**14.4729**	<.0001	**15.3362**	<.0001	**15.2550**	<.0001	**17.6870**	<.0001

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1. Q1, Q2, and Q3 are indicator variables equal to one if in quarter 1, 2, or 3 respectively. LNASSETS is the log of total assets. CAPRATIO is the equity-to-assets ratio. NETINTINC is net-interest income, scaled by assets. FIDUINC is fiduciary income divided by assets. EXTRAORD is extraordinary income divided by assets. NONACCRU is non-accruing loans, divided by assets. AGLOANS is agricultural loans divided by assets. USCNILOAN and FORCNILOAN are US and Foreign commercial and industrial loans, divided by assets. BIGCDS are large CDs divided by assets. ALLL and PLLL are the allowance for loan and lease losses and provision for loan and

lease losses respectively, with both scaled by assets. GDPGROWTH is the annualized quarterly growth rate in US Gross Domestic Product. DEMDEPS is demand deposits, scaled by assets. TECHNFA is technological and fixed-asset expenditures, scaled by assets. NOW, MMDA, and SMALLCD are NOW accounts, money market accounts, and small CDs, with each scaled by assets. FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA and IBBEA2 are indicators equal to one from 1995Q2 through 1995Q4 and 1997Q1 through 1997Q3 respectively for the passage of the Interstate Banking and Branching Efficiency Act and when the branching provisions went into effect. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. PATRIOT is an indicator variable equal to one from 2001Q4 through 2002Q2 after the passage of the PATRIOT Act. DODDFRANK and DODDFRANK2 are indicator variables equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act and from 2013Q1 to 2013Q4 for the rulemaking period of the Dodd-Frank Act, respectively.

Table 8
Technology and fixed asset expenditures-to-assets dependent variable auto-regression results with four lags, by asset size groups.

	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
INTERCEPT	**1.4546**	0.0065	**1.9477**	0.0007	1.0677	0.3452	**2.7446**	<.0001	**2.5069**	<.0001
Q1	**-2.0954**	<.0001	**-2.3986**	<.0001	**-2.2578**	<.0001	**-1.5439**	<.0001	**-1.2324**	<.0001
Q2	**-1.4480**	<.0001	**-1.5690**	<.0001	**-1.4628**	<.0001	**-1.0054**	<.0001	**-0.7845**	<.0001
Q3	**-0.6975**	<.0001	**-0.7163**	<.0001	**-0.6752**	<.0001	**-0.4657**	<.0001	**-0.3542**	<.0001
LNASSETS	0.0129	0.6040	**0.0777**	0.0149	0.0960	0.1772	**-0.0517**	<.0001	**-0.0228**	0.0001
CAPRATIO	0.0472	0.9471	**-4.1992**	<.0001	**-4.4810**	<.0001	**-3.4685**	<.0001	**-6.9868**	<.0001
NETINTINC	**35.1138**	<.0001	**28.8590**	<.0001	**29.2838**	<.0001	**55.8561**	<.0001	**67.3004**	<.0001
FIDUINC	**53.0400**	<.0001	**71.2177**	<.0001	**62.0612**	<.0001	**75.5986**	<.0001	**89.4571**	<.0001
EXTRAORD	-34.3298	0.1138	**71.7682**	<.0001	**100.1554**	0.0247	**-24.9199**	0.0082	-1.9427	0.6975
NONACCRU	**11.5577**	0.0007	1.5948	0.3192	**5.5303**	<.0001	**7.1763**	<.0001	**9.8962**	<.0001
AGLOANS	**24.9406**	<.0001	**15.7253**	<.0001	-2.0411	0.0556	**-2.1239**	<.0001	**-1.8933**	<.0001
USCNILOAN	**-1.5744**	<.0001	**-2.0762**	<.0001	**1.5811**	<.0001	**-0.2419**	0.0045	**0.2911**	<.0001
FORCNILOAN	**5.4052**	<.0001	**7.0169**	<.0001	1.0343	0.4858	**-0.9882**	0.0091	**2.9508**	<.0001
BIGCDS	0.4082	0.4402	0.4894	0.0639	**-1.7295**	<.0001	**-0.6139**	<.0001	**-0.7304**	<.0001
ALLL	**10.1821**	0.0246	2.1729	0.4754	**10.5954**	0.0010	-2.1811	0.1031	**-7.1786**	<.0001
PLLL	**15.1927**	0.0121	**12.8700**	0.0018	0.8062	0.8259	-0.2373	0.8822	-0.7274	0.4762
GDPGROWTH	**9.2798**	<.0001	-0.1705	0.8669	0.8860	0.2918	**-1.2865**	<.0001	**-2.2622**	<.0001
DEMDEPS	**3.5243**	<.0001	**1.4021**	<.0001	**0.8998**	0.0008	**2.3725**	<.0001	**2.7397**	<.0001
NOW	**-3.3194**	<.0001	**5.2830**	<.0001	**1.9522**	<.0001	**1.6037**	<.0001	**0.7588**	<.0001
MMDA	**0.7375**	<.0001	**1.0442**	<.0001	**1.2992**	<.0001	**0.6665**	<.0001	**0.5069**	<.0001
SMALLCD	**1.7675**	<.0001	**-0.7675**	0.0001	**0.6375**	0.0002	**0.1793**	0.0105	**-0.7095**	<.0001
FDICIA	0.3451	0.1495	**0.2401**	0.0020	**0.1834**	0.0148	**0.1389**	0.0002	**-0.0490**	0.0068
IBBEA	**0.6883**	<.0001	0.1094	0.1511	0.0201	0.8061	-0.0626	0.0978	-0.0241	0.2208
IBBEA2	0.1326	0.3906	-0.0489	0.5630	0.1336	0.0985	-0.0646	0.0986	**0.0664**	0.0004
GLBA	0.1089	0.3786	**0.2399**	0.0020	**0.2555**	0.0005	**0.0884**	0.0077	**0.1114**	<.0001
PATRIOT	0.2080	0.1076	0.1705	0.0592	**0.1903**	0.0318	0.0411	0.2580	0.0190	0.2570
DODDFRANK	**-0.5298**	0.0001	**-0.2830**	0.0116	**-0.2506**	0.0046	**-0.1013**	0.0009	**-0.0862**	0.0015
DODDFRANK2	**-0.4622**	0.0001	**-0.4549**	<.0001	**-0.2638**	0.0004	**-0.2135**	<.0001	**-0.2051**	<.0001

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demand deposits, scaled by assets. TECHNFA is technological and fixed-asset expenditures, scaled by assets. NOW, MMDA, and SMALLCD are NOW accounts, money market accounts, and small CDs, with each scaled by assets. FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA and IBBEA2 are indicators equal to one from 1995Q2 through 1995Q4 and 1997Q1 through 1997Q3 respectively for the passage of the Interstate Banking and Branching Efficiency Act and when the branching provisions went into effect. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. PATRIOT is an indicator variable equal to one from 2001Q4 through 2002Q2 after the passage of the PATRIOT Act. DODDFRANK and DODDFRANK2 are indicator variables equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act and from 2013Q1 to 2013Q4 for the rulemaking period of the Dodd-Frank Act, respectively.

Table 9
Interaction terms for regulatory acts with selected variables, by size groups. (Other coefficient estimates not reported).

Panel A: Pre-tax ROA										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NoAccru	0.1754	0.2013	0.0547	0.1482	**-0.0868**	0.0289	**0.0731**	0.0011	-0.0031	0.7209
IBBEA*USCnI	0.0098	0.6881	-0.0048	0.6035	0.0065	0.5089	0.0016	0.7740	0.0027	0.1353
IBBEA*FORCnI	0.0178	0.7265	0.0364	0.3349	-0.1741	0.1569	0.0069	0.8878	**0.0597**	<.0001
IBBEA*Size	0.0004	0.9034	0.0007	0.6385	-0.0029	0.4950	-0.0005	0.5203	0.0002	0.3762
GLBA*Size	0.0010	0.3449	**0.0031**	0.0115	**-0.0076**	0.0311	0.0009	0.2122	0.0001	0.7081
DFA*Capratio	**-0.0821**	0.0303	**-0.1787**	<.0001	-0.0013	0.9698	-0.0121	0.1302	**-0.0364**	<.0001
DFA*USCnI	0.0123	0.3965	-0.0110	0.5430	**0.0893**	0.0003	**-0.0149**	0.0021	**-0.0130**	<.0001
DFA*FORCnI	-0.1001	0.4408	0.1866	0.4318	**0.1105**	0.0287	-0.1440	0.0767	**0.0981**	0.0081
Panel B: Loans-per-employee										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NoAccru	-11.0598	0.2932	-1.5649	0.6211	0.5851	0.8676	-0.0755	0.9708	-0.2797	0.7563
IBBEA*USCnI	0.8608	0.6503	0.8687	0.2618	-0.9019	0.2979	-0.9021	0.0763	**-0.4672**	0.0103
IBBEA*FORCnI	6.5900	0.0853	-0.5024	0.8725	-0.2613	0.9808	**-12.0879**	0.0067	-0.4886	0.4484
IBBEA*Size	-0.2452	0.3191	0.0290	0.8112	0.1146	0.7574	0.0651	0.3996	**-0.0760**	0.0012
GLBA*Size	-0.0647	0.4270	0.1944	0.0539	**1.1002**	0.0007	-0.0815	0.2384	**-0.0438**	0.0183
DFA*Capratio	-0.8835	0.7647	**-8.3483**	0.0150	-3.6726	0.2056	0.9714	0.1931	-0.5322	0.2405
DFA*USCnI	-0.0435	0.9688	**4.4882**	0.0032	2.8218	0.1920	**1.1791**	0.0078	**1.8731**	<.0001
DFA*FORCni	**-21.8067**	0.0308	**74.3069**	0.0002	8.6731	0.0501	**-42.2655**	<.0001	-1.8509	0.6222

Panel C: Change in the number of employees										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NoAccru	**-625.3731**	0.0037	**108.6239**	0.0374	63.2533	0.2796	-39.5720	0.2279	-26.2919	0.0606
IBBEA*USCnI	**-112.4019**	0.0052	-6.7952	0.5950	-13.7787	0.3426	-2.6791	0.7434	0.2148	0.9393
IBBEA*FORCnI	6.6806	0.9351	**113.6119**	0.0284	236.9973	0.1924	2.0790	0.9767	**-29.1273**	0.0036
IBBEA*Size	-5.8915	0.2677	**-4.4479**	0.0271	**-16.7209**	0.0064	0.6915	0.5732	**-1.2204**	0.0008
GLBA*Size	0.4221	0.8013	0.4198	0.8038	9.3279	0.0836	-0.9906	0.3697	-0.3896	0.1758
DFA*Capratio	-23.3648	0.7057	**-207.1548**	0.0002	-72.9698	0.1355	**27.7508**	0.0196	-13.1538	0.0614
DFA*USCnI	0.4258	0.9856	**94.0601**	0.0001	8.5351	0.8144	**20.3626**	0.0038	**20.9821**	<.0001
DFA*FORCni	14.5076	0.9460	**-1332.0000**	<.0001	-48.5048	0.5149	**-643.2497**	<.0001	-58.0087	0.3175

Panel D: Salaries-to-assets										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NoAccru	0.0823	0.1265	0.0227	0.2029	-0.0129	0.3703	**-0.0329**	0.0002	-0.0034	0.4598
IBBEA*USCnI	-0.0163	0.0908	**-0.0092**	0.0330	-0.0015	0.6679	-0.0019	0.3857	**-0.0024**	0.0110
IBBEA*FORCnI	0.0118	0.5438	**0.0492**	0.0057	**0.1024**	0.0217	0.0016	0.9351	**-0.0100**	0.0030
IBBEA*Size	-0.0008	0.5069	**-0.0017**	0.0121	-0.0024	0.1155	-0.0002	0.6254	**-0.0003**	0.0146
GLBA*Size	**0.0008**	0.0462	-0.0009	0.1092	0.0010	0.4557	0.0001	0.7755	-0.0002	0.0696
DFA*Capratio	-0.0255	0.0896	-0.0170	0.3688	-0.0022	0.8575	0.0027	0.3885	**0.0064**	0.0068
DFA*USCnI	0.0027	0.6390	0.0118	0.1665	-0.0029	0.7513	0.0030	0.1187	**-0.0034**	0.0370
DFA*FORCni	0.0461	0.3680	**-0.4450**	<.0001	-0.0205	0.2652	-0.0160	0.6181	**-0.0608**	0.0023
Panel E: Average Pay										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NoAccru	6.9897	0.9058	-33.3223	0.0707	-24.8963	0.1903	-10.4115	0.3481	3.0208	0.6127
IBBEA*USCnI	-4.4308	0.6741	-2.2740	0.6114	4.0311	0.3914	**-5.6984**	0.0328	1.3416	0.2775
IBBEA*FORCnI	2.0741	0.9218	7.0474	0.7006	-27.1304	0.6481	-0.2326	0.9923	**9.1116**	0.0362
IBBEA*Size	-2.5223	0.0726	-0.6896	0.3258	1.4747	0.4641	0.1192	0.7742	-0.2230	0.1617
GLBA*Size	0.3223	0.4944	-0.6989	0.2401	-0.2410	0.8852	0.6811	0.0673	-0.1856	0.1355
DFA*Capratio	15.8853	0.3343	6.2983	0.7479	-3.0276	0.8536	5.8203	0.1403	**12.1943**	<.0001
DFA*USCnI	-2.5860	0.6785	7.6977	0.3868	0.1628	0.9891	-0.4171	0.8628	1.7003	0.4236
DFA*FORCni	4.6764	0.9336	-110.6852	0.3412	-9.2059	0.7082	-31.6703	0.4345	-32.5635	0.2079

Panel F: Technology and fixed-asset expenditures-to-assets										
	Assets > $50 billion		Assets $10 to $50 billion		Assets $5 to $10 billion		Assets $1 to $5 billion		Assets < $1 billion	
Variable	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value	Estim.	p-value
FDICIA*NOACCRU	-10.3276	0.3895	**12.8843**	0.0022	**12.9282**	0.0009	**6.1117**	0.0029	**6.4813**	<.0001
IBBEA*USCNI	-1.5277	0.4753	**4.1956**	<.0001	-0.5793	0.5472	**2.1160**	<.0001	-0.1847	0.4826
IBBEA*FORCNI	2.0139	0.6474	-4.3317	0.2997	**25.9638**	0.0334	**14.8752**	0.0009	**-3.8546**	<.0001
IBBEA*SIZE	-0.0149	0.9588	-0.0719	0.6547	**-1.4862**	0.0003	0.1113	0.1463	0.0277	0.4137
GLBA*SIZE	0.1630	0.0901	**-0.3007**	0.0256	-0.1975	0.5686	**-0.1486**	0.0312	-0.0242	0.3637
DFA*CAPRATIO	1.3438	0.6959	-3.2212	0.4739	-1.6102	0.6272	0.5059	0.4884	**2.0179**	0.0021
DFA*USCNI	0.5766	0.6536	0.2623	0.8969	3.6475	0.1407	-0.8652	0.0519	0.2691	0.5515
DFA*FORCNi	**-26.0938**	0.0266	47.4295	0.0737	-4.3204	0.3919	2.6424	0.7234	**12.3327**	0.0247

The data are from the FR-Y9C reports for bank holding company quarterly date from 1991Q1 through 2014Q1 FDICIA is an indicator variable equal to one from 1994Q1 through 1992Q2 after the passage of the FDICIA Act. IBBEA is an indicator equal to one from 1995Q2 through 1995Q4 for the passage of the Interstate Banking and Branching Efficiency Act. GLBA is an indicator variable equal to one from 2000Q1 through 2000Q3 after the passage of the Gramm-Leach-Bliley Act. DFA is an indicator variable equal to one from 2010Q3 through 2011Q1 after the passage of the Dodd-Frank Act. These indicator variables are multiplied against several independent variables to create interaction terms. The indicators are multiplied by: NOACCRU is non-accruing loans, divided by assets; USCnI and FORCnI are US and Foreign commercial and industrial loans, divided by assets; SIZE is the log of total assets; CAPRATIO is the equity-to-asset ratio. Significant coefficients with a p-value of 0.05 or less are bolded.