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Bank Capital Ratios and the Structure of Nonfinancial Industries

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Abstract

We exploit variation in commercial bank capital ratios across states to identify the impact of commercial bank balance sheet pressures manifested through changes in capital ratios on employment in the manufacturing sector. For industries dependent on external finance, we find that an increase in the capital ratio has no statistically significant effect on net firm creation, but has an economically significant impact on average firm size, as measured in the number of employees. Our findings indicate a lack of substitutes for bank funding both in the short and long run. This lack of substitutes implies a notable adverse impact of balance sheet pressures on employment in industries dependent on external sources of funding. Our results highlight the potential effects that bank balance sheet pressures, for example, from tightening capital adequacy standards, such as Basel III, may have on nonfinancial firm dynamics.

JEL CLASSIFICATION: G21, G28, G30, J20, L25

KEYWORDS: bank capital ratios, bank capital regulation, non-financial firm dynamics.

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Introduction

This paper investigates the effects of banks' balance sheet pressures on the structure of nonfinancial industries. More specifically, we look at how state-level capital ratios of commercial banks affected the dynamics of manufacturing establishments for a sample period that includes two waves of changing capital regulatory standards.¹ This empirical investigation is motivated by the recent financial crisis and the large balance sheet adjustments (in the form of deleveraging) that presumably will be made in anticipation of changes in regulatory capital requirements due to Basel II and Basel III. Although a large part of the adjustments in capital ratios made since the height of the most recent financial crisis have been affected by capital injections through the Trouble Assets Relief Program (TARP), the current international and domestic proposals for stricter capital rules will probably force banks to increase their capital ratios even further. If TARP was implemented with the hope of easing banks' balance sheet pressures to stimulate lending during the financial crisis, stricter capital standards will be set with the hope of buttressing the banking sector to withstand any future crises, but with real costs to firms and households.

As, historically, banks' adjustment to higher capital ratios have been associated with stricter lending standards and terms, such as higher loan spreads, and lower loan volumes, we examine the potential effects that these adjustments to limit credit may have had on the structure of manufacturing industries. Our main identification assumption is through the construction of state-level capital ratios that would tend to be more affected by larger banks, whose balance sheets are reflective of economic conditions of other industries, states and countries, and look at how changes in these capital ratios affect the number and the average size of establishments at the industry-state level during the period between 1977 and 1997. Garmaise and Moskowitz (2006) and Peek and Rosengren (2000) use a similar argument to address possible reverse causality by studying the effects of changes in large bank mergers on changes in crime at the MSA level and the effects of the Japanese banking crisis on construction activity in the U.S. commercial real estate market, respectively. In addition, the period we study encompasses two waves of changes in numerical capital standards; the first in the first half of the 1980s, and the second that includes the

¹Consistent with much of the literature, we use "establishments" and "firms" interchangeably throughout this paper.

introduction of Basel I and the leverage ratio in 1990 and the passing of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) in 1991. The changes in regulatory capital ratios in the early 1980s varied by bank size, which gives us cross-sectional variation in capital ratios, while the changes in the early 1990s also provide us with significant variation in capital ratios through time. Finally, we also use the identification assumption used by Cetorelli and Strahan (2006) in that firms that are in industries that are heavily dependent on external finance are the ones that are affected by such changes as opposed to firms that are not, which helps us to address omitted variable bias. Although capital ratios may change for a variety of reasons including shocks to earnings in general, over the longer term, they likely provide a good proxy for bank balance sheet pressures in obtaining a certain target level of leverage.

In examining both the effects on employment through firm creation and firm size, we look at both short and long-term effects of higher capital ratios. These two effects may not necessarily be similar in magnitude and direction. One might imagine that a severe initial impact of higher capital ratios on availability and pricing of credit and, hence, firm dynamics might dissipate somewhat over time as firms switch to cheaper sources of funding. Alternatively, the long-term effects on firm dynamics might be more adverse than the short-term effects if the adjustment of bank balance sheets is a prolonged process and firms are not able to find cheaper alternatives to bank funding, for example, because of informational opaqueness, highlighting the advantage of commercial banks in screening.

After controlling for branch deregulation indicators, bank concentration, and demand side factors, our results show that positive changes in the capital ratio results in contractions in the size of establishments in the manufacturing sector, but has no net effect on the creation of establishment. We do not find any permanent impact on the long-run growth rates of either the number of establishments or their average size.

The outline of the paper is as follows. The first section describes our contributions to the literature and lays out the hypotheses we aim to test. The second section provides a historical review of various capital ratios at commercial banks. In particular, we describe the various changes to capital adequacy guidelines in the first half of the 1980s and the early 1990s and the time-series of aggregated and state-level capital ratios during that period. The third section provides a description of our sample

of establishments based on the U.S. Census County Business Patterns Survey. The fourth section goes over our empirical strategy, econometric specification, and summary statistics of the variables of interest. After detailing our panel regression results with regressions on growth rates of both the number and average size of firms. We then detail the economic significance of the effects to the manufacturing sector by estimating how many employees would be displaced, both in the short-run and in the long-run. We end with some concluding remarks in the final section by comparing our results to other studies that focus primarily on estimating the real effects of the new Basel III regulations.

I Literature and Hypotheses

A strand of policy papers and other research has focused on how capital regulation and banks' balance sheet pressures affected capital ratios, loans, deposits, and bank risk. Keeley (1988) presents evidence that, for the largest BHCs, uniform capital requirements introduced in the early 1980's increased the book capital ratios for the capital-deficient banks by adjusting assets rather than capital compared to capital-sufficient banks. Furlong (1992) analyzes how higher capital ratios relative to an estimated target positively affects lending.² Peek and Rosengren (1995) find a strong relationship between capital shocks and the growth rate of its deposits as evidence for a capital crunch (to obtain higher capital ratios) in New England during the early 1990s. Aggarwal and Jacques (1998) looks at the extent to which FDICIA boosted capital ratios and reduced bank risk. Finally, Aiyar, Calomiris, and Wieladek (2011) studies the bank-specific changes in minimum capital requirements in the United Kingdom and find a statistically and economically significant effect on lending from 1998 to 2007. All of these studies examined the effects reflected in banks' balance sheets. However, a drawback of this approach is that this does not take into account the possible substitution of funding sources at the firm level. One might imagine that firms will substitute away from more expensive bank funding to cheaper alternatives, perhaps mitigating the effect of higher capital ratios and more expensive bank funding

²There is an abundant amount of literature on how capital ratios or deviations from a target ratio affects loan growth - see Berrospide and Edge (2010), Hancock and Wilcox (1994), Hancock and Wilcox (1993), and Bernanke and Lown (1991). Our analysis, however, is more concerned with the real effects of deleveraging (in terms of higher capital ratios) rather than the relationship between loan growth and a given level of leverage.

on firms' economic activity.³ In our analysis, to address this issue, we look at the real effects that can be seen from firm level data.

Less related to capital regulation *per se*, other research has focused more on market-based motives to adjust banks' balance sheets, which has provided implications for how capital levels may be related to spreads on loans. Diamond and Rajan (2000) discusses the incentives of low-capital banks to charge higher spreads on loans for cash-flow purposes, while Allen, Carletti, and Marquez (2011) argues that banks' equity capital is a credible commitment to reduce moral hazard. To test empirical implications of these theories, Santos and Winton (2010) find that low-capital banks charge higher spreads for low-cash-flow borrowers and lower spreads for high-cash-flow borrowers compared to high-capital banks as argued in Diamond and Rajan (2000) and Fischer, Mattes, and Steffen (2009) find that high-capital banks are able to charge higher spreads in general as argued in Allen, Carletti, and Marquez (2011), both using the same Loan Price Corporation's Dealscan syndicated loan database for large corporations, but for different periods. In our analysis, we look at a more complete universe of firms by using the state-level U.S. Census Country Business Patterns data.

Finally, another strand of research has focused on how the (de)regulation of the broader banking industry has had real economic consequences for non-financial industry structure. For example, Cetorelli and Strahan (2006) find that inter and intra-state branching deregulation in the United States had significant effects on the entry and average size of establishments in the manufacturing sector. Cetorelli (2004) investigate how enhanced bank competition in the E.U. area led to markets in non-financial sectors being characterized by lower average firm size in the early 1990s. In addition, using a different dataset and including an analysis of long-term effects, Kerr and Nanda (2010) find that U.S. banking deregulations induced small changes in startup entry sizes or none at all, while Kerr and Nanda (2009) maintain that both entrepreneurship and business closures grew after interstate banking deregulations. One nice feature about the feature of bank branch deregulation is that such deregulation has a well-defined date against which one can analyze the behavior of different variables before and after the event. Beck, Levine, and Levkov (2010) provides a useful framework to analyze the changes to the distribution of income after bank branch

³Rice and Strahan (2010) find, for example, that more competition across banks improves loan pricing and encourages firms to substitute toward bank debt away from other sources of debt.

deregulation. However, as we detail in the section on this history of bank capital regulation, instead of a well-defined date around which one can analyze the effect on the structure of firms, regulatory capital requirements changed gradually through a series of adjustments. The first set of changes in regulatory capital requirements in our sample was introduced during the early 1980s and the second during the late 1980s and early 1990s.

In our paper, we look at how banks' capital ratios affect manufacturing establishment dynamics at the industry-state level, controlling for bank-branch deregulation indicators. On the surface, our paper is somewhat related to Hancock and Wilcox (1998), which looks at how changes in the dollar volume of capital affected real economic activity at the state level, such as employment, payrolls, and the number of firms by firm size, with a focus on small businesses. However, their analysis was at the state level, limited to the period of 1989-1992, and looked at how dollar-volume changes in capital had real effects. In addition, they simply use lags of state-level capital as instruments to assess the impact on real activity. In contrast, we look at how changes in capital ratios affect the average size of establishments (and the extent that new establishments are created) at the industry-state level for the period 1977-1997. We also emphasize that our measure of state-level capital ratios, which tend to be heavily influenced by bank operations in other states, nationally, or internationally, may provide sufficient exogenous variation in capital ratios that are not affected by economic conditions in a given state.

Based on the literature, our first testable hypothesis is that the formation of establishments dependent on external finance should be negatively affected by banks' balance sheet pressures to increase capital ratios (or deleverage). This may occur through a variety of channels such as stricter lending standards. However, we are open to the possibility that higher capital ratios may not necessarily lead to a reduction in the number of firms. Such a view is consistent with the literature on lending relationships such as in Berger and Udell (1998) and Petersen and Rajan (1994), which rely on data from the Survey of Small Business Finance (SSBF), that show nascent firms depending less on bank loans than older firms. In addition, setting up an establishment (the extensive margin) may not be that costly relative to maintaining or expanding one. To put things in perspective, according to Djankov, Porta, Lopez-De-Silanes, and Shleifer (2002), entrepreneurs' average cost of starting a firm (including the time to start up a firm) was 1.7 percent of per-capita income in the United

States in 1999, or \$520; expanding firm size through hiring one additional employee is far more costly.⁴ Finally, layoffs by firms that are induced by stricter lending standards may spur some creation of establishments, which may boost the number of establishments in times of distress. Aaronson, Rissman, and Sullivan (2004), for example, document the increase in the number of firms, which was accompanied by a fall in employment at the aggregate level, in the context of the 2001 recession. Finally, by analogy with the "exporter hysteresis" international trade literature (as in Baldwin (1998), Baldwin and Krugman (1989), Dixit (1989a), Dixit (1989b), and Alessandria and Choi (2007)), following a tightening of access to credit, the sunk cost aspect of the firm entry decision in the presence of fixed per period costs to maintain that sunk asset may lead larger firms to continue serving the market despite unfavorable economic (weak demand for output) or financial (costly and limited access to external finance) conditions, but perhaps at a smaller scale requiring less employees.

In contrast, we are more assertive of our second hypothesis, which is that adjustments to higher capital ratios negatively affect firm size (the intensive margin). Although our period of analysis coincides with two waves of tightening capital adequacy standards, banks may have also increased capital ratios due to low cash flow or due to market discipline. Regardless, such capital ratio adjustments and deleveraging are, almost by definition, accompanied by a more limited supply of credit, at least in the short run, if we assume issuing equity is costly. This will presumably lead to stricter lending standards and terms, such as higher loan spreads, that decreases investment on the intensive margin. Recent policy papers, such as Elliott (2009) have used such a channel to estimate the effects of new capital regulations on the broader economy. For our purposes, such dynamics are reflected in the the average size of firms, as we assume physical capital and labor are largely complementary.

⁴For other countries, the relative cost is far greater. For example, for the 85 countries studied in Djankov, Porta, Lopez-De-Silanes, and Shleifer (2002), the average cost was 66 percent of average per capita income.

II Brief History of Capital Regulation and Capital Ratios

A Bank Capital Regulation Changes in the Early 1980s

Capital regulation by the federal bank regulatory agencies in the 1970s was conducted through ad-hoc target capital ratios based on peer-group comparisons along with bank-specific considerations.⁵ The long-term fall in bank capital levels and the failures of several large banks, however, prompted bank regulators to consider enforcing a fixed minimum level of capital relative to assets on the balance sheet in 1979. Though the banking industry resisted such developments at first, due to the concern over banks' foreign debt exposure and exposure to the deteriorating energy industry, the the Office of the Comptroller of the Currency (OCC) and the Federal Reserve Board succeeded in announcing minimum capital guidelines in December 1981. 17 multinational banks were exempted from this requirement and continued to be regulated and supervised on an ad-hoc basis.⁶ In August 1983, the guidelines were amended so that the multinational banks had to adhere to the same minimum capital requirements as regional banks, though prior to the amendment, the multinational banks had already strengthened their capital positions through the prompting of the federal agencies. The International Lending Supervision Act of 1983 empowered the three federal financial regulatory agencies, including the FDIC, to establish and enforce minimum capital requirements for all banking institutions. As a result, in 1985,

⁵For more information on capital regulation in the 1980s, see Federal Deposit Insurance Corporation, *A history of the 80s: Lessons for the Future*, July 28, 1999.

⁶The new guidelines were based on three categories of banks under the supervision of the OCC and the Federal Reserve Board: community banks with assets under \$1 billion were subject to minimum primary and total capital ratios of 6 percent, regional banks with assets over \$1 billion were subject to minimum primary ratio of 5 percent and total capital ratio of 6 percent, while the seventeen largest banks (the multinationals) did not have to adhere to preset numerical guidelines. The definition of the primary and total capital ratios changed over time. In 1985 primary capital consisted of stockholders' equity, perpetual preferred stock, loan loss reserves and certain debt instruments that must be converted to common or preferred stock at maturity, while total capital consisted of primary capital plus secondary capital instruments such as limited-life preferred stock and certain qualifying debt instruments. These definitions were slightly different at the bank holding company level. The FDIC enforced a more stringent capital standard based on its own definition of adjusted capital to adjusted assets which was uniform across all state nonmember banks regardless of size. Vokey and Kearns (1985) provides a detailed description of the changes in capital regulation during the early 1980s, while Berger, Herring, and Szegö (1995) provides a review of the role of bank capital and describes the dramatic decrease in equity as a percent of assets since the first half of the 19th century.

all banks and BHCs had to maintain a primary capital ratio of 5.5 percent or more and a total capital ratio of at least 6 percent.

All told, from 1981 to 1985 multinational banks saw their primary capital ratio requirement increase from having no pre-set requirement to having at least 5.5 percent, whereas regional banks saw their primary capital requirement increase from 5 percent to 5.5 percent. Finally, community banks saw their primary capital requirement actually decrease from 6 percent to 5.5 percent.

B Bank Capital Regulation Changes in the Early 1990s

Soon problems with the uniform numerical minimum capital requirements began to surface. First, banks did not need to hold capital for off-balance sheet assets, though losses could potentially stem from such exposures. Second, banks had plenty of opportunity for capital arbitrage as on-balance sheet exposures required a fixed level of capital irregardless of how risky the exposures were. Third, for multinational banks, different capital standards across jurisdictions led to competitive inequity concerns.

As a result, the United States agreed to the Basel I international accord on capital adequacy standards in 1988, which tried to address the three concerns by introducing the concept of risk-weighted assets which allocated risk-weights to different types of exposures (including off-balance exposures). Risk-weighted assets were used as the denominator in calculating minimum regulatory capital ratios. Likewise, banks had to maintain a tier 1 capital ratio of at least 4 percent and a total risk-based capital ratio of at least 8 percent by the end of 1992.⁷

The three federal regulatory agencies then in 1990 agreed upon a leverage ratio, defined simply as tier 1 capital to average tangible assets, which was derived from the capital ratios used since the mid 1980s for regulatory purposes.⁸ According to Berger, Richard, Kashyap, Scalise, Gertler, and Friedman (1995), the leverage ratio was introduced to capture risks related to the leverage of banks not considered in the Basel I risk-based capital standards. The new rules stated that banks had to maintain a leverage ratio of at least 3 percent.

⁷Tier 1 capital consisted of common equity, some preferred stock, minority interest in consolidated subsidiaries less goodwill, while tier 2 capital consisted of loan loss reserves (limited to 1.25 percent of risk-weighted assets), subordinated debt (limited to 50 percent of tier 1 capital), and other preferred convertible stock. The total risk-based capital ratio was defined as the sum of tier 1 and tier 2 capital relative to risk-weighted assets. For a more detailed definition, please refer to Table I

⁸For a more detailed definition, please refer to Table I

Finally, FDICIA was passed in 1991 and took effect in 1992, which established five capital categories or thresholds for each of the three new regulatory capital ratios and had corresponding menus of mandatory and optional enforcement actions, otherwise known as Prompt Corrective Action (PCA), as the capital ratios declined. The adequate level of capital was defined as at least 5 percent for the leverage ratio, 6 percent for the tier 1 capital ratio, and 10 percent for the total risk-based capital ratio, each 2 percentage points above the respective minimums.

C Bank Capital Ratios

Increases in aggregate regulatory bank capital ratios and the simple equity to assets ratio at commercial banks have broadly been consistent with the two waves of changes in capital adequacy standards. Although data for the primary and total capital ratios used for regulatory purposes in the early 1980s is not available due to data limitations on several deduction items, the simple equity to assets ratio in Figure 2 steadily rises during the first half of the 1980s. The primary and total capital ratios continue to rise afterwards, but this is due to the dramatic increase in loan loss reserves in the banking industry. Later, the new regulatory capital standards set in place during the early 1990s appears to have been an important factor in increasing the leverage ratio, the tier 1 ratio, and the total risk-based capital ratios. In particular, Wall and Peterson (1987) and Wall and Peterson (1995) argue that capital ratios at the BHC level are determined by two forces - regulatory and market-based, and that, more likely, regulatory forces were the predominant factors that explain capital ratio adjustments seen at the large BHCs during the years 1982 - 1984 and 1990 - 1992. These periods coincided with the two waves of regulatory tightening of capital adequacy standards, especially for the large banks. Furthermore, Flannery and Rangan (2008) attribute the capital build-up in the early 1990s to the market's response to the regulatory innovations that weakened conjectural government guarantees and enhanced counterparties' incentive to monitor and price default risk. However, the extent to which capital ratios adjusted to new regulations as opposed to market discipline is not estimated and significant changes in the capital ratios may have been due to non-regulatory market-based motivations.

Since the only capital ratio that spans the sample of both waves of changes in capital adequacy standards is the equity to assets ratio, we use an adjusted capital ratio (which is the equity to assets ratio with deductions for intangible assets for

both the numerator and denominator) for our analysis. Wall and Peterson (1987) uses the primary capital ratio in analyzing whether regulatory pressures affected capital ratios, which can be roughly be split into the adjusted ratio and the loan loss reserve ratio, which we separately control for in our analysis. Wall and Peterson (1995) uses the leverage ratio in their analysis as Baer and McElravey (1993) find that the leverage ratio was the more binding of standards in the early 90s and as Berger and Udell (1994) find that the leverage ratio is more related to changes in bank loans than the the tier 1 or total risk-based capital ratios. Without the simple adjustment of deducting intangible assets from both the numerator and the denominator in the adjusted capital ratio, the equity to assets ratio displays a significant upward trend due to increasing Mergers and Acquisitions (M&A) activity during the latter part of our sample period. Such activity has been historically associated with large goodwill increases at the acquiring institutions as they predominantly funded their acquisitions with capital. Goodwill has been traditionally deducted in regulatory capital calculations as the portion of capital that supports goodwill does not have the ability to absorb losses at a bank in times of stress. The goodwill data item is only available since 1985, but since goodwill comprises the majority of intangible assets, we deduct intangible assets instead. This allows us to use a sample that goes back to 1983. In addition, since we want to take full advantage of the county business pattern data that goes back to 1977 and also encompass the timeframe in which the regulatory environment first began to change in the early 1980s, we replace the adjusted capital ratio with the simple equity to assets ratio prior to 1983. This is not as problematic as replacing the series in later years since prior to 1983, M&A activity was considerably muted than in periods afterwards. For instance, as seen in Figure 1 from 1976 to 1982, the average assets of the acquired commercial banks as a percentage of beginning of year total industry assets was 1.2 percent; whereas from 1983 to 1997, average acquired assets was over 6 percent.⁹ For our growth regressions, we use changes in the adjusted capital ratio as the explanatory variable in our analysis, which will be already highly correlated with changes in the equity to assets ratio.

⁹In addition, prior to 2001, banks could structure some acquisition transactions to meet certain criteria to record a business combination using the pooling-of-interests accounting method. Unlike the purchase accounting method, which records any price paid above the value of acquired assets (or liabilities) as goodwill, the pooling-of-interests accounting method simply combined the book value of assets and liabilities of the two banks to create a new balance sheet of the combined entity. Pooling-of-interests is now only possible if a combination involves banks within the same bank-holding-company structure.

Figure 2 illustrates how the adjusted capital ratio compares to the leverage ratio in the aggregate. The rise in the early 1980s and the sharper rise in the early 1990s reflects banks' deleveraging pressures during the two periods of regulatory capital tightening. The adjusted capital ratio is very similar to the leverage ratio since it was introduced. However, the adjusted capital ratio also deducts other intangible assets such as mortgage servicing rights and includes unrealized gains and losses as part of capital such as cumulative foreign currency valuations since the early 1984 and losses on marketable equity securities since 1989. Likewise, the changes in the adjusted capital ratio not only reflects changes in the regulatory capital environment but may reflect changes in market discipline and financial markets in general, though large and sustained movements have been found to be more correlated with regulatory tightening.

Consequently, there is both empirical and theoretical reasons for banks responding to higher capital requirements by adjusting assets rather than issuing equity. Figure 3 plots the deviation from trend (as measured by the aggregate respective seasonally adjusted HP-filtered series) of both the adjusted capital ratio and total loans outstanding (deflated by the GDP-deflator) at all commercial banks. The correlation between the two series is -0.477, and even stronger during the two periods of changes in minimum regulatory capital standards in the beginning of the 1980s and the early 1990s. In aggregate, as banks deleveraged (relative to the aggregate trend) during these two periods, loans outstanding fell below trend for sustained periods. Myers and Majluf (1984) provides a justification for why issuing equity is costly. They argue that adjusting to higher capital ratios will come more from shrinking assets rather than issuing new equity due to asymmetric information and the lemons problem; potential equity holders would be concerned that only problem banks would be willing to dilute shares of current equity holders.¹⁰

In order to better parse out supply and demand effects, we take advantage of the differences in bank presence in different states to come up with state-level capital ratios. The assumption is that capital ratios at the bank level affect credit supply decisions at the branch level in a given state. For example, credit supply conditions in a given state are represented by the balance sheets of banks that have branches in that state. Whether through regulatory pressures or through market discipline, in-

¹⁰Aiyar, Calomiris, and Wieladek (2011) provides a more detailed theoretical literature review of the costs to issuing equity.

dustries in states that have more banks with higher capital ratios are, *ceteris paribus*, are assumed to have more limited access to credit to support higher costs of funding, possibly through higher spreads on loans or tighter credit standards in general than for industries in other states. This fact is also consistent with the fact that smaller banks that have higher capital ratios charge higher spreads on their loans. We also emphasize that our measure of state-level capital ratios, which are on average heavily influenced by bank operations in other states, nationally, or internationally, may provide sufficient exogenous variation in capital ratios that are not affected by economic conditions in a given state. For example, the mean percentage of loans held in domestic offices at commercial banks that have a branch outside a particular state is 45.65 percent (with a standard deviation of 27.57 percent) from 1974 to 1996. If we do a similar exercise at the BHC level, the mean percentage goes up to 61.71 percent (with a standard deviation of 24.53 percent) from 1976 to 1996.

Our identification approach is similar to that which can be found in a few other studies. Garmaise and Moskowitz (2006) also use a similar argument to address possible reverse causality by studying the effects of changes in large bank mergers on changes in crime at the MSA level, arguing that such merger activity instruments for changes in bank competition at the local level. Similarly, Peek and Rosengren (2000) use the Japanese banking crisis to test whether a loan supply shock to branches and agencies of Japanese banks affected construction activity in the U.S. commercial real estate market. Nonetheless, there exist some states that only have BHCs or banks that operate within its own boundaries for a certain number of years. Still, we believe that even in these states, state-level capital ratios, which are reflective of financial conditions of not only businesses in other industries, but households and government as well, can be considered a relatively exogenous proxy for lending terms and standards.

In addition, we further address possible endogeneity problems by using lags and the Arellano-Bond dynamic panel estimator. Our prior is that firms dependent on external finance should be influenced in a systematically different manner by bank capital ratios in a difference-in-difference approach.

Consistent with Wall and Peterson (1987) and Wall and Peterson (1995), which noted evidence of capital tightening at large BHCs in response to increases in the minimum capital requirements, the state-level loan-weighted capital ratios for California, Texas, and New York, which tended to have higher concentrations of such

banks, increases in the early 1980s and once again in the early 1990s as shown in Figure 4.¹¹ The weights are applied to any bank that has a branch in a particular state to consider the balance sheet pressures at banks with the infrastructure and ability to provide loans in a given state. We assume that the presence of the following branches are enough to affect the credit conditions in a given state - headquarters, full service branches, limited service branches, and loan production offices. These offices do not necessarily hold deposits.¹² We also consider weights by the number of branches and weights that multiply deposits by the loans to deposit ratio at a given bank for a given state for robustness checks.¹³

III The Dynamics of Manufacturing Industries

Our data of interest to analyze the dynamics of firms comes from the County Business Patterns, which is an annual survey conducted by the Census Bureau. These data are said to provide “the best way to consider industry structure over a long span of time at a disaggregated level” as noted by Cetorelli and Strahan (2006) in their study of how bank branching deregulation affected the dynamics of firms. The annual survey collects data on the number of establishments, employment in mid March of each year, first quarter payrolls, and the annual payrolls. The data includes establishments that did not report any paid employees in the mid-March period but paid wages to at least one employee at some time during the year, therefore includes some businesses that are composed of only one person as of March of each year. The period of the data we use begins in 1977 and ends in 1997, which encompasses the two waves of changes in regulatory capital adequacy standards. After 1997, the data categorizes industry codes according to the North American Industry Classification System (NAICS) which replaced the Standard Industrial Classification (SIC) system, creating a break in the time series. As in other studies related to the structure of

¹¹More precisely, the weights are loans booked in domestic offices. However, the adjusted bank-level capital ratios themselves reflect banking conditions abroad as well.

¹²The branches are based on the National Information Center (NIC), which is a central repository of data about banks and other institutions for which the Federal Reserve has a supervisory, regulatory, or research interest. Our branch count outnumber branches identified in the FDIC Summary of Deposits data because it includes branches that do not hold deposits.

¹³We use this as a robustness check due to the possibly close linkage between deposits and credit that may have been supported by the Community Reinvestment Act of 1977. However, we prefer our measure because some branches of banks that offer credit do not necessarily hold deposits in the same state.

nonfinancial firms, we focus on the manufacturing sector because industries in this sector have relatively stable structures over time. In contrast, for example, Jarmin, Klimek, and Miranda (2009) report that the share of U.S. retail activity accounted for single-establishment firms fell from 60 percent in 1967 to just 39 percent in 1997. Then, as in Cetorelli and Strahan (2006), we distinguish the ten manufacturing industries that are dependent on external finance from the 10 that are not, based on two-digit SIC codes. This identification is based on loans to assets ratios according to the 1998 SSBF, but instrumented by external financial dependence measures for mature Compustat firms from 1980 to 1997 as their observed financial policy will unlikely be skewed by financial constraints that may affect smaller businesses that make up the vast majority of our sample.¹⁴ Our assumption is that bank balance sheet pressures, in addition to the deregulation of inter and intra-state banking, only affect those industries which are dependent on external finance. We also note that an establishment in the context of the data is an economic unit which employs workers and produces goods and services, such as a plant, a factory, or a restaurant that employs people, and does not necessarily correspond to a firm. However, as in literature, we use the data with evidence that the two types of entities are highly correlated and that the number of firms make up the majority of establishments. For example, Black and Strahan (2002) note that the rate of creation of new businesses is correlated with share of new establishments in a local economy, while Davis, Haltiwanger, Jarmin, and Miranda (2006) find that, though each publicly traded firm operates about 90 establishments on average, there are only 1.16 establishments per privately held firm.

Figure 5 and Figure 6 plot the average establishment size in industries not dependent on external finance and the average in industries dependent on external finance, respectively, measured by employees per establishment for the three states plotted in Figure 4. At approximately the same periods, once in the early 1980s and again

¹⁴The external finance dependence equals the proportion of capital expenditures financed with external funds. According to Cetorelli and Strahan (2006), the ten manufacturing industries (along with their SIC codes) are the following: Chemicals and allied products (28), Electrical and electronic equipment (36), Textile mill products (22), Petroleum and coal products (29), Paper and allied products (26), Rubber and plastic products (30), Lumber and wood products (24), Primary metal industries (33), Industrial machinery and equipment (35), and Transportation and equipment (37). The industries that are not dependent on external finance are the following: Instruments and related products (38), Printing and publishing (27), Miscellaneous manufacturing (39), Stone, clay, glass, and concrete products (32), Furniture and fixtures (25), Fabricated metal products (34), Food and kindred products (20), Apparel and other textiles (23), Tobacco manufactures (21), and Leather and leather products (31).

around the early 1990s when regulatory capital standards tightened for large banks, the average size of establishments dropped noticeably. However, the drop was far more pronounced in Figure 6 for industries dependent on external finance as the scale is far greater than in Figure 5. In contrast, the number of establishments showed less of a dramatic change in the two respective periods and did not show distinctive patterns across industries as shown in Figures 7 and 8. Our panel that spans both periods allows us to control for multiple factors, such as state-level Gross State Product (GSP) and aggregate industry dynamics, that may also have contributed to a decrease in the size of establishments in one or both periods. In our data analysis, we restrict our sample to include only industry-state-year observations that have no missing or zero values for both employees and establishments to maintain a stable and balanced panel.¹⁵

The state-level CBP data as of 1997 encompasses 101 million total employees from 6.8 million establishments.¹⁶ For the manufacturing sector that we use based on the state-level data, industries that are dependent on external finance encompass 7.7 million total employees from 208 thousand establishments and industries that are not dependent on external finance encompass 9.5 million total employees from 175 thousand establishments. When we clean the sample for a balanced panel, these totals decrease about 5 percent each.

IV Empirical Strategy, Specification, and Data Summary

A Empirical Strategy

Figure 9 illustrates the econometric strategy we use, along with the propagation mechanism that may be in force, that relates bank capital ratios to the dynamics

¹⁵To our understanding, the majority of the observations with zero values were dropped due to disclosure rules, as no data are provided that would disclose the operations of an individual employer, which creates a natural criterion for our sample as we do not want our results to be determined by very few observations or observations that are based on a single large entity.

¹⁶This is based on state level data. Based on national CBP data, where disclosure rules do not apply, the 1997 survey encompasses 105 million total employees from 6.9 million establishments. Among these aggregates, there are 18.6 million employees from 393 thousand establishments. Over half of these establishments have less than 10 employees and more than 98 percent of establishments have less than 500 employees.

of manufacturing firms. First, as much of the literature suggests, we use a time period when large and sustained movements in capital ratios were driven by changes in minimum capital requirements. Still, many of the changes may be an endogenous result of market conditions or market discipline. Therefore, we use state-level capital ratios that are heavily influenced by banks with operations in multiple states and foreign countries, which provides an exogenous shifter in financing conditions. For those states which this is not a good assumption, we emphasize that state-level capital ratios are reflective of financials of not only businesses in other industries, but households and governments as well. Furthermore, we use the Arellano-Bond estimator to address the possibility of endogeneity and to eliminate the bias that comes from using lagged dependent variables as regressors.

Our identification assumption is that the capital ratio adjustments only affect industries dependent on external finance, which accounts for any omitted financial and non-financial variables that may affect firm dynamics. Our first hypothesis is that changes in capital ratios will affect firms on the extensive margin, resulting in fewer firms created. However, we note that the number of firms may not necessarily decline with higher capital ratios as setting up a small business itself may not be that costly and some of the displaced workers that are affected at the intensive margin establish their own businesses. Following the international trade literature, it may also be that larger firms try to weather unfavorable economic or financial conditions due to higher sunk costs. We are more assertive in our second hypothesis, which states that higher capital ratios will lead to more displaced workers in industries dependent on external finance.

Finally, using our estimation results, we will be able to gauge whether the credit-supply effects of higher capital ratios on the size or number of establishments is economically significant by calculating the aggregate effect on employment, which is the sum of the effect on the creation of firms multiplied by average firm size and the effect on the average size multiplied by the number of firms.

B Econometric Specification

Our identification assumption is that state-level bank balance sheet measures only affect the dynamics of firms that are dependent on external finance. We also calculate state-level reserve ratios and include them in our regression to control for forward-looking measures of losses on banks' balance sheets that affect only those industries

dependent on external finance. Similarly, we assume that deregulation of inter and intra-state banking and the commercial bank HHI index are also related only to industries dependent on external finance as in Cetorelli and Strahan (2006).

In addition, we use lags of all our explanatory variables to limit issues related to reverse causality and include multiple lags to account for dynamic effects. Aggregate credit conditions are proxied by the real interest rate that is calculated by subtracting the inflation rate from the one-year treasury rate. As a proxy for demand, we also control for growth in state level output deflated by the national GDP deflator. We include industry-year fixed effects to control for national trends in the growth of a particular sector.

Finally, we include lagged dependent variables in our analysis as there is significant persistence in the both the number and average size of establishments, which also allows us to calculate propagation mechanisms related to the structure of firms. However, the fixed effects used in our panel structure are likely correlated with the explanatory variables, the presence of lagged dependent variables gives rise to “dynamic panel bias” as in Nickell (1981). Since the rate at which this bias disappears is $1/T$, we believe that our 20 year sample period alleviates some of this endogeneity problem. In the Appendix, we also examine the relationship between bank capital ratios and the structure of firms by using dynamic panel analysis based on Arellano and Bond (1991). We also investigate how changes in capital ratios impact the growth rates of average size and number of firms, which allows us to control for aggregate trends.

Our specification is the following:

$$Y_{j,s,t} = \alpha_{j,s} + \sum_{i=1}^{n-1} \delta_i + \sum_{k=1}^m \sum_{i=1}^n \beta_{i,k} External_j BankVariable_{k,s,t-i} + \sum_{i=1}^n \omega_i CreditConditions_{t-i} + \sum_{i=1}^n \gamma_i MarketTrends_{s,t-i} + \kappa_{j,t} IndustryTrends_{j,t} + \epsilon_{j,s,t}$$

where,

- $Y_{j,s,t}$ is either the log of average size of establishment or log of the number of establishments in sector j and state s at time t ;
- $\alpha_{j,s}$ is the coefficient for the industry-state fixed effect;

- δ_i is the coefficient of the i th lagged dependent variable, $Y_{j,s,t-i}$;¹⁷
- $\beta_{i,k}$ is the coefficient of *External*, which is an indicator of whether a sector is dependent on external finance, interacted with i th lagged bank variable k in state s , or *BankVariable* $_{k,s,t-i}$, which includes the adjusted capital ratio, the reserve to loans ratio, and the Herfindahl-Hirschman Index (HHI) at the state level, and whether states deregulated inter or intra state bank branching¹⁸;
- ω_i is the coefficient of aggregate credit conditions proxied by the i th lagged one-year realized real interest rate, *CreditConditions* $_{t-i}$;
- γ_i is the coefficient of the i th lagged state market variable, where the local market trend, *MarketTrends* $_{s,t-i}$, is captured by the state level gross state product (GSP) or state-year fixed effects;
- $\kappa_{j,t}$ is the coefficient of the industry-year fixed effect;
- and, $\epsilon_{j,s,t}$ is the error term robust to heteroskedasticity.

C Data Summary

Our sample of industry-state-year observations encompass 21 years from 1977 to 1997, including 668 industry-state groups with 14028 observations. Table II describes the summary statistics at the industry-state level for manufacturing sectors that are dependent on external finance and those that are not. Industries that are dependent on external finance are generally larger in terms of employees; compared to an average establishment size of 91 employees per establishment, the average size for industries not dependent on external finance is 52. In contrast, there are more establishments which are not dependent on external finance.

Table III describes the explanatory variables at the state level. Since we use lagged explanatory variables we consider the sample of state-level bank balance sheet

¹⁷To maximize the number of available observations, we use one fewer lag of dependent variables than that of other independent variables. When we add additional lags, the coefficients quickly converge to zero.

¹⁸The assumption of having banking variables only related to industries dependent on external finance is justified by empirical analysis as well. For example, the inclusion of a few lags of state-level capital ratios themselves does not affect the coefficients on state-level capital ratios interacted with the external dependence measure, *External*, while the coefficients on the lags of state-level capital ratios are not statistically significant.)

does not change our results and their coefficients show up as statistically insignificant

measures from 1976 to 1996, which includes measures for all 50 states and the District of Columbia. During that period and across the different states, the average adjusted capital ratio amounts to 6.4 percent, with a standard deviation of 1.2 percent. Loan loss reserves in relation to loans are lower on average, at 1.7 percent, with a standard deviation of 0.9 percent. As data on the microstructure of establishments are as of March, we use a year and three quarters lagged HHI indices since the SOD data is as of June in a given year. The HHI index, or the sum of squared local market commercial bank deposit shares, averages about 0.16 with a standard deviation of about 0.07. Similarly, since GSP is given at the end of a year, we use a year and a quarter lag for real GSP in our regressions. The average, in billions of 2005 dollars, is 1.3 billion with a standard deviation of 1.6 billion from 1975 to 1996. Finally, the post-intrastate branching deregulation indicator and the post-interstate banking deregulation indicator have means of 0.65 and 0.5, respectively, from 1976 to 1996, reflective of the fact that intrastate branching was generally deregulated earlier.¹⁹

V Empirical Results

A Panel Regression Results

We look both at the panel regression results for the average size of the establishments and the number of establishments as any change in the average size can be driven by the denominator, the number of establishments. Our basic panel regressions in Table IV and Table V for the number of establishments and the average size, respectively, includes two to three lags of the explanatory variables with coefficients and standard errors robust to heteroskedasticity and clustered at the state-industry level. Specification (3) includes state-year dummies. The results reveal that there is significant persistence in the dependent variables as up to several lags determine much of the variation in both the average size of establishments and the number. We report within R-squareds, as between R-squareds are exceptionally high due to statistically significant industry-state fixed-effects. Within R-squareds, on the other hand, range from 0.78 to 0.92.

From the results in Table IV, we reject our first hypothesis that there are any

¹⁹The Interstate Banking and Branching Efficiency Act (IBBEA) permitted unrestricted interstate banking in 1995 and interstate branching in 1997. These effects are subsumed in our industry-year fixed effects as they were implemented nationally at once.

negative effects of capital ratios on the net creation of establishments, and, hence, on employment through this extensive margin. For the average size of establishments, however, the adjusted capital ratio interacted by whether a sector is dependent on external finance or not, shows up statistically significant and is negative, supporting our second hypothesis. Ultimately, a 1 percent increase in the adjusted capital ratio leads to an economically significant decline of between 0.73 to 1.21 percent in the average size of the firms that depend on external finance the following year. As the adjusted capital ratio seems to have no impact on the number of establishments in the aggregate and on net, such balance sheet adjustments by banks seem to affect mainly the intensive margin of employment at manufacturing firms.

By no means do we assert that bank deleveraging has no effect on the number of establishments. Based on the literature on small business finance and start-up costs, we note that the the negative effects on starting up businesses from bank deleveraging may be hard to pin down due to the fact that bank loans are not as critical as personal savings or assistance from family in setting up a business, while setting up a business itself is relatively cheap in the U.S. compared to the vast majority of other countries. In other words, both displaced workers and new entrepreneurs may have incentive to start businesses when other entrepreneurs decide to fold their businesses due to bank deleveraging. In addition, it may be that larger businesses may be less sensitive to economic and financial conditions when it comes to deciding whether to exit the market in the presence of higher fixed sunk costs. We look more closely at the data by looking at if both the shares and the number of establishments (in industries dependent on external finance) with a size of less than 5, 10, or 20 employees change due to higher capital ratios, but could not find any statistically significant results, possibly implying that both the creation and destruction of establishments occurs, mainly, among the universe of small businesses.²⁰

Meanwhile, what does seem to matter at the extensive margin is GSP. For specifications (1) and (2), we can conclude that a 1 percent increase in GSP leads to about a 0.1 percent increase in the number of establishments the following year, though the following year after that the number of establishments decrease. This is reflected in the negative coefficients in the regressions for average size. However, for the panel regressions, this effect is insignificant. As we use contemporary state-year dummies in

²⁰We cannot look at the average size by establishment-size category, because much of the data is not available due to disclosure rules that prohibit disclosure of operations of an individual employer on a more granular level.

specification (3) for the regression on the number of establishments, the effects of real GSP are less apparent for the nearer lags, as both are state-level variables, though the third lag does seem to have some positive effect on the number of establishments.

In addition, some of the results shown in Cetorelli and Strahan (2006) for the effects of the HHI index and intra-state branching remain. For example, there seems to be statistical evidence that interstate banking and greater decentralization of banks (measured in terms of deposits) increases the number of establishments.

B Growth Regression Results

We also consider regressing the growth rate of average size of establishments and establishments on the changes in capital ratios to eliminate the persistent trends seen in the levels. Taking first differences to the econometric specification described in the basic panel regressions provides similar results in terms of the signs in the coefficients.²¹ The growth regressions would then look like the following:

$$\Delta Y_{j,s,t} = \sum_{i=1}^{n-1} \delta'_i \Delta Y_{j,s,t-i} + \sum_{k=1}^m \sum_{i=1}^n \beta'_{i,k} \text{External}_j \Delta \text{BankVariable}_{k,s,t-i} + \sum_{i=1}^n \omega'_i \Delta \text{CreditConditions}_{t-i} \\ + \sum_{i=1}^n \gamma'_i \Delta \text{MarketTrends}_{s,t-i} + \kappa'_{j,t} \text{IndustryTrends}_{j,t} + \epsilon'_{j,s,t}$$

where the coefficients primed are analogous to the coefficients described in our level regressions.

The average growth rate of establishments in our balanced panel is -0.35 percent with a standard deviation of about 11.1 percent for industries that are dependent on external finance, while the average growth rate is about -0.3 percent with a standard deviation of about 10.5 percent for those are are not dependent on external finance. Meanwhile, the average growth rate of the number of establishments is 1.5 percent with a standard deviation of about 6.8 percent for industries dependent on external finance and the average growth rate is 1.4 percent with a standard deviation of about 6 percent for industries that are not. The mean change in the adjusted capital ratio is 0.05 percent with a standard deviation of about 0.5 percent.

Results in Table VIII and Table IX are consistent with our findings in terms of

²¹For robustness, we also consider sector-state fixed effects. Although, the results are not shown, they lead to very similar results.

levels. Namely, we see that a one percentage point increase *in the change* in the adjusted capital ratio leads to about 0.88 to 1.22 percentage point decline in the growth rate of the average size of establishments without affecting establishments in the extensive margin in the following year. As with earlier results, what seems to be driving the extensive margin is local market trends proxied by GSP - a one percentage point increase in the growth rate of GSP leads to about a 0.12 to 0.15 percentage point increase in the growth rate of the number of establishments. The pooled R-squareds range from 0.29 to 0.45.

C Economic Significance and Long-Run Macro Effects

The economic significance of our results can be quantified by looking at both the short and long-term elasticities with respect to the adjusted capital ratio.²² The short-run (one-year) elasticities of a one percentage increase in the adjusted capital ratio on the average size of establishments are directly inferred from the Tables IV to VII. For the level equations, they ranged from -0.73 to -1.41 (excluding specification (3) of the dynamic panel regressions). Given that there were about 9.5 million employees for the manufacturing sector dependent on external finance as of 1997, a one percentage point increase in the capital ratio would have led to a displacement of 140 thousand to 270 thousand workers from these sectors in the following year according to the following equation.

$$\frac{\Delta Employment}{\Delta Capital Ratio} = \underbrace{\frac{\Delta Number of Establishments}{\Delta Capital Ratio}}_{=0} \times Average Size + \frac{\Delta Average Size}{\Delta Capital Ratio} \times Number of Establishments$$

The long-run elasticities can be defined as the sum of the significant coefficients on the various lags of the adjusted capital ratio divided by one minus the sum of the significant coefficients on the various lags of the dependent variable used as explanatory variables. The long-run elasticities measured in this manner range from -3.48 to -5.88 (again, excluding specification (3) of the dynamic panel regressions), indicating that a one percentage point increase in the adjusted capital ratio leads to a decrease

²²We think of this exercise as comparing employment in manufacturing industries dependent on external finance across two steady states: one with the base capital requirements and another with higher capital requirements.

in the number of employees for the sector dependent on external finance of up to 5.88 percent.²³ Likewise, a one percentage point increase in the capital ratio would result in, as of 1997, over five hundred thousand displaced employees according to this upper bound.

Meanwhile, the short-run and elasticities for the growth regressions are also economically significant, as the temporary effects of a one percentage point increase in the change in capital ratios on the percentage point increase in the growth rate of average establishment size ranging from -0.88 to -1.75 percentage points, respectively.²⁴

Although these results imply that regulation of capital ratios in banking has the ability to permanently tilt the composition of employment, for example from manufacturing to other sectors in the economy, we do not consider such inter-sector movements in our analysis.

D Other Robustness Checks

We conduct several robustness checks. We use alternative measures of state aggregated capital ratios; our panel regression results is robust to capital ratio measures that are weighted by the number of branches. In addition, we can also weight capital ratios by deposits multiplied by aggregated loan to deposit ratios at a given bank for a given state, though this ignores the potential to offer credit to businesses that are not headquartered in a state where the bank does not book deposits. We note that these measures would be more prone to endogeneity issues as local economic conditions may affect the balance sheets of banks. Our results are also robust to eliminating two states with many credit-card processing banks and high volatility in their capital ratios, namely Delaware and South Dakota, and to the inclusion of only smaller states where state-level capital ratios are usually more influenced by banks with presence in multiple states and/or foreign countries. Finally, our results are robust to different proxies for market trends - instead of or addition to state-level real-GSP, we can include state population or aggregate real GDP, but our results change very little.

²³Including insignificant coefficients, the elasticities range from 0.33 to -5.25, where the positive elasticity is derived from specification (2) of Table V.

²⁴Long-run elasticities of a one percentage point increase in the change in capital ratios do not make sense in our framework as this implies increasing capital ratios indefinitely.

VI Conclusion

Our method of constructing bank capital ratios to the state level allows us to take advantage of the exogenous variations in state-level differences in capital ratios. In addition, we control for omitted financial and nonfinancial variables that may affect firm dynamics by exploiting variation in external finance dependence across industries, branch deregulation indicators, bank concentration, and demand side factors. Our results show that positive changes in the capital ratio results in contractions in the size of establishments in the manufacturing sector, but has no net effect on the net creation of establishments.

Our results point to the potential adjustment costs to banks' deleveraging that may accompany the proposals to tighten capital adequacy standards and restrict certain banking activities. Increasing safety and soundness in the financial sector through requiring higher capital ratios is an admirable goal. Recent research on estimating the costs of some of the initiatives is limited to the relationship between bank balance sheets and larger borrowers who also had access to broader capital markets. For example, Kashyap, Stein, and Hanson (2010) and Kiley and Sim (2011), point to only modest effects of higher minimum capital requirements on loan rates or aggregate output. In contrast, our study incorporates even the smallest of establishments and may be more informative about adjustment channels and costs of stricter capital requirements. For example, banks may adjust different credit standards and terms based on borrower characteristics and the impact may be disproportionately be felt by certain industries dependent on external finance.

Our estimate of the impact of higher capital ratios on nonfinancial firm dynamics may also have implications for the labor market in the current economic environment. For example, the greater anticipated regulatory burden faced by commercial banks may temporarily hold back employment growth in manufacturing industries dependent on external finance, thus contributing to weak labor-market conditions. In the longer term, the displaced workers in these industries will likely be absorbed by other sectors in the economy as our results do not suggest permanent impediments to growth.

As we attempt to understand how current bank deleveraging relates to nonfinancial firm dynamics, our analysis, based on the regulatory and economic environments in the early 1980s and 1990s, has its limitations. Important differences in financial

markets, such as the explosion in the shadow banking system that occurred since the late 1990s, will complicate an exact comparison. For example, other sources of non-bank financing may be more available in the current environment to mitigate some of the effects that we find based on historical data. In addition, by concentrating on the manufacturing sector alone, we do not consider how many of the displaced employees were absorbed by other sectors in the economy, such as the service industry. In the current economic environment, some of the effects on employment may well be less pronounced due to technological advances such as the internet as displaced workers may not be as restricted in their current geographical locations in searching for new jobs or starting up businesses. Finally, though the degree of regulatory tightening may be stronger than in the past, banks that have historically held substantial buffers of capital above the required minimums may also choose to hold less of a buffer that may mitigate some of the effects on the real sector. In terms of the implementation of the new Basel III capital requirements, regulators have been careful to allow sufficient time of about five years to increase capital ratios in the hope that banks will achieve higher capital ratios through retained earnings rather than the shrinking of assets, which gives banks more time than they were given during the two previous waves of changes in regulatory capital regimes.

We tried to disentangle the effects of the demand for credit from its supply on firm dynamics, and found the former seemed to affect the extensive margin and the latter the intensive with respect to employment in the manufacturing sector. However, further research will be necessary to disentangle the degree in which banks adjust their capital ratios due to regulatory pressures as opposed to market discipline, since regulatory changes in required capital levels tends to accompany financial and banking crises. This will help to pin down more accurately the effects of increasing the minimum level of capital ratios in the banking system.

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Appendices

A Dynamic Panel Regression Results

Potential endogeneity problems may arise if changes in the firm dynamics lead to changes in state-level output or bank balance sheets that may not be controlled for in our difference-in-difference approach. We also try to alleviate the dynamic panel bias present in panel data analysis with fixed effects and lagged dependent variables using the dynamic panel estimators and show results from the difference GMM procedure introduced by Arellano and Bond (1991). Furthermore, we assume a linear functional relationship that allows us to take advantage of the Arellano-Bond estimation that deals with autocorrelation in reduced form in the the number of and the average size of establishments. Our assumption is that such autocorrelation (and heteroskedasticity) is within industry-state groups, but not across them. In addition, we estimate Windmeijer (2005) standard errors to correct for the finite sample, without which the standard errors are prone to be severely downward biased.

Table VI and Table VII reports results for average size with specifications similar to Table IV and Table V with the exception of state-industry and state-year fixed effects. The state-industry effects do not provide variation in the difference equation for which the dynamic panel is based upon. For specification (1), we consider two lags of banks' balance sheet measures, the HHI index, and the log of real GSP. For the first-differenced equations, we use as instruments the third to fifth lags of all the bank balance sheet measures, HHI, and GSP that are used as explanatory variables, and lagged values of all the remaining explanatory variables (as strictly exogenous variables). For specification (2), we use three lags of bank balance sheet measures and use the fourth to sixth lags as instruments. Specification (3) looks at the years 1988 to 1997, where we use up to the thirteenth lag of the banks' balance sheet measures, HHI, and GSP as instruments. Standard errors, in parentheses, are robust to autocorrelation and heteroscedasticity.

We also report goodness-of-fit measures of the squared correlation between the actual and predicted dependent variables. In addition, second-order serial correlation in the first-differenced residuals is tested using a Lagrange multiplier test, while instrument validity is tested using a Sargan-Hansen test of the overidentifying restrictions. In general, we find minimal statistical evidence that second-order serial correlation in the first-differenced residuals exist, while for our specifications, the Sargan-Hansen test generally does not reject the validity of the overidentifying restrictions. Goodness-of-fit measures are also exceptionally high, as much of variation in the dependent variable is determined by its own lag and with the introduction of industry-year dummies.

The dynamic panel regression results are generally consistent with the panel regression results. Again, we reject the hypothesis that capital ratios have any effect on

the establishment of establishments with the exception of the limited sample period of 1988 to 1997. However, the coefficient is far less (0.80) in absolute size than the coefficient (-1.22) for the capital ratios interacted with the indicator for dependence on external finance in the dynamic panel regression for average size, implying there is still a substantial effect on the intensive margin. More generally, in the dynamic panel for average size, a one percentage point increase in the capital ratio leads to a 1.21 to 1.41 percent decline in the average size of establishments in the following year. Another difference between the panel and the dynamic panel regression results is that interest rates seem to matter in a consistent manner in the latter, implying higher interest rates are associated with a smaller number of establishments, perhaps due to an increase in business start-ups as firms shed employees in the intensive margin. Again, the coefficients for credit conditions are far greater for the average establishment size than for the number of establishments, implying that there are still notable effects on the intensive margin in the following year.

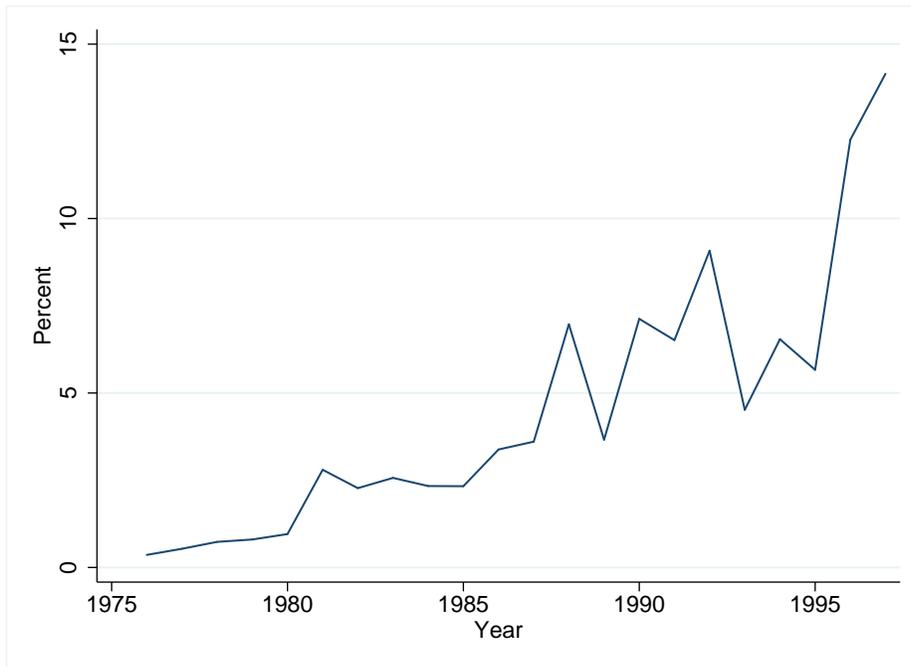
Finally, compared to the basic panel regression, the significant effect of the HHI index on average size disappears in the dynamic panel regression, while there is evidence that intrastate branching had negative effects on the average size of firms.

In the long-run, due to the positive coefficients on the dependent lagged variables, any short-term effects on the number or average size of establishments are amplified, but converge to a new steady state.²⁵ A more detailed analysis of the long-run effects are described when we later analyze economic significance of our results for both the panel and dynamic panel regressions.

Dynamic panel regressions with the same specification (excluding the state-year fixed effects) yields similar results. As shown in Table X and Table XI, the magnitudes for the effect of a one percentage point increase in the change in capital ratios on the decline in the growth rate of the average size of establishments ranges from 1.35 to 1.75 percentage points in the following year with little evidence that capital ratios affect the extensive margin for the full sample period.

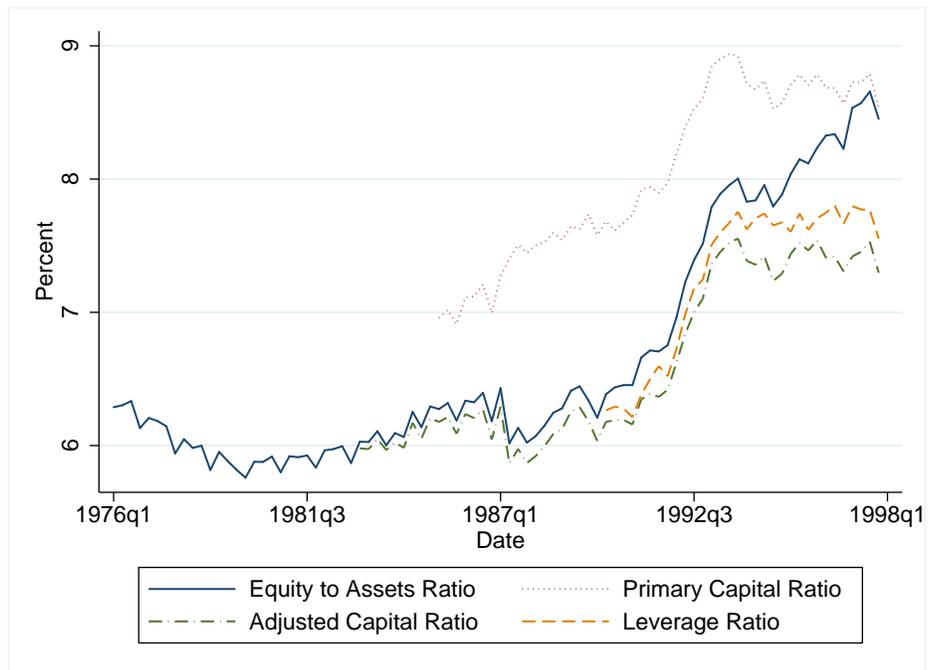
²⁵Our results are robust to adding additional lags of the dependent variables, as their coefficients quickly converge to zero.

Figure 1: Commercial Bank-Merger Intensity



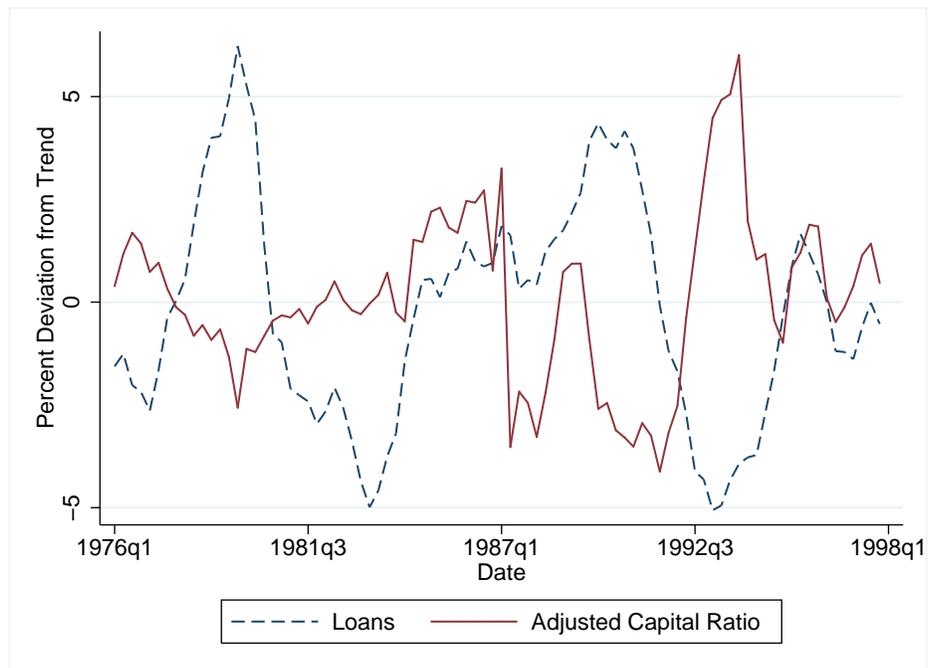
NOTES: Commercial bank-merger intensity is calculated as sum of the within-year average assets of acquired commercial banks relative to beginning-of-year total commercial bank assets. The intensity is plotted in percentages. Source: National Information Center(NIC) and Call Reports.

Figure 2: Selected Capital Ratios



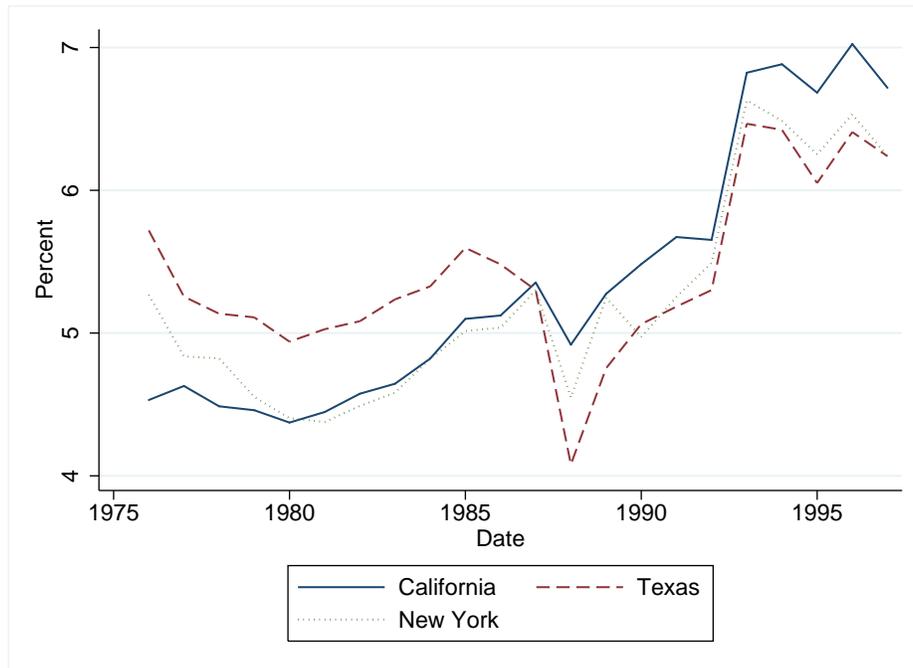
NOTES: Refer to Table I for definitions of the capital ratios. Source: Call Reports.

Figure 3: Adjusted Capital Ratios and Loans as Percentage Deviations from Trend



NOTES: Trends are calculated from the HP-filtered series of the respective seasonally adjusted series of adjusted capital ratios and loans outstanding deflated by the GDP-deflator. Source: Call Reports and H.8 Federal Reserve Statistical Release.

Figure 4: Adjusted Capital Ratio for Selected States



NOTES: A particular state-level capital ratio is calculated by a weighted sum of the adjusted capital ratios of banks with branches in that state. The weights are total loans booked in domestic offices. Source: National Information Center(NIC) and Call Reports.

Figure 5: Average Size of Establishments (as measured by employees, in industries not dependent on external finance)

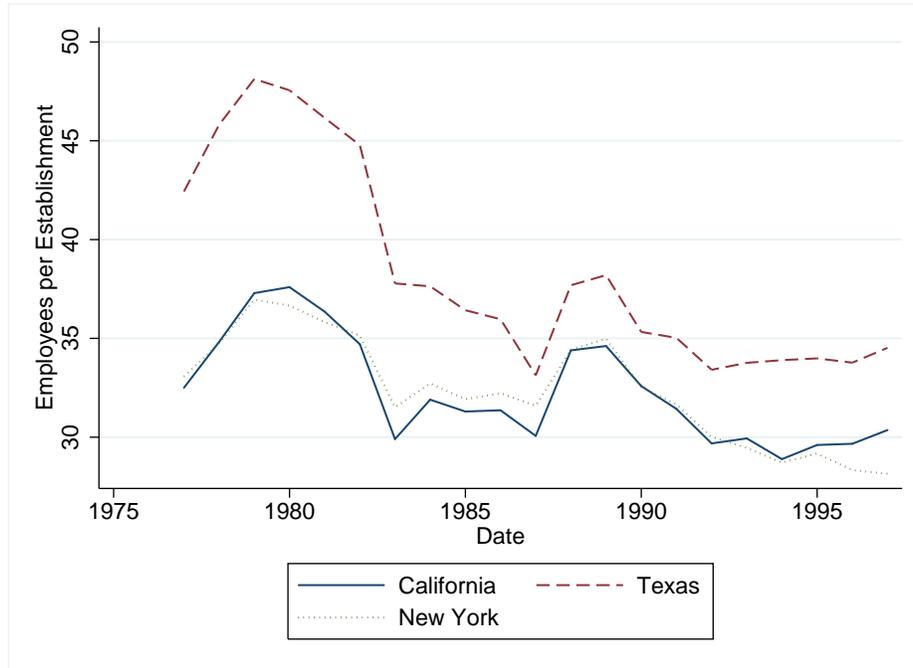


Figure 6: Average Size of Establishments (as measured by employees, in industries dependent on external finance)

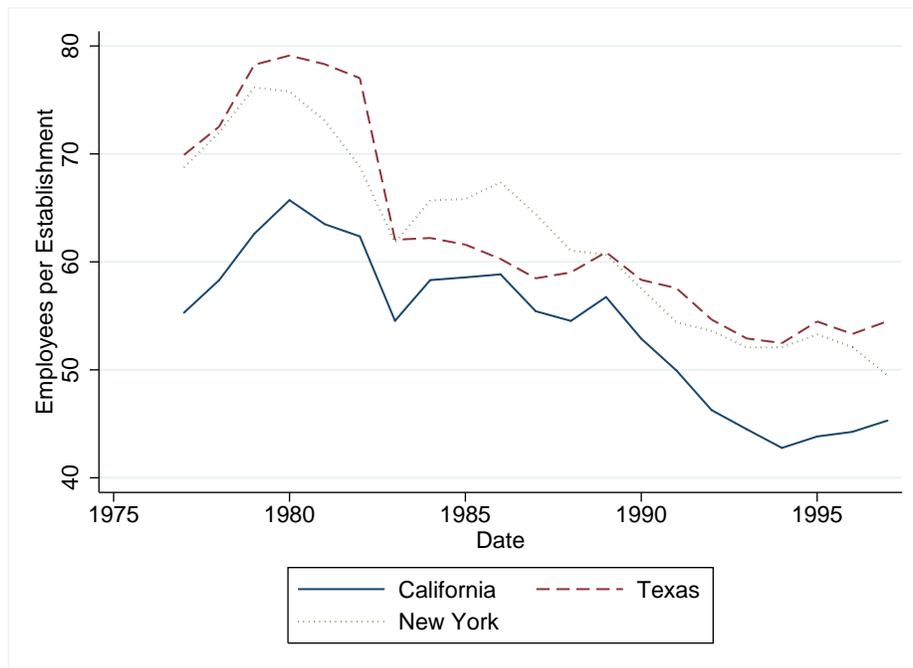


Figure 7: Number of Establishments (in industries not dependent on external finance)

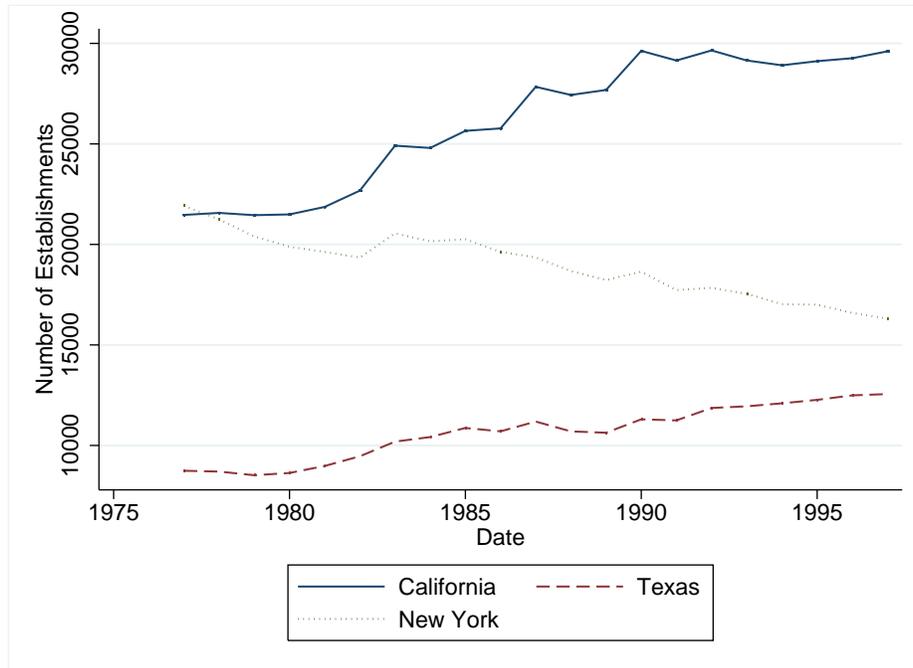


Figure 8: Number of Establishments (in industries dependent on external finance)

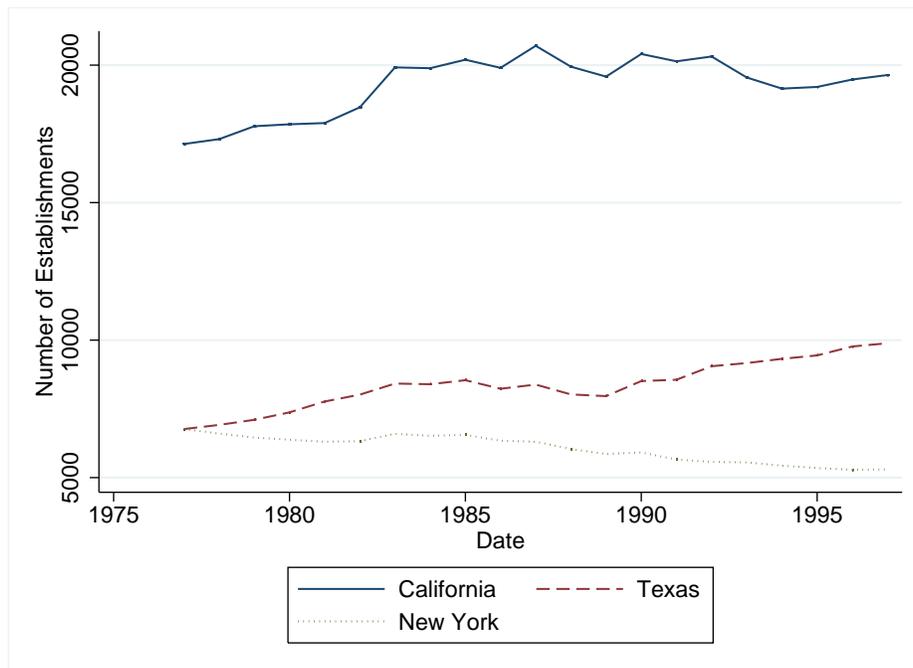
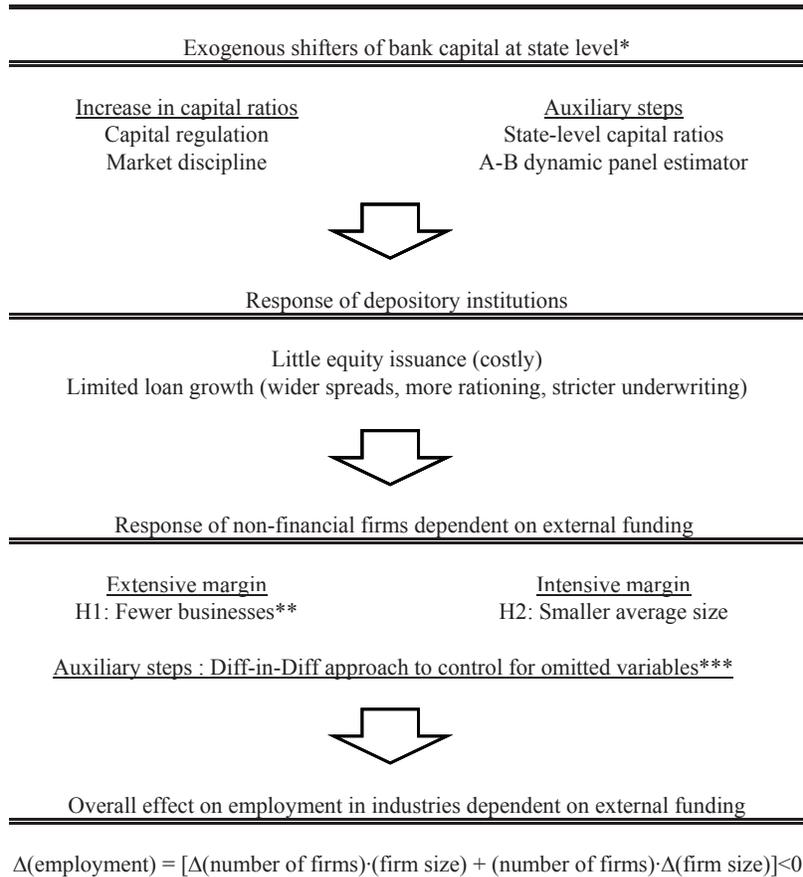


Figure 9: Propagation Mechanism of Bank Balance Sheet Pressures on Firms



* One may argue that both capital regulation and market discipline are not exogenous. For example, tighter capital regulation might be construed as an endogenous policy response to a financial crisis. Similarly, stricter market discipline might follow or coincide with a financial crisis. Hence, we take extra steps to focus on exogenous movement in capital ratios. First, we use state-level capital ratios that are heavily influenced by banks that have operations in other states and countries. Second, we use the Arellano-Bond (A-B) estimator to try to control for further endogeneity.

** The number of incorporations might not necessarily decline in response to more limited access to finance. First, setting up a business itself is not costly. Second, some of the displaced workers have been shown to establish their own firms, perhaps relieving the downward pressure on the number of firms.

*** Our main identification assumption is to assume that bank balance-sheet pressures only affect industries dependent on external finance.

Table I: Definitions of Regulatory Capital Ratios

Primary Capital Ratio	Primary capital consisted of stockholders' equity, perpetual preferred stock, loan loss reserves and certain debt instruments that must be converted to common or preferred stock at maturity. Intangible assets except mortgage servicing rights were deducted from both the denominator and the numerator for the ratio of primary capital to assets. Minimum primary capital ratios were introduced in 1981 for community and regional banks and in 1983 for multinational banks. Regulators set a uniform minimum level of the primary capital ratio in 1985 for all banks, thereby raising the minimum ratios for multinational and regional banks, and lowering the ratio for community banks.
Total Capital Ratio	Total capital consisted of primary capital plus secondary capital instruments such as limited-life preferred stock and qualifying debt not included in primary capital. The denominator was the same as for the primary capital ratio. Regulatory minimum total capital ratios were introduced at the same time as those for the primary capital ratio.
Tier 1 Risk-Based Capital Ratio	Tier 1 capital consists of common equity and certain perpetual preferred stock, and minority interest in consolidated subsidiaries less certain intangible assets, such as goodwill, and net unrealized gains on investment account securities classified as available for sale. The tier 1 capital ratio is defined as tier 1 capital relative to risk-weighted assets and was partially introduced in 1989 before being fully adopted in 1992 in accordance with Basel I.
Total Risk-Based Capital Ratio	The total risk-based capital ratio is defined as tier 1 and tier 2 capital relative to risk-weighted assets. Tier 2 capital consists primarily of subordinated debt, preferred stock not included in tier 1 capital, and loan loss reserves up to a cap of 1.25 percent of risk-weighted assets. The total capital ratio was introduced and adopted along with the tier 1 capital ratio in accordance with Basel I.
Leverage Ratio	The leverage ratio is the ratio of tier 1 capital to average tangible assets, which is equal to total average consolidated assets less assets excluded from common equity in the calculation of tier 1 capital. The leverage ratio was introduced in 1990.
Adjusted Capital Ratio	The adjusted capital ratio is the ratio of total equity minus intangible assets relative to total assets minus intangible assets.

Table II: Summary Statistics at Industry-State Level (1977 - 1997)

	Mean	Standard Deviation
Industries dependent on external finance		
Number of establishments per industry-state	423	671
Average establishment size (employees per establishment)	91	75
Industries not dependent on external finance		
Number of establishments per industry-state	560	854
Average establishment size (employees per establishment)	52	52

Table III: Summary Statistics at State Level

	Mean	Standard Deviation
Adjusted capital ratio (<i>CapRatio</i>)	6.4%	1.2%
Loan loss reserves to total loans (<i>ResRatio</i>)	1.7%	0.9%
HHI (sum of squared local market deposit share)	0.16	0.07
Real gross state product in billions of 2005 dollars (<i>GSP</i>)	1.3	1.6
Post-branching deregulation indicator (<i>Intra</i>)	0.65	–
Post-interstate banking deregulation indicator (<i>Inter</i>)	0.50	–

NOTES: Adjusted capital ratio, loan loss reserves to total loans, and post-branching deregulation and post-interstate banking deregulation indicators are from 1976 to 1996. HHI and Gross state product are from 1975 to 1995.

Table IV: Panel Regression Results for Number of Establishments

Dependent Variable: Log of Establishments	(1)	(2)	(3)
Lags of Dependent Variable			
$Y_{j,s,t-1}$	0.88 (115)***	0.79 (44.7)***	0.73 (44.8)***
$Y_{j,s,t-2}$		0.10 (5.76)***	0.09 (5.72)***
Credit Supply Factors			
$External \times CapRatio_{s,t-1}$	0.19 (0.68)	0.15 (0.53)	0.16 (0.50)
$External \times CapRatio_{s,t-2}$	0.04 (0.16)	-0.05 (0.16)	-0.13 (0.30)
$External \times CapRatio_{s,t-3}$		0.05 (0.26)	0.12 (0.40)
$External \times Interest_{t-1}$	0.18 (0.80)	0.89 (5.19)***	-0.43 (3.21)**
$External \times Interest_{t-2}$	0.22 (2.20)**	-0.25 (0.96)	0.03 (0.26)
$External \times Interest_{t-3}$		0.09 (0.86)	-0.10 (0.67)
$External \times ResRatio_{s,t-1}$	0.04 (0.15)	-0.01 (0.03)	-0.08 (0.27)
$External \times ResRatio_{s,t-2}$	0.01 (0.06)	0.24 (0.67)	0.37 (0.78)
$External \times ResRatio_{s,t-3}$		-0.12 (0.47)	-0.53 (1.53)
$External \times HHI_{s,t-1}$	-0.07 (1.44)	-0.06 (1.06)	-0.19 (2.52)**
$External \times HHI_{s,t-2}$	0.09 (1.49)	0.00 (0.03)	0.18 (1.46)
$External \times HHI_{s,t-3}$		0.12 (1.52)	0.02 (0.18)
$External \times Intra_{s,t-1}$	0.23 (0.86)	0.38 (1.33)	0.41 (1.17)
$External \times Inter_{s,t-1}$	0.57 (1.85)*	0.75 (2.25)**	0.49 (1.13)
Credit Demand Factors			
$GSP_{s,t-1}$	0.10 (4.68)***	0.12 (4.86)***	-0.08 (0.76)
$GSP_{s,t-2}$	-0.11 (5.09)***	-0.16 (4.17)***	-0.45 (3.28)***
$GSP_{s,t-3}$		0.02 (1.17)	0.59 (5.15)***
$Industry \times State$	yes	yes	yes
$Industry \times Year$	yes	yes	yes
$State \times Year$	no	no	yes
Number of Observations	13360	12692	12692
Years covered	1978-97	1979-97	1979-97
R-Squared (within)	0.905	0.899	0.916

NOTES: Log of establishments (Y) and log of real Gross State Product (GSP) is multiplied by 100. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $CapRatio$ is the state-level adjusted capital ratio, $Interest$ is the one-year Treasury rate minus the realized CPI inflation rate, $ResRatio$ is the state-level loan loss reserves to loans ratio, and HHI is the state-level Herfindahl-Hirschman Index based on deposits, all of which are in percentage terms. $Intra$ is an indicator for whether a state has deregulated intra-state bank branching and $Inter$ is an indicator for whether a state has deregulated inter-state bank branching. Coefficients are reported along with the absolute values of t - statistics in parentheses. Errors are robust to heteroskedasticity and clustered at the state-industry level. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table V: Panel Regression Results for Average Size of Establishments

Dependent Variable: Log of Average Size	(1)		(2)		(3)	
Lags of Dependent Variable						
$Y_{j,s,t-1}$	0.79	(73.7)***	0.72	(44.0)***	0.71	(45.0)***
$Y_{j,s,t-2}$			0.07	(5.07)***	0.07	(5.05)***
Credit Supply Factors						
$External \times CapRatio_{s,t-1}$	-0.78	(1.91)*	-0.73	(1.76)*	-1.21	(2.33)**
$External \times CapRatio_{s,t-2}$	0.61	(1.54)	0.67	(1.33)	0.98	(1.52)
$External \times CapRatio_{s,t-3}$			0.13	(0.36)	-0.33	(0.65)
$External \times Interest_{t-1}$	-0.53	(2.66)***	-0.69	(2.59)**	-0.39	(1.43)
$External \times Interest_{t-2}$	0.70	(3.76)***	-0.78	(3.93)***	-0.64	(2.56)**
$External \times Interest_{t-3}$			0.42	(3.10)***	0.42	(2.75)***
$External \times ResRatio_{s,t-1}$	-0.11	(0.31)	-0.35	(0.91)	-0.99	(2.07)**
$External \times ResRatio_{s,t-2}$	0.07	(0.19)	0.64	(1.08)	1.24	(1.72)*
$External \times ResRatio_{s,t-3}$			-0.80	(1.59)	-0.78	(1.31)
$External \times HHI_{s,t-1}$	0.12	(1.13)	0.11	(1.03)	0.14	(1.02)
$External \times HHI_{s,t-2}$	-0.15	(1.21)	-0.28	(1.78)*	-0.43	(2.15)**
$External \times HHI_{s,t-3}$			0.17	(1.54)	0.27	(1.93)*
$External \times Intra_{s,t-1}$	-0.36	(0.79)	-0.54	(1.13)	0.37	(1.20)
$External \times Inter_{s,t-1}$	0.22	(0.47)	0.23	(0.46)	0.75	(2.35)**
Credit Demand Factors						
$GSP_{s,t-1}$	-0.05	(1.18)	-0.05	(1.18)	0.05	(0.36)
$GSP_{s,t-2}$	-0.04	(0.68)	-0.03	(0.68)	0.76	(3.64)***
$GSP_{s,t-3}$			0.00	(0.00)	-0.74	(4.91)***
$Industry \times State$	yes		yes		yes	
$Industry \times Year$	yes		yes		yes	
$State \times Year$	no		no		yes	
Number of Observations	13360		12692		12692	
Years covered	1978-97		1979-97		1979-97	
R-Squared (within)	0.797		0.787		0.815	

NOTES: Log of average size of establishments (Y) and log of real Gross State Product (GSP) is multiplied by 100. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $CapRatio$ is the state-level adjusted capital ratio, $Interest$ is the one-year Treasury rate minus the realized CPI inflation rate, $ResRatio$ is the state-level loan loss reserves to loans ratio, and HHI is the state-level Herfindahl-Hirschman Index based on deposits, all of which are in percentage terms. $Intra$ is an indicator for whether a state has deregulated intra-state bank branching and $Inter$ is an indicator for whether a state has deregulated inter-state bank branching. Coefficients are reported along with the absolute values of t -statistics in parentheses. Errors are robust to heteroskedasticity and clustered at the state-industry level. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table VI: Dynamic Panel Regression Results for Number of Establishments

Dependent Variable: Log of Establishments	(1)		(2)		(3)	
Lags of Dependent Variable						
$Y_{j,s,t-1}$	0.92	(33.0)***	0.84	(11.3)***	0.72	(11.7)***
$Y_{j,s,t-2}$			0.09	(1.34)	0.14	(2.50)**
Credit Supply Factors						
$External \times CapRatio_{s,t-1}$	0.57	(1.46)	0.55	(1.33)	0.80	(2.06)**
$External \times CapRatio_{s,t-2}$	0.56	(1.24)	-0.36	(0.71)	-0.52	(1.26)
$External \times CapRatio_{s,t-3}$			-0.18	(0.57)	0.00	(0.05)
$External \times Interest_{t-1}$	2.27	(4.50)***	2.32	(4.74)***	2.11	(3.85)***
$External \times Interest_{t-2}$	1.08	(3.37)***	1.38	(3.53)***	1.49	(4.24)***
$External \times Interest_{t-3}$			-0.26	(0.46)	0.14	(0.23)
$External \times ResRatio_{s,t-1}$	-0.10	(0.35)	-0.03	(0.09)	0.16	(0.60)
$External \times ResRatio_{s,t-2}$	-0.16	(0.47)	-0.13	(0.29)	0.18	(0.53)
$External \times ResRatio_{s,t-3}$			0.20	(0.60)	-0.02	(0.09)
$External \times HHI_{s,t-1}$	-0.04	(0.37)	0.02	(0.13)	0.06	(0.61)
$External \times HHI_{s,t-2}$	-0.23	(1.57)	-0.22	(1.16)	-0.24	(1.99)**
$External \times HHI_{s,t-3}$			-0.02	(0.14)	0.26	(2.17)**
$External \times Intra_{s,t-1}$	0.03	(0.79)	0.50	(1.10)	-0.23	(0.47)
$External \times Inter_{s,t-1}$	0.06	(1.85)*	0.36	(0.75)	-0.00	(0.01)
Credit Demand Factors						
$GSP_{s,t-1}$	0.03	(0.79)	0.04	(1.02)	0.20	(3.40)***
$GSP_{s,t-2}$	-0.06	(1.85)*	-0.10	(2.07)**	-0.15	(2.46)**
$GSP_{s,t-3}$			0.02	(0.60)	0.03	(0.88)
$Industry \times Year$	yes		yes		yes	
Number of Observations	12692		12024		6012	
Years covered	1979-97		1980-97		1988-97	
Goodness of fit - $Corr(Y_{j,s,t}, \widehat{Y}_{j,s,t})^2$	0.998		0.998		0.996	
Serial correlation (p -value)	0.098		0.664		0.132	
Sargan-Hansen (p -value)	0.017		0.017		0.043	

NOTES: The dynamic panel regressions are based on the difference GMM procedure introduced by Arellano and Bond (1991). Log of establishments (Y) and log of real Gross State Product (GSP) is multiplied by 100. *External* is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). *CapRatio* is the state-level adjusted capital ratio, *Interest* is the one-year Treasury rate minus the realized CPI inflation rate, *ResRatio* is the state-level loan loss reserves to loans ratio, and *HHI* is the state-level Herfindahl-Hirschman Index based on deposits, all of which are in percentage terms. *Intra* is an indicator for whether a state has deregulated intra-state bank branching and *Inter* is an indicator for whether a state has deregulated inter-state bank branching. For specification (1), we use as instruments the third to fifth lags of all the bank balance sheet measures, HHI, and GSP, and one-period lagged values of all the remaining strictly exogenous variables. For specification (2), we use the fourth to sixth lags as instruments of the endogenous variables and for specification (3), we use up to the thirteenth lag. Coefficients are reported along with the absolute values of t -statistics in parentheses. Errors are Windmeijer (2005) standard-errors and are robust to autocorrelation and heteroscedasticity. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table VII: Dynamic Panel Regression Results for Average Size of Establishments

Dependent Variable: Log of Average Size	(1)		(2)		(3)	
Lags of Dependent Variable						
$Y_{j,s,t-1}$	0.71	(15.8)***	0.60	(10.5)***	0.56	(10.4)***
$Y_{j,s,t-2}$			0.16	(3.29)***	0.02	(0.48)
Credit Supply Factors						
$External \times CapRatio_{s,t-1}$	-1.21	(2.22)**	-1.41	(2.47)**	-1.22	(1.97)**
$External \times CapRatio_{s,t-2}$	0.16	(0.28)	0.42	(0.66)	0.95	(1.38)
$External \times CapRatio_{s,t-3}$			-0.27	(0.52)	0.13	(0.24)
$External \times Interest_{t-1}$	-2.98	(2.88)***	-3.72	(3.31)***	-3.01	(3.09)***
$External \times Interest_{t-2}$	-0.33	(0.64)	-0.72	(1.27)	-0.58	(1.09)
$External \times Interest_{t-3}$			-1.79	(1.59)	-0.92	(0.82)
$External \times ResRatio_{s,t-1}$	0.02	(0.04)	-0.35	(0.73)	-0.07	(0.13)
$External \times ResRatio_{s,t-2}$	0.46	(0.90)	1.07	(1.85)*	0.52	(0.93)
$External \times ResRatio_{s,t-3}$			-0.57	(1.06)	-0.84	(1.64)
$External \times HHI_{s,t-1}$	0.28	(1.23)	-0.04	(0.17)	0.02	(0.11)
$External \times HHI_{s,t-2}$	-0.34	(1.59)	0.09	(0.31)	0.04	(0.17)
$External \times HHI_{s,t-3}$			-0.22	(0.91)	-0.19	(1.14)
$External \times Intra_{s,t-1}$	-0.93	(1.33)	-1.53	(2.07)**	-1.63	(1.63)
$External \times Inter_{s,t-1}$	-0.25	(0.33)	0.73	(1.05)	0.11	(0.09)
Credit Demand Factors						
$GSP_{s,t-1}$	-0.07	(0.92)	-0.05	(0.71)	-0.07	(0.81)
$GSP_{s,t-2}$	0.00	(0.05)	-0.04	(0.39)	0.16	(1.74)*
$GSP_{s,t-3}$			0.01	(0.12)	-0.13	(2.22)**
$Industry \times Year$	yes		yes		yes	
Number of Observations	12692		12024		6012	
Years covered	1979-97		1980-97		1988-97	
Goodness of fit - $Corr(Y_{j,s,t}, \widehat{Y}_{j,s,t})^2$	0.968		0.930		0.969	
Serial correlation (<i>p</i> -value)	0.379		0.046		0.488	
Sargan-Hansen (<i>p</i> -value)	0.076		0.326		0.055	

NOTES: The dynamic panel regressions are based on the difference GMM procedure introduced by Arellano and Bond (1991). Log of the average size of establishments (Y) and log of real Gross State Product (GSP) is multiplied by 100. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $CapRatio$ is the state-level adjusted capital ratio, $Interest$ is the one-year Treasury rate minus the realized CPI inflation rate, $ResRatio$ is the state-level loan loss reserves to loans ratio, and HHI is the state-level Herfindahl-Hirschman Index based on deposits, all of which are in percentage terms. $Intra$ is an indicator for whether a state has deregulated intra-state bank branching and $Inter$ is an indicator for whether a state has deregulated inter-state bank branching. For specification (1), we use as instruments the third to fifth lags of all the bank balance sheet measures, HHI, and GSP, and one-period lagged values of all the remaining strictly exogenous variables. For specification (2), we use the fourth to sixth lags as instruments of the endogenous variables and for specification (3), we use up to the thirteenth lag. Coefficients are reported along with the absolute values of t -statistics in parentheses. Errors are Windmeijer (2005) standard-errors and are robust to autocorrelation and heteroscedasticity. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table VIII: Panel Regression Results for the Growth in the Number of Establishments

Dependent Variable: Growth of Establishments	(1)	(2)	(3)
Lags of Dependent Variable			
$\Delta Y_{j,s,t-1}$	-0.06 (3.72)***	-0.06 (3.56)***	-0.13 (8.00)***
$\Delta Y_{j,s,t-2}$		0.02 (1.21)	-0.05 (3.25)***
Credit Supply Factors			
$External \times \Delta CapRatio_{s,t-1}$	0.20 (0.70)	0.30 (1.05)	0.16 (0.47)
$External \times \Delta CapRatio_{s,t-2}$	0.14 (0.65)	0.12 (0.56)	0.04 (0.14)
$External \times \Delta CapRatio_{s,t-3}$		0.41 (1.36)	0.10 (0.29)
$External \times \Delta Interest_{t-1}$	0.40 (1.26)	0.49 (2.20)**	0.30 (1.33)
$External \times \Delta Interest_{t-2}$	0.21 (0.85)	0.23 (1.57)	0.05 (0.26)
$External \times \Delta Interest_{t-3}$		0.09 (0.83)	0.08 (0.57)
$External \times \Delta ResRatio_{s,t-1}$	-0.03 (0.09)	0.00 (0.00)	0.10 (0.31)
$External \times \Delta ResRatio_{s,t-2}$	0.21 (0.82)	0.26 (1.00)	0.56 (0.26)
$External \times \Delta ResRatio_{s,t-3}$		-0.16 (0.62)	-0.53 (1.63)
$External \times \Delta HHI_{s,t-1}$	-0.04 (0.78)	-0.05 (0.84)	-0.20 (2.43)**
$External \times \Delta HHI_{s,t-2}$	-0.03 (0.31)	-0.02 (0.17)	0.03 (0.25)
$External \times \Delta HHI_{s,t-3}$		0.00 (0.01)	-0.04 (0.43)
$External \times \Delta Intra_{s,t-1}$	0.06 (0.16)	0.26 (0.71)	0.39 (0.80)
$External \times \Delta Inter_{s,t-1}$	0.22 (0.62)	0.17 (0.48)	-0.05 (0.12)
Credit Demand Factors			
$\Delta GSP_{s,t-1}$	0.14 (5.29)***	0.15 (5.23)***	0.12 (1.19)
$\Delta GSP_{s,t-2}$	-0.03 (1.35)	0.01 (0.42)	-0.15 (1.36)
$\Delta GSP_{s,t-3}$		-0.06 (2.67)***	-0.14 (1.88)*
$Industry \times Year$	yes	yes	yes
$State \times Year$	no	no	yes
Number of Observations	12692	12024	12024
Years covered	1979-97	1980-97	1980-97
R-Squared (within)	0.321	0.330	0.447

NOTES: Growth in establishments (ΔY) and real Gross State Product (ΔGSP) are in percentages. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $\Delta CapRatio$ is the change in state-level adjusted capital ratio, $\Delta Interest$ is the change in one-year Treasury rate minus the realized CPI inflation rate, $\Delta ResRatio$ is the change in state-level loan loss reserves to loans ratio, and ΔHHI is the change in the state-level Herfindahl-Hirschman Index based on deposits, all of which are multiplied by 100. $\Delta Intra$ is an indicator for the year in which a state deregulated intra-state bank branching and $\Delta Inter$ is an indicator for the year in which a state has deregulated inter-state bank branching. Coefficients are reported along with the absolute values of t - statistics in parentheses. Errors are robust to heteroskedasticity and clustered at the state-industry level. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table IX: Panel Regression Results for the Growth in the Average Size of Establishments

Dependent Variable: Growth of Average Size	(1)		(2)		(3)	
Lags of Dependent Variable						
$\Delta Y_{j,s,t-1}$	-0.13	(8.90)***	-0.13	(8.63)***	-0.14	(9.81)***
$\Delta Y_{j,s,t-2}$			-0.05	(3.90)***	-0.07	(5.41)***
Credit Supply Factors						
$External \times \Delta CapRatio_{s,t-1}$	-0.88	(2.11)**	-0.91	(2.28)**	-1.22	(2.24)**
$External \times \Delta CapRatio_{s,t-2}$	-0.06	(0.15)	-0.07	(0.21)	0.11	(0.24)
$External \times \Delta CapRatio_{s,t-3}$			-0.20	(0.46)	-0.29	(0.53)
$External \times \Delta Interest_{t-1}$	-1.21	(5.09)***	-0.90	(2.46)**	-0.64	(1.70)*
$External \times \Delta Interest_{t-2}$	-0.83	(2.86)***	0.22	(0.57)	0.38	(0.92)
$External \times \Delta Interest_{t-3}$			-0.79	(3.04)***	-0.64	(2.10)**
$External \times \Delta ResRatio_{s,t-1}$	-0.07	(0.20)	0.11	(0.33)	-0.69	(1.47)
$External \times \Delta ResRatio_{s,t-2}$	0.74	(1.43)	0.53	(1.06)	0.64	(1.06)
$External \times \Delta ResRatio_{s,t-3}$			0.90	(2.40)**	0.33	(0.73)
$External \times \Delta HHI_{s,t-1}$	0.18	(1.45)	0.18	(1.46)	0.13	(0.88)
$External \times \Delta HHI_{s,t-2}$	-0.14	(1.10)	-0.17	(1.34)	-0.32	(1.90)*
$External \times \Delta HHI_{s,t-3}$			0.09	(0.71)	0.15	(0.90)
$External \times \Delta Intra_{s,t-1}$	-1.26	(1.80)*	-1.35	(1.91)*	-1.49	(1.52)
$External \times \Delta Inter_{s,t-1}$	1.04	(1.85)*	1.01	(1.83)*	0.12	(0.15)
Credit Demand Factors						
$\Delta GSP_{s,t-1}$	-0.01	(0.32)	-0.01	(0.22)	-0.11	(0.79)
$\Delta GSP_{s,t-2}$	-0.07	(1.94)*	-0.04	(1.26)	0.42	(3.00)***
$\Delta GSP_{s,t-3}$			-0.12	(3.86)***	0.19	(1.40)
$Industry \times Year$	yes		yes		yes	
$State \times Year$	no		no		yes	
Number of Observations	12692		12024		12024	
Years covered	1979-97		1980-97		1980-97	
R-Squared	0.291		0.294		0.379	

NOTES: Growth in the average size of establishments (ΔY) and real Gross State Product (ΔGSP) are in percentages. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $\Delta CapRatio$ is the change in state-level adjusted capital ratio, $\Delta Interest$ is the change in one-year Treasury rate minus the realized CPI inflation rate, $\Delta ResRatio$ is the change in state-level loan loss reserves to loans ratio, and ΔHHI is the change in the state-level Herfindahl-Hirschman Index based on deposits, all of which are multiplied by 100. $\Delta Intra$ is an indicator for the year in which a state deregulated intra-state bank branching and $\Delta Inter$ is an indicator for the year in which a state has deregulated inter-state bank branching. Coefficients are reported along with the absolute values of t - statistics in parentheses. Errors are robust to heteroskedasticity and clustered at the state-industry level. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table X: Dynamic Panel Regression Results for the Growth in Establishments

Dependent Variable: Growth of Establishments	(1)	(2)	(3)
Lags of Dependent Variable			
$\Delta Y_{j,s,t-1}$	-0.10 (5.65)***	-0.16 (2.02)**	-0.21 (3.52)***
$\Delta Y_{j,s,t-2}$		-0.04 (1.82)*	-0.05 (1.90)*
Credit Supply Factors			
$External \times \Delta CapRatio_{s,t-1}$	0.56 (1.42)	0.65 (1.65)	0.87 (2.24)**
$External \times \Delta CapRatio_{s,t-2}$	0.02 (0.08)	0.07 (0.25)	0.28 (0.88)
$External \times \Delta CapRatio_{s,t-3}$		0.38 (1.29)	0.27 (0.78)
$External \times \Delta Interest_{t-1}$	1.81 (3.61)***	1.14 (2.61)***	1.12 (2.34)**
$External \times \Delta Interest_{t-2}$	2.94 (5.02)***	1.62 (2.99)***	1.66 (3.44)***
$External \times \Delta Interest_{t-3}$		1.48 (0.83)***	1.63 (4.18)***
$External \times \Delta ResRatio_{s,t-1}$	0.01 (0.04)	0.13 (0.41)	-0.10 (0.36)
$External \times \Delta ResRatio_{s,t-2}$	-0.15 (0.57)	-0.02 (0.07)	0.12 (0.46)
$External \times \Delta ResRatio_{s,t-3}$		-0.26 (0.98)	-0.33 (1.13)
$External \times \Delta HHI_{s,t-1}$	0.12 (0.92)	0.11 (1.13)	0.03 (0.35)
$External \times \Delta HHI_{s,t-2}$	-0.05 (0.61)	-0.04 (0.31)	-0.18 (1.58)
$External \times \Delta HHI_{s,t-3}$		-0.03 (0.40)	0.04 (0.46)
$External \times \Delta Intra_{s,t-1}$	-0.15 (0.33)	-0.02 (0.04)	0.43 (0.87)
$External \times \Delta Inter_{s,t-1}$	0.53 (0.34)	-0.19 (0.53)	0.02 (0.05)
Credit Demand Factors			
$\Delta GSP_{s,t-1}$	0.11 (2.87)***	0.12 (2.80)***	0.16 (3.33)***
$\Delta GSP_{s,t-2}$	0.53 (0.16)	0.06 (1.70)*	-0.04 (1.03)
$\Delta GSP_{s,t-3}$		-0.04 (1.42)***	-0.11 (3.21)***
$Industry \times Year$	yes	yes	yes
Number of Observations	12024	11356	6680
Years covered	1980-97	1981-97	1988-97
Goodness of fit - $Corr(Y_{j,s,t}, \widehat{Y}_{j,s,t})^2$	0.210	0.260	0.291
Serial correlation (p-value)	0.924	0.213	0.348
Sargan-Hansen (p-value)	0.047	0.048	0.049

NOTES: The dynamic panel regressions are based on the difference GMM procedure introduced by Arellano and Bond (1991). Growth in establishments (ΔY) and real Gross State Product (ΔGSP) are in percentages. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $\Delta CapRatio$ is the change in state-level adjusted capital ratio, $\Delta Interest$ is the change in one-year Treasury rate minus the realized CPI inflation rate, $\Delta ResRatio$ is the change in state-level loan loss reserves to loans ratio, and ΔHHI is the change in the state-level Herfindahl-Hirschman Index based on deposits, all of which are multiplied by 100. $\Delta Intra$ is an indicator for the year in which a state deregulated intra-state bank branching and $\Delta Inter$ is an indicator for the year in which a state has deregulated inter-state bank branching. For specification (1), we use as instruments the third to fifth lags of all the bank balance sheet measures, HHI, and GSP, and one-period lagged values of all the remaining strictly exogenous variables. For specification (2), we use the fourth to sixth lags as instruments of the endogenous variables and for specification (3), we use up to the thirteenth lag. Coefficients are reported along with the absolute values of t -statistics in parentheses. Errors are Windmeijer (2005) standard-errors and are robust to autocorrelation and heteroscedasticity. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table XI: Dynamic Panel Regression Results for the Growth in the Average Size of Establishments

Dependent Variable: Growth of Average Size	(1)	(2)	(3)
Lags of Dependent Variable			
$\Delta Y_{j,s,t-1}$	-0.11 (6.45)***	-0.27 (4.76)***	-0.23 (4.38)***
$\Delta Y_{j,s,t-2}$		-0.05 (3.06)***	-0.06 (3.62)***
Credit Supply Factors			
$External \times \Delta CapRatio_{s,t-1}$	-1.35 (1.99)**	-1.75 (3.24)***	-1.70 (2.65)***
$External \times \Delta CapRatio_{s,t-2}$	0.03 (0.08)	-0.88 (1.77)*	-0.48 (0.96)
$External \times \Delta CapRatio_{s,t-3}$		-0.06 (0.14)	-0.18 (0.37)
$External \times \Delta Interest_{t-1}$	-2.85 (2.58)**	-1.81 (2.89)***	-1.87 (3.25)***
$External \times \Delta Interest_{t-2}$	-3.27 (2.33)**	-1.30 (2.26)**	-1.23 (2.45)**
$External \times \Delta Interest_{t-3}$		-2.07 (2.24)**	-2.00 (2.25)**
$External \times \Delta ResRatio_{s,t-1}$	-0.50 (0.99)	-0.53 (1.19)	-0.04 (0.10)
$External \times \Delta ResRatio_{s,t-2}$	0.87 (2.11)**	0.18 (0.36)	0.63 (1.30)
$External \times \Delta ResRatio_{s,t-3}$		1.01 (2.51)**	0.87 (2.19)**
$External \times \Delta HHI_{s,t-1}$	0.32 (1.15)	0.19 (0.87)	0.08 (0.48)
$External \times \Delta HHI_{s,t-2}$	-0.20 (1.39)	0.00 (0.01)	0.24 (1.24)
$External \times \Delta HHI_{s,t-3}$		0.03 (0.23)	0.20 (1.39)
$External \times \Delta Intra_{s,t-1}$	-1.13 (1.48)	-1.41 (2.01)**	-1.81 (1.90)*
$External \times \Delta Inter_{s,t-1}$	0.49 (0.51)	0.41 (0.72)	0.54 (0.65)
Credit Demand Factors			
$\Delta GSP_{s,t-1}$	-0.09 (1.25)	-0.10 (1.50)	-0.25 (2.99)***
$\Delta GSP_{s,t-2}$	0.03 (0.51)	-0.10 (1.86)*	-0.06 (1.00)
$\Delta GSP_{s,t-3}$		-0.10 (2.07)**	-0.07 (1.33)
$Industry \times Year$	yes	yes	yes
Number of Observations	12024	11356	6680
Years covered	1980-97	1981-97	1988-97
Goodness of fit - $Corr(Y_{j,s,t}, \widehat{Y}_{j,s,t})^2$	0.362	0.316	0.426
Serial correlation(p-value)	0.039	0.044	0.085
Sargan-Hansen (p-value)	0.198	0.428	0.182

NOTES: The dynamic panel regressions are based on the difference GMM procedure introduced by Arellano and Bond (1991). Growth in the average size of establishments (ΔY) and real Gross State Product (ΔGSP) are in percentages. $External$ is an indicator for industries dependent on external finance based on Cetorelli and Strahan (2006). $\Delta CapRatio$ is the change in state-level adjusted capital ratio, $\Delta Interest$ is the change in one-year Treasury rate minus the realized CPI inflation rate, $\Delta ResRatio$ is the change in state-level loan loss reserves to loans ratio, and ΔHHI is the change in the state-level Herfindahl-Hirschman Index based on deposits, all of which are multiplied by 100. $\Delta Intra$ is an indicator for the year in which a state deregulated intra-state bank branching and $\Delta Inter$ is an indicator for the year in which a state has deregulated inter-state bank branching. For specification (1), we use as instruments the third to fifth lags of all the bank balance sheet measures, HHI, and GSP, and one-period lagged values of all the remaining strictly exogenous variables. For specification (2), we use the fourth to sixth lags as instruments of the endogenous variables and for specification (3), we use up to the thirteenth lag. Coefficients are reported along with the absolute values of t -statistics in parentheses. Errors are Windmeijer (2005) standard-errors and are robust to autocorrelation and heteroscedasticity. *** indicates significance at the 1 percent confidence level, ** at the 5 percent level, and * at the 10 percent level.

Table XII: Back-of-the-Envelope Macro Effects on Employment

	Panel	Dynamic Panel
First year effect of a 1% increase in adjusted capital ratio	[-70;-115]	[-115;-135]
Long Run effect of a 1% increase in adjusted capital ratio	[-330;-525]	[-340;-560]

NOTES: Back-of-the-envelope macro effects on the change in employment (or displacement of workers) are calculated by multiplying the long-run elasticity of a one percentage increase in the adjusted capital ratio on the average size of establishments with the total number of employees. The number is represented in thousands of employees.